

**The *Historia Plantarum Generalis* of John Ray:  
Book I - a translation and commentary.**

In three volumes

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of  
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in  
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Volume Two

## Table of Contents

### Volume Two: Commentary

Table of contents	498
Illustrations and diagrams	500
Chapter 13: Certain general observations on the seeds of plants.	501
Chapter 14: On the leaves of plants called seed leaves.	537
Chapter 15: On the seedling and other things contained in the seed.	544
Chapter 16: On the secondary or auxiliary parts of plants: tendrils, thorns etc.	574
Chapter 17: On the nutrition of plants.	585
Chapter 18: On the sowing and propagation of plants.	605
Chapter 19: On grafting.	663
Chapter 20: Concerning the specific differences (as they call them) of plants.	689
Chapter 21: On the transmutation of species in plants.	712
Chapter 22: On the stature and size of plants.	738
Chapter 23: On the age and lifespan of plants.	765
Chapter 24: On the powers and uses of plants in food and medicine.	779
Chapter 25: On the position of plants.	827
Chapter 26: On the division of plants according to their genus.	835
Chapter 27: On the division of plants into trees, shrubs, subshrubs and herbaceous plants: and of individuals into their subordinate genera.	847
Chapter 28: On the collection, drying out and preservation of plants and their parts.	886
Chapter 29: On the chemical analysis of plants and the use of their dissolved parts.	905
Chapter 30: On the diseases of plants and their remedies.	940

General table of herbaceous plants showing the main types.	953
Table 1: Imperfect plants.	959
Table 2: Herbaceous plants with very small seed, which is scarcely visible to the naked eye.	973
Appendix: Table of authors etc. referred to by Ray in <i>Historia Plantarum</i> , Book I.	981
Bibliography.	984

## Illustrations and diagrams

### Volume Two

Broad Bean seed	549
Seed leaves from:	
<i>Historia Plantarum: 27</i>	554
Malpighi, <i>Anatome Plantarum: Tab. LIII, figs 18 and 19</i>	554
Sycamore fruit showing the rolled up embryo	555
Cross sections of the seeds of <i>Ricinus communis</i> (Castor-oil plant) and <i>Zea mays</i> (Maize)	556
Epigeal germination ( <i>Phaseolus</i> )	
from Malpighi, <i>Anatomes Plantarum Pars Altera: Tab.II</i>	560
Hypogeal germination ( <i>Faba</i> )	
from Malpighi, <i>Anatomes Plantarum Pars Altera: Tab.III</i>	561
<i>Avena</i> from Malpighi, <i>Anatome Plantarum: Tab.LIV, fig.324.</i>	570
Pine seed	572

### Chapter Thirteen:

#### *Certain general observations on the seeds of plants.*

Ray had presented to The Royal Society on December 17th 1674 *A Discourse on the Seeds of Plants*; it had been read for him in his absence by Henry Oldenburgh, the Secretary to the Society. Ray himself had doubts as to the quality of this work, feeling that it was not ready for the public:

I have this week by the Tamworth carrier sent you a paper of such sorry observations as I have made concerning the Seeds, and concerning the specific difference of Plants. .... The former concerning the seeds of Plants are but inchoate & imperfect. I should not have presented them so soon to the Society but that I have nothing better to send, & am unwilling to be wanting in the carrying on so good a design as they have now set on foot.<sup>996 997</sup>

After the presentation of this paper, Oldenburgh wrote to Ray indicating that The Royal Society hoped to receive further work from him on this subject.<sup>998</sup> This chapter of *Historia Plantarum* is largely based on this paper, the full text of which is given in *The Further Correspondence of John Ray*;<sup>999</sup> since *Historia Plantarum* was published by The Royal Society, perhaps it can be considered to be Ray's further observations. Ray's *Methodus Nova* published in 1682 also includes a section entitled *De Plantarum seminibus observationes quaedam generales*. Vines describes these first three sections of the *Methodus*, which correspond to Chapters 13, 14 and 15 of *Historia Plantarum*, as giving:

an account of Ray's observations upon seeds and seedlings, with quotations from Malpighi's recent work on the same subject

996 Letter from John Ray to Henry Oldenburgh, dated 30th November 1674; *Further Correspondence*: 67-68.

997 NB. The Royal Society, at this time, required all members annually to submit recent research work for presentation at their meetings.

998 Henry Oldenburgh to John Ray: letter written on 21st December 1674; *Correspondence* 114-115:

They doubt not but that you will in good time communicate to them also what you shall farther observe concerning the seeds of bulbous plants.

999 *Further Correspondence*: 70-77.

(*Anatomes Plantarum, Pars Prima*, 1675; *Pars altera*, 1679), recognizing the fact that the seedlings of some plants have two seed-leaves or cotyledons (as Malpighi first called them),<sup>1000</sup> those of others only one, a fact which came to be of great systematic importance.<sup>1001</sup>

Basically Ray adopted the ideas of Grew that there is a difference of sex in the vegetable kingdom and he developed the ideas of Cesalpino that there is a substance in a seed, which he calls *pulpa* or *medulla*, now known as the endosperm, and that there are either one or two cotyledons.

Text page 24.

Line 2. *ut majus semen majorem semper producat plantam, minus minorem.*

Ray discusses whether larger seeds produce larger plants, and comes to the conclusion that this is not necessarily so. Modern research has produced some interesting results, that large seeds are an advantage to a plant, when it is to grow in a densely packed community and must therefore contain enough food for it to grow to a point where light can reach it and it can thus photosynthesise. Conversely, small seeds usually grow in more open habitats, where they do not have to grow to such a height to begin manufacturing their own food.<sup>1002</sup>

Line 4. *Fabiæ: Faba:* see above Cap.9, line 20.

Line 4. *Pisi: Pisum:* see above Cap.9, line 20.

Line 4. *Viciæ: Vicia:* see above Cap.9, line 20.

Line 4. *Lupini: Lupinus:* see above Cap.9, line 16.

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1000 See notes to Cap. 15, lines 13-15.

1001 Vines: 35-36.

1002 Turrill: 176.

- Line 4. *Peponis: Pepo*: see above Cap.9, line 180.
- Line 4. *Melonis: Melo*: see above Cap.10, line 12.
- Line 5. *Cucurbitæ: Cucurbita*: see above Cap.9, line 180.
- Line 5. *Ulni: Ulmus*: see above Cap.4, line 145.
- Line 5. *Populi: Populus*: see above Cap.5, line 63.
- Line 5. *Salicis: Salix*: see above Cap.5, line 26.
- Line 5. *Betulæ: Betula*: see above Cap.4, line 12.
- Line 5. *Ficûs: Ficus*: see above Cap.4, line 143.
- Line 7. *Atque hoc non in plantis duntaxat diversorum generum observari potest*: Is Ray using the term genus in a modern sense or merely for the 'kinds' of plants? In the late sixteenth and early seventeenth centuries, because of the great number of new plants being discovered, botanists were beginning to recognize groups of related species approximating to modern genera and to distinguish more carefully between the species within them. This process led to the establishment of genus and species as the basic units of taxonomy.<sup>1003</sup> It was not, however, until the time of Linnæus in the eighteenth century that the definition was refined into our modern concept based on the characteristics of flowers and fruit.<sup>1004</sup> Perhaps, therefore, Ray is still using the term *genus* in a

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1003 Morton: 146.

1004 *ibid.*: 265.

looser sense but with overtones of the division into genera in a modern sense.

Lines 8-9. *arborum glandiferarum ..... glandem*: Ray defines the term *glans* in his glossary to *Historia Plantarum* as follows:

*Glans dicitur quod cortice constat crustoso unicum tantum semen continente, cujus pars posterior, quæ arbore adhæret, calyce proxime cooperitur, parte superiore nuda. Spigel. Isag. Rectius Glans dicitur ipse fructus calyce contentus.*<sup>1005</sup>

Line 8. *Ilex coccifera*: note that the plant Ray is using as a comparison with *Quercus vulgaris*, is not the modern *Ilex*, which is a member of the *Aquifoliaceæ* family, producing as its fruit a drupe with three or more stones and not an acorn as Ray says here; he is giving *Quercus Ilex* (L.), also known as *Quercus coccifera* (L.) as his example: see below.

Line 8. *Ilex coccifera*.

[C.T.& M. 317] *Quercus ilex* (L.), Evergreen Oak, Holm Oak; a species of the *Quercus* genus of the *Fagaceæ* or Oak family.

B.& G.-W. 56: B.& H. 407: Linn.*Sp.Pl.* 995:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1391: *H.P.III D.* - no ref.:

*Tri.* 16.43: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1391:

*Ilex arborea* J.B. *major glandifera* Ger. *major aculeata & non aculeata* Park. *IV seu folio rotundiore, molli modiceq. sinuato* C.B. *necnon I. seu folio oblongo serrato* C.B.

**The Holm-Oak.**

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<sup>1005</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.



Tri. 16.43:

The Holm-Oak: *Ilex*, -icis, f.: Πρῖνος, -ίνου, f.

Line 9. *Quercûs*: *Quercus*: see above Cap.4, line 145.

Line 9. *Cerrus*.

[C.T.& M. 317] *Quercus cerris* (L.), [*Quercus hispanica* (Lam.):  
*Quercus cerris* x *Quercus suber*. (L.)] Turkey Oak; a species of the  
*Quercus* genus of the *Fagaceæ* or Oak family.

B.& G.-W. 56: B.& H. 407: Linn.*Sp.Pl.* 996:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1387: *H.P.III ?D* 21-23:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1387:

*Ægilops sive Cerrus mas majore glande* Park. *Quercus calyce*  
*echinato, glande majore* C.B. αἰγίλωψ *Idæorum, Aspris*  
*Maurorum, Latinorum Cerrus* ejusdem. *Cerrus Ægilops, Aspris*  
*Theophrasti putata* J.B.

*H.P.III ?D.* 21-23:

*Ad cap. de Euphorbio Speciem 2<sup>dam</sup>* : called 'among us' ***The***  
***Didlo-tree or Torchwood.*** 12 additional species given.

Line 9. *Quercui*: *Quercus*: see above Cap.4, line 145.

Line 10. *Cerinthæ purpurea annua*:

Some pointers to suggest that this is *Cynoglossum officinale*: both  
*Cynoglossum* and *Cerinthæ* are members of the *Boraginaceæ* or  
Borage family.

C.T.& M. - no ref.

However see page 357, *Cynoglossum officinale* (L.), Hound's-  
tongue.

B.& G.-W. 320;

the only annual form given is *Cerintho minor* (L.), Lesser Honeywort, but it has yellow flowers.

But see page 328, *Cynoglossum officinale* (L.), Hound's-tongue. Medium greyish, softly hairy biennial. Leaves lanceolate to oblong, untoothed, the lower short-stalked, the upper clasping the stem. Flowers dull purple, 5-6mm. funnel-shaped. Fruit flattened, the nutlets with hooked spines and a thickened flange. Dry grassy habitats, woodland margins, gravelly ground and stabilized sand dunes to 2400m. May-August. The plant smells distinctly of mice and was formerly used as a medicinal plant. Widespread in England and Wales to S.Scotland, mainly coastal in the north.

B.& H. 316:

*Cynoglossum officinale* (L.), Common Hound's-tongue.

Linn.*Sp.Pl.* 136-137:

4 species given, including:

*Cerintho foliis amplexicaulibus, fructibus geminis, corollis obtusiusculis patulis.*

*Cerintho foliis cordatis sessilibus.* Hort.cliff.48. Hort.ups.35. Roy.lugdb.408.

*Cerintho foliis caulem amplexantibus, dentibus floris revolutis brevissimis.* Hall.helv.515.

*Cerintho flore rubro purpurascente.* Bauh.pin.258.

*Habitat in Europa australi.*

*Syn.Meth.St.Br.* 226:

*Cynoglossum* Ger. 659. *vulgare* J.B.III 598. *majus vulgare* C.B.Pin. 257. Ger.Em.804. Park.511.

***Great Hounds [sic]Tongue.***

*H.P.* 506-507:

(Tr.) *Cerintho* is said by Pliny to be a herb with a white

leaf, curving in like an elbow, with a concave head, and having the sap of honey; bees are very eager for its flowers. It gets its name because it produces wax, which the Greeks call *χηρός* [*sic*].

In this species two seeds follow a single flower, smooth and black in maturity; in this it differs from all others of its kind. But it is like the others in its shape and in the method of being born from its mother. The flowers are cylindrical and pendulous like the flowers of *Symphytum* and generally its leaves are spotted.

6 species given, including:

*Cerithe quorundam major flore ex rubro purpurascente* Clus.  
J.B. *Cer. flore ex rubro purpurascente* C.B. *Cer. major flore purpurante* Park. **Great purple flowered Honey-wort.**

*H.P.III 272*: incorrect reference in the index to Volume III - it should read 273.

3 additional species given, but not *purpurea annua* or *montana perennis*, following at line 10.

*Tri.* - no reference.

*Cat.Angl.* - no reference.

*Camb. 58*:

*Cynoglossum vulgare*, Great Hound's-tongue [*Cynoglossum officinale* (L.)].

Everywhere along roads.

N.1. The smell of this plant is 'doggy' C.Hofman. *de medicam Offic. Lib.2. cap.79*. Certainly when passed between the fingers it gives off an odour of a hot, wet dog.

N.2. Dioscorides writes that *Cynoglossum* does not put up a flowering stalk until after the third year. Marant. *Method. cogn. simpl. lib.2, cap.4*.

Line 10. *Cerinthe montana perenni*: *Cerinthe montana perennis*.

[C.T.& M. 357] *Cynoglossum germanicum* (Jacq.), [*Cynoglossum montana* (auct. non L.)], Green Hound's-tongue; a species of the *Cynoglossum* genus of the *Boraginaceæ* or Borage family.

B.& G.-W. 320:

The only perennial form given is *Cerinthe glabra* (Miller), [*C. alpina*], Smooth Honeywort.

But see page 328: Green Hound's-tongue, *Cynoglossum germanicum* (Jacq.).

B.& H. 316:

*Cynoglossum montanum* (Lam.), [*Cynoglossum sylvaticum* (Haenke)], Green Hound's-tongue.

Linn.*Sp.Pl.* 136-137:

4 species given, including this mountain form:

*maculata*:

*Cerinthe foliis amplexicaulibus emarginatis, fructibus geminis, corollis acutis clausis.*

*Cerinthe s. Cynoglossum montanum majus*. Bauh.pin.258?

*Habitat in montanis Europæ australis.*

*Differt a C.minore cui flore convenit, quod major & folia maculataemarginata.*

*Syn.Meth.St.Br.* - no ref.

*H.P.* 506-507:

*Cerinthe major* Ger. *Cerinthe seu Cynoglossum montanum majus* C.B. *Cer. major flore luteo & rubro* Park. *quorundam major versicolore flore* J.B. **Great Mountain Honey-wort.**

*H.P.III* 273:

3 additional species given, but not *montana perennis*.

*Tri.* - no reference.

*Cat.Angl.* - no reference.

*Camb.* - no reference.

Line 12. *Rapistri: Rapistrum.*

[C.T.& M. 74] *Sinapis arvensis* (L.) [*Brassica arvensis* ([L.] Rabenh., non L.): *Brassica sinapistrum* (Boiss.): *Brassica sinapis* (Vis.): *Brassica kaber* ([D.C.] L.C.Wheeler)], Charlock, Wild Mustard; a species of the *Sinapis* genus of the *Cruciferae* or Cress family.

B.& G.-W. 158: B.& H. 38: Linn.*Sp.Pl.* 668:

*Syn.Meth.St.Br.* 295-301: *H.P.* 802: *H.P.III* - no ref.: *Tri.* 9.38: *Cat.Angl.* 251: *Camb.* 101-102.

*H.P.* 802:

*flore luteo i. Sinapi: Rapistrum arborum* Ger. Park. *flore luteo*  
C.B. J.B. **Charlock or wild Mustard.**

*Tri.* 9.38:

Charlock: *Rapistrum*, -i, n.: [No Greek].

Line 12. *Sinapeos: Sinapi.* 1006

[C.T.& M. 74] *Sinapis alba* (L.), [*Brassica hirt* (Moench): *Brassica alba* ([L.] Rabenh)] White Mustard; a species of the *Sinapis* genus of the *Cruciferae* or Cress family.

B.& G.-W. 158: B.& H. 35: Linn.*Sp.Pl.* 668-669:

*Syn.Meth.St.Br.* 295: *H.P.* 802-803: *H.P.III* 40 (incorrect reference in index to Volume III): *Tri.* 12.130: *Cat.Angl.* 273-274: *Camb.* 113.

*H.P.* 802-803:

4 species given, including:

*Sinapi sativum* 2. Ger.emac. descrip. *Sinapi siliqua latiuscula glabra, semine ruffo sive vulgare* J.B. **Common Mustard.**

*Tri.* 12.130:

Mustard: *Sinapi*, -is, n.: Σίνηπι, -ιος, n.

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1006 NB: in the translation I have given Ray's nominative of *Sinapi* rather than the modern *Sinapis*, as in the text of *Dictionariolum Trilingue* and in *Historia Plantarum* he gives the nominative as *Sinapi*.

Line 13. *Rapistri: Rapistrum*: see above Cap.13, line 12.

Line 13. *Sinapeos: Sinapi*: see above Cap.13, line 12.

Line 13. *Rapistrum*: see above Cap. 13, line 12.

Line 13. *Sinapi*: see above Cap.13, line 12.

Line 16. *Locustas & Astacos*: Lobsters and Crayfish are members of the *Crustacea* family, which also includes crabs, shrimps, slaters, woodlice and barnacles.<sup>1007</sup>

Line 17. *Anatis Arcticæ Clusii Alkæ Hoieri ejusdemque Lomwiæ tanto Anatum domesticarum ....* : the *Anatidæ* family, to which Ray seems to be referring here, includes swans, geese and ducks,<sup>1008</sup> but I have been unable to identify these birds as species of *Anatidæ*. However, in his *Discourse on the seeds of plants*, which Ray mostly paraphrases, or indeed translates into Latin, for this chapter he discusses in the parallel section the eggs of Duffin, Auk and Guillemot.<sup>1009</sup> The *Alcidæ* or Auk family does include birds which can be identified with those mentioned by Ray here. They are:

*Anatis Arcticæ* = *Fratercula arctica* or Puffin.

*Alkæ* = *Alca torda* or Razorbill, a member of the Auk family.

*Lomwiæ* = *Uria lomvia* or Brünnich's Guillemot. <sup>1010</sup>

This identification of the Puffin is confirmed by the letter sent by

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1007 *Oxford Dictionary of Natural History*: 173.

1008 Christopher M. Perrins, *The Illustrated Encyclopædia of Birds: The Definitive Guide to Birds of the World*, Guild Publishing, London and New York 1990: 76; Heinzel, Fitter and Parslow: 50-57.

1009 *Further Correspondence*: 70.

1010 Heinzel, Fitter and Parslow: 164.

Henry Oldenburgh to Ray on 21st December 1674, after he had read the above discourse for Ray to the Royal Society; in this he mentions three loose inserts (sent with the letter to Ray) which he had found in a book recently received on Africa. That marked number 1:

seems to represent the *Anas arctica Clusii* [the Puffin],  
the eye only is different, if I mistake not.<sup>1011</sup>

Line 17. *Clusii: Clusius*: for de l'Écluse see above Cap.11, line 77.

Line 17. *Hoieri*: the only reference I can find to Hoier is in Pulteney's *Linnæus*, where he gives as number 48 of Linnæus' *Amœnitates Academicæ*, Volume II, published in 1756, the work entitled *Demonstrationes Plantarum* by J.G. Hojer, published in 1753.<sup>1012</sup> Although the following is mere conjecture and its date would suggest that this cannot be by the same Hoier, it may be a later edition of a work known to Ray, and other work by the same author, perhaps on birds [hence the naming of *Alca Hoieri*], might have been known to Ray. Or the Hoier referred to in *Historia Plantarum* could conceivably have been a relative, perhaps this author's father.

Line 21. *Papaver*: see above Cap.10, line 30.

Line 21. *Nicotiana*: see above Cap.3, line 140.

Line 21. *Digitalis*: see above Cap.10, line 55.

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1011 *Correspondence*: 114.

1012 Pulteney, Richard. *A General View of the Writings of Linnæus*; T.Payne and B.White, London 1731: 263-264.

Line 21. *capillares omnes: capillares* is the name given by Ray to the ferns. He distinguished between flowering and non-flowering plants, including giving a more precise definition of the ferns than previous botanists.<sup>1013</sup> See also Cap.12, line 170, on the spores of ferns. In classical Latin *capillaris, -e*, is an adjective meaning ‘of’ or ‘pertaining to the hair’;<sup>1014</sup> this is an accurate description of many, but not all, ferns.

Line 21. *Sinapi*: see above Cap.13, line 12.

Line 22. *Typha*: see above under *Typha major* Cap.12, line 161.

Line 23. *fabā: Faba*: see above Cap.9, line 20.

Line 23. *piso: Pisum*: see above Cap.9, line 20.

Line 24. *lupino: Lupinus*: see above Cap.9, line 16.

Line 24. *cicere: Cicero*: see above Cap.12, line 111.

Line 24. *melone: Melo*: see above Cap.10, line 12.

Line 24. *pepone: Pepo*: see above Cap.9, line 180.

Line 24. *cucurbitā: Cucurbita*: see above Cap.9, line 180.

Line 24. *flore solis: Flos solis*: see above Cap.10, line 91.

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1013 Morton: 205.

1014 Lewis and Short: 283.



Line 24. *Phaseolo: Phaseolus.*

[*Kit.Gar.* 128]<sup>1015</sup> *Phaseolus vulgaris* (L.), French Bean, Kidney Bean ; a species of the *Phaseolus* genus of the *Leguminosæ* or Pea family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 101:

*Linn.Sp.Pl.* 723-725: *Syn.Meth.St.Br.* - no ref.: *H.P.* 884-890:

*H.P.III* 436-437: *Tri.* 11.100: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 884-890:

31 species given, including:

*Smilax hortensis* J.B. *Sm. hort. sive Phaseolus major* C.B.

*Phaseolus albus* Ger. *Phaseolus vulgaris* Park.

***Common Kidney-beans.***

*H.P.III* 436-437:

88 additional species given.

*Tri.* 11.100:

Kidney or French Bean: *Phaseolus*, -i, m.:

Φασίολας, -όλου, m.

Lines 24-29. *In iis etiam generibus .... non exceptis.* The examples given by Ray certainly do differ in size of seed between the annual and perennial forms.

Text page 25.

Line 26. *Pisa: Pisum:* see above Cap.9, line 20.

Line 26. *Latfyri: Lathyrus.*

[C.T.& M. 190-192] *Lathyrus* (L.), Vetch and Pea; a genus of the *Leguminosæ* or Pea family.

B.& G.-W. 210-212: B.& H. 124: *Linn.Sp.Pl.* 729-734:

*Syn.Meth.St.Br.* 319-320: *H.P.* 893-899: *H.P.III* 447:

*Tri.* - no ref.: *Cat.Angl.* 182: *Camb.* 78.

*H.P.* 893-899:

19 species given, including:

*Lathyrus major latifolius* Ger.emac. *major perennis* Park.  
*latifolius* C.B. *major latifolia, flore majore purpureo speciosior*  
J.B. *Clymenum* Matth. ***Pease everlasting.***

*H.P.III* 447:

20 additional species given.

Line 27. *Triticum.*

[C.T.& M. 634] *Triticum* resembles *Elymus* but has 1-2 hermaphrodite florets at the base of the spikelets and a number of male or sterile florets above, and the veins of the lemma are not convergent. The subspecies are annual or rarely biennial. The cultivated variants do not become naturalised and seldom persist for more than a year. *Gramineæ* or Grass family.

B.& G.-W. - no ref.: B.& H. 529: *Linn.Sp.Pl.* 85-86:

*Syn.Meth.St.Br.* 386-387: *H.P.* 1236: *H.P.III* 597: *Tri.* 14.206:

*Cat.Angl.* 294-296: *Camb.* 121-122.

*H.P.* 1236:

9 species given, including:

*Triticum spica mutica* Ger. Park. *Triticum hybernum aristis carens* C.B. *vulgare, glumas trituro deponens*. J.B.

***White or Red Wheat without awns.***

*H.P.III* 597:

3 additional species given.

*Tri.* 14.206:

Wheat: *Triticum*, -i, n.: Πυρὸς, -οῦ, m.

Ray comments in a later work that:

It is worthy the noting, That *Wheat*, which is the best  
Sort of Grain, of which the purest, most savoury and

wholesome Bread is made, is patient of both Extremes, Heat and Cold, growing and bringing its Seed to maturity, not only in temperate Countries, but also on one Hand in the Cold and Northern, viz. *Scotland, Denmark &c.*; on the other, in the hottest and most Southerly, as *Egypt, Barbary, Mauritania, the East Indies, Guinea, Madagascar, &c.* scarce refusing any Climate.<sup>1016</sup>

Ray attributes this fruitfulness of Wheat to divine creation:

Nor is it less observable, and not to be commemorated without Acknowledgment of the Divine Benignity to us, that (as *Pliny* rightly notes) nothing is more fruitful than Wheat ..... If *Pliny*, a Heathen, could make this Fertility of Wheat argumentative of the Bounty of God to Man, making such plentiful Provision for him of that which is of the most pleasant Taste and wholesome Nourishment, surely it ought not to be passed over by us *Christians* without Notice taking and Thanksgiving.<sup>1017</sup>

Line 27. *Secale*: see above Cap.7, line 23.

Line 27. *Hordeum*: see above Cap.7, line 23.

Line 27. *Oriza*.

[*Mac.Enc.* 1037] *Oryza sativa* (L.), Rice; a species of the *Oryza* or *Leersia* genus of the *Gramineæ* or Grass family.

C.T.& M. 650 - various of the *Leersia* or *Oryza* genus but not 'Rice' itself: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 333: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1246:

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<sup>1016</sup> *The Wisdom of God*: 84.

<sup>1017</sup> *ibid.*: 84-85.

*H.P.III* - listed in the index to Volume III but no page number given: *Tri.* 13.166: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1246:

(Tr.) As the seed of *Oryza* was first brought from India, so Lobelius ascribed it the name *Indida*.

1 species only given:

*Oryza* J.B. C.B. Ger. Park. & aliorum omnium. **Rice.**

*Tri.* 13.166:

Rice: *Oryza*, -æ, f.: Ὄρυζα, -ης, f.

Line 27. *Avena*:

[C.T.& M. 635-636] *Avena* (L.), Oats; a genus of the *Gramineæ* or Grass family.

B.& G.-W. - no ref.: B.& H. 522: *Linn.Sp.Pl.* 79-80:

*Syn.Meth.St.Br.* 389: *H.P.* 1253: *H.P.III* - no ref.: *Tri.* 12.135:

*Cat.Angl.* 34: *Camb.* 46.

*H.P.* 1253:

4 species given, including:

*Avena alba* J.B. *vulgaris seu alba* C.B. *vesca* Lob. Ger. Park.

**White Oats.**

*Tri.* 12.135:

Oats: *Avena*, -æ, f.: Βρώμος, -ου, m.

Line 27. *Maiz*: see above Cap.10, line 3; see also *Fruentum* Cap.7, line 50; see also *Fruentum Indicum* Cap.10, line 3; see also *Fruentum Turcicum* Cap.12, line 144.

Line 27. *Fruentum Indicum*: see above Cap.10, line 3; see also *Maiz* Cap.10, line 3; see also *Fruentum* Cap.7, line 50; see also *Fruentum Turcicum* Cap.12, line 144.

Line 28. *Graminum: Gramineae*: see above Cap.7, line 51.

Line 29. *Arundinibus: Arundo*: see above Cap.7, line 50.

Lines 29-30. *Semina omnia ....*: he is incorrect in saying that these are all annual plants as they do in fact have both annual and perennial forms.<sup>1018</sup> He contradicts himself in the earlier and more detailed *Discourse on the Seeds of Plants*,<sup>1019</sup> when he admits that some are perennial, saying:

For I doubt not but many perennial grasses bear esculent seed, as well as these annual ones, which we call corns; and I believe some perennial pulse too, though none so large as these annual ones we use.<sup>1020</sup>

Line 31. *Secale*: see above Cap.7, line 23.

Line 31. *Triticum*: see above Cap.13, line 27.

Line 31. *Oriza*: see above Cap.13, line 27.

Line 31. *Sorghum*: [*Mac.Enc.* 1137] Sorghum, a genus of annual or perennial grasses (*Gramineæ*) with about 30 species, native to Africa, especially *Sorghum vulgare*, of which there are several varieties, such as sweet Sorghum or *Durra*, and Kaffir corn, widely cultivated as cereal crops. Usually growing up to 2.5 metres high, they have rigid stalks, sometimes containing a sweet sap, long flat

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1018 Clapham, Tutin and Moore: *passim*.

1019 *The Discourse on the Seeds of Plants* is much more detailed than the comparable section of *Historia Plantarum*; although written much earlier (1674) Ray seems to have used it extensively for this section although in an abbreviated and less qualified form, which could explain the apparent contradictions.

1020 *Further Correspondence*: 71.

leaves, and terminal flower clusters bearing 800-3000 starch-rich seeds. The seeds are used as grain for making bread etc. and as a source of edible oil, starch and sugar. The stalks are used as fodder or sometimes for syrup manufacture.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1047: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1252:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1252:

2 species given, including:

*Sorghum* Ger. J.B. *Melica sive Sorghum* Park. *Milium*

*Arundinaceum sive Indicum semine subrotundo* C.B.

**Indian Millet.**

Line 31. *Frumentum Indicum*: see above Cap.10, line 3; see also *Maiz*

Cap.10, line 3; see also *Frumentum* Cap.7, line 50; see also

*Frumentum Turcicum* Cap.12, line 144.

Line 31. *Milium*: see above Cap. 7, line 24.

Line 31. *Panicum*.

[C.T.& M. 650] *Panicum* (L.), Panic Grass; a genus of the *Panicaceæ* tribe of the *Gramineæ* or Grass family.

B.& G.-W. - no ref.: B.& H. 509: Linn.*Sp.Pl.* 55-59:

*Syn.Meth.St.Br.* 393-394: *H.P.* 1247: *H.P.III* 597: *Tri.* 12.139:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1247:

(Tr.) In Lib. 18, Cap.7.,<sup>1021</sup> Pliny gives the etymology

of *Panicum*, which is to the Greeks <sup>7</sup>Ἐλυμος and

Μελίνη, when he says that *panicum* comes from

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1021 Pliny, *Historia Naturalis* XVIII, x: 53; Loeb edition V: 223-224.

*panicula*.<sup>1022</sup> A little later he says, "There is a particular variety of *panicum*, which is clustered with small tufts growing out of the ear."<sup>1023</sup>

But *panicum* cannot be said to come directly from *panicula*; for he repudiates the analogy, *panicula* being a diminutive of *panus*, which is therefore the origin of both *panicum* and *panicula*. Moreover *panus* comes from πῆνος for which the Dorians and Aeolians wrote πᾶνος: from πῆνος moreover πήνικη ἢ θρίξ καὶ κομή. Voss. Etymolog.

4 species given, including:

*Panicum Germanicum sive panicula minore* C.B. *Panicum vulgare* J.B. Ger. *Panicum album vulgare* Park. **Panick**. In *Gerardo emaculat, icones duas ultimæ sunt transpositæ*.

H.P.III 597:

1 additional species given:

*Tenna* H.M.p.12.F.79. *vel idem est cum Panico vulgari vel ei valde simile*.

Tri. 12.139:

**Panick**: *Panicum*, -i, n.: Ἐλυμος, -ύμου, m.

Line 31. *Αvena*: see above Cap.13, line 27.

Line 31. *Hordeum*: see above Cap.7, line 23.

Line 32. *Faba*: *Faba*: see above Cap.9, line 20.

Line 32. *Pisa*: *Pisum*: see above Cap.9, line 20.

1022 *panicula* = 'a tuft', Lewis and Short: 1297

1023 Pliny, *Historia Naturalis* XVIII, x: 53; Loeb edition V: 223-224.

Line 32. *Lentes: Lens.*

[Mac.Enc. 715] *Lens culinaris* [*Ervum lens* (L.)], Lentil; a species of the *Lens* genus of the *Leguminosæ* or Pea family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 738: *Syn.Meth.St.Br.* 323: *H.P.* 904-905:

*H.P.III* 449: *Tri.* 11.109: *Cat.Angl.* 183: *Camb.* 79.

*H.P.* 904-905:

(Tr.) *Lens*, says Priscianus in VII, is either derived from *lenis* or *lentis*, as Vett. correctly stated. The reason for the name is believed to come about because it makes a smooth and palatable food. Pliny, Book VII, Cap.12, says "I find in other authors that it causes a calmness in those eating it."

*Lens* is distinguished from the remaining

*Viciae* by its flattened seed and broad, short pods.

5 species given, including:

*Lens* J.B. *minor* Ger. *Park. vulgaris* C.B. *Lentils.*

*H.P.III* 449:

*Ad cap. de Vicia, post decimam speciem:*

*Lens Africana, Elatines foeminae folio singulari, pilis longioribus hirsuta, a Promont. Bae. Spei. Pluk. Mantiss.*

*Tri.* 11.109:

Lentils: *Lens, Lentis*, f.: Φακὴ, ἤσ, f.

*Camb.* 79:

*Lens, Lentills.* [*Ervum lens* (Linnæus)].

(Tr.) It is grown in fields and very often mingled with barley.

For the great value attached to *Lens* in the past see Athenæus Lib.4, Cap.18.

N. Concerning this plant I can bear witness by an actual



experiment that it sometimes turns to stone in a field in spring. C.Hofman. *De Medicam Officin.:* Lib.2, Cap.124.

For why legumes grow more quickly and exhaust the ground less than wheat, see Theophr. *De Causis Plantarum:* Lib.14, Cap.9.

Line 32. *Viciae:* *Vicia:* see above Cap.9, line 20.

Lines 36-37. *Vinca Pervinca .... eas scilicet semen rarius perficere:* contrary to what Ray says here these plants all do produce seed.<sup>1024</sup>

Line 36. *Vincā Pervincā:* *Vinca Pervinca.*

[C.T.& M. 350-351] *Vinca minor* (L.), Lesser Periwinkle; a species of the *Vinca* genus of the *Apocynaceæ* or Periwinkle family.

B.& G.-W. 310: B.& H. 298: Linn.*Sp.Pl.* 209:

*Syn.Meth.St.Br.* 268: *H.P.* 1091: *H.P.III* - no ref.: *Tri.* 12.145:

*Cat.Angl.* 305 with a ref. to see *Clematis daphnoides* 72-73:

*Camb.* - no ref.

*H.P.* 1091:

2 species given, including:

*Clematis daphnoides minor* C.B. J.B. *Vinca pervinca minor*

Ger. *vulgaris* Park. ***Periwinkle.***

*Tri.* 12.145:

Periwinkle: *Vinca pervina*, -æ, f.:

Κληματίς, -ίδας, δαφνοειδής, f.

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1024 Clapham, Tutin and Moore: 350-351, 583, 447 and 91.

Line 36. *Colocasīā: Colocasia.*

[C.T.& M. 583] but not this species; a species of the *Arum* genus of the *Araceæ* or Arum family.

B.& G.-W. 470 (not this species): B.& H. 420 (not this species):

Linn.*Sp.Pl.* 965: *Syn.Meth.St.Br.* 266 (not this species):

*H.P.* 1209: *H.P.III* 581: *Tri.* - no ref.: *Cat.Angl.* - no ref.:

*Camb.* - no ref.

*H.P.* 1209:

*Arum maximum Ægyptiacum, quod vulgo Colocasia* C.B. *Ar.*

*Ægypt. rotunda & longa radice, vulgo Colocasia dicta* Park.

*Colocasia* J.B. *Ægyptiacum* Ger.

*H.P.III* 581:

5 additional species given.

Line 36. *Battatā Canadensi: Battata Canadensis.*

[C.T.& M. 447] *Helianthus tuberosus* (L.), Jerusalem Artichoke; a species of the *Helianthus* genus of the *Compositæ* or Daisy family.

B.& G.-W. 406: B.& H. 225: Linn.*Sp.Pl.* 905:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 335: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 335:

*Flos solis pyramidalis, parvo flore, tuberosa radice,*

*Heliotropium Indicum quorundam* Ger.emac. *Helianthemum*

*Indicum tuberosum* C.B. *Battata Canadensis* Park.

**Jerusalem Artichoke.**

See also under *Flos solis pyramidalis* Cap.3, line 87.

Line 37. *Raphano rusticano: Raphanus rusticanus.*

[C.T.& M. 91] *A Armoracia rusticana* (P.Gaertner, B.Mayer and Scherb), Horse-radish; a species of the *A Armoracia* genus of the *Cruciferæ* or Cress family.

B.& G.-W. 138: B.& H. 39: Linn.*Sp.Pl.* 648:

*Syn.Meth.St.Br.* 301: *H.P.* 818: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 251: *Camb.* 101.

*H.P.* 818:

*Raphanus rusticanus* Ger. Park. C.B. *sylvestris sive Armoracia multis* J.B. **Horse-radish.**

Line 41. *Herba Gerardii*

[C.T.& M. 283] *Ægopodium podagraria* (L.), Goutweed, Ground Elder, Herb Gerard; a species of the *Aegopodium* genus of the *Umbelliferae* or Carrot family.

B.& G.-W. 272: B.& H. 182: Linn.*Sp.Pl.* 265:

*Syn.Meth.St.Br.* 208: *H.P.* 435: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 159 with a ref. to see *Angelica sylvestris* 22:

*Camb.* - no ref.

*H.P.* 435:

*Angelica sylvestris minor sive erratica* C.B. *sylv. repens* J.B.

*Herba Gerardii* Ger. *Podagraria vulgaris* Park.

**Herb Gerard, Gout-wort, or Ashweed.**

Line 41. *Solanum halicacabum.*

[C.T.& M. 367] *Physalis alkekengi* (L.), Cape Gooseberry; a species of the *Hyoscyamus* genus of the *Solanaceae* or Potato family.

B.& G.-W. 348: B.& H. 317: Linn.*Sp.Pl.* 183:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 681: *H.P.III* 356: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 681:

*Solanum halicacabum vulgare* J.B. *vesicarium* C.B.

*halicacabum* Ger. *halicacabum sive Alkekengi vulgare* Park.

**Winter Cherry.**

H.P.III 356:

14 additional species given, including:

*Alkakengi foliis mollibus, fructu Asparagi* D.Petiver in  
*Act.Philosoph.Lond.N.271*, p.855. *Aumacarum-calunga* Malab.  
*Ad 4 pedum altitudinem excrescit. Radicem habet tuberosam,*  
*pugnum crassam, quae cum Lini succo pista, & apposita*  
*Apostemata sanat, in pulvere sumpta febres hecticas profligat.*  
D.S.Brown.

Line 41. *Herba Gerardi, Solanum halicacabum*: Ray is correct in saying that these two plants propagate vegetatively by means of 'creeping roots' or what we now call rhizomes, but nevertheless produce seed.<sup>1025</sup>

Line 42. *Fragaria*: see above Cap.7, line 56.

Line 42. *Ranunculus repens*.

[C.T.& M. 41] *Ranunculus repens* (L.), Creeping Buttercup; a species of the *Ranunculus* genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 114: B.& H. 9: Linn.*Sp.Pl.* 554:

*Syn.Meth.St.Br.* 247: *H.P.* 581: *H.P.III* - no ref.:*Tri.* - no ref.:  
*Cat.Angl.* 250: *Camb.* 101.

*H.P.* 581:

*Ranunculus pratensis repens* Park. *prat. repens hirsutus* C.B.  
*pratensis etiamque hortensis* Ger. *repens flore luteo simplici*  
J.B. **Common creeping Crowfoot or Butter-cups.**

Line 42. *Fragaria & Ranunculus repens*: again he is correct in saying that, as well as producing seed, these two plants reproduce vegetatively by means of 'shoots', or what we now call stolons which root at the

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<sup>1025</sup> Clapham, Tutin and Moore: 283 and 367.

nodes and usually produce further flowering stems in the current season.<sup>1026</sup>

Line 46. *Plinius aliquae rei naturalis scriptores .... longiora vitae spatia*: Ray seems to be referring to the passage of Pliny in which he is discussing the life span of elephants. Pliny states that the period of gestation of an elephant is usually believed to be ten years, but he says that Aristotle gives it as two. He continues by saying that elephants can live for up to three hundred years.<sup>1027</sup>

Line 50. *Ulnum: Ulmus*: see above Cap.4, line 145.

Line 52. *Semina plantarum oleo copiosiore scatent ....*: Ray has correctly observed that the seeds of plants are as he says 'oily'. The most characteristic seed reserve material is fat, normally in a liquid or, as Ray says, 'oily' form. Fats have a high calorific content and so more calories can be stored in a small space than with other food reserves such as starch.<sup>1028</sup>

Line 55. *salem volatilem*: the term sal volatile had been first used in English in 1654; it is composed of Ammonium carbonate, especially an aromatic solution of this used as a restorative in fainting fits.<sup>1029</sup>

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1026 Clapham, Tutin and Moore: 217 and 41.

1027 Pliny: *Historia Naturalis* VIII, x: 28; Loeb edition III: 22.

Pliny is correctly quoting Aristotle here: Aristotle, *Τῶν Περὶ Τὰ Ζῷα Ἱστορίων* [*Historia Animalium*]: 54 6b, 11.

1028 *Lowson's Botany*: 131-132.

1029 *OED*: 1881.

Line 56. *Wedelius in Experimento novo chymico de sale volatili plantarum.*<sup>1030</sup>

*Wedelius* / Georg Wolfgang Wedel studied philosophy and medicine. In 1667 he practised briefly in Landsberg and then returned to Jena, where he qualified in medicine and began giving lectures. In 1673 he took up the chair in anatomy, surgery and botany, and following this the chair in theoretical medicine. After the death of a colleague he assumed the chair of practical medicine and chemistry in 1719. In a sense he stood midway between mediaeval and modern views of science, defending astrology and alchemy yet supporting iatrochemistry. Wedel had described the preparation of Woad and this is referred to by Ray in *Historia Plantarum*, page 842, but it is supplemented by an account given him by an unnamed friend.<sup>1031</sup>

Lines 58-67. *Quot annos semina plantarum fœcunda durabunt ..... :*

Ray continues his discussion of seeds with facts and figures on the longevity of seeds, that is on how long they remain viable and can germinate.

Ray himself believed that nature, that is the divine creator, had enabled seeds to survive for long periods of time as a means of ensuring the perpetuation of the species:

And for the Security of such *Species* as are produced only by Seed, it hath endued all Seed with a lasting Vitality, that so if by Reason of excessive Cold, or Drought, or any other Accident, it happen not to germinate the first Year, it will continue its Fecundity, I do not say two or three, nor six or seven, but even twenty or thirty Years; and when the Impediment is removed, the Earth in fit Case, and the Season proper,

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1030 That Ray did not own a copy of this work is indicated by the sale catalogue of his library: British Musuem: S-C 326 (6).

1031 *DSB XIV*, 212-213; Raven, 227.

spring up, bear Fruit, and continue its Species. Hence it is that Plants are sometimes lost for a while in Places where they formerly abounded; and again, after some Years, appear new: Lost either because the Springs were not proper for their Germination, or because the Land was fallowed, or because Plenty of Weeds or other Herbs prevented their coming up, and the like, and *appearing* again when these Impediments are removed.<sup>1032</sup>

There is an interesting discussion on this in a modern work, which I quote in full:

In uncontrolled or 'natural' conditions of storage many seeds soon lose their viability. With seeds which have fairly permeable coats and which germinate readily when moistened, the period of survival ranges from a few days (willows and poplars) to about twenty-five or thirty years (some grasses and legumes). The longer periods and the very short ones are relatively uncommon; with most species in this category (which, of course, includes all the common crops) death at two to five years may be regarded as the normal thing. In any one seed sample the death rate is low at first, then rises to a peak which brings the death of most of the seeds, and falls again until the death of the last survivor. With wheat, for instance, a very few seeds may survive twenty years or even a little longer, but most are dead at twelve, and some are dead at five.<sup>1033</sup>

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<sup>1032</sup> *The Wisdom of God*: 83.

<sup>1033</sup> *Lowson's Botany*: 130-131.

That the number of seeds produced is not necessarily an indicator of viability is shown in the following chart, giving the 'average reproductive capacity':<sup>1034</sup>

	% of seeds viable
<i>Mercurialis perennis</i> (dog's mercury)	5-15
<i>Mercurialis annua</i> (annual mercury)	70
<i>Alnus glutinosa</i> (alder)	25
<i>Betula pendula</i> (birch)	25
<i>Fraxinus excelsior</i> (ash)	90
<i>Verbascum thapsus</i> (mullein)	88

Line 59. *D. Morrisonus*: Morrison / Robert Morison: 1620-1683. Physician and first holder of the chair in botany established at Oxford in 1669; it was left in abeyance for forty years after his death in 1683.

Morison attacked Ray in 1669, after Ray's tabular classification of plants was published by the Royal Society in 1668 to accompany his friend John Wilkin's *Essay Towards a Real Character and Philosophical Language*. This classification was artificial and drawn up in a bifurcating form in accordance with Wilkin's requirements and could not really be said to be the work of Ray.<sup>1035</sup> Morison had disregarded the context in which it had been written and he implied that Ray knew no botany. This episode led to lasting bad feeling between the two men, although Ray did not enter into open argument with Morison.<sup>1036</sup>

Morison regarded himself as a pioneer in plant classification and had written a monograph on the *Umbelliferae*, which had some merit. His scheme of classification was not published until after his death, when it was edited by J. Bobart. It

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1034 Turrill: 176.

1035 Vines: 31-34; *Syn.Meth.St.Br.* 39.

1036 Raven, 183-186; Vines: 21.



was, however, mainly based on the work of Cesalpino.<sup>1037</sup>

Morison's botanical works are:

1. *Hortus regius Blesensis auctus, præludium botanicorum*  
(London 1669), known as *Prælu di a botanica*.<sup>1038</sup>
2. *Plantarum Umbelliferarum distributio nova* (Oxford 1672).
3. *Plantarum historiæ universalis Oxoniensis pars secunda* (Oxford 1680).<sup>1039</sup>
4. *Plantarum historiæ universalis Oxoniensis pars tertia*, Jacob Bobart [ed.] (Oxford 1699) introduced with a biographical sketch of Morison by Archibald Pitcairne.
5. Morison also edited Paulo Boccone's *Icones et descriptiones rariorum plantarum* (Oxford 1674).<sup>1040</sup>

Line 63. *Lennæ Norfolkicæ*: this is presumably a description of the composition of the dung-hill, but I have been unable to trace the origin of the term.

It is possible that he is meaning *lemmæ* and not *lennæ*; the lemma is the term used for the lower chaffy part of the floret of a grass spikelet.<sup>1041</sup> He could therefore be referring to a compost heap of grass or hay cuttings.

On the other hand he may mean that the compost heap is composed of *Lemna* or Duckweed (sometimes called *Lens palustris*), which is very common in marshy areas such as East Anglia.<sup>1042</sup> Linnæus in

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1037 Vines: 21-22; see also Britten and Boulger: 221; and G.C.Druce, *Account of the Morisonian Herbarium* 1914; Sachs 66-68 *et passim*; Raven 30, 64, 77, 151.

1038 That Ray owned a copy of this work is indicated by the sale catalogue of his library: *Prælu di a Botanica*, edition published in London in 1669; British Musuem: S-C 326 (6): 11, *Libri Latine &c. in Octavo*, number 82.

1039 This and the following book are presumably the works listed in the sale catalogue of Ray's library as:  
*Historia Plantarum Tom.I and Tom.II*, edition published in Oxford in 1680 and 1699; British Musuem: S-C 326 (6): 1, *Libri Latine &c. in Folio*, number 28.

1040 *DSB IX*: 528-529.

1041 *Oxford Dictionary of Natural History*: 281.

1042 Clapham, Tutin and Moore: 583.

his *Species Plantarum* has *Lemma* (*Lens palustris*) as one of the names for *Marsilea quadrifolia*: 1099:

*Marsilea foliis quaternatis.*

*Lemma.* Juss.act. 1740.p.263. Guett.stamp.1.p.62.

*Lenticula palustris quadrifolia.* Bauh.pin. 362.

Mapp.alsat.166.t.166.

*Lens palustris quadrifolia.* Bauh.hist.3.p.789.

Moris.hist.3.p.619.s.15.t.4.f.5.

A third, although more remote possibility, is that Ray intends to mean 'lentils' (*Ervum lens*), which are members of the *Leguminosæ* or Pea family, and as such are rich in nitrogen and could have been used for composting, indeed possibly have even been grown specifically for the purpose as a 'green compost'.

Lines 67-70. *Multum autem conducit ad fœcunditatem prorogandam seminum conservatio*: Ray realised that the conditions under which seeds are kept influences their viability.

The discussion quoted above from Lawson continues:

Where the expectation of life is short (not more than a year or two) it is often possible to maintain viability far beyond the normal term by controlling the conditions of storage. This usually involves keeping the seed in dry air at a temperature only slightly above freezing. In the laboratory poplar seeds can be kept viable for at least twenty times their normal span. Seeds which naturally live longer do not react in this way; so far as can be seen at present no amount of tinkering will make much difference to life-spans of ten years and over.<sup>1043</sup>

Lines 73 and 74. *Sinapeos*: *Sinape*: see above Cap.13, line 12.

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1043 *Lowson's Botany*: 131.

Lines 58-75. Section VI. *Quot annos .... per tot annos residuis etiam prolificis.*

Throughout this section Ray gives examples from several sources of the longevity of various seeds; although he has doubts he does believe, as in the case of *Sinapis*, that seeds can lie dormant for many years before germinating.

Lowson too gives (modern) facts and figures but without giving actual examples:-

Among the hard-coated seeds, which occur in a large number of species, survival to eighty years is certainly quite common, and there are several reliable records (all for rather large seeds) in the range 150-200 years. Beyond this it is difficult to go, because a dated collection of seeds more than 200 years old is a very uncommon thing. It will not, however, be very surprising if the figures ultimately have to be raised a little. Very much longer periods of survival, running into thousands of years, have sometimes been claimed, but are not generally accepted.<sup>1044</sup>

Line 74. *Quam tamen non sponte ortam suspicor, sed e seminibus in terra per tot annos residuis etiam prolificis.* Ray here denies the possibility of spontaneous generation. He is agreeing with Jung, who had discussed Theophrastus' work on this at length,<sup>1045</sup> and came to the conclusion that spontaneous generation was unlikely.<sup>1046</sup>

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<sup>1044</sup> Lowson's *Botany*: 131.

<sup>1045</sup> Theophrastus believed that climatic conditions caused changes in plants:  
ἀλλ' ἐκεῖνο συμβαίνει περὶ τὰ δένδρα καὶ ὅλως πᾶσαν  
τὴν ὕλην, ὥσπερ ἐλέχθη καὶ πρότερον, ὥστε αὐτομάτην  
μεταβλαστάνειν μεταβολῆς τινος γινομένης ἐκ τῶν  
οὐρανίων τοιαύτης.

[That kind of change occurs in trees and in all woodland plants generally, as was said before, and its effect is that, when a change of the required character occurs in the climatic conditions, a spontaneous change in the way of growth ensues.]

Theophrastus, *Περὶ Φυτῶν Ἱστορίας* [*Enquiry into Plants*] II.iv.4.

<sup>1046</sup> Morton on the fourth fragment of Jung's *Doxoscoπiα*: 174.

Lines 76-82. *Semina omnia .... quo nutritur & augetur*. Ray is incorrect here in believing that seeds derive their first nourishment from an outside source.

All requirements for early growth are met from within the seed itself with the single exception of water, which at this stage does no more than soften the testa or seed coat to enable the seedling to emerge. Until the root system is developed a seedling cannot absorb minerals or vitamins from outside; it has to contain within itself all of these requirements for growth.<sup>1047</sup>

Line 79. *fenestella*: cf. Cap.12, line 100.

Lines 83-117. *Magna est analogia .... cum successu frequentari scribit*. This is virtually a transcription and translation into Latin of the comparable paragraphs in *The Discourse on the Seeds of Plants* apart from two particular sections at lines 91-92 and line 116, for which see below.<sup>1048</sup> Both Ray and Malpighi<sup>1049</sup> created problems for themselves by implying analogies between the structures of the uterus of animals and plants; Grew did not fall into this trap.

Lines 87-90. *sic pariter ovum Animalis vivipari .... alimentum per membranas involventes seu secundas attrahit*. Ray is almost correct in the details of the development of the egg of 'a viviparous animal'.

After the egg leaves the ovary, fertilisation takes place in the fallopian tube (Ray believes it to happen in the ovary itself), and then the blastocyst (the developed form of the fertilised egg or zygote) is implanted in the lining of the uterus (the endometrium) at

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1047 *Lowson's Botany*: 132.

1048 *Further Correspondence*: 76-77.

1049 Malpighi, *Anatome Plantarum*: 57-63.

the point where the placenta then forms.<sup>1050</sup> However apart from a short period before implantation it is never really 'free' in the uterus as Ray implies. The embryo is nourished through the 'afterbirth' as Ray calls it, at least through a part of what we now term the afterbirth, which consists of the placenta and membranes surrounding the foetus.<sup>1051</sup>

Lines 91-93. *Ovario voco .... quem congeries seu racemos ovarum necessario confitebitur.* Ray seems, despite being a scientist, to be embarrassed at giving this information but he says he can produce proof, if necessary, that the ovaries are nothing more than a cluster of eggs. Ray's informant had correctly observed the structure of the ovary, that it contains many immature eggs in tiny follicles, which are released individually at the time of the menstrual cycle (or ovulation).<sup>1052</sup> However compare the section in *The Discourse on the Seeds of Plants* in which Ray discusses the same phenomenon, where he appears to be citing the evidence of his own eyes. Here he says:

By the ovaria, I mean the bodies usually called testes foeminei, which whosoever will but make use of his eyes, diligently to view in swine, and other multiparous and salacious animals, must needs acknowledge to be nothing but masses or clusters of eggs.<sup>1053</sup>

NB The term female testicles for the ovaries had been used first by the Alexandrian physician, Herophilus.<sup>1054</sup>

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1050 *Harrap's Dictionary of Medicine*: 211.

1051 *ibid.*: 8.

1052 *ibid.*: 295.

1053 *Further Correspondence*: 76.

1054 For a discussion of Herophilus' investigations of the reproductive organs, see *Greek Rational Medicine*: 197-199.

Text page 26.

Line 98. *capillarium fibrarum*: Ray's capillary fibres are the root hairs, which are single-celled projections from the root serving to increase the surface area for absorption of water and solutes from the soil.<sup>1055</sup>

Line 100. *P. Laurembergius: Horticult. cap.21§1*: reference in text to Lauremberg, followed by a direct quotation: *Nulla (inquit ille) fere stirps est ..... sursum nonnihil vergat:*

Line 102.  $P\chi^{2/3}i$   $ceræ^{2/3}$   $terebinth.^{2/3}i$   $resinæ^{2/3}i$   $communi_s^{2/3}ii$   $commixtis:$

This formula of Lauremberg's may be a mixture for preventing water loss at the cut end rather than being similar to a modern rooting compound. [Note the use of the abbreviation used in medical prescriptions, Pχ, the contracted form of the Latin *recipe*, i.e. 'take'.]

Ray's *Discourse on the seeds of plants*, delivered to the Royal Society on 17th December 1674, suggests that a wound seal is meant here.<sup>1056</sup>

Graft seals (known as 'pugs') and wound dressings are still used on occasion nowadays, although not usually for the basal cut of a stem cutting. They may be made of grafting clay (clay, cow-dung and hay), hot grafting waxes (resin, Burgundy pitch and tallow), cold brush waxes (resin, beeswax, talc and methylated spirit), rubber latex seals (vulcanised rubber), bitumen emulsions, paraffin wax (melted candle wax), petroleum jelly or waxed cloth held with adhesive tape.<sup>1057</sup>

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<sup>1055</sup> *Penguin Dictionary of Botany*: 317.

<sup>1056</sup> *Further Correspondence*: 76-77.

<sup>1057</sup> The formulæ for preparing these graft seals may be found in Garner, *Grafter's Handbook*: 76-82.

The description of the cutting here suggests that it is a hardwood cutting rather than a soft or semi-ripe cutting, although perhaps the Greek word ἀποσπασμάτια, ‘fragments torn off’ [line 100],<sup>1058</sup> suggests a semi-ripe cutting, which would be ‘torn off’ with the heel of the main stem attached. The cutting mentioned in Lauremberg’s description may just be the trimming of this heel before planting. As all except soft cuttings take a considerable time to root, Lauremberg’s elaborate formula for treating the cut end and the method of bending the stem may be unnecessary, as once a callus has formed at the cut end adventitious roots will grow.<sup>1059</sup>

Lines 104-105. *ita tamen ut delitescat. In hoc casu ....* : are these Ray’s words? Although not in italics (as a quotation) it does, however, since the first four words follow a comma in the text, appear to be part of the quotation from Lauremberg.

Line 107. *Pomiferis: Pomiferae*: literally ‘apple-bearing’.

Line 114. *Codlings & Moyls*: English terms used by Ray perhaps for added clarity.

*Codlings*.

[B.& H. 146] Codlings; a species of the *Pyrus* genus of the *Rosaceæ* or Rose family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: Linn.*Sp.Pl.* - no ref.:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1447: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

<sup>1058</sup> ἀποσπασμάτια from ἀποσπᾶω, ‘to tear’ or ‘drag away from’: Liddell and Scott: 218.

<sup>1059</sup> Garner, *Grafter’s Handbook*: 48-49.

H.P. 1447:

*The Codling. Pomum coctile. Externe albicat, e latere foli  
obverso rubore perfusum; cuticula lævi, quam a coctione facile  
exiit. Crudum vix editur ob duritiem & aciditatem, sed coctum  
vel cum cremore lactis, vel cum aqua rosacea & Saccharo  
comestum inter laudatissima fercula habetur.*

Moyls: presumably a species of Apple.

Line 115. *D. Josselino*: John Josselyn: that Ray had read Josselyn's description of New England<sup>1060</sup> is also mentioned by him in his address given to The Royal Society in December 1674, in which he gives more details on the propagation of fruit trees.<sup>1061</sup>

Line 116. *in omne genus Malis & Pyris cum successu*:

*Malis: Malus*: see above Cap.4, line 145.

*Pyris: Pyrus*: see above Cap.4, line 145.

In *Historia Plantarum* Ray cites Josselyn as saying that this method of propagation was used successfully 'in all kinds of Apples and Pears', but in the comparable passage of *The Discourse on the Seeds of Plants* he cites Josselyn as saying,

That the inhabitants there do practise, with good success,  
this manner of propagating all sorts of fruit-trees.<sup>1062</sup>

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1060 John Josselyn, *New England's Rarities Discovered*, London 1672.

Ray does not appear to have owned a copy of this work, as is indicated by the sale catalogue of his library: British Museum: S-C 326 (6).

1061 *Further Correspondence*: 77; see also Raven: 332.

1062 *Further Correspondence*: 77.



## Chapter Fourteen:

### *On the leaves of plants called seminal or seed leaves.*

In this chapter Ray begins to define cotyledons although nowhere in this chapter does he use the actual term 'cotyledon'; this term does not appear in *Historia Plantarum* until Chapter 15, line 129, when Ray gives it in a quotation from Malpighi. The whole of this short chapter is translated into Latin from Ray's earlier work *A Discourse on the Seeds of Plants*.<sup>1063</sup> <sup>1064</sup> Ray also included much of this material in *Methodus Nova* in 1682 in the section *De Foliis Plantarum seminalibus dictis*.<sup>1065</sup> By the time of the publication of *Methodus Plantarum emendata et aucta* in 1703, Ray had refined his system of classification and, although not applying it to trees and shrubs, he used it to classify herbs, using the number of seed leaves as a specific characteristic.<sup>1066</sup>

A modern definition of a cotyledon is that it is the first leaf of the embryo in seed bearing plants (Angiosperms) and in most non-endospermic plants contains the main food reserves for the developing seedling. The number of cotyledons is an important taxonomic characteristic which separates the two classes of Monocotyledons and Dicotyledons.<sup>1067</sup> The cotyledons vary in character (thin or fleshy) and may remain inside the seed or emerge to become the first photosynthesizing organs. There is a modern conflicting idea that it is wrong to regard the cotyledons as leaves, although they can show leaf-like

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1063 John Ray, *A Discourse on the Seeds of Plants*, presented at a meeting of The Royal Society on 17th December 1674; reprinted in *Further Correspondence*, this section on page 71.

1064 NB. Ray does not use the term 'cotyledon' in this work either.

1065 Raven (p.195) has a footnote stating that:  
'It is interesting that the earliest publishers' review, *Weekly Memorials for the Ingenious*, issued by Faithorne and Kersey and bound up as a volume in 1683, in a notice of the *Methodus Plantarum*, 26 June 1682, draws attention to the seed-leaves and calls them cotyledons.'

1066 NB. Although the number of cotyledons seems to be in isolation an accidental characteristic, when it is linked with other characteristics it signifies 'a true congeneric grouping'.  
Morton: 204.

1067 *Penguin Dictionary of Botany*: 89.

tendencies, preferring instead to regard them as fleshy lobes distinct from leaves.<sup>1068</sup> Throughout this chapter Ray is describing epigeal seedlings, that is with the cotyledons emerging above the ground from the seed and photosynthesizing; he gives many differences between these cotyledons and true leaves.<sup>1069</sup>

Ray uses the existence of seed leaves as proof of the impossibility of spontaneous generation;<sup>1070</sup> in *The Wisdom of God*, published in 1691, he states that:

I demand farther, Whether any of the Patrons of Spontaneous Generation in Plants did ever see any Herbs, or Trees, except those of the Grass-leaved Tribe, come up without two Seed-leaves? which, if they never did or could, it is to me a great Argument that they came all of Seed; there being no Reason else, why they should at first produce two Seed-leaves different from the Subsequent? And if all these *Species* (which are far the greatest Number) come from Seed, there is not the least Reason to think that any of the rest come up spontaneously.<sup>1071</sup>

Ray's work on the number of seed leaves for classification, *generalis plantarum distinctio*, into two broad divisions was in itself important, but had a broader impact. It was as Morton says:

of supreme importance for understanding the real "inner nature" of plants: it represented in botany the same kind of deepening of comprehension as the discovery of a "natural law" in the physical science. .... This division into *Dicotyledones* and *Monocotyledones* (dicotyledons and monocotyledons) was soon to be generally accepted and to become a basic feature of the classification of flowering plants.<sup>1072</sup>

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1068 *Lowson's Botany*: 132.

1069 *Oxford Dictionary of Botany*: 145.

1070 See note at Cap.18, line 164.

1071 *The Wisdom of God*: 228.

1072 Morton: 203.

Text page 26.

Line 1. *Seminum satorum pars maxima binis primulum foliis e terra exoritur:*  
he is correct in stating that the majority of plants have two 'seed leaves' since by far the larger group of Angiosperms are the Dicotyledons with about 250 families as opposed to the Monocotyledons with about 60 families.<sup>1073 / 1074</sup>

Lines 6-14. *Figura .... Urticæ aut Betonicæ modo:* for a discussion on the variations of shape in 'seed leaves' see *Lowson's Botany*, pages 136-143, where examples of the germination of various seeds is given and how the cotyledons may be lobed or folded.

There was obviously much doubt in the seventeenth century on the shape and number of seed leaves, as is indicated by a letter written by Ray to Tancred Robinson, in which he says:

I doubt whether Mr. Lewenhoeck's observations be exact; for in those of the seeds of plants I find him mistaken in some, v.g. radish, turnips, and others of that kind, which I have forty times dissected and opened with my hands, and seen clearly with my naked eyes. He saith they have four leaves, and figures them accordingly; whereas they have but two only, with a notch or crena at the top, but that not very deep, so as to make any show or appearance of two leaves. And it is clear, by their coming up, that they have but two leaves, for they bring up the very same that were inclosed in the seed. And Signor Malpighi agrees exactly with me, both in the number of leaves and the manner of their

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1073 *Penguin Dictionary of Botany*: 105 and 232-233.

1074 NB; there are exceptions to the rule concerning the number of cotyledons, as among dicotyledons seedlings occur in significant numbers with more than two cotyledons or even occasionally one, and more rarely among monocotyledons some species may produce two cotyledons: *Lowson's Botany*: 132-133.

complication, both in his figures and descriptions.<sup>1075</sup>

Line 7. *Umbelliferis. Umbelliferae*: see above Cap.11, line 55.

Line 10. *nasturtii hortensis: Nasturtium hortense.*

[C.T.& M. 79] *Lepidium sativum* (L.), Garden Cress; a species of the *Lepidium* genus of the *Cruciferae* or Cress family.

B.& G.-W. 154: B.& H.49: Linn.*Sp.Pl.* 644:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 825: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 825:

*Nasturtium hortense* Ger. Park. *vulgare* J.B. *hortense vulgatum*

C.B. *Common Garden-Cress.*

Line 11. *Brassicæ [sic]: Brassica*: see above under *Brassica* Cap.9, line 113.

Line 11. *Raphani: Raphanus.*

[C.T.& M. 76-77] *Raphanus* (L.), Radish; a genus of the *Cruciferae* or Cress family.

B.& G.-W. 160: B.& H. 49: Linn.*Sp.Pl.* 669:

*Syn.Meth.St.Br.* 296: *H.P.* 804-805: *H.P.III* - no ref.: *Tri.* 13.156:

*Cat.Angl.* 251: *Camb.* 101.

*H.P.* 804-805:

6 species given, including:

*Raphanus* J.B. *sativa* Ger. *vulgaris* Park. *Raph. major orbicularis vel rotundus* C.B. *item minor oblongus ejusdem*

*Radish.*

*Tri.* 13.156:

Radish: *Raphanus*, -i, m.: *Ῥάφανος, -άνου*, m.

Line 11. *Sinapeos: Sinapis*: see above Cap.13, line 12.

Line 11. *Rapæ: Rapa*: see above Cap.3, line 18.

Line 12. *Nasturtii Indici: Nasturtium Indicum*: see above Cap.7, line 54.

Line 12. *Geranii moschati: Geranium moschatum*.

[C.T.& M. 175] *Erodium moschatum* ([L.] L'Herit), Musk Stork's-bill; a species of the *Erodium* genus of the *Geranaceæ* or Geranium family.

B.& G.-W. 230: B.& H. 93: Linn.*Sp.Pl.* 680:

*Syn.Meth.St.Br.* 357-358: *H.P.* 1057: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* 131: *Camb.* - no ref.

*H.P.* 1057:

*Geranium cicutæ folio inodorum* Ger. *cicutæ folio minus & supinum* C.B. *moschatum inodorum* Park. *moschatum folio ad myrrhidem accedente minus* J.B.

**Field Cranes-bill. without sent** [sic].

*Geranium moschatum* Ger. Park. *Cicutæ folio moschatum ad Myrrhidem accedente majus* J.B.

**Musked Cranes-bill, Muscovy.**

Line 14. *Urticæ: Urtica*: see above Cap.9, line 59.

Line 14. *Betonicæ: Betonica*.

[C.T.& M. 413] *Stachys officinalis* ([L.] Trev.), [*Stachys betonica* (Bentham), *Betonica officinalis* (L.)], Betony; a species of the *Stachys* genus of the *Labiatae* or Mint family.

B.& G.-W. 338: B.& H. 355: Linn.*Sp.Pl.* 573:

*Syn.Meth.St.Br.* 238: *H.P.* 550: *H.P.III* 297: *Tri.* 8.18:

*Cat.Angl.* 39-40: *Camb.* 47.

H.P. 550:

4 species given, including:

*Betonica* Ger. *purpurea* C.B. *vulgaris purpurea* J.B. *vulgatior flore purpureo* Park. **Wood-Betony.**

H.P.III 297:

8 additional species given.

Tri. 8.18:

Betony: *Betonica*, -æ, f.: Κέστρον -ου, n.<sup>1076</sup>

Line 16. *Boraginis*: *Borago*: see above Cap.10, line 88.

Line 16. *Buglossi*: *Buglossus*: see above Cap.9, line 49.

Line 16. *Asperifoliis*: *Asperifoliae*: literally 'rough-leaved'.

Line 21. *Asperulā*: *Asperula*.

[C.T.& M. 426-427] *Asperula* (L.), Woodruffs; a genus of the *Rubiaceæ* or Bedstraw family.

B.& G.-W. 310: B.& H. 214: Linn.*Sp.Pl.* 103-104:

*Syn.Meth.St.Br.* 224: H.P. 483: H.P.III 284: Tri. 14.209:

*Cat.Angl.* 30: *Camb.* 45.

H.P. 483:

3 species given, including:

*Asperula* Ger. *Asp. II. sive Rubeola montana odora* C.B.  
*Asperula aut Aspergula odorata* Park. *Rubiis accedens Asperula quibusdam, sive Hepatica stellaris* J.B. **Woodruff.**

H.P.III 284:

Incorrect reference in the index to Volume III.

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1076 See the note above under *Carpinus*, ὄστρουσ at Cap.5, line 26, on *ς* being used for *στ*; i.e. κέστρον = κέστρον.

Tri. 14.209:

Woodruff: *Asperula*, -ae, f.: [No Greek].

Line 21. *Aparis*: *Aparine*: see above Cap.9, line 67.

Line 22. *Lino*: *Linum*: see above Cap.12, line 34.

Line 22. *Linariū*: *Linaria*: see above Cap.11, line 52.

Line 22. *Tithymalo*: *Tithymalus*: see above Cap.4, line 23.

Lines 23-25. *Folia semina totaque ....* : Ray seems to assume here that all seeds have fleshy cotyledons within the seed along with the embryonic plant. Some seeds have a fleshy endosperm containing food reserves as opposed to fleshy cotyledons; in these seeds the cotyledons draw on this food reserve but are not themselves fleshy. In non-endospermic seeds the main food reserves for the seedling are in the cotyledons which are then thick and fleshy.<sup>1077</sup>

## Chapter Fifteen:

### *On the seedling and other things contained in the seed.*

Throughout this chapter Ray continues his discussion on the cotyledons and their role in the development of the seedling. Much of this chapter, like the last, is taken from his earlier work *A Discourse on the Seeds of Plants*.<sup>1078</sup> As with the previous two chapters, he was discussing material also elaborated upon in his *Methodus Nova* of 1682, this third section being entitled *De Plantula seminali reliquisque semine contentis*. However, much of this chapter also comes from direct observation on the part of Ray and Malpighi and is not based on hypothesis as is much of the earlier work mentioned above; indeed, in this work Ray says that ‘The next spring, I intend (God willing) by ocular inspection to determine this’ [the function of the cotyledons etc.] ‘and not to go upon probabilities’.<sup>1079</sup> Before the seventeenth century we have to go back as far as the third century B.C. to Theophrastus for a clear exposition of the development of germinating seeds; his explanations are of course incomplete because of the lack of even a simple magnifying lens.<sup>1080</sup>

#### Text page 26.

Lines 1-4. *In omnibus quæ unquam dissecui idoneæ magnitudinis seminibus plantulam seminalem semper inveni .... certe partes ejus non ita facile a me potuerunt discerni.* Ray has correctly observed that some seedlings are not as well developed within the seeds as in others. For example in Orchid seeds the embryo, even in a ripe seed, is still so undeveloped that distinct organs cannot be recognised.<sup>1081</sup>

Line 6. *Gemino dixi lobo foliis seminalibus respondente ....* : he has doubts as to whether ‘seed leaves’, which do not emerge from the earth as

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1078 John Ray, *A Discourse on the Seeds of Plants*, delivered to The Royal Society on 17th December 1674; reprinted in *Further Correspondence*: 70-77.

1079 *ibid.*: 76.

1080 Theophrastus *Περὶ Φυτῶν Ἰστορίας* (*Enquiry into Plants*): VIII, ii: 1-4.

1081 *Lowson's Botany*: 132.



the seedling grows, can be classified as 'seed leaves'. There are in fact many plants which have cotyledons remaining within the seed coat or testa even after germination and usually below the earth; hence they are known as hypogeal forms [literally 'below the earth'].<sup>1082</sup> Ray says that some people only accept as 'seed leaves' the cotyledons of epigeal forms [literally 'on the earth'], but he feels that as the underground ones seem to serve the same function then they must be accepted as 'seed leaves' too.

Lines 11-13. *In nonnullis seminum generibus ....* : Ray has observed that some seedlings do not have obvious cotyledons [above the earth]. He then differentiates between 'a stem alone without leaves' and 'a leafy stem or a leaf alone without a stem'. He seems to be describing here the various forms of monocotyledon seedlings.<sup>1083</sup>

Text page 27.

Lines 13-15. *Ex hac seminum divisione .... in eas scil. quæ plantula seminali sunt bifolia aut διλόβω, & quæ plantuls seminali adultæ analogæ.*

Ray gives here what is perhaps his most important botanical discovery that seed-plants fall into two broad natural divisions based on the number of cotyledons or, as he still calls them at this stage, 'seed leaves'. This division soon became an accepted method of classifying flowering plants. He had first propounded this idea in 1674 in his paper *A Discourse on the Seeds of Plants* presented to The Royal Society on December 17th.; here he noted the differing structure of dicotyledons and monocotyledons.<sup>1084</sup> Ray had discussed the seed leaves in his *Methodus Nova* in 1682 but did not use it as a method of classification at this date. He first used the term

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1082 *Lowson's Botany*: 134.

1083 *ibid.*: 132 and 143-147.

1084 *Further Correspondence*: 70-77.

cotyledon in *Historia Plantarum* 1085 in 1686 and in *Methodus Emendata* in 1703 he defined the cotyledons as ‘supplying food to the [seedling] in the same way as the uterine placenta or cotyledons in animals. In some plants there is only one cotyledon but in most there are two (called seed-leaves)’. In *Historia Plantarum* he divided herbs, but not trees, according to this classification but finally in *Methodus Emendata* he divided herbs and trees, although separately, into Dicotyledons and Monocotyledons.<sup>1086</sup>

Line 15. διλόβω: Ray, despite having been appointed lecturer in Greek at Cambridge in 1651, rarely uses Greek in his works; when he does it is indicative of his sources as in this instance and often used for emphasis. It appears to mean ‘two-lobed’ from δι and λοβός.

Theophrastus described the two types of seed leaves or cotyledons in *Περὶ Φυτῶν Ἱστορίας [Enquiry into Plants]*.<sup>1087</sup> Ray does not, however, use the same terminology as Theophrastus; the word διλόβω, used by Ray, does not seem to exist in classical Greek.<sup>1088</sup> The text of Theophrastus gives:

πάντα γὰρ πῶς καὶ ταῦτα διμερῆ,<sup>1089</sup> τὰ δὲ δὴ  
 χεδροπὰ φανερώς πάντα δίθυρα<sup>1090</sup> καὶ σύνθετα  
 – τὴν δὲ ρίζαν εὐθὺς ἔξω προωθεισθαι ἐν δὲ τοῖς  
 σιτηροῖς διὰ τὸ καθ’ ἐν αὐτὰ εἶναι τοῦτο μὲν οὐ

1085 Quoting Malpighi at Cap.15 line 129.

1086 Morton: 203-204 and 228-229, note 44.

1087 Theophrastus, *Περὶ Φυτῶν Ἱστορίας [Enquiry into Plants]*, VIII, ii 2.

1088 cf. Liddell and Scott.

1089 διμερῆ = ‘in two parts’.

1090 δίθυρα = ‘of two doors’.

συμβαίνει, προτερεῖ δὲ ἡ ῥίζα μικρόν.<sup>1091</sup>

Lines 16-18. *E primi generis seminibus .... nihil omnino pulpæ aut medullæ continetur*: there are, as Ray says, many seeds in which the embryo makes up the greater part of the bulk of the seedling. He is describing non-endospermic seeds here; that is, seeds in which the endosperm has been digested and disappeared before the seed is fully ripe.<sup>1092</sup>

Lines 18-19. *sunt etiam ..... seu in quibus plantula pars tantum est pulpæ seu medullæ*. This is slightly less clear but he seems to be describing endospermic seeds, where the endosperm survives until the point of germination and in which the digestion and absorption of the food materials in the endosperm is carried out by the cotyledons.<sup>1093</sup>

Line 20. *Semina illa quæ nihil aliud continent præter plantulam seminalem ....*: non-endospermic seeds.<sup>1094</sup>

Line 23. *Avellanā: Avellana*: See above Cap.5, line 63.

Lines 25-26. *Fabæ, Pisa etc.*: he gives an accurate description of the symmetry of the seeds of dicotyledons.

Line 25. *Fabā: Faba*: see above Cap.9, line 20.

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<sup>1091</sup> Text quoted from Theophrastus, *Περὶ Φυτῶν Ἱστορίας [Enquiry into Plants]*, VIII, ii. 2.

[For all such seeds are in two halves, and those of legumes clearly have two valves and are double - and thence the root is thrust straight out; but in cereals since the seeds are in one piece this does not happen but the root grows a little while before the bud.]

<sup>1092</sup> *Lowson's Botany*: 128-129.

<sup>1093</sup> *ibid.*: 129 and 134.

<sup>1094</sup> *ibid.*: 129 and 135-139.

Line 25: *Pisā: Pisum:* see above Cap.9, line 20.

Line 25. *Phaseoli: Phaseolus:* see above Cap.13, line 24.

Line 25. *Vicia: Vicia:* see above Cap.9, line 20.

Line 25. *Amygdalæ: Amygdala.*

[C.T.& M. 232] *Prunus dulcis* ([Miller] D.A.Webb), [*Prunus amygdalus* (Batesch.)], Almond; a species of the *Prunus* genus of the *Rosaceæ* or Rose family.

B.& G.-W. - no ref.: B.& H. 128: Linn.*Sp.Pl.* 472-473:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1519: *H.P.III D.* 39:

*Tri.* 15.4 / 15.5: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1519:

*Amygdalus sativa* C.B. *Amygd. dulcis & amara* J.B.

***The Almond-tree.***

*H.P.III D.* 39:

2 additional species given.

*Tri.* 15.4:

An Almond-tree: *Amygdalus*, -i, f.: Ἀμυγδαλή, -ῆς, f.

*Tri.* 15.5:

An Almond: *Amygdala*, -æ, f.: Ἀμυγδαλή, -ῆς, f.

Line 26. *Pruna: Prunus:* see above Cap.4, line 23.

Line 26. *Glandes: Glans:* 'an acorn'.

*Tri.* 19.127:

An Acorn: *Glans*, *glandis*, f.: Βάλανος, -άνου, f.

Line 27. *Hic obiter notare .... fructui aut vasculo seminali cohæret*: this point of cohesion between the seed and its container may be seen clearly in a broad bean seed; at the side of the seed is a narrow scar, the hilum, which marks the place where the seed has broken away from the stalk or funicle which attached it to the inside of the bean pod.<sup>1095</sup> See diagram below at line 29.

Line 28. *qua semen fructui aut vasculo seminali cohæret*: the embryo of a seed is usually protected by a covering, the pericarp, Ray's 'fruit' or 'seed container'. There is however a class of plants with naked seeds, the Gymnosperms, where the seed has no enclosing carpellary structure.<sup>1096</sup>

Line 29. *nec in omnibus speciebus germinatio a puncto cohæisionis incipit*: when a seed germinates the first thing to grow is the radicle and as Ray says and as may be seen in the following diagram of a broad bean seed it is not necessarily next to the hilum or point of cohesion with the pericarp.<sup>1097</sup>

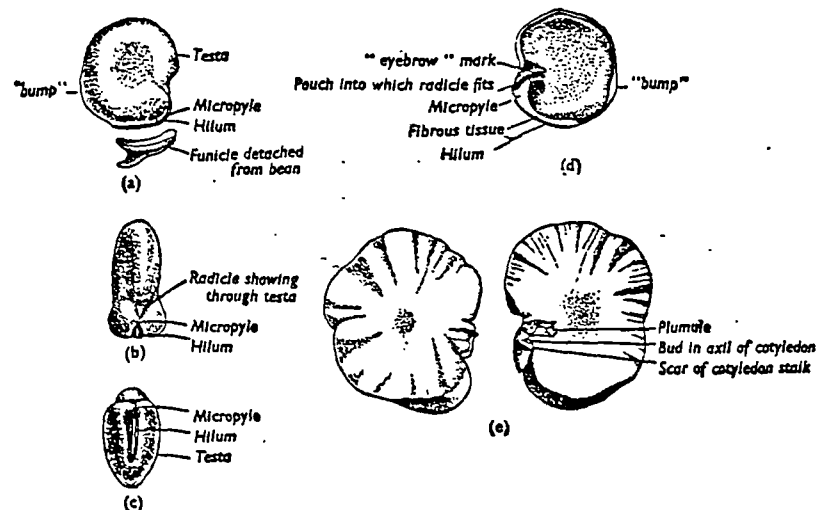


FIG. 114.—The Broad Bean Seed.

(a), (b), (c), Different Views. (d), Inner Surface of Half the Testa.  
(e), Bean with Testa removed and one Cotyledon broken away.

1095 Cooke, Burkitt and Barker: 183.

1096 *Penguin Dictionary of Botany*: 165.

1097 Cooke, Burkitt and Barker: 184; taken from Priestley and Scott's *Introduction to Botany*.

- Line 30. *Fabīs: Faba:* see above Cap.9, line 20.
- Line 30. *Lupinis: Lupinus:* see above Cap.9, line 16.
- Line 31. *Glandibus: Glans:* see above Cap.15, line 26.
- Line 31. *Juglandi: Juglans:* see above Cap.4, line 144.
- Line 31. *Amygdalis: Amygdala:* see above Cap.15, line 25.
- Line 31. *Prunis: Prunus:* see above Cap.4, line 23.
- Line 31. *Boragine: Borago:* see above Cap.10, line 88.
- Line 31. *Buglosso: Buglossus:* see above Cap.9, line 49.
- Line 31. *Asperifoliis: Asperifoliae:* see above Cap.14, line 16.
- Line 34. *Pomi: Pomus:* see above Cap.4, line 12.
- Line 34. *Pyrī: Pyrus:* see above Cap.4, line 145.
- Line 34. *Floris Solis: Flos solis:* see above Cap.10, line 91.
- Line 34. *Melonis: Melo:* see above Cap.10, line 12.
- Line 34. *Peponis: Pepo:* see above Cap.9, line 180.

Line 34. *Cucumeris: Cucumer.*

[C.T.& M. 294] *Cucumis sativus* (L.), the Cucumber; a species of the *Cucumis* genus of the *Cucurbitaceæ* or Gourd family.

B.& G.-W. 256: B.& H. 157: Linn.*Sp.Pl.* 1011-1012:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 645-646: *H.P.III* - no ref.:

*Tri.* 9.54: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.*645-646:

(Tr.) Some deduce the name of *Cucumis* from its curvature, hence Maro:

.....*tortusque per herbam*

*Cresceret in ventrem Cucumis.*

But more truly Scaliger deduces it from *κικυῶς*, which

is the old word of the Greeks; Vossius says 'but *κίκυος*

I suspect comes from the Hebrew', i.e *Cucumis*.

Caspar Hofman proves with many arguments that this fruit was not the *Cucumer* of the Ancients, and indeed was unknown to them. See *Medicam Offic.* Lib.2, Cap.76.

The characteristics of *Cucumis* are a tube-like spiny swollen fruit, seeds in a plentiful damp pulp, contained in a bag of gelatine.

I certainly, when I was travelling in Italy, was amazed that the Italians called this fruit a *Citrullus*, and moreover Water Melons, *Pepones* and *Cucumeres* too.

*Κικυῶς* is the general name among the Greeks for all *horariorum* (?hourly) fruits, just as *Cucumer* is among the Latins, namely of *Pepo*, *Melo*, *Cucumer*, *Anguria* and others of the same genus, as Guilandinus also noted.

5 species given, including:

*Cucumis vulgaris* Ger. *sativus* Park. *sat. vulgaris* C.B. *vulgaris*,  
*viridis & albus* J.B. **Cowcumber.**

Tri. 9.54:

A Cucumber: *Cucumis*, -*eris*, m.: Σίκυον, -ου, n.<sup>1098</sup>

Line 34. *Verticillatarum:Verticillatae*: see above Cap.11, Table 113.

Line 36. *Glandis: Glans*: see above Cap.15, line 26.

Line 36. *Amygdali: Amygdala*: see above Cap.15, line 25.

Line 36. *Boraginis: Borago*: see above Cap.10, line 88.

Line 36. *Buglossi: Buglossus*: see above Cap.9, line 49.

Line 43. *Hæc observatio nonnullius usus esse potest in serendis seminibus saltem grandioribus .... ita ea serere ut plantulæ radicis apex deorsum spectet*: as Ray says it is a good idea to plant larger seeds where the radicle is visible with its point in a downwards direction. See the diagram of the Broad Bean above at line 29.

Line 59. *Raphano: Raphanus*: see above Cap.14, line 11.

Line 61. *Brassicis: Brassica*: see above Cap.9, line 113.

Line 61. *Rapis: Rapa*: see above Cap.3, line 18.

Line 62. *Sinapi: Sinapis*: see above Cap.13, line 12.

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1098 Note that Ray has two different spellings for the Greek in *Historia Plantarum* and *Dictionariolum Trilingue*: Κικυδός and Σίκυον.



Line 62. *Rapistro: Rapistrum*: see above Cap.13, line 12.

Line 62. *Erucā: Eruca*.

[C.T.& M. 76] *Eruca vesicaria* ([L.] Cav.), subsp. *sativa* ([Miller] Thell), [*Brassica eruca* (L.): *Eruca sativa* (Miller)], Rocket; a species of the *Eruca* genus of the *Cruciferæ* or Cress family.

B.& G.-W. 158: B.& H. 36: Linn.*Sp.Pl.* 667:

*Syn.Meth.St.Br.* 296-297: *H.P.* 806-807: *H.P.III* 412:

*Tri.* 13.161: *Cat.Angl.* 99-100: *Camb.* 62.

*H.P.* 806-807:

6 species given, including:

*Eruca major sativa, annua, flore albo, striato* J.B. *Er. sativa*

*Ger. latifolia alba sativa Dioscoridis* C.B. *sativa alba* Park.

**Garden Rocket.**

*H.P.III* 412:

22 additional species given.

*Tri.* 13.161:

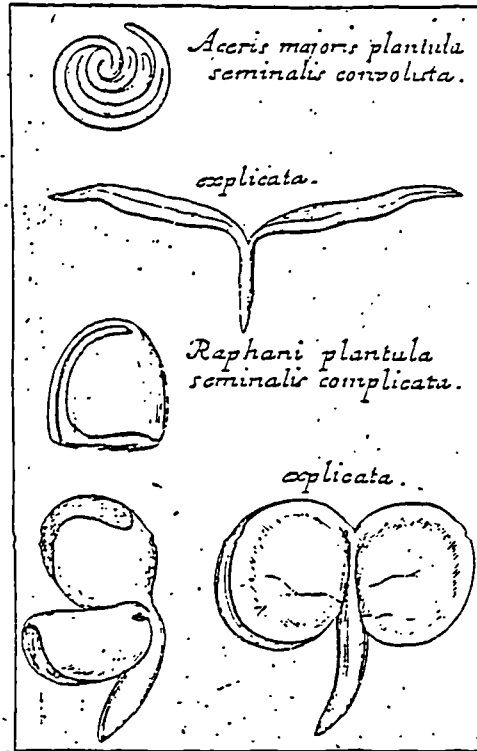
Rocket: *Eruca*, -æ, f.: <sup>γ</sup>*Ευζωμον*, -ώμου, n.

Line 71. *e Malpighii Plantarum Anatome desumptas, Tab.53, Fig.319.*

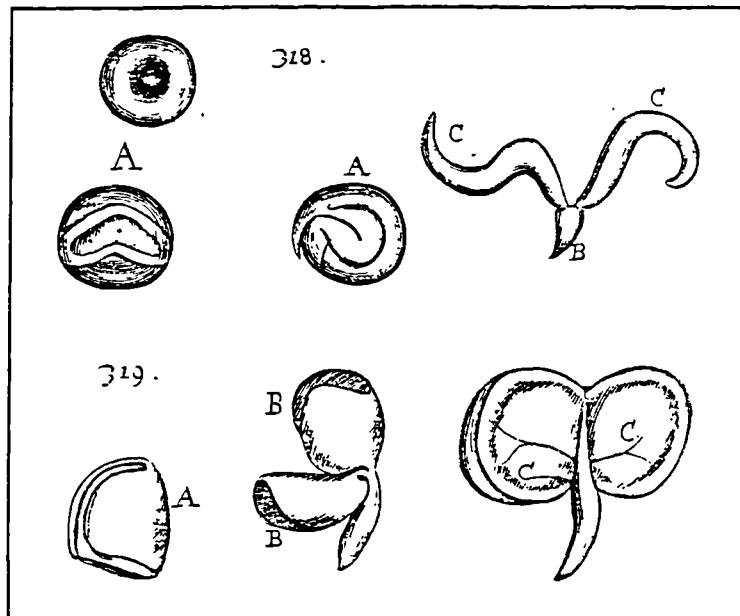
I give here the diagram from Malpighi as given by Ray,<sup>1099</sup> but note that only the lower three drawings are directly from Malpighi and are, as Ray says, Figure 319. The upper two drawings labelled as *Aceris majoris plantula seminalis convoluta* seem to be a version of Malpighi's Figure 318, which he describes as being of *Vesicaria* not *Acer major*; they could however be Ray's own drawing of a Sycamore seedling added to those of *Raphanus* by Malpighi. Ray's plate in Volume I of *Historia Plantarum* is taken from his *Methodus*

<sup>1099</sup> *Historia Plantarum*: Book I: 27.

Historia Plantarum:



Anatome Plantarum:1101



(See also diagram below at line 73.)

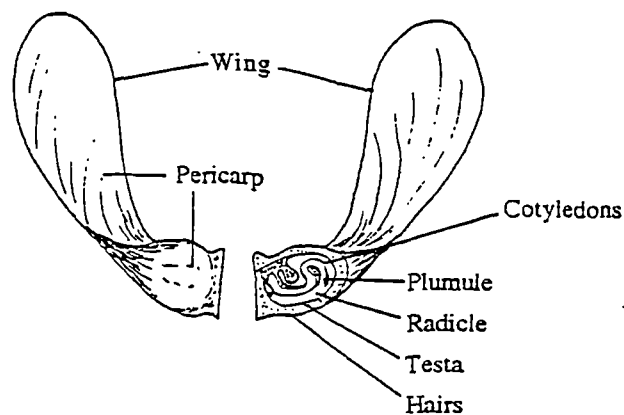
1100 Keynes: 76 and 80.

1101 Malpighi, *Anatome Plantarum*: Plate LIII, figures 18 and 19.

Line 72. *Acere: Acer:* see above Cap.5, line 26.

Line 73. *Sycamoro falso: Sycamorus falsus:* is Ray referring to our Sycamore here? The modern Latin name for Sycamore is *Acer pseudoplatanus*, Acer 'false plane tree'.

Sycamore fruit with the fruit cut on the right side to show the seed with the rolled up embryo.<sup>1102</sup>



Line 81. *Nasturtii hortensis: Nasturtium hortense:* see above Cap.14, line 10.

Text page 28.

Line 87. *Convolvulorum: Convolvulus:* see above Cap.1, line 50.

Line 88. *Soldanellæ: Soldanella.*

[C.T.& M. 365]*Calystegia soldanella* ([L.] R.Br.), Sea Bindweed; a species of the *Calystegia* genus of the *Convolvulaceæ* or Bindweed family.

B.& G.-W. 318: B.& H. 305: Linn.*Sp.Pl.* 159:

*Syn.Meth.St.Br.* 276: *H.P.* 726: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 277: *Camb.* - no ref.

H.P. 726:

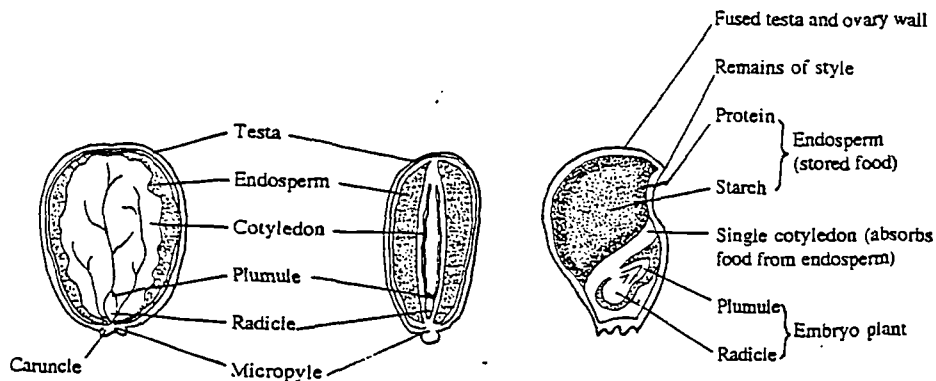
3 species given, including:

*Soldanella marina* Ger. *maritima minor* C.B. *vulgaris sive*

*Volubilis marina* Park. *Brassica marina sive Soldanella* J.B.

**Sea-Bindweed, Sea-Colewort, Scottish Scurvy-grass.**

Line 95. *sequitur ut de iis agam in quibus præter plantulam seminalem aliud etiam corpus continetur*: Ray seems to be referring to the endosperm here, which is a layer of the testa composed of parenchymatous cells containing reserves of oil and protein.<sup>1103</sup> This *aliud etiam corpus* or 'other body' can be seen in the following cross sections of the seeds of *Ricinus communis* (Castor-oil plant) and of *Zea mays* (Maize):<sup>1104</sup>



Line 98. *Fraxini: Fraxinus*: see above Cap.4, line 144.

Line 98. *Umbelliferarum: Umbelliferae*: see above Cap.11, line 55.

Line 100. *Malvæ: Malva*: see above Cap.12, line 43.

Line 100. *Stramonii: Stramonium*: see above Cap.3, line 141.

1103 *Lowson's Botany*: 141.

1104 Drawn from *Lowson's Botany*: 140; and from Beckett: 197.

Line 100. *Atriplicis: Atriplex*: see above Cap.9, line 109.

Line 100. *Spinachia: Spinachia*: see above Cap.10, line 123.

Lines 103-256. *In priore genere caro seu pulpa ..... & tam amæno spectaculo vehementer capi & delectari.* From line 103 to the end of the chapter he discusses the nourishment of the seedling and the role of the cotyledons with lengthy quotations from Malpighi's *Anatomy of Plants*, published in 1675 and 1679. Ray had basically formulated his ideas on the cotyledons by 1674, when he presented his paper *A Discourse on the Seeds of Plants*; in this he says:

[On dicotyledons]

for the greatest number of seeds contain nothing of nourishment for the young plant, more than the pulp of the lobes; which yet may, and most probably doth, supply nourishment to the radicle, while it is shot forth, and comes to draw from the ground for itself, and reciprocally for them too.

[On monocotyledons]

for that these have no seed-leaves, but come up with leaves like the succeeding, is evident; and at first springing up upon their leaf, the husk of the seed empty, it is most probable, that there was nothing else in the seed but the young plant: for, had there been any thing in the seed of nourishment for the young plant, most probable it is, that the husk being the vessel containing such nourishment ....<sup>1105</sup>

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<sup>1105</sup> John Ray, *A Discourse on the Seeds of Plants*, presented to The Royal Society on 17th December 1674; reprinted in *Further Correspondence*: 75-76.

Line 103. *In priore genere caro seu pulpa foliorum seminalium seu loborum primum radici nutrimentum, cum primulum germinat suppeditare videtur:* as Ray says the cotyledons do supply nourishment to the developing seedling. See the introduction to Chapter 14 for a fuller discussion on cotyledons and to Chapter 15, lines 13-15 for Ray's discovery of them.

Line 105. *Folia enim .... :* Ray then goes on to describe accurately the process of germination: the absorption of water through the testa,<sup>1106</sup> the bursting of the testa firstly by the developing radicle, the role of the radicle in nourishing the seedling,<sup>1107</sup> the lengthening of the hypocotyl and emergence above ground of the cotyledons<sup>1108</sup> (he describes this as the growing and unfolding of the seed leaves). Ray is describing epigeal germination here.<sup>1109</sup>

Line 111. *& producta in terram descendit:* Ray does not discuss the problem of geotropism. That the root descended into the earth because it was seeking contact with the earth and that the shoot grew upwards seeking the air was an ancient belief; Grew proved by experiments that, even when germinated away from the earth in moist air, the root grows downwards.<sup>1110</sup>

Line 114. *Verum in seminibus quorum folia seu lobi seminales supra terram non exurgunt.* Ray is aware that in some seeds the cotyledons do not rise above the surface of the earth but stay within the seed while they nourish the seedling. This is known as hypogeal germination.<sup>1111</sup> He gives as examples Broad Bean Pea and Vetch.

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1106 *Lowson's Botany:* 129-130.

1107 *Penguin Dictionary of Botany:* 305.

1108 *Lowson's Botany:* 132.

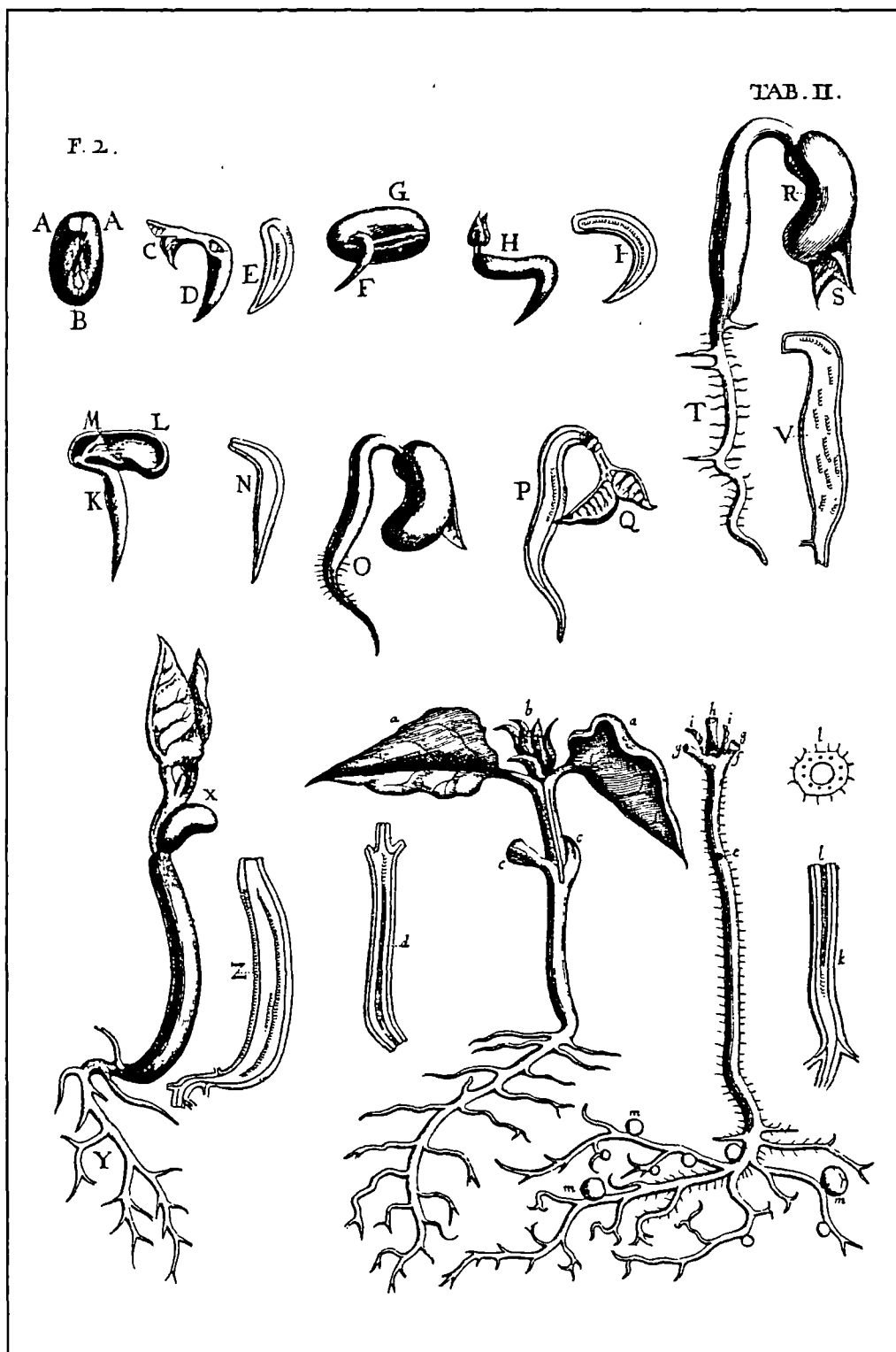
1109 *ibid.:* 134.

1110 Morton: 193.

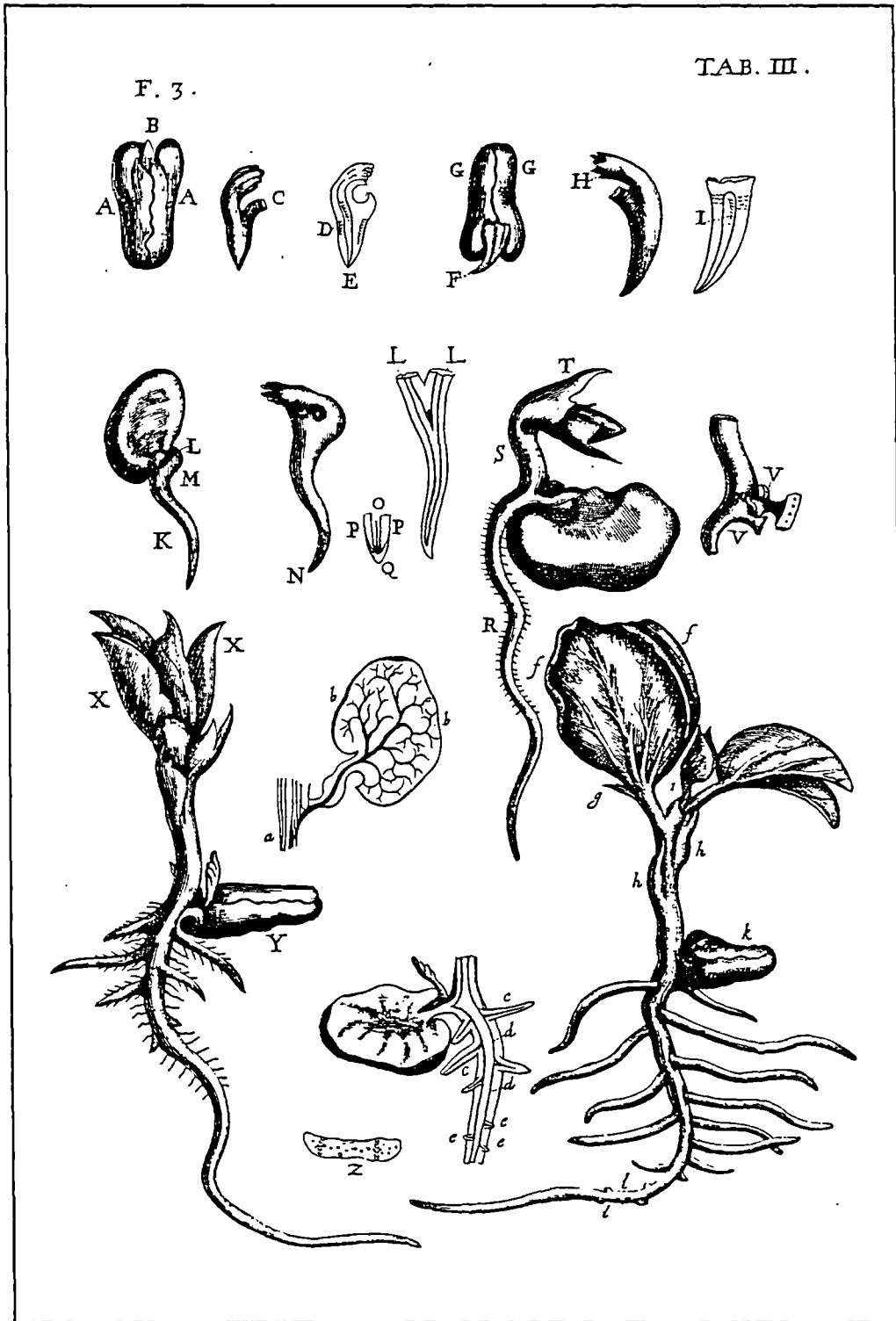
1111 *Lowson's Botany:* 134.

Ray and Malpighi both used as examples large seeds, such as *Phaseolus* (French Bean), and *Faba* (Broad Bean), which were easy to dissect and in which the various parts were clearly visible.

Malpighi has beautiful diagrams illustrating the development of these two seeds and showing epigeal and hypogeal germination, which I reproduce overleaf.







Line 115. *Fabis: Faba:* see above Cap.9, line 20.

Line 115. *Pisis: Pisum:* see above Cap.9, line 20.

Line 115. *Viciis: Vicia:* see above Cap.9, line 20.

Line 116. *qui idcirco crescere ....* : see the experiment described in *Lowson's Botany*, page 130, on the absorption of water by dried peas.

Line 118. *Lobi ut & folia seminalia:* Ray gives the cotyledons of hypogeal and epigeal seedlings different names 'lobes' and 'seed leaves' to distinguish them.

Line 120. *An nutrimentum aliquod .... mihi non constare fateor.* Ray is unsure of the role of the cotyledons after the emergence of the seedling from the earth; they do continue to nourish the seedling and indeed those above ground can photosynthesise a little.<sup>1114</sup>

Lines 121-124. *Experimentum autem facile fieri posset ....* : he goes on to describe an experiment on the nourishing role of the cotyledons after germination.

Line 126. *Marcelli Malpighii Anatomes Plantarum pars altera:* part two of Malpighi's *Anatome Plantarum* had been published in 1679.<sup>1115</sup>

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<sup>1114</sup> *Lowson's Botany:* 134.

<sup>1115</sup> As Ray says *Ex quo hæc primum scripsi ad manus meas venit .....* *Marcelli Malpighii Anatomes Plantarum pars altera.* Whether Ray actually owned this book at the time of writing or had been lent it by a friend is not known but by the time of his death the following of Malpighi's works were in his possession, as is indicated in the sale catalogue of his library:  
*Anatomia Plantarum*, 2 vols., edition published in London (no date indicated); British Museum: S-C 326 (6): 1, *Libri Latine &c. in Folio*, number 33.  
*Opera Posthuma*, edition published in London in 1697; *ibid.*: 1, *Libri Latine &c. in Folio*, number 34.

Lines 128 to 159. *in qua experimentum hoc a summo viro factum invenio in variis seminum generibus*: Ray quotes here a large section of *The Anatomy of Plants*.<sup>1116</sup> Apart from one mistake or printing error his text agrees completely with the original Malpighi text.<sup>1117</sup> Ray uses the word *orbatæ* three times at line 146 (*quorum plantulæ cotyledonibus orbatæ*), line 156 (*tres primæ plantulæ, cotyledonibus orbatæ*) and line 158 (*Fabarum plantæ cotyledonibus orbatæ*). The text of Malpighi gives for the second *tres primæ plantulæ, cotyledonibus mutilatæ*: a slight difference only - *orbatæ*, 'deprived', in Ray and *mutilatæ*, 'damaged', in Malpighi.

Line 128. *Faba*: see above Cap.9, line 20.

Line 129. *detractis prius cotyledonibus ....*: this, in the quotation from Malpighi, is the first use of the term *cotyledon* in *Historia Plantarum* for Ray's 'seed leaves'. Malpighi does not, however, use them as a form of classification: see notes for lines 13 to 15 of this chapter. It is surprising to note that, although Ray adopts the term *cotyledon*, he does not include it in his glossary to *Historia Plantarum*, where one would expect an explanation of a new term to appear.<sup>1118</sup>

Lines 134-140. *Primo, inquit, vere Faborum plurimas plantulas sevi ..... qui insigni pollent trunco & gemma*. Malpighi describes here his experiment on depriving Broad Beans, French Beans and several other seeds of their cotyledons before germination. The germination of the Broad Bean is hypogeal, below the surface, and that of the French Bean is epigeal but its cotyledons do not open up like leaves

<sup>1116</sup> The whole of this chapter in Malpighi, *De Seminum Vegetatione*, is devoted to these experiments; *Anatomes Plantarum pars altera*: 1-21.

<sup>1117</sup> *ibid.*: 17-19.

<sup>1118</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

as in other epigeal seedlings; they behave more like hypogeal cotyledons as though this plant is half way in development between the two forms of germination.<sup>1119</sup>

Line 134. *Fabarum: Faba:* see above Cap.9, line 20.

Line 134. *Phaseolorum: Phaseolus:* see above Cap.13, line 24.

Line 135. *Fabæ: Faba:* see above Cap.9, line 20.

Line 138. *Fabarum: Faba:* see above Cap.9, line 20.

Line 139. *Cucurbitæ: Cucurbita:* see above Cap.9, line 180.

Line 140. *Peponum: Pepo:* see above Cap.9, line 180.

Line 140. *Lupinorum: Lupinus:* see above Cap.9, line 16.

Line 140. *Phaseolorum: Phaseolus:* see above Cap.13, line 24.

Lines 141-159. *Hanc eandem observationem progrediente in cubatu*<sup>1120</sup> & *post inchoatam vegetationem tentavi:* Malpighi now goes on to describe his experiment to remove the cotyledons after germination had begun. He is describing epigeal germination here.

Line 142. *Cucurbitæ: Cucurbita:* see above Cap.9, line 180.

Line 145. *Lupinis: Lupinus:* see above Cap.9, line 16.

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<sup>1119</sup> Lowson's Botany: 136-139.

<sup>1120</sup> NB: *incubatu* is written as one word in Malpighi's text. as two in Ray's.

Line 146. *Peponibus: Pepo:* see above Cap.9, line 180.

Line 146. *Lactucā: Lactuca:* see above Cap.4, line 46.

Line 146. *Endiviā: Endivia:* see above Cap.9, line 115.

Line 146. *Raphano: Raphanus:* see above Cap.14, line 11.

Line 146. *Rapis: Rapa:* see above Cap.3, line 18.

Lines 151-159. *Vegetantium cotyledonum vim & durationem exploraturus ....:*

cotyledons can live for a considerable length of time in epigeal seedlings as is seen in the Parsnip, where the seedling is fed by the reserves in its photosynthesising cotyledons for a considerable period before the first true leaves are sufficiently large to photosynthesise enough to support the growing plant. In hypogeal seedlings, however, the survival of the seedling depends on true foliage being sufficiently developed before the reserves of food run out in the cotyledons.<sup>1121</sup>

Line 151. *Lupinorum: Lupinus:* see above Cap.9, line 16.

Line 151. *Cucurbitæ: Cucurbita:* see above Cap.9, line 180.

Line 152. *Fabarum: Faba:* see above Cap.9, line 20.

Line 153. *Lupinis: Lupinus:* see above Cap.9, line 16.

Line 153. *Cucurbitā: Cucurbita:* see above Cap.9, line 180.

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<sup>1121</sup> Lowson's Botany: 135.

Line 154. *Fabā: Faba*: see above Cap.9, line 20.

Text page 29.

Line 157. *Cucurbitæ:Cucurbita*: see above Cap.9, line 180.

Line 158. *Fabarum: Faba*: see above Cap.9, line 20.

Lines 160-165. *Ex his igitur conjectari licet .... sed ad vegetandum excitatur.*

This is not a quotation but rather a precis of Malpighi's text, unlike the previous thirty two lines which are quoted directly.<sup>1122</sup>

Line 161. *uterinæ placentæ vel cotyledonum vices explere*: the term cotyledon had been used in zoology since classical times for the uterine placenta.<sup>1123</sup>

Lines 166-172. *Quod folia seminalia ad primam vegetationem seu germinationem necessaria sint*: the cotyledons in non-endospermic seeds store the food reserves for the seedling.<sup>1124</sup>

Line 168. *ut Malpighius conjectatur*: Malpighii discusses the cotyledons and their role in the second part of his *Anatome Plantarum*.<sup>1125</sup>

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<sup>1122</sup> Malpighi, *Anatomes Plantarum Pars Altera*: 19.

<sup>1123</sup> Hippocrates, *Ἀφορισμοί*:S.45; Aristotle, *Περὶ ζώων Γενέσεως*, (*de Generatione Animalium*): 45b30 ff / 71b29. I am indebted to James Longrigg for the following references Aristotle, *Περὶ ζώων Γενέσεως*, (*de Generatione Animalium*): 740a33 and 746a19; Aet. V 16; Hippon DK38A17; Diogenes DK64A25; Atomists DK68A144.

<sup>1124</sup> *Penguin Dictionary of Botany*: 89.

<sup>1125</sup> Malpighi, *Anatomes Plantarum pars altera*: 20-21.

Lines 175-176. *Quod vero non semper necessaria sint ....*: despite his statement at line 166 that the 'seed leaves' are necessary he begins to have doubts since they are not permanent features of a plant. Once their food reserves are used up they do wither and fall off.

Line 180. *partem ore admittunt*: Ray incorrectly assumes that once a foetus has developed a mouth it takes in food through it although still in the womb.

Lines 180-181. *siquidem in ventriculo dissecto idem plane humor invenitur qui in qmnio cernitur*: he wrongly believes that the digestive juices in the stomach and the amniotic fluid are of the same composition.

Lines 183-188. *Ex his omnibus colligere licet .... animalia ore, plantæ radicibus integrum suum alimentum hauriunt aut capessunt*. Ray is correct on the nourishment of seedlings but wrong on that of animals. Animals in the womb draw all their nourishment through the placenta: see note at line 180 above.

Lines 189-190. *Superest jam .... sed cujus folia primum apparentia subsequentibus similia sunt*. This is rather an ambiguous statement as he could be referring to seeds with hypogeal germination (below the earth) in which the first visible leaves are true foliage leaves; or, more probably, he could be referring to monocotyledons, whose leaves, as he says, are 'when they first appear similar to those that follow'. This is because the cotyledon in this type of plant usually elongates below ground, driving the radicle downwards; thus the plumule, beginning its growth within the protection of the cotyledon a considerable distance below ground, breaks through with its first foliage leaves visible when it reaches ground level.<sup>1126</sup>

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<sup>1126</sup> *Lowson's Botany*: 143-147; Cooke, Burkitt and Barker: 188-189.

Lines 191-193. *Primum est eorum .... trunco aut ramo appositæ.*

He describes here a seed with its embryo at the end nearest the stalk which had attached it to its seed vessel. He gives as his example *Hordeum*. Maize is also of this type - see diagram above at Cap.15, line 95.

Line 192. *figura fere gemmæ cum scuto suo in emplastratione arboris alicujus trunco aut ramo appositæ.* He compares the position of the embryo within the seed to that of a bud when grafted to a tree. See below Chapter 19 on grafting.

Lines 193-194. *Secundum est eorum .... pulpa velut medulla includitur.* He continues with those having the embryo embedded within 'the pulp or pith of the seed', that is within the endosperm. Ray gives a Pine seed as his example - see note and diagram at line 228.

The Onion is also of this type.<sup>1127</sup>

Line 195. *Prioris generis sunt frumenta omnia & gramina quæ fibrosas obtinent radices.* Ray correctly observes that the monocotyledons develop their main root system from adventitious roots growing from the base of the stem with the radicle being less prominent and less important than in dicotyledons.<sup>1128</sup>

Line 197. *Hordei: Hordeum:* see above Cap.7, line 23.

Line 199. *Reliqua pulpa seu farina ....* : he has noted that in such seeds most of the bulk is taken up with 'pulp or meal'. This is the endosperm, which in grasses contains most of the starch and some of the protein

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<sup>1127</sup> See the diagram in *Lowson's Botany*, page 144, of the germination of the onion seed.

<sup>1128</sup> *Lowson's Botany*: 143.



needed by the developing embryo.<sup>1129</sup>

Line 203. *Marcellus Malpighius in Plantarum Anatomes parte prima, pag.77.*

This, as Ray says, quoted from the first part of Malpighi's *Anatome Plantarum*, which had been published in 1675.<sup>1130</sup>

Line 205. *pomi Armeniaci: Pomus Armeniaca.*

[Mac.Enc. 65] *Prunus armeniaca* (L.), Apricot; a species of the *Prunus* genus of the *Rosaceæ* or Rose family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 128:

Linn.*Sp.Pl.* 474: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1513:

*H.P.III* - no ref.: *Tri.* 15.6 / 18.109: *Cat.Angl.* - no ref.:

*Camb.* - no ref.

*H.P.* 1513:

*Armeniaca mala minora* J.B. *Malus Armeniaca minor* C.B. Ger.

*Armeniaca mala majora* J.B. C.B. *Armeniaca malus major*  
Ger.

*Tri.* 15.6:

An Apricock-tree: *Armeniaca malus*:

Μηλέα Ἀρμενιακή, -ῆς, f.

*Tri.* 18.109:

An Apricock: *Malum Armeniacum*, -i, n.:

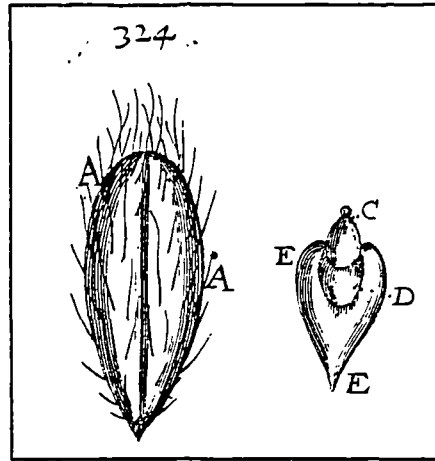
Μῆλον Ἀρμενιακόν. n.

<sup>1129</sup> Lowson's *Botany*: 147.

<sup>1130</sup> Malpighi, *Anatome Plantarum*: 77-78.

Line 210. *Avenā: Avena*: see above Cap.13, line 27.

Malpighi gives a diagram to illustrate the point of germination of the  
*Avena* seed:1131



Line 213. *Verum hæc medulla seu caro farinacea seminis .....*: Ray is undecided as to what the pith should be called. He seems to have noticed a difference in the characteristics of the pith, but without appreciating that although most of the obviously monocotyledonous seeds (such as the grasses) are endospermic, some do have a more parenchymatous cotyledon containing the food supply for the seedling.<sup>1132</sup>

Lines 195-225. *Prioris generis .... in hoc genere quam in illo*. Throughout this section (apart from one mention of the apricot) Ray / Malpighi have been discussing the 'seeds' of members of the grass family. These 'seeds' are in fact one-seeded fruits with testa and pericarp fused together. They have most of their volume occupied by endosperm but have a more developed embryo than other endospermic seeds.<sup>1133</sup>

Line 220. *tritico: Triticum*: see above Cap.13, line 27.

1131 Malpighi, *Anatome Plantarum*: Tab. LIV, fig.324.

1132 *Lowson's Botany*: 143.

1133 *ibid.*: 145.

Line 220. *secafi: Secale*: see above Cap.7, line 23.

Line 222. *Hordeo: Hordeum*: see above Cap.7, line 23.

Line 222. *Avenā: Avena*: see above Cap.13, line 27.

Line 227. *in nucleis pineis*: Ray is not using the term nucleus in quite the modern sense of the part of the individual cell containing the genetic material, but rather for the embryo of a seed, consisting of many cells. He defines *nucleus* in the following way in his glossary to *Historia Plantarum*:

*Nucleus, Veteribus Nuculeus, id vescum quod sub  
putamine nucis latet, & generalius semen quodcunque  
nucibus vel fructibus inclusum & occultatum.*<sup>1134</sup>

Line 228. *Pinum: Pinus*: see above Cap.4, line 23.

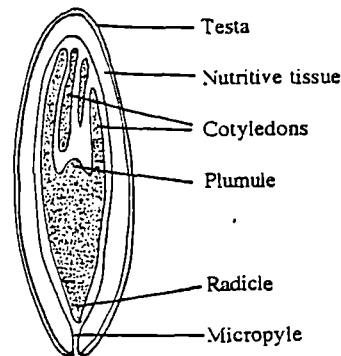
Pines are members of the class known as Gymnosperms, which have naked seeds with no enclosing carpellary structure. They do not develop a true endosperm and usually have a cluster of several linear cotyledons.<sup>1135</sup> Ray does describe the appearance of the Pine seed correctly in that the embryo lies in the centre of the seed, but he has not realised that it has several cotyledons.

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<sup>1134</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

<sup>1135</sup> *Penguin Dictionary of Botany*: 165; *Lowson's Botany*: 487-488.

Diagram of a Pine seed:1136



Morton says that 'it is to be noted that Ray did not separate the gymnosperms (Coniferales) from flowering plants. In his earlier classification in *Historia Plantarum* he put *Pinus* with the monocotyledons, but in his final classification in *Methodus Emendata* the Coniferales are (more correctly) included with dicotyledons'.<sup>1137</sup>

Text page 30.

Line 241. *Iridium: Iris:* see above Cap.3, line 36.

Line 241. *Ari: Arum:* see above Cap.3, line 35.

Line 241. *Asparagi: Asparagus:* see above Cap.3, line 89.

Line 242. *Pæonia: Pæonia:* see above Cap.3, line 19.

Line 242. *Cyclamini: Cyclamen:* see above Cap.11, line 32.

Line 242. *Nam in seminibus Cephæ & Porri ....* : he seems to have noticed that the cotyledon of the monocotyledons usually elongates below

1136 Drawn from *Lowson's Botany*: 487.

1137 Morton: 229, note 45.

ground, driving the radicle downwards; the cotyledon then extends upwards pushing the plumule above ground level and, as Ray has observed, carrying the testa with it, from which it absorbs the endospermic reserves.<sup>1138</sup>

Line 243. *Cepæ: Cepa:* see above Cap.3, line 12.

Line 243. *Porri: Porrum:* see above Cap.7, line 29.

Line 250. *Siquis autem plantulam seminalem videre desiderat:...* the inner tissues of a resting seed usually contain little water and germination begins with absorption of a considerable amount of water; the weight of a seed can double in a few hours. Thus, as Ray says, it is a good idea to soak a seed prior to investigating its structure.<sup>1139</sup>

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1138 *Lowson's Botany:* 143-147; Cooke, Burkitt and Barker: 188-189.

1139 *Lowson's Botany:* 129-130.

## Chapter Sixteen:

### *On the secondary or auxiliary parts of plants, tendrils, thorns etc.*

Ray's auxiliary or secondary parts of plants, the tendrils and thorns, are modifications of the shoot. Simon, Dormer and Hartshorne have the following to say on these structures:

If a plant is to produce some special type of organ such as a spine or tendril, it is understandable that it should often do so by modifying one of the structures which it is already accustomed to produce, such as a leaf or root. But we know of no law of nature which absolutely compels it to follow that course. It may adopt a completely novel and independent line of development, and grow a spine or tendril where nothing stood before.<sup>1140</sup>

Ray does not attempt to analyse these structures, that is to decide whether they are formed from stems or leaves. In *The Wisdom of God* he describes them thus:

That some Sorts of Plants, as *Vines*, all Sorts of *Pulse*, *Hops*, *Briony*, all Pomiferous Herbs, *Pumpions*, *Melons*, *Gourds*, *Cucumbers*, and divers other *Species*, that are weak and unable to raise or support themselves, are either endued with a Faculty of twining about others that are near, or else furnished with Claspers and tendrils, whereby, as it were with hands, they catch Hold of them, and so ramping upon Trees, Shrubs, Hedges or Poles, they mount up to a great Height, and secure themselves and their Fruit. Thirdly, that others are armed with Prickles and Thorns, to secure them from the Browsing of Beasts, as also to shelter others that grow under them.<sup>1141</sup>

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1140 *Lowson's Botany*: 76.

1141 *The Wisdom of God*: 83.

Text page 30.

Line 2. *necesse est in alienis adminiculis sustententur*: climbers depend for support on other plants and structures such as walls. We now recognise four such methods of climbing:<sup>1142</sup>

1. by adventitious roots.
2. by scrambling through other vegetation, and relying on hooks and prickles to hold them in position.
3. by twining of their stems around the support.
4. by means of tendrils.

Line 6. *Aliis enim Capreolos concessit seu claviculos, quibus (ut Caesalpini verbis utar) .....* : Ray uses Cesalpino's words here.

Ray defines *capreolus* in his glossary to *Historia Plantarum*:

*Capreolus, est pars quaedam auxiliaris, filamentum aut funiculi æmulus, cincinni in modum contortus, quæ planta quævis vicinis stirpibus aliisve stipitibus se implicans, in altum enititur. Angl. A clasper or tendrel. Hujusmodi cernuntur in Vite & Leguminibus.*<sup>1143</sup>

Line 7. *Viti: Vitis*: see above Cap.5, line 26.

A climber with tendrils.<sup>1144</sup> The tendril of *Vitis* is particularly interesting in that it is a branched structure positioned opposite to a foliage leaf, and which may itself be a modified leaf.<sup>1145</sup>

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<sup>1142</sup> Lowson's *Botany*: 622.

<sup>1143</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

<sup>1144</sup> Clapham, Tutin and Moore: 183.

<sup>1145</sup> Lowson's *Botany*: 77-78.

- Line 7. *Cucurbitæ: Cucurbita:* see above Cap.9, line 180.  
With spirally coiled, often branched tendrils, each arising at the side of a leaf axil.<sup>1146</sup>
- Line 7. *Piso: Pisum:* see above Cap.9, line 20.  
Climber with branched tendrils.<sup>1147</sup>
- Line 9. *Leguminibus: Legumines:* see above Cap.11, line 56.  
The leaves of *Leguminosæ* may be simple or usually compound, 'sometimes ending in a tendril'.<sup>1148</sup>
- Line 9. *Hujusmodi capreoli styliformes appendices ..... & non raro etiam sex.* Ray is virtually quoting Malpighi, who says:  
*Hujusmodi pediculus styliformes appendices, seu flagella exerit modo tria, frequenter quatuor & non raro etiam sex.*<sup>1149</sup>
- Line 10. *modo tria, frequenter quatuor, & non raro etiam sex.*  
Presumably Ray is referring to the branching habit of some tendrils, as in the Pea (*Pisum*) mentioned above.
- Line 11. *Hæc a primordiis tenella, & parum obliqua .... producuntur:* is he referring to the habit of young tendrils of nutating, that is of swaying from one side to the other, which could be seen as 'stretching out' from the parent plant?<sup>1150</sup>

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1146 Clapham, Tutin and Moore: 294.

1147 *ibid.*: 192.

1148 *ibid.*: 183.

1149 Malpighi has a short chapter *De Capreolis et Consimilibus Vinculis* in *Anatomes Plantarum pars altera*: 60-61; this section is taken from page 60.

1150 Clapham, Tutin and Moore: 285-286.



Line 11. *Hæc a primordiis tenella ..... (verba sunt Malpighii) ..... & interpositis utriculorum ordinibus compaginantur.* This is a direct quotation from Malpighi.<sup>1151</sup>

Lines 11-12. *temporis tractu .... ramos arcte amplexantur.* As they develop and coil round their support the growth of tendrils accelerates on the side of the tendril opposite the point of contact with the stem, thus making the tendril fit the shape of the stem and become more firmly attached to it.<sup>1152</sup>

Line 14. *Sic Hederæ vulgari cirros quosdam seu radículas pilosas indulsit per totam caulem frequentes hinc inde, velut Millepedum pedes, qui, observante sagacissimo Malpighio, glutinosum fundunt humorem seu terebinthinam ..... : for Hedera see above Cap.4, line 119.*

*Hedera* climbs by means of adventitious roots closely clothing the stems.<sup>1153</sup> Ray takes this example from Malpighi, but adds the parallel with millipedes to Malpighi's discussion.<sup>1154</sup>

*glutinosum fundunt humorem seu terebinthinam .... : several other plants have this habit of attaching themselves to their supports by means of adhesion: for example, Vitis Parthenocissus tricuspidata (Siebold & Zucc.) whose tendrils end in adhesive disks.*<sup>1155</sup>

Line 18. *Hederæ Canadensi: Hedera Canadensis.*

C.T.& M. - no ref.: B.& G.-W. - no ref.:

B.& H. - no ref.: but see Linn.*Sp.Pl.* page 202, which indicates that this is another name for *Hedera helix* or Common Ivy, growing in Canada.

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1151 Malpighi, *Anatomes Plantarum pars altera*: 60.

1152 Lowson's *Botany*: 287-288.

1153 Clapham, Tutin and Moore: 277.

1154 Malpighi, *Anatomes Plantarum pars altera*: 61.

1155 Clapham, Tutin and Moore: 183.

*Hedera foliis quinatis ovatis serratis.* Hort.cliff.74.

Roy.lugdb.223. Gron.virg.24.

*Vitis hederacea indica.* Stapel.theatr.364.

*Edera quinquefolia canadensis.* Corn.canad.99.t.100.

*Helix.* Mitch.gen.30.

*Habitat in Canada.*

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1699: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1699:

*Edera trifolia Canadensis* Cornuti. *Trif. Virginiensis* Park.

*Epimedium fruticans Canadense* Londiniensibus. *Edera*

*quinquefolia Canadensis* Cornuti. *Vitis seu potius Hedera*

*quinquefolia Virginiensis* Park.parad.

Line 23. *Aliis autem plantis infirmis.....vel caules volubiles concessit ... :*

Ray continues with examples of other plants with 'weaker' stems, that is which are unable to climb without supports, and which use twisting stems for this purpose.

Line 23. *Convolvulo: Convolvulus:* see above Cap.1, line 50.

*Convolvulus* climbs by an increased method of nutation which enables it to twine its stems around its support in a counter-clockwise direction.<sup>1156</sup>

Line 24. *Lupulo: Lupulus:* see above Cap.7, line 53.

The stems of Hops (Ray's *Lupulus*) climb by twisting in a clockwise direction.<sup>1157</sup>

Line 24. *Phaseolis: Phaseolus:* see above Cap.13, line 24.

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1156 *Lowson's Botany:* 622; Clapham, Tutin and Moore: 364.

1157 *ibid.:* 310.

Line 24. *Helxine*:

The modern plant known as Helxine is *Soleirolia* (Gaud. - Beauv.) [*Helxine* Req.]. *Soleirolia soleirolii* [*Helxine soleirolii*], Mind Your Own Business, of the *Urticaceæ* or Nettle family. But it seems likely from the description of the plant here as having twining stems that Ray is meaning *Fallopia convolvulus* ([L.] A.Löve) [*Bilderdykia convolvulus*: *Polygonum convolvulus* (L.)], a species of the *Polygonaceæ* or Dock family - see C.T.& M. 364-365.

William Turner in his *Libellus*<sup>1158</sup> and his *Names of Herbes*<sup>1159</sup> used the name Helxine for Paritory, Parietorie or Pelletorie of the Wal (*Parietoria diffusa* (Mart. & Koch): *Parietaria officinalis* (auct.)), both species of the *Urticaceæ* or Nettle family.

Ray does not use the name *Helxine* for Pellitory-of-the-Wall in *Historia Plantarum*. On page 205 he gives its names thus:

*Parietaria* Ger. J.B. *vulgaris* Park. *Officinarum & Dioscoridis*  
C.B. **Pellitory of the Wall.**

Ray only lists in the index to *Historia Plantarum* two varieties of *Helxine*:

H.P. 182:

*Convolvulus minor Atriplicis folio* Park. *Volubilis nigra* Ger.  
*Convolvulus minor semine triangulo* C.B. *Helxine semine*  
*triangulo* J.B. **Black Bindweed.**

H.P. 725:

*Convolvulus minor vulgaris* Park. *minor arvensis* C.B. *Helxine*  
*cissampelos multis sive Convolvulus minor* J.B. *Smilax lenis*  
*minor* Ger. **Small Bindweed.**

Ray, in his *Synopsis Methodica Stirpium Britannicarum*,<sup>1160</sup> describes Black Bindweed thus:

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1158 Turner, *Libellus*: 50.

1159 Turner, *Names of Herbes*: 107.

1160 *Syn. Meth.St.Br.*: 144.

*Fegopyrum scandens sylvestre. Convolvulus minor Atriplicis folio* Park.171, 172. *Volubilis nigra* Ger.713. *Convolvulus minor semine triangulo* C.B.Pin.295. *Helxine semine triangulo* J.B.II 157. **Black Bindweed.** *Inter segetes, inque hortis & vineis, locisque cultis.*

Linnæus, in his *Species Plantarum*,<sup>1161</sup> gives Black Bindweed as:

*Polygonum convolvulus:*

*Polygonum foliis cordatis, caule volubili, floribus planiusculis.*

*Helxine caule volubili.* Fl.lapp.154. Fl.suec.323.

Hort.cliff.150. Gron.virg.157. Roy.lugdb.217.

*Convolvulus minor, semine triangulo.* Bauh.pin.294.

*Convolvulum nigrum.* Dod.pempt.396.

*Habitat in Europæ agris.*

Thus it seems probable that Ray is referring to *Fallopia convolvulus* or Black Bindweed here.

Line 25. *vel foliorum pediculos tortiles:* 'twisting little feet of leaves'. Ray is referring here to the habit of some plants of climbing by means of twisting the petioles or leaf stalks around the stems of their supports. He gives three examples of this: *Clematis*, *Fumaria* and *Nasturtium Indicum*.

Line 25. *Clematide: Clematis.*

[C.T.& M. 38] *Clematis* (L.), *Clematis*; a genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 112: B.& H. 2: Linn.*Sp.Pl.* 543-544:

*Syn.Meth.St.Br.* 258: *H.P.* 620-622: *H.P.III* 307 / 547 / 339-340:

*Tri.* - no ref.: *Cat.Angl.* - no ref. (only *daphnoides* - Periwinkle 72-

73): *Camb.* - no ref.

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<sup>1161</sup> Linnaeus, *Species Plantarum*: 364.

H.P. 620-622:

*Clematitis, Clematis:*

(Tr.) *Clematis* is named from κλήμα *sarmentum* <sup>1162</sup>,  
since it climbs trees like the young shoots of vines.

Its characteristics are a four-petalled or  
cross-shaped flower, curls or long hairy plumes  
developing on most species of seeds, and a fiery taste.

8 species given, including:

*Clematis latifolia sive Atrogene quibusdam* J.B. *Clematitis sylv.*  
*latifolia* C.B. *Clematis sylv. latifolia, sive Viorna Park. Viorna*  
Ger. **Great Wild Climber or Traveller's Joy.**

H.P.III 307:

Incorrect reference in the index to Volume III.

H.P.III 547:

*Ad caput de Clematide Daphnoide:* 3 additional species given.

H.P. 339-340:

*Ad caput de Grenadilla:* <sup>1163</sup> several species are called *Clematis*  
*Indica.*

Line 26. *Fumariā: Fumaria:* see above Cap.7, line 55.

Line 26. *Nasturtio Indico: Nasturtium Indicum:* see above Cap.7, line 54.

Lines 27-39. *Alias præterea Plantis partes minus principales.....:*

he continues with a discussion of the uses and positioning of hairs  
and thorns, although without discussing their origins.

The spines of plants vary in origin; they may be  
developed from the stipules, be short lateral branches of twigs with  
sharp ends, be spines developed from the lamina of a leaf, or as in

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1162 "A twig" or "branch".

1163 *Grenadilla* = Passion Flower.

the spines of Cacti be of doubtful origin.<sup>1164</sup>

Line 28. *vel (quod opinatur Malpighius) ut turgentis alimonix sub harum forma incongrua portio erumpat & digeratur*: this is taken from Malpighi's chapter *De Pilis & Spinis*.<sup>1165</sup>

Line 31. *Rubo: Rubus*.

[C.T.& M. 205-212] *Rubus* (L.), Brambles or Blackberries; a genus of the *Rosaceæ* or Rose family.

B.& G.-W. 176: B.& H. 132: Linn.*Sp.Pl.* 492-494:

*Syn.Meth.St.Br.* 467: *H.P.* 1639: *H.P.III* - no ref.: *Tri.* 15.16:

*Cat.Angl.* 258-260: *Camb.* 105.

*H.P.* 1639:

6 species given, including:

*Rubus major fructu nigro* J.B. *Rubus vulgaris, sive Rubus fructu nigro* C.B. *Rubus vulgaris major* Park.

***The common Bramble, or Black-berry-bush.***

*Tri.* 15.16:

A Bramble: *Rubus*, -i, m.: *Βάτος*, -ου, f.

The Blackberry has various forms of spine:

1. Prickles, which can vary in size.
2. Pricklets, which are small and often with stout bases.
3. Acicles, which are slender and hair-like.<sup>1166</sup>

Line 31. *Agrifolio: Agrifolium*: see above Cap.4, line 144.

The Holly has leaves with large triangular spine-pointed teeth.<sup>1167</sup>

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1164 *Lowson's Botany*: 76.

1165 Malpighi, *Anatomes Plantarum pars altera*: 55-59, this particular section being from page 58.

1166 Clapham, Tutin and Moore: 207.

1167 *ibid.*: 181.

Line 31. *Tribulo: Tribulus.*

[C.T.& M. 529] *Potamogeton crispus* (L.), Curled Pondweed  
[incl. *Potamogeton serratus* (auct.mult.)], a species of the  
*Potamogeton* genus of the *Potamogetonaceæ* or Pondweed family.

B.& G.-W. 446-447: B.& H. 428: Linn.*Sp.Pl.* 126:

*Syn.Meth.St.Br.* 149: *H.P.* 189 and 1321: *H.P.III* 649:

*Tri.* - no ref.: *Cat.Angl.* 288: *Camb.* 118.

*H.P.* 189:

2 species of *Potamogeton* are called *Tribulus* by Ray including:

*Fontinalis crispa* J.B. *Potamogeton foliis crispis sive Lactuca*

*ranarum* C.B. *Tribulus aquaticum minor Quercus floribus*

Ger.emac. Clus. *Tribulus aquaticus minor* prior Park.

***Water Caltrops or Frogs Lettuce.***

*H.P.* 1321:

It is listed here in a section on plant anomalies:

*Tribulus aquaticus* J.B. C.B. Ger. *aquaticus major* Park.

***Water Caltrops.***

*H.P.III* 649:

*Ad cap. de Tribulo terrestri:*<sup>1168</sup> 4 additional species given.

The Curled Pondweed has fruits with a hooked and pointed beak  
almost equalling the fruit in length.<sup>1169</sup>

Line 32. *Ononi: Ononis.*

[C.T.& M. 192] *Ononis* (L.), Restharrow; a genus of the  
*Leguminosæ* or Pea family.

B.& G.-W. 212: B.& H. 104: Linn.*Sp.Pl.* 716-719:

*Syn.Meth.St.Br.* 332: *H.P.* 957-958: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* 214 with a ref. to see *Anonis* 22-23:

*Camb.* 43.

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1168 N.B. *terrestri*: Ray is not talking of a water plant here.

1169 Clapham, Tutin and Moore: 529.

H.P. 957-958:

18 species given, including:

*Anonis spinosa flore purpureo* C.B. Park. A. sive *Resta bovis*

Ger. An. sive *Resta bovis vulgaris, purpurea & alba spinosa*

J.B. *Rest-harrow, Cammock, Petty-whin.*

The stems of this plant are usually spiny with two rows of hairs.<sup>1170</sup>

Line 32. *Acanaceis: Acanacei:* the *Acanacei* of Cesalpino are presumably plants with thorns<sup>1171</sup> rather than particular plants.

Line 33. *inquit Plinius:* Ray ends this chapter by giving Pliny's reasons for the development of such hairs and spines.

*Inde excogitavit ..... excogitatum est.* This section is taken from Pliny's *Historia Naturalis*, Book XXII, vii: 17; Loeb edition, Volume VI: 306.

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1170 Clapham, Tutin and Moore: 193.

1171 Liddell and Scott: 46; ἄκαινα, -ης, a spike, prick or goad, from ἀκῆ, -ῆς or ἀκίς, -ίδας, a pointed object.



## Chapter Seventeen:

### *On the nutrition of plants.*

Here Ray discusses the nourishment of plants through the roots, the passage of air and water through the fibrous tissue and also the ascent of sap; he acknowledges the works of Malpighi and Grew. He draws parallels with the animal world, comparing the ability of water plants and fish to obtain air, believing that, whatever the circumstances, 'air permeates nature'. He is concerned to discover how sap can reach the top of plants such as trees.

Plant nutrition had puzzled scholars since ancient times. Aristotle in the third century B.C. was puzzled as to how plants can produce food for man and animals without apparently 'eating' anything themselves; he believed that since animals and plants, after death, decay into the soil, the soil must provide food materials to be absorbed by plant roots as nutrition for the rest of the plant. Actual experiments to prove that plants extract food materials from the soil were not performed until 1692, when Van Helmont in Holland planted a willow tree seedling in 90 kilograms of soil and left it to grow for five years with no nutrition except water; after this time he found that the tree had increased in weight by 74 kilograms but that the soil had only lost 56 grams (which he concluded was an experimental error). Thus he believed that plants derive their nourishment solely from water in the soil, not realising that the bulk of a plant's raw materials come from some source other than the soil. The work of Julius von Sachs in the nineteenth century showed that plants obtain minerals from the soil; that is, that they will not thrive in plain (distilled) water alone. By Ray's time in the seventeenth century, the pores of the leaves, known as stomata, had been discovered, and this led to speculation on the role of air in plant growth. However, as has been mentioned in Chapter 9 line 148), Ray himself believed light rather than air to be the cause of the green colour in plants [*Nobis tamen non tam aer quam lumen ....*] The first real advance in the study of photosynthesis was made by Stephen Hales. Morton, without giving the actual source, quotes Hales as saying, 'May not light also, by freely

entering the expanded surfaces of leaves, contribute to the ennobling of the principles of vegetables?'<sup>1172</sup> Although vague, the idea of photosynthetic nutrition was beginning to develop. It was to be another hundred years before it was realised that both light and the green pigment of plants were involved in plant nutrition.<sup>1173</sup> Joseph Priestley (1733-1804) provided the evidence that there is a link between plants and the atmosphere; he discovered that

flames will quickly go out, and that animals will suffocate when enclosed in a limited amount of air. He concluded that animals and flames 'damage' the air in some way so that it can no longer support combustion or life. What puzzled Priestley was the fact that the earth's atmosphere does not become permanently damaged in this way.<sup>1174</sup>

He experimented by placing a sprig of mint in a jar in which a candle flame had burnt out; ten days later he found that a flame would again burn in this atmosphere. From this he concluded that plants could restore the quality of the air. However, this was not completely accurate; Jan Ingenhousz' (1730-1799) experiments showed that only the green parts of plants can achieve this result. Later in the eighteenth century, after oxygen and carbon dioxide had been isolated, it was realised that plants restore the atmosphere in daylight hours by absorbing carbon dioxide and releasing oxygen.<sup>1175</sup>

Briefly, photosynthesis is the process by which green plants produce carbohydrates from carbon dioxide and water using the energy of the sunlight absorbed by the chlorophyll, or green pigment, in the leaves. Oxygen, which is needed by aerobic organisms, is released as a by-product into the atmosphere.<sup>1176</sup>

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1172 Morton: 253.

1173 Beckett: 53.

1174 *ibid.*

1175 *ibid.*

1176 *Penguin Dictionary of Botany*: 273.

Text page 31.

Line 4. *tam Plantarum, quam Animalium in perpetuo fluxu sunt*: Ray reiterates what was a commonly held belief, that all matter was in a state of continuous change. This goes back to the beliefs of the ancients and the statement by Heraclitus, ‘πάντα ῥεῖ’, that ‘everything is in a state of flux’. ‘Heraclitus wished to emphasise the changes and interactions taking place in the world at large. Change is confined within certain limits or “measures” which ensure a balance between the things that interact.’<sup>1177</sup> In the seventeenth century many scholars, such as Ray and Boyle, believed in a mechanical theory which indicated that physical phenomena were caused by minute particles of matter in random motion.<sup>1178</sup>

Line 6. *Eadem autem succi evaporatio ....* : for Ray on the flow of the sap see this commentary, Chapter 5.

Lines 8-16. *Plantarum autem nutritio .... sed quem in terra inveniunt succum radicibus excipiunt & assimilant*. Ray here discusses the differences between the nutrition of plants and animals.

Simon, Dormer and Hartshorne a similar comparison; they say:

Plants have a different type of nutrition and consequently a different type of metabolism. The great majority of plants consume no organic substances, requiring only some of the inorganic materials that are present in their environment, water and inorganic salts found in the soil and gases from the atmosphere. The leading characteristic of plants, the one by which they were first

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1177 G.E.R.Lloyd, *Ancient Culture and Society: Early Greek Science: Thales to Aristotle*, Chatto and Windus, London 1970: 37.

1178 David Goodman and Colin Russell, *The Rise of Scientific Europe 1500-1800*, Hodder and Stoughton, London 1991: 215.

recognised, is their green colour. The significance of the colour is that the green pigment, known as chlorophyll, plays a central role in photosynthesis. This is a process in which solar radiation absorbed by chlorophyll provides the energy necessary for the synthesis of sugars from carbon dioxide and water. Just as in animals, some of the sugar forms the starting point for the synthesis of yet more complex molecules, while some is oxidised in respiration to provide the energy needed for the syntheses. This type of nutrition is described as autotrophic.<sup>1179</sup>

Line 17. *An Plantæ electione quadam in alimento attrahendo utantur ....* : Ray speaks almost as though the nutritional process was one of automatic 'magnetism'; he does not believe that plants are capable of selecting their nutrients.

Line 21. *Fieri tamen potest ut radicum pori taliter figurati sint ....* : 'the pores of the roots', that is the root hairs.  
For root hairs see above Cap.3, lines 151-159.

Line 24. *Aqua enim vulgaris, fibrarum cava facile subintrat .....*: he is referring back to Chapter 5 here. Plants derive from the soil both the water, which passes through in transpiration, and that which is stored in the individual cells.<sup>1180</sup>

Line 25. *Deinde verno tempore qui facta incisione effluit liquor ....* : for sap in spring see Chapter 5, lines 26-38 and lines 105-123.

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<sup>1179</sup> *Lowson's Botany: 2.*

<sup>1180</sup> *ibid.:* 205-206.

Lines 28-32. *superfluo & ad nutriendum inutili rejecto & evaporato ....* : Ray is discussing the process of transpiration or loss of water from a plant surface. He compares it to a similar process in animals saying that they lose more water ‘through an imperceptible transpiration’ than any other way; this is certainly true of plants which lose 90% of their surplus water through the stomata.<sup>1181</sup>

Line 32. *ut \*Sanctorius demonstrat*: Santorio Santorio, 1561-1636.

Margin reference to *Lib. de Medicina Statica*.<sup>1182</sup>

His main interests were in the fields of medicine, physiology and the invention of measuring instruments. He qualified in medicine in 1582; some of his earliest pioneering experimental work was to carry out a systematic study of the changes in weight which occurred in his own body following the ingestion of food and the elimination of excrement; this study of human metabolism quantitatively by the repeated weighing of a man (usually himself) suspended in a cage from a balance established a method of scientific enquiry of far more importance than the actual results he achieved.<sup>1183</sup>

Santorio’s most famous work is the *Ars de statica medicina sectionibus aphorismorum septem comprehensa* (Venice 1614); the second is *De medicina statica libri octo* (Venice 1615).<sup>1184</sup>

Line 33. *Plantas aqua sola nutriri posse & augeri*:

Ray makes a rather sweeping statement that ‘plants can be nourished and increased by water alone’ but at line 40 below qualifies this adding that the water also contains minerals; these are

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<sup>1181</sup> *Penguin Dictionary of Botany*: 366.

<sup>1182</sup> That Ray owned a copy of this work is indicated by the sale catalogue of his library: *lib. de Medicina Statica*, edition published in the Hague in 1657; British Museum: S-C 326 (6): 15, *Libri Latine &c. in Duodecimo*, number 266.

<sup>1183</sup> Morton: 175.

<sup>1184</sup> *DSB XII*, 101-104.

inorganic nutrients contained in the soil such as nitrogen, sulphur, magnesium and potassium.<sup>1185</sup>

Ray and Sharrock experimented with growing plants in water alone. This is possible and is known now as Hydroponics or Hydroculture. Hydroponics is a method of growing in water to which all necessary nutrients are added.; in Hydroculture the roots are supported in sterile aggregates to which is added water with nutrients.<sup>1186</sup>

Line 34. † *D. Sharroccus*: margin reference to *Lib. de propagat. Vegetabilium*.  
Ray then gives Sharrock's list of plants which he has successfully rooted from cuttings placed in water.

Line 35. *Balsamita fœmina*.  
[C.T.& M. 472] *Achillea* (L.), Sneezeworts; a genus of the *Compositæ* or Daisy family.<sup>1187</sup> Or [C.T.& M. 476] *Tanacetum vulgare* (L.), [*Chrysanthemum vulgare* ([L.] Bernh.): *Chrysanthemum tanacetum* (Karsch. non vis.)], Tansy; a species of the *Tanacetum* genus of the *Compositæ* or Daisy family.  
B.& G.-W. 408 - *Achillea*, and 410 - *Tanacetum*: B.& H. 225 - *Ageratum* and 240 - *Tanacetum vulgare*, Common Tansy:  
Linn.*Sp.Pl.* 897 - *Ageratum*: *Syn.Meth.St.Br.* - no ref.:  
*H.P.* 364 - *Ageratum*: *H.P.III* 636: *Tri.* 14.191 - *Tanacetum*:  
*Cat.Angl.* - no ref. but see *Tanacetum* 281-282:  
*Camb.* 116 - *Tanacetum*.  
Linn.*Sp.Pl.* 897:  
*Ageratum*:  
*Achillea foliis lanceolatis obtusis acute serratis*. Hort.cliff.413.

1185 *Lowson's Botany*: 206.

1186 Brickell, *Gardening*: 449 and 587.

1187 Turner, *Names of Herbes*: 37, has *Achillea ageratum* for *Eupatorium* or in English 'Maudlene'.

Hort.ups.265. Mat.med.399. Roy.lugdb.176. Sauv.monsp.88.

*Ageratum foliis serratis*. Bauh.pin.221.

*Balsamita minor*. Dod.pempt.295.

Moris.hist.3.p.38.s.6.t.1.f.2.

H.P. 364:

For a translation of Ray's description of this genus in *Historia Plantarum* see above under *Ageratum*, Cap.10, line 90.

4 species given, including:

*Ageratum vulgare sive Costus hortorum minor* Park. *Ager. foliis*

*serratis* C.B. *Ageratum plerisque, Herba Julia quibusdam* J.B.

*Balsamita fœmina sive Ageratum* Ger.

***Maudlin, or Maudlin-Tansy.***

H.P.III 636:

(Tr.) *Balsamina* varies in the colour of its flower. This is from *Cat.H.L.Bat.* Herman.

2 additional species given - one with a white flower and one with white but partly red.

Also 7 other additional species given.

Tri. 14.191:

Tansie: *Tanacetum, -i, n.:* [No Greek].

Camb. 116:

*Tanacetum, Tansie.*

Grigson 380:1188

Maudlin' is a local name in Wiltshire for Ox-eye Daisy or Moon Daisy, [*Chrysanthemum leucanthemum* (Linnaeus)].

Tansy, *Tanacetum vulgare* (Linnæus), has characteristics, which seem to fit with Ray's Latin text in *Historia Plantarum*.

Vulnerary, uterine and nephritic - useful on many counts.

Culpeper says:

Let those women that desire Children love this herb, 'tis  
their best companion, their Husband excepted.

He recommended it either bruised and laid upon the navel, or boiled  
in beer and drunk to stay miscarriages.<sup>1189</sup>

However, the poisonous oil of Tansy was taken to procure  
abortions.<sup>1190</sup>

Linnæus explained the name *Tanacetum*, the 'deathless' plant, as  
derived from the Greek ἄθανασία; it was the plant which made  
bodies deathless. Gerard explained the name from the flowers,  
'which do not speedily wither.'

The settlers of New England introduced the plant to the eastern  
seaboard, perhaps to be sure of peopling the New World without  
miscarriages.<sup>1191</sup>

Line 35. *Menthae quæcunque: Mentha:* see above Cap.3, line 25.

Line 36. *Pulegium.*

[C.T.& M. 404] *Mentha pulegium* (L.), Pennyroyal; a species of  
the *Mentha* genus of the *Labiatae* or Mint family.

B.& G.-W. 344: B.& H. 348: Linn.*Sp.Pl.* 577:

*Syn.Meth.St.Br.* 235: *H.P.* 533: *H.P.III* 283: *Tri.* 12.144:

*Cat.Angl.* 244-245: *Camb.* 99.

*H.P.* 533:

7 species given, including:

*Pulegium* J.B. *vulgare* Park. *regium* Ger. *latifolium* C.B.

***Penny-royal or Pudding-grass.***

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1189 Nicholas Culpeper, *The English Physitian Enlarged*, 1669: 361-362.

1190 H.C.Long, *Plants poisonous to Livestock*, 1924.

1191 John Josselyn, *New England's Rarities*, 1672.



*H.P.III* 283:

7 additional species given.

*Tri.* 12.144:

Peniroial or Pudding Grass: *Pulegium*, -ii, n.:

Γλήχων, -ωνος, m.

Line 36. *Sedum multifidum*: no reference to any *Sedum* as *multifidum*, but probably Ray is referring to *Sedum sempervivum tectorum* (L.), the Houseleek, or to *Sedum acre* (L.), Wall-pepper, Biting Stonecrop. C.T.& M. 245-247: B.& G.-W. 164-166: B.& H. 159: Linn.*Sp.Pl.* *Sedum* 129 / 142 / 144 / 221 / 236 / 398-400 / 402 / 405 / 425 / 429 / 464 / 465 / 642: *Syn.Meth.St.Br.* 269-271: *H.P.* 687-688: *H.P.III* - no ref.: *Tri.* 14.190: *Cat.Angl.* 269-271: *Camb.* 112.

*H.P.* 687-688:

*Sedum majus vulgare* C.B. J.B. Park. *Sempervivus majus* Ger.  
**Houseleek.**

*Tri.* 14.190:

Stone-crop: *Sedum minus*, n.: Ἀείζωον -ώου, n.

Line 36. *Prunella*: see *Brunella* above Cap.9, line 65.

*H.P.III* 297:

7 additional species given.

Line 36. *Nasturtium aquaticum*.

[C.T.& M. 99] *Nasturtium officinale* (R.Br.), [*Sisymbrium nasturtium-aquaticum* (L.), *Rorippa nasturtium-aquaticum* ([L.] Hayek)], Green Water-cress, Summer Water-cress; a species of the *Nasturtium* genus of the *Cruciferae* or Cress family.

B.& G.-W. 138: B.& H. 27: Linn.*Sp.Pl.* 657:

*Syn.Meth.St.Br.* 299-301: *H.P.* 814: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* 211: *Camb.* 87.

*H.P.* 814:

6 species given, including:

*Nasturtium aquaticum amarum* Park. *aquat.* 2. *sive majus & amarum*, item 3. *sive aquat. erectum folio longiore* C.B. *Sium Matthioli & Italarum* Ger. *Sisymbrium Cardamine*, *sive Nasturtium aquat. flore majore elatius* J.B. **Bitter Cresses.**

*Nasturtium aquaticum vulgare* Park. *aquaticum supinum* C.B. *aquat. sive Cratevae Sium* Ger. *Sisymbrium Cardamine sive Nasturtium aquaticum* J.B. **Water-Cresses.**

Line 36. *Bugula*: see above Cap.7, line 59.

Line 36. *Trifolium purpureum*.

[C.T.& M. 198] *Trifolium pratense* (L.), Red Clover; a species of the *Trifolium* genus of the *Leguminosæ* or Pea family.

B.& G.-W. 220: B.& H. 111: *Linn.Sp.Pl.* 768:

*Syn.Meth.St.Br.* 327-331 / 478: *H.P.* 943: *H.P.III* 458-459:

*Tri.* - no ref. except *Trifolium* itself, *Tri.* 10.57 / 14.197:

*Cat.Angl.* 292: *Camb.* 120.

*H.P.* 943:

*Trifolium pratense purpureum* C.B. *pratense purp. vulgare* Park. *pratense* Ger. *purp. vulgare* J.B.

**Common purple Trefoil or Honey-suckle Trefoil.**

*H.P.III* 458-459:

*Ad cap. de Trifolio spicato*: 2 additional species given:

*Trifolium purpureum erectum*.

*Trifolium purpureum spicatum erectum*.

Tri. 10.57:

Claver-grass: *Trifolium*, -ii, *majus sativum*, n.:

Τρίφυλλον μείζον.

Tri. 14.197:

Trefoil: *Trifolium*, -ii, n.: Τρίφυλλον, -ου, n.

Line 36. *Clematis daphnoides*.

[C.T.& M. 351] *Vinca major* (L.), Lesser Periwinkle: *Vinca major* (L.), Greater Periwinkle; both species of the *Vinca* genus of the *Apocynaceæ* or Periwinkle family.

B.& G.-W. 310: B.& H. 298: Linn.*Sp.Pl.* 209:

*Syn.Meth.St.Br.* 268: *H.P.* 1091: *H.P.III* 547: *Tri.* - no ref.:

*Cat.Angl.* 72-73: *Camb.* 54.

*H.P.* 1091:

2 species given, both called *Clematis daphnoides*:

*Clematis Daphnoides minor* C.B. J.B. *Vinca pervinca minor*

Ger. *vulgaris* Park. **Periwinkle.**

*Clematis Daphnoides major* C.B. *Cl. Daph. major flore coeruleo*

& albo J.B. *Cl. Daph. sive Pervinca major* Ger. *Clem. Daph.*

*latifolia sive Vinca pervinca major* Park.

*H.P.III* 547:

3 additional species given.

Line 37. *Herba Doria*.

[C.T.& M. 466] *Solidago virgaurea* (L.), Golden-rod; a species of the *Solidago* genus of the *Compositæ* or Daisy family.

B.& G.-W. 394: B.& H. 228: Linn.*Sp.Pl.* 880:

*Syn.Meth.St.Br.* 177: *H.P.* 279: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

H.P. 279:

*Herba Doria Lobelii* Ger. *H.D. vulgaris* Park. *Alisma Matthioli sive Doria* J.B. *Virga aurea major vel Doria* C.B.

***Doria's Woundwort.***

In the main text of *Historia Plantarum* Ray includes this plant with the *Solidago* or Golden Rods, a genus of the *Compositæ* or Daisy family and not with the plants now known as Woundworts, which are members of the *Stachys* genus of the *Labiatae* or Mint family. Golden Rod was well known in Tudor times as a wound herb, and this would account for Ray's name of 'Woundwort'; it was applied either externally or taken as a drink. Such herbs were expensive and in demand.<sup>1192</sup> Gerard said that Golden Rod, brought in from overseas, cost half a crown an ounce. But then it was found

even as it were at our townes end, neere unto the gate that leadeth out of the wood, unto a village called Kentish Towne; and that nowe, no man will give half a crowne for an hundred weight of it; which plainly setteth forth our inconstancie and sudden mutabilitie, esteeming no longer of anything (however pretious soever it be) than whilst it is strange and rare.<sup>1193</sup>

Line 37. *Ranunculus*: see above Cap.7, line 57.

Line 37. *Becabunga*.

[C.T.& M. 378] *Veronicabeccabunga* (L.), Brooklime; a species of the *Veronica* genus of the *Scrophulariaceæ* or Figwort family.

B.& G.-W. 362: B.& H. 335: Linn.*Sp.Pl.* 12:

*Syn.Meth.St.Br.* 280: *H.P.* 852: *H.P.III* - no ref.: *Tri.* - no ref.:

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1192 Grigson: 372.

1193 Gerard (Ed. Johnson): 109.

*Cat.Angl.* 37 with a ref. to see *Anagallis aquatica* 19-20: *Camb.* 42.  
*H.P.* 852:

6 species of *Anagallis* given; 2 include *Becabunga* in their various names:

*Anagallis rectius Veronica aquatica minor folio subrotundo* C.B.  
*aq. vulgaris sive Becabunga Park. aq. sive Becabunga* Ger.

***Common Brooklime.***

*Anagallis rectius Veronica aquatica folio rotundiore major* J.B.  
*aquat. major folio subrotundo* C.B. *aquat. sive Becabunga &*  
*major* Park. *Anagallidis sive Becabunga & varietas major* Ger.

***The Greater round-leaved Brooklime.***

Line 37. *Althaea*: see above Cap.9, line 120.

Line 37. *Lauro-cerasus*.

[C.T.& M. 233] *Prunus laurocerasus* (L.), [*Cerasus laurocerasus*,  
*Laurocerasus officinalis*], Cherry Laurel; a species of the subgenus  
*Laurocerasus* ([Duh.] Rehder) of the *Prunus* genus of the *Rosaceæ*  
or Rose family.

B.& G.-W. 198: B.& H. - no ref.: *Linn.Sp.Pl.* 474:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1549: *H.P.III* - no ref.: *Tri.* 16.49:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1549:

*Lauro-cerasus* Ger. J.B. Clus. *Cerasus folio Laurino* C.B.  
*Cerasus Trapezuntina* Park.

***The Cherry Bay, commonly called the Laurel.***

*Tri.* 16.49:

Laurel: *Laurocerasus*, -i, m.: [No Greek].

Ray's note in *Trilingue* says:

The tree we now commonly call Laurel is not the Laurel  
or *Laurus* of the Antients, that being our Bay-tree, but a

Plant unknown till of late, bearing an esculent Fruit like a Cherry, and yet an ever-green. This is to be carefully heeded, lest anyone be deceived by the confusion of these names.

Line 37. *Scordium*: see above Cap.11, line 44.

Line 37. *Tripolium*.

[C.T.& M. 467] *Aster tripolium* (L.), Sea Aster; a species of the *Tripolium* genus of the *Compositæ* or Daisy family.

B.& G.-W. 396: B.& H. 226: Linn.*Sp.Pl.* 872:

*Syn.Meth.St.Br.* 175: *H.P.* 270: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 293-294: *Camb.* 121.

*H.P.* 270:

*Aster maritimus purpureus Tripolium dictus, Tripolium majus & minus* J.B. *vulgare majus & vulgare minus* Ger. *majus sive vulgare & minus* Park. *majus cæruleum & minus* C.B.

**Sea Starwort.**

Line 38. *Polygonum*.

[C.T.& M. 300-303] *Polygonum* (L.), Knotgrasses; a genus of the *Polygonaceæ* or Dock family.

B.& G.-W. 62-66: B.& H. 383: Linn.*Sp.Pl.* 359-364:

*Syn.Meth.St.Br.* 146-147: *H.P. Polygonum ejusque species* 184

(also many others listed in the index): *H.P.III* 109-110:

*Tri.* - no ref.: *Cat.Angl.* 238-239: *Camb.* 96.

*H.P.* 184:

6 species given, including:

*Polygonum mas vulgare* Ger. *mas vulgare majus* Park. *latifolium* C.B. *Polygonum sive Centinodia* J.B.

**Common Knotgrass.**

H.P.III 109-110:

Incorrect reference in the Index to Volume III.

Line 38. *Nummularia*: see above Cap.7, line 48.

Line 38. *Panax coloni*.

[C.T.& M. 412] *Stachys palustris* (L.), Marsh Woundwort; a species of the *Stachys* genus of the *Labiatae* or Mint family.

B.& G.-W. 338: B.& H. 355: Linn.*Sp.Pl.* 580:

*Syn.Meth.St.Br.* 242: H.P. 563: H.P.III 251: *Tri.* - no ref.:

*Cat.Angl.* 221 with a ref. to see *Sideritis Anglica* 273: *Camb.* 113.

H.P. 563:

*Sideritis Anglica strumosa radice* Park. *Panax coloni* &

*Marrubium aquaticum acutum* Ger. *Stachys palustris fœtida*

C.B. *Galeopsis angustifolia fœtida* J.B. **Clowns All-heal.**

H.P.III 251:

*Panax Coloni* or *Panax Herculeum*: 1 additional species given.

Line 38. *Matricaria*: see above Cap.11, line 73.

Line 42. *Quomodo autem Aer hujusmodi Plantarum radices intret ....* : Ray is obviously puzzled as to how air can enter the roots of plants grown in water. Fresh water containing dissolved oxygen must be guaranteed for this method of growth to be successful. He compares water growth of plants with that of fish, where equally the water must be fresh. Once the oxygen levels drop both plants and fish will suffer. From this paragraph it can be seen that he assumed that plants respire since enough air obviously enters through the water for plants to grow and fishes to breath.

Morton discusses this problem:

A study of the records of the Royal Society shows that a number of experiments were either done or planned, to see whether plants, like animals, succumbed if deprived of air by being placed in a vacuum. The exiguous records suggest that ..... the results were neither striking nor clear when green plants were tested. Ray would certainly be aware of the lack of clear-cut evidence from these experiments. Unfortunately a treatise which he wrote on respiration has not been preserved.<sup>1194 1195</sup>

Although he had no absolute proof of respiratory means, Ray remained convinced that 'Air permeates nature'.<sup>1196</sup>

Line 53. *Quod si nitrum ....* : Ray is perhaps using the term nitrum for salts in general in this context.

*Nitrum* -i, n. = νίτρον: also *sal nitrum*, native mineral alkali, native soda, natron.<sup>1197</sup>

Natron is defined as 'native sesquicarbonate of soda, occurring as a solution or as a deposit (mixed with other substances) in various

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1194 Morton: 210.

1195 There is extant however, a letter concerning this treatise; it was written by a Dr. Connor, an acquaintance of Sloane's, to Ray on 9th November 1696. The treatise appears to have concerned only the respiration of animals, without mention of plants. *Correspondence*: 309-310 and 302. See also note 1196 below.

1196 Ray's respiratory theories are also mentioned in the epitomes of his letters to Tancred Robinson by Dr. Derham; a letter of 17th October 1694 reads as follows: 'Plumier. *Syn. Av. Vernon's Hist of Moths & Doodie's*. Lister's notion of Respir[ation] (in *De Cochleis*). [1685] opposed. He maintains ye aerial Pabulum largely. Air permeates nature'. *Further Correspondence*: 299.

Another epitome, dated 28th November 1694, mentions:

'His *Tract. of Respir[ation]* to be prefixed to his *Synopt. Av.* He adheres to his no[tion] which he long had publicly maintained. Bovallis no[tion]'.  
*Further Correspondence*: 299.

1197 Lewis and Short: 1210.



parts of the world'.<sup>1198 1199</sup>

Lines 59-102. *Quomodo succus nutritus per fibrarum poros arborum etiam altissimarum summa fastigia conscendat ....* : Ray is puzzled as to how sap reaches the tops of trees; see his earlier Chapter 5 on the movement of sap. He discusses this for the remainder of the chapter, with discussion of the work of Boyle, Grew and Malpighi. Simon, Dormer and Hartshorne have much detail on this;<sup>1200</sup>

In physical systems composed of pumps and pipes it is found that water cannot be sucked up to heights greater than about 11 m[etres] high in a single lift. If a pump is set at the top of a pipe 20 m[etres] high with its lower, open end in water, the pump may raise the water to 11 m[etres] but above this will appear a vacuum. This is the height of water which atmospheric pressure will support, and the system is comparable to a water barometer.<sup>1201</sup>

It seems therefore that we must envisage some force exerted from below that is pushing the water up the tree - or perhaps there are pumping stations situated at regular intervals up the bole of the tree? Such theories generally require that the pump is operated by the living tree itself; they are not purely physical systems but are powered by the metabolic activities of the cell, making use of the energy released in respiration. If this were the case then water should be unable to rise up the bole of a tree in which the cells were dead.

In the 1890s Strasburger's experiments proved that this could not depend on a pumping action in the roots, and also since he had used

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1198 *OED*: 1386.

1199 NB The Egyptians used natron for embalming, although the form of the word used in Herodotus is λίτρον: Herod. II, 86 and 87.

1200 *Lowson's Botany*: 188-191.

1201 See notes on Boyle below at line 64.

a poison, picric acid, for his tests he proved that the ascent of sap does not rely on metabolic energy. The theory accepted today is 'the cohesion theory proposed by Dixon and Joly .... in 1894'.<sup>1202</sup>

They suggested that:

the motive power for the ascent of sap was generated in the leaves as water evaporated from the moist surfaces of leaf cells and passed into the intercellular air spaces of the leaf. This water vapour diffused out through the stomata into the atmosphere.

Water is thus drawn from the xylem vessels and tracheids to the leaf cells and as it ascends the xylem the plant needs to draw more water from the roots. The motive power thus comes from above.<sup>1203</sup>

Text page 32.

Line 64. *nobilissimo Boylio*: Robert Boyle, 1627-1691.

British physicist and chemist, born in Ireland. Boyle showed that air possesses weight, that it is necessary for sound propagation, and that its pressure affects the boiling point of water. His chemical work, summarized in *The Sceptical Chymiste*<sup>1204</sup> of 1661, distinguished between elements, compounds and mixtures and dismissed the Aristotelian concept of the four elements.<sup>1205</sup>

In this paragraph of *Historia Plantarum* Ray refers to an experiment performed by Robert Boyle. Boyle performed many experiments on air pressure including devising an air-pump, and his work with Robert Hooke on gases and vacuums led to the law that bears his name, discovering the relationship between pressure and

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1202 *Lowson's Botany*: 188.

1203 *ibid.*

1204 That Ray owned a copy of *The Sceptical Chymiste* is indicated by the sale catalogue of his library:  
*Sceptical Chymist*, edition published in London in 1661; British Museum: S-C 326 (6): 25, *English Books in Octavos & Twelves*, number 4.  
Ray also owned many other works by Boyle, for which see the above sale catalogue.

1205 *DSB II*: 377-382.

volume in a gas: Boyle's Law - for a given quantity of a gas at a constant temperature, Pressure x Volume = Constant.<sup>1206</sup> Boyle published his law in 1663, but in France the law is known as Marriotte's law, after Edme Marriotte (1620-1684) who did not publish it until 1676.<sup>1207</sup>

Boyle performed various experiments on plant nutrition, including growing Squash and Cucumber plants to the fruiting stage in soil, and rooting cuttings of Mint, Balm, Marjoram and Pennyroyal in water only, which demonstrated a big increase in weight despite being 'cherished only by water'. He distilled one of his well-grown plants and found that several volatile substances came off leaving a coal-like residue of 'salt and earth'. He described his experiments in *The Skeptical Chymiste*.<sup>1208</sup> Both he and Van Helmont, who had conducted similar experiments earlier in the 1640s, concluded that water had been transmuted into the various substances of the plant body and could not therefore be a simple element. Boyle says, 'I may deduce from what I have tried concerning the growth of vegetables, nourished with water .... that salt, spirit, earth and even oyl (.... of all bodies most opposite to water) may be produced out of water'.<sup>1209</sup> These experiments were noted by botanists and horticulturalists; Ray himself carried out some experiments on these lines. The conclusion was that water, absorbed principally through the roots, could provide all the food a plant requires.<sup>1210</sup>

Line 81. *in menstruis: menstruus*, 'monthly', used of the menstrual discharge, but also, as here, from 1612 of solvents: any liquid

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1206 David Goodman and Colin Russell, *The Rise of Scientific Europe 1500-1800*, Hodder and Stoughton, London 1991: 216.

1207 *Mac.Enc.*: 177.

1208 Boyle, *The Skeptical Chymiste*.

1209 Morton: 176.

1210 *ibid.*: 177.

agent by which a solid substance may be dissolved. In alchemy the base metal undergoing transmutation was compared to the seed within the womb in relation to the menstrual blood, hence the meaning of solvent.<sup>1211</sup>

Line 84. *D.Grew: margin reference to Lib. de Anatome truncorum.*

Line 86. *ut in Spongiis apparet, quarum textura plantarum parenchymati non adeo dissimilis est.* Ray gives Grew's comparison of sponges and parenchyma, which when expanding must necessarily compress the water-bearing vessels and thus force up the water in them. However Ray says that he is unhappy with this argument because water can be forced downwards as well as upwards.

Lines 93-102. *Nos equidem succum eodem fere modo plantarum fibras subire & conscendere ....* : Ray ends this chapter by giving Malpighi's comparison of water-bearing vessels with fibres.<sup>1212</sup>

Line 97. *Subintrans itaque humor (D.\*Malpighii verba sunt) sursum ascendit ..... seu per gradus ad ingens deducitur fastigium.* \* indicates a margin reference to *Anat. plant. part 1, pag.5* from which this is, as Ray says, quoted.<sup>1213</sup>

Line 98. *Singula namque portio quæ fibrarum frustula unit ....* : he believes there to be valves between the sections of the water-bearing vessels. Perhaps he is referring to the sieve plates at the ends of the sieve tubes, which look like valves.<sup>1214</sup>

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<sup>1211</sup> OED: 1307.

<sup>1212</sup> Malpighi discusses the nutrition of plants in his first chapter, *De Cortice*, of *Anatome Plantarum*: 5-6.

<sup>1213</sup> Malpighi, *Anatome Plantarum*: 5.

<sup>1214</sup> *Penguin Dictionary of Botany*: 330.

## Chapter Eighteen:

### *On the sowing and propagation of plants.*

In this chapter Ray discusses the main ways of propagating plants beginning with sowing from seed, followed by the various forms of vegetative reproduction from cuttings etc. removed from the parent plant, and finally vegetative reproduction by means of runner etc. still attached to the parent plant. He continues in Chapter 19 with a discussion on the various methods of grafting. Although he differentiates between the various types of 'cutting' giving different technical terms, he sometimes seems to use these terms indiscriminately in a rather random fashion.

Plant reproduction and propagation was believed by Ray to be a fine example of the divine creation:

Nature hath taken more extraordinary Care, and made more abundant Provision for their Propagation and Increase; so that they are multiplied and propagated not only by the Seed, but many also by the Root, producing Off-sets or creeping under Ground, as *Strawberry*, and the like, some by Slips or Cuttings, and some by several of these Ways.<sup>1215</sup>

#### Text page 32.

Line 1. *Semine, ramo, surculo, talea, malleolo, gemma, stolone, viviradice.*

Ray begins by giving the forms of propagation used by the ancients.

*semen, -inis, n.* = a seed

*ramus, -i, m.* = a branch

*surculus, -i, m.* = a graft

*talea, -æ, f.* = a cutting<sup>1216</sup>

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<sup>1215</sup> *The Wisdom of God: 83.*

<sup>1216</sup> Cato, *de Agri Cultura* XLV: 1, uses the phrase *taleas oleagineas* for 'truncheons' or sections of Olive trunk used for propagation  
Theophrastus, *Περὶ Φυτῶν Αἰτίων*, *de Causis Plantarum* I, XX: 10 [Loeb edition: 172] uses the word θαλλία for a twig, especially of the Olive; Theophrastus in *Περὶ Φυτῶν Ἱστορίας*, *Historia Plantarum* II, ii: 12 [Loeb edition II: 118] θαλλία for the same.

*malleolus*, -i, m. = a mallet-shoot

*gemma*, -æ, f. = a bud

*stolo*, -onis, m. = a sucker

*viviradix*, -icis, f. = a layer<sup>1217</sup>

*The Scots Gard'ner*, an interesting seventeenth century vernacular gardening manual, gives a similar list:

The several wayes of increasing them are.

First by seeds, Kyes, Kirmells, Nuts, Stones.

Secondly by off-sets, Suckers, Slivings taken from the mother-Plant.

Thridly by Cuttings, Stems, Slips set without Roots.

Fourthly by laying the branch of a growing Plant down into the Earth.

Fifthly by carrying up soil to it, where it will not bend down.

Sixthly by various wayes of Graffings.

Lastly by several wayes of Inoculation.<sup>1218</sup>

Line 3. *Semen quid sit notius est quam ut definiri debeat; Ramus pariter, & Surculus.* Ray then attempts to define his various methods of propagation, drawing largely from ancient sources for his definitions.

Line 4. *Varro lib. I, de Re Rustica cap.xi.* <sup>1219</sup>

Ray, or more probably his typesetter, has made a slight mistake in

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1217 Lewis and Short: *passim*.

1218 *The Scots Gard'ner*: I 2 (55).

Although there are many similarities to Reid's work in chapters 18 and 19 of *Historia Plantarum* and one might assume that Ray had a copy of this work, there is no indication from the sale catalogue of his library that he owned a copy; British Museum: S-C 326 (6). *The Scots Gard'ner* is, no doubt, similar to many other vernacular gardening manuals of the period, which Ray would have read.

1219 There is no indication from the sale catalogue of his library that Ray owned a copy of this work; British Museum: S-C 326 (6).

this reference; the text of *Historia Plantarum* has cap. xi, that is a lower case i. It should read cap. XL, that is chapter 40.

Marcus Terentius Varro, 116-27 B.C. Roman scholar and poet.

After a varied public career he was appointed public librarian by Julius Caesar in 47 B.C. Only a three volume work *Rerum Rusticarum* 'On Agriculture' and parts of a twenty-five volume work *De Lingua Latina* 'On the Latin Language' survive.<sup>1220</sup>

Varro wrote for the guidance of large land owners not small farmers as did Vergil;<sup>1221</sup> he produced a systematic treatise, which is a primary source of information on the agriculture of his time. He defined agriculture as 'not only an art but also a science which instructs us what crops should be sown in each type of soil and what should be done so that the land may continue to give the highest yields';<sup>1222</sup> this is taken directly from Theophrastus.

Lines 4-7. *Demum in oleagineis seminibus .... ac faciunt circiter pedales.*  
This quotation from Varro is referring to Olive cuttings, although strictly speaking the text refers to 'oily seeds', that is to 'olives'.<sup>1223</sup>

Line 7. *Plinius lib.1, cap.17.*

This is not quite a correct reference to Pliny. In Book I Pliny lists the contents of his later books; this is a reference from Book I to Book XVII, not Chapter 17 as cited by Ray.<sup>1224</sup>

Line 7. *Plinius Taleam a Ramo atque etiam Surculo distinguit .....*

Ray gives Pliny's differences between cutting, branch and graft.

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<sup>1220</sup> Lemprière: 708; *Mac.Enc.*: 1259.

<sup>1221</sup> *DSB XIII*: 588-589.

<sup>1222</sup> Morton: 78, note 32.

<sup>1223</sup> Varro, *Rerum Rusticarum* I, XL: 4; Loeb Edition: 268.

<sup>1224</sup> Pliny, *Historia Naturalis* XVII, xxvii-xxviii: 123-124; Loeb edition V: 86.

*Multa sic seruntur ..... donec robur planta capiat:* as stated in the note above, this is a quotation from Book XVII;<sup>1225</sup> although Ray's text differs in a few minor instances from the Loeb text, the sense is not significantly altered. There is, however, one difference, which is not listed in the *apparatus criticus* of the Loeb; Ray has *cavendum in eo ante omnia* and the Loeb has *servandum in eo ante omnia*. This difference, again, does not materially alter the meaning. In his introductory glossary to *Historia Plantarum*, Ray defines *talea* as follows and refers the reader to this chapter:

*Talea nonnullis est surculus præcisus ab utraque parte ut terræ inseratur. Vid. lib.I. cap.18. pag 32.*<sup>1226</sup>

He also defines *surculus*:

*Surculus est quod in ramis simplex assurgit, tenerum & exile. Est etiam ramulus novellus, qui inspiciatur ad ferendum. A small twig of a tree, also a Cyon or graft, germen arboris anniculum.*<sup>1227</sup>

Line 8. *Ficus*: see above Cap.4, line 143.

Line 10. *Punica*.

[*Flowers G. & B.347*]<sup>1228</sup> *Punica granatum*, the Pomegranate; a species of the *Punica* genus of the *Punicaceæ* or Pomegranate family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:  
Linn.*Sp.Pl.* 472: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1461-1462:  
*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.  
*H.P.* 1461-1462:

<sup>1225</sup> Pliny, *Historia Naturalis* XVII, xxvii-xxviii: 123-124; Loeb edition V: 86.

<sup>1226</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

<sup>1227</sup> *ibid.*

<sup>1228</sup> Polunin: 347.\*\*827.



*Malus Punica* J.B. *Punicasativa* C.B. Park. *Granata sive Punica*  
Ger. *The Pomegranate-tree.*

*Malus Punica sylvestris* C.B. Ger. *agrestis* J.B.  
*The wild Pomegranate.*

Line 11. *Myrtus.*

[*Flowers G. & B.* 346-347]<sup>1229</sup> *Myrtus communis* (L.), Myrtle; a  
species of the *Myrtus* genus of the *Myrtaceæ* or Myrtle family.

C.T. & M. - no ref.: B. & G.-W. - no ref.: B. & H. 148:

Linn.*Sp.Pl.* 471-472: *Syn.Meth.St.Br.* 443 (only *Myrtus*  
*Brabantica* or Goule, Sweet Willow, Dutch Myrtle):

*H.P.* 1501 (*Brabantica* 1707): *H.P.III D.* 33: *Tri.* - no ref.:

*Cat.Angl.* 210 with a ref. to see *Elagnus Cordi* 94: *Camb.* - no ref.

*H.P.* 1501:

9 species given, including:

*Myrtus communis Italica* C.B. *item Myrtus sylvestris foliis*  
*acutissimis* Ejusdem *Myrtus latifolia vulgaris* Park. *item Myrtus*  
*Bætica sylvestris* ejusdem & Ger. *Myrtus vulgaris nigra & alba,*  
*sativa & sylvestris* J.B. *The common Myrtle.*

*H.P.III D.* 33:

20 additional species given.

Line 12. *trunco exacuto*: the Loeb edition has a note here: 'i.e. the branch that  
is being planted so as to strike root and form the trunk of a new  
tree'.<sup>1230</sup>

Line 12. *Myrtus*: see above Cap.18, line 11.

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1229 Polunin: 346-347.\*\*824-826.

1230 Pliny, *Historia Naturalis* XVII, xxvii: 123; Loeb Edition V: 86.

Line 12. *morus: Morus.*

[Trees: B.& N.E. 160]<sup>1231</sup> *Morus* (L.), the Mulberry; a genus of the *Moraceæ* or Mulberry family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 399:

Linn.*Sp.Pl.* 986: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1429-1430:

*H.P.III D.* 14: *Tri.* 17.57 / 19.113: *Cat.Angl.* - no ref.:

*Camb.* - no ref.

*H.P.* 1429-1430:

3 species given, including:

*Morus nigra* J.B. *nigravulgaris* Park. *fructu nigro* C.B. *Morus*  
Ger. **The black Mulberry.**

*Morus alba* Ger. Park. J.B. *fructu albo* C.B.

**The white Mulberry.**

*H.P.III D.* 14:

3 additional species given.

*Tri.* 17.57:

A Mulberry-tree: *Morus*, -i, f.: *Μορέα*, -ας, f.

*Tri.* 19.113:

A Mulberry: *Morum*, -i, n.: *Μόρον*, -ου, n.

Line 12. *quoniam ramis eam seri religio fulgurum prohibet*: Ray's text and that given in the Loeb edition differ here; Ray has *ramis*, which seems to me to make perfect sense, whereas the Loeb text has *in ulmo*, that is, that 'grafting onto an elm' is forbidden, rather than 'growing from branches' which better fits the context of the rest of the paragraph.<sup>1232</sup>

Line 16. *quod erat ab radice ....* : 'which was from the root end'.

The Loeb edition again has a different text here, although it does not

<sup>1231</sup> Mitchell and Wilkinson: 160.

<sup>1232</sup> Pliny, *Historia Naturalis* XVII, xxviii: 124; Loeb Edition V: 86.

affect the meaning: *quod fuerit ab radice*. Mueller suggests *erit*.<sup>1233</sup>

Line 17. *Palladius Clavolam*<sup>1234</sup> *a Talea diversam facit*: Ray next cites the difference between a graft and a cutting as given by Palladius.

Rutilius Taurus Æmilianus Palladius was a Roman who lived at the time of Hadrian, although this date is disputed by some. He wrote *De Re Rustica* or *Opus Agriculturæ* in thirteen books; editions of this work were published in Paris in 1536 and in Heidelberg in 1598.<sup>1235</sup>

Ray's text differs from Palladius slightly; whereas Ray says there are 4 *modis*, 'four ways' of propagating the Citrus, the text of Palladius gives *multis modis*, 'many ways'. Ray omits two sentences from this section of Palladius as he shows in the first instance with the phrase *& paulo post*. In his second section of the quotation there is a discrepancy between his text and the one I consulted: Ray has *relicta summitate gemmarum*, whereas the Teubner text has *integra summitate gemmarum*;<sup>1236</sup> neither markedly affects the meaning.

Line 18. *Citri arbor*.

[Mac.Enc. 280] *Citrus medica* (L.), Citron, a Citrus tree; a species of the *Citrus* genus of the *Rutaceæ* or Rue family.

*Flowers G. & B.* 322:<sup>1237</sup> C.T. & M. - no ref.:

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1233 Pliny, *Historia Naturalis* XVII, xxviii: 124; Loeb Edition V: 86.

1234 NB Ray does not give a definition for *clavola* in his introductory glossary to *Historia Plantarum*.

*Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1235 Lemprière: 475.

1236 Palladius, *Opus Agriculturæ*, Book IV, 11-13.

There is no indication from the sale catalogue of his library that Ray himself owned a copy of Palladius' work; British Museum: *S-C* 326 (6). The slight discrepancies in the quotation could be accounted for if Ray is quoting here from memory or perhaps sketchy notes, without the availability of a text for checking.

1237 Polunin: 322.689, \*\*690 and \*\*693.

B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 782: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1654:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1654:

*De malo Citris sive Medica. The Citron Tree.*

Line 23. *Malleolus* ....: Ray gives Columella's definition of a mallet-shoot. Ray defines *malleolus* in the same words in his glossary to *Historia Plantarum*.<sup>1238</sup> It is now defined in the same terms as a semi-ripe cutting taken from the current season's growth and attached to a piece of the stem from the previous year's growth so that its base forms a mallet shape. Mallet shoots are a useful way of propagating plants with pithy or hollow stems because older stems are less likely to rot.<sup>1239</sup>

Line 23. *Columella de Re Rust. l.3, c.5*: 1240

Lucius Junius Moderatus Columella. Like Varro he wrote for the benefit of large landowners; he also produced a treatise on agriculture, the *de Re Rustica*. His work continued to be the main source of scientific agriculture throughout the Middle Ages, and, like that of other classical writers, was copied and re-copied with increasing numbers of inaccuracies and omissions.<sup>1241</sup> He was a native of Gades (Cadiz) in Bætica in southern Spain and was born near the beginning of the first century A.D. It is uncertain at what date he left Spain for Rome, but here *in hoc Latio and saturnia terra* he seems to have spent most of his life.<sup>1242</sup>

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1238 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1239 Brickell, *Gardening*: 85.

1240 That Ray owned a copy of this work is indicated by the sale catalogue of his library: *de re Rustica*, edition published in 1595; British Museum: S-C 326 (6): 10, *Libri Latine &c. in Octavo*, number 29.

1241 Morton: 78, note 34.

1242 Lemprière: 180.

Morton states that:

It is worth noting that in almost his only reference to botanical theory (*De Re Rustica* III, X, 10-11) Columella quotes Aristotle's teleological view that the function of leaves is to protect the fruits, a theory which Theophrastus certainly did not accept.<sup>1243</sup>

Line 23. *Malleolus novellus est palmes .... malleoli speciem præbet*: this quotation from Columella is from Book III, chapter 6, not chapter 5 as given by Ray.<sup>1244</sup>

Ray's text differs slightly from the Loeb; he has *similitudine rei* and the Loeb *similitudinem*, but again neither makes a marked difference to the sense. The *apparatus criticus* of the Loeb text gives, *a similitudine rei ac M, et vulgo ante Schm.*; presumably the text such as Ray used. Ray also gives *malleoli* as opposed to *mallei* in the Loeb.<sup>1245</sup>

Line 25. *Plinius l.17, c.21.*

*solebat capitulatus utrimque e duro surculus seri, eoque argumento malleolus vocatur etiam nunc.* Ray is quoting directly from Pliny here, although the quotation is from chapter 30 and not 21.<sup>1246</sup> Like Columella above, Pliny is discussing mallet-shoots taken from vines.<sup>1247</sup>

Line 26. *surculus*: Ray usually uses the word *surculus* for a graft, but here is using it in a more general sense.

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1243 Morton: 78, note 35.

1244 Columella, *de Re Rustica*: Book III, Chapter 6.

1245 *ibid.*

1246 Pliny, *Historia Naturalis* XVII, xxxv: 156; Loeb edition V: 108.

[It used to be the custom to plant the shoot with a knob of the hard wood on each side of it, and this explains why it is still called a "mallet-shoot".]

1247 *ibid.* XVII, xxxv: 156; Loeb edition V: 108.

*surculus*, -i, m.: 'a young twig or branch, a shoot, sprout, sprig' (syn. *malleolus*): in particular used of 'a scion, graft, sucker, slip, set' of a plant for growth.<sup>1248</sup>

Line 26. *Malleolis autem sic ab iisdem .... suo capitulo sarmentum depresserunt.* This is a quotation, with a small section omitted by Ray, from Columella Book III, Chapter 21. One slight difference: Ray has *prorumpentes*, 'breaking through', whereas the Loeb text has *prorepentes*, 'creeping out', but the basic sense is unchanged.<sup>1249</sup>

Text page 33.

Line 28. *Nam quicquid ex vetere materia relictum erat depressum atque obrutum celeriter humore putrescebat.* Mallet shoots, despite this statement, are a useful way of propagating some types of shrub: see note at line 23 above.

Line 30. *Secuti ergo ....* : Ray merely says 'later' [farmers] but the Loeb text is more specific, giving 'Julius Atticus and Cornelius Celsus, the most distinguished authorities of our time, following the example of the Sasernas, father and son ....'<sup>1250</sup>

Line 33. *Et ad faciendum malleolum .... nec dodrante minor esse debet:* this is also taken from Columella.<sup>1251</sup>

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1248 Lewis and Short: 1816.

1249 Columella, *de Re Rustica*: Book III, xvii: 3-4.

1250 *ibid.*

1251 *ibid.* III,xix: 1.

Lines 37-42. *Sagitta quid*: margin sub-heading.

*Superior pars surculi .... ab Antiquis accusata est.* Again from Columella, but not a direct quotation.<sup>1252</sup>

Pliny also has a version of this.<sup>1253</sup>

Ray paraphrases this for his definition of *sagitta* in the glossary to *Historia Plantarum*.<sup>1254</sup>

Line 39. *nec immerito*: Ray in his paraphrasing has changed the sense of Columella's text here; he implies that the farmers had a good reason for not recommending the planting of 'arrows', whereas Columella says *nec tamen sententiæ suæ rationem nobis prodiderunt*, 'and yet they have failed to give us the reason for their opinion'.<sup>1255</sup>

Line 43. *Stolo quid & unde dictus*: margin sub-heading.

Line 44. *quod effodiebat circum arbores e radicibus quæ nascerentur e solo quas Stolones appellabant.* This section is quoted directly from Varro although Ray gives no attribution.<sup>1256</sup> Pliny also gives this story but not in the same words.<sup>1257</sup> In his glossary to *Historia Plantarum*, Ray gives the definition from à Stapel, in almost the same words as given here, but prefixes this with the following:

*Stolones sunt cauliculi inutiles a radicibus aut caudicis lateribus succrescentes. Suckers from the root.*<sup>1258</sup>

A stolon is now defined as a branch bending to the soil surface and

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1252 Columella, *de Re Rustica*: Book III, xvii: 2-3; Loeb edition Volume I: 326.

1253 Pliny, *Historia Naturalis* XVII, xxxv: 156; Loeb edition V: 108.

1254 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1255 Columella, *de Re Rustica*: Book III, xvii: 3; Loeb edition Volume I: 326.

1256 Varro, *Rerum Rusticarum* I, ii: 9; Loeb edition: 172.

1257 Pliny, *Historia Naturalis* XVII, i: 7; Loeb edition V: 6.

1258 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

eventually rooting itself at a distance from the parent plant. Stolons root at the end where the new plant is to develop.<sup>1259</sup>

Line 45. *J. Bodaeo à Stapel*: in the list of abbreviations and recent works at the beginning of *Historia Plantarum* Ray says of him,

(Tr.) Joannes. Bodaeus à Stapel was a doctor of Amsterdam, who published in 1644 a commentary or notes on the historian Theophrastus together with the Greek text. There are contained in this work very many illustrations of both common and rarer plants.<sup>1260</sup>

Line 46. *Viviradix*: margin sub-heading.<sup>1261</sup>

Line 47. *Plin. lib.17, cap.10. Et aliud genus simile natura monstravit ..... fimbriato corpore*. This is a direct quotation from Pliny but from Book XVII, Chapter 13, not Chapter 10 as given by Ray.<sup>1262</sup>

Line 53. *Antequam exponamus quot modis arte propagentur plantæ ....* : Ray continues by explaining the various methods used by nature for propagation.

The way in which nature herself indicates the correct method of propagation for plants is beautifully expressed by a slightly younger

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1259 *Lowson's Botany*: 74-75; *Penguin Dictionary of Botany*: 345.

1260 *Historia Plantarum Generalis*, Volume I, 'List of abbreviations and recent works' (un-numbered pages).

NB. The date of death of à Stapel is given as 1636 by J. L. Heller in the *Index auctorum librorum a Linnæo (Species Plantarum, 1753) citatorum*, appended to the Ray Society facsimile edition of Linnæus' *Species Plantarum 1753*, published in London in 1959: 55.

There is no indication in the sale catalogue of his library that Ray owned this edition of Theophrastus, or indeed any edition of Theophrastus' works; see above Cap.9, line 8. British Museum: S-C 326 (6).

1261 NB Ray does not give a definition of *viviradix* in the introductory glossary to *Historia Plantarum*.

*Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1262 Pliny, *Historia Naturalis* XVII, xiii: 67: Loeb Edition V: 46.



contemporary of Ray's, Peter Aram (c.1660-1735) in his poem Studley-Park, dedicated to a fellow gardener, William Fisher (c.1680-1743), the gardener at Studley Royal. Aram had trained as a gardener in the Fulham Palace garden of Henry Compton, Bishop of London, referred to by Ray in Chapter 21 (line 43); he was later the gardener at Newby Hall in Yorkshire and at the time of writing this poem in 1733 was working for Sir John Ingilby at Ripley Castle.<sup>1263</sup>

Adept in all the GARDEN Mysteries,  
Of Herbs and Flow'rs, in Legumes, and in Trees;  
Their various Qualities and habits show,  
How best to plant, and when the Time to sow:  
To each its proper Soil, and Aspect, give;  
Tell where it will, and where it will not thrive.<sup>1264</sup>

Line 54. *Flagellis ceu funiculis ....* : he seems to be referring to what we now call runners, which are creeping stems arising from an axillary bud and rooting at the nodes or apex, as in *Fragaria* cited by Ray.<sup>1265</sup>

Line 57. *Fragariā: Fragaria*: see above Cap.7, line 56.

Line 57. *Pentaphyllo: Pentaphyllum*: see above Cap.7, line 57.

Line 58. *Sobolibus*<sup>1266</sup> *ex radice ....* : 'by runners from the root'.

Ray begins this section by describing a rhizome, a term which is used of any shoot running near the surface of the soil; most are

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<sup>1263</sup> Aram: *A Practical Treatise of Flowers*: 7-10.

<sup>1264</sup> Peter Aram, the dedication to *Studley-Park, A Poem*, published in Thomas Gent, *The Antient and Modern History of the Loyal Town of Rippon*, York 1733: 17-18.

<sup>1265</sup> *Penguin Dictionary of Botany*: 319.

<sup>1266</sup> NB Another technical term not defined by Ray in his glossary. *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

subterranean but a few like the Iris rhizome may run along the surface.<sup>1267</sup> He continues with a description of offsets; this term is used either for short shoots arising from an axillary bud near the base of the stem or for bulbils and cormlets forming at the side of the parent plant.<sup>1268</sup> Ray ends this section with a description of tubers, which are swollen parts of underground stems with buds or 'eyes' which can develop into new plants.<sup>1269</sup>

Line 61. *Caulibus ipsis, humi procumbentibus*: Ray is describing stolons here: see definition at line 43 above.

Line 63. *Ficus Indica*. Although *Ficus Indica* is now the specific name of a member of the *Opuntia* genus of the *Cactaceæ* or Cactus family,<sup>1270</sup> because of Ray's description *gummi e ramis in terram ....* he is probably using *Ficus Indica* to indicate *Ficus elastica*, the India Rubber tree or Rubber plant.

For *Ficus* see above Cap.4, line 143.

*Ficus elastica* is an evergreen tree up to 30 metres high with broad, oval, leathery, deep green leaves.<sup>1271</sup>

Line 63. *gummi e ramis in terram ....* : this is an odd way of describing the buttress roots or prop roots which provide extra support for certain trees such as various species of *Ficus*.<sup>1272</sup>

Line 64. *Allii quædam genera bulbulis ....* : Ray has correctly observed the development of small bulbs at the tops of the stems; some of the *Allium* family produce bulbils in place of flowers. These are small

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1267 *Lowson's Botany*: 70-71.

1268 *Penguin Dictionary of Botany*: 249.

1269 *ibid.*: 369.

1270 See below line 66 and also Brickell, *Plants and Flowers*: 526

1271 *ibid.*: 470.

1272 *Penguin Dictionary of Botany*: 52.

buds, which are bulb-like in form and which fall and root independently.<sup>1273</sup>

*Allium*: see above Cap.3, line 12.

Line 65. *Chelidonium minus tuberibus in alis imorum foliorum ortis*: Ray has observed the tubercles or bulbils developing in the axils of the leaves of the Lesser Celandine.<sup>1274</sup>

*Chelidonium minus*: see above Cap.3, line 70.

Line 66. *Moly Homericum*:

In mythology *Moly Homericum* was a plant with a white flower and black root endowed with magical properties, said by Homer to have been given by Hermes to Odysseus as a charm against the sorceries of Circe. The term has been applied since 1597 to various plants supposed to be identical to that of Homer, such as Wild Garlic, *Allium moly* [*Allium ursinum*].<sup>1275</sup>

Grigson<sup>1276</sup> gives Moly as a local name for *Allium ursinum* (L.) in Devon and Somerset. *Allium ursinum*, Ramsons or Wild Garlic: a species of the *Allium* genus of the *Liliaceæ* or Lily family.<sup>1277</sup>

C.T.& M. 539: B.& G.-W. 460: Grigson 410: B.& H. 466:  
Linn.*Sp.Pl.* 295 / 296 / 298 / 300 / 301: *Syn.Meth.St.Br.* - no ref.:  
*H.P.* 1118-1124 - *Moly*: *H.P.III* - listed in the index to Volume III  
but no page number given: *Tri.* - no ref.: *Cat.Angl.* - no ref.:  
*Camb.* - no ref.

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1273 *Lowson's Botany*: 75; *Penguin Dictionary of Botany*: 51.

1274 Clapham, Tutin and Moore: 49.

1275 *OED*: 1345; Homer, *Odyssey*: 210.305.  
*Μῶλυ, τὸ*, *Moly*: Liddell and Scott: 1158.

1276 Grigson: 410.

1277 Although this may be Ray's *Moly Homericum*, Clapham, Tutin and Moore, page 539, state that it is 'without bulbils' as Ray describes.

H.P. 1122:

*Moly Theophrasti magnum* J.B. *Moly Theophrasti sive Homeri*  
Park. *Moly Homericum* Ger. *Moly latifolium, liliflorum* C.B.

Perhaps Ray is referring not to a particular species of *Allium* but to the sub genus *Molium* of the *Allium* genus, which does include several species bearing bulbils, such as *Allium roseum bulbiferum*.<sup>1278</sup>

Line 66. *Opuntia*.

[*Flowers G. & B. 345*]<sup>1279</sup> *Opuntia*; a genus of the *Cactaceæ* or Cactus family.

C.T. & M. - no ref.: B. & G.-W. - no ref.: B. & H. - no ref.:  
Linn. *Sp. Pl.* 1463: *Syn. Meth. St. Br.* - no ref.: H.P. 1463:

H.P. III D. 119: *Tri.* - no ref.: *Cat. Angl.* - no ref.: *Camb.* - no ref.

H.P. 1463:

*De Ficu Indica Tuna dicta seu Opuntia*:

*Ficus Indica major* Park. *Indica* Ger. *Indica folio spinoso, fructu majore* C.B. *Opuntia vulgo Herbariorum* J.B.

*The Prickly Pear-tree*.

H.P. III D. 119:

Incorrect reference in the index to Volume III.

Line 66. *Opuntia foliis depactis*: so far I have found no information on the vegetative reproduction of *Opuntia*.

Line 68. *Superest jam ut exponamus quot modis plantæ arte propagari possint, aut soleant*. Ray continues with artificial means of propagation, which he describes as of two types, *sationem nimirum & insitionem*, 'sowing and insertion'.

He then subdivides the first of these, 'sowing', into

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1278 Clapham, Tutin and Moore: 539.

1279 Polunin: 345\*\*818.

three categories. Ray is using the term 'sowing' to include any propagative part of a plant - true seeds, cuttings, layers etc. - but not grafting; this term was used in the same way by Columella in his work *On Agriculture*.<sup>1280</sup> Ray's three categories of artificial propagation by 'sowing' basically parallel those he gives earlier at lines 53-62 for nature's own methods of propagation.

In his glossary to *Historia Plantarum*, he does not give a definition for *satio* but does give one for *insitio* in line 1 of Chapter 19, for which see below.

Line 68. *De Satione*: margin sub-heading.

Line 70. *Propagatio per Semen*: margin sub-heading.

*Semine*: that is, by means of a true seed.

Line 70. *Ramo . . . . . taleam, clavolam, malleolum, surculum*: Ray's second method of 'sowing' is the various types of cutting.

Line 72. *Sobole*: his third category of 'runner'.

Line 72. *Fragariā: Fragaria*: see above Cap.7, line 56.

Line 74. *Bulbosis: Bulbosae*: literally 'bulbous plants'.

Line 77. *Potest etiam propagari planta radice divisa in tot scil. partes . . . . .* :  
Ray adds to nature's methods, mentioned above, instructions for the division of plants.

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<sup>1280</sup> Columella, *de Re Rustica*, Book III, x: 18: Loeb edition Volume I: 294.

Lines 80-221. *Primo ergo plantæ seruntur Semine ..... Per foramina (inquiens) inferne dato radicibus spiramento.* The whole of this lengthy section is taken up by a discussion on propagation by seeds.

Lines 81-92. *Antequam autem Semina terræ mandentur .... quam Animalibus superius ostendimus.* Ray gives here instructions for the preparation of the soil before the sowing of seeds.

That gardening books giving good advice proliferated then as now is shown in a vernacular gardening book, published in 1683:

Endeavour to sow when the soil is in good temper, a hot furrow is good, but some grounds will not harrow or Rake when new delv'd or Plow'd, which when exposed sometime to air, Frost, Sun, and Showres doth crumble and fall tender; hence ought such to be prepared by fallowing.<sup>1281</sup>

Line 86. *tum ut particulæ aeris nitrosæ:* see note above at Cap.17, line 42.

Line 93. *Commodissimum serendi tempus Natura indicat.* Ray now has a lengthy discussion on the correct times for sowing various types of seed as shown by nature.

The same contemporary vernacular gardening book, cited at line 81 above, also gives very similar advice to that given here in *Historia Plantarum* by Ray:

The most naturall time for sowing is, when the seeds of their own accord falls into the ground, nevertheless that many doth well at this season, as stony seeds and such as endure winter, yet the tender which ar many with us, doth best in the spring, but for convenience we sow at severall other seasons, as in summer, (at which time they

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<sup>1281</sup> *The Scots Gard'ner: I 3 (57).*

require watering and shade) and in Autumne (which is the only season for some) who if tender requires defence & shelter; nor can we have others early at spring without hot beds, which is required in speciall by such as comes not to perfection in our short Summer.<sup>1282</sup>

Lines 96. *Harum nonnulla Autumno plantas producunt ....* : literally 'some of these produce plants in autumn', i.e. 'some of these germinate in autumn'. He gives the benefits of sowing seed in the autumn.

Line 98. *Angelicæ: Angelica:* see above Cap.9, line 31.

Text page 34.

Line 108. *Triticum:* see above Cap.13, line 27.

Line 108. *Avena:* see above Cap.13, line 27.

Line 110. *Reliqua quæ per hyemem in terra restant:* Ray has realised that there is some force which breaks the dormancy of seeds after the winter. Some seeds have chemical inhibitors preventing germination, or hardened seed coats which have to rot down, or need alternating periods of cold and heat before germination can take place.<sup>1283</sup>

Line 114. *Exoticas tamen plantas ....* : he continues with instructions for growing tender and more exotic plants. Tender plants must be sown after the last frost in spring.<sup>1284</sup>

Line 115. *quandoquidem illæ hyemes nostras non tolerant:* Ray is correct is saying that some tender plants cannot survive English winters. The

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1282 *The Scots Gard'ner:* I 3 (57).

1283 Brickell, *Gardening:* 535.

1284 *ibid.:* 515.

problem is not so much due to the average minimum temperature of the area as to sudden frosts.<sup>1285</sup>

Line 117. *oportet ut pulvino calenti ....* : Ray now gives directions for preparing a 'warm bed' from horse manure etc.

Detailed contemporary instructions for preparing such a hot bed are given in a work published in 1683:

As for making the hot-bed for raising early and tender plants, dig a pit (4 foot deep, and of length and breadth, as you have occasion) in a convenient and warme place, lying well to the Sun and sheltered from winds (which you may help by art, if not so naturally) fill it with dung and leitter from the Stables, about a fourthnights gathering, (some makes it of Barley-straw, or the same mixt with bran, because it keeps heat long, and its heat not so excessive nor so noisome to plants as dung) and when well Tread, and even on the Top, lay about 4 Inches thick of rich, light (but fresh and clean) sifted mould thereon: arch it over with sticks, and cover with matts 4 or 5 dayes to cause it heat, then uncover and give it Air a day or two, that its violent heat may pass; then sow your seeds and cover the bed again .....<sup>1286</sup>

Modern instructions for such a hot bed state that one should thoroughly mix together equal parts of fresh horse manure and deciduous leaves, and turn the heap three or four times during the course of a fortnight. The leaves [like Ray's straw] help to moderate the heat and release it

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<sup>1285</sup> Brickell, *Gardening*: 515.

<sup>1286</sup> *The Scots Gard'ner*: L 2 (71).

It is amusing to note that following these instructions for preparing a hot bed, since he considers 'there is great trouble in rightly ordering this sort of hot-bed', Reid gives instructions for making a garden frame covered with glass, similar to our modern cold frames, to be sunk into the pit and surrounded by the 'dung and leitter'.



over a longer period. Dig a hole three feet deep .... fill the hole with the fermenting mixture, firming it in layers and position the [cold] frame on top.

The modern instructions then add a layer of soil into which pots containing the seeds should be put.<sup>1287</sup>

Line 120. *eligantur recentia ....* : he correctly states that fresh seeds are best. Generally seed should be collected from a plant as soon as it is ripe and stored, if necessary, in a dark, dry and airy place.<sup>1288</sup>

Line 121. *Quamvis enim Plantæ nonnullæ ad decennium ....* : Ray again mentions the length of time a seed can remain fertile; see above Chapter 13, lines 58-75. Modern methods of collecting and packaging seeds (in foil packs for example) enable seeds to germinate much longer after collection than previously, although once such packets are opened the natural aging process begins.

Line 126. *Caryophyllis: Caryophyllus*: see above Cap.11, line 16.

Line 127. *Quod si flores multiplices aut variegatos desideras*: Ray believes that by collecting the seeds of such 'sports', he will be able to reproduce such flowers. This was of great interest to gardeners of the period, as is shown in Peter Aram's *A Practical Treatise of Flowers*, where he refers to Lauremberg's experiments on 'making single Flowers double & imposing divers Colours on them not naturally their own';<sup>1289</sup> although Ray does not mention it here, he too no doubt had read this work. In fact, unless normal cross pollination has been prevented and very carefully controlled manual pollination has been

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1287 *Your Gardening Questions Answered*: 83.

1288 Brickell, *Gardening*: 535.

1289 Aram: *A Practical Treatise of Flowers*: 2.

practised, such plants cannot be guaranteed.<sup>1290</sup>

Line 130. *quemadmodum videmus in Animalibus ....* : he continues by giving parallels with genetic disorders in the animal kingdom [such as X-linked disorders like hæmophilia and colour blindness].<sup>1291</sup>

Line 132. *Mirabili Peruvianā: Mirabilis Peruviana.*

[R.H.S. 205 and 515]<sup>1292</sup> *Mirabilis jalapa* (L.), Marvel of Peru, Four o'clock plant; a species of the *Mirabilis* genus of the *Nyctaginaceæ* family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:  
Linn.*Sp.Pl.* 177: *Syn.Meth.St.Br.* - no ref.: *H.P.* 397-398:  
*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.  
*Linn.Sp.Pl.* 177:

*Mirabilis.* Hort.cliff.53. Hort.ups.43. Fl.zeyl.85. Mat.med.76.

*Nyctage.* Roy.lugdb.417. Cold.noveb.29.

*Jalapæ species omnes.* Tournes.inst.130.

*Solanum mexiocanum, flore parvo.* Bauh.pin.168.prodr.91.

*Admirabilis peruviana.* Clus.hist.2.p.87.

*Habitat in India utraque.*

*H.P.* 397-398:

*Mirabilis Peruviana* Ger. Park. *Hachal Indi sive Admirabilis*

*Peruana* Clus. *Solanum Mexicanum flore magno* C.B.

*Jasminum Mexicanum sive Flos Mexicanus multis* C.B.

*The Marvel of the World.*

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1290 For further discussion of this see Brickell, *Gardening*: 536-537; and *Your Gardening Questions Answered*: 308.

1291 *Harrap's Dictionary of Medicine and Health*: 90 and 420.

1292 Brickell, *Plants and Flowers*: 205 and 515.

Line 135. *inquit Ferrarius*: margin reference to *Horticult. lib.3.c.1*<sup>1293</sup>

Giovanni Battista Ferrari was cited by Ray as one of Parkinson's sources for his *Theatrum Botanicum* of 1640; 'First he takes all the plants contained in G.Bauhin's *Pinax* .... to which he adds .... some out of Ferrarius his *Flora* ....'.<sup>1294</sup>

In the preface to *Historia Plantarum* Ray says that:

(Tr.) he wrote four books about plants or the cultivation of plants, published eventually in 1646 in Amsterdam. This book contains some illustrations and descriptions of new plants.<sup>1295</sup>

This is a later date than indicated in Ray's letter to John Aubrey cited above.

Lines 134-136. *Nec tamen ..... radices exputrescant*. Ray quotes Ferrari's instructions here, from *Horticult. lib.3, c.1*, about the condition of soil suitable for sowing. Soil should be neither too dry nor too waterlogged.<sup>1296</sup>

Line 137. *Myrrhidae: Myrrhis*: see above Cap.9, line 115.

Line 137. *Ocymo: Ocimum*.

[C.T.& M. 409] *Clinopodium vulgare* (L.), [*Calamintha vulgaris* ([L.] Druce): *Calamintha clinopodium* (Bentham): *Satureja vulgaris*], Wild Basil; a species of the *Clinopodium* genus of the *Labiatae* or Mint family.

B.& G.-W. 342: B.& H. 351: Linn.*Sp.Pl.* 597:

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1293 There is no indication from the sale catalogue of Ray's library that he owned a copy of this work; British Museum: S-C 326 (6).

1294 Letter written to John Aubrey on May 8th 1678: *Further Correspondence* : 162.

1295 *Historia Plantarum*, Volume I: 'List of abbreviations and recent works' (un-numbered pages).

Giovanni Battista Ferrari, S.J., *Flora seu De Florum Cultura*, Rome 1633.

1296 Brickell, *Gardening*: 536.

*Syn.Meth.St.Br.* 238: *H.P.* 540-541: *H.P.III* 289: *Tri.* 8.13:  
*Cat.Angl.* - no ref.: *Camb.* - no ref.

H.P. 540-541:

(Tr.) Varro writes that *Ocimum* takes its name from the Greek ὠκύς or ὠκέως, because it grows quickly. Theophrastus says that it appears on the third day after sowing, *Lib.7, Cap.1*. Yet (says Jo. Bodaeus à Stapel) more learned botanists write that this etymology comes from the food *ocymum*; indeed they derive it from ἀπὸ τοῦ ὄζειν, 'to smell' or 'to be scented'. For it is an extremely scented little herb, which strikes both the head with its scent and causes sneezing. Also more significantly they thought it should be written ὄζυμον with a ζ.

*Ocymum* (the same author says) differs from *Ocimum*. *Ocymum* is a type of food, *Pliny Lib.17, Cap.24*.

Ray's quotation of the Pliny text is as follows:  
*Ocymum quod in vinea seri jubent, Antiqui appellabant pabulum, umbræ patiens, quod celeriter proveniat.*<sup>1297</sup>

*Ocimum*, however, is a scented plant. The food *Ocymum* the ancients wrote ὠκυμον with an υ, the herb ὠκιμον with an ι. But this is not perpetual and consistent among them.

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<sup>1297</sup> In the Loeb text of Pliny, this is not a reference to *Ocymum* but to *Ocinum*. Loeb, Vol. V: 136, *Lib. XVII, xxxv: 198* gives:

*Ocinum, quod in vinea seri iubet, antiqui appellabant pabulum umbrae patiens, quod celerrime proveniat*'.

[*Ocinum*, which he (Cato) recommends planting in a vineyard, was the old name for a fodder-plant capable of standing shade, and refers to its rapid growth.]

This herb is called *Basilicum* by more recent scholars because of its dignity, because it was deemed worthy to be used on account of its outstanding fragrance in a royal household and on royal hands.

The characteristics of *Basilicum* are leaves like Marjoram, the sweet smell of Lemon or Pink, flowers in loose spikes growing from widely spread whorls.

5 species given, including:

*Ocimum vulgatius* C.B. *medium vulgatius & nigrum* J.B.  
*vulgare majus* Park. *medium citratum* Ger. **Common Basil.**

*H.P.III* 289:

21 additional species given.

*Tri.* 8.13:

Basil: *Ocimum*, -i, n.: Ὠκίμων, -ίμου, n.

Line 137. *Scorzonerā: Scorzonera*: see above Cap.11, line 83.

Line 141. *Nonnulli Semina aquæ seu simplicis, seu nitratae ....* : Ray does not believe it is necessary to dip seeds into such preparations. The only advantage would seem to be that hard or old seeds could benefit from soaking or moisturising. See above Cap.15, line 250.

Line 144. *Hen. Corvini*: I have been unable to identify Corvinus but Ray mentions him again in a letter to Hans Sloane, dated 15th August 1696.<sup>1298</sup> From the first name, Hen[ry?], given here it would appear that Ray is not referring to an ancient source, although the letter cited above also mentions Terentius [the comic poet of the second century B.C.?]. Several Romans named Corvinus are remembered today: two of whom were orators, but not known for

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<sup>1298</sup> *Correspondence*: 302.

pronouncements on natural history.<sup>1299</sup>

Line 144. *Ferrarius: Horticult. l.3*: margin reference.

Line 149. *Generale est in omni satione ut semina terra operiantur*: Ray believes that seeds when planted should be covered by earth, although at line 159 below he indicates *solarium radiorum tepore fovenda* etc., that is, so that they might benefit from the heat of the sun they should not necessarily be buried deeply.

Line 154. *Summopere autem cavendum est . . . . .* : he continues by discussing the depth at which seeds should be planted. A good general rule is to cover seeds with about their own depth of soil or compost. Some very fine seeds, however, such as Begonias and Celery do require light to germinate; see note at line 149 above.

Line 156. *Triticum*: see above Cap.13, line 27.

Line 156. *Cerealia*: 'cereal plants'; various species of the *Gramineæ* or Grass family.

Line 156. *leni etiam colore*: this is a difficult phrase. Presumably he means that a certain amount of light can be beneficial to them for germination.

Line 162. *Quo Semina maturius seruntur vere*: Ray continues by instructing that seeds 'must be protected from the cold' and also if sown later 'must be watered and shaded more'. The primary requirements for germination are water, air and warmth.<sup>1300</sup> Most biological processes are speeded up when the temperature is higher and so

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<sup>1299</sup> Lemprière: 1958 edition: 176; 1984 edition: 200.

<sup>1300</sup> Brickell, *Gardening*: 536.

heating the temperature of the soil or compost, either naturally/seasonally or artificially<sup>1301</sup> helps speed up germination.

Line 164. *An Plantæ aliquæ nollo semine prævio sponte e terra oriantur difficilis quæstio est.* Ray again mentions the then frequently held belief in spontaneous generation; see above Cap.13, lines 72-75, where Ray discusses the germination of seeds of *Sinapi* on the banks of ditches.

He had written in 1671 to Henry Oldenburgh stating that he did not believe in spontaneous generation, in this instance of insects;<sup>1302</sup> he reiterates this belief in the case of animals very forcibly, although with perhaps some hesitation concerning plants, in *The Wisdom of God*:

A third and most effectual Argument against Spontaneous Generation is, that there are no new Species produced, which would certainly now and then, nay, very often happen, were there any such Thing. .... In my Denial of the Spontaneous Generation of *Plants*, I am not so confident and Peremptory; but yet there are the same Objections and Arguments against it, as against that of Animals, *viz.* because it would be a Production out of indisposed Matter, and consequently a Creation: .... If it could do so, what need of all that *Apparatus* of Vessels, Preparation of Seed, and, as I also suppose, Distinction of Masculine and Feminine, that we see in Plants?<sup>1303</sup>

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1301 See note above at Cap.18, line 117.

1302 John Ray to Henry Oldenburgh, July 3rd 1671; *Further Correspondence*: 56.

1303 *The Wisdom of God*: 221-228 and commented upon in the appendix to the Wernerian Club edition: 318, note F.

Lines 169-170. *Sinapeos, Sinapeos, Sinapi:*  
for *Sinapis*: see above Cap.13, line 12.

Lines 168-210. *Deinde in aggeribus fossarum .... cum nullum in iis ostendere possimus.* Ray elaborates on his discussions on spontaneous generation of animals<sup>1304</sup> by investigating spontaneous generation in plants. He begins by discussing *Sinapi* and its apparently spontaneous generation in the Isle of Ely.<sup>1305</sup> He sums up his opinions on this in *The Wisdom of God*:

Whereas I have often written in many Places, that such and such Plants are spontaneous, or come up spontaneously; I mean no more by that Expression, but that they were not planted or sown there industriously by Man.<sup>1306</sup>

See also the note below at line 173.

Text page 35.

Lines 171-180. *In ruderibus etiam Urbis Londiniensis .... semina autem minutissima & numerosissima profert.* He then goes on to discuss *Erysimum angustifolium Neapolitanum* growing apparently spontaneously after the great fire of London in 1666. See also the note below at line 173.

Line 173. *Erysimi angustifolii Neapolitani: Erysimum angustifolium Neapolitanum.*

See entry below for *Erysimum* Cap.18, line 174.

C.T.& M. 101; there is a reference here to an annual form *Erysimum repandum*, which has narrowly lanceolate leaves. Is this the plant to which Ray is referring?

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1304 See note at line 164.

1305 See *Historia Plantarum*, Volume I, Cap.13, lines 72-75.

1306 *The Wisdom of God*: 228.



B.& G.-W. *Erysimum repandum*: B.& H. - no ref.:  
Linn.*Sp.Pl.* - no ref.: *Syn.Meth.St.Br.* 298 - broad-leaved  
*Erysimum Neapolitanum* but not narrow-leaved: *H.P.* 811:  
*H.P.III* 515: *Tri.* - no ref.: *Cat.Angl.* 100: *Camb.* - no ref.  
*H.P.* 811:

*Erysimum angustifolium majus* C.B. item *rapistrum Italicum*  
*siliquis longissimis* ejusd. *angustifolium Neapolitanum* Park.  
*Rapistrum montanum Irionis folio λεπτομακροχέρατον* Col.  
*Erysimum latifolium Neapolitanum* Park. *latifolium majus*  
*glabrum* C.B. *Irio leavis Apulus Erucæ folio* Col.  
**Smooth Broader-leaved Hedge-Mustard.**

*H.P.III* 515:

Incorrect reference in the Index to Volume III.

*Cat.Angl.* 100:

Note that in *Catalogus Angliæ* there is a discrepancy in Ray's description of *Erysimum Neapolitanum*, where he gives it as *latifolium* ['broad-leaved'] rather than *angustifolium* ['narrow-leaved']. He is obviously referring to the same plant here since he tells the same story of its growth after the great fire of London (despite differing dates being given for the fire).

*Erysimum latifolium Neapolitanum* Park IV, sive *latifolium majus glabrum* C.B. **Broad-leaved Hedge Mustard of Naples.** *Circa Londinum variis in locis, præcipue in aggeribus terrenis inter Urbem & Kensingtong. Ex quo Urbs incensa est annis 1667. and 1668. intra muros ipsos in ruderibus circa templum S.Pauli copiosissime provenit.*

That *angustifolium* is the same plant as *latifolium* is confirmed by Ray's description in *Historia Plantarum*, where both terms are used for Smooth Broader-leaved Hedge-Mustard, for which see above.

Line 173. *Autores fide dignos habemus*: Ray does not identify these authors either here or in the main body of the text of *Historia Plantarum*.<sup>1307</sup> However, in his *Methodus Nova* of 1682, Ray, according to Raven:

quotes Morison, though without discussing the case of *Sisymbrium irio* after the Great Fire in 1666 with which Morison deals in *Praeludia Botanica*. Ray takes instead the rapid appearance of *Brassica sinapis* on dykes in the fens.<sup>1308</sup>

Thus it is possible, despite his antipathy towards Morison, that Ray is referring to him here as one of his 'authors of trust', especially since in this passage of *Historia Plantarum* Ray again mentions *Sinapi* and, although he uses a different member of the *Cruciferae* as his example, does at least cite a member of this family as springing up after the Great Fire in 1666.

Line 174. *Erysimi: Erysimum*.

[C.T.& M. 101] *Erysimum cheiranthoides* (L.), Treacle Mustard; a species of the *Erysimum* genus of the *Cruciferae* or Cress family.

B.& G.-W. 134: B.& H. 35: Linn.*Sp.Pl.* 660-661:

*Syn.Meth.St.Br.* 298: *H.P.* 810-814: *H.P.III* 515: *Tri.* - no ref.:

*Cat.Angl.* 100: *Camb.* 62.

*H.P.* 810-814:

16 species given, including:

*Erysimum Galeno & Theophrasto*, *Myagro affinis planta siliquis longis* J.B. *Camelina* Ger. *Camel. sive Myagrum alterum amarum* Park. *Myagrum siliqua longa* C.B. **Treacle Wormfeed.**

*H.P.III* 515:

Incorrect reference in the Index to Volume III.

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1307 *Historia Plantarum*: 811.

1308 Raven: 194, footnote 1.

The text at this point would indicate that Ray means the same species in the last two references to *Erysimum*. See discussion at line 173 above.

Line 181. *Plantas imperfectas*: Ray recognised the distinction between plants with flowers [*Floriferæ*] and those without [*Floræ destitutæ*]; he gradually began to substitute these terms for his earlier *perfectæ* and *imperfectæ*.<sup>1309</sup>

Lines 181-186. *Fungos, Tubera, Muscos .... Algas, Fucos, Corallia, Alcyonia &c.*: this is an odd list as the various methods of reproduction of the organisms cited by Ray vary a great deal. For example, fungi reproduce by means of sexual or asexual spores and usually forming hyphæ:<sup>1310</sup> tubers vegetatively:<sup>1311</sup> and mosses by means of spores.<sup>1312</sup>

Ray in these lines expresses his doubts on the existence of seeds in *fungi*, ending with the hope that ‘others coming after us, who are more careful or luckier, will detect the seeds ... or will discover their method of propagation’. Ramsbottom in his *Mushrooms and Toadstools* states that:

The spores of fungi are very small and those of only three or four species are sufficiently large to be within the range of unaided vision. Those of toadstools average about 10 $\mu$  in length, a  $\mu$  (micron or mu) being  $\frac{1}{1000}$  of a millimetre, i.e.  $\frac{1}{25400}$  of an inch.<sup>1313</sup>

In fact the spores of fungi had been observed by Ray’s time by at least two scholars, although neither realised the significance of the

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1309 See the discussion in Morton: 205.

1310 Buczacki: 8.

1311 *Penguin Dictionary of Botany*: 369.

1312 Phillips, *Grasses*: 9.

1313 Ramsbottom: 12.

spores. Two sections of Robert Hooke's *Micrographia*, published in 1665, are devoted to fungi; observation 19 includes the words:

So that the little cases which appear to grow on the top of the slender stalks, may, for ought I know, though I should suppose them to spring from the perverting of the usual course of the parent Vegetable, contain a seed.<sup>1314</sup>

Hooke reiterates his belief in spontaneous generation in similar words to those of Ray:

as Mushrooms may be generated without seed, so does it not appear that they have any such thing as seed in any part of them; for having considered several kinds of them, I could never find any thing in them that I could with any probability gness [*sic*]to be the seed of it, so that it does not as yet appear (that I know of) that Mushrooms may be generated from a seed, but they rather seem to depend merely upon a convenient constitution of the matter out of which they are made.<sup>1315</sup>

Malpighi in his *Anatome Plantarum pars altera*, published in 1679, had noticed the actual spores, although he believed them to be florets carried in an inflorescence (the sporangiophore).<sup>1316</sup>

Line 181. *Fungos: Fungus.*

[P.Dict.Bot. 145]<sup>1317</sup> *Fungi, Fungi*; a group of saprobic, symbiotic, or parasitic eukaryotic organisms containing some 50,000 recognized species divided among some 5100 genera. However, it has been estimated that the actual number of species

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1314 Robert Hooke, *Micrographia*, London 1665; reprinted by Weinheim, New York 1961; quoted by Ramsbottom: 15.

1315 *ibid.*: 16.

1316 Malpighi, *Anatome Plantarum pars altera* and Ramsbottom: 16-17.

1317 *Penguin Dictionary of Botany*: 145.

may be between 100,000 and 250,000. The name Fungi has been used as a general term, lacking any systematic meaning, but now such organisms are often placed in a separate kingdom the Fungi (*Mycota*), distinct from the green plants. They differ from green plants in not possessing chlorophyll and are thus heterotrophic, usually obtaining food by absorption, though some lower fungi, possibly more closely allied to the Protozoa, take in food by ingestion. Fungal cell walls are characteristically chitinised or composed of fungal cellulose. The kingdom Fungi contains two divisions, the *Myxomycota* and the *Eumycota*.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 547:

Linn.*Sp.Pl.* 1141-1184: *Syn.Meth.St.Br.* 1-29: *H.P.* 85-111:

*H.P.III* 17-25: *Tri.* 12.131: *Cat.Angl.* 117-124: *Camb.* 65-66.

*H.P.* 85-111:

Ray says that (Tr.) 'Fungi are the most imperfect type of plant'.

He then lists in sections:

Section 1.

*De Fungis terrestribus pileatis simul & lamellatis:*

1. *De Fungis terrestribus lamellatis esculentis*, subdivided into 24 subsections.
2. *De Fungis lamellatis terrestribus noxiis*, subdivided into 35 subsections.

Section 2.

*De Fungis terrestribus lamellis carentibus*, subdivided into 18 subsections.

Section 3.

*Fungi Arborei*, subdivided into 15 subsections.

Section 4.

*De Fungis subterraneis, seu Tuberibus terrae.*

H.P.III 17-25:

many additional species given:

*Fungus ophioglossoides [digitelli]* - 24.

*Fungus phalloides* - 25.

*Fungus pulverulentus* - 19.

*Fungus ramosus* - 21.

Tri. 12.131:

Mushroom or Toadstool: *Fungus*, -i, m.: Μύκης, -ητος, m.

There is an interesting comment on the derivation of the name *fungus*, which had also interested Ray, in Ramsbottom's *Mushrooms and Toadstools*:

It is commonly believed to be cognate with or derived from the Greek word for sponge, *sphonggos* (σφόγγος), [sic]<sup>1318</sup> which agrees with the ideas the Romans expressed about the nature of fungi. A derivation which was apparently first suggested by J. Bauhin in *Historia Plantarum* (1650), appealed to several of the herbalists because of its supposed aptness - *funus*, funeral, and *ago*, I lead to. John Ray, in *Historia Plantarum* (1681),<sup>1319</sup> says whatever the etymology the idea is not unmerited.<sup>1320</sup>

Ray's actual words are:

*Fungus nonnullis a Funere, vel a Funus & ago, vel a Fungor dictus videtur, quia veneno suo ad Funus vescentes deducit. Quicquid fit de Etymo, Fungus certe hoc nomine non immerito male audit, ut qui avide*

1318 NB This is the spelling of σφόγγος given by Ramsbottom, although the rare spelling of σφόγγος is found in *IG II* (2). 144 A 37. (Delos iv. B.C.), *PSI* 6. 558.7 (iii B.C.), *POxy.* 1384.25 (v A.D.); Liddell and Scott: 1628.

1319 This should read 1686.

1320 Ramsbottom: 4.

*deglutientibus non raro funestus & exitialis fuerit.*<sup>1321</sup>

Morton says that Ray made a serious attempt to define anew their [i.e. the Fungi's] features as a class:

Fungi have almost nothing in common with more perfect plants, neither green colour, nor texture, nor the possession of flower or seed as far as known, one or two forms only excepted,<sup>1322</sup> nor any leaf in the strict sense. They are ephemeral, except those on trees.<sup>1323</sup>

Ray also made the first attempt to classify fungi according to the morphology of the sporophore, rather than their esculent properties, and this was in itself a considerable advance.<sup>1324</sup>

Line 181. *Tubera: Tuberum:* tubers are thick underground stems or roots in which food is stored; they last for one year only and new tubers do not arise from the site of the previous one. The tubers of the Potato are examples of stem tubers and those of the Dahlia of root tubers. Root tubers develop from adventitious roots; a stem tuber has buds or 'eyes' in modified leaf axils from which new plants can grow. Tubers are organs of perennation and vegetative reproduction.<sup>1325</sup>

Line 181. *Muscos: Muscus:* [G.F.M.& L. 9] Mosses and Liverworts are plants which reproduce by spores, as do the Fern group, but they have a simpler structure. They have stems and leaves but no roots, only modified stems forming root-like structures known as rhizoids. Botanically they make up an order called *Bryophyta* and are

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1321 *Historia Plantarum:* 84.

1322 NB. Ray meant the birdsnest fungi (*Nidulariæ*) in which he took the peridiola for possible seeds.

1323 Morton: 205-206.

1324 *ibid.:* 206.

1325 *The Penguin Dictionary of Botany:* 369.

classified into two groups: *Musci* - Mosses, and *Hepaticæ* - Liverworts.

Mosses produce spores in capsules, which may either eject them forcibly through a small opening when ripe (*Sphagnum*), release them through four slits (*Andrea*), or, as in the majority of mosses, through an opening or mouth exposed when a lid drops off. On the ground they develop into new plants, not into prothalli as in ferns. The plant contains the male and female sexual structures, which are minute and often difficult to find, but may also be quite obvious as with the clusters of male structures in *Polytrichum* species. Male and female may be close together on the same plant but may also occur on separate plants, characteristics which vary with the species. Male cells migrate through the water film on the plant's surface to the female structure which has been found to secrete a chemical to guide them. Thus, as with the ferns, damp conditions are essential to the sexual process. Once fertilised in this way the female receptacle develops a capsule which in turn produces spores.<sup>1326</sup>

There are about 15,000 species of *Musci* in about 610 genera. The *Musci* class is divided into three orders on the basis of difference in capsule structure and in formation of the protonema (the juvenile form). The *Bryales* (the 'true' mosses) is the largest order containing about 600 genera, including the *Polytrichum*. The *Sphagnales* (bog or peat mosses) is the second order containing a single genus, *Sphagnum*. The third order is the *Andreaeales*, again containing a single genus, *Andreaea*.<sup>1327</sup>

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 547:

Linn.*Sp.Pl.* 1100-1130: *Syn.Meth.St.Br.* 54-116:

*H.P.*

*Muscus ejusque species* 112, &c. *ad.* 124. *item* 1851. *marinus*

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1326 Phillips, *Grasses*: 9.

1327 *Penguin Dictionary of Botany*: 236.



65. *item* 78, 79. *corniculatus* 113. *coralloides* 114. *Islandicus*  
115. *clavatus* 120. *erectus abietiformis* 121. *terrestris vulgaris*  
112. *aquaticus terrestri similis* 122. *Filicinus* *ib. pyxiodes* 114.  
*arboreus, Usnea Officin.* C.B. 114. *arboreus cum orbiculus*  
*Ibid. pulmonarius* 116:

*H.P.III* 15-44: *Tri.* 12.125: *Cat.Angl.* 202-209: *Camb.* 86.

*H.P.III* 15-44:

Many additional species given.

*Tri.* 12.125:

Moss: *Muscus*, -i, m.: *Βρύον*, -ου, n.

Line 182. *Algas: Algae.*

[P.Dict.Bot.11] Extremely diverse group consisting of predominantly aquatic plants showing relatively little differentiation of tissues and organs as compared to bryophytes and tracheophytes. The group includes both prokaryotic and eukaryotic organisms ranging from unicells through colonial and filamentous forms to parenchymatic seaweeds over 50 metres long. Some 23,000 species of eukaryotic algae and some 1450 species of prokaryotic algae have been described. Adaptation to an aquatic environment has led to the development of many distinctive biochemical traits. Algal sex organs are usually unicellular.<sup>1328</sup>

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 547:

*Linn.Sp.Pl.* 1131-1171: *Syn.Meth.St.Br.* 52-53: *H.P.* 70-71:

*H.P.III* 8-9: *Tri.* 14.211: *Cat.Angl.* 12 with a ref. to see *Fucus*  
114-116: *Camb.* - no ref.

*Syn.Meth.St.Br.* 52-53:

Ray appears to be describing one of the parenchymatous seaweeds rather than a small alga, as he says it is a genus of plants swimming in the sea, with long, grassy, thin leaves etc. He goes on

to describe various specimens.

*Alga* Ger.Em.1569. *angustifolia vitriariorum* J.B.III.794.  
C.B.Pin.364.5 *Fucus marinus sive Alga marina graminea*  
Park.1242. *Potamogeton gramineum marinum, imo caule*  
*geniculatum* Pluk.Mant.155. **Grass-Wrack.** *In littoribus*  
*marinis ubique.*

H.P. 70-71:

Rays says that

(Tr.) *Alga* is a marine Lichen brought from the sea for  
making manure especially in Scotland and Gallia  
Narbonensis.

He lists many species, using the English name of Wrack, with *Alga*  
being by and large an alternative to *Fucus* (Lichen).

*Fucus sive Alga marina angustifolia vesiculas habens. Fucus*  
*maritimus nodosus* C.B. *Quercus marina tertia* Ger.emac. *i.e.*  
*Fucus maritimus* 3. Dod.Belg.

**Long narrow-leaved Sea-Wrack.**

H.P.III 8-9:

Many additional species given.

Tri. 14.211:

Wrack: *Alga*, -æ, f.: Φύκος, -εος, -ους, n.

Line 183. *Fucos: Fucus.*

[Mac.Enc. 1316] a large brown seaweed of the order *Fucales*,  
found almost worldwide on rocky shores and prominent in colder  
regions. Leathery straplike branching fronds arise from a circular  
rootlike anchor (holdfast), often bearing air bladders to aid flotation.  
Examples are Bladderwrack (*Fucus vesiculosus*) and serrated Wrack  
(*Fucus serratus*).

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1158-1162: *Syn.Meth.St.Br.* 39-51: H.P. 70-71:

*H.P.III* 9-11: *Tri.* - no ref.: *Cat.Angl.* 114-116: *Camb.* - no ref.

*H.P.* 70-71:

13 species given, including:

*Fucus maritimus vel Quercus maritima vesiculas habens* C.B.

*Quercus marina* Clus. Ger. Park. *Fucus sive Alga marina latifolia vulgatissima.*

***The most common broad-leaved Sea-wrack.***

*H.P.III* 9-11:

Many additional species given.

Line 183. *Corallia: Corallium.*

Coral is a sedentary marine animal belonging to a class (*Anthozoa*) of cœlenterates rather than a stony plant as was believed in Ray's time. Individual corals - polyps - produce a protective skeleton that may be soft and jelly-like, horny, or stony. They usually occur in colonies and are found in all oceans, particularly warm, shallow waters, feeding mainly on small animals. Reproduction can be asexual (by budding) or sexual, the eggs being fertilised in the water.

The stony (or true) corals (order *Madreporaria*: about 1000 species) secrete a rigid external skeleton made of almost pure calcium carbonate. Coral reefs are produced by succeeding generations of stony corals, occurring in dense colonies. The principal reef building occurs at depths of less than 50m. and at temperatures above 20°C. Within this zone symbiotic algae (*zooxanthellae*) are present in coral tissues and stimulate the secretion of calcium carbonate, accelerating the growth of coral skeletons. The Great Barrier Reef of N.E.Australia is the best-known example.<sup>1329</sup>

*Linn.Sp.Pl.* - no ref.: *Syn.Meth.St.Br.* 32: *H.P.* 61-62:

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<sup>1329</sup> *Mac.Enc.*: 313.

*H.P.III 2-3 / H.P.III D. 108: Tri. - no ref.: Cat.Angl. 79:*

*Camb. - no ref.*

*Syn.Meth.St.Br. 32:*

*Corallium est plantæ genus fere lapideum, ramosum, arbusculæ aut fruticis aphylli figura, nullis foraminibus conspicuis pervium.*

*Corallium album pumilum nostras Syn.II.1.1.*

*Small white Coral. A Corallio albo Lob. Ger. Park. differt.*

*H.P. 61-62:*

(Tr.) Some wish coral to be so-called ὅτι ἐν ἅλιῳ κούρεται, because it is cropped in the sea, to which Pliny refers, Lib.32, Cap.2.

It is said that at a touch it immediately petrifies, if it continues living; and that therefore it is quickly seized and pulled away in nets or cut off by a sharp iron instrument. In this way they explain its name 'coral'.<sup>1330</sup>

Moreover it is written in various ways, either with a simple *l*, *Coralium*, or with two, with an *i* following, *Corallium*, or without an *i*, *Corallum*.

It is distinguished by its solid, stony substance from so-called *Porum* and the remaining marine stones by its less porous and less spongy character. The authors Dioscorides and Pliny said it was called by some in antiquity *Lithodendron*.<sup>1331</sup>

12 species given, including:

*Corallium rubrum* J.B. Ger. *rubrum majus* Park. *Corallum rubrum* C.B. **Red Corall.**

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1330 Greek κείρω, 'I cut'.

1331 Lithodendron, Λιθόδενδρον, 'a stone plant'.

*H.P.III 2-3 / H.P.III D. 108:*

*Lithophyta:* several additional species given.

*Ad cap. de Coral arbore:* 10 additional species given.

Line 183. *Alcyonia: Alcyonium.*

Ray defines *Alcyonium* as a species of Sponge. Both he and Linnaeus in the eighteenth century still believed that Sponges were plants rather than animals.

Sponge: an aquatic invertebrate animal belonging to the phylum *Porifera* (about 5,000 species). Most sponges are marine, found attached to rocks or the sea bed, and measure up to several metres across; they may be tree-like, cylindrical or flat irregular masses. Sponges have an internal skeleton of lime, silica or a fibrous protein (spongin). The simplest type of sponge has a vase-shaped body with a pore at the top and smaller pores in the sides. The inside is lined with flagellated collar cells, which maintain a flow of water through the side pores and out at the top. Food particles in the water are extracted by the collar cells; other cells in the body wall digest food, secrete the skeleton, and produce eggs and sperm. Fertilised eggs are dispersed in the water current and the free-swimming larvae eventually settle and become new sponges. The animals can also reproduce asexually, by budding or fragmentation.<sup>1332</sup>

*Linn.Sp.Pl. 1169-1171, Spongia: Syn.Meth.St.Br. 30-31:*

*H.P. 81-82: H.P.III 16: Tri. - no ref.: Cat.Angl. - no ref.:*

*Camb. - no ref.*

*Syn.Meth.St.Br. 30-31:*

*Alcyonium est plantæ genus in aquis nascens, fungiforme, variæ figuræ, crusta in quibusdam scruposa, in aliis callosa tectum, substantiæ intus spongiosæ in aliis speciebus quasi carnosæ;*

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<sup>1332</sup> *Mac.Enc.:*1149.

D. Breynius Eph.N.Cur.Cent.VII & VIII.App.p.158.

H.P. 81-82:

9 species given, including:

*Alcyonium spongiosum Officinarum* J.B. *Ælcyon. durum sive*  
*I. Diosc. Imper.* C.B.

H.P.III 16:

Listed as *Spongia* not *Alcyonium* in the Index to Volume III.

Ray says that (Tr.) 'Sponges approximate closely to Fungi'.

Various additional species given.

Line 188. *Fungi: Fungus*: see above Cap.18, line 181.

Line 189. *Fungorum: Fungus*: see above Cap.18, line 181.

Line 190. *Fungorum: Fungus*: see above Cap.18, line 181.

Line 191. *ut in \* Mali Cydoniæ*: for *Malus Cydonia*: see above Cap.5, line 63.

Margin reference here to † *Sfarroc. de Propag. Vegetab. c.3.n.5.*

Line 195. *Viscus: Viscum*.

[C.T.& M. 275] *Viscum album* (L.), Mistletoe; a species of the *Viscum* genus of the *Loranthaceæ* or Mistletoe family.

Regularly branched, yellowish green, parasitic shrub, hairless, forming rounded tufts up to 1m. across on tree branches. Leaves oblong, leathery, opposite, untoothed. Flowers inconspicuous, unisexual, male and female on separate plants, 4-parted, in small stalkless clusters. Fruit a white berry, 6-10mm. during winter. Parasitic on deciduous trees, especially *Malus* and *Populus*. England and Wales as far north as the Humber.

B.& G.-W. 62: B.& H. 204: Linn.*Sp.Pl.* 1023:

*Syn.Meth.St.Br.* 464: H.P. 1583 and 1918: H.P.III 590-591:

Tri. 17.56: *Cat.Angl.* 307-308: *Camb.* 125.

*H.P.* 1583 and 1918:

*Viscum* Ger. *vulgare* Park. *baccis albis* C.B. *Viscus Quercus & aliarum arborum* J.B. *Misteltoe and Missel.* *Aureus Virgilii ramus Æneid 6.* nonnullis existimatus.

*H.P.III* 590-591:

To page 1583, *ad cap. de Orchide:*

51 additional species given, including 6 called *Viscum*.

To page 405, Section on Dipetallic and Tripetallic flowers:

6 additional species called *Viscum caryophylloides*, including:

*Viscum caryophylloides maximum, flore tetrapetalo, pallide luteo, semine filamentoso* Slon.Cat.Jamaic. *Viscum peruvianum aliud, Aloes facie, Arboribus item innascens* Ad.Lob.p.452 & 455. *Synonyma reliqua vide in Hist.nost.p.1583. Wild Pine.*

Tri. 17.56:

Mistleto: *Viscus*, -i, m.: Ἰξὸς, -οῦ, m.

*Camb.* 125:

*Viscum* Mistletoe [*Viscum album*, Linnaeus].

Upon apple trees chiefly; we have sometimes found it upon White-thorne.

N. We suggest that an investigation should be made by careful investigators into whether the seed of this fruit tree (when it is fully grown and ripe) produces a plant of its kind without a host plant.

Aristotle, Pliny and the whole assembly of the Ancients maintain the affirmative view; Julius Scaliger, J.Bauhin and many of the moderns the negative. See Scal. *Subtil. exer.* 168. and J.Bauhin t.1.p.2.lib.7.p.91.

Whereas it seems to us to be fairly certain that mistletoe often grows without seed, particularly on that part of the bough that faces the ground, yet it is scarcely credible

that nature has created a perfect seed in a whole species which is infertile and useless for the purposes of germination.

Lines 194-199. .... *argumentum Viscus suppeditat* .... : Ray is puzzled by the parasitic development of Mistletoe. Parasitism is the interaction between two species, where one lives in or on its host, from which it derives food and shelter. The dependent plant does not necessarily harm its host.<sup>1333</sup>

Line 198. *Quanto rectius Maro: Publius Vergilius Maro, 70-19 B.C.*

Roman poet, born into a farming family near Mantua in northern Italy. He completed his education in Rome, where he became a friend of Horace and Mæcenas. Reacting against the troubled political background of civil war, he described in his *Eclogues* (42-37 B.C.) an idealised pastoral landscape. His more practical vision of Italy in the *Georgics* (36-29 B.C.) is informed by his passionate interest in agriculture. During his final years he worked on the *Æneid*, a national epic in twelve books describing the wanderings of Æneas, the founding of Rome, and extolling the Julian dynasty and Augustus, who claimed descent from Æneas. He died from fever after returning from a voyage to Greece. The supreme poet of imperial Rome, Vergil became the object of superstitious reverence to later generations. The *Æneid* was used for divination and its author was imagined to be a magician with supernatural power. In the middle ages Vergil was treated almost as a Christian prophet because of a passage in the fourth *Eclogue* that seems to predict the



birth of Christ.<sup>1334</sup>

Vergil's *Georgics* was written for the gentlemen smallholders of his day;<sup>1335</sup> it is a work of supreme artistry, inspired by the ancient scientific and agricultural tradition expressed by Epicurus and Lucretius. It also contains much valuable practical farming instruction; the influence of Theophrastus is evident in many places. Vergil refers to seed selection,<sup>1336</sup> and although this is not in our present texts of Theophrastus it was a principle known since ancient times and would have been well known to him.<sup>1337</sup>

Line 197. *Turdus malum ipse .... quam non sua seminat arbor:* this quotation is taken from Vergil, *Georgics* I, 139.

Line 198. *Viscum:* see above Cap.18, line 195.

Line 202. *His omnibus rationibus & experimentis contrariam opponimus Clarissimi Viri Marc. Malpighii experientiam.* Ray now discusses Malpighi's experiment to show that soil does not necessarily produce plants spontaneously.

Line 204. *terram e profundo erutam:* 'earth dug up from the depths'. This would suggest that Malpighi had used not productive topsoil with nutrients, which might be expected to harbour dormant seeds, but

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1334 *Mac.Enc.:* 1269.

That Ray owned several copies of the works of Vergil is indicated by the sale catalogue of his library:

*Opera*, edition published in Basle (no date given); British Museum: S-C 326 (6): 2, *Libri Latine &c. in Folio*, number 58.

*Opera*, edition published in Cologne in 1620; *ibid.:* 8, *Libri Latine &c. in Quarto*, number 160.

*Opera*, edition published in Cambridge in 1632; *ibid.:* 12, *Libri Latine &c. in Octavo*, number 134.

1335 Morton: 78, note 31.

1336 *ibid.*.

1337 *ibid.*

subsoil without nutrients and which had been taken from too great a depth to contain naturally deposited seeds.

Line 204. *Sericum*, -i, n.: silk, a fabric made by the Seres people of Eastern Asia.

Lines 207-210. *Ego equidem sententiam opinantium .... cum nullum in iis ostendere possimus*. Ray, despite his 'gut feelings', shows that he is still unsure about spontaneous generation in 'imperfect' plants, that is in those without obvious flowers or seeds.

Ramsbottom believes that it was the problem of the reproduction of fungi, which contributed much to the debate on the possibility of spontaneous generation in plants, which had continued from ancient times up to the nineteenth century.<sup>1338</sup> He cites Cesalpino as one who believed in spontaneous generation, when he says:

Some plants have no seed;<sup>1339</sup> these are the most imperfect, and spring from decaying substances; and they therefore have to feed themselves and grow, and are unable to produce their like; they are a sort of intermediate existence between plants and inanimate nature. In this respect fungi resemble zoophytes, which are intermediate between plants and animals.<sup>1340</sup>

Ramsbottom adds that 'several, like Linnaeus, thought fungi might form a new natural kingdom between those of plants and animals'.<sup>1341</sup>

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1338 Ramsbottom: 13-17.

1339 See the discussion at Cap. 18, line 181 above.

1340 Cesalpino, *De Plantis*, published in 1583.

1341 Ramsbottom: 14.

Line 211. *Notandum tamen ....* : Ray continues with what seem to be examples of spontaneous generation, but which are in fact forms of vegetative reproduction.

Line 212. *Raphano rusticano: Raphanus rusticanus*: see above Cap.13, line 37.

Line 212. *Scorzonera: Scorzonera*: see above Cap.11, line 83.

Line 213. *Jo.Bodæus à Stapel*: reference to his *Comment. in Theophr. hist.lib.2, cap.1, pag.73*.

Line 213. *Salice: Salix*: see above Cap.5, line 26.

Line 213. *Rosā centifoliā: Rosa centifolia*.

[C.T.& M. 227] *Rosa* (L.), Rose; a genus of the *Rosaceæ* or Rose family.

Is Ray referring to *Rosa multiflora* (Thunb.) [C.T.& M. 227], with pectinate stipules and many-flowered inflorescences (rarely naturalised)? Although this translates as 'many-flowered', until Ray's time the word *folium* was used for 'a petal' and so *centifolia*, 'hundred leaved', could be a seventeenth century interpretation of 'many-flowered'. But I feel that this identification is unlikely as *Rosa multiflora*, according to Clapham, Tutin and Moore is a native of Japan and Korea and Linnæus (see below) gives the habitat if *Rosa centifolia* as European.

B.& G.-W. - no ref.: B.& H. - no ref.: Linn.*Sp.Pl.* 491:

*Syn.Meth.St.Br.* 454-455 - not *centifolia*: *H.P.* 1467-1474:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

Linn.*Sp.Pl.* 491:

*Rosa caule aculeato, pedunculis hispidis, calycibus semipinnatis glabris.*

*Rosa multiplex media*. Bauh.pin.482.

*Rosa centifolia batavica II*. Clus.hist.I.p.114.

*Habitat in Europa*.

H.P. 1467-1474:

None of the 37 species listed here by Ray have the description *centifolia*.

Line 214. *D.Sharrocos*: reference to his *Lib. de propag. Plant. cap.3, n.5*.

Line 214. *malo cydoniā: Malus Cydonia*: see above Cap.5, line 63.

Line 220. *quam rationem Plinius etiam ipse eleganter pro more suo innuit, Per foramina (inquiens) inferne dato radicibus spiramento.*

The nearest I can find in Pliny to this quotation is: *dato per cavernas radicibus spiramento*, 'provided with breathing holes for the roots'.<sup>1342</sup>

Line 222. *Propagatio ex Surculo sato*: margin sub-heading.

*Secundo, Plantæ seruntur ramo aut surculo*: Ray now turns to his second method of propagation, 'by branch or graft'.

Line 226. *Oleæ:Olea*.

[C.T.& M. 349] *Oleaceæ* only, not the Olive Tree itself: [Flowers G.& B. 363-364] *Olea europaea* (L.), Olive; a species of the *Olea* genus of the *Oleaceæ* or Olive family.

B.& G.-W. 302: B.& H. 297: Linn.*Sp.Pl.* 8:

*Syn.Meth.St.Br.* - no ref.: H.P. 1540-1544: H.P.III D. 47:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

H.P. 1540-1544:

*Olea sativa* J.B. C.B. ger. Park. **The Olive-tree.**

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<sup>1342</sup> Pliny, *Historia Naturalis* XII, vii: 16; Loeb edition IV: 13.

H.P.III D. 47:

8 additional species given.

Line 226. *Oleæ tamen rami etiam sicci germinant*: Olives are usually propagated from stem cuttings, which may be either hardwood (from one or two year old wood) or semi-ripe cuttings from the current year's growth.<sup>1343</sup>

A dry stem cutting such as mentioned here by Ray could root successfully as hardwood cuttings do contain sufficient food reserves from the previous year's growth and so do not need leaves to photosynthesise.<sup>1344</sup>

Line 227. *ut v.g. Virgilio Truditur e sicco radix oleagina ligno*: a quotation from Vergil *Georgics* 2. 31.

Line 229. *Scribit autem Licetus* ..... : the sale catalogue of Ray's library indicates that he owned a copy of *de Spontaneo Viventum Ortu* by Licetus, but I have been unable to find out more about him.<sup>1345</sup>

Line 230. *Oleæ sativæ: Olea sativa*: see above Cap.18, line 226.

Line 231. *neque posthac unquam terræ implantatum, ad alterius ligni fulcrum in terram demissum*: the text does not read well at this point. Perhaps the word *sed* has been omitted from the manuscript between ..... *implantatum* and *ad* ..... ['since when it had never been planted in the earth, but had been put into the earth as a support for another piece of wood'].

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1343 Brickell, *Gardening*: 425.

1344 *ibid.*: 539.

1345 British Museum: *S-C* 326 (6): 4, edition published in 1618 [no place of publication given]; *Libri Latine &c. in Folio*, number 169.

Line 234. *Olivarum: Oliva: Tri. 17.60:*

An Olive-tree: *Oliva*, -æ, f.: Ἐλαία, -ας, f.

*Tri. 18.97:*

An Olive: *Olivum*, -i, n.: Ἐλαιον, -αίου, n.

Line 236. *Quo teneriores sunt plantæ eo surculi earum serius pangendi sunt:*

Ray is correct in saying that cuttings need a reasonable amount of heat to root, that is that they should be propagated at a warm time of year. For example, in the case of Olive cuttings, which he mentions above, we would now take hardwood cuttings in winter but grow them under greenhouse conditions and maintain a temperature of 13-21°C (55-70°F).<sup>1346</sup>

Vernacular seventeenth century advice to gardeners was on similar lines:

Young Tender-trees, with Hardie-greens, let the winter frost be over, and before the sap rise, *April* best for greens.<sup>1347</sup>

Line 238. *nimius humor recens plantatos facile corrumpit:* he correctly says that too much water can rot the cutting, but equally cuttings, especially softwood ones with leaves, do need a considerable amount of moisture as well as heat.<sup>1348</sup>

Line 239. *cælo radii Solares umbraculo opposito solicite arcendi sunt:* cuttings do need to be protected from the rays of the sun; this is now usually done with some form of greenhouse shading.<sup>1349</sup>

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1346 Brickell, *Gardening*: 425.

1347 *The Scots Gard'ner*: I + (58).

1348 Brickell, *Gardening*: 526 and 542.

1349 *ibid.*: 543.

Line 241. *Observandum etiam in plantis quarum caules nodis intercepti sunt :*  
a correct observation that cuttings root at the nodes and therefore  
should be cut at this point. At the node the cambium (the layer of  
cells involved in stem thickening) is most active and it is here that  
roots develop.<sup>1350</sup>

Text page 36.

Line 245. *docet P. Laurembergius his verbis:* Ray again cites Lauremberg.

Line 246. *anniculum (reliqui illi poterit portio exigua adhærescentis rami bini):*  
Lauremberg is talking of hardwood cuttings here; see note at line  
226 above.

Line 248. *ad profunditatem dimidiæ ulnæ arcuatim impone:* this is rather an  
odd instruction, as planting to the depth of ‘half an ell’ implies a  
very long stem used for the cutting. An ell is a measure of length,  
which varies from country to country: in England = 45 inches: in  
Scotland = 37.2 inches: in the Low Countries = 27 inches.<sup>1351</sup> The  
usual recommended length for various types of cutting nowadays is:  
for softwood 6 inches, for semi-ripe 4-6 inches and for hardwood  
2-3 inches long;<sup>1352</sup> the bulk of a cutting should be below the  
surface of the compost. It is not usual now to bend cuttings into the  
shape of an arc as recommended here.

Line 250. *Fruticum herbarumque taleolis vel ramulis pangendis ..... ut  
filamenta ducat.* Contemporary gardening advice gave similar  
instructions, but only for cuttings from hard woods:

The better to effect their Rooting, (if a hard substance, as  
Yew, Quince, &c.) Twist there ends a little or cleave

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1350 Brickell, *Gardening*: 539.

1351 *OED*: 640.

1352 Brickell, *Gardening*: 112.

them a piece: If tender Plants of great Pith as Jasmynes, July-flowers, &c. Cut only at a joynt or knot, and plant them: If large stems of Pithy Trees, as Poplars &c. Sharp their ends down to a point, reserving the bark whole on one side.<sup>1353</sup>

Crushing the end of a cutting is not a practice recommended now; rather cuttings should be neatly trimmed.<sup>1354</sup>

Line 253. *Pχ Ceræ, Terebinthinæ ana 2/3i. Resinæ communis 2/3ii.*

*commisceantur.* Ray is quoting the same formula from Lauremberg as given in Chapter 13, line 102:<sup>1355</sup> *vide supra.*

Line 255. *Non directe infigas terræ ramulum sic oblitum:* see note at line 248 above. The bending of a stem in this way for rooting purposes is done when layering, that is, when the stem to be rooted is still attached to the parent plant; adventitious roots will develop at the nodes along the stem. Stems separated from the parent plant are usually planted vertically.<sup>1356</sup>

Line 259. *Alium adhuc modum proponit Stapelius: Ramus ab arbore avellitur superne deorsum ....* : Ray now gives an alternative method of taking a cutting proposed by à Stapel. This is now known as a heel cutting, which has a portion of the bark or mature wood at its base.<sup>1357</sup>

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1353 *The Scots Gard'ner*: 15 (59).

1354 Brickell, *Gardening*: 112-113.

1355 Ray, in Chapter 13, gives the reference to Lauremberg as *Horticult. cap.21. § 1.*

1356 Brickell, *Gardening*: 537.

1357 *ibid.*: 586.



Line 262. *Submersio*: margin sub-heading.<sup>1358</sup>

*Propagationem illam quæ sit ramulorum submersione ipsa etaim natura docuit*: Ray continues with a natural method of vegetative reproduction, that of layering; much of this paragraph is taken from Pliny and Cato.<sup>1359</sup>

Line 268. *In Caryophyllis (monente D. Sharroco:) Caryophyllus*: see above Cap.11, line 16.

Line 268. *surculi submergendi scapum sub infimo seu radicis capiti proximo*: Ray next gives from Sharrock a very involved description of the method of propagation by means of layering for members of the *Caryophyllaceæ* family.

Similar contemporary instructions from 1683 were:

To force their Rooting (if July-flowers) Prune off the under and withered leaves, and cut it at a joynt into the pith (i.e. half way through) and slit it up to the next joynt, thrust down the cut part Gently into the ground, making it fast, cover as before.<sup>1360</sup>

Modern instructions for simple layering are:

Trim the leaves and any side shoots from the section of stem to be layered to provide a clear length of stem for about 12 inches behind the tip of the shoot. Gently bend the stem to the ground .... wound the underside of the stem close to a node, making an angled cut halfway through with a sharp knife.... Peg the stem firmly to the ground with one or more 'U' shaped pieces of wire, and

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1358 NB Ray does not give a definition for *submersio* in his glossary. *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1359 Pliny, *Historia Naturalis* XVII, xxi: 96; Loeb edition V: 66;  
Cato, *de Agri Cultura* CXXXIII §1-4; Loeb edition: 112-113.

1360 *The Scots Gard'ner*: I 5 (59).

cover with not more than 3 inches of soil. Attach the tip  
of the layered stem to a stake so that it stays upright.<sup>1361</sup>

Line 278. *exceptis iis quæ quoquo modo depositæ comprehendunt, ut Vitis, &c.:* vines do, as Ray says, reproduce vegetatively in various ways - for example, by means of grafting and hardwood cuttings.<sup>1362</sup>

Line 278. *Vitis*: see above Cap.5, line 26.

Line 279. *Tempestate etiam sicca surculi submersi assidue irrigandi sunt:* advice to water layers in dry weather to ensure rooting. The same contemporary gardening book in its section on layering says:

If drought, Water Shrubs, and Fibrous Rooted Plants, upon their first Planting, at least shade from the Ensuing scorchings, by covering the surface with some vegetable or leitter and Water through the same if needful.<sup>1363</sup>

Line 281. *Tempestates autem huic operationi cum successu ....* : Ray correctly says that the best times for layering are spring and autumn.<sup>1364</sup>

Line 283. *Circumpositio*: margin sub-heading.<sup>1365</sup>

*Circumpositio non differt a submersione, nisi quod ....* : Ray continues by explaining the difference between layering and air layering. Our contemporary source gives the following instructions:

Ciruomposition [*sic*] is in all cases, as laying [*sic*], save only that the earth must be raised up to the branch,

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1361 Brickell, *Gardening*: 115.

1362 *ibid.*: 373-374.

1363 *The Scots Gard'ner*: I 5 (58).

1364 Brickell, *Gardening*: 537.

1365 NB Ray does not give a definition for *circumpositio* in his glossary.

*Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

because it will not bend down to it. Therefore fasten a Pot, Basket, old Hatt or the like on the Tree (by a stake or some supporter) let it have a hole in its bottome, through which you must put the branch to be propagated, and then fill the Pot with rich earth, (having ordered the branch as before to cause it to Root) and Water it often; willow earth or Rotten willow sticks at the bottom of the Pot helps to retain the moistuer. I have effected this with clay and Cowes dung well mixt (after part of the Bark has been taken off round) clapt about with a double or triple swadling of Straw, or Hay Roaps.<sup>1366</sup>

This method is also now known as Chinese layering or marcottage. Modern instructions are that an aerial shoot should be slit and the tongue packed with sphagnum moss; this is then to be covered with plastic until roots develop, Rooting may take up to two years.<sup>1367</sup>

Line 292. \**P. Lauremberg: Horticult. lib.1. cap.22.*: margin reference.

Line 293. *Plinii, lib.17, cap.13.*

This is quoted from Pliny, Book XVII, Chapter xxi § 98, not from Chapter xiii as Ray says.<sup>1368</sup>

Line 296. *Tertio, Plantæ propagantur sobole*: he continues with naturally occurring methods of vegetative reproduction.

Line 298. *Ex flagellis seu cauliculis ..... Fragaria, Pentaphyllo, Ranunculo &c.*: these three plants all reproduce by means of natural layering, that is by sending out a series of runners, which then root at a node

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1366 *The Scots Gard'ner*: I 6 (60).

1367 Brickell, *Gardening*: 537.

1368 Pliny, *Historia Naturalis* XVII, xxi: 98; Loeb edition V: 68.

forming a new plant.<sup>1369</sup>

Line 298. *Fragariā: Fragaria:* see above Cap.7, line 56.

Line 298. *Pentaphyllo: Pentaphyllum:* see above Cap.7, line 57.

Line 298. *Ranunculo: Ranunculus:* see above Cap.7, line 57.

Line 299. *Ex radicibus transversis ..... ut in Ulmo, Pruno sylvestri, Ceraso &c. :* Ray now discusses propagation by means of suckers, which are adventitious shoots developing from the root and which often come up some distance from the parent plant.<sup>1370</sup>

Line 300. *Ulmo: Ulmus:* see above Cap.4, line 145.

Line 300. *Pruno sylvestri: Prunus sylvestris.*

[C.T.& M. 231] *Prunus spinosa* (L.), Blackthorn Sloe; a species of the *Prunus* genus of the *Rosaceæ* or Rose family.

B.& G.-W. 198: B.& H. 128: Linn.*Sp.Pl.* 475:

*Syn.Meth.St.Br.* 462: *H.P.* 1527: *H.P.III* - no ref.: *Tri.* 17.79:

*Cat.Angl.* 243-244: *Camb.* 99.

*H.P.* 1527:

*Prunus sylvestris* Ger. Park. J.B. C.B. *Acacia Germanica*

Schrod. Σποδιάς *Theophrasto: Spinus Virgilio.*

***The Black Thorn, or Sloe-tree.***

*Tri.* 17.79:

Sloe-tree or Blackthorn: *Prunus sylvestris*, f.:

Ἄγριοκοκκυμηλέα, -ας, f.

<sup>1369</sup> Brickell, *Gardening*: 537.

<sup>1370</sup> *Penguin Dictionary of Botany*: 348.

Line 300. *Ceraso: Cerasus*: see above Cap.4, line 12.

Line 303. *In herbis radicibus tuberosis donatis ..... ut in Chelidoniā minore, Flore Solis pyramidalis, Croco* : he next discusses the rhizome system of vegetative reproduction, in which the reserves are stored in thickened portions of stem known as corms or tubers,<sup>1371</sup> as in the three examples given here.

Line 303. *Chelidoniā minore: Chelidonium minus*: see above Cap.3, line 70.

Line 303. *Flore Solis pyramidalis: Flos solis pyramidalis*: see above Cap.3, line 87.

Line 304. *Croco: Crocus*: see above Cap.3, line 18.

Line 305. *In bulbosis ....* : the bulb is a modified shoot made up of cataphylls containing the food reserves; vegetative reproduction in bulbs is by means of lateral buds developing in the axils of the scale leaves.<sup>1372</sup>

Line 306. *Tulipā: Tulipa*: see above Cap.3, line 12.

Line 306. *Narcisso: Narcissus*.

[C.T.& M. 552-553] *Narcissus* (L.), Daffodils; a genus of the *Amaryllidaceæ* or Daffodil family.

B.& G.-W. 464: B.& H. 453: Linn.*Sp.Pl.* 189-290:

*Syn.Meth.St.Br.* 371: *H.P.* 1130: *H.P.III* 554: *Tri.* 10.58:

*Cat.Angl.* 210-211: *Camb.* 87.

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1371 *Lowson's Botany*: 72.

1372 *ibid.*: also *Penguin Dictionary of Botany*: 51.

H.P. 1130:

52 species given, including:

*Narcissus sylvestris pallidus calice luteo* C.B. *Pseudonarcissus*  
*Anglicus* Ger. *Anglicus vulgaris* Park. *Bulbocodium vulgatius*  
J.B. **Wild English Daffodil.**

H.P.III 554:

3 additional species given.

Tri. 10.58:

Daffodil: *Narcissus*, -i, m.: *Νάρκισσος*, -κίσσου, m.

Line 306. *Allio*: *Allium*: see above Cap.3, line 12.

Line 307. *De his nihil præcipiendum habemus*: Ray concludes this chapter by saying that he has no further advice except that, when transplanting, young plants should be placed in a more fertile soil and indeed should not be taken from the parent plant until they are sufficiently mature as to be viable.

## Chapter Nineteen:

### *On grafting.*

In this chapter Ray discusses the various methods of grafting, in both a practical and historical sense. Although *Historia Plantarum* is primarily a scientific rather than horticultural textbook, the relationship between botany and gardening in the seventeenth century is clearly seen here. This chapter, perhaps above all others, is directed to gardeners rather than to scientists, even to the extent of including a formula for grafting plaster. Much of this chapter is taken from Pliny's *Historia Naturalis*, which goes into great detail on the various methods of grafting;<sup>1373</sup> Pliny's material too is derivative, much of it coming from Cato's *De Agricultura*.<sup>1374</sup>

Text page 37.

Lines 1-7. *Insitio quid*: margin sub-heading.

*Insitio .... facilis & expeditus succi transitus fiat.* In the first two paragraphs of this chapter Ray gives his definition of a graft; in his introductory glossary to *Historia Plantarum* he elaborates on this definition somewhat:

*Insitio latissimo sensu est ejusmodi applicatio surculi seu gemmæ ad truncum ramumve, vel suum vel alienum, ut tandem uniantur & coalescant: & multas species seu modos sub se complectitur. Angl. Grafting.*<sup>1375</sup>

A contemporary vernacular definition of grafting published in 1683 gives the following:

Grafting is to take a cyon or twig of a tree and place into another (call'd the stock) fit to receive the same that the inward Bark, or rind of Both may Joyn & saps unite,

1373 Pliny, *Historia Naturalis* XVII, xxii-xxvi: 99-122; Loeb edition V: 68-86.

1374 Cato, *de Agri Cultura* XL-XLII; Loeb edition 56-60.

1375 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

&c. Whereof there be several wayes, as..... 1376

A modern definition would be that grafting is:

A horticultural method of plant propagation in which a segment (the scion) of the plant to be propagated is inserted onto another plant (the stock) in such a way that their vascular tissues combine, so allowing growth of the grafted segment. The technique, which is mainly used on woody species, relies on the natural regenerative capacities of plants following wounding. In addition to the cambia of scion and stock growing together to form a continuous column, prolific development of callus around the graft area ensures a firm union. Grafting is only successful between closely related species.<sup>1377</sup>

Line 8. *Insitio quotuplex*: margin sub-heading.

*Insitio est vel surculi vel gemmae*: the scion may be, as Ray says, a single bud on a short portion of stem (Ray's bud) or a multi-budded length of stem (Ray's shoot).<sup>1378</sup>

Line 9. *Gemma & Surculus quid differant*: margin sub-heading.

Ray's definitions of *gemma* and *surculus* are given in his introductory glossary to *Historia Plantarum*;<sup>1379</sup> both have been quoted earlier in this commentary: *gemma* at Cap.8, line 1: and *surculus* at Cap.18, line 7.

Line 12. *Surculum inserendi modi*: margin sub-heading.

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1376 *The Scots Gard'ner*: 16 (60).

1377 *Penguin Dictionary of Botany*: 162.

1378 Brickell, *Gardening*: 541.

1379 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.



Lines 14-18. *Primus coaptandi modus*: margin sub-heading.

*Quando virgæ minori transversim oblique dissectæ ....* : Ray describes the procedure known, as he says, in English as 'Whipgrafting'. A splice or whip graft is a very simple form of grafting stocks and scions of the same diameter. A long slanting cut is made in each and then the cut surfaces are placed together so that the cambium of each matches up. Stock and scion are then bound together.<sup>1380</sup>

Line 17. *ob difficultatem surculum virgæ ....* : despite what Ray says here, if scion and stock are of different thicknesses and the cambial regions are thus slightly out of alignment it does not make a great deal of difference to the success of the graft provided that some cambium is touching.<sup>1381</sup>

Lines 19-24. *Secundus modus*: margin sub-heading.

*Vel secundo coaptatio sit ....* : this is a rather involved description, called by Ray in English 'shoulder-grafting'. This is not a term used now for any of the many forms of grafting, but he seems to be describing here either basal-whip grafting, where the stock is thicker than the scion and in which the stock is cut horizontally and then obliquely to match an oblique cut on the scion; or he is describing a form of saddle-grafting, which would now be performed with the top of the stock cut to a point with the scion cut to fit over it, but could be done with a horizontal cut and an oblique one provided that the scion is cut to fit.<sup>1382</sup>

The method of grafting known in the seventeenth century as shoulder grafting is described in a contemporary source:

Shouldering is to cut off the head of the stock, and

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1380 Garner, *Grafter's Handbook*: 124; also Brickell, *Gardening*: 542.

1381 Garner, *Grafter's Handbook*: 124.

1382 Brickell, *Gardening*: 542.

smooth it, as at first; then cut the Graff from a knot, or bud on one side sloping about ane Inch and half long, with a shoulder, but not deep, that it may rest on the head of the stock. the Graff must be cut from the shoulder smooth and even, sloping gradually, that the lower end be thin: place the shouldering on the head of the stock, and mark by the end of the cut part of the Graff, and cut away so much Bark of the stock as the Graff did cover; then place both together, that the cut parts of both may joyn and saps unite one on the other: bi them close together with bass,<sup>1383</sup> and hood them with clay tempered with dung or wax, as before.<sup>1384</sup>

Line 26. *Insitio inter corticem & lignum*: margin sub-heading.

*Inter corticem & lignum*. Grafting between the cortex and the cambium. See notes below at lines 26–41 for more detail.

Line 26. *Timebant scilicet Prisci, referente Plinio, truncum findere*: Ray is referring to a section of Pliny Book XVII.<sup>1385</sup> It is interesting to note that this statement is a direct quotation from Pliny; thus Ray is not referring merely to ‘the ancients’ of Pliny’s time, but that Pliny himself is referring back to long before his own time.

Line 27. *\*D.Langford*: margin reference.

Thomas Langford was the author of *Plain and full instructions to*

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1383 NB Bass was the term used for the inner bark of the lime or linden and came to be used for any similar fibre; *OED*: 163.

Bæst, *bast*, *philyra*, *tiliæ cortex interior*. Gl. M.M. 163b.

*Rerum Britannicarum Medii Ævi Scriptores or Chronicles and Memorials of Great Britain and Ireland during the Middle Ages: A Glossary of Names of Plants from the Library of the Cathedral, Durham*.

1384 *The Scots Gard'ner*: I 8 (62).

1385 Pliny, *Historia Naturalis* XVII, xxiv: 102; Loeb edition V: 70.

*raise all sorts of fruit-trees that prosper in England.*<sup>1386</sup>

Line 28. *cortex a ligno ob ascensum succi prius separabilis est quam surculi ob gemmas nimis explicatas insitioni inepti:* Ray is indicating a spring-time graft while the sap is rising and before the buds have unfolded. In late winter and early spring the cambium layer is particularly active and callus cells can also develop easily around the wound at this time of year.<sup>1387</sup>

Line 29. *Mali: Malus:* see above Cap.4, line 145.

That this was a well established practice for grafting apples is seen in the contemporary gardening handbook cited below in notes to lines 26-41. Modern authorities recommend that grafts be taken from apples during the winter when the trees are dormant; the shoots should be from one year old wood with two or more buds on each. The shoots should then be placed in a plastic bag of moist peat in the refrigerator until the time of grafting.<sup>1388</sup>

Lines 26-41. *Inter corticem & lignum ..... Trunco ergo & surculo .... :*

Ray is describing the process of bark grafting, 'in which the bark is separated from the wood and the scion laid directly against a section of cambium'. There are many forms of bark grafting including the slit graft described here by Ray. In a slit graft 'the scions should be 4-5 inches long'.<sup>1389</sup>

Contemporary instructions for this type of grafting are very similar to Ray's, even to the side on which the slit must be made (south west in Ray, south here):

Grafting in the Bark may be used in greater stocks, or in

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1386 *The Scots Gard'ner:* xi.

1387 Brickell, *Gardening:* 541.

1388 Allen, *Pruning and Grafting:* 65.

1389 *ibid.:* 68.

regraffing of old trees, and is only for aples; because later in performing, which may be the latter end *April*, when the Bark of the stock will peel: for when both stock and Graff is prepared, (as in shouldering) instead of cutting away some Bark of the stock; for receiving the Graff you must slit it on the South-side from the top almost as long, as the sloped part of the Graff, and loosen the Bark at the top of the slit with the point of the half round wedg, (made a purpose tapering down-wards to a point) which also thrust down between the Bark and stock, to make room for the Graff; but first cut a little Bark at the thin end of the slope of the *Cyon*, that it double not in going down, yet leave it with a sharp edge; and because when the *Cyon* is put in, it will bear the Bark hollow from the stock nick or slit, the Bark on each side the cyon, so that it may fall close to the stock and to the edges of the cyon; then bind and cover, as before.<sup>1390</sup>

Modern instructions are:

Start the graft by preparing the scion, tapering it to a point that slopes gently for a distance of about 2 inches, then ends abruptly at a very sharp angle. If your stock has thin bark, prepare it by making a 2 inch lengthways cut through the bark to the cambium. Using your knife, prise up the bark on both sides of the cut to create a space behind the bark wide enough for the scion. Gently slide the scion down into this space, with its cut surface facing inwards, until it is lying flat against the surface of the cambium.

If the rootstock has bark too thick to be prised up, make

two parallel cuts instead of a single cut, positioning them just far enough apart to allow the scion to fit snugly between them. Remove the outer bark between the cuts and peel back the inner bark at the bottom of the cut, exposing the cambium. Now slide your scion down into this space with its pointed lower end tucked under the flap of the inner bark.<sup>1391</sup>

Lines 42-44. *Institio in fissura*: margin sub-heading.

*quam Plinii verbis exsequar. Aufertur serra .... in ramum calamus.* Ray is quoting from different sections of a chapter of Pliny here. *Aufertur serra .... falce truncus*<sup>1392</sup> precedes his quotation from Pliny at line 26 above and *per media leniter fisso .... in ramum calamus*<sup>1393</sup> is taken from several lines later in the same chapter.

Line 49. *e Petri Laurembergii Horticulturæ, lib.1, cap.24.*

Lines 51-65. *Elige (inquit) verno tempore arbusculam .... aut cannabino vinculo obliga fortiter.* Ray now gives more explicit instructions for this type of cleft grafting from Lauremberg's *Horticultura*, published in 1654.

Reid in 1683 describes this method of grafting in a similar way:

First of Graffing in the clift, saw off the head of the stock in a smooth place, about half a foot above ground, for Dwarfs and Wall-trees; as also for Standard, Aple, and Pear, (for they will shoot up for a body) but betwixt 3 and 4 foot for Standard-cherrie, and Plum. Pare smooth its head Ragled by the sow, then cleave it a little

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1391 Allen, *Pruning and Grafting*: 68.

1392 Pliny, *Historia Naturalis* XVII, xxiv: 101; Loeb edition V: 70.

1393 *ibid.*: XVII, xxiv: 102; Loeb edition, V: 72.

beside the pith, and with your Pen-knife cut away any jags, roughness, or blackness that remains after cleaving on each side the clift within; then prepare the graff by cutting on both sides from some knot or bud in forme of a wedg suitable to the clift with little shoulderings, not Ragling the end: for if the bark be raised at the tail or lower end of the graff (especially the Cherrie) Impeds its growing, cut off its Top about 2 Inches above the shoulderings close behind a leaf-bud; then open the clift with the Graffing Iron, set the graff (or two Graffs if the stock be great) in the clift, so as the inward part of the rind of the Graff may joyn exactly & close to the inward part of the Bark of the stock, and if it Pinch, as great stocks will, ty it not as you must do the smaller: or put in a little wedg Gently to keep it, Take a Slice-bark (from the cut-off head) and cut a hole therein, as it may slide on, & joyn round the butt of the Graff, and cover the stock close over in forme of a hawks hood. lastly cover with clay tempered with Horse-dung, that hath a little short leitter in it, or with soft wax for smaller stoks: this is to preserve it from cold & drying-winds, and from wet which harms most.<sup>1394</sup>

Modern instructions would be:

To prepare a rootstock for cleft grafting, cut off a stem or trunk 2 to 3 inches in diameter. With a sharp heavy knife, split the stock vertically to a depth of 2 inches, tapping the knife gently. Force a screwdriver into the cleft.

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<sup>1394</sup> *The Scots Gard'ner*: I 7-8 (60-61).

It is interesting to note that Reid also includes another form of cleft grafting, not mentioned by Ray, where the incision or cleft is made in the graft itself rather than the stock.

From a compatible species, cut a scion of dormant one-year-old wood 6 to 8 inches long with 4 to 6 buds. With buds pointing upwards, make two long tapering cuts matching scion to cleft. Insert scions in the cleft, aligning the cambium..... Cover the union and tops of the scions with grafting wax.<sup>1395</sup>

Line 61. *non præsecto cortice ab uno loco, \* integraque servata quantum fieri potest, medulla.* Ray has a note in the margin at this point, '*Hanc observationem nihili esse puto*', indicated by the asterisk. I assume that he is disagreeing with the preceding statement that the cortex should be left intact at one point, rather than the following statement.

Text page 38.

Line 66. *Emplastrum hoc emphyteuticumnon ....* : Ray, in the seventeenth century, does not consider grafting plaster to be necessary but gives the formula for anyone wanting to use it. Reid has a less specific form of grafting plaster,<sup>1396</sup> for which see the notes at lines 51-65 above. Pliny cites Cato as recommending a similar grafting plaster;<sup>1397</sup> Pliny does not quote Cato, but rather paraphrases him. Cato's text reads as follows:

*Argillam vel cretam coaddito, harenæ paululum et fimum bubulum, hæc una bene condepsito, quam maxime uti lentum fiat.*<sup>1398</sup>

More modern twentieth century books do still recommend it, either bought ready-mixed or prepared in various ways.<sup>1399</sup> See note at

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1395 Allen, *Pruning and Grafting*: 65.

1396 *The Scots Gard'ner*: I 7 (61).

1397 Pliny, *Historia Naturalis* XVII, xxiv: 111; Loeb edition V: 76-78.

1398 Cato, *de Agri Cultura* XL: 2; Loeb edition 58.

[Mix clay or chalk, a little sand, and cattle dung, and knead them thoroughly so as to make a very sticky mess.]

1399 Garner, *Grafter's Handbook*: 76-81.

Cap.13, line 102 above. Clear plastic tape is also much used nowadays.<sup>1400</sup>

Line 68. *Pχ Resinæ commun.<sup>2/3i</sup>. Ceræ <sup>2/3β</sup>. Visci <sup>2/3</sup> [?] ij. Butyriantiq. q.s. ad form. empl.* Another of Lauremberg's formulæ.<sup>1401</sup>

Line 69. *Quæ arborum species sibi mutuo insitæ coalescunt:* margin sub-heading.  
*Primum omnium quæ patiatu coitum talem arbor ....* : this is taken, as Ray says, from Pliny, again from Book XVII.<sup>1402</sup>

Line 70. *Facillime coalescunt ....* : taken from later in the same chapter of Pliny.<sup>1403</sup>

Line 73. *Pyrum: Pyrus:* see above Cap.4, line 145.

Line 73. *Cydoniæ: Cydonia.*

[C.T.& M. 244] *Cydonia oblonga* (Miller), Quince; a species of the *Cydonia* genus of the *Rosaceæ* or Rose family.

B.& G.-W. - no ref.: B.& H. 145: Linn.*Sp.Pl.* 480:

*Syn.Meth.St.Br.* - no ref.: *H.P.*1452: *H.P.III* - no ref.:

*Tri.* 18.104: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1452:

*Malus Cydonia seu Cotonea. The Quince-Tree.*

*Tri.* 18.104:

A Quince: *Cydonium*, -ii, n.: *Κυδώνιον*, -ίου, n.

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1400 Brickell, *Gardening*: 541.

1401 For Lauremberg's formula for a wound dressing to seal the cut ends of stems, see *Historia Plantarum*, Book I, Chapter XIII, line 102.

1402 Pliny, *Historia Naturalis* XVII, xxiv: 103; Loeb edition V: 72.

1403 *ibid.*: XVII, xxiv:104; Loeb edition V: 72.



Line 73. *Oxyacanthæ: Oxyacantha:* see above Cap.4, line 143.

Line 73. *Mespilum: Mespilus:* see above Cap.12, line 91.

Line 73. *Pruno Armeniacam: Prunus Armeniaca.*

[C.T.& M. 231] *Prunus armeniaca* ([L.] Koch), the Apricot; a species of the *Prunus* genus of the *Rosaceæ* or Rose family.

B.& G.-W. - no ref.: B.& H. 128: *Linn.Sp.Pl.* 474:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1513: *H.P.III* - no ref.: *Tri.* 15.6:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1513:

*De Malo Armeniaca. The Apricock-tree.*

*Tri.* 15.6:

An Apricock-tree: *Armeniaca malus:*

Μηλέα Ἀρμενικῆ, -ῆς, f.

Line 74. *Malus Cydonia:* see above Cap.5, line 63.

Line 74. *Pyrus:* see above Cap.4, line 145.

Line 74. *Malus Armeniaca:* see above Cap.19, line 73.

Line 75. *Pruni: Prunus:* see above Cap.4, line 23.

Line 75. *Oxyacanthæ: Oxyacantha:* see above Cap.4, line 143.

Line 75. *Pyro: Pyrus:* see above Cap.4, line 145.

Line 76. *Pyrus:* see above Cap.4, line 145.

Line 76. *Malus*: see above Cap.4, line 145.

Line 76. *Malus*: see above Cap.4, line 145.

Line 76. *Oxyacantha*: see above Cap.4, line 143.

Line 77. *Pyrus*: see above Cap.4, line 145.

Line 77. *Sorbus*: see above Cap.9, line 9.

Line 77. *Hæ tamen (ut ex ejusdem observatione habeo) ....* : Ray continues by stating that, although some unusual combinations of plants do initially succeed in being grafted, they may later fail. There is a lengthy discussion on this in Pliny.<sup>1404</sup>

Generally the more closely related two plants are the more successfully they can be grafted; grafting within a species, therefore, almost always works, while combining different species only occasionally works. Between genera grafting rarely works (although an exception is pear grafted onto quince). As Ray says, despite seeming to take a graft may fail after several years; this problem of incompatibility is sometimes overcome by grafting a third element, which is known to be compatible to both, between the stock and the scion.<sup>1405</sup>

Line 81. *Fissura qualis esse debet*: margin sub-heading.

*Alia observatio est .... ne translucens*: Ray, as before, is quoting directly from Pliny Book XVII; he has again omitted some of Pliny's text, choosing what he considers to be the salient

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1404 Pliny, *Historia Naturalis* XVII, xxvi: 1120-122; Loeb edition V: 84-86.

1405 Allen, *Pruning and Grafting*: 63.

points.<sup>1406</sup>

This advice is also given by Reid, writing in 1683, quoted in the notes at lines 51-65 above.

Line 82. *ne hiscat nimium rima .... aut expressum necet.* This quotation from Pliny follows immediately in Ray's text but is taken from much later in the same chapter of Pliny Book XVII.<sup>1407</sup>

Line 88. *Electio surculorum:* margin sub-heading.

*Certum est (inquit Plinius) ab humeris arborum Orientem æstivum spectantibus ....* : most of this paragraph is taken from an earlier section of Pliny's chapter 24 of Book XVII,<sup>1408</sup> although again Ray omits some of Pliny's text, and in this case adds comments of his own such as *denique ut e pulcherrimis & robustissimis ramis eligantur.*

Line 92. *Hortulani nostri præcipiunt .....* : this method 'laid down by our gardeners', despite what Ray says, is not given by Reid in his work *The Scots Gard'ner.*

Line 95. *Surculum nimis graciliem .... ob contrarias rationes.* The Pliny text, despite what Ray says, in fact states that the scions should be at least two years old and not thinner than a little finger.<sup>1409</sup>

Line 97. *Surculi longitudo & gemmæ quot:* margin sub-heading.

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1406 Pliny, *Historia Naturalis* XVII, xxiv: 105; Loeb edition V: 72.

1407 *ibid.* XVII, xxiv: 108; Loeb edition V: 76.

1408 *ibid.* XVII, xxiv: 105; Loeb edition V: 72.

1409 *ibid.* XVII, xxiv: 105; Loeb edition V: 74.

Line 101. Margin reference to Pliny: *Plinius surculum inversum inseri jubet, cum id agitur ut minor altitudo in latitudinem se diffundat.*

The Pliny text is as follows:

*inseruntur autem et inversi cum id agitur ut minor altitudo in latitudinem se fundat.*<sup>1410</sup>

Line 107. *Surculos decisos duas tresve septimanas antequam inserantur .... :*

Ray believes that it is best to keep scions for two or three weeks after cutting before attaching to the rootstock. We would apply Ray's advice now only to scions used for dormant grafts taken early in the season, and then kept in a cool but moist place until the weather is warmer and more suitable for grafting.<sup>1411</sup> This is not now considered to be a general rule for all grafts, since herbaceous grafts, that is leafy scion material, loses water rapidly unless kept humid and so must be grafted as soon as possible after collection.<sup>1412</sup>

Line 111. *Si longius afferantur surculi .... :* Ray implies that this is a quotation from Pliny; he is, in fact, giving a précis of Pliny here rather than a direct quotation.<sup>1413</sup>

Line 115. *Qua parte trunci inserere convenit:* margin sub-heading.

*Inserere aptissimum quamproximum terræ, si patiatur nodorum truncique ratio.* This is again a direct quotation from Pliny, but Ray uses it rather out of its original context. Pliny is not speaking of grafting generally here but is discussing the methods of grafting

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<sup>1410</sup> Pliny, *Historia Naturalis* XVII, xxiv: 106; Loeb edition V: 74.

[but grafts are also inserted the other way round when the intention is for them not to grow so long but to spread out.]

<sup>1411</sup> Allen, *Pruning and Grafting*: 64; also Garner, *Grafter's Handbook*: 66.

<sup>1412</sup> Garner, *Grafter's Handbook*: 64.

<sup>1413</sup> Pliny, *Historia Naturalis* XVII, xxiv: 114; Loeb edition V: 80.

cherry trees.<sup>1414</sup>

Line 116. *Pyrum: Pyrus*: see above Cap.4, line 145.

Line 116. *Cydoniæ: Cydonia*: see above Cap. 19, line 73.

Line 117. *Oxyacanthæ: Oxyacantha*: see above Cap.4, line 143.

Line 122. *Quot surculi inserendi*: margin sub-heading.

*Eidem trunco plures inserere ....* : either Ray is using a different (and better) text of Pliny here or he is paraphrasing that used for the Loeb edition. He is suggesting the method of grafting where several scions are inserted into the cleft at the same time. The Loeb text reads as follows: *subtilior postea ratio vel senos addi mortalitati eorum et numero*; there is the following footnote to explain the text here: 'if the text is correct, both to replace any grafts that died and to make a larger total number of living grafts'.<sup>1415</sup>

Line 129. *Cur stipiti cicuri potius quam sylvestri*: margin sub-heading.

*Surculus decisis arbori suæ iterum insitus*: an odd concept to graft a scion onto its original stock.

Line 130. *Tempus inserendo aptissimum*: margin sub-heading.

*Tempus inserendo aptissimum ....* : Ray now give suitable times for grafting. Some kinds of grafts are done, as he says, in the early spring just before the sap rises in the rootstock, while others may be performed into the summer months when the plants are growing strongly. As Ray says for spring grafts the scions should be

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<sup>1414</sup> Pliny, *Historia Naturalis* XVII, xxiv: 110; Loeb edition V: 76.

<sup>1415</sup> *ibid.* XVII, xxiv: 102; Loeb edition V: 72.

[Subsequently a more elaborate method is for as many as six grafts to be added to reinforce their liability to die and their number.]

dormant, with unopened buds.<sup>1416</sup>

Line 132. *D. Sfarrocos asserit: se observasse surculos Malo insitos ... ..*:  
*Malus*: see above Cap.4, line 145.

Line 133. *Pyrum vel florentem inserere licet ....* : he quotes Pliny as saying that a pear can be planted even when flowering in the month of May.<sup>1417</sup> For *Pyrus* see above 4, line 145.  
If grafting of pears is done as late in the season as mentioned here it usually takes the form of Chip- or T-budding.<sup>1418</sup>

Line 136. *Lutum ad insitum muniendum quale*: margin sub-heading.  
*Ad insitum muniendum contra injurias ....* : Ray gives various forms of grafting plaster, beginning with one from Cato;<sup>1419</sup> this is also quoted by Pliny although with slight differences.<sup>1420</sup> A seventeenth century version of this is given by Reid:

cover the stock close over in forme of a hawks [*sic*] hood. lastly cover with clay tempered with Horse-dung, that hath a little short leitter in it, or with soft wax for smaller stoks: this is to preserve it from cold & drying-winds, and from wet which harms most.<sup>1421</sup>

Text page 39.

Line 138. *Plinii ætate abunde arbitrabantur paleato luto libros farcire ....* : he continues with a formula used in Pliny's time.<sup>1422</sup>

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1416 Allen, *Pruning and Grafting*: 62.

1417 Pliny, *Historia Naturalis* XVII, xxiv: 114; Loeb edition V: 78.

1418 For a fuller explanation of this method of propagation see Brickell, *Gardening*: 542.

1419 Cato, *de Agri Cultura* XL. 2; Loeb edition: 58.

1420 Pliny, *Historia Naturalis* XVII, xxiv: 111; Loeb edition V: 76.

1421 *The Scots Gard'ner*: I 7 (61).

1422 Pliny, *Historia Naturalis* XVII, xxiv: 112; Loeb edition V: 78.

- Line 140. *Insitio fructum non multas*: margin sub-heading.  
*P. Laurembergius emplastrum emphyteuticum commendat, de quo supra*. Ray is referring back to Cap.13, line 102 above.
- Line 142. *Novæ fructuum species ab insitione frustra sperantur*. Ray is correct here in stating that new fruits cannot be achieved from grafts between species. Usually the closer plants are related the better a graft will be; for example, a graft of lemon, lime or grapefruit onto an orange stock will be successful. Some grafts between species will work one way but not the reverse; for example a plum scion will take on a peach rootstock but not *vice versa*. Between genera grafting rarely takes, although a pear scion will take on a quince rootstock.<sup>1423</sup>
- Line 144. *Aiunt tamen transmarinos quosdam Horticultores ....* : it is certainly possible to graft two or more species onto a single rootstock, as for example the various species of apple now grafted onto dwarf rootstocks for fruit-growing in small gardens and advertised by all major modern fruit nurseries.
- Line 148. *Nonnulli truncum non findunt ....* : Ray describes here another method of grafting as opposed to cleft grafting just mentioned. He says that some people remove a piece from the side of the trunk and insert a graft cut to fit; this is known as Chip-budding.<sup>1424</sup>
- Line 151. *D. Langford*: the book referred to here by Ray is *Plain and full instructions to raise all sorts of fruit-trees that prosper in England*.<sup>1425</sup>

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1423 Allen, *Pruning and Grafting*: 63.

1424 Brickell, *Gardening*: 542.

1425 *The Scots Gard'ner*: xi.

Line 152. *Quinam inserendi modus præstantior*: margin sub-heading.

Line 154. *ob has rationes*: this is an odd phrase at this point in the text as it seems to contradict what Ray has just said. He is not giving Dr. Langford's reasons for preferring the second and third alternatives, but rather his own reasons for preferring the first form of grafting.

Line 163. *Ab lactatio*: margin sub-heading.<sup>1426</sup>

*Datur adhuc & alia inserendi ratio*: Ray now turns to the method of grafting known as 'approach grafting', in which the scion and stock are not severed from the parent plant until they have successfully united. This is now sub-divided into true approach grafting, inarching and bridging.<sup>1427</sup>

Reid also describes this form of grafting:

Grafting by approach, is good for these that holds not well otherways: but herein the stocks must be placed so near the Tree, (where the graffs are) that the branch may reach it; then may you clift or shoulder-graff the twig yon mean to propagate, into the stock; and as soon as graff and stock do unite and ar incorporated together, cut off the cyon or graff underneath, close to the grafted place, that it may subsist by the stock only.<sup>1428</sup>

Line 166. *Vite: Vitis*: see above Cap.5, line 26.

Line 166. *Plinius in Vite hance operationem sic breviter præcipiendo e Catone describit*. Pliny does, as Ray says, describe this briefly;<sup>1429</sup> as too

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<sup>1426</sup> NB Ray does not give a definition of *ablactatio* in his glossary. *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

<sup>1427</sup> Garner, *Grafter's Handbook*: 87.

<sup>1428</sup> *The Scots Gard'ner*: I 8-9 (62-63).

<sup>1429</sup> Pliny, *Historia Naturalis* XVII, xxv: 115; Loeb edition V: 80.



does his source Cato.<sup>1430</sup>

Line 166. *Præcipuendo e Catone describit*: Marcus Porcius Cato (the Elder), 234-149 B.C. Roman statesman, who wrote the first history of Rome. A moral and political conservative, Cato as Censor (184) legislated against luxury and sponsored improvements in public works. His embassy to Carthage (153) led him to fear the resurgence of Rome's old enemy; 'Carthage must be destroyed' [*delenda est Carthago*] was his repeated cry until the Third Punic War was declared in 149. His simple writing style was influential and he is the first important Latin prose author.<sup>1431</sup> His treatise called *De Agri Cultura* in the manuscripts and *De Re Rustica* in the early printed editions is our earliest extant specimen of connected Latin prose; Hooper says that 'it resembles rather a farmer's notebook in which the author had jotted down in random fashion all sorts of directions for the care of the farm, for his own private use or for the benefit of his friends and neighbours'.<sup>1432</sup> Cato showed hostility towards the intrusion of Greek medicine into Rome; he advocated the use of simple herbal remedies, especially the medicinal use of the cabbage plant. Whatever his original intention, Cato's work had obviously been used extensively by Pliny and either directly, or from Pliny's text, by Ray.<sup>1433</sup>

Line 166. *Vites: Vitis*: see above Cap.5, line 26.

Line 169. *Vites: Vitis*: see above Cap.5, line 26.

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1430 Cato, *de Agri Cultura* XLI. 2; Loeb edition: 60.

1431 *Mac.Enc*: 241.

1432 Cato, *de Agri Cultura*: Loeb edition, introduction by William Davis Hooper: xiii.

1433 There is no evidence from the sale catalogue of his library that Ray himself owned a copy of Cato's work; British Museum: S-C 326 (6).

Line 169. *Mali Armeniacæ: Malus Armeniaca*: see above Cap.19, line 74.

Line 169. *Mali Persicæ: Malus Persica*: see above Cap.12, line 91.

Line 170. *Gemma inserendi ratio duplex*: margin sub-heading.

*Gemma inserendi ratio duplex est, altera Inoculatio dicitur, altera, quæ sola nunc dierum in usu est, Emplastratio.* Ray turns next to the method of grafting known as budding, which as he says can take two forms, Inoculation and Scutcheon grafting. As in Ray's time, Scutcheon grafting is now much more common than grafting by insertion of bud alone.

Line 172. *Inoculatio*: margin sub-heading.<sup>1434</sup>

*Inoculatio Antiquis usitata, describente Plinio, ....* : Ray is again quoting from Book XVII of Pliny.<sup>1435</sup>

Although Ray says that in his time scutcheon grafting, *emplastratio*, was more popular, Reid in 1683 describes what he calls inoculation rather than scutcheon grafting; however, his instructions and especially his various methods of preparing the stock to receive the bud<sup>1436</sup> are similar to those given by Ray for scutcheon grafting:

In some convenient and smooth part of the stock (at the same height as for grafting) with the penknife cut the rind overthwart, and from the middle thereof gently slit the bark about an Inch long in forme of a T, not wounding the stock; then nimbly prepare the bud by cutting off the leaf till a little of the tail, then slit the bark on each side a little distance from the bud, and about half Inch above

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1434 NB Ray does not give a definition of *inoculatio* in his glossary. *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1435 Pliny, *Historia Naturalis* XVII, xxiii: 100; Loeb edition V: 70.

1436 For these methods of preparing the stock, see below the notes to lines 187-188.

and below the same, sharp that end below that it may the more easily go down, and having a quill, cut more than half away about an Inch long at the end, (for dividing the bud and rind from the stalk) therewith take it off dextrously and leave not the Root behind: for if you see a hole under the bud on the inside, the Root is gone, cast it away and prepare another. when the bud is ready, then with a bone (made half round and sharp at the point tapering on the one side) raise the bark or rind on each side the slit carefully, not hurting the inner rind, and with care put in the bud, thrusting it down till its top Joyn with the cross cut: then bind it close above and below the bud with dry'd Rushes or bass.<sup>1437</sup>

Line 174. *Emplastratio*: margin sub-heading.

*Emplastratio, eodem Plinio auctore ....*: Ray quotes again from Pliny.<sup>1438</sup> Rackham, in the *apparatus criticus* to the Loeb text, would prefer the text to read, as Ray's obviously did, *ex alia arbore cortex*.<sup>1439</sup>

Although he omits many of the other technical terms for grafting from his glossary to *Historia Plantarum*, Ray does include a brief mention of *emplastratio*, referring his reader to this chapter:

*Emplastratio, Budding or inoculating, cujus descriptionem vide Lib.1. cap.19.*<sup>1440</sup>

Scutcheon grafting, also called shield budding or chip-budding, is a simple and highly successful method of vegetatively reproducing plants, with a success rate of approximately 90%.<sup>1441</sup>

<sup>1437</sup> *The Scots Gard'ner*: I 9-10 (63-64).

<sup>1438</sup> Pliny, *Historia Naturalis* XVII, xxvi: 118; Loeb edition V: 82.

<sup>1439</sup> *ibid.*: footnote 3.

<sup>1440</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

<sup>1441</sup> Allen, *Pruning and Grafting*: 70.

Lines 179-226. *Alii non eximunt corticem .... tempestate insitioni aptissima.*

For the rest of the chapter Ray gives instructions for various methods of scutcheon grafting.

Lines 179-183. *Alii non eximunt corticem .... vinculo ligatis in situ omnia continentur.* In this paragraph Ray is describing the process known as T-budding, in which two slits are made in the rootstock to form the shape of a 'T', after which the bark may be lifted slightly and the scion bud be inserted behind it and then tied securely into place.<sup>1442</sup>

Lines 184-186. *Alii perpendiculari incisione facta .... ut in præcedente sectione.* This is a description of 'patch-budding', in which a section, in Ray's example a diamond shape, is cut from the bark of the rootstock exposing the cambium, and then the bud, cut to the same size, is fitted to the stock to replace the bark removed from the stock and then tied securely into place.<sup>1443</sup>

Lines 187-188. *Alii quadrata incisione .... vinculo ligant.* This is a variation on the last method but only part of the bark is removed from the stock, leaving a flap of bark, behind which to tuck the scion; this is known as the Forkert method of grafting.<sup>1444</sup>

These last three methods of preparing the stock to receive the bud are also described by Reid:

Or, You may slit the bark of the Stock upwards from the cross cut. Or, Cut the edges of the bark about the bud oblong squair, and the bark of the stock fit to receive the

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<sup>1442</sup> Brickell, *Gardening*: 373 and 542; also Garner, *Grafter's Handbook*: 99-100.

<sup>1443</sup> Garner, *Grafter's Handbook*: 104; also Allen, *Pruning and Grafting*: 73.

<sup>1444</sup> For a fuller description of this method of grafting see *Planting Manual No. 8* (1939), issued by the Rubber Research Institute of Malaya; Garner, *Grafter's Handbook*: 107-109.

same. Or Reserve  $\frac{1}{4}$  of this squair piece of bark of the stock untaken off at the upper end, which must be raised, that the shild may slide up betweixt the same and the stock; and so bind gently, as before.<sup>1445</sup>

Lines 189-192. *Quomodo gemma a surculo extirpanda:* margin sub-heading.

*Optima ratio gemmam a surculo integram .... gemmam excindere seu extirpare.* This is a rather involved instruction for the preparation of the scion bud; compare the description from Reid given above at line 172.<sup>1446</sup> Modern instructions, equally involved, state that one should:

hold a piece of budwood upside down and, from just above the base of a bud, use the budding knife to scoop out the bud together with a thin tail. This shield-like piece of bark, about 2.5 cm. (1 in.) long, within which the growth bud is contained, is known as the scion. Remove the small sliver of pith behind the bud; if retained, it will prevent the bud from uniting with the rootstock or “taking”. It is difficult to do this without damaging the bud if the shield has been cut too deeply from the shoot. The base of the bud should then be visible as a small, circular growth.<sup>1447</sup>

Lines 193- 196. *Ut loco denudato scutum exacte congruat .....*: Ray now adds a warning that the area of bark bared must be very carefully matched by the shield of the scion.

Lines 197-198. *Gemma exempta statim inserenda:* margin sub-heading.

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1445 *The Scots Gard'ner*: I 10 (64).

1446 *ibid.*: I 9-10 (63-64).

1447 Brickell, *Gardening*: 133; there is also a lengthy description in Garner, *Grafter's Handbook*: 99-100.

*Antequam scutum cum gemma eximitur ....* : he advises that the place on the rootstock be prepared first so that the scion may not dry out. Modern advice is to put the scion aside 'preferably in the shade in a saucer of water so that it will not dry out, while you prepare the stock'; note that the scion is to be cut first in these instructions.<sup>1448</sup>

Lines 198-200. *Vincula fiant ex materia extendi apta ....* : Ray now describes the type of material suitable for tying the scion to the stock. Reid recommends 'dry'd Rushes or bass'.<sup>1449</sup> Various materials are also recommended nowadays: raffia, plastic film or rubber bands, all of which, like Ray's examples, can 'yield to the swelling cortex'. Again following his instructions, we would not recommend removing the ties until the buds have successfully taken. He does not mention the use of grafting wax here, and indeed it is not used now for such grafts.<sup>1450</sup>

Line 199. *Juncis: Juncus*: see above Cap.9, line 44.

Lines 201-204. *Tempus emplastrioni aptissimum*: margin sub-heading.

*Tempus inserendi gemma .... circa festum S. Joannis Baptistæ.*

Ray continues with advice on the best time for the grafting of buds.

Reid gives similar advice:

The time for Inoculation is, when the sap is most in the stock, namely from *June* till *August*, neer a moneth after unbind *i.e.* cut through binding and bark with a gentle slit on the back side of the stock, leaving the binding to fall away of its own accords: at which-time you will see who holds. In *March* following, cut off the head of the stock 4 Inches above the bud, and that time twelve

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1448 Allen, *Pruning and Grafting*: 71.

1449 *The Scots Gard'ner*: I 10 (64).

1450 Allen, *Pruning and Grafting*: 72.

moneths the stub too, that it may heal over the wound.<sup>1451</sup>

It is now considered that the best time for bud grafting is late summer because an inserted bud 'will produce a healthier plant if the plant enters into dormancy shortly after grafting'.<sup>1452</sup> Budding succeeds if 'carried out during the height of the growing season when the rind parts easily from the wood'.<sup>1453</sup> Bud-grafting should in addition be done in cool showery weather when the air is not too dry.<sup>1454</sup>

Lines 206-208. *Si gemma comprehendat ....* : a similar recommendation is made today that the rootstock above the graft should be cut back during the following winter.<sup>1455</sup> See note immediately above for a seventeenth century gardener's advice.

Text page 40.

Line 209. *Que arbores emplastra admittunt*: margin sub-heading.

Line 210. *Vitis*: see above Cap.5, line 26.

Lines 210-211. *Fertilissima omnium inoculatio, eadem tamen infirmissima.*

Ray has omitted a section of Pliny's text here, which changes the meaning slightly. It should read *fertilissima omnium inoculatio, postea emplastratio, sed utraque infirmissima*: 'inoculation is the most prolific of all methods of grafting, and grafting by scutcheon comes next, but both are very subject to displacement'.<sup>1456</sup>

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1451 *The Scots Gard'ner*: I 10 (64).

1452 Allen, *Pruning and Grafting*: 70.

1453 Garner, *Grafter's Handbook*: 99.

1454 Brickell, *Gardening*: 133 and 372.

1455 *ibid.*: 372.

1456 Pliny, *Historia Naturalis* XVII, xxvi: 121; Loeb edition V: 84: translated here in the Loeb edition by H. Rackham.

Line 213. *Mali Persicæ & Armeniacæ raro & difficulter insitione, emplastratione facile propagantur.* For *Malus Persica*: see above Cap.12, line 91, and for *Malus Armeniaca*: see above Cap.19, line 74. Ray says that Peach and Apricot are difficult to graft but may be easily propagated by bud grafting; Reid also recommends this method for Apricots and Peaches and for other fruit trees, but not for Cherries:

most proper for Apricoks and peaches: any sort will more readily hold by this than by graffing, except Cherries; they come quickly to be a Tree: for I had a plum shoot above 6 foot, 10 Inches the first year.<sup>1457</sup>

Line 214. *Emplastrionem insitio præferendam probatur*: margin sub-heading.

Lines 216-226. *Qua stipes seu truncus .... tempestate insitioni aptissima.* Ray concludes this chapter with Langford's reasons for preferring scutcheon grafting. Ray does not say whether he agrees with these opinions, but one suspects that he is not totally convinced by them, since he says that Langford *probare nititur*, 'endeavours to prove', rather than that 'he proves' by his arguments.

Line 221. *Arborem minus lædit quam insitio .....*: this agrees with Reid's comment that 'tho they miss, yet the stock is not the worse'.<sup>1458</sup>

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<sup>1457</sup> *The Scots Gard'ner*: I 9 (63).

<sup>1458</sup> *ibid.*



## Chapter Twenty:

### *Concerning the specific differences (as they call them) of plants.*

In this chapter Ray discusses the differences between various species of plants, coming to the conclusion that the classification of plants should be based on natural affinities or essential characteristics, *differentiæ* or *notæ characteristicæ*. Ray had first presented his thoughts on this subject in a paper read to the Royal Society by Henry Oldenburgh, in Ray's absence, on December 17th 1674, entitled *A Discourse on the Specific Differences of Plants* <sup>1459</sup> As with the discourse on seeds, delivered at the same time, Oldenburgh asked Ray, on behalf of The Royal Society, to continue with this research;<sup>1460</sup> in this chapter of *Historia Plantarum* he revises this paper given to the Royal Society. In the preface to the *Catalogus Angliæ* of 1670 he had also discussed this. He further developed these ideas in his *Methodus Nova* of 1682 and in *Methodus Emendata* of 1703.

Morton summarizes Ray's ideas on the specific differences of plants very succinctly, so I therefore quote him at length:

like Cesalpino he rejected the use of such accidental characters (*accidentia*) as habitat, size, time of flowering, medicinal powers, utility to man, or mere variations in colour, taste or smell. Accidental characters separate manifestly cognate species (*cognatas species*) and combine those which are unrelated (*alienas*)..... It is worth noting that Ray's deciding reasons for rejecting accidental characters are derived from horticultural observations and experiment. Changing conditions or place of cultivation affects the size of plants, the amount of fruit they bear, even the degree of

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1459 It was presented together with his paper 'A Discourse on the Seeds of Plants'; both of these papers are reprinted in *Further Correspondence*: 70-83.

1460 Henry Oldenburgh to John Ray: letter written on 21st December 1674;  
They doubt not but that you will in good time communicate to them also what you shall farther observe concerning the seeds of bulbous plants, and the positive specific difference of plants.  
*Correspondence*: 114-115.

“doubling” of flowers. Different varieties may arise from the same root or from different seeds of the same plant, but they cannot be propagated true from seed but only by vegetative offsets or cuttings. Essential characters on which a method of classification can be based, should be taken from the principal parts of plants, that is, from the flower, calyx, seed and seed-vessel. The reason why these parts are selected is because for any one species they are stable and constant in form and are reproduced from seed; furthermore they are readily observed, have many conspicuous features of position, form and number, and are associated with other characters common to a particular group (*genus*). The final clause shows Ray’s grasp of the basis for determining natural affinity.<sup>1461</sup>

Ray also wonders whether plants can change into each other, that is, whether transmutation of species is possible; he has doubts about this but also concedes that there are well-proven examples of it happening, such as the change from cauliflower to cabbage, which led to a court case in London.<sup>1462</sup> He discusses transmutation of species more fully in the following chapter.

We would now define a species as:

All populations of a group, which can interbreed within the group but cannot normally exchange genes outside the group; if such cross-breeding does occur the resulting individuals are usually sterile, so that in effect the reproductive barrier between species is maintained.<sup>1463</sup>

However, this is far too simplistic a definition of a very complex situation.

Ray, himself, later admitted in a letter to Hans Sloane that there had been much confusion over the classification and multiplication of species of plant:

You have, in my opinion, done botanists great service, by

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1461 Morton: 201.

1462 See below Cap.21, lines 44-47.

1463 *Oxford Dictionary of Botany*: 383; see also *Penguin Dictionary of Botany*: 336.

illustrating and clearing up many obscurities in authors, and contracting and reducing to one many plants distracted into many species by the unskilfulness of some, and misapprehension of others, even the best writers, who, having not seen the plants themselves, but only meeting with descriptions or light mentions of some of their parts in some, and others in other travellers, must needs be at a loss about them, and often multiply species beyond what there are in nature; or else, for fear of unnecessary multiplication, contract two or three into one, as I find myself to have done more than once or twice.<sup>1464</sup>

Ray continues with a few specific questions addressed to Sloane concerning particular plants.<sup>1465</sup> Ray later admits his limitations to Sloane, regretting his lack of field work:

You have done botanists great service in distributing or reducing the confused heap of names, and contracting the number of species. But who is able to do the like? No man but who is alike qualified, and hath seen the things growing in their natural places. For my own part, I do freely acknowledge myself altogether insufficient for such a task, having not seen the plants themselves, nor of many of them so much as dried specimens, and of the rest having had but a transient view.<sup>1466</sup>

Ray's debt to Sloane is repeated in his preface to the latter's *Jamaica Catalogue*:

The author in this Catalogue hath done great service to at least the inferior ranks of herbarists, in reducing and cutting short the number of species, which were unnecessarily multiplied. For observing that those who have published Itineraries ..... have repeated one and the same species, once, twice, thrice, (nay, some great authors sometimes even nine times) over, for different kinds. Now the

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1464 Letter from John Ray to Hans Sloane dated 21st February 1695: *Correspondence*: 287-289.

1465 *ibid.*

1466 Letter from John Ray to Hans Sloane dated 23rd June 1696; *ibid.*: 295- 296.

number of plants being in nature so vast, it is pity to add to it more than there are in nature, making two or three of one, thereby both deterring and confounding the learner.<sup>1467</sup>

Ray's final classification system as given in the *Methodus Plantarum emendata et aucta* is given in the introduction to the notes to Chapter 27 of this commentary. It is surprising, after Ray's clear thinking on classification that he should still adopt the division into woody plants and herbs, trees and shrubs being distinct because of the formation of buds (i.e. winter buds). However, despite this error, he must be remembered for his division into plants with one or two seed-leaves or cotyledons, and for his recognition of natural affinities in a broader sense if not into the smaller groupings.

Text page 40.

Line 1. *Ut Plantarum numerus iniri possit ....* : here Ray discusses the differences which occur between plants of a particular type grown from seed. It is possible to have much variation within a species, as occurs in *Capsella bursa-pastoris* [Shepherd's Purse] and *Plantago coronopus* [Buck's-horn Plantain]; although there is usually a regional emphasis, any two individual plants, however different they may appear to be, may cross with each other and produce a huge variety of new forms.<sup>1468</sup> Species also occur with two or more distinct forms, which rarely cross breed, for example, *Armeria maritima* [Thrift or Sea Pink], which differs depending on whether it grows on a mountain side or on a coastal saltmarsh; these differences occur because of differing environmental conditions.<sup>1469</sup>

Lines 6 and 7. *Caryophyllos, Caryophyllis, Caryophyllos:*  
for *Caryophyllus*: see above Cap.11, line 16.

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<sup>1467</sup> 'Preface by Mr. Ray to Dr. Hans Sloane's *Catalogue of Plants*': *Correspondence*: 465-468.

<sup>1468</sup> *Lowson's Botany*: 406.

<sup>1469</sup> *ibid.*: 407.

- Lines 11-16. *Sicut enim in Animalibus sexuum distinctio ....*: Ray seems to be stating the obvious here that, for instance male and female cattle, belong to the same species; he had, however, realised that plants differ in sex<sup>1470</sup> and yet are of the same species.
- Line 18. *Hinc pro distinctis plantarum speciebus non habendas censeo*. Ray continues with his reasons for the differences he considers insufficient to prove distinctness.
- Line 19. *Quæ solo floris colore ....*: he begins by saying that differing appearances in the flower are not an indication of differing species.<sup>1471</sup>
- Line 20. *\*Deus sexto die ab omni opere suo, hoc est, a novarum specierum creatione, requievit.* \*Genes 2: margin reference to Genesis 2.<sup>1472</sup>  
Ray sticks to his belief that all species were created at one time and does not believe that new species can be created or even lost, since it could happen that a species lost in one area still exists in another. As

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1470 See Cap.10. above..

1471 See also 'A Discourse on the Specific Differences of Plants',  
*Further Correspondence: 78-79.*

1472 Ray, as a clergyman, having been ordained in 1660, had a very extensive theological collection in his library. It contained several editions and commentaries on the Bible, including:  
*Bible Hebræ*, edition published in Amsterdam in 1639; British Museum: S-C 326 (6): 13, *Libri Latine &c. in Octavo*, number 149.  
*Bible Latina a Junio*, edition published in Hanover in 1618; *ibid.*: 13, *Libri Latine &c. in Octavo*, number 150.  
*Annotationes in Vet. testament*, edition published in Cambridge in 1693; *ibid.*: 13, *Libri Latine &c. in Octavo*, number 146.  
*Novum Testamentum Syriace*, edition published in Antwerp in 1675; *ibid.*: 19, *Libri Latine &c. in 24°*, number 42.  
*Novum Testamentum Græc. cum Psalm. Angl.*, edition published in Amsterdam in 1633; *ibid.*: 19, *Libri Latine &c. in 24°*, number 43.  
*Novum Testamentum Latine*, edition published in Antwerp in 1584; *ibid.*: 19, *Libri Latine &c. in 24°*, number 44.  
*Novum Testamentum Franc. cum Psalm.*, edition published in Geneva in 1653; *ibid.*: 19, *Libri Latine &c. in 24°*, number 45.  
*Holy Bible, neatly bound in Turkey Leather, with Cuts*, edition given no place of publication or date; *ibid.*: 22, English Books in Folio, number 76.

Raven says, 'though he still clings to the idea of a creation once for all, he no longer states it on *a priori* and dogmatic grounds'.<sup>1473</sup>

Lines 24-26. *Deinde, si hæc sufficerent ad specificam distinctionem inferendam*: although he seems to be stating the obvious, many specific distinctions had been made between such entities. Gerard and Parkinson in the field of botany had made many unnecessary distinctions between plants of slightly differing appearances.

Line 24. *Aethiops*: see above Cap.10, line 159.

Line 27. *Quinimo hæ varietates cæli, aut soli, alimentive differentiis debentur*: he is correct in saying that plant variations can occur because of varying conditions; for example, *Anthyllis vulneraria* [Kidney Vetch or Ladies' Fingers] appears to be different when growing on coastal sand-dunes and inland chalk pastures;<sup>1474</sup> four subspecies occur in Britain and there are also many intermediates between them found where subspecies overlap.<sup>1475</sup>

Line 32. *Præterea hæ varietates seminio non propagantur ....*: he correctly states that the only guaranteed way to reproduce a particular plant is by vegetative reproduction.<sup>1476</sup>

Line 35. *P. Laurembergius vir fide dignus: Horticult. cap.28, Sect.3.*

In *A Discourse on the Specific Differences of Plants* Ray cites several other references to this experiment of Lauremberg's: *lib.1, cap.31 § 5: item cap.19 § 10 and cap.13 § 6*.<sup>1477</sup>

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1473 Raven: 191.

1474 *Lowson's Botany*: 407.

1475 Clapham, Tutin and Moore: 201.

1476 See Caps.18 and 19 above.

1477 *Further Correspondence*: 82.

Line 36. *Caryophyllis* and *Caryophyllos*:

for *Caryophyllus*: see above Cap.11, line 16.

Lines 36–43. *Caryophyllos quos simplices Vere primum ..... partim naturali.*

A lengthy quotation from Lauremberg.

Line 38. *Terra pinguisissima*: in *A Discourse on the Specific Differences of*

*Plants* Ray uses the words ‘very fat earth’ for this phrase;<sup>1478</sup>

although it can mean ‘fat’ or ‘grease’ it also means ‘fertile’,<sup>1479</sup>

which I assume is what Ray is indicating here.

Line 43. *Laurembergio*: Ray trusts Lauremberg to have correctly observed

this phenomenon; it is similar to the experiments carried out later by

Strasburger in the 1890’s on the ascent of sap, when he added

fuchsin to water, which was then absorbed by the cut end of an oak

tree trunk; the staining thus produced indicated the passage of water

through the xylem vessels.<sup>1480</sup>

Line 44. ἀξιόπιστω: <sup>1481</sup> one of Ray’s rare uses of a Greek word, used here

for emphasis; Morton says of Ray’s use of Greek that ‘the special

reason for it is never far to seek’.<sup>1482</sup>

#### Text page 41.

Line 48. *Idem esto iudicium de floribus nudis ....* : a reference to Ray’s

distinction between ‘perfect’ and ‘imperfect’ flowers.<sup>1483</sup>

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1478 *Further Correspondence*: 82.

1479 Lewis and Short: 1378.

1480 *Lowson’s Botany*: 188.

1481 ἀξιόπιστω: ‘worthy of belief’, ‘trustworthy’. See the note above under *Carpinus*, \*Οστρυς at Cap.5, line 26, on ς being used for στ.

1482 Morton: 204.

1483 See Cap.10 above and *Further Correspondence*: 79, notes 4, 5 and 6.

Lines 48-51. *Chamæmelum, Cotula .... Flos Africanus*: all members of the *Compositæ* or Daisy family, in which the heads or *capitula* do, as Ray says, vary a great deal.<sup>1484</sup>

Line 48. *Chamæmelo*: *Chamæmelum*: see above Cap.11, line 73.

Line 49. *Cotulā*: *Cotula*.

[C.T.& M. 472] *Anthemis cotula* (L.), Stinking Mayweed; a species of the *Anthemis* genus of the *Compositæ* or Daisy family.

B.& G.-W. 408: B.& H. 238: Linn.*Sp.Pl.* 894:

*Syn.Meth.St.Br.* 185: *H.P.* 355: *H.P.III* - no ref.: *Tri.* 120:

*Cat.Angl.* 81: *Camb.* 57.

*H.P.* 355:

*Cotula fætida* Ger. Park. *Chamæmelum fætidum* C.B.

*Chamæmelum fætidum sive Cotula fætida* C.B.

***Stinking Mayweed, or Maithes.***

*Tri.* 11.120:

May-weed: *Cotula*, -æ, f.: ἄνθεμις, -ιδος, f.

Line 49. *Parthenio*: *Parthenium*.

[C.T.& M. 476] *Tanacetum parthenium* ([L.] Schultz Bip.):

[*Matricaria parthenium* (L.): *Chrysanthemum parthenium* ([L.]

Bernh): *Pyrethrum parthenium* ([L.] Sm.)], Feverfew; a species of the *Tanacetum* genus of the *Compositæ* or Daisy family.

B.& G.-W. 410: B.& H. 237: Linn.*Sp.Pl.* 890-891:

*Syn.Meth.St.Br.* 187: *H.P.* 357: *H.P.III* 224: *Tri.* 10.70:

*Cat.Angl.* 225: *Camb.* 92.



H.P. 357:

2 species given, including:

*Matricaria* Ger. *vulgaris* Park. *Matricaria vulgo, minus*  
*Parthenium* J.B. *Parthenium I, sive Matricaria vulgaris* C.B.  
**Feverfew.**

H.P.III 224.

*Ad cap. de Matricaria seu Parthenio: 5 additional species given.*

Tri. 10.70:

Feverfew: *Matricaria, -æ, f.: Παρθένιον, -ίου, n.*

Line 49. *Bellidæ: Bellis:* see above Cap.7, line 5.

Line 49. *Calendulā: Calendula:* see above Cap.1, line 49.

Line 50. *Bellidæ: Bellis:* see above Cap.7, line 5.

Line 50. *Flore Africano: Flos Africanus:* see above Cap.11, line 18.

Line 52. *Quoniam vero varietates hæ floribus plenis aut variegatis insignes*  
.... : as he also says in his paper to the Royal Society mentioned  
above,<sup>1485</sup> Ray realises the worth of unusual forms of flowers and  
proceeds to explain how they may be obtained.

Line 55. *Et quod ad Caryophyllos attinet .... :*

Ray again cites Lauremberg,<sup>1486</sup> but both are incorrect in their  
beliefs here. It is mere coincidence that repeated transplantation has  
produced double flowers; these hybrid forms would rather have  
been produced by cross pollination.

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1485 *Further Correspondence:* 81.

1486 In 'A Discourse on the Specific Differences of Plants', Ray gives the actual reference  
to Lauremberg as *Horticul.*, lib.1. cap.28 § 3; *Further Correspondence:* 81.

Line 55. *Caryophyllos: Caryophyllus*: see above Cap.11, line 16.

Line 59. *D. Sharrocos se novisse ait* .....

*\*Lib. de propag. Vegetabilium*: margin reference.

Line 59. *Anemonas nemorum: Anemone nemorum*.

[C.T.& M. 36-37] *Anemone nemorosa* (L.), Wood Anemone; a species of the *Anemone* genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 110: B.& H. 5: Linn.*Sp.Pl.* 541:

*Syn.Meth.St.Br.* 259: *H.P.* 624: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 21: *Camb.* 43.

*H.P.* 624:

6 species given, including:

*Anemone nemorum alba* Ger. *nemorosa flore majore* C.B.

*Ranunculus nemorosus albus simplex* Park. *Ranun. phragmites albus & purpureus vernus* J.B. **Wood-Anemony.**

Line 59. *Colchica: Colchicum*: see above Cap.11, line 65.

Line 62. *Verum quicquid fit de translatione ....* : he continues with the theory that out of many seeds sown a few will produce unusual flowers; he gave this theory in his earlier paper cited above,<sup>1-487</sup> but in the earlier case added an important extra comment that:

if you sow the seed, for example, of a single julyflower in good ground, among many that bear single flowers, it shall give you some roots, that yield double, and some of different colours, from the mother-plant, which you may afterward propagate by the slip.

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1-487 'A Discourse on the Specific Differences of Plants': *Further Correspondence*: 82 § 3.

It is true that vegetative reproduction, from a slip [cutting] as Ray says, will produce a plant with the same genetic composition.

Line 66. *Caryophlleorum: Caryophyllus*: see above Cap.11, line 16.

Line 66. *Aurantii mali: Malus Aurantia*.

[Mac.Enc. 903] *Citrus*, Orange; a genus of the *Rutaceæ* family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 782: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1658:

*H.P.III D.* 80: *Tri.* 17.59: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1658:

*De Malo Aurantia. The Orange.*

*Aracynappil Malis Aurantiis parvis similis fructus* J.B. *Malo*

*Aurantio parvis fructibus similis* C.B. *Arbor peregrina Aurantio*

*simili fructu* Clus. J.B. C.B.

*H.P.III D.* 80:

*De Malo Aurantia & Limonia*: 4 additional species given, plus one to be added to page 1659.

*Tri.* 17.59:

An Orange-tree: *Malus aurantia*: [No Greek].

Line 68. \**Ferrario autore: \*Horticult. lib.3, cap.15*: margin reference.

Line 68. *Caryophylli: Caryophyllus*: see above Cap.11, line 16.

Line 70. *Leucoia: Leucoium*: see above Cap.11, line 15.

Line 72. *Tulipis: Tulipa*: see above Cap.3, line 12.

Line 75. *Plantas sola magnitudine differentes*. Ray now gives his second reason why a different appearance should not be considered to be an indication of species: in this case he says that size alone cannot be considered thus.

Again, these opinions repeat and develop his earlier ideas.<sup>1488</sup> In his paper delivered to The Royal Society in 1674, he threw doubts on the work of his predecessors stating that:

in Gerard's and Parkinson's herbals we find many plants put down for different species, which themselves confess to differ in no other point, than being in all parts less or greater than others of their kind before described.<sup>1489</sup>

Line 76. *Grossularia*: see above Cap.11, line 125.

Line 77. *Quercûs*: *Quercus*: see above Cap.4, line 145.

Line 79. *Quæ tamen differentia vel soli ubertati aut sterilitati ....* : he correctly states that environmental conditions can affect the size of a plant. In studies of plant ecology, it has been shown that, although certain habitats are generally colonised by certain species, similarity of habitat conditions can result in a species growing in more than one type of area.<sup>1490</sup>

Line 84. *per hyemem Boreæ penetrabile frigus adurit*: Ray is referring to a passage from Vergil's *Georgics* here, although he does not give this as his source. This quotation is not given in his earlier paper on

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1488 'A Discourse on the Specific Differences of Plants': *Further Correspondence*: 78 and 79-80.

1489 'A Discourse on the Specific Differences of Plants': *ibid.*: 78.

1490 For a fuller discussion see the chapter on plant ecology in *Lowson's Botany*: 595-636; see also note at Cap.20, line 1 above.

the subject.<sup>1491</sup>

The Oxford text of the *Georgics* has:

*aut Boreæ penetrabile frigus adurat.*<sup>1492</sup>

- Line 85. *hortum pinguem*: again the word *pinguis* used for ‘fertile’, although Ray uses the English word ‘fat’ in his earlier discourse.<sup>1493</sup> See also note above at Cap.20, line 38.
- Line 89. *quinque solidis ....* : the word *solidus*, when used for a coin, at the time of the Roman emperors, meant ‘a gold coin’, worth originally about twenty-five denarii;<sup>1494</sup> it later came to be used for ‘a shilling’ (as in £.s.d.), its earliest known usage as such being in 955.<sup>1495</sup>
- Line 90. *Equi etiam qui in montibus Cambricis ....* : a reference to the small stature of Welsh ponies.
- Line 92. *Vidimus enim Cestriæ ....* : of or pertaining to Chester; Cester is the Old English for Chester.<sup>1496</sup>
- Lines 97-102. *Tales sunt Hyssopifolia major & minor ....* : Ray now gives examples of what he considers to be different species of various plants, but which are most probably examples of different heights within the same species.

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1491 ‘A Discourse on the Specific Differences of Plants’: *Further Correspondence*: 80.

1492 Vergil, *Georgics* I: 93.

1493 ‘A Discourse on the Specific Differences of Plants’: *Further Correspondence*: 80.

1494 Lewis and Short: 1719.

1495 J.H.Baxter and Charles Johnson, *Medieval Latin Word-List from British and Irish Sources*, Oxford University Press, London 1934, reprinted 1947: 393.

1496 *OED*: 308.

The name is derived from the Latin *castrum*, -i, n.: a fortified place, a castle, fort or fortress; Lewis and Short: 298.

His examples can vary in height as follows:

*Hyssopifolia* from 10-25 cm.

*Alchimilla vulgaris* from 5-45 cm.

*Heliotropium* from 5-30

*Millefolium aquaticum*: its height is not given in modern floras as it is an aquatic plant with leaves floating on the surface of the water, but presumably varying in size according to the conditions under which it grows.

*Astrantia* from 30-100 cm.<sup>1497</sup>

Line 97. *Hyssopifolia major & minor*.

[C.T.& M. 259] *Lythrum hyssopifolia* (L.), Grass Poly; a species of the *Lythrum* genus of the *Lythraceæ* or Loosestrife family.

B.& G.-W. 258: B.& H. - no ref.: Linn.*Sp.Pl.* 17:

*Syn.Meth.St.Br.* 367: *H.P.* 1055: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* 72.

*H.P.* 1055:

*Gratiola angustifolia* Ger.emac. *angustifolia sive minor* Park.

*Hyssopifolia* C.B. *Hyssopifolia aquatica* J.B. *Hysoopifolia minor vel potius Thymifolia maritima*. J.B.

Line 98. *Alchimilla major & minor*.

[C.T.& M. 221] *Alchemilla vulgaris* (L.), Lady's mantle; a species of the *Alchemilla* genus of the *Rosaceæ* or Rose family.

B.& G.-W. 190: B.& H. 139: Linn.*Sp.Pl.* 123:

*Syn.Meth.St.Br.* 158: *H.P.* 208-209: *H.P.III* 129:

*Tri.* - no ref.: *Cat.Angl.* 11: *Camb.* - no ref.

*H.P.* 208-209:

4 species given, including:

*Alcimilla* Ger. *vulgaris* Park. *major vulgaris* C.B. *Pes Leonis*

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<sup>1497</sup> Clapham, Tutin and Moore: *passim*.

*sive Alchimilla* J.B. *Ladies Mantle*.

*H.P.III* 129:

4 synonyms for *Alchimilla* given here.

Line 98. *Heliotropium majus Siculum* and *Heliotropium majus vulgare*.  
[B.& G.-W. 320] *Heliotropium europæum* (L.), Heliotrope; a species of the *Heliotropium* genus of the *Boraginaceæ* or Borage family.

C.T.& M. - no ref.: B.& H. 308: *Linn.Sp.Pl.* 130-131:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 501: *H.P.III* 207: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 501:

5 species given, including:

*Heliotropium majus* Lob. *Ger. Park. majus flore albo* J.B.  
*majus Dioscoridis* C.B.

*The greater Heliotrope, or Turnsole.*

*Heliotropium Siculum majus flore amplo, odorato* Bocconi.

*H.P.III* 207:

Incorrect reference in the Index to Volume III.

Line 98. *P. Boccone*: Paolo Boccone.<sup>1498</sup>

Ray appears to have written to Boccone in 1674 at the time of the publication of Boccone's *Icones et Descriptiones rariorum Plantarum*,<sup>1499</sup> although without signing his letter as the letter from 'Mr. Oldenburgh to Mr. Ray' dated September 15th 1674 indicates.<sup>1500</sup> Oldenburgh quotes from Boccone's letter to him written in French, showing how much he appreciated Ray's kind

1498 Raven: 67, 191, 220, 231, 283, 301, 447.

1499 That Ray owned a copy of this edition of Boccone's work is indicated by the sale catalogue of his library:

*Icones & Descriptiones Plant.*, edition published in Oxford in 1674; British Museum: S-C 326 (6): 5, *Libri Latine &c. in Quarto*, number 5.

1500 *Correspondence*: 108-109.

words on his work:

L'autheur de la lettre latine tesmoigne d'avoir beaucoup de bonté por moi, et ce ne puis luy respondre dans les formes, à cause que la dite lettre n'est point signée. Je croy pourtant de pouvoir deschiffrer l'autheur, par l'histoire de ses voïages en Sicile, et à Malthe, et de m'arrester sur la personne illustre de Monsieur Rayus. Je vous prié donc, de lui vouloir rendre mes tres-humble reconnoissances, et de luy temoigner mes obligations; et que, s'il arrive jamais qu'il revient en Italie, je le serviray pour compaignon dans toutes les peines inevitables, qu'on rencontre dans les occasions d'herboriser.

In the preface to *Historia Plantarum* Ray says of Boccone:

(Tr.) Paulus Boccone Siculus Panormitanus: he published at Oxford in 1674 illustrations and descriptions of the rarer plants of Sicily, Malta, France and Italy. His four letters on the French topic, published at Amsterdam, contain some information about Lithophytes and other submarine plants.<sup>1501</sup>

Line 99. *Millefolium aquaticum majus & minus*.

[C.T.& M. 47] *Ranunculus aquatilis* (L.), Water Crowfoot; a species of the *Ranunculus* genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 120: B.& H. 7: Linn.*Sp.Pl.* 556: *Syn.Meth.St.Br.* 249: *H.P.* 459 / 1322 / 1101 / 1322 / 191 / 586: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* 200-201: *Camb.* 85.

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<sup>1501</sup> *Historia Plantarum*, Explanation of the abbreviations of names and recent works .... : unnumbered pages.



*H.P.:*

459: *aquaticum umbellatum.*

1322: *aquaticum minus.*

1101: *aquaticum dictum Viola aquaticum.*

1322: *palustre galericulatum.*

191: *aquaticum pennatum spicatum.*

586: *aquaticum cornutum ibid. aquaticum Ranunculi flore & capit.*

Line 99. *D. Dent:* Dr. Dent (not cited as an author here) was a friend of Ray's from Cambridge;<sup>1502</sup> his name first appears in a letter from Ray to Lister dated 18th June 1667.<sup>1503</sup> He contributed to the *Catalogus Angliae* in 1670, and produced the second appendix to the *Cambridge Catalogue* in 1686. He also helped Ray in the study of fishes, and sent him some wildfowl in 1674.<sup>1504</sup> He is believed to have lived near St Sepulchre's Church.<sup>1505</sup> He obtained his M.B. from Lambeth in 1678 and was incorporated at Trinity in 1680; he died in 1689. Dent is mentioned in the preface to *Historia Plantarum* as one of the people who helped Ray in its preparation.<sup>1506</sup>

Line 100. *D. Caroli Hatton:* Charles Hatton (not cited as an author here) was the younger son of Christopher, Baron Hatton.<sup>1507</sup> The first mention of Hatton by Ray is in a letter to John Aubrey written on May 8th 1678, when he tells Aubrey that Hatton has sent him a copy of Colonna's book *Minus cognitarum variorumque in nostro caelo stirpium Ecphrasis*.<sup>1508</sup> Ray mentions in a letter, now lost,

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1502 Raven: 54.

1503 *Further Correspondence:* 113.

1504 Raven: 54.

1505 *Diary of Samuel Newton:* 103 6 39.

1506 *Historia Plantarum:* page 4 (unnumbered) of preface.

1507 Raven: 192.

1508 *Further Correspondence:* 161-164.

addressed to Tancred Robinson, that Hatton had encouraged him to begin writing the *Historia Plantarum*,<sup>1509</sup> which is dedicated to him.

Line 100. *Astrantiæ nigræ: Astrantia nigra.*

[C.T.& M. 279] *Astrantia major* (L.), Great Masterwort; a species of the *Astrantia* genus of the *Umbelliferæ* or Carrot family.

B.& G.-W. 268: B.& H. 178: Linn.*Sp.Pl.* 235:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 474: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 474:

*Astrantia nigra* Lob. *Helleborus niger Saniculæ folio major* C.B.

Park. *Sanicula fœmina quibusdam, aliis Elleborus niger* J.B.

*Astrantia nigra, sive Veratrum nigrum* Ger.

**Black Masterwort.**

Line 102. *D. Morisonum in Historia Plant. univers.*

Ray is referring to Morison's *Plantarum historiæ universalis Oxoniensis pars secunda*, which was published in 1680; the third part, *Plantarum historiæ universalis Oxoniensis pars tertia* was edited by Jacob Bobert and published in 1699 after Morison's death and also after the first two volumes of Ray's *Historia Plantarum*.

Line 103. *Foliorum variegatio*: Ray has correctly observed that variegation of leaf colour can be due to infection, or as he puts it to *symptoma morbidæ constitutionis*. It can be due particularly to viral infection, mineral deficiency or to physiological or genetic differences between the cells.<sup>1510</sup>

Again in this paragraph he is using material already published.<sup>1511</sup>

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1509 *Further Correspondence*, letter dated January 1684: 287.

1510 *Penguin Dictionary of Botany*: 374.

1511 'A Discourse on the Specific Differences of Plants', *Further Correspondence*: 80.

Line 103. *Alaterno: Alaternus.*

[C.T.& M. 183] *Rhamnus alaternus* (L.), a species of the *Rhamnus* genus of the *Rhamnaceæ* or Buckthorn family.

B.& G.-W. 240: B.& H. 99: Linn.*Sp.Pl.* 193:

*Syn.Meth.St.Br.* 445: *H.P.* 1608: *H.P.III D.* 66: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref. to *Alaternus*.<sup>1512</sup>

*H.P.* 1608:

2 species given, including:

*Alaternus major & minor* Park. *Alaternus Plinii & Alat. humilior*

Ger. *Spina Bourgi Monspeliensium & Alaternus* J.B. *Philyca elatior & humilior* C.B.

*H.P.III D.* 66:

10 additional species given.

Line 103. *Buxo: Buxus*

[C.T.& M. 182] *Buxus sempervirens* (L.), Box; a species of the *Buxus* genus of the *Buxaceæ* or Box family.

B.& G.-W. 240: B.& H. 396: Linn.*Sp.Pl.* 983:

*Syn.Meth.St.Br.* 445: *H.P.* 1693-1694: *H.P.III D.* 88:

*Tri.* 15.15: *Cat.Angl.* 47-48: *Camb.* - no ref.

*H.P.* 1693-1694:

2 species given, including:

*Buxus* J.B. Ger. *arborescens* C.B. *arborvulgaris* Park.

*The Box-tree.*

*H.P.III D.* 88:

5 additional species given.

*Tri.* 15.15:

A Box-tree: *Buxus*, -i, f.: Πύξος, -ov, f.

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<sup>1512</sup> The only reference to *Rhamnus* is on page 104 of the *Cambridge Catalogue to Rhamnus catharticus*, Buckthorne or common purging Thorne (*Rhamnus catharticus* of Linnaeus).

Line 103. *Rosmarino: Rosmarinus.*

[Mac.Enc. 1051] *Rosmarinus officinalis* (L.), Rosemary; a species of the *Rosmarinus* genus of the *Labiatae* or Mint family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 344:

Linn.*Sp.Pl.* 23: *Syn.Meth.St.Br.* 472: *H.P.* 515: *H.P.III* 276:

*Tri.* 17.75: *Cat.Angl.* 257: *Camb.* - no ref.

*H.P.* 515:

2 species given, including:

*Rosmarinus coronarius fruticosus* J.B. *hortensis angustiore folio* C.B. *coronarius* Ger. *Libanotis coronaria sive Rosmarinus vulgare* Park. **Common Rosemary.**

*H.P.III* 276:

1 additional species given.

*Tri.* 17.75:

Rosemary: *Ros marinus*, -i, m.: Λιβανωτὰς, -οῦ, f.

Line 103. *Dulcamarā: Dulcamara:* see above Cap.10, line 88.

Line 106. *An floris petalorum variegatio morbi etiam symptoma sit inquirendum.* He is unsure about variegation in the colour of flower petals. This too can be due to the same causes as that in leaves: see note above at Cap.20, line 103.<sup>1513</sup>

Line 108. *An planta foliorum marginibus crispis a congeneribus foliis planis specie differant ambigo.* He has doubts as to whether a curled leaf is a mark of a specific distinction. Again this is a repetition of his earlier argument in his paper on the specific differences of plants.<sup>1514</sup>

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1513 *Penguin Dictionary of Botany:* 374.

1514 'A Discourse on the Specific Differences of Plants', *Further Correspondence:* 78.

Line 110. *Nasturtii hortensis: Nasturtium hortense*: see above Cap.14, line 10.

Line 113. *Quæ radicis colore solo differunt ....* : he incorrectly believes that the plants cited in this paragraph with differing colour or shape of root are not of different species.

Line 113. *Pastinacæ tenuifoliæ: Pastinaca tenuifolia*: see above Cap.3, line 126.

Lines 114 and 115. *Rapæ: Rapa*: [two references] see above Cap.3, line 18.

Line 116. *Quæ fructus seu Pericarpium magnitudine, sapore, figura, colore differunt*: his final example of non-specific differences in plants is to be seen in fruits: again taken from his earlier paper.<sup>1515</sup>

Line 116. *Pomorum: Pomus*: see above Cap.4, line 12.

Line 117. *Pyrorum: Pyrus*: see above Cap.4, line 145.

Line 117. *observante \*D. Sfarroco: Lib. de propag. Vegetab.*: margin reference.

Line 117. *Mali: Malus*: see above Cap.4, line 12.

Line 118. *Pyri: Pyrus*: see above Cap.4, line 145.

Text page 42.

Line 121. *Quæ item seminis colore ludunt ....* : his next difference, which he does not consider to be an indication of species, is the colour of seeds. Again this follows on from his earlier discussion, in which

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<sup>1515</sup> 'A Discourse on the Specific Differences of Plants', *Further Correspondence*: : 79.

he also gives millet as an additional example, saying that:

accidents of the seed are variety of colour observable in the seed of millet, which is found of a yellow and golden colour; of maiz or Indian wheat, which is sometimes spadiceous; of common beans, which are sometimes red; and of kidney-beans, which are of many differing colours.<sup>1516</sup>

Line 121. *Phaseoli: Phaseolus*: see above Cap.13, line 24.

Line 121. *Fabæ vulgares: Faba vulgaris*: see above under *Faba* Cap.9, line 20.

Line 121. *Fru mentum Indicum*: see above Cap.10, line 3.

Line 122. *Quin de industria experiundi causa Fabas rubras ....* : he correctly finds that plants do not necessarily 'come true' from seeds. This is due to cross pollination between related species.<sup>1517</sup>

Line 122. *Fabas rubras: Faba rubra*: see above under *Faba* Cap.9, line 20. *Faba rubra* may be the Runner Bean, *Phaseolus coccineus* of Linnæus, which can have a scarlet flower.

Runner beans may have been introduced some time early in the sixteenth century,<sup>1518</sup> although the date often suggested is 1633, the date at which Johnson wrote that 'it was procured by Mr. John Tradescant, and grew in his time in our gardens .... that his flowers are large, many, and of an elegant scarlet colour; whence it is vulgarly termed by our florists, the Scarlet Bean'.<sup>1519</sup> It was grown as a garden decoration. Even Phillips, writing in the early

<sup>1516</sup> 'A Discourse on the Specific Differences of Plants', *Further Correspondence*: 79.

<sup>1517</sup> For a detailed discussion see *Lowson's Botany*: 344-367.

<sup>1518</sup> N.W. Simmonds (Ed.), *The Evolution of Crop Plants*, 1976.

<sup>1519</sup> Stuart (*Kitchen Garden*: 220) gives this reference to Johnson's edition of Gerard's *Herball*, although it is not to be found in Woodward's edition.

nineteenth century,<sup>1520</sup> could remember them being thus used, and there was no thought of gathering the pods and taking them to the kitchen, although Miller himself is credited with being the first gardener adventurous enough to cook them.<sup>1521</sup> Vilmorin-Andrieux wrote in 1885, 'In small gardens, they are often trained over wire or woodwork, so as to form summer-houses or coverings for walks'.<sup>1522</sup> By then the pods were much valued at table as now.

The crop is another introduction from South and Central America, where it grows in cool, humid upland conditions and is always perennial. In Mexico, archæological datings show cultivation at least 2,000 years ago.<sup>1523</sup> Various species were in cultivation in Britain in the seventeenth century.<sup>1524</sup>

Line 123. *Fabas albas: Faba alba:* see above under *Faba* Cap.9, line 20.

*Faba alba*, Runner Bean, *Phaseolus coccineus* (L.). various species were in cultivation in Britain in the seventeenth century, some with white flowers.<sup>1525</sup>

Lines 127-130. *Deinde cum dicimus in Plantis specie distinctis hanc ab illius semine non oriri ....* : he ends this chapter with his conclusion that a species may be defined as a plant which comes true from seed, although, as he obviously still has some doubts about this, he adds that there are exceptions.

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1520 Cited by David Stuart, without giving the actual reference to Phillips, in *The Kitchen Garden*: 219.

1521 Philip Miller, *Gardener's Dictionary*, first published 1724.

1522 Stuart, *Kitchen Garden*: 220.

1523 N.W. Simmonds (Ed.), *The Evolution of Crop Plants*, 1976.

1524 Sir Robert Sibbald, *Scotia Illustrata*, 1684.

1525 *ibid.*

## Chapter Twenty-one:

### *On the transmutation of species in plants.*

In this chapter Ray discusses whether transmutation is possible between species; he has doubts about this but also concedes that there are well-proven examples of it appearing to happen, such as the change from cauliflower to cabbage, which led to a court case at Westminster.<sup>1526</sup> In effect, he is saying here that a particular form may change into an already existing species - cauliflower to cabbage - as when a cultivated plant reverts to the wild and usually simpler form, such as the cultivated double to the wild single form of *Bellis perennis*. He believes that transmutation can only occur, if at all, between closely related species; he does not speak of the appearance of completely new forms but 'that certain inconsiderable variations are possible within a narrow circle of affinity, especially in cultivated plants'<sup>1527</sup> as above.

That the transmutation of species was a well discussed problem in the late seventeenth century may also be seen in the writings of a professional gardener, Peter Aram, who states in his essay *Of ye Origin of Variety in Flowers in general* that:

Seeds of Vegetables from their Original have a mutative Power in them, whence all the variety of Fruits & Flowers proceeds; and this mutative or changing Power was given them at their first formation by the Omnipotent Author of their being. Yet, this property in ye Seed is not equally alike in all the several species of Plants & Flowers. Some kinds are much more apt or inclinable to break into Varieties than others.<sup>1528</sup>

Like Ray, at line 71, Aram believes that changes can occur between related species.

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<sup>1526</sup> See below Cap.21, lines 44-47.

<sup>1527</sup> Sachs: 70.

<sup>1528</sup> Aram: *A Practical Treatise of Flowers*: 64.



Text page 42.

Line 5. *Verum nota hæc quamvis satis constans sit specificæ convenientiæ signum, non tamen perpetuum est & infallibile.* Because of variations, which can and do occur, between species Ray believes that transmutation does occur. Within a particular species there will inevitably be, within one area, some variation; this was regarded by early botanists, such as Ray and his contemporaries, as evidence of separate species.<sup>1529</sup>

Species show variation in several ways:

1. Some species show little variation and do not cross with each other.
2. Species connected by hybrids; the two native species of Oak, *Quercus*, although usually growing in distinctly different regions, do sometimes occur in the same area, in which case they can and do hybridise, producing a fertile hybrid, which will again hybridise with either parent, thus producing an immense variety of plants.<sup>1530</sup>
3. True-breeding hybrids; a hybrid, 'by modification of the chromosome complement and especially by becoming polyploid,<sup>1531</sup> it is possible for a hybrid to become true-breeding'. That is, a hybrid can reproduce itself as if it were a true species.<sup>1532</sup>
4. Apomicts or plants produced from seeds without fertilisation occurring;<sup>1533</sup> in these instances the chromosomes are identical

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1529 *Lowson's Botany*: 404.

1530 *ibid.*: 405.

1531 Polyploidy is the term used for the condition, when an organism has three or more sets of chromosomes in its nuclei. Polyploid plants may be incapable of reproducing with their parents and so constitute new species. This condition is common in flowering plants - 40% of dicotyledons and 60% of monocotyledons are polyploid. The genetic variability of polyploid plants helps them to have greater evolutionary potential, and thus enables what Ray terms 'transmutation of species' to occur. *Penguin Dictionary of Botany*: 288.

1532 *Lowson's Botany*: 405, 2.

1533 *Penguin Dictionary of Botany*: 26.

to those of the parent, resulting in a clone. Certain plants, for example, *Hieracium* and *Rubus*, both produce about 400 apomicts in Britain alone; they have been given specific names but ‘the feeling is growing that minor apomictic variants ought not to be given Latin names or allowed to rank as species’.<sup>1534</sup>

5. Species with a free assortment of genes; plants, such as *Capsella Bursa-pastoris*, cross freely and produce too many variations to distinguish them all as separate species.<sup>1535</sup>
6. Species containing distinct forms; plants within a species, because they grow under very different conditions, can appear to be of different species. *Armeria maritima*, which grows both on mountainsides and in coastal sites, appears wrongly to be two distinct species.<sup>1536</sup>
7. Clines or gradients of variation, such as spotting of the leaves, as occurs in *Arum maculatum*.<sup>1537</sup>

Lines 9-19. *Triticum, referente Sennerto, .... praeterea Aparinem enatam.*

In these lines Ray gives a comprehensive list of plants where transmutation is said to have taken place.

Aram also lists ‘the Flowers most inclinable to augment their Species with new Varieties by seminal productions’:

Auricula’s, Polyantho’s, Irises, Ranunculus’s.  
Anemonies, Narcissus, Tulips, Gilliflowers,  
Hyacinths.<sup>1538</sup>

Line 9. *Triticum*: see above Cap.13, line 27.

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1534 *Lowson’s Botany*: 406, 3.

1535 *ibid.*: 406, 4.

1536 *ibid.*: 407, 5.

1537 *ibid.*: 407, 6.

1538 Aram: *A Practical Treatise of Flowers*: 64.

Line 9. \*Sennerto: margin reference given to Sennert *Hyppomn. 5, cap.2.*

Line 9. *Lolium: Lolium.*

[C.T.& M. 619] *Lolium* (L.), Rye-grass; a genus of the *Gramineæ* or Grass family.

B.& G.-W. - no ref.: B.& H. 530: Linn.*Sp.Pl.* 83:

*Syn.Meth.St.Br.* 395: *H.P.* 1262: *H.P.III* - no ref.: *Tri.* 10.61:

*Cat.Angl.* 190: *Camb.* 81.

*H.P.* 1262:

(Tr.) *Lolium*, Ἰαίρα to the Greeks, is an adulteration of

δόλιον. For it is believed to have evolved as a cross

between *Triticum* and *Hordeum*. Moreover *D* changes to

*L*, as *Ulysses* from the Aeolic Ὀδύσσευς,<sup>1539</sup>

*Lachryma* from δάκρυα, or the word derives ἀπὸ τοῦ

λαῖον ὀλεῖν, that is 'crop destroying'; or as if from

λαῖον ὄλοον, that is 'poisonous crop'. Thus Martinius

and from him Vossius.

8 species given, including:

*Lolium album* Ger. Park. *Lolium gramineum spicatum caput*

*tentans* J.B. *Gramen loliaceum spica longiore* C.B. **Darnel**,

*Ivray Gallis, quoniam inebriat.*

*Gramen loliaceum angustiore folio & spica* C.B. *Lolium rubrum*

Ger. *Lolium rubrum sive Phœnix* Park. *Phœnix Lolio similis*

J.B. **Red Darnel-grass.**

*Tri.* 10.61:

Darnel: *Lolium*, -ii, n.: Ἰαίρα, -ας, f.

Line 9. *Rapum*: see above under *Rapa* Cap.3, line 18.

<sup>1539</sup> NB The Aeolic form is Ὀλύσσευς; Liddell and Scott: 1199.

Line 9. *Rhaphanum: Rhaphanus*: see above under *Raphanus* Cap.14, line 11.

Line 9. *Sisymbrium*.

[C.T.& M. 92] *Cardamine pratensis* (L.), Cuckoo Flower, Lady's Smock; a species of the *Cardamine* gnus of the *Cruciferæ* or Cress family.

B.& G.-W. 140: B.& H. 31: Linn.*Sp.Pl.* 657-660:

*Syn.Meth.St.Br.* 300: *H.P.* 814-818: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 814-818:

15 species given of *Cardamine*, including 5 also called *Sisymbrium*, for example:

*Cardamine impatiens altera hirsutior. Sisymbrium Cardamine hirsutum minus flore albo* J.B.

***The lesser Cockow-flower, or Ladies Smock.***

Line 10. *Mentham: Mentha*: see above Cap.3, line 25.

Line 10. *Ocimum*: see above under *Ocimum* Cap.18, line 137.

Line 10. *Serpyllum: Serpyllum*.

[C.T.& M. 407] *Thymus serpyllum* (L.), Breckland Thyme; a species of the *Thymus* genus of the *Labiatae* or Mint family.

B.& G.-W. 342: B.& H. 348-349: Linn.*Sp.Pl.* 590:

*Syn.Meth.St.Br.* 230-231: *H.P.* 520-523: *H.P.III* 278:

*Tri.* - no ref.: *Cat.Angl.* 271-272: *Camb.* 113.

*H.P.* 520-523:

11 species of *Thymus* given, including 8 also called *Serpyllum*, for example:

*Serpyllum vulgare* Ger. J.B. *vulgare minor* Park. C.B.

***Common Mother of Thyme.***

*H.P.III* 278:

7 additional species given.

Line 10. *Vitis nigra*.

[C.T.& M. 557] *Tamus communis* (L.), Black Bryony; a species of the *Tamus* genus of the *Dioscoreaceæ* family.

B.& G.-W. 464: B.& H. 455: Linn.*Sp.Pl.* 1028:

*Syn.Meth.St.Br.* 262: *H.P.* 660: *H.P.III D.* 97: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 660:

*Bryonia alba baccis nigris* C.B. *alba vulgaris fructu nigro* Park.

*Vitis sive Bryonia nigris baccis* J.B.

*H.P.III D.* 97:

9 additional species given, some of which are *Vitis nigra*.

Line 10. *Vitis alba*.

[C.T.& M. 294] *Bryonia cretica* (L.), subsp. *dioica* ([Jacq.] Tutin), White or Red Bryony; a species of the *Bryonia* genus of the *Cucurbitaceæ* or Gourd family.

B.& G.-W. 256: B.& H. 157: Linn.*Sp.Pl.* 1012:

*Syn.Meth.St.Br.* 261-262: *H.P.* 659: *H.P.III D.* 97: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 659:

*Bryonia alba* Ger. *alba vulgaris* Park. *aspera, sive alba baccis*

*rubris* C.B. *Vitis alba sive Bryonia* J.B. **White Bryony.**

*H.P.III D.* 97:

9 additional species given, some of which are *Vitis alba*.

Line 10. *Zea*.

[Mac.Enc. 763] *Zea mays* (L.), Maize; a species of the *Zea* genus of the *Gramineæ* or Grass family.

See also under *Maiz* Cap.10, line 3: under *Fruentum* Cap.7, line 50: under *Fruentum Indicum* Cap.10, line 3: and under *Fruentum Turcicum* Cap.12, line 144.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 508:

Linn.*Sp.Pl.* 971-972: *Syn.Meth.St.Br.* 386-389: *H.P.* 1249:

*H.P.III* 597: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1249:

*Triticum Indicum* J.B. *Fruentum Indicum Mays dictum* C.B.

*Item frumentum Indicum mays dictum alterum ejusdem. Milium*

*Indicum maximum Mays dictum, seu Fruentum Indicum*

Park. *Fruentum Turcicum & Indicum* Ger. **Indian Wheat.**

*H.P.III* 597:

Not listed in the Index to Volume III as *Zea*, but as *Mayz* (*Mayez*): 1 additional species given.

Line 10. *Triticum: Triticum*: see above Cap.13, line 27.

Line 11. *Triticum*: see above Cap.13, line 27.

Line 11. *Zeam: Zea*: see above Cap.21, line 10.

Line 11. *Si in Ungaria Secale Germaniæ seratur, generatur inde Triticum.*

Ray seems to be describing the apparent difference of species when seed is sown under very different conditions; that is, one must assume that the area of Hungary where the seed was sown differed markedly from that in Germany.<sup>1540</sup>

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1540 See note at Cap.21, line 5, section 6, above: also *Lowson's Botany*: 406, 4.

Line 11. *Secale*: see above Cap.7, line 23.

Line 12. *Triticum*: see above Cap.13, line 27.

Line 12. *Avena alba* and *Avena nigra*.

See above under *Avena* Cap.13, line 27. Both are now considered as *Avena sativa* (L.), Oats; a species of the *Avena* genus of the *Gramineæ* or Grass family.

Linn.*Sp.Pl.* 79-80:

10 species given, including:

*Avena calycibus dispermis, seminibus lævibus.* Hort.cliff.25.

Hort.ups.20. Mat.med.38. Roy.lugdb.65.

*Avena nigra.* Bauh.pin.23.

*Avena alba.* Bauh.pin.23.

*Syn.Meth.St.Br.* 389:

(Tr.) 'Avena is distinguished from other corns by its wide-spread panicle, long narrow seed, sometimes bare, sometimes with a glume with a thicker covering in spikelets split into two.'

*Avena alba* J.B.432. *vulgaris, seu alba* C.B.Pin.23. *vesca* Lob.Ic.31. Ger.68. Park.1134. **White Oats.**

*Avena nigra* J.B.II 432. C.B.Pin.23. **Black Oats.**

*H.P.* 1253:

*Avena alba* J.B. *vulgaris seu alba* C.B. *vesca* Lob. Ger. Park. **White Oats.**

*Avena nigra* J.B. C.B. **Black Oats.**

*Camb.* 46:

*Avena, Common or maured Oates.*

N. The awns of this and the following are dry when fully grown and beautifully twisted; when lightly sprinkled with water they untwist. *Vide*

*Bacon.hist.nat.cent.5.exp.492.*

*Avena nigra*, **Black Oats** [*Avena sativa*, Linnæus].

This does not occur in Gerard or Parkinson although it is grown more frequently in England than White Oats. Moufet praises this type as less 'flatulent' and of greater food value than other kinds of oats. *Moufet. lib. de diæt. Anglice conscripto.*

*Tri.* 12.135:

Oats: *Avena*, -æ, f.: *Βρωμος*, -ου, m.

Line 12. *Si idem semen eodem in agro aliquot annis seratur in vilis degenerat.* A correct observation that certain plants should not be grown in the same soil on a regular basis, because soil-borne pests and diseases specific to a particular crop multiply rapidly when the same plant is grown in the same place for a number of years, and, as Ray says, the quality of the crop degenerates. Another advantage of crop rotation is that leguminous plants add nitrogen to the soil, which can then benefit the following crop. A usual timescale for rotation is four years, although some diseases such as clubroot may survive in the soil for up to twenty years.<sup>1541</sup>

Line 13. *Triticum: Triticum:* see above Cap.13, line 27.

Line 13. *Hordeum: Hordeum:* see above Cap.7, line 23.

Line 15. *Lolium:* see above Cap.21, line 9.

Line 15. *Ægilops.*

[B.& H. 529] a Mediterranean genus believed to have been the parent of the Wheats.

C.T.& M. - no ref.: B.& G.-W. - no ref.: Linn.*Sp.Pl.* 1050-1051:

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<sup>1541</sup> Brickell, *Gardening*: 307-308.



*Syn.Meth.St.Br.* 389: *H.P.* 1289: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* 8 with a ref. to see *Gramen festucæ*:15+2 *Camb.* 39.

*H.P.*1289:

*Festuca Avenacea sterilis elatior* C.B. *Bromos herba sive Avena sterilis* Park. *Bromos sterilis* Ger. *Ægilops Matthiolo forte* J.B.  
**Great wild Oat-grass, or Drank.**

Line 16. *Tritico: Triticum*: see above *Cap.13*, line 27.

Line 17. *Lolio: Lolium*: see above *Cap.21*, line 9.

Line 17. *Hordeo: Hordeum*: see above *Cap.7*, line 23.

Line 17. *Ægilopis: Ægilops*: see above *Cap.21*, line 15.

Line 18. *Lente: Lens*: see above *Cap.13*, line 32.

Line 18. *Aracum: Aracus*.

[C.T.& M. 189] *Vicia cracca* (L.), Tufted Vetch; a species of the *Vicia* genus of the *Leguminosæ* or Pea family.

B.& G.-W. 206: B.& H. 120: *Linn.Sp.Pl.* 735:

*Syn.Meth.St.Br.* 321: *H.P.* 902: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* 25 with a ref. to see *Vicia* 304-305: *Camb.* 44.

*H.P.* 902:

*Arachus Viciæ species.*

*Vicia sylvestris sive Cracca major* Ger. *Aracus seu Craccamajor* Park. *Vicia vulgaris sylvestris semine parvo & nigro frugum* J.B. *Vicia semine rotundo nigro* C.B.

**Strangle Tare or Wild Vetch.**

*Vicia segetum cum siliquis plurimis hirsutis* C.B. *Vic.*

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1542 However, Ray does not mention this species among the grasses in *Catalogus Angliæ*.

*parva sive Cracca minor cum multis siliquis hirsutis* J.B. Vic.  
*sylvestris sive Cracca minima* Ger.emac. **Small Wild tare or**  
**Fine Tare.** *Aracus sive Cracca minor* Park.

Line 18. *Securinum*: no reference to this as a plant in any of the sources.

Line 19. *Aparinem*: *Aparine*: see above Cap.9, line 67.

Lines 20-36. *Hæc experimenta .... ut superius ostendimus.*

In these two paragraphs Ray expresses his doubts on the transmutation of the species given as examples in lines 9-19.

Line 23. *phænomenon assignandis .....*: again an example of Ray's occasional use of Greek; although here he is only using a single letter, we must assume that it is used deliberately.<sup>1543</sup>

Lines 26-27. *Lolium*: *Lolium*, for which see above Cap.21, line 9, occurs five times in these two lines.

Lines 26-31. *Tritico*: *Triticum*, for which see above Cap.13, line 27, occurs six times in these lines.

Lines 28-31. *Ægilopem*: *Ægilops*, for which see above Cap.21, line 15, occurs four times in these lines.

Line 34. *Nec dubium est quin semina plantarum ....* : he comments on the dormancy of seeds, which he has discussed at length above, *ut superius ostendimus*.<sup>1544</sup>

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<sup>1543</sup> See also above Cap.15, line 15, for Ray's use of Greek in *Historia Plantarum*.

<sup>1544</sup> See above Cap. 13, lines 58-75.

Line 37. *Verum quanvis experimenta allata incerta ....* : Ray continues with proof of transmutation of species.

Lines 40-68. *E Brassicæ floridæ semine sato Brassicam capitatam sæpius enatam .... tria aut quatuor grana Avenacea undique perfecta enata sunt.* In these lines Ray gives trustworthy examples of transmutation of species.

The majority of Ray's examples are taken from the *Brassica* family, although as he says in the last paragraph of this section, transmutation occurs in other genera too. His transmutation is, as he says, a degeneration into the wild or original form - *sed hujus semen denuo satum degeneravit in vulgarem apertam lævam Brassicam.* This occurs because of frequent cross fertilisation between closely related species.<sup>1545</sup>

Line 40. *Brassicæ floridæ: Brassica florida:* see under *Brassica* above Cap.9, line 113.

Cauliflower is a subspecies of *Brassica oleracea*, a species of the *Brassica* genus of the *Cruciferæ* or Cress family.

H.P. 795:

*Brassica florida* Ger. *cauliflora* C.B. *multiflora* J.B. *caule florida* Park. *Colliflower.*

H.P.III - no ref.

Line 40. *Brassicam capitatam: Brassica capitata:* see under *Brassica* above Cap.9, line 113.

Cabbage is a subspecies of *Brassica oleracea*, a species of the *Brassica* genus of the *Cruciferæ* or Cress family.

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<sup>1545</sup> See notes above Cap.21, line 5.

H.P. 794-795:

*Brassica capitata alba* J.B. C.B. Ger. Park. **White Cabbage.**

*Brassica capitata rubra.* J.B. C.B. Ger. Park. **Red Cabbage.**

H.P.III - no ref.

Line 41. *imo Brassicæ species omnes satione in se invicem transmutari affirmat R. Morisonus, & experimentis probat:* for *Brassica*: see above Cap.9, line 113. Ray cites evidence given by Robert Morison.

Line 42. *Brassicæ tophosæ: Brassica tophosa.*

[C.T.& M. 72] *Brassica nigra* (Koch), [*Sinapis nigra* (L.)], Black Mustard; a species of the *Brassica* genus of the *Cruciferæ* or Cress family.

B.& G.-W. 158: B.& H. 36: Linn.*Sp.Pl.* 667:

*Syn.Meth.St.Br.* - no ref.: H.P. 796: H.P.III - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

H.P. 796:

*Brassica fimbriata* C.B. *tophosa* J.B. Ger. *nigra* Dod.

Line 42. *ad Reverendissimum Episcopum Londiniensem D. Hen. Compton:* seeds were frequently sent back home by travellers at this time. As Hadfield says, 'Bishop Compton, too, received a number from the Rev. John Banister, perhaps the first of the long line of missionary botanists'.<sup>1546</sup>

Compton, the son of the second Earl of Northampton, was:

a soldier in 1660, ordained in 1662, and made Bishop of Oxford in 1674 and then of London in 1675 - had been suspended by the High Court of Ecclesiastical Commission in 1686 for refusing to inhibit John Sharp,

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<sup>1546</sup> Hadfield: 142.

afterwards Archbishop of York. Deprived of the exercise of his functions, but not of the temporalities of his see, he had devoted himself to the planting of his gardens at Fulham, and with the aid of an expert gardener, George London, had successfully established many varieties imported from America and collected the finest arboretum in England.<sup>1547</sup> Ray evidently spent some time there and paid a glowing tribute to the ‘Mæcenas of botany’.<sup>1548</sup>

Line 43. *Brassicam tophosam: Brassica tophosa:* see above Cap.21, line 42.

Line 44. *degeneravit in vulgarem apertam lævem Brassicam:*

*Brassica vulgaris aperta laevis:* presumably this is *Brassica oleracea*, the common *Brassica*, for which see above Cap.9, line 113.

Line 44. *Idem dicendum de Brassica florida botryte .... :* he gives here an example of transmutation from cauliflower to cabbage, which was considered of sufficient importance to lead to a court case.

Line 44. *Brassicā floridā botryte: Brassica florida botrytis:*<sup>1549</sup> see above under *Brassica florida* (Cauliflower) Cap.21, line 40. Linnæus *Species Plantarum*, page 667, gives this as a subspecies of *Brassica oleracea:*

*Brassica botrytis, Brassica cauliflora.* Bauh.pin.111.  
Renealm.spec.131.t.133. Cam.epit.253.

1547 See above Cap.18, line 53, for Peter Aram’s apprenticeship in this garden.

1548 Raven: 229.

1549 The word *botrytis* comes from the Latinized form of βότρυς, *botrys*, ‘a grape’, whence *botryo*, *-ionis*, m. ‘a cluster of grapes’, *botryodes*, *-is*, adj. ‘in the form of a cluster of grapes’, and thus, as here, the shape of a cauliflower head. [Lewis and Short: 248.]

Line 45. *Brassicam longifoliam apertam: Brassica longifolia aperta:* see above under *Brassica* Cap.9, line 113.

In Bentham and Hooker, *British Flora*, page 36, there is a *Brassica* called *tenuifolia* ('thin-leaved'); could this be *longifolia* ('long-leaved') as here?

Line 47. *Brassicæ floridæ: Brassica florida:* see above Cap.21, line 40.

Line 48. **the Heat-houses:** an example of Ray's occasional usage of English in *Historia Plantarum*; perhaps it is, like his use of Greek, for emphasis, or perhaps because 'Heat-houses', i.e. greenhouses, were a new development and the concept was not easily translated into Latin, except literally.

Greenhouses had originated as a means of preserving tender plants, 'greens', over the winter, containing no heating other than a very basic stove. By the latter part of the seventeenth century they were becoming more sophisticated because of the increasing number of exotic seeds being brought into the country by travellers.<sup>1550</sup> Hans Sloane in a letter to Ray, written on 11th November 1684 describes such a greenhouse with much improved heating:

Mr Watts having a new contrivance (at least in this country), viz. he makes under the floor of his greenhouse a great fire-place with grate, ash-hole, &c., and conveys the warmth through the whole house by tunnels, so that he hopes, by the help of weather-glasses within, to bring or keep the air at what degree of warmth he pleases, letting in upon occasion the outward air by the windows. He thinks to make, by this means, an

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<sup>1550</sup> See the reference to Dr. Compton at Cap.21, line 42, above.

artificial spring, summer, winter, &c.<sup>1551</sup>

This particular greenhouse, which was obviously a novelty at the time, is mentioned again the following year by John Evelyn in his *Diary* for 7th August 1685:

to see Mr Watts, keeper of the Apothecaries Garden of simples at Chelsea where there is a collection of innumerable rarities of that sort, particularly beside many rare annuals the tree bearing the Jesuit's bark,<sup>1552</sup> which had done such cures in quartans, and what was very ingenious the subterranean heat, conveyed by a stove under the conservatory, which was all vaulted with brick, so as he leaves the doors and windows open in the hardest frosts, secluding only snow, etc.<sup>1553</sup>

In 1691 John Evelyn published his own design for a heated greenhouse.<sup>1554</sup>

In 1690 Hatton, to whom *Historia Plantarum* is dedicated, visited and praised this new style of greenhouse at Hampton Court; he said that the heated house, in which were kept the plants brought from India by Fagel,<sup>1555</sup> was 'the best contrived in England'.<sup>1556</sup>

Line 50. *Brassicas: Brassica*: see above Cap.9, line 113.

Text page 43.

Line 56. *Brassicæ sabaudæ: Brassica sabauda*: see above under *Brassica* Cap.9, line 113.

This is the Savoy Cabbage, a subspecies of *Brassica oleracea*, a

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1551 *Correspondence*: 158.

1552 Quinine from the bark of the *Cinchona* tree.

1553 John Evelyn, (ed. E.S. de Beer), *Diary*.

1554 John Evelyn, *Kalendarium Hortense*.

1555 Hadfield: 142.

1556 E.M. Thompson (Ed.), *Correspondence of the Family of Hatton*, Camden Society N.S., xxii, xxiii.

species of the *Brassica* genus of the *Cruciferae* or Cress family.

Linn.*Sp.Pl.* 667: *Syn.Meth.St.Br.* - no ref.: *H.P.* 795:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 795:

*Brassica Italica tenerrima glomerosa, flore albo* J.B. *Bras. alba capite oblongo non penitus caluso* C.B. *Bras. Sabauda* Ger. Park. **The Savoy Cabbage.**

*Brassica Sabauda rugosa* J.B. *patula* Ger. Park. *An Brassica alba crispa* C.B?

Line 56. *Idem accidit Brassicæ Sabaudæ ....* : in this paragraph Ray expresses the belief that the Savoy cabbage will not grow true from seed in this country but that seed must be imported each year from abroad. The degeneration he reports is due, not to climatic conditions in England, but to the fact that highly bred species, such as modern F1 hybrids, do not breed true from seed.<sup>1557</sup>

Line 58. *Brassicam apertam: Brassica aperta.*

See above under *Brassica* Cap.9, line 113. No reference to this as a separate species of *Brassica*. Does it mean a species with 'open' or 'loose' leaves? It is used here as if it were the original or common *Brassica*.

Line 60. *Brassicæ: Brassica:* see above Cap.9, line 113.

Line 60. *Primulæ veris: Primula veris:* see above Cap.7, line 13.

Line 60. *Paralyseos.*

[C.T.& M. 345] *Primula veris* (L.), Cowslip, Paigle; a species of the *Primula* genus of the *Primulaceæ* or Primrose family.



B.& G.-W. 296: B.& H. 289: Linn.*Sp.Pl.* 142:

*Syn.Meth.St.Br.* 284-285: *H.P.* 1080: *H.P.III* - no ref.: *Tri.* 9.48:

*Cat.Angl.* - no ref.: *Camb.* 98.

*H.P.* 1080:

*Primula veris major* Ger. *veris odorata flore luteo simplici* J.B.

*verbasculum pratense odoratum* C.B. *Paralysis vulgaris*

*pratensis flore flavo simplici odorato* Park.parad.

***Common Paigles or Cowslips.***

*Tri.* 9.48:

Cowslips or Paigles: *Paralysis*, -is, f.: Φλομίσκος, -ου, m.

Line 60. *Nec Brassicæ tantum semina sata degenerem prolem producunt .... :*

the plants cited here all hybridise very easily. As Raven says:

Cowslip crossed with Primrose might produce the hybrid which superficially resembles the true Oxlip, but could not produce pure Primrose. Possibly Bobart had sown seed of the hybrid Oxlip and obtained the natural result, Primroses, Cowslips and hybrids.<sup>1558</sup>

Line 61. *Jacobus Bobertus*: Jacob Bobart, a native of Brunswick, was appointed *Horti Præfectus* of the Oxford Botanic Garden in 1632 and kept that position until his death. He published in 1648 the first catalogue of its contents.<sup>1559</sup> He was followed as custodian of the gardens by his son, also Jacob. He, or Sir John Millington, had perhaps guessed at the male fertilising function of pollen from his experiment in 1680 at the Oxford gardens that seeds from a flower of *Lychnis*, in which no anthers were present, were infertile when

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1558 Raven: 174.

1559 Hyams: 102.

There is no indication in the sale catalogue of his library that Ray owned a copy of this catalogue of the plants in the Oxford Botanic Garden; British Museum: S-C 326 (6).

sown.<sup>1560</sup> Bobart's garden was criticised for having too many clipped yew and box trees, but Celia Fiennes, who visited it in 1695 said that 'the variety of flowers and plants would have entertained one a week'.<sup>1561</sup>

Line 61. *Horti publici Academici*: the 'public academic garden', that is, the Oxford Botanic Garden, founded in 1621 by Lord Henry Danvers, Earl of Danby.<sup>1562</sup>

Line 62. *Primulæ veris majoris*: *Primula veris major*.  
See above under *Paralyseos* Cap.21, line 60.

Line 62. *Primulam vulgarem*: *Primula vulgaris*.

[C.T.& M. 346] *Primula vulgaris* (Hudson), [*Primula acaulis* ([L.] Hill)], Primrose; a species of the *Primula* genus of the *Primulaceæ* or Primrose family.

B.& G.-W. 296: B.& H. 289: Linn.*Sp.Pl.* 142-143:

*Syn.Meth.St.Br.* 284: *H.P.* 1080: *H.P.III* - no ref.: *Tri.* 13.153:  
*Cat.Angl.* 242: *Camb.* 98.

*H.P.* 1080:

*Primula veris vulgaris* Park. *veris minor* Ger. *veris floribus ex singularibus pediculis, majoribus, simplicibus* J.B.  
*Verbasculum sylvarum majus singulari flore* C.B.

**Common Primrose.**

*Tri.* 13.153:

Primrose: *Primula*, -æ, *veris*, f.: Φλομῖς, -ίδας, f.

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1560 Bobart is credited with this idea by Morton: 240; Millington is credited with the idea by Hyams: 102.

1561 Celia Fiennes (Ed. Christopher Morris), *The Journeys*, revised edition 1967.

1562 Hyams: 102.

Line 62. *Primulam pratensem: Primula pratensis.*

[C.T.& M. 346] *Primula elatior* ([L.] Hill), Oxlip, Paigle; a species of the *Primula* genus of the *Primulaceæ* or Primrose family.

B.& G.-W. 296: B.& H. 289: Linn.*Sp.Pl.* 142-143:

*Syn.Meth.St.Br.* 284: *H.P.* 1081: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 242: *Camb.* - no ref.

*H.P.* 1081:

*Primula pratensis inodora lutea Ger. veris caulifera, pallido flore inodoro aut vix odoro J.B. Verbasculum pratense aut sylvaticum inodorum C.B. Paralysis altera odorata flore pallido polyanthos Park.parad. Great Cowslips or Oxlips.*

Line 64. *Olaus Wormius Musei, lib.2, cap.7. pag. mihi 150.*

Ray says that he must believe in a true transformation of species because of first hand and reliable information; he cites Olaus Worm's *Museum Wormianum*, Leyden 1655, for the occurrence of seeds of barley and rye in a single ear.<sup>1563</sup>

Ray received details of foreign fruits from Worm among others,<sup>1564</sup> but believes that he does not have the experience to classify them correctly.

Line 64. *Hordeum*: see above Cap.7, line 23.

Line 65. *Hordeum*: see above Cap.7, line 23.

Line 65. *Secale*: see above Cap.7, line 23.

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1563 Despite his reference here to his own copy, there is no indication in the sale catalogue of his library that Ray owned a copy of this work; British Museum: S-C 326 (6).

1564 Raven: 230.

Line 66. *Johnsonus .... apud Gerardum emac. lib.1, cap.46, pag.65.*<sup>1565</sup>

John Gerard, 1545-1612.<sup>1566</sup> he was born at Nantwich in Cheshire; his main interests were in botany, pharmacy and horticulture. He is the best known of the English herbalists, and was a barber-surgeon, although he seems to have spent most of his time working on horticulture. He had a famous garden in Holborn, and also supervised the gardens of Lord Burleigh in the Strand and at Theobalds in Hertfordshire. In 1596 he published a list of the plants which he grew at Holborn - the first list of all the plants in a particular garden. His most famous work is *The Herball or Generall Historie of Plantes* published by John Norton in 1597. It was not, however, a completely original work; Norton had commissioned Dr. Priest to translate Dodoens' *Pemptades* of 1583 into English, but he died before completing it. Gerard took over, adapting Priest's translation, completing it, altering the arrangement to that of de l'Obel and publishing it as his own. It contains about 1800 woodcuts, mostly taken from other works, especially the *Eicones* of Tabernæmontanus of 1590. His employment as a barber-surgeon made him very aware of the medicinal properties of plants, and together with his abilities as a practical gardener, led to his appointment from 1586 to 1604 as curator of the physic garden of the College of Physicians of London. In 1597 he became junior warden of the Barber-Surgeons' Company and in 1608 its master.<sup>1567</sup>

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<sup>1565</sup> That Ray owned a copy of the second edition of Johnson's version of Gerard's *Herbal*, published in 1636 'with minor alterations', is indicated by the sale catalogue of his library:

*Gerrard's* [sic] *Herbal* by Johnson, edition published in London in 1636; British Museum: S-C 326 (6): 21, English Books in Folio, number 13.

<sup>1566</sup> *DSB V*: 361-363 gives Gerard's dates as 1545-1612, whereas Arber, *Herbals*: 131, has his dates as 1545-1607.

<sup>1567</sup> Arber: 129-137, 157; also *DSB V*: 361-363.

Gerard's original works are:

1. *Catalogus arborum, fruticum ac plantarum tam indigenarum, quam exoticarum in horto Johannis Gerardi* (London 1596: 2nd edition 1599).<sup>1568</sup>
2. *The Herball or generall Historie of Plantes Gathered by John Gerard, Master in Chirurgie* (London 1597: reprinted 1598).<sup>1569</sup>

Thomas Johnson: c.1600-1644.<sup>1570</sup> Little is known of his early life, although he was certainly born in Yorkshire. On 28th November 1620 he was apprenticed to the London apothecary William Bell and after eight years became a free brother of the Society of Apothecaries. He met John Parkinson, George Bowles and John Goodyear; together they can be considered to be the most able British botanists of the early seventeenth century.<sup>1571</sup>

When Parkinson's *Herbal*<sup>1572</sup> was imminent the publishers of Gerard's *Herball* decided to publish a new edition and Thomas Johnson was commissioned to edit the original within a year. As a well-known apothecary and botanist, he added a balanced and comprehensive historical introduction, and indicates where in the text (with a dagger †) he had altered and emended Gerard's original, and also where he had added new material (indicated with a double cross ‡); he also included acknowledged contributions by Parkinson, Bowles and Goodyear. His new edition was illustrated with 2766 blocks, previously used in works by Plantin. This edition

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1568 Reprinted in B.D.Jackson (Ed.), *A Catalogue of Plants Cultivated in the Garden of John Gerard, in the Years 1596-1599, Edited with Notes, References to Gerard's Herball, the Addition of Modern Names, and a Life of the Author*, London 1876.

1569 Extracts from the 'very much enlarged and amended' edition by Thomas Johnson (London 1633) are in the edition by Marcus Woodward, *Gerard's Herball, the Essence Thereof Distilled* (London 1927: reprinted 1964).

1570 *DSB VII*: 146.

1571 *ibid*: 147.

1572 *Arber*: 134.

is a far more scholarly work than Gerard's original.<sup>1573</sup>

Johnson was also a significant botanist in his own right; his accounts of his plant hunting excursions, published from 1629 onwards, are the earliest attempts to list all the plants of England and Wales with their localities.<sup>1574</sup>

Johnson fought on the Royalist side in the Civil War and died from gun shot wounds. He was described as 'no lesse eminent in the Garrison for his valour and conduct, as a Souldier, than famous throughout the Kingdom for his excellence as an Herbarist, and Physician'.<sup>1575</sup>

Ray took from Johnson's edition of Gerard's *Herball* the information on the frauds of herb women,<sup>1576</sup> to which he strongly objected. In the *Catalogus Angliæ* he says that:

*Inexcusabilis est (inquit Johnsonus) quorundam nostris temporibus ignorantia, qui radices hujus herbæ Pæoniæ radicum loco coernunt & divendunt. Quin sibi compertum affirmat, mulierculas rhizotomas & botanopolas Londinienses radices hasce sub nomine Levistici aquatici vendere. An adeo venenatæ sint & malignæ hujus plantæ radices nonnullos dubitare video: Ego ulteriori examini relinquo.*<sup>1577</sup> [The herb women sold the roots of Hemlock Dropwort (*Ænanthe crocata*) as roots of Pæony.]

Ray ends by saying that he will investigate the matter at a later date. He in fact carried out further investigation into this and reported on it to the Royal Society;<sup>1578</sup> see also his letter to Hans Sloane.<sup>1579</sup>

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1573 Arber: 134.

1574 DSB VII: 147; H.W.Kew and H.E. Powell, *Thomas Johnson, Botanist and Royalist*, Longmans, Green & Co, London 1932.

1575 Arber: 135.

1576 Gerard (Ed. Johnson): 1060.

1577 *Catalogus Plantarum Angliæ*, London 1677: 214.

1578 *Philosophical Transactions* XIX: 634.

1579 *Correspondence*: 313-315.

Johnson's original works on botany are:<sup>1580</sup>

1. *Iter plantarum investigationis ergo susceptum. A decem sociis, in agrum Cantainum, Anno Do. 1629, Julli 13. Ericetum Hampstedianum .... 1 August* (London 1629).<sup>1581</sup>
2. *Descriptio itineris plantarum investigationis ergo suscepti, in agrum Canatainum Anno. Dom. 1632. Et enumeratio plantaum in ericeto Hampstediano* (London 1632).
3. *The Herball or Generall Historie of Plantes, gathered by John Gerarde .... Very Much Enlarged and Amended* (London 1633: reprinted with minor alterations 1636).
4. *Mercurius botanicus, Sive plantarum gratia suscepti itineris, anno 1634 descriptio* (London 1634).
5. *Mercurii botanici pars altera sive Plantarum gratia suscepti itineris in Cambriam sive Walliam descriptio* (London 1641).

Line 67. *D. Goodyer*: Goodyear was a contributor, with Parkinson and Bowles, to Johnson's edition of Gerard's *Herball*. He is described as an 'Elm expert', a close friend of Johnson's and enthusiastic botanist and plant hunter, who accompanied Johnson on his plant hunting expeditions; after Johnson's death he gave up practical botany and turned, in his grief, to translating and writing out by hand in 4,500 pages the whole of Dioscorides into English, a task which took him three years.<sup>1582</sup>

Line 67. *Tritici albi: Triticum album*.

See above under *Triticum* Cap.13, line 27.

This appears to be *Triticum vulgare*; there is no reference to this as a

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<sup>1580</sup> DSB VII: 148.

<sup>1581</sup> This and the following work have been reprinted as Thomas Johnson, *Botanical Journeys in Kent and Hampstead. A facsimile reprint with Introduction and Translation of his Iter Plantarum 1629, Descriptio Itineris Plantarum 1632*; edited by J.S.L.Gilmour, The Hunt Botanical Library, Pittsburgh, Pennsylvania 1972.

<sup>1582</sup> Tyler-Whittle: 33-35.

separate species of *Triticum* in any of the sources.

Ray himself, *Historia Plantarum* page 1236, divides *Triticum*, **White or Red Wheat without Awns** into:

*Triticum spica & granis rubentibus*, and

*Triticum spica & granis albis*.

Also in the *Cambridge Catalogue*, page 121, he gives:

*Triticum spica mutica et spica et granis albicantibus*,

**White Wheat, White Lammas.**

This seems to be the *Triticum vulgare* of Linnæus.

H.P.III 597:

1 additional species given:

*Triticum Chalapense, spica brevior nitidissima, alba, seu Triticum Josephi Moris.hist.p.3. Humilior hæc planta spicas profert breves & aristatas; glumæ albidæ & glabræ sunt grana brevia & turgida. Ob spicæ munditiem Josephi nominarunt Orientales; quod nomen ob insignem hominis formam cuilibet rei pulchræ & speciosæ solent attribuere. D.Bobart.*

Line 67. *Avenacea*: presumably this is an adjective meaning 'oaten'.

Line 69. *Hæc si vera sunt* ..... : Ray says that because of reliable evidence, both written (by Worm and Johnson) and from personal discussion (with Bobart) he is forced to believe in the transmutation of species.

Line 71. *Observandum tamen transmutationem hanc dari tantum inter species cognatas & ejusdem generis participes; quasque nonnulli fortasse specie differre non concedent.* A very 'modern' observation; some related plants do cross freely and produce too many variants to be considered true species.<sup>1583</sup>



Line 74. *ut v.g. \* Crocum in Gladiolum, Leucoium in Hyacinthum, & vice versa.*  
*\*Sharroc. de propagat. Plant. cap.1, n.4.: margin reference.*

Line 74. *Crocum: Crocus:* see above Cap.3, line 18.

Line 74. *Gladiolum: Gladiolus:* see above Cap.3, line 46.

Line 75. *Leucoium: Leucoium:* see above Cap.11, line 15.

Line 75. *Hyacinthum: Hyacinthus:* see above Cap.3, line 12.

## Chapter Twenty-two:

### *On the stature and size of plants.*

This chapter, despite Ray's comment at the beginning about microscopic plants, is concerned only with the immense size of various trees, especially the oak, and the volume of usable wood, which could be obtained from them. Although in *Historia Plantarum*, Ray writes in a pragmatic and wholly scientific manner, rather than in a philosophical manner and without reference to divine creation, here in considering the size of plants, as with other physiological characteristics, he nevertheless believes in a divine creator. He later expresses this thus:

For what Account can be given of the Determination of the Growth and Magnitude of Plants from Mechanical Principles, of *Matter moved* without the Presidency and Guidance of some superior Agent?<sup>1584</sup>

#### Text page 43.

Line 1. *ab Historiæ naturalis conditoribus traduntur.* Ray admits that he relies heavily on the evidence of 'the founders of natural history', although the only ancient author he cites is Pliny. His main contemporary sources in this chapter are the *Hortus Malabaricus*, Sir Walter Raleigh, John Evelyn, Julius Scaliger and Robert Plot.

Line 3. *Dari in unaquaque specie certos dimensionum terminos:* he now explains his belief that all species have a limit on their natural growth, although there are variations within these limits.

Line 5. *Arbores Animalia, saltem terrestria ..... statura & magnitudine tantum excedunt:* he comments on the great size of trees in comparison with land animals. His definition of a tree in the

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<sup>1584</sup> *The Wisdom of God: 74.*

introductory ‘glossary’ to *Historia Plantarum* emphasises the immense size:

*Arbor [Δένδρον] est planta lignosa , crassitudine & altitudine inter omnes maxima, cui caudex pro superficie est perennis & natura simplex, qui in multos ramos majores, quos ἀκρεμόνας & ὄξους Græci vocant, & deinde in ramusculos complures, quod iidem κλάδους, 1585 Latine surculos appellant, dividitur. Anglice a Tree. 1586*

Line 5. *Belluæ enim marinæ excipiendæ videntur*: Ray shows how careful and thoughtful a scholar he is in this clause. He must have heard of the enormous size of some marine creatures, such as the large whales, but by using the term *videntur* [‘it would seem’] shows that he has no personal evidence to prove their size in comparison to that of trees.

Line 8. *Arbores omnium maximas & altissimas India utraque aliæque regiones fervidæ producunt*: Ray implies that the trees of ‘each India’, that is east and west, were well known in his day, but as Raven says:

Considering the extent to which the world had been opened up for trade, it is remarkable that the records of Asiatic and American species should be so few..... Of the wealth and characteristics of tropical vegetation there

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1585 NB ὄξους and κλάδους; James Longrigg informs me that both these terms are used by Empedocles, although I can find no evidence to suggest that he actually used them of plants; he used them metaphorically for ‘ears’ and ‘arms’ respectively in 99 and 29.1 Diels.

1586 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

is as yet hardly a hint.<sup>1587</sup>

Lines 11-14. *Ibidem & animalia visendæ magnitudinis: in Quadrupedibus, Elephas..... aliaque portentosæ molis innumera nascuntur.* In this paragraph Ray gives examples of exceptionally large, mostly well-known, specimens from the animal kingdom.

Line 13. *Murices: murex, -icis, m.:* ‘the purple fish’ or ‘sharp murex shell’, used by the Tritons as a tuba: also used for holding liquids.<sup>1588</sup> The name possible derives from the Greek μύαξ, a sea mussel. A murex is a kind of shell-fish, which yields a purple dye; the term was first used in English in 1589.<sup>1589</sup>

Line 13. *Buccina: Buc[c]ina, -ae, f.:* in classical Latin is ‘a crooked horn or trumpet’;<sup>1590</sup> it is used by Ovid for ‘a circular winding shell on which Triton blew’.<sup>1591</sup> Buccinum was first used in English in 1601 for a genus of Molluscs such as the Whelk.<sup>1592</sup>

Line 15. *Mira sunt & fidem pene superantia:* Ray continues for the rest of the chapter with examples from various sources of very large trees.

Lines 16-26. *Plinium attendamus, Volum. 16. cap.40 exempla producentem. Amplissima arborum ..... & triginta homines ferunt.* In this section Ray quotes, but with several omissions, a much longer passage of Pliny; his text also varied somewhat from that used for

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1587 Raven: 225-226.

1588 Lewis and Short: 1177.

1589 OED: 1373.

1590 Lewis and Short: 254.

1591 Ovid (Publius Ovidius Naso), *Metamorphoses I*: 335 and 337.

1592 OED: 246.

the Loeb edition.<sup>1593</sup>

Line 18. *Larice: Larix.*

[C.T.& M. 27] *Larix* (Miller), Larch; a genus of the *Pinaceæ* or Pine family.

B.& G.-W. 40 and 45: B.& H. 416: Linn.*Sp.Pl.* 1001:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1405: *H.P.III D.* 9: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1405:

1 species only given:

*Larix* Ger. C.B. Park. *folio deciduo conifera* J.B.

***The Larch-tree.***

*H.P.III D.* 9:

3 additional species given.

The European Larch was introduced into Britain in 1620. The largest European Larch known at present in Britain is found at Glenlee Park, New Galloway, Kirkcudbrightshire; it measures 46 metres in height and 95 centimetres in diameter.<sup>1594</sup>

Line 21. *Abies: see above Cap.4, line 22.*

The Common Silver Fir, introduced in 1603, was the only species known in Britain in Ray's time. The tallest specimen at present is to be found at Benmore Arboretum, near Dunoon, Argyll, measuring 48 metres in height; that with the largest diameter is to be found at Strone House, Cairndow, Argyll, measuring 292 centimetres in diameter.<sup>1595</sup>

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1593 Pliny, *Historia Naturalis* XVI, lxxvi: 200-203; Loeb edition IV: 518-520.

1594 Mitchell and Wilkinson: 267 and 279.

1595 *ibid.*: 266, 278 and 281.

Line 24. *Cedrus*.

[C.T.& M. 28] *Cedrus libani* (Rich.), [*Cedrus libanensis* (Mirbel)], Cedar of Lebanon; a species of the *Cedrus* genus of the *Pinaceæ* or Pine family.

B.& G.-W. - no ref.: B.& H. 416: Linn.*Sp.Pl.* 1001:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1404: *H.P.III D.* 9:

*Tri.* 15.19: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1404:

1 species only given:

*Cedrus conifera foliis laricis C.B. magna, sive Libani conifera*  
*J.B. magna conifera Libani Park. The Cedar of Lebanon.*

*H.P.III D.* 9:

*Ad cap. de Cedro conifera:* 1 additional species given:

*Cedrus conifera, Juniperinis foliis, racemosa, conis*  
*candicantibus parvis, ex Promontorio B\*\* Sp. seu Oxycedrus*  
*Africana conophoros Plik.Almag.Bot.T.275.F.2.*

*Tri.* 15.19:

A Cedar-tree: *Cedrus*, -i, f.: *Κέδρος*, -ου, f.

The Cedar of Lebanon was introduced into Britain in the seventeenth century; Mitchell and Wilkinson give the date as 1638,<sup>1596</sup> whereas Thacker is not so specific giving it as before 1659.<sup>1597</sup> There are several specimens in Britain today reaching a height of 40 metres, for example at Bowood, Calne, Wiltshire and Goodwood Park, Chichester, Sussex. The largest in diameter is at Goodwood Park, measuring 286 centimetres.<sup>1598</sup>

Line 26. *Congenses arbores*: presumably this means 'trees of the same stock' or 'trees produced together at the same time'.

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1596 Mitchell and Wilkinson: 68.

1597 Thacker, Christopher. *The History of Gardens*; Croom Helm, London 1979, reprinted 1985: 127.

1598 Mitchell and Wilkinson: 68 and 267.

Line 29. *Atti-meer-alou*: no reference to this in any of the sources, but, although not listed in the Index to any of the three volumes of *Historia Plantarum*, there is a mention of it on page D15 of Volume III, where Ray gives the following reference:

p.1436, *Ad cap. de Ficu Indica Europæa analogæ.*

14 species given, including:

*Ficus Indica maxima, cortice nigricante, folio oblongo, funiculis e summis ramis demissis & radices agentibus se propagans, fructu Caprificûs* Slon.Cat.Jamaic. Fig-tree of Ligon. *An Atti-meer-Alou.* H.M.part.3.p.7?

Also *H.P.* 1438:

*Atti-meer-alou* H.M.P.3.T.58.p.75.

*'Vastæ magnitudinis est hæc arbor, caudice crasso, tenues quasdam & singulares fibras deorsum mittente, quæ ipsi caudici adhærescentes crassissimum eum reddunt, adhæc eisdem fibris arbor terræ firmatur, multisque ramis in orbem diffusis longe lateque propagatur. Lignum albicans, molle & flexile, cortice subviridi cinereo obductum, qui ubi inciditur succum stillat lacteum, acrem, odoratum.'*

*'Radix albicans, glabro & nigricante cortice tecta, necnon fibris late per terra diffusa, læsa liquorem fundit candidum unctuosum, qui dein cum incisa radice purpureus evadit.'*

*Folia foliis Atti-alou haud absimilia brevibus petiolis novellis ramis inhærent, oblongo-rotunda, acuminata, densa, communi virore nitentia, superne glabra, inferne nonnihil aspera, nervis aliquot e media costa, in duas inæquales partes folium dividente, in latera excurrentibus: sapor amaricans & acerbus. Fructus brevibus petiolis inter folia ramulis inhærent, fructibus Arealou persimiles.'*

*'Provenit ubique in Malabar, per totum annum  
viret fructusque fert.'*

Line 31. *Hort. Malab.: Hortus Malabaricus*.<sup>1599</sup>

Five volumes published between 1678 and 1684. It had life-sized engravings and names in four languages; written by Hendrik Rheede van Draakenstein and others, especially Arnold Syen of Leiden and Jan Commelin. It was expected to be 13 volumes in all; twelve volumes were eventually published.<sup>1600</sup> In a letter to Ray from Leyden, dated June 4th 1684, Tancred Robinson said of this work that 'The fifth volume is ready to come forth, and eight more are designed - a mighty work of thirteen volumes'.<sup>1601</sup> Ray at this time did not approve of the work, although by the time of the publication of the first volume of *Historia Plantarum* in 1686, he was prepared to use it for reference for the plants of India. He replied to Robinson on June 16th 1684, 'The *Hortus Malabaricus*, which the Dutch herbarists are so busy in carrying on, is too pompous and costly a work, and not to be purchased by mean persons. They might have thrust it into a quarter of the compass, and rendered it more useful'.<sup>1602</sup>

Line 32. *Ficûs Indicæ: Ficus Indica*: see above Cap.18, line 63.

Line 39. *D. Joannis Evelyn Sylva*: John Evelyn, 1620-1706.

His main scientific interests lay in arboriculture and horticulture; he is also perhaps best known for his '*Diary*', which he

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<sup>1599</sup> Ray, despite his misgivings about this work did own part of it, as is indicated by the sale catalogue of his library:

*Hortus Malabaricus* 2 vol., edition published in Amsterdam in 1679;  
British Museum: S-C 326 (6): 4, *Libri Latine &c. in Folio*, number 161.

<sup>1600</sup> Raven: 220.

<sup>1601</sup> *Correspondence*: 143.

<sup>1602</sup> *ibid.*: 145-146.



kept throughout his adult life, it being a personal record of the years 1641-1706, although this can be considered a contribution to letters rather than to science. He travelled in Europe during the Civil War and after the Restoration in 1660 he held several administrative posts and was one of the founders of the Royal Society. Between 1654 and 1660 Evelyn, John Wilkins, Christopher Wren and Robert Boyle had discussed the formation of a society or 'Mathematical College' to promote the study of science. In December 1660 Evelyn was proposed as a member of the society for promoting science then meeting at Gresham College; he was instrumental in obtaining the title of 'Royal Society' for this group in 1662.<sup>1603</sup>

His main work *Sylva* was the first book published by order of the Royal Society; in September 1662 the commissioners of the navy had asked the Royal Society about timber trees, and as a result Evelyn drew up a report presented to the Royal Society on 16th February 1664: this was published later in 1664. It is not a scientific work but rather a book written to persuade his fellow countrymen to replant the trees lost as a result of the Civil War; it is a mixture of practical information and classical references.<sup>1604</sup>

In the second edition of *Sylva*,<sup>1605</sup> Evelyn, when dealing with the rising of sap in trees, seems to be referring to the experiments of Ray and Willughby, and he is cited by Ray for his claim that the Elm (*Ulmus campestris*) is native to Britain.<sup>1606</sup>

Evelyn's main botanical works are:<sup>1607</sup>

- 1 *The French Gardiner: Instructing how to Cultivate all Sorts of Fruit-trees, and Herbs for the Garden*, translated from N. De Bonnefons (London 1658).

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1603 *Mac.Enc.*: 428.

1604 *DSB IV*: 494-497.

1605 Published in 1669.

1606 *Raven*: 236.

1607 *DSB IV*: 496-497.

2. *Elysium britannicum* (London c.1659).
3. *The Manner of Ordering Fruit-trees*, translated from 'Le Sieur le gendre' (London 1660).
4. *Sylva, or a Discourse of Forest-Trees, and the Propagation of Timber in His Majesties Dominions .... To Which is Annexed Pomona; or, An Appendix Concerning fruit-Trees in Relation to Cider; The Making and Several Ways of Ordering It .... Also Kalendarium Hortense; or Gard'ners Almanac; Directing What He Is to Do Monethly Throughout the Year* (London 1664).
5. *The English Vineyard Vindicated by John Rose Gard'ner to His Majesty* (London 1666).
6. *A Philosophical Discourse of Earth, Relating to the Culture and Improvement of It for Vegetation, and the Propagation of Plants, & c. as It Was Presented to the Royal Society, April 29, 1675* (London 1676); called *Terra* in later editions.<sup>1608</sup>
7. *The Compleat Gard'ner; or Directions for Cultivating and Right Ordering of Fruit-Gardens and Kitchen-Gardens; With Divers Refections on Several Parts of Husbandry*, translated from J. de La Quintinie (London 1693).

Line 41. *Arborum in Fortunatis insulis proceritatem ad 144. pedes adolescere prodidit Sebosus*. This is paraphrased from Pliny, as cited by Ray below. The text of Pliny reads:

*Invallis circuitu CCC p.; arborum ibi proceritatem ad  
CXL pedes adolescere.*<sup>1609</sup>

*Fortunatae Insulae* or Isles of Bliss, Greek τῶν Μακάρων νῆσοι,

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1608 This is the only work by Evelyn listed in the sale catalogue of Ray's library: *Earth*, edition of 1676 [no place of publication given]; British Museum: S-C 326 (6): 26, English Books in Octavo, number 21.

1609 Pliny, *Historia Naturalis* VI, xxxvii: 202; Loeb edition II: 488.  
[Invallis measuring 300 miles round; and that on it trees grow to a height of 140 feet.]

Note that the Loeb text of Pliny has 140 feet, not 144 as in Ray's text.

the fabulous isles of the Western Ocean, the homes of the blessed, were names given to the Canary Islands.<sup>1610</sup>

Stattius Sebosus was a geographer, used by Pliny as a source of information.<sup>1611</sup>

Line 42. *Plin. lib.6, cap.31.* <sup>1612</sup>

Line 42. *Idem in India arbores quasdam tantæ proceritatis inveniri refert, ut sagittis superari nequeant, lib. 7, cap.3.* Pliny says that India teems with marvels, including:

*arbores quidem tantæ proceritatis traduntur ut sagittis superiaci nequeant.....* <sup>1613</sup>

Line 44. *Palmitas regales*: literally ‘royal palms’.

There are about 2,500 species of palms world wide, varying in height from 1 to 60 metres.<sup>1614</sup> They usually have an unbranched trunk, which could account for Mattioli’s *quæ ad 144 pedum altitudinem materiem produxit.*, quoted here by Ray.

Line 45. *testes αὐτόπτας*: another example of Ray’s use of Greek for emphasis, from *αὐτοπτέω*, ‘to see with one’s own eyes’.

Text page 44.

Line 46. *Matthiolus*: Pierandrea Mattioli / Pietro Andrea Gregorio Mattioli, 1501-1577.

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1610 Lewis and Short: 773. NB The phrase occurs first in Hesiod, *Works and Days* [line 171], long before the Canary Islands were discovered.

1611 Pliny, *Historia Naturalis* VI, xxxv: 183 (Loeb edition II:474); VI, xxxvi: 201 (Loeb edition II: 488).

1612 For this reference in Pliny see note at line 41 above.

1613 Pliny, *Historia Naturalis* VII, ii: 21; Loeb edition II: 518.

[some trees are said to be so lofty that it is not possible to shoot an arrow over them.]

1614 *Mac. Enc.*: 920.

His main interests lay in medicine and botany. he was a doctor and son of a doctor, who practised in Sienna, Rome, Trentino, Görz and Prague; he died of the plague at Trento in 1577.<sup>1615</sup> He wrote widely on botany and *materiamedica*;<sup>1616</sup> his botanical works are:

1. *Epistola de bulbocastaneo* (Prague 1558), which gives his new botanical methods and his contribution to the identification of plants mentioned in classical works, with synonyms and proper names.
2. *Epistolarum medicinalium libri quinque* (Prague 1561). This is a series of works on medical topics, including great detail on plants - identification and medicinal properties, together with instructions for preparing them as drugs.
3. *Commentarii a Dioscoride* (Venice 1544) is an Italian version of *de Materia Medica* (*περὶ ὕλης ἰατρικῆς*). He intended to provide an edition enabling Italian doctors to identify the medicinal plants of Dioscorides. It was reprinted with a new commentary in 1548, 1550 and 1552. His commentaries on Dioscorides were like a general Flora and contained many good illustrations. Morton says that Gesner's criticisms of him as over-bearing and careless were well-founded, and that 'Cesalpino thought that he owed more to Ghini than he admitted, but he and Ghini were undoubtedly far greater botanists than Brunfels and Fuchs'.<sup>1617</sup>
4. *Commentarii, in libros sex Pedacii Dioscoridis anazarbei, De Materia Medica. Adjectis quam plurimis plantarum et animalium*

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1615 DSB IX: 178-180.

1616 That Ray owned two works by Mattioli is indicated by the sale catalogue of his library:

*de Plantis*, edition published in Frankfurt in 1586; British Museum: S-C 326 (6): 9, *Libri Latine &c. in Quarto*, number 186.

*Senensis Medici Opera*, edition published in Venice in 1565; *ibid.*: 4, *Libri Latine &c. in Folio*, number 170.

1617 Morton: 154, note 32.

*imaginibus, eodem authore* (Venice 1554). This is a translation into Latin of the original Greek; it enabled the work to be read throughout Europe, and continued to be published until the eighteenth century.

Ray gives Mattioli as one of the sources of prescriptions given in the *Catalogus Angliæ*.<sup>1618</sup>

Line 53. *Ciennich*: Ray explains this term in parenthesis as meaning ‘ a tree, which is one hundred years old’. It is also similar to the place name *Kien* in the following line, but because of Ray’s interpretation is unlikely to be an adjective derived from *Kien*.

Line 58. *Verum ut exotica mittamus ..... ex domesticis & Europæis in specie exempla proponemus*. Ray now goes on to give examples of native British and European trees; he probably felt happier about the verification of the facts concerning these trees.

Line 60. *Pyrus*: margin sub-heading.

*Pyrus*: see above Cap.4, line 145.

The Common Pear is not native to Britain but was introduced very early before the time of reliable records. The tallest in Britain today, measuring 21 metres in height, is to be found at Tickford Grange, Guildford, Surrey; and that with the greatest diameter - 100 centimetres (but of un-measured height) is at Forthampton Church, Gloucestershire.<sup>1619</sup>

Line 60. *Autor noster*: i.e. John Evelyn.

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<sup>1618</sup> An example of Mattioli’s prescriptions is to be found in Ray’s *Catalogus Plantarum Angliæ*: 37.

<sup>1619</sup> Mitchell and Wilkinson: 274.

Line 62. *Castanea*: margin sub-heading.

*Castanearum*: *Castanea*.

[C.T.& M. 316] *Castanea* (Miller), Chestnut; a genus of the *Fagaceæ* or Oak family.

B.& G.-W. 56: B.& H. 403: Linn.*Sp.Pl.* 997:

*Syn.Meth.St.Br.* 440: *H.P.* 1382: *H.P.III D. 7: Tri.* 15.21:

*Cat.Angl.* 57-58: *Camb.* - no ref.

*H.P.* 1382:

6 species given, including:

*Castanea* J.B. Ger. *sativa* C.B. *vulgaris* Park.

***The Chestnut-tree.***

*H.P.III D. 7:*

3 additional species given.

*Tri.* 15.21:

A Chestnut-tree: *Castanea*, -æ, f.: *Καστάνεια*, -ας, f.<sup>1620</sup>

The Horse Chestnut was introduced to Britain about 1615. The tallest growing in Britain today, measuring 39 metres in height, is to be found at Ashford Chase, near Petersfield, Hampshire; that with the greatest diameter, at 213 centimetres, is to be found at Hurstbourne Priors [*sic*] Church, Whitchurch, Hampshire.<sup>1621</sup>

Ray quotes Kircher here as saying that this chestnut tree could accomodate a flock of sheep. Ray believed Kircher to be an extremely credulous person, so this may be untrue or exaggerated.<sup>1622</sup> It could, however, have been a chestnut, which had propagated itself by layering, such as the sweet-chestnut

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1620 NB See the note above under *Carpinus*, Ὀστρυς at Cap.5, line 26, on *ς* being used for *στ*.

1621 Mitchell and Wilkinson: 275.

1622 In a letter to Edward Lloyd dated 7th November 1690, Ray says,  
And for father Kircher I account him a credulous person,  
possessed with ye vanity of most of ye Religious of his church  
who delight to tell strange & miraculous tales to amuse &  
delude ye vulgar.

*Further Correspondence*: 211.

mentioned by Rackham at Tortworth in Gloucestershire, which was already described in 1706 as a tree of legendary antiquity.<sup>1623</sup> It has propagated itself by the sprawling and rooting of its lower limbs, which now form seventeen secondary trunks around the parent trunk. This one tree begins to constitute a wood, with dog's mercury, bluebell, lesser celandine, and wild garlic under it. The original trunk has not changed much in appearance; in 1977 it measured 36 feet 1 inch in girth below the lowest branch, whereas eighteenth-century figures vary from 44 to 57 feet!<sup>1624</sup>

There is a photograph of this tree<sup>1625</sup> and mention of others of similar size in another work by Rackham.<sup>1626</sup>

Line 62. *meminit Kircherus*: reference in text to *Chinæ illustr. p.185*.

Athanasius Kircher, 1602-1680, was a polymath and interested in the dissemination of knowledge. He wrote forty-four books<sup>1627</sup> and more than 2,000 letters and manuscripts are extant from his writings.<sup>1628</sup> Ray read his book *Mundus subterraneus* (published in 1665) in 1666 after his return from Europe.<sup>1629</sup>

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1623 Evelyn. J, *Sylva*, 4th edition.

1624 Rackham, *Countryside*: 231.

1625 Rackham, *Trees*: Plate XXI.

1626 *ibid.*: 98.

1627 That Ray owned two of Kircherus' works is indicated by the sale catalogue of his library:

*Itinerarium ex f[ra]ntia*, edition published in Rome in 1656; British Museum: S-C 326 (6): 6, *Libri Latine &c. in Quarto*, number 43.

*de Peste*, edition published in 1659; *ibid.*: 14, *Libri Latine &c. in Duodecimo*, number 235.

1628 *DSB VII*: 374-378; Raven 143, 421, 429, 442.

1629 See the letter, dated June 18th 1667, from Ray to Martin Lister, Fellow of St. John's College, Cambridge; *Further Correspondence*: 112.

Line 65. *Tilia*: margin sub-heading.

*Tilia*: [C.T.& M. 164] *Tilia europæa* (L.), [*Tilia cordata* x *Tilia platyphyllos*: *Tilia vulgaris* (Hayne): *Tilia intermedia* (DC)], Common Lime; a species of the *Tilia* genus of the *Tiliaceæ* or Lime tree family.

B.& G.-W. 240: B.& H. 87: Linn.*Sp.Pl.* 514:

*Syn.Meth.St.Br.* 473: *H.P.* 1694-1695: *H.P.III D.* 88:

*Tri.* 17.51: *Cat.Angl.* 285-286: *Camb.* - no ref.

*H.P.* 1694-1695:

3 species given, including:

*Tilia vulgaris platyphyllos* J.B. *fœmina* Ger. *fœmina major* Park. *fœm. folio majore* C.B.

*The common Lime, Line or Linden-tree.*

*H.P.III D.* 88:

5 additional species given.

*Tri.* 17.51:

A Lime or Linden-tree: *Tilia*, -æ, f.: Φίλυρα, -ας, n.

The date of the introduction of the Common Lime to Britain is unknown. The tallest known today, measuring 46 metres in height, is to be found at Duncombe Park, Helmsley, North Yorkshire; that with the greatest diameter, at 213 centimetres, is to be found at East Carlton Park, Corby, Northamptonshire.<sup>1630</sup>

Line 66. *D. Thomas Brown Norwicensis*: (not cited as an author here).<sup>1631</sup>

Browne (1605-1682) was born in London, educated at Winchester and Oxford. He took his M.A. in 1629 and then proceeded to

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1630 Mitchell and Wilkinson: 276.

1631 There are two works listed in the sale catalogue of Ray's library by Thos. Brown, presumably the Thomas Browne mentioned here, although these two works are not listed in the *DSB* entry (*DSB II*: 522-523): *Myographia Nova*, edition published in London in 1684; British Museum: S-C 326 (6): 4, *Libri Latine &c. in Folio*, number 165. *Enquiry into vulgar Errors*, edition of 1650; *ibid.*: 22, English Books in Folio, number 71.



Montpellier to study medicine. He returned after four years to do his medical apprenticeship;<sup>1632</sup> and took his M.D. at Oxford in 1637. In 1642 he published his most famous work *Religio medici*, which describes the philosophy of a tolerant and educated mind. His next long book was *Pseudodoxia epidemica: or Enquiries Into Very Many Received Tenets, And Commonly Presumed Truths* (1646). He was also interested in archaeology and published in 1658 *Hydriotaphia, or, Urneburiall*; he also published in 1658 *The Garden of Cyrus*. He is remembered as a learned man, who enjoyed corresponding with scholars of his day including John Ray, rather than as the contributor of any original scientific knowledge.<sup>1633</sup> Arber says of Browne, ‘In 1613 appeared Besler’s *Hortus Eystettensis*, called by Sir Thomas Browne “the massiest” of the herbals’.<sup>1634</sup>

Ray’s interest in the cotyledons was aroused by reading Browne’s work, *The Garden of Cyrus*, where Browne says that it is not true, as Ray (and Theophrastus) believed, that each part of a plant derives from a particular part of the seed. Ray had met Browne by the time he wrote the *Catalogus Plantarum Angliæ*, as under *Acorus* he says (Tr.) ‘First observed by the famous Mr. Tho. Brown M.D. in the River Yare near Norwich and shown to me ten years ago’.<sup>1635</sup>

Line 69. *Tiliam: Tilia*: see above Cap.22, line 65.

Line 72. *Tilia*: see above Cap.22, line 65.

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1632 N.B. Foreign medical graduates could not be incorporated at Oxford or Cambridge until they had spent four years working with an established doctor.

1633 *DSB II*: 522-523; Raven: 116-117.

1634 Arber: 244.

1635 *Cat. Angl.*: 6.

Line 73. *Linden*: die Linde is German for *Tilia* or Lime tree, for which see above Cap.22, line 65.

Line 76. *Platanus*: margin sub-heading.

*Platanus*: [C.T.& M. 245] *Platanus* (L.), Plane; a genus of the *Platanaceæ* or Plane family.

B.& G.-W. 236: B.& H. 403: Linn.*Sp.Pl.* 999:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1706-1707: *H.P.III* - no ref.:

*Tri.* 17.66: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1706-1707:

(Tr.) *Platanus* is so-called from πλατῦς, both because it has very broad leaves and because the tree is broad and spreads widely.

2 species given, including:

*Platanus Orientalis vera* Park. *alius autoribus simpliciter*

*Platanus dicitur, Platan. Orient. pilulis majoribus* Herman.

***The Plane-tree.***

*Tri.* 17.66:

A Plane-tree: *Platanus*, -i, f.: Πλάτανος, -άνου, f.

The London Plane tree was introduced to Britain about 1680, so was a new species at the time Ray was writing *Historia Plantarum*. The tallest known today, measuring 48 metres in height, is to be found at Bryanston School, Blandford, Dorset. That with the greatest diameter, at 365 centimetres, is to be found at Mottisfont Abbey, Romsey, Hampshire, although this may be a 'double' tree; the next largest in diameter is at the Bishop's Palace, Ely, Cambridgeshire, measuring 281 centimetres.<sup>1636</sup>

Lines 76-83. *Nunc est clara in Lycia gelidi fontis socia amœnitate* .....  
*laquearium auro cubuisse in eadem.*

As Ray says this is a quotation from Pliny's *Historia Naturalis*.<sup>1637</sup>

Line 80. *Licinius Mutianus ter Consul, & nuper provinciæ ejus legatus:*  
a Roman who wrote about the history and geography of the eastern  
countries, often quoted, as here, by Pliny.<sup>1638</sup> Gaius Licinius  
Mucianus, cos. I A.D. 64 (?), cos. II A.D. 70, cos. III A.D. 72,  
appointed legate of Syria by Nero in A.D. 67, he became one of  
Vespasian's principal supporters in the 'Year of the Four Emperors'  
(A.D. 69). For his character see especially Tacitus *Histories* 1.10  
and 2.5.

Line 84. *cujus Dominus Autoris nostri frater:* i.e. John Evelyn's brother.

Line 84. *Ulmus:* margin sub-heading.

Line 85. *Ulmus:* see above Cap.4, line 145.

Line 85. *etiamnum:* 'even now'. Elm trees seem to have suffered from Elm  
disease even in Ray's time.

Elm Disease is a fungus, *Ceratocystis ulmi*, which is  
carried by an Elm-bark beetle when it hatches from its  
pupa in dead elm wood and flies to shoots high in the  
crown of a healthy elm where the beetle feeds. A mild  
form was common 1920-1945, but a virulent form was  
brought here from N.America in the mid-1960s. The  
name 'Dutch Elm Disease' is used because the Dutch

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1637 Pliny, *Historia Naturalis* XII, v: 9: Loeb edition IV: 9.

1638 Lemprière: 331.

studied it to breed resistant trees,<sup>1639</sup> before the worse form arose.<sup>1640</sup>

Dr Thomas Brown, mentioned by Ray in the previous paragraph, mentions the spread of elm disease in *The Garden of Cyrus* published in 1658:

..... the perill of συνολεθρισμὸς or one tree perishing with another, as it happeneth oftentimes from the sick *effluvioms* or entanglements of the roots, falling foul with each other. Observable in Elmes set in hedges, where if one dieth the neighbouring Tree prospereth not long after.<sup>1641</sup>

Line 86. *Ulmus folio lævi*: for *Ulmus* see above Cap.4, line 145.

The particular species referred to here is either the European White Elm, now known in Latin as *Ulmus lævis* [‘smooth-leaved’], which barely exists in Britain today because most specimens were in southern Britain where Elm disease has been worse; this tree could reach a height of 20 metres. However, Ray is more probably referring to the tree known in English as the Smooth-leaved Elm, whose Latin name is now *Ulmus carpinifolia*; this tree was brought to Britain by pre-Roman tribes and was common in Kent and East Anglia, and thus would have been well-known to Ray. It reaches a greater height (32 metres) than the previous species mentioned,

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1639 That the Dutch were noted for their research and growing of Elm trees even in the seventeenth century is indicated by Reid’s comment that:

The Elm that growes with a clean and taper body is best worthy your care. we\* have extraordinary clean and smooth barked Elms from Holland: but I think they take more paines in preparing and making their Earth fine, which certainly is most conducible thereunto.

\*[we - sic lower case ‘w’]

[*The Scots Gard’ner*: III 22 (76)]

1640 Mitchell and Wilkinson: 154; also Rackham, *Countryside*: 240-247.

1641 *ibid.*: 232; quoted by Rackham, who credits Dr. Hilary Belcher with finding this passage.

which again indicates that it is probably the species meant here.<sup>1642</sup>

Rackham has a whole chapter on Elms in his book *The History of the Countryside*; he indicates the huge size attainable by elms in a discussion of buildings made from elm wood.<sup>1643</sup>

Line 89. *Vir D.Rob.Plot in Hist. Nat. Oxoniensi*: Robert Plot, 1640-1696.

His main interests were in natural history, archæology and chemistry. Plot graduated from Magdalen Hall in 1661 and became secretary to the Royal Society in 1682, Keeper of the Ashmolean Museum on its foundation in 1683, and Professor of Chemistry at Oxford also in 1683.<sup>1644</sup> Ray did not appear to have had a very high opinion of him; in a letter of January 1692 to Lhwyd, Plot's underkeeper at the Ashmolean, Ray says,

I fear also he may be too much influenced by worldly advantages of honour & profit, for I have been told that he was inclinable to change his Religion in the Reign of ye late King James.<sup>1645</sup>

Raven says that Ray 'in botany, though he refers respectfully to his [Plot's] records, he does not accept them without question'.<sup>1646</sup>

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1642 Mitchell and Wilkinson: 155-156.

NB The elm usually reproduces itself by root suckers, but, when it does reproduce from seed, the resultant plants vary from their parents, and so many different forms develop, which because of their multiplicity are not all given new Latin names.

1643 Rackham, *Countryside*: 232-247; the discussion of size is to be found on page 238.

1644 *DSB XI*: 40-41.

For further information on Robert Plot, see:  
Britten and Boulger: 245.

J.E.Dandy, *The Sloane Herbarium*, 1958: 182.

D.Baker, 'A Kentish Pioneer in Natural History: Robert Plot of Borden, 1640-1696', *Transactions of the Kent Field Club* 3, Maidstone 1971: 213-224.

1645 *Further Correspondence*: 224-225.

1646 Raven: 250.

Plot's works are:

1. *The Natural History of Oxfordshire* (Oxford 1677).<sup>1647</sup>
2. *De origine fontium* (Oxford 1684).
3. *The Natural History of Staffordshire* (Oxford 1686).<sup>1648</sup>
4. *Philosophical Transactions of the Royal Society*: various papers on curiosities of nature (1682-1686).<sup>1649</sup>

Line 90. *Ulmi: Ulmus*: see above Cap.4, line 145.

Line 93. *Fraxinus*: margin sub-heading.

*Fraxinos: Fraxinus*: see above Cap.4, line 144.

The Common Ash is native to Britain, the tallest specimen at present, at 39 metres, being found at Petworth House, Petworth, Sussex; that with the greatest diameter, at 223 centimetres, is to be found at Clapton Court, Crewkerne, Somerset.<sup>1650</sup>

Line 94. *Taxus*: margin sub-heading.

*Taxus*: [C.T.& M. 31] *Taxus baccata* (L.), Yew: a species of the *Taxus* genus of the *Taxaceæ* or Yew family.

B.& G.-W. 42: B.& H. 417: Linn.*Sp.Pl.* 1040:

*Syn.Meth.St.Br.* 445: *H.P.* 1416: *H.P.III* - no ref.: *Tri.* 18.88:

*Cat.Angl.* 282: *Camb.* 116.

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1647 Despite his low opinion of Plot [see the note immediately above], Ray did own a copy of this work, as is evident from the sale catalogue of his library: *Oxfordshire*, edition published in Oxford in 1677; British Museum: S-C 326 (6): 21, English Books in Folio, number 28.

1648 Ray also owned a copy of this work: *Staffordshire*, edition published in Oxford in 1686; British Museum: S-C 326 (6): 21, English Books in Folio, number 29.

1649 *DSB XI*: 41.

1650 Mitchell and Wilkinson: 277.

H.P. 1416:

1 species only given:

*Taxus* Ger. Park. J.B. C.B. & *omnium fere Botanicorum*.

*Smilax Dioscoridis lib.4 cap.86. Μίλος Theophrasti 3. hist.10.*

Tri. 18.88:

A Yew-tree: *Taxus*, -i, f.: *Μίλος*, -ου, f.

The Common Yew is native to Britain. The tallest today, at 29 metres, is to be found at Belvoir Castle in Leicestershire; that with the greatest diameter is to be found at Selbourne Church in Hampshire.<sup>1651</sup>

Yew trees are frequently to be found growing in churchyards, and although there are many explanations for this, as Rackham says, 'The age and meaning of churchyard yews remain a mystery'.<sup>1652</sup>

Line 98. *Salix*: margin sub-heading.

*Salix*: see above Cap.5, line 26.

The most common native willow today is the Crack Willow, *Salix fragilis*; the tallest specimen, at 28 metres, is to be found at the Botanic gardens in Oxford, and that with the greatest diameter, 203 centimetres, at Terling Place, Witham, Essex.<sup>1653</sup>

Line 100. *Quercus*: margin sub-heading.

*ad Quercus*: *Quercus*: see above Cap.4, line 145.

The tallest common native oak in Britain today, at 42 metres, is to be found at Abbotsbury in Dorset; that with the greatest diameter, at 383 centimetres, is to be found at Bowthorpe Farm, Bourn, Lincolnshire.<sup>1654</sup>

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1651 Mitchell and Wilkinson: 265.

1652 Rackham, *Countryside*: 230.

1653 Mitchell and Wilkinson: 269.

1654 *ibid.*: 271.

That the size and straightness of trunk of the oak tree is still of importance for the timber trade, as indicated here by Ray, can be seen from a very recent item in *The Times* newspaper:

Tons of East European acorns are being imported to create new forests in England, even though the countryside is littered with acorns at this time of year.

Hungarian and Polish seeds are being shipped in because a Brussels directive says acorns for plantations must come from trees regarded as upright, of superior quality, and “pure”.

The Forestry Commission has to ensure that English trees from which acorns are collected are straight enough to be harvested for commercial timber in 100 years’ time. Only 42 varieties of English oak pass a new EU test, insufficient to meet the demand for three to four million new trees a year.

The Forestry Commission said straightness of trunk was important and the rules only applied to forests. But Mike Harvey, managing director of the tree nursery Maelor, said the EU rule was a bureaucratic joke because trees grew straight only in certain soil and planting conditions.<sup>1655</sup>

Line 100. *idem celeberrimus Vir*: i.e. Dr. Robert Plot.

Line 103. *Quercuum*: *Quercus*: see above Cap.4, line 145.

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<sup>1655</sup> *The Times*, Wednesday November 16 1994: 9.



Line 106. *Silentio transmittendæ non sunt arbores illæ imprimis memorabiles quas Galfridus Chaucerus poeta ævo suo celeberrimus in Parco Denningtonensi plantasse fertur, tanto satore dignæ, quarum una Regis, altera Reginæ, tertia ipsius Chauceri dicebatur.*

In this paragraph Ray discusses the oak trees planted by Chaucer at Dennington Park. In Chaucer's day there were probably only the two native species (the Common Oak, *Quercus robur*, and the Sessile Oak, *Quercus petræa*) available. It is interesting that they rate in importance in ascending order of size, that named after the king being the largest. We might ask how Chaucer knew which would ultimately attain the greatest size? If he had several species with different growth habits available, this would have been possible. Ray says that the sizes of these trees, which cannot be more than 300 years old, indicates the immense height and girth of oak trees.

Following his own method of evaluating the age of trees by the measurement of the trunk, Mitchell, in 1965, estimated that the Major Oak in Sherwood Forest, with a girth of 402 inches (10½ feet in diameter) was then between 400 and 650 years old.<sup>1656</sup>

Line 109. ἄκλωνος: 'branchless'; Ray is again using Greek for emphasis.<sup>1657</sup>

Line 114. *Quercus*: see above Cap.4, line 145.

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<sup>1656</sup> Alan Mitchell, 'Dating the ancient oaks', *Quarterly Journal of Forestry* 60, 1966: 271-276.

<sup>1657</sup> NB Theophrastus uses the word ἄκλων rather than ἄκλωνος; *Περὶ Φυτῶν Ἱστορίας (Enquiry into Plants)*: VI.vi.6.

Line 114. *Ingens nobilis imprimis arbore erat ex qua trabes transversæ ad navem illam longe maximam & pulcherrimam* **the Royal Sovereign** *dictam*: the Royal Sovereign was designed by Phineas Pett and launched in 1637 as the Sovereign of the Seas. She was 170 feet long and 48 feet at the beam, and would certainly have needed enormous timbers in her construction, as Ray says.<sup>1658</sup> She carried 102 cannons on her three decks and cost £66,000 to build; she had a displacement of 1,541 tons. In 1652, she was turned into a two-decker to make her more stable and was re-named the Royal Sovereign.<sup>1659</sup>

Line 116. *ab optimo Principe Carolo primo*: in his early life Ray must have supported Charles I, as is indicated here, and although he initially accepted the return of Charles II, he was, as Morton says, ‘morally and intellectually, a man of the Commonwealth’.<sup>1660</sup> Although not active in politics, he, nevertheless, showed by his refusal to sign the Act of Uniformity in 1662 that he disapproved of the behaviour of Charles II after the Restoration. His Puritan beliefs forced him to relinquish his fellowship and any hopes of future academic or clerical advancement.

Line 117. *quamvis alterius generis*: Ray does not state the type of tree used for the mast, although he gives its dimensions.

Text page 45.

Line 120. *Vir D.Rob.Plot in laudatissima sua Historia Nat. Oxon: The Natural History of Oxfordshire* published in 1677.

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1658 NB James Longrigg understands that the wood for this ship came from Chopwell Woods in County Durham.

1659 Enzo Angelucci and Attilio Cucari, *Ships*, Macdonald and Jane’s, London 1975: 90. [There is also an interesting discussion on oak building timbers in Rackham’s section on the management of timber: Rackham, *Trees*: 67-70.]

1660 Morton: 196.

Line 120. *Quercus*: see above Cap.4, line 145.

Line 127. *D. Rob. Harley*: Robert Harley, 1st Earl of Oxford, 1661-1724.

English statesman under Queen Anne; an M.P. from 1688, he was a Tory but allied with the Whigs, becoming Speaker of the House of Commons in 1701 and then Secretary of State in 1704. Intriguing against his Whig colleagues, Godolphin and Marlborough, he was dismissed in 1708 and rejoined the Tories. After the fall of the Whigs, he became Anne's chief minister as Chancellor of the Exchequer from 1710-1711, and Lord Treasurer from 1711-1714. The machinations of his rival, Bolingbroke, brought about his dismissal and, after the accession of George I, he was imprisoned (1714-1717) for his Tory (and, by implication, Jacobite) views.<sup>1661</sup>

Is this Ray's Robert Harley? Ray calls him D. Robert Harley, implying a doctorate; perhaps he is referring to the first Earl of Oxford's father.

Line 127. *Quercûs*: *Quercus*: see above Cap.4, line 145.

Line 129. *Rami præterea 25 ligni chordas suppeditabant in focum.*

The first English usage of the term 'cord' in the following sense was in 1616.

A cord is a measure of wood, stone or rock (? originally measured with a cord); a pile of wood usually 8 feet by 4, and 4 feet high.<sup>1662</sup>

A cord is also defined as a measure, usually 128 cubic feet, of cut wood for fuel.<sup>1663</sup>

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1661 *Mac.Enc.*: 552.

1662 *OED*: 425.

1663 J.Coulson, C.T.Carr, Lucy Hutchinson and Dorothy Eagle (Eds.), *The Oxford Illustrated Dictionary*, Oxford at the Clarendon Press 1962: 178.

Line 131. *Autor quem sequimur ingeniosissimus*: i.e. John Evelyn.

Line 131. *Quercuum*: *Quercus*: see above Cap.4, line 145.

Line 134. *Qui plura desiderat librum ipsum adeat, cap. 30*. Ray refers his reader to Evelyn's *Sylva* for more information.

### Chapter Twenty-three:

#### *On the age and duration of plants.*

Ray begins this chapter with a short discussion on annuals, biennials and perennials; he follows, as in the previous chapter, with a lengthy discussion on trees.

#### Text page 45.

Line 3. *Aliæ Æstivæ sunt, quæ Vere oriuntur, Autumno intereunt, & sequenti iterum Vere ex semine in terra residuo se renovant.*

Ray is describing here what we now call annuals.

Annuals are defined as 'plants which naturally die after less than one year of independent life, survival of the race depending entirely on the production of seed'.<sup>1664</sup> That is they germinate from seed, grow, flower and produce seed within one year.

Line 4. *Hujusmodi sunt Atriplices, Blita, Sonchi &c.* Ray gives these three plants as examples of annuals, although the second and third are sometimes found in perennial forms.

Line 4. *Atriplices: Atriplex:* see above Cap.9, line 121.

Line 4. *Blita: Blitum.*

[C.T.& M. 154] *Amaranthus albus* (L.), White Amaranth; a species of the *Amaranthus* genus of the *Amaranthaceæ* or Amaranth family.

B.& G.-W. 80: B.& H. 371: Linn.*Sp.Pl.* 4:

*Syn.Meth.St.Br.* 157: *H.P.* 200: *H.P.III* 123: *Tri.* - no ref.:

*Cat.Angl.* 42-43: *Camb.* 48.

*Syn.Meth.St.Br.* 157:

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<sup>1664</sup> *Lowson's Botany:* 62.

*Blitum rubrum minus* C.B.Pin.118. Cam.Ep.235. *Amaranthus sylvestris & vulgaris* H.Pl.Par.385. *Hæc planta in Cat.Cant. recensita, nescio qua de causa in Synop. omissa est. Sponte passim in hortis & simetis provenit. Blito calyx triphyllos, stamina tria & vasculum tenue membranaceum horizontaliter per maturitatem se aperiens, quibus notis ab Atriplice & Chenopodio non minus quam Amarantho differt.*

Ray here differentiates between *Blitum*, *Atriplex*, *Chenopodium* and *Amaranthus*. Linnæus has *Blitum* as another name for *Atriplex*.

All very similar genera, but it seems likely that Ray is referring to *Amaranthus albus* when he uses the name 'Blite'.

H.P. 200:

(Tr.) We think that *Blitum*, as it is commonly called (as we have also mentioned above), contains seeds shut in capsules which burst asunder in maturity transversely, when touched lightly in the centre, as does *Portulaca*, in the manner of *Amarantus*; and so it differs from Amaranth especially in the colour and elegance of the spikes. Others examine this matter more carefully. If in respect of their seeds they go along with the *Bliti* discussed in the previous chapter, there is no reason why a special chapter should be assigned to them, but they may be subsumed under the former.

7 species given, all called 'Blite' in English, and including:

*Blitum rubrum majus* Ger. C.B. Park. *Blitum pulchrum rectum magnum rubrum* J.B. **Great red Blite.**

Ray also uses the name *Blitum* in *Historia Plantarum* for *Blitum sylvestris*, i.e. English Mercury or All-Good, *Blitum bonus Henricus* (p.195); also for *Atriplex* (p.197).

Camb. 48:

*Blitum album minus, The lesser wild white Blite*

(*Amaranthus albus*, Linnaeus).

‘Found in Kingston wood after it had been new felled, near Gamlingay rode side.’

*Blitum rubrum minus*, *The small wild red Blite*

(*Amaranthus albus*, Linnæus).

In various localities, as in some Osier holts by the river:  
also in a ditch on the backside of St. John’s Colledge in  
a close on the north of the back-gate.

*H.P.III* 123:

*Ad cap. de Blito sylvestri seu Chenopodio*: many additional species given.

Line 4. *Sonchi: Sonchus*: see above Cap.11, line 82.

Line 5. *Aliæ annuo spatio ætatem circumscribunt*. Ray continues with a description of what we also term as annual plants, although they can, as he says, survive over a winter.<sup>1665</sup>

Line 8. *Aliæ biennes aut triennes sunt, aut plurium etiam annorum*: this is a confusing section as Ray now classifies as of one type what appear to be our biennials and perennials. His examples are of both types, *Petroselinum vulgare* being a biennial and *Angelica* a perennial.

Biennials are now defined as:

plants, which devote their first year of life to the development of a massive body with large reserves of nutritive materials, and then flower and die in the second year.<sup>1666</sup>

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<sup>1665</sup> Lines 3-7. NB In this discussion of annuals Ray does not mention those plants with an exceptionally short life span, now known as ‘ephemerals’, which can last for as little as six weeks from seed to seed, and whose life span may be repeated several times within a growing season. Of this type are Groundsel (*Senecio vulgaris*) and Shepherd’s Purse (*Capsella bursa-pastoris*). *Penguin Dictionary of Botany*: 121.

<sup>1666</sup> *Lowson’s Botany*: 62.

Line 8. *Petroselinum vulgare*.

[ C.T.& M. 289] *Petroselinum crispum* (Miller), [*Petroselinum sativum* (Hoffm.): *Carum petroselinum* ([L.] Bentham)], Garden Parsley; a species of the *Petroselinum* genus of the *Umbelliferæ* or Carrot family.

B.& G.-W. 280: B.& H. 183: Linn.*Sp.Pl.* 252:

*Syn.Meth.St.Br.* 211: *H.P.* 448: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 448:

*Apium hortense* Ger. *hortense seu Petroselinum vulgo* C.B.

*Hortense multis, quos vulgo Petroselinum, Palato gratum* J.B.

*Petroselinum vulgare* Park. **Common Parsley.**

Line 8. *Angelica*: see above Cap.9, line 31.

Line 9. *Hæ primo aut secundo postquam satæ sunt anno in caulem non abeunt* ..... : Ray has confused biennials and monocarpic perennials here. His statement implies that these plants do not produce a flowering stem in the first or second year after (*postquam*) they have been sown, and that once the plant has flowered it dies. A biennial produces its flowering stem in the year after sowing and then dies. A monocarpic or hapaxanthic perennial produces flowers only once in its life and then dies; it behaves like a biennial but over a longer period of time.<sup>1667</sup>

Line 12. *Aliæ denique perpetuæ sunt*: Ray now defines what we call 'perennial' plants and he calls 'perpetual'.<sup>1668</sup>

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<sup>1667</sup> *Lowson's Botany*: 62.; *Penguin Dictionary of Botany*: 167.

<sup>1668</sup> He uses the term 'perennial' in a slightly different way - see note at line 14 below.



- Line 14. *Quæ radice tantum sunt perpetua restibiles appellantur*: he is describing here what we call an herbaceous perennial, that is, a perennial whose stem rises above the ground for one season only, then dies back, although its rootstock survives for several/many years. These rootstocks take the form of bulbs, corms, rhizomes and stem and root tubers.<sup>1669</sup>
- Line 14. *quæ etiam superficie perennes*: he now describes what we define as 'woody perennials', which are trees and shrubs with stems persisting above the ground; these may be deciduous or evergreen. Most perennials flower each year after reaching maturity.<sup>1670</sup>
- Line 15. *Quæ radice perpetuæ censentur non eandem omnes perpetuo radicem individuum servant*: Ray refers his reader to his earlier chapter 3 on the regeneration of the roots of perennial plants.
- Line 18. *Arbores admodum longævas esse*: Ray continues for the rest of this chapter on the life span of trees, which, as he says, are long-lived.
- Line 18. *Plinius, volumine xvi, cap.48. Vita arborum quarundam immensa credi potest (inquit) ..... tum dignam fuisse significat.*  
This long quotation is taken from several chapters of Book XVI of Pliny's *Historia Naturalis*.<sup>1671</sup>
- Line 20. *Olivæ: Oliva*: see above Cap.18, line 233.
- Line 21. *Myrtus*: see above Cap.18, line 11.

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1669 *Lowson's Botany*: 62; *Penguin Dictionary of Botany*: 264.

1670 *ibid.*

1671 Pliny, *Historia Naturalis*: Lines 19-24, XVI, lxxxv: 234.

Lines 25-27, XVI, lxxxvi: 236.

Lines 27-28, XVI, lxxxvii: 237.

In the Loeb edition this section is to be found in Volume IV: 538-540.

Line 21. *Lotos.*

[C.T.& M. 200] *Lotus* (L.), Trefoils; a genus of the *Leguminosæ* or Pea family.

B.& G.-W. 220: B.& H. 115: *Linn.Sp.Pl.* 773-775:

*Syn.Meth.St.Br.* 334: *H.P.* 967-969: *H.P.III* 469 (page actually numbered 472): *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* 118.

*H.P.* 967-969:

23 species given, including:

*Lotus corniculata glabra minor* J.B. *Lotus sive Melilotus pentaphyllos minor glabra* C.B. *Trifolium siliquosum minus Ger. corniculatum primum* Dod. ***Bird's-foot Trefoil.***

*H.P.III* 469:

39 additional species given.

Line 21. *in Lucinæ area:* Pliny gives this grove as the origin of the name of the goddess of childbirth, Lucina\*. Her name is derived from *lucus\*\**, 'a grove' or 'opening [to the light] among trees'; *lucus* itself is derived from *luceo*†, 'to shine' and *lux, -ucis, f.,††* 'the light' or 'light of day'. Thus the goddess is so named because she 'brings babies to the light'.<sup>1672</sup>

Line 21. *Anno qui fuit sine Magistratibus 369 Urbis æde condita:* the Loeb text gives this as *sine magistratibus CCCLXXIX urbis æde condita:*<sup>1673</sup> that is ten years later than Ray's text. Either Ray or his text must have made a mistake here, reading A.U.C. CCCLXIX (369) for CCCLXXIX (379), since curule magistrates were elected in 369 (385

1672 Lewis and Short: \*1080, \*\*1082, †1079, ††1088.

1673 Pliny, *Historia Naturalis*: XVI, lxxxv: 235; Loeb edition IV: 538.

BC)<sup>1674</sup> but not in 379 (375 BC).<sup>1675</sup>

Line 23. *Hæc nunc circiter annum 450. habet.* Ray quotes Pliny as saying that this tree is about 450 years old; the Loeb text has *hæc nunc D circiter annum habet*, that is, about 500 years old.<sup>1676</sup>

Line 25. *Lotos*: see above Cap.23, line 21.

Line 25. *Verum altera Lotos in Vulcanali, quod Romulus constituit ex victoria de decimis*: the cults of Vesta and Vulcan were supposed to have been founded by Tatius, the king of the Sabines, who made a treaty with Romulus to form the Roman nation. A temple to Vulcan is said to have been built near the site of the comitium, where the two kings met to discuss the affairs of state. According to Smith, Romulus used his spoils from his victory over the Fidenatans to dedicate a quadriga to Vulcan.<sup>1677</sup> Smith also says that:

According to others [not named] the temple was built by Romulus himself, who also planted near it the sacred lotus-tree which still existed in the days of Pliny.<sup>1678</sup>

Line 26. *est Massarius*: Massarius [Masurius in Loeb text].

This is presumably a reference to the distinguished jurist, Massurius Sabinus, who lived at the time of Tiberius in the early part of the first century A.D.<sup>1679</sup>

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<sup>1674</sup> T. Robert S. Broughton, *The Magistrates of the Roman Republic*, American Philological Association, New York 1951: Volume I: 101.

<sup>1675</sup> *ibid.*: 109.

<sup>1676</sup> Pliny, *Historia Naturalis* XVI, lxxxv: 235; Loeb edition IV: 538.

<sup>1677</sup> Smith: 822.

<sup>1678</sup> *ibid.*

<sup>1679</sup> *ibid.*: 664.

Line 27. *Cupressus*.

[C.T.& M. 30] *Cupressus* (L.), Cypress; a genus of the *Cupressaceæ* or Cypress family.

B.& G.-W. 42: B.& H. 415: Linn.*Sp.Pl.* 1002-1003:

*Syn.Meth.St.Br.* - no ref.; *H.P.* 1406: *H.P.III D.* 10: *Tri.* 16.28:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1406:

2 species given, including:

*Cupressus* J.B. C.B. Park. *sativa & sylvestris* Ger.

***The Cypress Tree.***

*H.P.III D.* 10:

4 additional species given.

*Tri.* 16.28:

A Cypress-tree: *Cupressus*, -i, f.: *Κυπάρισσος*, -ου, f.

Line 28. *Ilex*.

[C.T.& M. 317] *Quercus ilex* (L.), Evergreen Oak, Holm Oak; a species of the *Quercus* genus of the *Fagaceæ* or Oak family.

B.& G.-W. 56: B.& H. 407: Linn.*Sp.Pl.* 995:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1391: *H.P.III D.* 8: *Tri.* 16.43:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1391:

2 species given, including:

*Ilex arborea* J.B. *major glandifera* Ger. *major aculeata & non aculeata* Park. *IV. seu folio rotundiore, molli modeaq. sinuato*

C.B. *necnon I. seu folio oblongo serrato* C.B.

***The Holm-Oak.***

*H.P.III D.* 8:

6 additional species given.

Tri. 16.43:

The Holm Oak: *Ilex*, -icis, f.: Πρῖνος, -ίνου, f.

Line 28. *æreis literis Hetruscis*: the Etruscans were the early inhabitants of the area now called Tuscany; they were powerful from the 8th to the 5th centuries B.C. but were absorbed into the Roman confederacy in the early 4th century B.C. Their language was non-Indo-European, although its characters are not dissimilar in appearance to Greek.

Line 29. *Reliqua quia incerta & fabulosa nobis videntur, omittimus*: Ray omits the next section of Pliny, which describes trees commemorating events from Greek mythology and early Greek history, because he regards it as untrustworthy evidence, but the reader may see it 'in the section of Pliny cited' [*apud Plinium loco citato*].<sup>1680</sup>

Line 31. *Idem celeberrimus autor lib. xvi. cap.2*:<sup>1681</sup> that is Pliny, the last author referred to.

Line 31. *Hercyniæ, inquit, Sylvæ arborum vastitas*: Pliny mentions the Hercynian forest in Book IV of the *Natural History*;<sup>1682</sup> it seems to have been in the mountainous regions around Bohemia and through Moravia into Hungary. It is described by Cæsar as being 'nine days journey in width and more than 60 days journey in length, extending east from the land of the Helvetii, Nemetes and Rauraci, parallel to the Danube, to the frontier of the Dacians'.<sup>1683</sup>

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1680 Pliny, *Historia Naturalis* XVI, lxxxviii and lxxxix: 238-240; Loeb edition IV: 540-541.

1681 *ibid.*: XVI, ii: 6; Loeb edition IV: 390.

1682 *ibid.*: IV, xii:80; Loeb edition II: 178.

1683 Julius Cæsar, *De Bello Gallico*, VI: 24.

Line 35. *Josephus de Bello Judaico lib.5, cap.31*. Ray's reference is incorrect here; in my text of *Ἱστορία Ἰουδαικοῦ Πολέμου Πρὸς Ῥωμαίους*<sup>1684</sup> this reference is Book VII: 533.

Ray gives part of this quotation in Latin but leaves the latter part in Greek,<sup>1685</sup> which reads ὅ φασι ἀπὸ κτίσεως μέχρι νῦν διαμένειν. The Loeb text of Josephus gives, for the whole passage:

δείκνυται δ' ἀπὸ σταδίων ἕξ τοῦ ἄστεως  
τερέβινθος μεγίστη, καὶ φασι τὸ δένδρον ἀπὸ τῆς  
κτίσεως μέχρι νῦν διαμένειν.<sup>1686</sup>

Flavius Josephus / Joseph ben Mattityahu, c.38-c.100 A.D.

Jewish historian and apologist. During the Jewish revolt of 66 A.D. against the Romans he helped organise the defence of Galilee, but was captured and subsequently accompanied Vespasian to Rome. Here he wrote his surviving works: *The History of the Jewish War against the Romans*, *Contra Apionem* (a defence of Judaism), the *Vita* (or autobiography) and *Antiquitates Judaicæ*.<sup>1687</sup>

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1684 Flavius Josephus, *Ἱστορία Ἰουδαικοῦ Πολέμου Πρὸς Ῥωμαίους*, History of the Jewish War against the Romans. [Hereafter referred to as Josephus, *Jewish War*]

1685 The combination of the two languages here could be due to the fact that the text owned by Ray, as is evident from the sale catalogue of his library, was in both Greek and Latin:

*Opera, gr. & lat.*, edition published in Geneva in 1635; British Museum: S-C 326 (6): 1, *Libri Latine &c. in Folio*, number 24.

1686 Josephus, *Jewish War* IV: 533; Loeb edition: Volume III: 159.

[At a distance of six furlongs from the town there is also shown a huge terebinth-tree, which is said to have stood there ever since the creation.]

Translated here by H.St.J. Thackeray.

1687 *Mac.Enc.*: 654.

Line 35. *Terebinthum: Terebinthus.*

[Mac.Enc. 1198] *Pistacia terebinthus* (L.), Terebinth; a species of the *Pistacia* genus of the *Pistaciaceæ* family.

C.T.& M. no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1025-1026: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1577:

*H.P.III D. 50: Tri.* 18.83: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1577:

4 species given, including:

*Terebinthus* Ger. J.B. *vulgaris* C.B. *angustiore folio vulgatiore*  
Park. *The Turpentine-tree.*

*H.P.III D. 50:*

7 additional species given.

*Tri.* 18.83:

A Turpentine-tree: *Terebinthus*, -i, f.: *Τέρμινθος*, -ου, f.

N.B. There is a footnote to this passage of the Loeb edition of Josephus stating that:

The “oak” of Abraham (so LXX; Heb. “oaks” or “terebinths”) is mentioned in Gen.xiii.18, xiv.13, xviii.1. In the 5th cent. A.D. it was called *Τερέβινθος*, and was the scene of an annual feast and fair, Sozomen, *H.E.* ii.4 (Robertson Smith).

Line 37. *Lawsonus*: although Ray corresponded with Thomas Lawson,<sup>1688</sup> since he praises Lawson here in *Historia Plantarum* as ‘a writer on horticulture not uncelebrated’<sup>1689</sup> he appears to be referring to William Lawson, who wrote *A New Orchard and Garden, or the best way for Planting, Grafting, and to make any ground good for a Rich Orchard, particularly in the North of England, 1618*.<sup>1690</sup>

Line 37. *etiam frugiferas*: Ray cites Lawson’s evidence that even fruit trees can be of great size. He concludes this paragraph with a comment that trees not suffering intensive pruning in cultivation should inevitably be older and larger.

Line 37. *Malos*: *Malus*: see above Cap.4, line 145.

Line 37. *Pyros*: *Pyrus*: see above Cap.4, line 145.

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1688 Thomas Lawson, 1630-1691, clergyman, may have known Ray at Cambridge. He eventually settled at Great Strickland in Westmoreland and set up a school there.\* Ray may have visited him there, but the first mention of him in letters is in connection with Plukenet and Newton in 1685.† He sent *Cystopteris fragilis* to Ray some time before June 1689 and a packet of fossils later in the same year. He died in 1691; Ray praises him as ‘an industrious diligent and skilful botanist’ in the preface to the *Synopsis Britannicarum*.\*\*

\* Raven: 233.

Further biographical details of Thomas Lawson may be found in:

J.Britten and J.S.Boulger, *Biographical Index of deceased British and Irish Botanists*, 2nd edition, 1931: 182.

H.N.Clokie, *An Account of the Herbaria ..... of Oxford*, 1964: 198.

J.E.Dandy, *The Sloane Herbarium*, 1958: 154.

C.E.Raven, ‘Thomas Lawson’s Notebook’, *Proceedings of the Linnæan Society of London* 169, session 1947-1948: 3-12.

† *Correspondence*: 139; letter from Ray to Hans Sloane, dated Feb.11, 1684.

‡ *Further Correspondence*: 187; letter from Ray to Edward Lhwyd, dated June 21, 1689.

\*\**Synopsis Methodica Stirpium Britannicarum*, 1690: un-numbered pages.

1689 There is no evidence in the sale catalogue of Ray’s library that he himself owned anything written by Lawson; British Museum: S-C 326 (6).

1690 Bowle, John. *John Evelyn and his World: A Biography*; Routledge and Kegan Paul, London 1981: 251, note 4.



Line 43. ἀκμήν: again an odd word of Greek, although probably used by Ray here as a direct ‘translation’ of the English ‘acme’ rather than for emphasis, as is usual. Greek ἀκμή; first spelled as an English word by Venner in 1620.<sup>1691</sup>

Line 45. περιπτώμασι, *contaminatus*: again an odd word of Greek. περιπτώμασι, from περίττωμα, -ατος, the Attic form of περίσσωμα, -ατος, means ‘that which remains after the digestion of food, either as a secretion or an excretion’, and hence ‘refuse’, ‘dregs’. It is a term regularly used by Aristotle and ancient medical authors. The meaning of Ray’s phrase is therefore ‘contaminated by no excrements or excretions’.<sup>1692</sup>

Text page 46.

Line 51. *Verum facessant rationes quantumvis speciosæ*: Ray concludes by stating that he remains to be convinced about the longevity of trees, since there is little literary evidence which can really be believed.

Line 55. *Quercuum certe longævitati repugnant quæ D. Rob. Harley ad D. Rob. Murray literis ante decennium datis perscripsit*: Ray cites the evidence of Dr. Robert Harley sent to Dr. Robert Murray proving that the oak is not a long-lived tree.

For *Quercus* see above Cap.4, line 145.

In fact, as Rackham states, with examples, ‘An age of at least 400 years is not uncommon among oaks’.<sup>1693</sup> He also cites Mitchell as reckoning from his measurements that the Major Oak in

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1691 OED: 17.

1692 Liddell and Scott: 1387-1388.

1693 Rackham, *Trees*: 14.

Sherwood Forest to be (in 1965) then between 400 and 650 years old.<sup>1694</sup>

Line 56. *D. Rob. Harley*: for Harley's possible identification see above Cap.22, line 127.

Line 56. *D. Rob. Murray*: so far I have been unable to trace Murray. There is a Robert Murray (1635-?1725) mentioned in John Aubrey's *Brief Lives*;<sup>1695</sup> his dates would imply that the Robert Harley mentioned in the same line and in chapter 22 could rather be the first Earl of Oxford's father than the earl himself, although the identifications of both are tenuous. According to Aubrey, Murray was the inventor of the penny post set up in 1680, a banker and moneylender.<sup>1696</sup>

Line 59. *Quercium: Quercus*: see above Cap.4, line 145.

Line 60. *παρακμαζούσας*: 'past their prime'.

Greek, again probably for emphasis.<sup>1697</sup>

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<sup>1694</sup> Rackham, *Trees*: 14.

<sup>1695</sup> Barber, Richard (Ed.). *John Aubrey Brief Lives: a modern English version*; The Boydell Press, Woodbridge, Suffolk, 1982: 217-218.

NB This work was not published in Aubrey's lifetime; at his death in 1697 he left a mass of jumbled notes and manuscripts, amongst which was the material for *Brief Lives*.

<sup>1696</sup> Barber: 217-218.

<sup>1697</sup> Liddell and Scott: 1313.

NB The form given here is the feminine accusative plural of the present participle of παρακμάζω.

## Chapter Twenty-four:

### *On the powers and uses of plants in food and medicine.*

Before Ray's time interest was taken in plants mainly because of their practical uses especially in the fields of medicine and food, rather than as the academic discipline now termed botany or plant science. There is evidence from all early civilisations of herbal medicine; I give a few brief examples. Egyptian papyri dating to about 1700 B.C. show herbs such as hemp, *Cannabis sativa*, which is still used to treat glaucoma,<sup>1698</sup> being used for eye problems.<sup>1699</sup> The Greek Hippocrates categorized food and herbs by similar fundamental qualities as here in Ray's chapter - hot, cold, dry or damp; that the Greek tradition continued almost to Ray's time is indicated by the continued use of Dioscorides' *de Materia Medica* as the standard textbook. Avicenna's *Kitab al-Qanun*, which was translated from Arabic into Latin and reintroduced in the 12th century to western Europe, was based on Galenical principles. The Ayurvedic traditions of the Indian sub-continent also treated illness, which was seen as bodily imbalance, with herbs. Chinese herbal medicine can be traced back for about 5,000 years, herbs being used along with practices such as acupuncture to restore harmony and balance. The oldest European herbal written in the vernacular is the *Leech Book of Bald* from the 10th century, which recommends herbs such as wood betony, plantain and yarrow to be taken internally, but often also to be worn as an amulet. Healing and herbalism, despite the development of medical schools such as that at Salerno, were largely in the hands of the Church, with monasteries all having their own physic gardens. By the sixteenth century physicians such as William Turner were writing in English so that herbal remedies could become available to the apothecaries and herb women as well as to the physicians who still used Latin. By the end of the same century many new plants and thus herbal remedies were being imported from the East Indies and the Americas; for example, tea, now

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<sup>1698</sup> *Potter's Cyclopædia of Botanical Drugs*: 152-153.

<sup>1699</sup> Ody, Penelope. *The Herb Society's Complete Medicinal Herbal*; Dorling Kindersley, London 1993: 10.

regarded just as an everyday drink, was regarded in the seventeenth century as a cure-all. However, by the late seventeenth century there was a re-awakening of interest in the study of botany for its own sake, as can be seen in the works of Ray, Grew, Malpighi and their contemporaries; this would account for the minor consideration given to the actual uses of plants in *Historia Plantarum*.

Ray did, however, modify his opinions somewhat in *The Wisdom of God manifested in the Works of the Creation*, published in 1691, where, after rejecting the doctrine of signatures, he sums up his thoughts on the uses of plants in food and medicine:

That because they are designed for the Food of Animals, therefore Nature hath taken more extraordinary Care, and made more abundant Provision for their Propagation and Increase.<sup>1700</sup>

Howbeit, I will not deny, but that the noxious and malignant Plants do many of them discover something of their Nature by the sad and melancholic Visage of their Leaves, Flowers and Fruit. And that I may not leave that Head wholly untouched, one Observation I shall add relating to the Virtues of Plants, in which I think there is something of Truth; that is, that there are, by the wise Disposition of Providence, such *Species* of Plants produced in every Country, as are most proper and convenient for the Meat and Medicine of the Men and Animals that are bred and inhabit there: insomuch that *Solenänder* writes, that from the Frequency of the Plants that sprung up naturally in any Region, he could easily gather what Endemial Diseases the Inhabitants thereof were subject to: So in *Denmark, Friezland, and Holland*, where the Scurvy usually reigns, the proper Remedy thereof, *Scurvy-Grass*, doth plentifully grow.<sup>1701</sup>

We will only mention the Names of some other Vegetables, which, with Eighteen or Twenty Thousand more of that Kind, do manifest to Mankind the illustrious Bounty and Providence

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1700 *The Wisdom of God*: 82-83.

1701 *ibid.*: 85.

of the Almighty and Omniscient Creator, towards his undeserving Creatures;..... Of what great use all these, and innumerable other Plants, are to mankind in the several Parts of Life, few or none can be ignorant; besides the known Uses in Curing Diseases, in Feeding and Clothing the Poor, in Building, in Dyeing: In all Mechanics there may be as many more not yet discovered, and which may be reserved on purpose to exercise the Faculties bestowed on Man, to find out what is necessary, convenient, pleasant, profitable to him.<sup>1702</sup>

It should be noted that, although Ray believed that plants had been expressly created for man's use and pleasure, this was not a universal opinion at this time. Grew<sup>1703</sup> insisted that a plant, although pleasing and useful to man, is primarily designed for its own functional needs; “the inward ones [elegancies], which are as precise and various as the outward” must be for the benefit of the plants themselves'.<sup>1704</sup> Although this is an idea going back to the time of Aristotle, it had suffered from much religious interpretation; Grew's accounts indicate a more pragmatic viewpoint

notably in the discussions of the connection between anatomical structure and the mechanical properties of stems and roots, and of the sap between different organs and tissues.<sup>1705</sup>

Ray was willing to discuss and often accept the new scientific theories of his contemporaries, but always with the overriding belief in the divine creation and purpose as is shown in his work *The Wisdom of God Manifested in the Works of the Creation* published in 1691.<sup>1706</sup>

In this chapter Ray begins by listing the general uses of plants, but then says that he intends to concentrate on their medical uses. He first gives his reasons for rejecting the doctrine of signatures and then follows with the

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<sup>1702</sup> *The Wisdom of God:* 157-158.

<sup>1703</sup> Nehemiah Grew, *The Anatomy of Plants, with an Idea of a Philosophical History of Plants*, Rawlins for the author, London 1682.

<sup>1704</sup> Morton: 194.

<sup>1705</sup> *ibid.*: 194-195.

<sup>1706</sup> See the discussion in the general introduction to this commentary.

bulk of the chapter on the tastes of various parts of plants, citing Fernel and Grew. He rejects the explanation of the medicinal powers of plants in terms of temperament, that is, the degree of internal heat, cold, humidity and dryness, believing that his reader should go to other authors for such discussion. He favours the theory that plants with similar taste will have similar medicinal properties. Despite his declared intentions, in both chapter title and in the text, he does not go into much detail on the actual medical uses. He admits that he has to rely on the knowledge of others for such material:

As for the faculties and uses I must entreat the contributions and corrections of yourself and other learned and observant physicians.<sup>1707</sup>

Text page 46.

Line 3. *Quanto ex iis mensa innocentior, mundior, salubrior quam ex Animalium cæde & laniena?* This statement would imply that Ray was a vegetarian, disapproving of the slaughter of animals for food; he certainly had digestive problems, as he mentions in a letter to Martin Lister, dated 1 Oct. 1667;<sup>1708</sup> this was in reply to a letter from Lister enquiring after his health.<sup>1709</sup> However, there is no real evidence that he followed a vegetarian diet.

Line 7. *At non victum tantum nobis suppeditant, sed .....* : he lists briefly (to line 13) the uses of plants.

Line 8. *Verum, his missis, de earum tantum viribus seu usibus in Medicina verba faciam.* An odd statement as for the rest of the chapter, apart from giving his reasons for rejecting the doctrine of signatures, he discusses the various qualities of taste of parts of plants and not their

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<sup>1707</sup> Letter from John Ray to Tancred Robinson, dated 13th August 1684; *Further Correspondence*: 140-141.

<sup>1708</sup> *Correspondence*: 17-18; *Further Correspondence*: 113-116.

<sup>1709</sup> *Correspondence*: 17.

actual medical uses, other than occasionally and incidentally.<sup>1710</sup>

Line 15. *Medici tum Antiqui, tum Recentiores de Plantarum temperamentis ..... fuse differunt*: he continues by commenting on the varying opinions of ancient and more modern doctors, saying that their gradations of the qualities of plants are too complex and contrary to be considered here. He refers any interested reader to their various works [*qui iis delectantur Institutionum Medicarum Scriptores adeant*].

Line 21. *Magis ad rem foret Odorum sed præcipue Saporum differentias, causas, effectus indagare: ex his enim vires plantarum & usus in Medicina certius colligi posse ..... :* he now justifies his detailed analysis of the tastes of plant material at the expense of actual medical detail.

Line 23. *Quæcunque enim plantæ saporibus conveniunt, facultatibus quoque consentire verisimillimum est.* This is Ray's main thesis throughout this chapter, that plants which taste similar will have similar medical uses.

Line 25. *alios plantarum Vires indagandi modos excutiemus, quorum primus est ex signaturis dictis.* Ray then gives his reasons for the rejection of the doctrine of signatures, beginning with a definition of it.

The doctrine of signatures, mentioned in the works of Pliny, was again recommended in the sixteenth century by Paracelsus (Theophrastus Phillipus Aureolus Bombastus von Hohenheim: c1493-1541). He rejected the Galenic idea of *contraria contrariis curantur* (curing by opposites), and substituted the doctrine of similars. He tried to find the essence of medicaments to

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<sup>1710</sup> But see the comment at line 21 below.

combat the essence of disease; in his doctrine of signatures, plants showed by their external form the qualities with which they were endowed, that is that their colour and shape resembled the affected organ. In this way digitalis was used for diseases of the heart, figwort for scrofula, orchid for the testicles and hepatica for diseases of the liver.<sup>1711</sup>

Line 30. *Signaturas præcipue crepant Chymistæ*. Ray seems to show his disapproval of chemists by his use of the word *crepant*, ‘prattle’, and by association with the doctrine of signatures.

Paracelsus and his followers experimented with the use of individual chemicals as drugs instead of administering a selection of several dilute medicines at once in case one of them worked. In this he could be said to be the forerunner of pharmaceutical chemistry.

Line 31. *Chymicum autem dudum definivit Davisonus ut memini*: probably this is a reference to William Davison, 1593-1669.

Davison graduated from Marischal College, Aberdeen, in 1617. He then went to France, where he graduated in medicine, probably from Montpellier. He later moved to Paris, where in 1648 he became *intendant* of the Jardin Royal des Plantes (now the Musée d’Histoire Naturelle).<sup>1712</sup>

His major works are:<sup>1713</sup>

1. *Philosophia pyrotechnica seu curriculum chymiatricus*: four parts, (Paris 1633-1635, 1640).
2. *Oblatio Salis sive Gallia Lege Salis condita* (Paris 1641).
3. *Les Elémens de la philosophie de l’art du feu ou chemie* (Paris 1651, 1657).

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1711 *DSB X*: 304-313; Charles Greene Cumston, *An Introduction to the History of Medicine*, Dorset Press, New York 1987: 266-267.

1712 *DSB III*: 596-597.

1713 There is no indication in the sale catalogue of his library that Ray owned any of the writings of Davison; British Museum: S-C 326 (6).



4. *Commentariorum in .... Petri Severini Dani Idæam medicinæ philosophicæ.... Prodromus* (The Hague 1660).
5. *Plicomastix seu Plicæ numero morborum* (Danzig 1668), published under the pseudonym Theophrastus Scotus.<sup>1714</sup>

Line 31. (*quam recte ipse viderit*) *Animal credulum & mendax*. Ray, despite his wide interest in the natural world, obviously had no time for chemists; perhaps this was because at this time there was still a suspicion that chemists were alchemists.

Line 32. *Nos alibi Signaturas rejecimus ..... quas hic repetemus.*

Ray gives his reasons for rejecting the doctrine of signatures, which as he states he has already listed elsewhere - they are given in almost the same words as here (from lines 35-60) in the *Cambridge Catalogue* in a lengthy note appended to his entry for *Sambucus*.<sup>1715</sup>

Lines 35-67. *E plantis specificis dictis ..... si nimirum ab Avibus decerptos aut admorsos viderent.* Here Ray lists his reasons for rejecting the doctrine of signatures.

Ray continued to refute the doctrine of signatures as is seen here:

because all that I find mentioned and collected by Authors, seems to me to be rather fancied by Men, than designed by Nature to signify or point out any such Virtue as they would make us believe.<sup>1716</sup>

Line 40. *Orchidum: Orchis*: see above Cap.3, line 20.

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1714 *DSB III*: 597.

1715 *Camb.*: 110.

1716 *The Wisdom of God*: 85.

Line 43. *Bursæ pastoris: Bursa pastoris.*

[C.T.& M. 84] *Capsella bursa-pastoris* ([L.] Medic), Shepherd's Purse; a species of the *Capsella* genus of the *Cruciferae* or Cress family.

B.& G.-W. 152: B.& H. 45: Linn.*Sp.Pl.* 647:

*Syn.Meth.St.Br.* 306: *H.P.* 838: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 47: *Camb.* 49.

*H.P.* 838:

*Bursa pastoris* J.B. Ger. *major vulgaris* Park. *major folio sinuato* C.B. *Shepherds Purse.*

Line 43. *Thlaspeos: Thlaspi:* see above Cap.11, Table 122.

Line 43. *Antirhini vulgaris: Antirrhinum vulgare.*

[C.T.& M. 371] *Antirrhinum majus* (L.), Snapdragon; a species of the *Antirrhinum* genus of the *Scrophulariaceae* or Figwort family.

B.& G.-W. 356: B.& H. 326: Linn.*Sp.Pl.* 612-617:

*Syn.Meth.St.Br.* \*283: *H.P.* 760-761: *H.P.III* 392-393:

*Tri.* - no ref.: *Cat.Angl.* 23: *Camb.* 43.

*H.P.* 760-761:

5 species given, including:

*Antirrhinum vulgare* J.B. *purpureum* Ger. *purpureum sive roseum* Park. *majus alterum folio longiore* C.B.

*Purple Calves-snout or Snapdragon.*

*H.P.III* 392-393:

14 additional species given.

Line 44. *Phaseoli: Phaseolus:* see above Cap.13, line 24.

Line 44. *Tragopogon:* see above Cap.3, line 88.

Line 44. *radix Terræ: Radix terrae.*

Probably *Raphanus sativus* (L.), the Radish, or *Raphanus raphanistrum* (L.), the Wild Radish.

C.T.& M. 76-77: B.& G.-W. 160: B.& H. 49: Linn.*Sp.Pl.* 669:  
*Syn.Meth.St.Br.* 296: *H.P.* various: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.:*

*Radix* - 1339, *S. Helena.*  
975, *cava.*  
684, *cava minima.*  
1489, *Idæa, i. Uva Ursi.*  
684?, *Rhodia.*  
431?, *Ursina, i. Meum.*

Line 45. *Gladiolus:* see above Cap.3, line 46.

Line 45. *Fænuigræci: Fænuigræcus.*

[C.T.& M. 195] *Trifolium ornithopodioides* (L.), [*Trigonella ornithopodioides* ([L.] DC): *Trigonella purpurascens* (Lam.): *Falcatula falsotrifolium* (Brot.): *Falcatula ornithopodioides* ([L.] Brot. ex Bab.)], Fenugreek; a species of the *Trifolium* genus of the *Leguminosæ* or Pea family.

B.& G.-W. 214: B.& H. - no ref.: Linn.*Sp.Pl.* 777:

*Syn.Meth.St.Br.* 331: *H.P.* 954: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 954:

(Tr.) 'Fænuigræcum, for so it is written in the notes of Columella and Pliny, τῆλις to the Greeks, was usually sown by the ancients as fodder for cattle.

Its characteristics are rather long, curved and compressed pods filled with angled seeds, each row set in ridges

from angle to angle.’

5 species given, including:

*Fœnum Græcum* Ger. *Fœnuigræcum* J.B. *Fœnum Græcum sativum* C.B. Park. **Fenugreek.**

Line 45. *Medicæ cochleatæ: Medica cochleata.*

[C.T.& M. 194] *Medicago* (L.), Medicks; a genus of the *Leguminosæ* or Pea family.

B.& G.-W. 214: B.& H. 105: Linn.*Sp.Pl.* 778-781:

*Syn.Meth.St.Br.* 333: *H.P.* 961-966: *H.P.III* 471: *Tri.* - no ref.:

*Cat.Angl.* 197 with a ref. to see *Trifolium* 289: *Camb.* - no ref.

*H.P.* 961-966:

33 species given, including:

*Medica scutellata* J.B. *Trifolium cochleatum* Ger. *Trifolium cochleatum fructu latiore* C.B.

**The most common smooth Snail-Trefoil.**

*Medica cochleata spinosa, echinis magnis utrinque turbinatis cum spinulis reflexis. Medicæ majoris Baeticæ species prima, spinulis intortis* Ger.emac.

*Medica echinata glabra cum maculis nigricantibus* J.B. *Trifolium cochleatum folio cordato maculato* C.B. *Trif. cordatum* Park.

**Heart-Trefoil or Claver.**

*H.P.III* 471:

7 additional species of *Medica* given, including 2 named as *cochleata*.

*Cat.Angl.* 289:

Two of the species listed in the *Catalogus Angliæ* are described as *cochleata* and one also as *medica*:

*Trifolium cochleatum folio cordato maculato* C.B. *cordatum* Ger. *Medica echinata glabra cum maculis nigricantibus & sine illis* J.B. *Medica Arabica Camerarii sive Trifolium cordatum*

Park.

*Heart-Trefoil, or Claver.*

It is difficult to decide which species Ray is meaning here, but possibly he is meaning Medicks in general, as *cochleata* means 'twisted' or 'coiled' and all species are thus.

Line 46. *Pisum cordatum*: Ray includes this plant with *Nasturtium Indicum* or Indian Cress, Yellow Larks-spur, in the main text of *Historia Plantarum*,<sup>1717</sup> but it is not listed as such in any of the other sources. There is one reference in Linnæus *Species Plantarum* to *Pisum cordatum*,<sup>1718</sup> but this cannot be traced through the more modern sources.

Linn.*Sp.Pl.* 366:

*Paullinia pinnata*:

*Paullinia foliis pinnatis; foliolis incisiss, petiolis marginatis.*

Hort.cliff.52. \*Roy.lugdb.464.

*Cururu scandens pentaphylla.* Plum.gen.34.

*Clematis pentaphylla, pediculis alatida, fructu racemoso tricocco & coccineo.* Plum.amer.76.t.91.

*Pisum cordatum non vesicarium.* Sloan.jam.111.

*Cururu-ape.* Marcgr.bras.22. Pis.bras.114. Raj.hist.1347.

*Habitat in Brasilia, Jamaica, Domingo.*

H.P. 487:

*Pisum cordatum vesicarium* Park. *Pisum vesicarium fructu nigro, alba macula notato* C.B. *Halicacabum preregrinum*

Dod. Ger.

H.P.III - no ref.

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1717 *Historia Plantarum Generalis*: 487.

1718 Linnaeus, *Species Plantarum*: 366.

Line 49. *Anacardii: Anacardium.*

[Mac.Enc. 235] *Anacardium occidentale* (L.), a Cashew Tree; a species of the *Anacardium* genus of the *Anacardiaceæ* or Cashew nut family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:  
Linn.*Sp.Pl.* 110: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1649:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.  
*H.P.* 1649:

*Pomifera seu potius prunifera Indica nuce reniformi summo pomo innascente. Cajous dicta. Anacardii alia species* C.B.  
*Cajous* Ger. Park. J.B. *Acajaiba* Pisonis & Marcgravii. *Kapamara* H.M.P.3.T.54.p.65. *The Cajou or Cassu Tree.*  
*Anacardium occidentale Cajou dictum ossiculo reni leporis figura* Herman.

Line 49. *Fungi arborei:* see above under *Fungus* Cap.18, line 181.

*H.P.* 106-110:

16 species given, including:

*Fungi arborei ad ellychnia* J.B. *F. durus arborum, sive igniarius*  
Park. *F. nox. 3, sive in caudicibus nascens unguis equini figura*  
C.B. *Touch-wood.*

*H.P.III* - no ref.

*Cat.Angl.* 119:

*Fungi arborei ad ellychnia* J.B. *F. durus arborum sive igniarius*  
Park. *noxius 3, sive F. in caudicibus nascens unguis equini*  
*figura* C.B. *Touchwood, sic apud Parkinsonum Anglice*  
*vocatur. Tragus etiam modum conficiendi tradit. Decoquant*  
*fungos hosce in lixivio, & siccatos tundunt, rursus nitro coquant*  
*ut igni concipiendo idonei evadant.*

Line 50. *Fungus phalloides*: [Fungi 198]<sup>1719</sup> *Phallales*: a genus of the *Phallaceæ* or Stinkhorn family.<sup>1720</sup>

Terrestrial, on dung, wood and other plant material, saprotropic, not usually subterranean at maturity, with distinct spore-bearing surface, and the basidia maturing simultaneously. Fruit body structure complex, +/- spherical (and known as an egg) with +/- smooth membranous outer peridium covering a gelatinous layer within which is a fleshy brown gleba. In some species the peridium remains intact and the fruit body spherical but in others the gleba is borne on a spongy or honeycomb-like receptacle which elongates in various ways through the ruptured peridium to expose the gleba above the substrate. As this takes place the gleba changes chemically to form a repulsively smelling slime. Spores brown, smooth, ellipsoid-cylindrical and fairly large in the groups that retain spherical fruit bodies, colourless, smooth +/- cylindrical and very small in those that elongate. Six families, with marked individual features, but three are exotic and contain very few, imperfectly studied species. In the *Phallaceæ*, the elongated receptacle forms a phallus-like organ with the gleba on the outside. European genera are *Phallus* and *Mutinus*, the Stinkhorns. Despite their subsequent foul smell, some species are edible when young.<sup>1721</sup>

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:  
Linn.*Sp.Pl.* 1178-1179: *Syn.Meth.St.Br.* 12: *H.P.* 103:  
*H.P.III* 17-25: *Tri.* - no ref.: *Cat.Angl.* 122: *Camb.* - no ref.

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1719 Buczacki: 198.

1720 For Ray's theories on *Fungi*, see above Cap.18, line 181.

1721 Buczacki: 198.

H.P. 103:

*Fungus phalloides* J.B. *Phallus Hollandicus* Park. *F. virilis penis effigis* Ger. *F. fœtidus penis imaginem referens* C.B.

H.P.III 17-25:

25 additional species given.

Cat.Angl. 122:

*Fungus phalloides* J.B. *Phallus Hollandicus* Park. *Fungus virilis penis effigie* Ger. *noxius 38, seu fœtidus, penis imaginem referens* C.B.

Ray adds at this point in the *Catalogus Angliæ* that:

This was brought to Doctor Brown at Norwich.<sup>1722</sup>

This sort of Mushroom exactly answering the description of Hadrianus Junius sprang up this Autumn [1670] in the Orchard of Fr. Willughby Esquire at Middleton in Warwick-shire plentifully. I shall add a more exact description of the ball before the Phallus springs out of it.

This he proceeds to do at length.

Line 51. *Tithymalorum: Tithymalus*: see above Cap.4, line 23.

Text page 47.

Line 52. *Mespilorum: Mespilus*: see above Cap.12, line 91.

Line 57. *Narcissi: Narcissus*: see above Cap.18, line 306.

Line 58. *Tulipæ: Tulipa*: see above Cap.3, line 12.

Line 58. *Cepe: Cepa*: see above Cap.3, line 12.

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<sup>1722</sup> For an earlier mention of Dr. Brown of Norwich, see above Cap. 22, line 66.



Line 58. *Allium*: see above Cap.3, line 12.

Lines 68-78. *Verisimile etaim est viribus convenire quas eadem insecta arrodunt ..... quæ nullum fere escæ genus aversantur.*

Ray explains that he believes that insects choose to eat plants with similar properties, whilst rejecting others. Raven says that this is:

An original and profitable suggestion: he excepts omnivorous caterpillars<sup>1723</sup> and illustrates from larva of *Hipocrita jacobææ* feeding on Ragwort and Groundsel.<sup>1724</sup>

Line 70. *Piperitin*: *Piperitis*.

[C.T.& M. 79-80] *Lepidium* (L.), Pepperworts; a genus of the *Cruciferæ* or Cress family.

B.& G.-W. 154: B.& H. 45: Linn.*Sp.Pl.* 644:

*Syn.Meth.St.Br.* 304: *H.P.* 828: *H.P.III* 640: *Tri.* - no ref.:

*Cat.Angl.* - no ref. but see under *Lepidium* 183-184:

*Camb.* - no ref.

*H.P.* 828:

(Tr.) Λεπίδιον is so-called by Dioscorides 1, Cap.205,

because it can destroy λεπίδας or scales and spots on

the face; or ἀπὸ τοῦ λεπίζειν, that is ἐκδεῖρειν,

because it can ulcerate and strip off the skin by its

bitterness, or because it can destroy the marks burned by

iron on the foreheads of slaves, about which, for

example, see Columella Lib.10. *Lepidium*. Pliny Lib.20,

Cap.17.<sup>1725</sup> C.B.

1723 See lines 78-79 below.

1724 Raven: footnote to page 224.

1725 Pliny, *Historia Naturalis* XX, lxx: 181; Loeb edition VI: 104-106.

3 species given, including:

*Lepidium latifolium* C.B. *Lep. Pauli* J.B. *Piperitis sive  
Lepidium vulgare* Park. *Raphanus sylvestris Officinarum*,  
*Lepidium Æginetæ Lobelio* Ger. *Dittander, Pepper-wort.*

*H.P.III* 640:

2 additional species given.

Line 70. *Nasturtium*.

[C.T.& M. 79] *Lepidium sativum* (L.), Garden Cress; a species of the *Lepidium* genus of the *Cruciferae* or Cress family.

B.& G.-W. 154: B.& H.46: *Linn.Sp.Pl.* 644:

*Syn.Meth.St.Br.* 297-304: *H.P.* 825: *H.P.III* - listed in the Index to Volume III, but no page number given: *Tri.* 9.50: *Cat.Angl.* 211: *Camb.* - no ref.

*H.P.* 825:

(Tr.) *Nasturtium* is called Καρδάμον by Dioscorides, Lib.1, Cap.185: Theophrastus 7, Hist.I., as if from Καρήδαμον, because κάρα δαμᾶ, it cures a headache, that is, it cures by its bitterness.

10 species given, including:

*Nasturtium hortense* Ger. Park. *vulgare* J.B. *hortense vulgatum* C.B. **Common Garden-Cress.**

*Tri.* 9.50:

Cresses: *Nasturtium*, -ii, n.: Κάρδαμον, -άμου, n.

Line 71. *Iberidem: Iberis*.

[C.T.& M. 82-84] *Iberis* (L.), Candytuft; a genus of the *Cruciferae* or Cress family.

B.& G.-W. 152: B.& H.44: *Linn.Sp.Pl.* 648-650:

*Syn.Meth.St.Br.* 299: *H.P.* 827: *H.P.III* 515: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 827:

3 species given, including:

*Iberis* J.B. *Ib. Cardamantica* Lob. *Iberis latiore folio* C.B. Park.

Ger.emac. ***Sciatica cresses.***

*H.P.III* 515:

Incorrect reference in the Index to Volume III.

Line 72. *Erucam: Eruca:* see above Cap.15, line 62.

Line 73. *Jacobæam: Jacobæa.*

[ C.T.& M. 453] *Senecio jacobæa* (L.), Ragwort; a species of the *Senecio* genus of the *Compositæ* or Daisy family.

B.& G.-W. 418: B.& H. 245: *Linn.Sp.Pl.* 870:

*Syn.Meth.St.Br.* 177-178: *H.P.* 284-287: *H.P.III* 174:

*Tri.* - no ref.: *Cat.Angl.* 170-171: *Camb.* 76.

*H.P.* 284-287:

10 species given, including:

*Jacobæa vulgaris* J.B. *vulg. major* Park. *vulg. laciniata* C.B.

***Common Ragwort, Seggrum.***

*H.P.III* 174:

76 additional species given..

Line 73. *Senecio.*

[C.T.& M. 452-457] *Senecio* (L.), Ragworts; a genus of the *Compositæ* or Daisy family.

*Senecio vulgaris* (L.), Groundsel.

B.& G.-W. 416-418: B.& H. 243: *Linn.Sp.Pl.* 866-871:

*Syn.Meth.St.Br.* 178: *H.P.* 290: *H.P.III* 183: *Tri.* 10.80:

*Cat.Angl.* 271: *Camb.* 113.

*H.P.* 290:

4 species given, including:

*Senecio vulgaris* Park. *minor vulgaris* C.B. *vulgaris sive*  
*Erigeron* J.B. *Erigeron* Ger.

***Common Groundsel or Simson.***

*H.P.III* 183:

20 additional species given.

*Tri.* 10.80:

Groundsel: *Senecio*, *-ionis*, m.: Ἡριγέρων, -οντος, m.

Line 80. *Superest tertia & optima initio proposita Plantarum vires indagandi ratio, nimirum ex saporibus.* From here to the end of the chapter Ray discusses the tastes of plants.

Line 84. *Schola Salernitana*: the Salernitan School was an influential medical school founded in the ninth century at Salerno, and by 985 was awarding the title of Doctor to its graduates. Although secular in origin it was influenced by its near neighbour, the Benedictine monastery of Cassino, where the best texts of Greek medicine and botany were accessible. Salerno flourished for over three centuries and became the true seat of the revival of medicine, not without a considerable effect on botany.

For a thousand years from the death of Galen there had been little development in the knowledge of anatomy; even during Galen's lifetime dissection of the human body was not allowed at Alexandria. Probably during the Dark Ages some attempts were made at dissection, although it was generally against the law.

The anatomical works of Hippocrates, Aristotle and Galen were probably not available in Europe until the translations made at the end of the eleventh century. Constantine the African (died 1087) translated at Salerno many works from the Arabic. Later

in 1127 Stephen of Antioch translated the *Kitab al-Maliki* as the *Liber regalis*; the two chapters on anatomy in this book, both derived from Galen, exerted a strong influence on later anatomical writings at Salerno.

By the end of the eleventh century an annual public demonstration of porcine anatomy had become a traditional occurrence at Salerno. *De modo medendi (Anatomis porci)* deals only with the neck, chest and abdomen; it was probably published between 1080 and 1090.<sup>1726</sup> Whatever the actual value of the material contained here, it marks a huge step forward in medical teaching.

The number of anatomies attributed to Salerno varies but there are probably four.<sup>1727</sup> The second, the *Demonstratio anatomica*, is an enlarged form of the earlier *Anatomia porci*. The third, *Anatomia mauri*, is said to have been written by Master Maurus, the *optimus physicus* of the school, who lived in the second half of the twelfth century. The last porcine anatomy is said to have been written by Urso of Calabria.

In 1224 Frederick II ordered that all surgeons must study anatomy for a year, but it is not known whether this included human dissection or observation of dissection. There was an edict in 1231 ordering that all practising physicians and surgeons should attend a public dissection every five years, but because of the disturbed political situation at the time, it is unlikely that this was ever carried out.<sup>1728</sup>

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1726 See *DSB XII*: 81, footnote.

1727 There is no indication in the sale catalogue of his library that Ray owned any of the publications of the Schola Salernitana, although he appears to be quoting from such a work here; British Museum: S-C 326 (6).

1728 H.P.Bayon, *The masters of Salerno and the origins of medical practice in Science, Medicine and History*, 1953; also P.O.Kristeller, The School of Salerno, *Bulletin of the History of Medicine* 17, 1945: 138-194.

Line 87. *Jo. Fernelius Autor*: Ray's text indicates a christian name such as John/Jean in the Latinized form; thus it is probable that he means Jean François Fernel, 1497-1558.

Fernel's interests lay in medicine, although his earlier education was in the fields of astronomy, philosophy and mathematics. In 1527 he published his first book, *Monalosphaerium*, followed in 1528 by *Cosmotheoria*, both mathematical and astronomical. He qualified in medicine in 1530 and rapidly gained a reputation as a doctor. He published in 1542 *De naturali parte medicinae*, a book on human physiology. Although he believed in astrology in his early career he later came to condemn it and as a result was regarded as a heretic. His textbook *Medicina* was published in 1554. Published posthumously were *Universa medicina*, edited by Guillaume Plancy (Paris 1567) and *Febrium curandarum methodus generalis* (Frankfort am Main 1577).<sup>1729</sup> His main contribution lies in his efforts to replace magic and astrology with actual observation and practice.<sup>1730</sup>

Lines 89-108. *Sapor acer est ..... & cucurbita & citrulus*. Ray here quotes the different types of taste from Fernel.

A modern definition of taste is as follows:

Sensation originating in the mouth that consists of a (usually subtle) combination of sweetness, sourness, bitterness and saltiness.<sup>1731</sup>

Line 89. *Sapor acer est*: Fernel's first type of taste, sharpness, is exemplified by *Piperitis*, *Pyrethrum* and *Euphorbia*.

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1729 There is no indication in the sale catalogue of Ray's library that he owned any of Fernel's works; British Museum: S-C 326 (6).

1730 *DSB IV*: 584-586.

1731 *Harrap's Dictionary of Medicine and Health*: 382.

Line 90. *Pipere: Piperis*: see above Cap.24, line 70.

Line 90. *Pyrethro: Pyrethrum*.

[C.T.& M. 476-477] *Tanacetum* (L.), a genus of the *Compositæ* or Daisy family, which includes *Pyrethrum*, *Tanacetum parthenium* ([L.] Schultz Bip.), [*Matricaria parthenium* ([L.] Bernh.): *Pyrethrum parthenium* ([L.] Sm.)]. Most garden Pyrethrums are derived from *Tanacetum coccineum* ([Willd.] Schultz Bip.): e.g. *Pyrethrum roseum* (Bieb.). Pyrethrum powder, a valuable contact insecticide, is derived from *Tanacetum cinerariifolium* ([Trev.] Schultz Bip.), native to the Balkan peninsula, but widely cultivated on a commercial scale.

B.& G.-W. 410: B.& H. 237 - only *Chrysanthemum parthenium* (Pers.), *Pyrethrum parthenium* (Sm.), Feverfew:

Linn.*Sp.Pl.* - no ref.: *Syn.Meth.St.Br.* - no ref.: *H.P.* 353:

*H.P.III* - no ref: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 353:

1 species only given:

*Pyrethrum flore Bellidis* C.B. *vulgare Officinarum* Park.  
*Officinarum* Ger.

Line 90. *Euphorbio: Euphorbium*.

[C.T.& M. 296-300] *Euphorbia* (L.), Spurge; a genus of the *Euphorbiaceæ* or Spurge family.

B.& G.-W. 232-234: B.& H. 391: Linn.*Sp.Pl.* 450-463:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 872: *H.P.III* D. 21 / *Bot.* 432:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 872:

4 species given, including:

*Euphorbium vulgo sed falso creditum. Euphorbium* Ger. Park.

C.B. *Euphorbii tenella planta* Bod.à Stapel.

H.P.III D. 21 / Bot. 432:

D. 21, p.888, *Ad cap. de Euphorbio Speciem 2<sup>dam</sup>,*

*Planta hæc Cereus crassissimus, fructu intus & extus rubro D. Sloane dicitur, & hunc in modum describitur. Called in English 'The Dildo tree'.*

12 additional species given.

*Bot. 432, p.872, Ad cap. de Euphorbio speciem primam, seu Euphorbium Cerei effigie caulibus crassioribus spinis validioribus armatum Breyn.Prod.2.*

9 additional species given.

Line 91. *Acidus sapor*: Fernel's second type of taste, acidity, is exemplified by *Malus cytria* and *Limonum*.

Line 92. *mali cytrii*: *Malus cytria*.<sup>1732</sup>

[Mac.Enc. 280] *Citrus medica* (L.), Citron, Citrus Tree; a species of the *Citrus* genus of the *Rutaceæ* or Rue family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 782: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1654:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1654:

*De Malo Citria sive Medica, The Citron Tree.*

Line 92. *limonum*: *Limonum*.

[Flowers G.& B. 322]<sup>1733</sup> *Citrus limon* ([L.] Burm. fil.), Lemon; a species of the *Citrus* genus of the *Rutaceæ* or Rue family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 782: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1656:

*H.P.III D.* 80: *Tri.* 18.107: *Cat.Angl.* - no ref.: *Camb.* - no ref.

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1732 See also under *Citri arbor*, Cap.18, line 18.

1733 Polunin: 322.



H.P. 1656:

*Malus limonia*, *The Lemmon*.

Ray lists many species of Lemon. He says that there is no proof that the name is either Greek or Latin, but seems to come from a later century.

H.P.III D. 80:

5 additional species given.

Tri. 18.107:

A Lemon: *Limonium*, -ii, n.: [No Greek].

Line 93. *Pinguis sapor*: Fernel's third type of taste, richness, is exemplified by oil, butter and lard.

Line 95. *Salsus sapor*: Fernel's fourth type of taste, saltiness, is exemplified by common salt.

Line 97. *Austerus sapor*: Fernel's fifth type of taste, sourness, is exemplified by unripe fruits such as bitter grapes, unripe apples, pears and medlars.

Line 99. *uvæ*: *Uva*, -æ, f.<sup>1734</sup>

Etymology dubious: perhaps from *ug-va*, root *ug*,

'to be moist'; Greek ὑγρός; Latin *uvere*: cf. *umor*, *uvidus* etc: so

Corss refers it to root *ug*. Sanskrit *ugras*, 'strong': Greek ὑγιής,

'healthful'. *Uva*, -æ, f., 'a grape': in the plural 'grapes' or 'a bunch of grapes' and also of other fruits 'a bunch or cluster of fruit'.

See also Cap.12, line 39.

Line 99. *pomorum*: *Pomus*: see above Cap.4, line 12.

Line 99. *pyrorum: Pyrus*: see above Cap.4, line 145.

Line 99. *mespilorum: Mespilus*: see above Cap.12, line 91.

Line 102. *Dulcis sapor*: Fernel's sixth type of taste, sweetness, is exemplified by sugar, honey and liquorice.

Line 102. *Amarus sapor*: Fernel's seventh type of taste, bitterness, is exemplified by *Aloe*, *Absinthium*, *Centaurium minus* and *Colocynthis*.

Line 103. *Aloe*.

[Dict.Plant Names 23]<sup>1735</sup> Aloes are a genus of the *Liliaceæ* or Lily family and are tender succulents. The name is taken from the native S.African.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 452:

Linn.*Sp.Pl.* 319-323: *Syn.Meth.St.Br.* 290 (*Aloe palustris* only):

*H.P.* 1195-1196: *H.P.III* 268-269: *Tri.* 8.4: *Cat.Angl.* - no ref.:

*Camb.* - no ref.

*H.P.* 1195-1196:

13 species given, including:

*Aloe vulgaris* C.B. J.B. *vulgaris sive Sempervivum marinum*

Ger. Park. **Common Aloes.**

*H.P.III* 268-269:

Incorrect reference in the Index to Volume III.

*Tri.* 8.4:

Aloes: *Aloe*, -es, f.: Ἀλόη, -όης, f.

Line 103. *absinthium: Absinthium*: see above Cap.4, line 143.

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<sup>1735</sup> Coombes: 23.

Line 103. *centaurium minus*: *Centaurium minus*.

[C.T.& M. 352] *Centaurium pulchellum* ([Swartz] Druce),  
[*Erythræapulchella* ([Swartz] Fries), Lesser centaury; a species of  
the *Centaurium* genus of the *Gentianaceæ* or Gentian family.

B.& G.-W. 304: B.& H. 300: Linn.*Sp.Pl.* - no ref.:

*Syn.Meth.St.Br.* 286: *H.P.* 1092-1093: *H.P.III* - no ref.: *Tri.* 9.37:

*Cat.Angl.* 60: *Camb.* 52.

*H.P.* 1092-1093:

6 species given, including:

*Centaurium minus* C.B. *minus vulgare* Park. *minus flore  
purpureo & albo* J.B. *parvum* Ger. **Small purple Centory.**

*Tri.* 9.37:

Centory: *Centaurium*, -ii, n.: Κενταύριον, -ίου, n.

Line 103. *colocynthis*: *Colocynthis*.

[Flowers G.& B. 345]<sup>1736</sup> *Cucurbita maxima* (Duchesne),  
Pumpkin including Squash; a species of the *Cucurbita* genus of the  
*Cucurbitaceæ* or Gourd family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1011: *Syn.Meth.St.Br.* - no ref.: *H.P.* 642:

*H.P.III* 332: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 642:

(Tr.) I do not find a plausible reason for the name of  
*Colocynthis* in the Grammarians; for the conjectures of  
Martinius, which is given thus, that it comes from the  
words for the food of dogs, or that it moves the bowels,  
do not appeal to me.

2 species given, including:

*Colocynthis* Ger. J.B. *Colocynthis vulgaris* Park. *fructu*

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1736 Polunin: 345.

*rotundo minor* C.B. *Coloquintida*.

H.P.III 332:

5 additional species given.

Long thought to originate in the eastern Mediterranean, the group is American and has been domesticated there for at least ten thousand years.<sup>1737</sup> Other authorities suggest a lesser time of five to six thousand years.<sup>1738</sup> They have tough skins and bitter flesh, and so it is likely that it was the seeds which were first sought after, and that later forms with less bitter flesh were found to be consumed whole.

Pumpkins and squashes store well and so probably reached Europe not long after the discovery of the Americas.

They were thought to make more wholesome food than the cucumber.<sup>1739</sup> In the seventeenth century they were used mashed to bulk up bread.<sup>1740</sup> They were also eaten boiled and buttered.<sup>1741</sup> By the nineteenth century Pumpkins were used to bulk up stews in impoverished kitchens.

In the sixteenth century, the seeds were pounded in their own juice with oatmeal and the resultant mush was applied to the face. It was supposed to bleach freckles and other imperfections.<sup>1742</sup>

Κολοκύνη - a round gourd: *Cucurbita maxima*.<sup>1743</sup>

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- 1737 N.W. Simmonds, *The Evolution of Crop Plants*, 1976.  
1738 Thomas W. and David N. Whitaker, *Cucurbita: botany, cultivation and utilisation*, 1962.  
1739 Rembert Dodoens, *A Nieuwe Herball or Historie of Plants*, translated by Henry Lyte, 1578.  
1740 Nicolas Bonnefons (translated by John Evelyn), *The French Gardiner: instructing how to cultivate all sorts of fruit trees and herbs for the garden*, 1658.  
1741 John Gerard, *The Herball*, 1597; also Henry Phillips, *History of Cultivated Vegetables*, 1822.  
1742 Rembert Dodoens, *A Nieuwe Herball or Historie of Plants*, translated by Henry Lyte, 1578.  
1743 Liddell and Scott: 973.

- Line 104. *Acerbus sapor*: Fernel's eighth type, an acerbic taste, is exemplified by *Malicorium*, *Galla*, *Rhoe* and the nuts of *Cupressus*.
- Line 106. *malicorio*: *malicorium*, -ii, n.: the rind of a pomegranate.  
See Pliny, *Historia Naturalis* XXIII, vi: 57 § 107 and Petronius, *Satyricon*: 47.
- Line 106. *galla*: *Galla*, -æ, f.: Oak-apple, Gall-nut.  
Plin. XVI, vi: 9 § 26; XXIV, iv: 5. § 9.
- Line 106. *rhoe*: *Rhoe*: see above Cap.4, line 147.
- Line 106. *cupressi*: *Cupressus*: see above Cap.23, line 27.
- Line 107. *Inspidus*, ἄπινος *dictus*: Fernel's ninth and last type of taste, the negation of taste or tastelessness, is exemplified by *Cucurbita* and *Citrulus*.  
Although Ray's certainly wrote ἄπιμος, there does not seem to be such a word in Greek; the nearest is ἀπινής, 'clean';<sup>1744</sup> however, as James Longrigg suggests, he may have intended ἄπιμος, ἄπινους, 'lifeless', although I feel that this does not make such good sense here.<sup>1745</sup>
- Line 108. *cucurbita*: *Cucurbita*: see above Cap.9, line 180.

1744 ἀπινής, ἔς, (πίνας) 'without dirt', 'clean', e.g. Ath.14.661d; Liddell and Scott:189.  
[ἀπινής comes from α (negative) + πίνος ('dirt').]

1745 *ibid.*: 191.

Line 108. *citrulus: Citrus*.

[Mac.Enc. 1285] *Citrullus vulgaris* (L.), Watermelon; a species of the *Citrullus* genus of the *Cucurbitaceæ* or Gourd family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 157:

Linn.*Sp.Pl.* 1011: *Syn.Meth.St.Br.* - no ref.: *H.P.* 643:

*H.P.III* 379: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 643:

*Anguria citrullus dicta* C.B. *Citrullus folio Colocynthis secto, semine nigro, Quibusdam Anguria* J.B. *Citrullus Officinarum* Ger. *Anguria sive Citrullus vulgator* Park. ***Citruls.***

*H.P.III* 379:

Incorrect reference in the Index to Volume III.

Line 109. *in quibus tamen nobis non satisfacit*: Ray, although willing to list Fernel's categories of taste, says that they do not fully satisfy him.

Line 111. *& nonnullos etiam compositos pro simplicibus habuisse, alios gradum tantum diversos pro specie distinctis*. Ray believes that other scholars have either simplified or over-elaborated the degrees of taste.

Line 112. *in Scholis*: lit. 'in the schools', i.e. 'among scholars', 'in scholarship' or 'in the universities'.

Line 113. *sexdecim minimum simplicium saporum species diversas animadvertit & distinxit*. Ray again cites Nehemiah Grew, saying that Grew has differentiated sixteen types of simple tastes, which he then lists.

Lines 115-139. *Primo sapor amarus qualis in Absinthio sentitur .....nec seorsum & ab aliis omnibus separati existere.* Grew's list of tastes is briefly as follows:

- 1 Bitter - line 115
- 2 Sweet - line 115
- 3 Acid - line 116
- 4 Salty - line 116
- 5 Hot - line 116
- 6 Cold - line 117
- 7 Aromatic - line 118
- 8 Nauseous or  
malignant - line 123
- 9 Vapid - line 125
- 10 Oily - line 126
- 11 Penetrating - line 127
- 12 Stupefying - line 129
- 13 Astringent - line 132
- 14 Pungent - line 132
- 15 Intermittent - line 134
- 16 Fluctuating - line 136

Line 115. *Absinthio: Absinthium:* see above Cap.4, line 143.

Line 116. *Caryophyllis: Caryophyllus:* see above Cap.11, line 16.

Line 121. *Euphorbium:* see above Cap.24, line 90.

Text page 48.

Line 124. *Rhabarbaro: Rhabarbarum.*

[Mac.Enc. 1036] *Rheum rhaponticum*, Rhubarb; a species of the *Rheum* genus of the *Polygonaceæ* or Dock family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 379:

Linn.*Sp.Pl.* 372: *Syn.Meth.St.Br.* - no ref.: *H.P.* 170 / 171 / 1077:

*H.P.III* - no ref.: *Tri.* 13.163: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 170: *Officinarum:*

*Rhabarbarum* Alpin.exot. *Rha verum Dioscoridis* Ger.  
*Hippolapathum maximum rotundifolium exoticum, sive Rha*  
*Ponticum Thracium, sed verius Rhabarbarum verum* Park.

**True Rubarb.**

*H.P.* 171: *Monachorum S. Patientia:*

*Hippolapathum sativum* Ger. *Hippol. latifolium* C.B. *Lapathum*  
*majus sive Rhabarbarum monochorum* J.B. *Lapathum sativum*  
*sive Patientia* Park. **Monks Rubarb or Garden Patience.**

*H.P.* 1077: *lanuginosum:*

*Rhabarbarum lanuginosum, sive Lapathum Chinense*  
*longifolium* Munting. *Rhabarbarum* J.B. *Rhabarbarum I. seu*  
*Officinarum* C.B. *item II. quod Matthiolus pingit ejusdem.*

*Tri.* 13.163:

Rubarb: *Rhabarbarum*, -i, n.: 'Ρῆον, -ου, n.

Line 124. *Aloe:* see above Cap.24, line 102.

Line 128. *Cucumeris agrestis: Cucumer agrestis.*

See above under Cucumer Cap.15, line 34.

*H.P.* 647:

*Cucumis sylvestris sive asininus* J.B. *Syl. asininus dictus* C.B.  
*agrestis sive asininus* Park. *asininus* Ger. **Wild Cucumber.**



Line 129. *Hellebori nigri: Helleborus niger*: see above Cap.3, line 35.

Line 132. *Gallis*: see *galla* above Cap.24, line 106.

Line 134. *Dracontii: Dracontium*: see above Cap.3, line 46.

Line 136. *Pyrethro: Pyrethrum*: see above Cap.24, line 90.

Line 137. *Verum hæ duæ ultimæ species nobis potius Affectiones saporum videntur*: Ray says that he rather believes numbers 15 and 16 to be 'the acquisition' of tastes, that is additional impressions of tastes over and above the actual tastes themselves.

Line 140. *Sapores compositi numerosissimi sunt*: he now qualifies the previous statement which implied 'composite' tastes.

Line 142. *Ex innumeris fere saporum conjunctionibus ..... sex tantum (quod novimus) nomina imposita sunt*: he lists the only six words used of composite tastes, as far as he knows, blaming this small number on the lack of descriptive words in Latin [*ob linguæ Latinæ egestatem & inopiam verborum*].

Composite tastes may thus be described as:

'Harsh, sour, sharp, briny, alkaline and nitrous'.

Line 145. *plerique saporibus simplicibus annumerari solent, verum admodum improprie*: he repeats that these are 'composite' or 'complex' tastes, although they are usually regarded as 'simple'.

Lines 147-155. *Austerus ex adstringenti & amaro compositus ..... Nitrosus vocatur Salsus cum pungenti & frigido concurrens*. Ray's reasons for these six tastes being composite.

Line 149. *Omphacio: Omphacium*, -ii, n.: = 'Ομφάκιον, the oil or juice of unripe olives or grapes. Plin. 12, 27, 60 § 130; 14, 16, 18 § 98.<sup>1746</sup>

Line 151. *Zedoariæ: Zedoaria*.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 3: *Syn.Meth.St.Br.* - no ref.:

*H.P.* 1339 / 1912: *H.P.III* 648: *Tri.* - no ref.: *Cat.Angl.* - no ref.:

*Camb.* - no ref.

Linn.*Sp.Pl.* 3:

*Kaempferia foliis lanceolatis petiolatis* Fl.zeyl.9. Mat.med.9.

*Zedoaria rotunda*. Bauh.pin.31.

*Habitat in India*.

*H.P.* 1339:

*De Zedoaria, quæ forte ad Arundinis, forte ad Cyperi genus pertinet.*

4 species given, including:

*Zedoaria longa* C.B.

*Zedoaria rotunda* C.B.

*H.P.III* 648:

Listed under plant anomalies: 5 additional species given.<sup>1747</sup>

Line 151. *Millefolii: Millefolium*: see above Cap.9, line 33.

Line 151. *Contrayervæ: Contrayerva*.

[C.T.& M. 592] *Cyperus longus* (L.), Galingale; a species of the *Cyperus* genus of the *Cyperaceæ* or Sedge family.

B.& G.-W. - no ref.: B.& H. 478: Linn.*Sp.Pl.* 121:

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1746 Lewis and Short: 1265.

1747 cf. entry below on *Galanga* Cap.24, line 183.

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1339: *H.P.III* 647: *Tri.* - no ref.:  
*Cat.Angl.* - no ref.: *Camb.* 59.

*H.P.* 1339:

*Drakenaradix* Ger. *Contrayerva Hispanorum sive Drakena radix*  
*Clusii* Park. *Drakenaradix* J.B. *item Contrayerva radix* ejusdem  
*Cyperus longus inodorus Peruanum* C.B. *item Cyperus longus*  
*odorus Peruanus* ejusdem.

*H.P.III* 647:

*Ad cap.de Drakena radice seu Contrayerva Officinarum: de*  
*Contrayerva seu Dodo Dr. Georgii Camelli S.J. Observationes.*

Line 152. *Ari: Arum:* see above Cap.3, line 35.

Line 155. *Differunt præterea Sapores variis modis:* Ray further distinguishes taste into three other qualities: in respect of degrees [*respectu graduum*], in respect of duration [*respectu durationes*], in respect of the subject which they affect [*respectu subjecti quod afficiunt*].

Lines 158-237. *Differunt sapes in unaquaque specie respectu graduum ..... prout eam revera esse etiam experientia didici.*

A lengthy explanation of these three qualities of taste with many examples.

Lines 158-163. *Respectu graduum:* in respect of degrees of taste.

Line 160. *Cucurmæ: Curcuma:* see under *Cucumer* above Cap.15, line 34.

Line 160. *Gentianæ: Gentiana:* see above Cap.7, line 51.

Line 160. *Cardui benedicti: Carduus benedictus.*

[C.T.& M. 486] *Cnicus benedictus* (L.), Blessed Thistle; a species of the *Cnicus* genus of the *Compositæ* or Daisy family.

B.& G.-W. - no ref.: B.& H. - no ref.: Linn.*Sp.Pl.* 826:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 303: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 303:

In the section on Thistles distinguished by their yellow flowers:

*Carduus benedictus* J.B. Ger. Park. *Cnicus sylvestris hirsutior*

*sive Carduus benedictus* C.B. **Holy Thistle.**

Line 161. *Clematidis peregrinæ: Clematis peregrina.*

C.T.& M. 38: B.& G.-W. 112: no reference in either of these to this particular species. *Flowers G. & B.* 236.226:1748

B.& H. 2 - no reference to this species: Linn.*Sp.Pl.* 544:

*Syn.Meth.St.Br.* 258 - no reference to this species: *H.P.* 621:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*Flowers G. & B.* 236.226:

*Clematis cirrhosa* (L.), Virgin's Bower; a species of the

*Clematis* genus of the *Ranunculaceæ* or Buttercup family.

Linn.*Sp.Pl.* 544:

*Clematis cirrhosa:*

*Clematis cirrhos scandens.* Hort.cliff.226. Roy.lugdb.487.

*Clematis peregrina, foliis pyri incisis.* Bauh.pin.300.

*Clematis altera bætica.* Clus.hist.1.p.123.

*Clematis peregrina, foliis pyri incisis: nunc singularibus, nunc ternis.* Tournes.cor.20.

*Habitat in Bætica Arbores operiens & deprimens.*

H.P. 621:

*Clematis Bætica* Ger. *Bætica Clusio* J.B. *sylv. altera Bætica*  
Park. *peregrina, foliis pyri incisis* C.B.

Lines 164-201. *Respectu durationis*: in respect of duration of tastes.

Line 164. *Quemadmodum enim morborum ita & Saporum quatuor tempora sunt, seu motus termini, nimirum Principium, Augmentum, Status & Declinatio*. Ray compares the progress of tastes to that of diseases.

Line 168. *in pulverem tenuissimum reducantur*: Ray believes that, in order to evaluate the different durations of taste, a hard substance must first be reduced to a powder. This makes sense because a dry solid cannot be tasted; saliva is needed to help taste sensations be detected by the sense receptors or taste buds lying grouped around papillæ on the surface of the tongue.<sup>1749</sup>

Lines 170-181. *Principium voco* ..... : in this paragraph Ray discusses the beginning of a taste sensation, comparing the length of time before the bitterness and heat of various tastes begins.

Line 171. *Acetum*: 'sour': often used of 'sour wine' or 'vinegar'.

Line 172. *Absinthium*: see above Cap.4, line 143.

Line 174. *Clematidis peregrinæ*: *Clematis peregrina*.  
See above Cap.24, line 161.

Line 176. *Rosarum*: *Rosa*: see above Cap.9, line 22.

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<sup>1749</sup> *Harrap's Dictionary of Medicine and Health*: 382.

Line 177. *Hellebori nigri*: *Helleborus niger*: see above Cap.3, line 35.

Line 180. *Enulæ*: *Enula*.

[C.T.& M. 460] *Inula helenium* (L.), Elecampane; a species of the *Inula* genus of the *Compositæ* or Daisy family.

B.& G.-W. 402: B.& H. 233: Linn.*Sp.Pl.* 881-884:

*Syn.Meth.St.Br.* 176: *H.P.* 273: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 95-96: *Camb.* 61.

*H.P.* 273:

*Enula* i.e. *Helenium*. The index to *Historia Plantarum* gives page 353, which is incorrect, but the index reference under *Helenium* itself is correct, i.e. page 273.

*Helenium* Ger. *vulgare* C.B. *Helenium sive Enula campana*

Park. J.B. *Elecampane*.

Lines 182-186. *Augmentum appello* ..... : next he discusses the development time of various tastes.

Line 183. *Galangæ*: *Galanga*.

No reference in any of the modern sources to this as a plant, but see Linnæus *Species Plantarum* and Ray *Historia Plantarum*.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 2: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1337:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

Linn.*Sp.Pl.* 2:

*Galanga*:

*Kæmpferia foliis ovatis sessilibus*. Fl.zeyl.8. Mat.med.3.

*Kæmpferia*. Hort.cliff.2.t.3. Roy.lugdb.12.

*Wanhom*. Kæmpf.amoen.901.t.902.

*Habitat in India*.

*Kæmpferia foliis lanceolatis petiolatis*. Fl.zeyl.9. Mat.med.9.

*Zedoaria rotunda*. Bauh.pin.31.

*Habitat in India.*

H.P. 1337.:

*De Galanga, quæ ad Iridis genus pertinere videtur.*

*Galanga minor* Ger. J.B. C.B. Park.

*Galanga major* J.B. C.B. Ger. Park.

Line 184. ἀκμήν: probably Ray is again using this Greek word as a direct translation of the English 'acme'.<sup>1750</sup>

Line 184. *enulæ: Enula*: see above Cap.24, line 180.

Line 185. *Hellebori nigri: Helleborus niger*: see above Cap.3, line 35.

Line 187. *Status, seu spatium* ..... : the length of time a taste persists in its full form is now discussed. Ray again uses the Greek word ἀκμήν.<sup>1751</sup>

Line 188. *Helleborastri: Helleborastrum*: see above Cap.3, line 53.

Line 189. *Nasturtii hortensis: Nasturtium hortense*: see above Cap.14, line 10.

Line 189. *Asari: Asarum*: see above Cap.12, line 33.

Line 191. *Declinatio* ..... : lastly he discusses the length of time it takes for a taste to decline. In this paragraph he differentiates between the bitterness and heat of the various substances tasted, qualifying them by degree; for example, he says that the leaves of *Millefolium* are bitter in the fourth degree but only hot in the first and yet the heat

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1750 Cf Chapter 23, line 43.

1751 Cf notes above at Chapter 23, line 43 and Chapter 24, line 184.

lasts longer than the bitterness.

Line 192. *Millefolii: Millefolium:* see above Cap.9, line 33.

Line 193. *Calamus aromaticus.*

[C.T.& M. 582] *Acorus calamus* (L.), Sweet Flag; a species of the *Acorus* genus of the *Araceæ* or Arum family.

B.& G.-W. 470: B.& H. 421: Linn.*Sp.Pl.* 324:

*Syn.Meth.St.Br.* 437: *H.P.* 1313: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1313:

*Acorus verus sive Calamus Officinarum* Park. *verus, sive Calamus aromaticus Officinarum* C.B. *verus, Officinis falso Calamus* Ger. *Calamus aromaticus vulgaris, multis Acorum* J.B.  
***The Sweet-smelling Flag, or Calamus.***

Text page 49.

Line 195. *Contrayervæ: Contrayerva:* see above Cap.24, line 151.

Line 196. *Gialappæ: Gialappa.*

No reference to this as a plant in any of the sources. Is this another spelling for *Jalappa*? See below Cap.24, line 225.

Line 197. *Nasturtii fiortensis: Nasturtium hortense:* see above Cap.14, line 10.

Line 197. *cucumeris agrestis: Cucumer agrestis:* see above Cap.24, line 128.

Line 197. *Euphorbiü: Euphorbium:* see above Cap.24, line 90.

Line 198. *Hellebori nigri: Helleborus niger:* see above Cap.3, line 35.



Line 198. *Ari: Arum*: see above Cap.3, line 35.

Line 200. *Adeo ut augmentum rarius ultra 4. aut sex minuta a contactu primo extenditur, at declinatio ad 30, 40, aut etiam plura.*

He concludes this section by stating that the decline of a taste lasts far longer than its development.

Lines 202-237. *Differunt Sapores respectu subjecti seu sedis seu partis illius corporis quam præcipue afficiunt*: in respect of the subject which the tastes affect.

Line 203. *vel fixi, vel mobiles*:

Ray further divides this section into 'fixed' or 'mobile'.

Line 204. *Fixus sapor dicitur .....*

He begins by defining a 'fixed' taste as one which always affects the same part, for example the tip or root of the tongue.

Line 206. *Mobilis est vel diffusivus, vel transitivus.*

He then defines a mobile taste as 'diffuse' or 'transitory'.

Line 207. *Diffusivum voco .....*

He begins by defining 'diffusive', with examples, as one which spreads gradually into neighbouring parts but does not leave the part originally affected.

Line 208. *Hellebori nigri: Helleborus niger*: see above Cap.3, line 35.

Line 209. *Cucumeris agrestis: Cucumer agrestis*: see above Cap.24, line 128.

Line 211. *Sapor transiens dicitur* .....

He defines a 'transient' or 'transitory' taste as one which after a very short while leaves the part originally affected to affect another part.

Line 212. *Gentianæ: Gentiana:* see above Cap.7, line 51.

Lines 213-214. *Partes illæ quas modis prædictis sapes afficiunt* .....

*Labia, Lingua, Palatum, Fauces, Gula.*

Next Ray lists the parts affected by tastes, which he says can be said to be 'the seats and organs of taste'.

Line 215. *Labiis radix Hellebori albi* .....

Ray now begins working through the above list in more detail, starting with the effect of taste on the lips.

Line 215. *Hellebori albi: Helleborus albus.*

[B.& G.-W. 452] *Veratrum album* (L.), White false Hellebore; a species of the *Veratrum* genus of the *Liliaceæ* or Lily family.

C.T.& M. - no ref.: B.& H. - no ref.: Linn.*Sp.Pl.* 1044:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 168: *H.P.III* 114: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 168:

(Tr.) .... its fibrous root, which is endowed with the power to cleanse, to be emetic and to cause sneezing.

*Helleborus albus* Ger. J.B. *albus vulgaris* Park. *albus flore subviridi* C.B. **White Hellebore.**

*H.P.III* 114:

1 additional species given.

Line 215. *Pyrethri: Pyrethrum:* see above Cap.24, line 90.

Line 217. *Linguam tribus præcipue in locis sapes afficiunt.*

Ray begins a discussion of the parts affected by taste with three areas of the tongue.

Line 218. *Cucumeris agrestis: Cucumer agrestis:* see above Cap.24, line 128.

See above line 209.

Line 218. *Gentianæ: Gentiana:* see above Cap.7, line 51.

This is a somewhat contradictory statement by Ray, as at line 212 above he says that 'the bitterness of *Gentiana* passes from the tip of the tongue to its middle part immediately' implying that there is some sensation of its taste at the tip, if only momentary; here he says that although the taste of *Gentiana* is strong in the middle of the tongue, it is not felt on the tip of the tongue at all.

Line 218. *Colocynthisidis: Colocynthis:* see above Cap.24, line 103.

Line 221. *Palato radix Solani lethalis .....*

He continues with the effect of taste on the palate and the duration of this taste.

Line 221. *Solani lethalis: Solanum lethale.*

[C.T.& M. 366] *Atropa bella-donna* (L.), Dwale, Deadly Nightshade; a species of the *Atropa* genus of the *Solanaceæ* or Potato family.

B.& G.-W. 348: B.& H. 319: Linn.*Sp.Pl.* 181:

*Syn.Meth.St.Br.* 265: *H.P.* 679: *H.P.III* 360: *Tri.* - no ref.:

*Cat.Angl.* 276-277: *Camb.* 114.

H.P. 679:

*Solanum lethale* Park. Ger. *melanocerasos* C.B. *Sol. manicum*  
*multis sive Bella Donna. Deadly Night-shade.*

H.P.III 360:

4 additional species given.

Line 223. *Fauces seu Guttur saporum non raro sedes est.*

Ray's next part affected by taste is the throat or pharynx, which he says is often affected by tastes which do not make any impression on the tongue and other parts listed.

Line 225. *Bellidis minoris: Bellis minor.*

[C.T.& M. 470] *Bellis perennis* (L.), Daisy; a species of the *Bellis* genus of the *Compositæ* or Daisy family.

B.& G.-W. 394: B.& H. 229: Linn.*Sp.Pl.* 886-887:

*Syn.Meth.St.Br.* 184: H.P. 349: H.P.III - no ref.: *Tri.* 10.59:  
*Cat.Angl.* 38: *Camb.* 47.

H.P. 349:

(Tr.) *Bellis* is believed to have been so-called by the Latins from the beautiful or pretty colour of the flowers; it is not named by the ancient Greeks; this is remarkable since it seems to be as common in Greece as amongst us in England.

Two plants of different genus are known by this name. We deal here in this place with the smaller one, whose characteristics are a radiate flower with barbs or marginal leaves of different colour from the middle disc: a stem bare of leaves, which is not branched.

6 species given, including:

*Bellis sylv. minor* C.B. *minor sylv. simplex* Park. *minor 4. sive sylvestris* & *5. sive sylvestris altera* Ger. *minor sylv. spontanea*  
J.B. **Common Wild Daisie.**

Tri. 10.59:

Daisie: *Bellis, -idis, f.:* [No Greek].

Line 225. *Chelidonii minoris: Chelidonium minus:* see above Cap.3, line 70.

Line 225. *Jalappæ: Jalappa.*

[Mac.Enc. 639] *Ipomœa purga*, Jalap; a species of the *Ipomœa* genus of the *Convolvulaceæ* or Bindweed family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 177: *Syn.Meth.St.Br.* - no ref.: *H.P.* 724:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 724:

*Convolvulus Americanus Jalapium dictum. Mechoacanna nigricans* C.B. J.B. *Jalapium* Ger. **Jalap.**

Line 225. *Mercurialis: Mercurialis:* see above Cap.10, line 123.

Line 226. *Asparagi: Asparagus:* see above Cap.3, line 89.

Line 228. *Pyrethri: Pyrethrum:* see above Cap.24, line 90.

Line 228. *Gentianæ: Gentiana:* see above Cap.7, line 51.

Line 230. *Postremo, Saporis voce latissime accepta Gula quoque seu Œsophagus ejusdem sedes seu subjectum (ut vocant) esse potest.*

Ray's final affected part is the gullet or œsophagus, which he says

may be affected by a taste originating on the tip of the tongue.

Line 231. *Absinthii vulgaris: Absinthium vulgare:* see above Cap.4, line 143.

Ray believes a mere taste of the root of *Absinthium* to be beneficial for the stomach, with no juice actually being swallowed, but not its leaves which affect the head.

Line 238. *Quæ de Saporum causis Autor noster habet .....* : i.e. Grew.

Ray refers the reader to Grew's own work for the causes of tastes.

Line 240. *Cæterum Saporum in plantis diligens & curiosa observatio .....* :

Ray continues with a discussion on the relative merits and qualities of known plants, believing that ones not yet discovered and studied may have similar powers.

Line 243. *Jalappa, Mercurialis & Bellis.*

He says that it would be reasonable to assume that other plants affecting the pharynx in the same way as these three would have similar purging qualities.

Line 243. *Jalappa:* see above Cap.24, line 225.

Line 243. *Mercurialis:* see above Cap.10, line 123.

Line 243. *Bellis:* see above Cap.7, line 5.

Line 247. *Deinde in plantis ejusdem generis .....*

Ray then gives the contrary opinion, that plants of the same family, but with different tastes, would have different powers.

Line 248. *Rhabarbarum a reliquis Lapathis: Rhabarbarus:* see above Cap.24, line 124; *Lapathus:* see above Cap.8, line 37. Both are, as Ray says here, members of the same family (*Polygonaceæ*).

Line 249. *Interest quoque plurimum in diversis ejusdem plantæ partibus saporum differentias observare.*

Ray now adds a comment that it must be noted that different parts of a plant may have different tastes.

Line 250. *Sic v.g. cortex arboris Sassafras .....*

He discusses first the *Sassafras* tree believing that its bark is three times as strong as its wood; using this argument he believes that the bark of other trees will also be stronger than their wood.

Line 250. *Sassafras.*

[Trees B & N.E.169]<sup>1752</sup>*Sassafras albidum*, *Sassafras*; a species of the *Sassafras* genus of the *Lauraceæ* or Laurel family.

C.T.& M.- no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 371: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1568:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1568:

*Sassafras* Ger. Park. *Sassafras sive lignum Pavanum* J.B. *Sass.*

*Arbor ex Florida Ficulneo folio* C.B. *Anhuiba seu Sassafras*

*major* Piso. ***The Sassafras-tree.***

Line 251. *Santali: Santalum.*

[Mac.Enc. 1073] *Santalum* (L.), the Sandalwood genus of trees; *Santalum album* (L.), the true Sandalwood; a species of the *Santalum* genus of the *Santalaceæ* or Sandalwood family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

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<sup>1752</sup> Mitchell and Wilkinson: 169.

Linn.*Sp.Pl.* 349: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1804-1805:  
*H.P.III* - no ref.: *Tri.* 17.77: *Cat.Angl.* - no ref.: *Camb.* - no ref.  
*H.P.* 1804-1805:

*De Santalo, Saunders:*

*Santalum citrinum* Park. J.B. *pallidum* Ger. C.B.

**Yellow Saunders.**

*Santalum rubrum* J.B. C.B. Ger. Park. **Red Sanders** [sic].

*Tri.* 17.77:

Saunders: *Santalum*, -i, n.: [No Greek].

Line 251. *Ligni Rhodii: Lignum Rhodii / Ligni Aloes: Lignum Aloes.*

Ray includes these two plants in the same section of *Historia Plantarum* on page 1808.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:  
Linn.*Sp.Pl.* 708 / 709 / 722 / 723 - none called *Lignum Aloes* or  
*Lignum Rhodii* ( p.711-713, 13 species given, but none called  
*Agallochum* or *Oleaster*): *Syn.Meth.St.Br.* - no ref. - the only  
*Oleaster* given (on page 445) is *Germanicus*, an alternative name for  
Sallow-thorn or Sea Buck-thorn, but it is not given any of the other  
names from *H.P.* as listed below: *H.P.* 1808: *H.P.III* - no ref.:  
*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1808:

*Agallochum Officinarum* C.B. *Lignum Aloes* Park. *Lignum Aloes Officinarum & Agallaochum plerisque putatum* J.B.

*De Aspalatho:*

He considers whether this wood is the one given the name by botanists of *Lignum Rhodii* or *Oleaster*.

*Lignum Rosæ odore, aliis Lignum Thuriis, aliis Aspalathus* J.B.  
*Aspalathus colore Buxi* C.B. *item Aspalathus albicans torulo citreo ejusdem.*

*Aspalathus rubeus* C.B. *Aspal. Rhodius rubens, odoratiss* J.B.



Is Ray using the term *lignum* as in *lignosus*? In John Hutchinson's system of classification, *Lignosæ* are a subgroup of the dicotyledons into which the predominantly woody families are placed. The predominantly herbaceous plants are placed in the *Herbaceæ*. The division is considered unnatural by most taxonomists as it separates certain families generally thought of as closely related, e.g. the woody *Verbenaceæ* from the herbaceous *Labiataæ*.<sup>1753</sup>

Line 252. *Nonnullarum etaim partium ejusdam plantæ ..... : he adds that some parts of a particular plant may be more pleasing to the taste buds than others, giving as an example the pleasure given by the flowers of *Carduus Benedictus* as opposed to its leaves.*

Line 254. *Cardui benedicti: Carduus benedictus: see above Cap.24, line 160.*

Line 254. *in catal. plant. Cantabrig.: Ray is referring here to his first botanical publication *Catalogus Plantarum circa Cantabrigiam nascentium* (A Flora of Cambridgeshire), published in 1660.*

Line 257. *Observatu quoque dignum est quomodo plantarum sapes & facultates conservando ..... : he is correct in saying that the flavour of a plant is weakened or lost by preservation, drying or cooking; for example, the flavour of culinary herbs is less after drying and gradually, after time and exposure to light, loses even more flavour.*

Line 259. *Ari: Arum: see above Cap.3, line 35.*

Line 263. *Euphorbio: Euphorbium: see above Cap.24, line 90.*

Line 264. *Autor noster..... ::* i.e. Grew. Ray here gives Grew's opinion that since the taste of a plant is felt in one part of the mouth but not another, it follows that it might affect one part of the body and not another.

Text page 50.

Line 271. *in Latinum versa huc transferre non piguit:* Ray considered Grew's ideas to be of sufficient importance to translate them into Latin, the universal language of scholarship at the time, so that they would be available to all.

**Chapter Twenty-five:**  
*On the position of plants.*

In this chapter, half of which is concerned with mountainous or alpine plants, Ray discusses habitat and ecology. The habitat of a plant is the area in which it lives; this includes the topographic, biotic (regional terrestrial communities such as the tundra), soil and climatic factors. Ecology is the study of the relationships between plants and their environments.<sup>1754</sup> As Gibbons, echoing Ray, says, 'The broad characteristics of the vegetation are determined largely by climate as affected by latitude, altitude and more local factors'.<sup>1755</sup>

Text page 50.

- Line 1. *Plantæ loci respectu dividi possunt in eas ..... : Ray begins by dividing habitats into three basic types.*
- Line 1. *Quæ certo alicui loco aut sedi ita adstrictæ sunt ..... : his first category demonstrates that some plants can only exist in one type of environment. For example, one plant may act as host to another, as in the case of Mistletoe cited here; his second example of a restricted habitat is that of undersea plants, although he gives no examples. Underwater plants are now known as hydrophytes.<sup>1756</sup>*
- Line 2. *Viscus arboreus: see above under Viscus, Cap.18, line 195.*
- Line 2. *Submarinæ omnes: literally 'all undersea plants'.*
- Line 4. *Quæ quamvis locum aliquem peculiarem affectent ..... : he next discusses plants which will accept transplantation.*

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<sup>1754</sup> *Penguin Dictionary of Botany: passim; Lawson's Botany: 595-636.*

<sup>1755</sup> *Gibbons: 127.*

<sup>1756</sup> *Lowson's Botany: 619.*

Line 7. *Quæ plurimum locorum communes sunt .....* : thirdly he mentions those plants which are happy in almost any soil and climate.

Line 8. *Secundum genus multas admittit subdivisiones cæli, solique respectu:* as Ray says, varying climate and soil conditions favour the growth of different plants, and thus varying types of plant communities develop, such as those of deciduous woodland, chalk grassland, salt marshes, sand-dunes, lakesides etc..<sup>1757</sup>

Line 11. *De loco plantarum cæli respectu observavimus quod quo ad Meridiem & Solis cursum propius accedas .....* : here he comments on the increasing number of species to be found towards the equator.

This can be seen in the varying types of forest. Cold forests have 'relatively few types of tree, mainly fir, pine and spruce with some deciduous birches and larches'.<sup>1758</sup> Temperate forests, where there is a marked seasonal variation, consist of a good range of broad-leaved deciduous trees.<sup>1759</sup> Tropical rain forests have the greatest variety of trees because they 'have regular heavy rain, constantly high temperatures, and therefore prolific plant growth. Rain forest regions, such as the Amazon basin and the Malay-Indonesian region, contain thousands of different species'.<sup>1760</sup>

Line 14. *Cui accedit, quod juga, vertices aut etiam latera montium in regionibus calidis .....* : as Ray has observed there is a similarity between a southern mountain habitat and that of more northern temperate zones.

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<sup>1757</sup> *Lowson's Botany:* 601-605.

<sup>1758</sup> *Penguin Dictionary of Botany:* 140.

<sup>1759</sup> *ibid.*

<sup>1760</sup> *ibid.*

Line 18. *Deinde multæ plantæ quæ in frigidis & Septentrionalibus regionibus Fruticum modum non excedunt:* as Ray says there can be a marked difference in the size of plants between cold northern regions and warm southern ones. For example, at the upper limit of the tree-line in northern areas, the trees become stunted in growth, and above the tree-line dwarf carpeting shrubs and alpine species replace the trees, becoming even smaller the higher (and thus colder) one goes.<sup>1761</sup> Wind action and layers of snow also discourage plants from growing taller.<sup>1762</sup>

Line 21. *Tandem in regionibus calidis multæ observantur herbarum species fruticescentes:* to complete his discussion of his second category, Ray adds that in hot regions many herbaceous plants produce fruit, implying that they do not usually do so in a more temperate climate.

Line 21. *Sempervivi majoris: Sempervivum majus.*

See below under *Sempervivum* Cap.27, line 57.

Ray heads the section on *Sedum* in *Historia Plantarum*, pages 687-688, with the following:

*De Sedo seu Sempervivo majore:*

6 species given, including:

*Sedum majus vulgare* C.B. J.B. Park. *Sempervivum majus*

Ger. **Houseleek.**

Line 22. *Althææ: Althæa:* see above Cap.9, line 120.

Line 22. *Malvæ: Malva:* see above Cap.12, line 43.

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1761 Grey-Wilson and Blamey, *Alpine Flowers*: 7.

1762 Moggi: 43.

Line 22. *Tithymali: Tithymalus*: see above Cap.4, line 23.

Line 22. *Scabiosæ: Scabiosa*: see above Cap.7, line 19.

Line 23. *Respectu situs sublimioris aut humilioris in eadem regione observavimus .....* : Ray implies here that there are more species of plant in high mountainous regions than in lowland ones. This is not, in fact, true since in cold regions above the tree-line there is, as Grey-Wilson says, 'a poorer flora as regards numbers of species, but a much more highly specialised one'.<sup>1763</sup> Huxley gives the following approximate numbers of species for various heights in Switzerland showing the decrease with altitude:

120 species exceed 3,000 metres

12 species reach 3,500 metres

6 exceed 3,900 metres.<sup>1764</sup>

Line 25. *Alpes certe quæ Italianam & Galliam Germaniamque disterminant*:

it is odd that Ray describes this area without mentioning the Swiss federation, which had its origins in 1291 with the union of Uri, Schwyz and Nidwalden, being virtually independent of the Holy Roman Empire by the end of the fifteenth century. In the sixteenth century it was an important centre of the Reformation and in 1648, at the end of the Thirty Years' War, was recognised by the rest of Europe as an independent state.<sup>1765</sup> Thus, by the time Ray was travelling in Europe and writing *Historia Plantarum*, it had been a nation state for many years.

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<sup>1763</sup> Grey-Wilson and Blamey, *Alpine Flowers*: 7.

<sup>1764</sup> Huxley: 15.

<sup>1765</sup> H.A.L.Fisher, *A History of Europe*, Edward Arnold (Publishers) Ltd., London 1936, reprinted 1957: 340-344.

Line 27. *Nec ullus fere vertex excelsior est ..... quam in paris altitudinis & naturæ verticibus inveniendas producat.* Ray is not quite accurate here, as similarity of conditions can, but does not necessarily, mean that a particular species will be found there.<sup>1766</sup>

Line 28. *Quin & altissimos omnium montes ..... :* Ray had spent a considerable part of 1665 in Switzerland, so would have had much opportunity for studying alpine flora.

Line 30. *Hæc specierum diversitas soli differentiæ:* certainly soil type can dictate the species growing there. Grey-Wilson says that:

Some plants occur in a variety of different habitats, (e.g. meadows, open woodland and rocky places) while others are very specific (e.g. limestone rocks). Knowing the rock or soil type may help to separate closely related plants, especially in genera such as the Gentians, Primroses, Rock-jasmines and Saxifrages'.<sup>1767</sup>

Moggi elaborates on this:

Alpine plants are very sensitive to the type of ground in which they grow. Such factors as depth of soil, degree of moisture, chemical composition of the soil (the degree of acidity or silica content), the size and composition of the soil particles, give rise to numerous types of montane soil, each with its own distinctive vegetal characteristics and typical plant associations.<sup>1768</sup>

Line 31. *Si enim montes terræ motibus originem suam debent:* Ray next discusses Hooke's theory on the origin of mountains.

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1766 *Lowson's Botany:* 596.

1767 Grey-Wilson and Blamey, *Alpine Flowers:* 14.

1768 Moggi: 32.

The process of building major mountain chains is now called orogenesis; this includes folding, faulting and thrusting, resulting from the collision of two continents, which compresses the sediment between them into mountain chains. Examples of such mountain ranges are the Alps, Himalayas and Appalachians.<sup>1769</sup>

Line 32. *Hookii*: Robert Hooke, 1635-1703.

Although this is the first mention of Hooke by name in *Historia Plantarum*, for biographical details see above at Cap.3, line 84, where I have discussed his life and work in the section on microscopes.

Line 32. *materiam eructatam e visceribus terræ, & in montes aggestam, non in omnibus verticibus imo nec in eodem uniformem esse ..... unde nil mirum si diversas plantarum species producat.* Ray has realised that the geology of the land does affect the type of plant growing there. For example, limestone is usually richer in species than acid rocks such as granite, sandstone, gneiss, schist etc., although the latter have many specialised species. In many cases there are paired species, similar equivalents, one of which is lime-loving and one lime-hating.<sup>1770</sup>

Line 35. *Observavimus insuper Plantas montanas omnium sui generis plerunque maximas esse:* a strange statement, since mountain plants tend to be stunted in growth in comparison with their relatives growing in lower areas. See note above at line 18.

Lines 35-36. *& pulcherrimos flores edere:* Ray continues with a discussion of mountain flowers, which are, as he says, very beautiful, and also

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<sup>1769</sup> Alan Isaacs, John Daintith and Elizabeth Martin (Eds.), *The Concise Science Dictionary*, Oxford University Press, Oxford 1984: 495; *Mac.Enc*: 908.

<sup>1770</sup> Huxley: 14.



often very large in relative to their parent plant.<sup>1771</sup> Is this what he means by saying, in line 35, that 'mountain plants' are very large?

Because of their short reproductive cycle, mountain flowers tend to have either large brightly coloured flowers or large clusters of flowers to ensure rapid pollination and thus enable seed formation to take place quickly.<sup>1772</sup>

Line 37. *Quod tanta soli fertilitas dicam an luxuria nivibus imputanda sit:* Ray attributes the fertility of alpine soils to the snow. The snow in a nutritional sense is no more beneficial than rain water, but it does have an effect on the growth pattern of mountain plants. Snow covers the plants with a thick blanket, which helps to maintain the ground beneath at a favourable temperature, and so, when the snow melts, the plants are able to spring back to life very quickly; that is, their reproductive processes are already well advanced.<sup>1773</sup>

The 'fertility and richness' attributed by Ray to snow should instead be attributed to the remarkable ability of alpine plants to photosynthesise in a way which produces soluble sugars instead of starch, which is an insoluble sugar. These soluble sugars freeze at a considerably lower temperature than starches, thus enabling alpine plants to survive even at night temperatures of -20°C at altitudes of over 4,000 metres.<sup>1774</sup>

Line 38. *& ab injuriis cæli & frigoris vehementia defendat:* snow certainly protects plants from the extremes of temperature. Moggi states that:

In one particular locality, where the air temperature was 1.4°F (-17°C), the temperature at soil level under a 20-in (50-cm) layer of snow was found to be 30°F (-1°C), a

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1771 Grey-Wilson and Blamey, *Alpine Flowers*: 7.

1772 Moggi: 37.

1773 *ibid.*: 30.

1774 *ibid.*: 26-27.

difference of at least 29°F (16°C) between the temperature at ground level and the temperature of the air above the blanket of snow.<sup>1775</sup>

Line 39. *Ob quas rationes agricolæ etiam nostri hybernas nives ad satorum tutelam in terræ superficie aliquandiu restare exoptant.* Ray says that British farmers prefer a covering of snow as protection for their crops; see note above at line 38 on the temperature of the soil below the snow.

Line 41. *brevi temporis spatio, celerrimo auctu adeo proficiunt pascua:* as Ray says the growing season in high mountainous areas is very short sometimes only being snow free for a month in the year. The plants thus need to flower and seed in a very short space of time. Huxley has an interesting example of this:

Perhaps the most amazing record is a Norwegian observation of *Ranunculus nivalis*, which flowered five days after snow melted from the plant, and was in ripe seed seventeen days later!<sup>1776</sup>

Line 42. *ut montium juga vernantium pratorum speciem exhibeant:* mountain plants do come quickly into growth after the snows have melted as Ray says, because they have to complete their reproductive cycle in a relatively short space of time.<sup>1777</sup>

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1775 Moggi: 30-31.

1776 Huxley: 14.

1777 See notes above at lines 35-36, 37 and 41.

## Chapter Twenty-six:

### *On the division of plants according to their genus.*

In this chapter Ray voices his doubts on the feasibility of classifying all plants according to their type.<sup>1778</sup> Having listed the problems involved, Ray's final statement of this chapter, his definition of his method of plant classification, expresses one of his greatest contributions to botanical knowledge.

There had been many attempts at finding a workable classification system, as Pulteney says 'not only before, but since, the invention of systematic botany'.<sup>1779</sup> He records the following methods: plants alphabetically arranged: arranged according to the time of flowering: according to the actual place of growth: according to their virtues in medicine.<sup>1780</sup>

Up to the seventeenth century the classification system adhered to was that introduced by Theophrastus, based on trees, shrubs and herbs; although Ray did much to alter our perceptions of the classification of herbaceous plants, he still used the Theophrastian division into trees, shrubs and herbs. Up to the sixteenth century scholarly works on plants, if they were not actual commentaries on the writings of Dioscorides and Theophrastus, consisted mainly of discussions of the properties, medicinal or economic, of the plants, rather than actual characteristics and classification. Fuchs in the sixteenth century listed plants alphabetically in his *De Historia Stirpium Commentarii* of 1542; Dodoens in his *Cruydtboeck* of 1554 was beginning to attempt a

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1778 Ray uses the word *genus* here but is not perhaps using it in our modern sense for a subdivision of a plant family, rather as a synonym for 'type'. Vines [page 40] says that:

Before his time\* the word "genus" had been applied indiscriminately to every kind of plant-group ..... :the largest groups were the *summa genera*; the smaller, the *genera subalterna* or *infima*.

\*i.e. Tournefort's - published in 1694 and 1700

It is surprising that Ray does not attempt to define *genus* and *species* in his glossary at the beginning of *Historia Plantarum*.

*Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1779 Pulteney, Richard. *A General View of the Writings of Linnæus*; T.Payne and B.White, London 1781: 111.

1780 *ibid.*: 111-112.

classification system, although the groups themselves were not named. De l'Obel has a more carefully constructed classification in his *Nova Stirpium Adversaria* of 1570, which again is improved upon in Dodoens' *Stirpium Historiæ Pemptades Sex sive Libri XXX* of 1583. By 1583 and the publication of Cesalpino's *De Plantis Libri XVI* a classification based on morphological observation was being evolved; he based his classification on a division into trees and shrubs, subshrubs and herbs, these groups being sub-divided according to the nature of the fruit and the flower. In the seventeenth century the *Pinax Theatri Botanici* of Caspar Bauhin, published in 1623, contained about 6,000 plant names, but did not attempt a proper system of classification. Before Ray, in the seventeenth century Joachim Jung in his *Isagoge Phytoscopica* of 1678 had attempted to rationalise the previous attempts at classification; as Vines says:

He did not propound a system of his own, but he sought to arrive at the principles upon which a classification should be based, with the logical result that he rejected the time-honoured Theophrastian division of plants into Trees and Herbs. Though Jung failed to produce any immediate impression upon the Botany of his time, he powerfully influenced the great developments which took place in the eighteenth century.<sup>1781</sup>

That there had been much confusion in the classification of plants is emphasised by Pulteney in his *General View of the Writings of Linnæus*, in which he states that:

It is needless to urge the necessity of *method* in the study of nature, as it is the very soul of science; and, amidst such a multitude of objects which the vegetable kingdom affords, all attempts towards the acquisition of knowledge without it, must end in uncertainty and confusion. We have sufficient proofs of this in the writers upon plants before the invention of systems, and see and deplore the want of them, in the loss of many valuable articles ..... Articles, the

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<sup>1781</sup> Vines: 15.

virtues and properties of which appear to have been well ascertained, are now lost to us, for want of a more scientific arrangement of the subjects, and accuracy in the descriptions of them.<sup>1782</sup>

Ray had already begun to approach the problem of classification by 1660; he mentions Jung and his book *Isagoge Phytoscopica* and its 'Interpretation of Terms' in the closing pages of the *Cambridge Catalogue* published in 1660, eighteen years before its actual publication in 1678. He had received a manuscript copy of this work from Samuel Hartlib; in the preface to the *Methodus Plantarum* of 1682 he mentions that 'Jung's *Isagoge* in manuscript and received from Mr. Samuel Hartlib was communicated to me by that excellent and learned man Dr. John Worthington, my close friend, now deceased'. As Raven says:

It would seem that Ray only received Jung's book just before the completion of the *Catalogue*; for he is not included in the list of authorities nor elsewhere, and appears here in a form which suggests last-moment additions. Jung is important as a source of Ray's interest in plant-structure and of his ideas of classification; and although some estimates of his influence are gravely exaggerated, the *Historia Plantarum* acknowledges very freely the value of Jung's work upon physiology, bracketing him with Grew, and incorporating much of the *Isagoge*.<sup>1783</sup>

Ray had given much thought to the problems of plant classification; his first brief mention of the need for a better system of classification is appended to *The Cambridge Catalogue*, published in 1660, where after giving an outline classification, based on the usual groupings of trees, shrubs, subshrubs and herbs, he states that [Tr.]

Plants can also be classified by various other methods e.g. by the nature of their roots, stalks, flowers, seeds or leaves etc, but a

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1782 Pulteney, Richard. *A General View of the Writings of Linnæus*; T. Payne and B. White, London 1781: 111.

1783 Raven: 106.

detailed discussion of these topics is beyond the scope of my book.<sup>1784</sup>

His first true publication on the classification of plants was in 1668, however, and from the point of view of his later scholarship, it was an unfortunate one; he had been asked by Dr. John Wilkins, Bishop of Chester to contribute a section on plant classification, a *Table of Plants*, to his work entitled *An Essay towards a Real Character and Philosophical Language* published by the Royal Society.<sup>1785</sup> He was much criticised for this work by Robert Morison, who had formulated his own system of classification.<sup>1786</sup> However, Ray himself realised the limitations of the method expounded here; in a letter written (in Latin) to Martin Lister on May 7th 1669,<sup>1787</sup> he says that he

was constrained in arranging the tables not to follow the lead of nature, but to accomodate the plants to the author's prescribed system..... What possible hope was there that a method of that sort would be satisfactory, and not manifestly imperfect and ridiculous? I frankly and openly admit that it was; for I care for truth more than for my own reputation.

It must be said that this method of classification was still an improvement on anything so far produced; as Raven says,

The arrangement is exceedingly ingenious: it fastens upon many points valid for taxonomy: it establishes a number of genuinely natural groups.<sup>1788</sup>

As Knight says of Ray's classification according to Wilkins' requirements:

The attempt to fit plants into the procrustean system of Wilkins had convinced him that nature did not work in threes and that a return to, and then a going beyond, Aristotle was necessary if one was to get a

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1784 *Camb.*: 135.

1785 That Ray's own copy of this was sold in the sale of his library after his death is indicated from the sale catalogue:

*Real Character*, edition published in 1668 (no place of publication given); British Museum: S-C 326 (6): 21, English Books in Folio, number 35.

1786 Morison's method is given by Vines: 23-25.

1787 *Correspondence*: 39-42 [this translation by C.E.Raven].

1788 Raven: 183.

natural system. Wilkins' artificial language went the way of most such projects, into oblivion; but Ray set taxonomists on a new road, as Galileo had done for astronomers.<sup>1789</sup>

Ray next published a paper on *The Specific Differences of Plants* read to The Royal Society in 1674,<sup>1790</sup> which was, according to Raven, 'a great step taken towards a scientific classification'.<sup>1791</sup> Ray himself had doubts as to the quality of this work, feeling that it was not ready for the public.<sup>1792</sup>

Ray continued with the problems of classification in the *Methodus Plantarum Nova*, published in 1682,<sup>1793</sup> where one of the sections is entitled *De Divisione Plantarum generali in Arbores, Frutices, Suffrutices et Herbas*. Vines believes that Ray's classification in the *Methodus* 'is a discussion of the propriety of retaining the old Theophrastian sub-divisions: Ray agreed with Jung that these divisions are popular rather than accurate and philosophical, but he retained them on the ground of expediency'.<sup>1794</sup> He was greatly influenced by Theophrastus, Cesalpino and Jung; he adopted much of Jung's terminology and in the Preface praises Cesalpino:

The method of classification adopted here is not by habitat or by utility for food, medicine, pleasure or technical arts, but from the similitude and likeness of the principal parts, root, flower, calyx, seed, seed-vessel [conceptaculum]. This method was used with extraordinary sagacity by that most careful observer of plants, Andrea Cesalpino, who was the first, as far as I know, to classify plants according to the number of seeds and seed-vessels produced by each flower, and according to the position of the *corculum*

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1789 Knight, *Ordering the World*: 46.

1790 'A Discourse on the Specific Differences of Plants', *Further Correspondence*: 77-83.

1791 Raven: 189.

1792 See the introduction to Chapter 13 of this commentary concerning Ray's papers on this and on the seeds of plants.

1793 These tables are given in full in F.W. Oliver (Ed.), *Makers of British Botany*, Cambridge University Press 1913: 32-34. [The chapter on Ray and Morison is by S.H. Vines.] These tables are also analysed in detail by Raven: 195-200.

1794 Vines: 35.

*seminale*, that is, the point where germination begins.<sup>1795</sup>

He continued to develop this system of classification through the first volume of *Historia Plantarum*, into the first and second editions of his *Synopsis Methodica Stirpium Britannicarum* (1690 and 1696). His final version of his classification is to be found in the revised version of *Methodus Plantarum Nova*, the *Methodus Plantarum emendata et aucta* of 1703. It is to be noted that he applied his system only to herbaceous plants, keeping the three former categories of herbaceous plants, trees and shrubs. Cesalpino in his *De Plantis* of 1583 states his philosophy for the new approach to plant classification, which was followed by his successors including Ray:

*Cum autem formarum similitudines et dissimilitudines queramus, ex quibus constat plantarum substantia, non autem eorum, quæ accidunt ipsis; accidentia enim posterius innotescunt cognita substantia.*<sup>1796</sup>

This chapter of *Historia Plantarum* is taken almost directly from the preface to *Methodus Plantarum Nova*, in which Ray first gives his reasons for attempting a classification:

The number and variety of plants inevitably produce a sense of confusion in the mind of the student: but nothing is more helpful to clear understanding, prompt recognition and sound memory than a well-ordered arrangement into classes, primary and subordinate.<sup>1797</sup>

The development of Ray's ideas on classification can be clearly seen in the change from his earlier three-fold division in the *Methodus Nova* into plants with either 'no flowers or only apetaloid staminate ones, those with perfect flowers and naked seeds, and those with perfect flowers and seeds

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1795 Translation taken from Morton: 227, note 38.

1796 Cesalpino, *De Plantis*: Lib.I, cap.13.

[We look for those similarities and differences of form, which make up the essential nature of plants, not for those which are only accidental to them; for things perceived by the senses become understood primarily from their essential nature and only after that from their accidental characteristics.]

1797 *Methodus Plantarum Nova*, 1682: [this translation by C.E.Raven: 193].



enclosed in a seed-vessel'<sup>1798</sup> to the division into dicotyledons and monocotyledons demonstrated in his *Sylloge Europeanarum* of 1694.

Ray's final system of classification was based, like that of Cesalpino, on observation of the 'essential characters', *differentiæ* or *notæ characteristicæ*; these characteristics should be based on the main parts of plants, that is from the flower, calyx, seed and seed-vessel. He rejected accidental characteristics, *accidentiæ*;<sup>1799</sup> he believed that such accidental characteristics could separate related species and unite very dissimilar ones. As he says in his *Discourse on the Specific Differences of Plants* presented in 1674 to The Royal Society,

one may, with as good reason, admit a blackmore and European to be two species of men, or a black cow and a white to be two sorts of kine, as two plants, differing only in colour of flower, to be specifically distinct.<sup>1800</sup>

Morton comments that:

Ray's deciding reasons for rejecting accidental characters are derived from horticultural observations and experiment. Changing conditions or place of cultivation affects the size of plant, the amount of fruit they bear, even the degree of "doubling" of flowers. Different varieties may arise from the same root or from different seeds of the same plant, but they cannot be propagated true from seed but only by vegetative offsets or cuttings.<sup>1801</sup>

That Ray understood the true principles of classification is indicated by his statement in *Methodus Plantarum emendata et aucta* of 1703:

I do not fear to put in the same class plants which have many similar parts and characters and which agree in their total habit and construction, even though they differ in the form or number of petals of the flower, in whether the seed is naked or enclosed in a

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1798 Morton: 204.

1799 E.g. habitat, size, time of flowering, medicinal uses, usefulness to mankind, and variations in taste, smell or colour.

1800 Reprinted in *Further Correspondence: 77-83*.

1801 Morton: 201.

seed-vessel, in the number of divisions of the ovary, or any other particular individual character.<sup>1802</sup>

Ray's classification system and detailed observations of individual plants led to a better idea of the link between genus and species; he was indebted to Tournefort, who in his *Institutiones Rei Herbariæ* of 1700 defined 698 genera on the basis of the corolla and fructification.<sup>1803</sup> Although Ray did group plants into what he called families (e.g. *Tetrapetalæ*, *Stellatæ*, *Asperifoliæ*, *Compositæ*), the first suggestion that this could be used as a taxonomic grouping was made by Pierre Magnol in his *Prodromus Historiæ Plantarum in quo Familiæ Plantarum per Tabulas Disponuntur* of 1689. Magnol had praised Ray for his classification system, in which related plants are included in the same grouping. Magnol used the familial terms *Malvaceæ*, *Ranunculaceæ*, *Papaveraceæ*, *Papilionaceæ* etc.<sup>1804</sup> Morton comments that 'there is evidence that some of Ray's later modifications to his own scheme, which appear in *Methodus Emendata*, were made in the light of Magnol's suggestions'.<sup>1805</sup>

Although Ray added his own division according to number of cotyledons when classifying trees as well as herbaceous plants, he still retained the old division into trees and herbs. This artificial separation could be said to have spoiled the great advances he had made in formulating his classification system, especially since it had been shown by Jung and Magnol that this was an artificial division. Ray, himself, as he says below in Chapter 27 had doubts about such a division, yet he kept to it because it was

commonly noted by each scholar and accepted in all ages by popular usage and frequently adopted, yet nevertheless is not to be

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1802 *Methodus Plantarum emendata et aucta*, London 1703; [translated here by Morton: 202].

1803 Ray, however, had been criticised by Tournefort in his *Éléments de Botanique* of 1694 for using too many characteristics in his definitions of genus and species. Ray replied in his *Dissertatio de Methodis* of 1696, in which he defended his system 'against such artificial "essentialist" classifications as those of Bachmann, Tournefort and others'.

Morton: 228, note 42.

1804 NB. These are not equivalent to the modern families of the same names.

1805 Morton: 203.

considered accurate and philosophical'.<sup>1806</sup>

Morton comments that:

This curious failure to accept his own conviction seems to be the negative side of the scientific probity and punctilious regard for the contributions of others for which he gained universal respect.<sup>1807</sup>

However, Ray's classification system was adopted and used throughout Britain until well into the eighteenth century, when it was used and adapted by Linnæus in developing his own method, first employed in England by J.Hill in his *Flora Britannica* of 1760. In his *Classes Plantarum* of 1738 Linnæus emphasises that classification should be based on all structures: *nec una vel altera pars fructificationis, sed solum simplex symmetria omnium partium*.<sup>1808</sup>

Vines states that:

It was just because they had failed to formulate this principle that the earlier systematists, - whether Fructists, as Cesalpino, Morison, Ray, Knaut and Hermann; or Corollists, as Rivinus and Tournefort; or Calycists, as Magnol - were not more successful and that their systems, even the *Methodus emendata* of Ray, were more or less artificial.<sup>1809</sup>

Morton summarises Ray's 'combination of sound principle and practical common sense':

1. There should be the minimum innovation and changing of commonly accepted names.
2. The distinguishing characteristics of both the higher and lower classes must be clear and distinct and capable of precise definition (excluding, for example, vague distinctions based merely on size).
3. Characters should be obvious and readily observed (not

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<sup>1806</sup> *Historia Plantarum*, Cap. 27, lines 17-18.

<sup>1807</sup> Morton: 206.

<sup>1808</sup> Linnæus, *Classes Plantarum*: 485.

<sup>1809</sup> Vines: 40.

such as necessitate carrying round a microscope to see them).

4. Widely recognized classes (e.g. *Umbelliferæ*, *Papilionatæ*) should not be split.
5. Cognate and congeneric plants should not be separated, nor dissimilar and alien plants associated.
6. Defining characters of a class should be kept to the minimum needed for certain determinations.<sup>1810</sup>

One should, therefore, not minimise the importance of Ray's classification system, based on 'essential characteristics', and the impact it had on later classifications; it was the first truly natural system of plant classification in more ways than one, especially in the recognition that both trees and herbs are either monocotyledonous or dicotyledonous.

Text page 50.

Line 1. *Plantarum divisionem instituere*: Ray begins by expressing his doubts about the possibility of ever fully classifying all plants.

Line 6. *Cum enim Natura (ut dici solet) non faciat saltus, nec ab extremo ad extremum transeat nisi per medium*: he now expresses his opinion that there are no hard and fast boundaries between genera, but that all are interlinked.

Text page 51.

Line 9. *ut v.g. inter Plantas & Animalia Zoophyta dicta*. Ray again shows his confusion over the nature of Zoophytes; see note above at Cap.1, line 81.

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<sup>1810</sup> Morton: 206-207.

- Lines 13-18. *At neque secundo, si natura rei id pateretur ..... quod tamen ad eas inter se conferendas necessarium est?* In this paragraph, although actually saying that such a classification is beyond the abilities of mankind, Ray, by listing so many human deficiencies [*memoriæ imbecillitate, intellectus, inadvertentia & caligine*], shows his own modesty.
- Line 19. *Nos ergo Methodum Plantarum omnibus numeris absolutam non pollicemur:* Ray uses the word *Methodus* here for ‘the rule’ of classification; since he uses it with a capital initial letter he is almost using it in a technical sense as he had when using it as the title of his work *Methodus Plantarum* in 1682.
- Line 21. *non enim id unius est hominis aut ætatis:* he does not believe it possible for one man alone to evolve a classification system.
- Line 21. *sed quam potuimus accuratam pro ingenii nostri tenuitate, & modica harum rerum peritia.* Ray shows his modest nature even more here, where he states that he will be as accurate as possible despite his limitations.
- Line 23. *Methodos autem illas quæ plantas secundum locos natales ..... :* he concludes by rejecting those methods of classification based on similarity of place of growth, time of flowering or powers and uses, since this method would separate related plants and place together unrelated ones.
- Line 24. *eam autem quæ a similitudine & convenientia partium præcipuarum, floris scilicet, & calycis, seminis ejusque conceptaculi notas characteristicas generum sumit, amplectimur & usurpamus.*  
He concludes with a brief description of his method of classifying

plants, by similarity of 'flower, calyx, seed and its receptacle'.<sup>1811</sup>

Lines 23-26. *Methodos autem ..... ampleximur & usurpamus:*

Raven notes that in the Preface to his *Methodus*, published in 1682:

in this section he [Ray] agrees with Morison in his Dialogue,<sup>1812</sup> though he, unlike Morison, does not name the authors of the methods that he rejects ..... A warm tribute is then paid to Andrea Cesalpino.<sup>1813</sup> ..... After a similar tribute to Jung and the *Isagoge Phytoscopica* and to Colonna and the annotations to *Res Medica Novæ Hispaniæ*, and a mention of Morison and the *Præludia* and *Historia Universalis*, he claims that his work is not a compilation but is drawn from original observations and yields a new Method.<sup>1814</sup>

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1811 Morton [page 228, note 41] has an interesting footnote on this:

It is odd that in this quotation from *Historia Plantarum* the calyx seems to be separated from the flower, since Ray's definition of the flower comprises calyx, petals, stamens and style. Perhaps he was unconsciously recalling Jung's terminology in which the calyx was excluded.

1812 *Præludia Botanica*.

1813 Ray, although approving of the inclusion of number of seeds and seed vessels, rejected Cesalpino's method for not including corolla and calyx in his classification system.

1814 Raven: 193-194.

## Chapter Twenty-seven:

*On the division of plants into trees, shrubs, subshrubs and herbaceous plants, and of individuals into their subordinate genera.*

In this chapter Ray continues with the problem of classification begun in the previous chapter; here he goes into much more detail on the divisions into categories, giving many examples.<sup>1815</sup> In the *Methodus Plantarum Nova*, published in 1682, Ray gives in detail his own ideas of plant classification.<sup>1816</sup> The fifth essay in this work concerns Trees, Shrubs, Subshrubs and Herbs; in this work, as Raven says, he ‘thinks it best to maintain the three classes, dropping sub-shrubs, in deference to common usage .....’.<sup>1817</sup> It has been said of this division that:

Ray kept some of the traditional categories because he was engaged in a practical as well as a theoretical endeavour, and they were convenient. From Theophrastus, a pupil of Aristotle, had come the idea of separating plants into trees, shrubs and herbs; a classification useful for the gardener, but one which cuts across natural groups.<sup>1818</sup>

By 1686 and the publication of this first volume of *Historia Plantarum*, Ray initially seems to have reverted to the former classification, including subshrubs between shrubs and herbaceous plants, but later admits that it is perhaps best to include them with herbaceous plants.<sup>1819</sup>

For much of this chapter Ray is giving reasons and examples of why his essential characteristics of flower, calyx, seed and seed-vessel are the

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1815 NB Some of the material in this chapter’s introduction is included in a fuller discussion of classification in the introductory chapter to the thesis, but it seems appropriate to include it here also.

1816 As mentioned in the previous chapter these tables are given in full in F.W. Oliver (Ed.), *Makers of British Botany*: 32-34. [The chapter on Ray and Morison is by S.H.Vines.] These tables are also analysed in detail by Raven:195-200.

1817 Raven: 196.

1818 Knight, *Ordering the World*: 56.

1819 *Historia Plantarum*, Cap.27, line 83.

best indicators for classification. He believes that for any particular species these characteristics are stable and constant in form and will be reproduced from seed; they are also easily observable and with a particular position, form and number, and also are the common characteristics of a specific group or genus.<sup>1820</sup> As Morton says:

Ray's carefully argued statement of principle went much deeper, making clear the inadequacy of reliance only on one or two characters, however fundamental they appeared to be.<sup>1821</sup>

Ray attempted in *Historia Plantarum*::

not only to formulate a correct definition and arrangement of the 'genera' (that is, the large groups or orders), but to marshal correctly the 'species subalternae' (or genera) and the 'species infimae' (or species). He then briefly recapitulates the reasons for preferring his own Method as already published, though he alters it by uniting Shrubs with Trees and beginning not with Trees but with Algae.<sup>1822</sup>

If anything could show that the age of the herbalists was over and a new approach to the study of plants was beginning it would be the work of Ray, although he still adhered to the division into trees and herbs, exemplifying the influence of the Greeks; he based this distinction on his belief that trees and shrubs form buds, that is, distinct winter buds. However, this mistake is perhaps compensated for by his division of trees and herbs into monocotyledons and dicotyledons. He divided the herbs into *Imperfectæ* (algæ, fungi, mosses, ferns) and *Perfectæ*,<sup>1823</sup> which were further subdivided on the basis of the cotyledon into nineteen dicotyledonous and three monocotyledonous groups.

Ray's botanical works, and in particular, *Methodus Nova* of 1682, the first volume of *Historia Plantarum* of 1686 and *Methodus Emendata*

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1820 See especially line 88-94 below.

1821 Morton: 202.

1822 Raven: 219.

1823 NB The terms *imperfectæ* and *perfectæ* did not have the same connotations in the seventeenth century as now.



of 1703,

most completely sum up both the way his ideas grew and ripened, and the final result - the transformation of Cesalpino's brilliant vision into the first outline of a system of plant classification based on natural affinity.<sup>1824</sup>

Briefly, Ray's system did not bring together dissimilar species or separate those which were obviously closely allied. Knight sums up the state of classification at the beginning of the eighteenth century:

By the time Ray died in 1705, the essentially artificial or subjective systems that had been in use a hundred years before had been undermined.<sup>1825</sup>

It was said of Ray by Lindley, writing in 1850, that:

the classification he propounded, after the short period of domination of the artificial system of Linnæus, furnished the basis of that of De Jussieu, on which the system of De Candolle was subsequently founded; the system which underlies, to a great extent, the classification adopted by Bentham and Hooker in the *Genera Plantarum*. To Ray is thus due the germ of the classification still in vogue in England, though his proposals were very far from even indicating their final form.<sup>1826</sup>

In the Preface to *Historia Plantarum*, Ray describes how he has approached this work:

*Primo in loco omnes hactenus editas, & per multa volumina sparsas, in Genera & Species veluti tot membra distributas in unum quasi corpus redegi. Quod ut efficerem, non omnes quotquot extant Stirpium Historias, Theatra, Pandectas, Adversaria, Observationes, Illustrationes, Commentarios evolvere & examinare necessarium duxi, ne actum agerem, cum Viri longe eruditissimi maximeque industrii J. Bauhinus & Casp. Bauhinus fratres immenso labore*

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1824 Morton: 201.

1825 Knight, *Ordering the World*: 57.

1826 Reynolds Green: 70.

*diligenter perlectis & studiose inter se collatis Botanicorum scriptis ante se editis, species jam tum cognitae, paucissimis omissis excerptas & methodice digestas, hic in Theatri Botanici pinace, ille in Historia Plantarum generali exhibuerunt. Stirpes noviter inventas, & post Bauhinum utrumque denatum editas a Clariss. Viris Prospero Alpino, Joanne Veslingio, Jacobo Cornuto, Jaon. Parkinsono, aliisque superius memoratis ipse collegi & ad sua genera retuli: non paucas denique a meipso observatas tam in Anglia, quam in transmarinis regionibus adjeci.*<sup>1827</sup>

Ray's final classification system, given in his *Methodus Emendata*, which Sachs believes 'is undoubtedly the one which in the time preceding Linnæus does most justice to natural affinities' is summarised by him as follows:

PLANTÆ GEMMIS CARENTES (HERBÆ).

(a) *Imperfectæ.*

- I Plantæ submarinæ (chiefly Polypes, Fucus).
- II Fungi.
- III Musci (Confervæ, Mosses, Lycopods).
- IV Capillares (Ferns, Lemna, Equisetum).

(b) *Perfectæ.*

Dicotyledones (binis cotyledonibus).

- V Apetalæ.
- VI Planipetalæ lactescentes.
- VII Discoideæ semine papposo.
- VIII Corymbiferæ.

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<sup>1827</sup> Briefly, Ray is saying here that he first collated into a single body all the plants so far published and scattered over many volumes into tribes and groups. To do this he did not consider it necessary to read and examine all existing 'Histories' since the Bauhin brothers had completed this immense task with great care. He then adds that he has worked through the publications of subsequent authors and also includes material from his own observations both in England and abroad.

- IX Capitalæ [*sic*]<sup>1828</sup> (vi-ix are Compositæ)
- X Semine nudo solitario (Valerianeæ, Mirabilis, Thesium, etc.).
- XI Umbelliferæ.
- XII Stellatæ.
- XIII Asperifoliæ.
- XIV Verticillatæ.
- XV Semine nudo polyspermo (Ranunculus, Rosa, Alisma).
- XVI Pomiferæ (Cucurbitceæ).
- XVII Bacciferæ (Rubus, Smilax, Bryonia, Solanum, Menyanthes).
- XVIII Multisiliquæ (Sedum, Helleboreæ, Butomus, Asclepias).
- XIX Vasculiferæ monopetalæ (various).
- XX Vasculiferæ dipetalæ (various).
- XXI Tetrapetalæ siliquosæ (Cruciferæ, Ruta, Monotropa).
- XXII Leguminosæ.
- XXIII Pentapetalæ vasculiferæ enangiospermæ (various).  
Monocotyledones (singulis aut nullis cotyledonibus).
- XXIV Graminifoliæ floriferæ vasculo tricapsulari (Liliaceæ, Orchideæ, Zingiberaceæ).
- XXV Stamineæ (Grasses).
- XXVI Anomalæ incertæ sedis.

#### B. PLANTÆ GEMMIFERÆ (ARBORES).

(a) *Monocotyledones.*

XXVII Arbores arundinaceæ (Palms, Dracæna).

(b) *Dicotyledones.*

XXVIII Arbores fructu a flore remoto seu apetalæ (Coniferæ and

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<sup>1828</sup> Although the adjective *capital* (*capitalæ* here) does mean 'of' or 'relating to the head', this is perhaps a misprint in Sachs for the usual *capitatæ*.

various others).

- XXIX Arbores fructu umbilicato (various).
- XXX Arbores fructu non umbilicato (various).
- XXXI Arbores fructu sicco (various).
- XXXII Arbores siliquosæ (woody Papilionaceæ).
- XXXIII Arbores anomalæ (Ficus).<sup>1829</sup>

Text page 51.

Line 3. *Arbor [Δένδρον] definiente* ..... : here Ray gives à Stapel's definition of a tree, on which he also bases his own definition given in his introductory glossary to *Historia Plantarum*.<sup>1830</sup> A tree is now defined as:

A woody plant which may grow more than 10 m tall. Characteristically it has 1 main stem, although many trees (e.g. oak and ash) may grow multi-stemmed forms. At the end of each growing season there is no die-back of aerial parts, apart from the loss of foliage.<sup>1831</sup>

Line 3. *\*Jo. Bodæo à Stapel:* margin reference to *\*Comment. in Theophr. Hist.*

Line 5. *Pyrus:* see above Cap.4, line 145.

Line 6. *Abies:* see above Cap.4, line 22.

Line 6. *Quercus:* see above Cap.4, line 145.

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<sup>1829</sup> Sachs: 72-73.

The names in brackets, inserted by Sachs, are the Linnæan names for some of the genera of particular classes.

Sachs follows this with a critical appraisal of Ray's classification system.

<sup>1830</sup> *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis:* unnumbered pages at beginning of Volume I.

<sup>1831</sup> *Oxford Dictionary of Botany:* 414.

Line 7. *Frutex* [Θάμνος] *eodem definiente* .....: again a definition from à Stapel, which he gives in the same words in his glossary to *Historia Plantarum*.<sup>1832</sup> A shrub is now defined as:

A perennial woody plant, less than 10 m tall, which branches below or near ground level into several main stems, although it has no clear trunk. It may be deciduous (e.g. hawthorn) or evergreen (e.g. holly). At the end of each growing season there is no die-back of the aerial parts, apart from the loss of foliage.<sup>1833</sup>

Line 10. *Suffrutex* [Φρύγανον]..... : Ray says that à Stapel's definition of a subshrub does not distinguish it from a shrub and that he will define it himself later; this he does at line 80. In his glossary to *Historia Plantarum*, he gives a version of this second definition but seems to show that he has rethought this definition yet again by the time of writing the glossary, which, as I have said elsewhere, he appears to have written after the main work had been completed. In this glossary he defines a subshrub as:

*Suffrutex est planta humilior, lignescens & perennis, a radice non foliata, & ab imo statim ramosa; vel Planta inter lignosas minimæ & altitudinis, & crassitudinis superficie perenni, non gemmipara, ut Salvia, Ruta, Lavendula.*<sup>1834</sup>

A subshrub is now defined as:

A plant, smaller than a shrub, which produces wood only at its base and has abundant growth branching upwards from the base, the upper stems dying back at

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1832 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1833 *Oxford Dictionary of Botany*: 376.

1834 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

the end of each growing season.<sup>1835 1836</sup>

Ray's three definitions of tree, shrub and subshrub agree with the modern ones when discussing the trunks or stems, but he makes no mention of winter die-back, except indirectly in the later, more elaborate, definition of a subshrub at line 71, where he states that *surculos simplices non ramosos annuatim producunt ..... germina producentes eodem anno in ramos & ramulos interdum divisa.*

Line 12. *Rosmarinus*: see above Cap.20, line 103.

Line 12. *Lavendula*.

[Mod.Herb. 467]<sup>1837</sup> *Lavandula vera* (L.), English Lavender; a species of the *Lavandula* genus of the *Labiatae* or Mint family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 344:

Linn.*Sp.Pl.* 572-573: *Syn.Meth.St.Br.* - no ref.: *H.P.* 512:

*H.P.III* - no ref.: *Tri.* 11.102: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 512:

4 species given, including:

*Lavendula major sive vulgaris* Park. *Lavendula flore caeruleo & flo. albo* Ger. *Lavandula latifolia* C.B. *Pseudo-nardus, quae vulgo spica* J.B.

***The most common or broad-leaved Lavendar.***

*Tri.* 11-102:

Lavender: *Lavendula*, -æ, f.: [No Greek].

Ray's note in *Trilingue Dictionariolum*: 'This is taken to be a

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1835 *Oxford Dictionary of Botany*: 395.

1836 Morton [p.52, note 48] with reference to Theophrastus has an interesting note on sub-shrubs or under-shrubs and herbs:

The word translated as under-shrub (φρύγανον) has the literal meaning of fire-wood or sticks for kindling, whilst herb (πόα) is literally grass.

1837 Grieve, *A Modern Herbal*: 467.

species of *Stœchas*'.

Lines 12-13. *Hæc definitio nullas continet notas quibus Suffrutex a Frutice certo possit distingui; ideoque nos paulo post commodiorem dabimus.* Ray prints this sentence in italics; as it is a personal statement and not a quotation, which he would usually print in italics, he must consider this to be an important point and thus uses italics for emphasis. He gives the promised definition below at lines 80-82.

Line 14. *Herba [Πόα] eodem definiente .....*: here Ray gives yet another definition from à Stapel; in his glossary to *Historia Plantarum*, he uses the same definition but emphasises the medical usage of the leaves when he adds:

*In praxi medica pro foliis solis, ut plurimum usurpatur.*<sup>1838</sup>

Ray's (and à Stapel's) definition of an herbaceous plant agrees with the modern, which would be defined as:

A small, non-woody seed-bearing plant in which all the aerial parts die back at the end of each growing season.<sup>1839</sup>

Line 15. *Phyllitis*: see above Cap.12, line 171.

Line 17. *Divisio hæc quamvis unicuique e vulgo nota, & populari usu omnibus seculis recepta & frequentata fuit, non tamen accurata & Philosophica censenda est.* Ray, following Jung and Theophrastus, does not believe that the old division into trees, shrubs, sub-shrubs and herbs is wholly accurate. Jung had cited,<sup>1840</sup> from

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1838 *Historia Plantarum; Terminorum quorundam & vocum generaliorum Interpretatio & Explicatio brevis*: unnumbered pages at beginning of Volume I.

1839 *Oxford Dictionary of Botany*: 193.

1840 Morton on Jung's *Doxoscopiæ*: 174.

Theophrastus, the example of the Mallow, which may be either an herbaceous plant or a tree. Theophrastus describes this ambiguity:

Δεῖ δὲ τοὺς ὄρους ἀποδέχεσθαι καὶ λαμβάνειν ὡς  
τύπῳ καὶ ἐπὶ τὸ πᾶν λεγομένου. ἔνια γὰρ ἴσως  
ἐπαλλάττειν δόξειε, τὰ δὲ καὶ παρὰ τὴν ἀγωγὴν  
ἀλλιότερα γίνεσθαι καὶ ἐκβαίνειν τῆς φύσεως,  
οἶον μαλάχη τε εἰς ὕψος ἀναγομένη καὶ  
ἀποδενρουμένη.<sup>1841</sup>

Line 19. *inter duo genera*: Ray is using the word *genus* here for ‘type’ or ‘kind’ rather than the modern genus.

Line 20. *Vitis*: see above Cap.5, line 26.

Line 20. *Sic v.g. Vitis Theophrasto arbor est*: this is a reference to Theophrastus *Περὶ Φυτῶν Ἱστορίας* I, iii: 1,<sup>1842</sup> where in a discussion, very similar to that of Ray here, of the various classes into which plants may be divided, he describes a vine as being a tree.

Line 24. *frutices avulsis aut abscissis stolonibus in arbores facile transeunt*: he repeats here, with examples, his statement of lines 8-9 above that shrubs can grow into trees.

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1841 Theophrastus, *Περὶ Φυτῶν Ἱστορίας* [*Enquiry into Plants*] I.iii: 2.

[These definitions however must be taken and accepted generally and on the whole. For in the case of some plants it might seem that our definitions overlap; and some under cultivation appear to become different and depart from their essential nature, for instance, mallow when it grows tall and becomes tree-like.]

1842 *Περὶ Φυτῶν Ἱστορίας* [*Enquiry into Plants*].



Line 25. *Lentiscus*: see above Cap.9, line 20.

Line 27. \**Clusius*: margin reference to \**Hist.lib.1, cap.10*.

Line 27. *Juniperus*.

[C.T.& M. 30-31] *Juniperus communis* (L.), Juniper; a species of the *Juniperus* genus of the *Cupressaceæ* or Cypress family.

B.& G.-W. 42: B.& H. 417: Linn.*Sp.Pl.* 1038-1040:

*Syn.Meth.St.Br.* 444: *H.P.* 1411: *H.P.III D.* 12: *Tri.* 16.47:

*Cat.Angl.* 175-176: *Camb.* 77.

*H.P.* 1411:

5 species given, including:

*Juniperus vulgaris baccis parvis purpureis* J.B. *vulgaris* Park.

*vulgaris fruticosa* C.B. *item vulgaris arbor ejusdem Juniperus*

Ger. ***The common Juniper-tree.***

*H.P.III D.* 12:

7 additional species given.

*Tri.* 16.47:

Juniper: *Juniperus*, -i, f.: Ἰουγκυθαῖος, -εύθου, f.

Line 29. *Buxo*: *Buxus*: see above Cap.20, line 103.

Line 30. *Ilice cocciferā*: *Ilex coccifera*: see above Cap.13, line 8.

Line 31. *Myrtus*: see above Cap.18, line 11.

Ray considers Myrtle to be a subshrub, because unless it is pruned it becomes a shrub.

Line 31. *Theophrast. Hist. lib.1, cap.5.*<sup>1843</sup>

This is a direct translation from the Greek of Theophrastus, where he says:<sup>1844</sup>

ὁ δὲ μύρρινος μὴ ἀνακαθαιρομένουσ ἐκθαμνοῦται

Line 31. *Comarus.*

As Ray brackets this plant with *Arbutus*, he presumably means it to be the same plant and not the Marsh Cinquefoil, *Potentilla palustris* ([L.] Scop.), [*Comarum palustre* (L.): *Potentilla comarum* (Nestler)].

*Comarus* therefore is here:

[C.T.& M. 334] *Arbutus unedo* (L.), Strawberry-tree; a species of the *Arbutus* genus of the *Ericaceæ* or Heather family.

B.& G.-W. 292: B.& H. 280: Linn.*Sp.Pl.* 395:

*Syn.Meth.St.Br.* 464: *H.P.* 1576: *H.P.III* - no ref.: *Tri.* 17.80:

*Cat.Angl.* - no ref. but see under *Arbutus* 25-26: *Camb.* - no ref.

*H.P.* 1576:

*Arbutus* Ger. Park. *Arbutus, Comarus Theophrasti* J.B. *Arb. folioserrato* C.B. *The Strawberry-tree.*

*Tri.* 17.80:

Strawberry-tree: *Arbutus*, -i, f.: *Κόμαρος, -άρου*, f.

Line 32. *Arbutus*: see above Cap.11, line 128 and Cap.27, line 31.

Line 33. *Malus Punica*: see above under *Punica* Cap.18, line 10.

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1843 In the Loeb edition the reference is slightly different: *Περὶ Φυτῶν Ἱστορίας [Enquiry into Plants]: I, iii: 3* as opposed to Ray's I: section 5.

1844 *Περὶ Φυτῶν Ἱστορίας [Enquiry into Plants]: I, iii: 3.*

[On the other hand the myrtle, unless it is pruned, turns into a shrub.]

Line 33. *Bellon. de neglect. stirp. cult. Prob. 12:*

Pierre Bellon / Belon, 1517-1564. His main interests were in zoology and botany.<sup>1845</sup>

As a boy he was apprenticed to an apothecary of the bishop of Clermont. He did not derive his information only from books but was a great observer of the natural world. He wrote many works on natural history, among them the following botanical works:<sup>1846</sup>

1. *De arboribus coniferis resiniferis, aliis quoque nonnullis sempiterna fronde virentibus* (Paris 1553),<sup>1847</sup>
2. *Portraits d'oyseaux, animaux, serpens, herbes, arbres, hommes et femmes d'Arabie et d'Egypte, observez par P. Belon .... le tout enrichy de quatrains, pour plus facile cognoissance des oyseaux et autres portraits* (Paris 1557).
3. *Les remonstrances sur le défaut du labour et culture des plantes et de la cognoissance d'icelles* (Paris 1558).

In the preface to *Historia Plantarum* Ray says of Belon:  
(Tr.) Peter Bellon wrote three books, which were translated into Latin by C. Clusius<sup>1848</sup> with ten additional plates of plants and published at Antwerp in 1589.<sup>1849</sup>

Line 35. *Ricinus*: see above Cap.10, line 4; see also under *Palma Christi* Cap.10, line 3.

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1845 *DSB I*: 595-596.

1846 There is no indication in the sale catalogue of Ray's library that he owned any of Belon's works; British Museum: *S-C 326* (6).

1847 *Arber*: 276.

1848 i.e. by Charles de l'Écluse.

1849 *Historia Plantarum*: Explanation of names and recent works (unnumbered pages).

Line 35. *Lobelio in Adversar.*: Matthias de l'Obel, 1538-1616.

He was born at Lille and studied under Rondelet at Montpellier, either at the same time as de l'Écluse or a year or two afterwards. He collected widely in France, Italy, Switzerland, Germany and England, probably partly in the company of Pena. He first came to England at the age of twenty-one.<sup>1850</sup> He was proud of his classification, as can be seen from the preface to his *Stirpium Adversaria Nova*, published in London in 1570 together with Peter Pena. It set a pattern for the herbals of the century to follow. He published his *Observationes* with 2116 plates in Antwerp in 1581. Although he practised medicine both in the Netherlands and in England, he finally settled in England in 1591 and ended his days as Botanist to James I and superintendant of a botanic garden in Hackney. He died before his last work *Stirpium Illustrationes* could be printed.<sup>1851</sup> Parkinson seems to have bought the right to this manuscript, and was severely criticised for using it by How. De l'Obel had a good knowledge of the English flora and 'he is responsible for more than eighty "first records" of our native plants'.<sup>1852</sup> He wrote in poor Latin and his works did not gain wide circulation. Ray says of him in the *Historia Plantarum*:

(Tr.) If I remember correctly Jean Bauhin [who worked with de l'Obel at Montpellier] called him unreliable and vain; this seems rather severe, but I did notice that in his descriptions he is inexact - *parum curiosum* - and trusting his memory too often made mistakes especially in localities. He lists many plants as natives of England, which no-one else has observed and which cannot be found in the places specified or perhaps anywhere at

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1850 *DSB VIII*: 435-436.

1851 Raven: 73.

1852 Arber: 90.

all.1853

De l'Obel's works are:

1. *Stirpium adversaria nova* (London 1570).1854
2. *Plantarum seu stirpium historia*, 2 volumes (Antwerp 1576), which consists of the second edition of *Adversaria* and the *Stirpium observationes*.
3. *The Kruydtbæck*, a Flemish translation of the *Stirpium historia* (Antwerp 1581).
4. *Icones Stirpium*, a two volume work of engravings (Antwerp 1581).
5. *Balsami, opobalsami, carpobalsami et xylobalsami* (London 1598).
6. *Dilucidæ simplicium medicamentorum explicationes et stirpium adversaria* (London 1605).
7. *Stirpium illustrationes*, published posthumously (London 1655).1855

Line 37. \**Belloniustradit*: margin reference to *Observat. lib.1, cap.18*.

Line 37. *Ricinos*: *Ricinus*: see above Cap.10, line 4, and Cap.27, line 35.

Line 39. *Dioscoridis*: reference in text to *Schol. in Monard. cap.4*.

Line 40. *Ricinum*: *Ricinus*: see above Cap.10, line 4, and Cap.27, line 35.

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1853 *Historia Plantarum*: Explanation of names and recent works (unnumbered pages).

1854 That Ray owned an edition of this work is indicated in the sale catalogue of his library:  
*Adversaria*, edition published in Antwerp in 1596; British Museum: S-C 326 (6): 1, *Libri Latine &c. in Folio*, number 25.

1855 *DSB VIII*: 436.

That Ray owned an edition of this work is indicated in the sale catalogue of his library:  
*de Stirpibus*, edition published in London in 1655; British Museum: S-C 326 (6): 9, *Libri Latine &c. in Quarto*, number 196.

Line 40. *Sambuci: Sambucus*: see above Cap.4, line 154.

Line 41. *Rhododendri: Rhododendron*.

[C.T.& M. 331-332] *Rhododendron* (L.), Rhododendron; a genus of the *Ericaceæ* or Heather family.

B.& G.-W. 292: B.& H. 278: Linn.*Sp.Pl.* 392:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 1767: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1767:

5 species given, including:

*Nerium sive Oleander* Ger. *Nerium sive Rhododendron flore rubro & albo* J.B. *Nerium floribus rubescentibus, & Nerium floribus albis* C.B. *Oleander sive Laurus Rosea* Park.

***Oleander, or Rose-bay.***

Lines 41-42. *Rhododendri nonnullis Cretæ ..... quæ alibi parvæ sunt.*

The Rhododendron, as Ray says, varies from a small shrub to a fairly large tree.<sup>1856</sup>

Line 42. *Bellon. de neglect. stirp. cult. Probl.12. Idem Observ. lib.1, cap.43.*

Two references in this line to the work of Pierre Belon.

Line 43. *Rhododendri: Rhododendron*: see above Cap.27, line 41.

Line 44. *Arbuti: Arbutus*: see above Cap.11, line 128.

Line 45. *Bellon ibid.*: i.e. reference as at line 42.

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<sup>1856</sup> Clapham, Tutin and Moore: 331-332.

Line 45. *Cornus foemina*.

[C.T.& M. 276] *Cornus sanguinea* (L.), Dogwood; a species of the *Cornus* genus of the *Cornaceæ* or Dogwood family.

B.& G.-W. 266: B.& H. 204: Linn.*Sp.Pl.* 117-118:

*Syn.Meth.St.Br.* 460: *H.P.* 1591: *H.P.III D.* 58: *Tri.* 16.27:

*Cat.Angl.* 79: *Camb.* 56.

*H.P.* 1591:

*Cornus fœmina* Ger. C.B. Park. *Cornus fœmina putata*, *Virga sanguinea* J.B.

***The female Cornel, or Dog-berry-tree, or Gatter-tree, or Prickwood.***

*H.P.III D.* 58:

3 additional species given.

*Tri.* 16.27:

A Cornel-tree or Cornelian Cherry-tree: *Cornus*, -i, and -us, f.:

*Κρανία*, -ας, f.

Line 46. *Sanguineum fruticem appellant*: called by the Gauls, imitating the Romans, 'the bloody shrub', presumably because of its red stems and/or leaves which turn purplish-red in the autumn.<sup>1857</sup>

Text page 52.

Line 47. *Corni*: *Cornus*: see above Cap.27, line 45.

Line 47. *Idem Observat. lib.1, cap.56*: i.e. Bellon.

Line 48. *Corni*: *Cornus*: see above Cap.27, line 45.

Line 49. *Josephus*: for Josephus see above Cap.23, line 35.

This is a reference to Josephus, *Ἱστορία Ἰουδαικοῦ Πολέμου*

*Πρὸς Ῥωμαίους*:<sup>1858</sup> VII: 178, where he says:

Ἐπεφύκει δ' ἐν τοῖς βασιλείοις πῆγανον ἄξιον τοῦ  
μεγέθους θαυμάσαι. συκῆς γὰρ οὐδεμίας ὕψους  
καὶ παχους ἐλείπετο.<sup>1859</sup>

Line 49. *Rutæ: Ruta*: see above Cap.9, line 32.

Line 50. *Ficu: Ficus*: see above Cap.4, line 143.

Line 52. *Rutæ: Ruta*: see above Cap.9, line 32.

This story of a Rue, which grew large enough to be used for a walking stick, is reminiscent of stories in both Theophrastus and Pliny, referring to the mallow:

συμβαίνει γὰρ τοῦτο καὶ οὐκ ἐν πολλῷ χρόνῳ  
ἀλλ' ἐν ἕξ ἢ ἑπτὰ μηνσὶν, ὥστε μῆκος καὶ πάχος  
δορατιαῖον γίνεσθαι, δι' ὃ καὶ βακτηρίαις αὐταῖς  
χρώνται, πλείονος δὲ χρόνου γινομένου κατὰ  
λόγον ἢ ἀπόδοσις.<sup>1860</sup>

*namque tradunt auctores in Arabia malvas septimo*

1858 Josephus, *Ἱστορία Ἰουδαικοῦ Πολέμου Πρὸς Ῥωμαίους*: History of the Jewish War against the Romans.

1859 Josephus, *Jewish War* VII: 178; Loeb edition: Volume III: 557.  
[Within the palace once grew a plant of rue, of an amazing size; indeed, in height and thickness, no fig-tree surpassed it.]

1860 Theophrastus, *Περὶ Φυτῶν Ἱστορίας* [*Enquiry into Plants*] I.iii: 2.  
[For this comes to pass in no long time, not more than six or seven months, so that in length and thickness the plant becomes as great as a spear, and men accordingly use it as a walking stick, and after a longer period the result of cultivation is proportionately greater.]



*mense arborescere baculorumque usum præbere.*<sup>1861</sup>

Line 52. *uti retulit generosus quidam ex amicis nostris*: 'a certain generous friend of mine'. Ray is referring to the Rev. John Banister, who in 1680 sent Ray a list of the native plants of Virginia, where he worked as a missionary. In a letter to Tancred Robinson, dated 13 August 1684, Ray, in discussing the progress of his work on *Historia Plantarum*, says of Banister:

Mr. Bannister (who I hear is now in Virginia) might make a great addition to it by communicating the non-descript species of that country.<sup>1862</sup>

In a later letter, written about December 15th 1692 to John Aubrey, Ray again mentions Banister:

We have there [Virginia] an able Botanist, who will thoroughly search it, & give us an exact account of all that are to be found there, I mean Mr. Banister.<sup>1863</sup>

Line 56. *Buxi*: *Buxus*: see above Cap.20, line 103.

Line 56. *Amygdali*: *Amygdala*: see above Cap.15, line 25.

Line 57. *Sambuco*: *Sambucus*: see above Cap.4, line 154.

Line 57. *Hyperico*: *Hypericum*: see above Cap.12, line 33.

Line 57. *Tithymalo*: *Tithymalus*: see above Cap.4, line 23.

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1861 Pliny, *Historia Naturalis* XIX, xxii: 62; Loeb edition V: 460.

[For authorities report that in Arabia mallows grow into trees in seven months, and serve as walking sticks.]

See also note at Cap.27, line 17 above.

1862 *Further Correspondence*: 141.

1863 *ibid.*: 178.

Line 57. *Semperviva*: *Sempervivum*.

[C.T.& M. 247-248] *Sempervivum* (L.); a genus of the *Crassulaceæ* or Stonecrop family.

B.& G.-W. 164: B.& H. 162: Linn.*Sp.Pl.* 464-465:

*Syn.Meth.St.Br.* 269: *H.P.* 687: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 687:

6 species given, including:

*Sedum majus vulgare* C.B. J.B. Park. *Sempervivum majus*  
Ger. *Houseleek*.

Line 58. *Malvā*: *Malva*: see above Cap.12, line 43.

Line 58. *Scabiosā*: *Scabiosa*: see above Cap.7, line 19.

Line 58. *Ebulus enim quæ herba est*: as Ray says *Ebulus* 'has completely the same generic and essential marks as *Sambucus*'. *Sambucus ebulus*, Danewort or Dwarf Elder, is one of the few herbaceous members of the *Sambucus* genus, which are usually shrubs or small trees.<sup>1864</sup>

Line 58. *cujusque superficies quotannis emoritur*: Ray is here referring to a geophyte, which is a perennial whose overwintering buds lie below soil level. Geophytes include plants having tubers, bulbs and rhizomes,<sup>1865</sup> such as *Sambucus ebulus*, mentioned by Ray.

Line 59. *Sambuco*: *Sambucus*: see above Cap.4, line 154.

*quæ arbor Botanicis censetur*: 'the elder, which is considered by botanists to be a tree'; as Ray says, the elder can grow to tree size, reaching a height of about ten metres.<sup>1866</sup>

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1864 Clapham, Tutin and Moore: 433.

1865 *Lowson's Botany*: 618.

1866 Clapham, Tutin and Moore: 434.

Line 60. *Tragium*.

[C.T.& M. 114] *Hypericum hircinum* (L.), [probably *Hypericum androsæmum x hircinum*], Stinking Tutsan; a species of the *Hypericum* genus of the *Hypericaceæ* or Hypericim family.

B.& G.-W. 246: B.& H. 79 (*Androsæmum* but not *hircinum*):

Linn.*Sp.Pl.* 784: *Syn.Meth.St.Br.* 342-344 (*Androsæmum* but not *hircinum*): *H.P.* 514: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

Linn.*Sp.Pl.* 784:

*Hypericum floribus trigynis, staminibus corolla longioribus caule fruticoso ancipiti.* Hort.cliff.331. Hort.ups.237. Roy.lugdb.374.

*Hypericum fætidum frutescens minus.* Dill.elth.182.

*Androsæmum fætidum, capitulis longissimis filamentis donatis.*

Bauh.pin.280.

*Tragium.* Clus.hist.2.p.205.

*Habitat in Sicilia, Calabria, Creta.*

*H.P.* 514:

*Stæchadi serratæ affinis* C.B. *Tragium alterum Dioscoridis quibusdam, folio Trichomanis* J.B.

Line 60. *Hyperico: Hypericum:* see above Cap.12, line 33.

Line 60. *Tithymalus:* see above Cap.4, line 23.

Line 61. *Sempervivum arborescens*.

For *Sempervivum* see above Cap.27, line 57.

*arborescens*:

Linn.*Sp.Pl.* 464:

*Sempervivum arboreum*:

*Sempervivum caule arborescente lævi ramoso.*

*Sempervivum caule inferne nudo lævi ramoso.* Hort.cliff.179.

Hort.ups.118. Roy.lugdb.456.

*Sedum majus arborescens, flosculis candidis.* Bauh.pin.282.

*Sedum majus legitimum.* Clus.hist.2.p.58.

*Habitat in Lusitania, Creta, Corcyra, Zacintho.*

Line 61. *Scabiosa arborea*:

C.T.& M. - no ref. B.& G.-W. 374 (but not this species).

*Globulariaceæ* - Globularia family. Perennial herbs with alternate, untoothed leaves. Flowers irregular (zygomorphic), 5-parted, 2-lipped, borne in dense rounded heads surrounded by a ruff or involucre of bracts. Stamens 4. Fruit dry, surrounded by the persistent calyx.

B.& H. - no ref.: Linn.*Sp.Pl.* 96:

Ray uses the name *Alypum*, *Frutex / Herba terribilis* and *Cattu* for similar plants under the same heading. Linnæus differentiates them, but in adjoining sections: see below.

*Cephalanthus orientalis*:

*Cephalanthus foliis oppositis.* Fl.zeyl.53.

*Platanocephalos citri foliis bijugis, capite majore.*

Vaill.act.1722.p.259.

*Katu-Tsiaca.* Rheed.mal.3.p.29.t.33.

*Habitat in India & Africa.*

*Globularia alypum*:

*Globularia caule fruticoso, foliis lanceolatis tridentatis*

*integrisque*. Roy.lugdb.190.

*Alypum monspeliensium* s. *Frutex terribilis*. Bauh.hist.1.p.598.

Niss. [?] act.1712.p.336.t.18.

*Thymelæa foliis acutis, capitulo succisæ*. Bauh.pin.473.

*Habitat Monspeli & in regno Valentino*.

*Globularia bisnagarica*:

*Globularia caule fruticoso, foliis radicalibus cuneiformibus retusis, caulinis lanceolatis*.

*Scabiosa bisnagarica* s. *Globularia frutescens, rigidis foliis ad radicem rotundioribus cordatis*. Pluk.alm.336.t.58.

Moris.hist.3.p.51.

*Habitat in Bisnagaricæ sylvis*.

*Syn.Meth.St.Br.* - no ref.

*H.P.* 1443 (*Indica arborea*), 1444 (*Africana arborea*):

*Alypum montis Ceti, sive Herba terribilis Narbonensium* Lob.

*Al. Monspeliensium sive Herba terribilis* Park. *Al.*

*Monspelianum sive Frutex terribilis* J.B. *Thymelæa foliis acutis, capitulo Succisæ* C.B. **Herb terrible**.

*Cattu-Schiragam* H.M. P.2.F.24.p.39. *Scabiosa Indica arborea*.

*Scabiosa Africana arborescens seu Cupresso pinulus Capitis Bonæ spei* Breyn. *Scabiosæ affinis arbuscula Africana ericoides, sphærocephalos*.

All seem to be species of what Ray calls 'Herb Terrible'.

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

Line 62. *Malva arborea*.

[C.T.& M. 167] *Lavatera arborea* (L.), Tree Mallow; a species of the *Lavatera* genus of the *Malvaceæ* or Mallow family.

B.& G.-W. 242: B.& H. 85: Linn.*Sp.Pl.* 690:

*Syn.Meth.St.Br.* 252: *H.P.* 601: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 196: *Camb.* - no ref.

*H.P.* 601:

2 species given, including:

*Malva arborea* Park. J.B. *arborea*, *Veneta dicta*, *parvo flore*

C.B. *maritima arb. Ven. dicta parvo flore* Morisoni. *Malva arborea maritima nostras* Park. **English Sea-Mallow.**

Line 62. *primo statim aspectu*: 'at first sight'.

Does this imply that Ray did not believe that they were the same genus?

Line 65. *nos quoque eam retinebimus, certiores tamen inter Fruticem, Suffruticem & Herbam distinctionis notas afferemus*. Ray, accepting earlier methods of classification into trees, shrubs, sub-shrubs and herbs, feels he must add more specific differences between the latter three.

It is interesting to note that Jung, one of Ray's major sources for this work:

In rejecting the tree-herb dichotomy as a valid major division of plants (and Jung makes clear that he is speaking of major taxonomic ranking, "*de summis speciebus*"), he was opposing, or at any rate abandoning, Cesalpino's half-way proposal to retain the division into trees and herbs whilst distributing shrubs and under-shrubs between them.<sup>1867</sup>

Line 67. *Plantas ergo initio, divisione dichotoma*: he begins by dividing plant types into two, basically divided up according to size and whether the stem is annual (*quæ caule sunt annuo, vel si perenni non lignoso*) or perennial (*quæ caule perenni lignoso*).

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<sup>1867</sup> Morton: 174.

Line 68. *Quarumcunque caules annui sunt, Herbas appellamus*: Ray calls 'herbaceous', plants with annual stems. This agrees with modern definitions, an herbaceous perennial being defined as a non-woody plant surviving the winter as underground storage organs, 'such as bulbs, corms, rhizomes and stem and root tubers'.<sup>1868</sup>

Line 69. *sive radices perennent sive non*: the term herbaceous is usually applied to perennial plants but can, as Ray says here, apply to annuals [and indeed to biennials].<sup>1869</sup>

Line 70. *Brassicæ: Brassica*: see above Cap.9, line 113.

Line 70. *Nicotiana*: see above Cap.3, line 140.

Line 70. *Malva arborea marina*: as *Malva arborea* above Cap.27, line 62.

Lines 71-73. Ray gives here his definitions of subshrubs, giving additional details to those of à Stapel given at line 10.

Line 71. *Quæ caule sunt perenni vel gemmiparæ sunt, & surculos simplices non ramosos annuatim producunt: .....in ramos & ramulos interdum divisa*. These lines are rather confusing, but Ray seems to be classifying trees and shrubs as producing buds and subshrubs as not producing buds.

Line 75. *Gemmas appello ..... vere novo in surculos explicari incipiunt, ut superius diximus*. Ray gives a definition of the buds of trees and shrubs. In modern terms he is saying that the dormant winter buds of deciduous trees and shrubs are covered by bud scales or

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1868 *Penguin Dictionary of Botany*: 264; Brickell, *Gardening*: 587.

1869 Brickell, *Gardening*: 587.

cataphylls, which are often resinous, to prevent dessication.<sup>1870</sup>

Line 79. *Arbores ergo & Frutices a Suffruticibus distinguo ..... :*  
he reiterates his differentiation that trees and shrubs produce buds  
but that subshrubs do not.

Lines 80-82. *Esto ergo Suffrutex nobis definientibus ..... :* for emphasis  
Ray gives two versions of his definition of a subshrub, repeating  
that it lacks buds. See notes at line 10 above for both Ray's and  
modern definitions of a subshrub.

Line 83. *Verum quoniam Suffrutices plerique cum Herbis ..... eos Herbis  
admiscebimus:* because of similar characteristics, Ray has decided to  
include subshrubs with herbaceous plants.

Line 84. *adeoque tria duntaxat summa Plantarum genera constituemus,  
Arbores, Fruticem, Herbam.* Here Ray reverts to his thesis of the  
*Methodus* of 1682, that trees, shrubs, subshrubs and herbs should  
be divided into three classes not four.<sup>1871</sup>

Line 86. *Summis autem generibus constitutis sequitur ut subalterna .....:*  
Ray now proceeds to analyse his system of classification in more  
detail.<sup>1872</sup>

Line 88. *Horum autem notæ characteristicæ non tantum a semine ejusque  
conceptaculo ..... sed & a flore ejusque calice desumendæ sunt:*  
here Ray re-iterates his thesis from the *Methodus Plantarum Nova* of  
1682, where he breaks with previous ideas, stating that classification

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1870 *Penguin Dictionary of Botany*: 50.

1871 See Raven: 196.

1872 See the introductory section to the commentary for Chapter 26 and the first footnote  
to Chapter 26 on *genus*.



should be indicated by flower and fruit together:

*Methodus hæc differentias sumit a similitudine et convenientia partium præcipuarum, radicis puta, floris et ejus calicis, seminis ejusque conceptaculi.*

This coincides with Jung's theories *de inferioribus speciebus*:

At lower levels of classification Jung closely follows Cesalpino, emphasizing that the essential criterion for classification must be the form of the plant, above all the form and relative position of floral parts and fruit, adding that he himself nevertheless always pays great attention to the leaves since they can be found at any age of the plant and are very conspicuous parts. Accidental characters (*differentiæ*) such as colour, odour, medicinal powers, habitat, are useless.<sup>1873</sup>

Line 90. *nonnullorum generum ..... in genere Leguminoso ..... notam generis indicem*: see the first footnote to Chapter 26 on the term *genus*.

Line 91. *Sic v.g. in genere Leguminoso ..... :* he gives the butterfly-like flowers of the *Leguminosæ* as indicators of classification.

Vines has an interesting comment on Ray's system of classification, as given here:

The result is that many of the sub-divisions consist of groups of plants which are really natural, the precursors of several of the recognized Natural Orders of Phanerogams\*<sup>1874</sup>

\*including the *Leguminosæ*.

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1873 Morton on Jung's *Doxoscopiæ*: 174.

1874 Vines: 34.

Line 92. *Flos papilionaceus*: a flower in the shape of a butterfly; the flowers of the *Leguminosæ* or Pea family.

Line 92. *Leguminum*: *Legumines*: *legumen*, -inis, n.: pulse, any leguminous plant.<sup>1875</sup>

A legume is a dehiscent pod containing seeds developed from a single carpel (the female reproductive unit of a flower, consisting of the ovary with ovules). The fruit of the family *Leguminosæ* (beans, clovers, acacias etc.).<sup>1876</sup>

Line 95. *De Arborum & Fruticum divisione instituenda . . . . .*: Ray repeats his belief that trees and shrubs are separate orders, not needing special methods of classification; it is to be noted that he applied his system only to herbaceous plants, keeping the three former categories of herbaceous plants, trees and shrubs.

Line 96. *in iis rite distribuendis & ordinandis præcipua est difficultas*: in his *Methodus Plantarum Nova* of 1682, he emphasises this difficulty, when he first gives his reasons for attempting a classification:

The number and variety of plants inevitably produce a sense of confusion in the mind of the student: but nothing is more helpful to clear understanding, prompt recognition and sound memory than a well-ordered arrangement into classes, primary and subordinate.<sup>1877</sup>

Line 97. *Nobis diu multumque considerantibus non alia prior aut potior differentia videtur quam quæ desumitur a Plantula seminali.*

Ray repeats his thesis, detailed in Chapter 14 of *Historia Plantarum*, that plants can be divided according to the number of cotyledons or

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1875 Lewis and Short: 1048.

1876 *Penguin Dictionary of Botany*: 207-208.

1877 *Methodus Plantarum Nova*, 1682: [this translation by C.E.Raven].

seed-leaves.

Line 99. *in eas quæ Plantulam seminalem habent bifoliam aut bivalvem, seu mavis, binis cotyledonibus instructam; & eas quæ eandem obtinent altero vel utroque folio seu cotyledone carentem.* As in chapter 14 he re-iterates his conviction, adopted by all subsequent botanists, that plants may be classified as having either one or two seed-leaves or cotyledons; that is, that they are either monocotyledons or dicotyledons.<sup>1878</sup>

Line 102. *Asparago, Pæonia, Aro, Cyclamino:* Ray gives all of these plants as monocotyledons with non-grass-like leaves. In fact only *Asparagus* and *Arum* are monocotyledons, *Pæonia* and *Cyclamen* being dicotyledons.<sup>1879</sup>

Line 102. *Asparago: Asparagus:* see above Cap.3, line 89.

Line 102. *Pæoniâ: Pæonia:* see above Cap.3, line 19.

Line 102. *Aro: Arum:* see above Cap.3, line 35.

Line 102. *Cyclamino: Cyclamen:* see above Cap.11, line 32.

Line 103. *quæ floribus sunt apetalis seu stamineis & eas quæ floribus petaliferis seu bracteatis:* he now divides them according to whether they have flowers with or without petals; see note at Cap.10, line 25 (p.264) and Cap. 10 *passim*.

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1878 The term *cotyledon* had first been used for the seed lobe by Malpighi in his *Anatome Plantarum* published in 1679.

1879 Clapham, Tutin and Moore: *passim*.

Line 104. *Culmiferas:Culmiferae*: literally ‘bearing a culm’. A culm is the jointed stem of members of the *Gramineæ* or *Cyperaceæ*. In grasses it is, as Ray says here, usually hollow, but occasionally filled with pith.<sup>1880</sup>

Line 107. *Frumenta: frumentum, -i, n.*: corn.<sup>1881</sup> Ray uses *frumentum* for Maize or Sweet Corn, a species of the *Gramineæ* or Grass family. See under *Frumentum* Cap.7, line 50.

Line 107. *Cerealìa*: Ray uses *Cerealìa* for plants of the *Gramineæ* or Grass family, which produce grain for food, such as *Triticum*, *Secale*, *Hordeum*, *Avena* and *Ægilops*.

Line 108. *Gramina*: grasses. *Gramineæ* is the Grass family.

Line 108. *vel conceptaculum seminale in terna loculamenta divisum obtinent*  
Ray continues by describing fruits divided into three carpels.<sup>1882</sup>

Line 111. *Crocon Colchicum: Crocus Colchicus*.

[C.T.& M. 541] *Colchicum autumnale* (L.), Meadow Saffron, Naked Ladies, Autumn Crocus; a species of the *Colchicum* genus of the *Liliaceæ* or Lily family.

B.& G.-W. 452: B.& H. 468: Linn.*Sp.Pl.* 341-342:

*Syn.Meth.St.Br.* 373: *H.P.* 1170: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1170:

*Colchicum commune* C.B. *Colch. Anglicum purpureum*, &  
*Anglicum album* Park. Ger. *Colchicum* J.B.

***Meadow Saffron.***

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1880 *Penguin Dictionary of Botany*: 92.

1881 Lewis and Short: 785.

1882 For more detail on carpels, see *Lowson's Botany*: 324-327.

Line 111. *Asphodelus*: see above Cap.3, line 19.

Line 111. *Phalangium*: *Liliaceæ* - Lily family.

C.T.& M. 533: B.& G.-W. 452 [*Narhtecium ossifragum*, *Tofieldia palustris* and *Anthericum liliago*]:

Bog Asphodel, *Narhtecium ossifragum* (L.) Hudson.

Low to medium, rather variable, rhizomatous, hairless perennial with fans of fleshy, sword-shaped leaves, basal, often orange-tinged; stem leaves small and bract-like, the upper larger than the lower. Flowers greenish-yellow or orange-yellow, 10-16mm., starry, in a rather lax spike-like raceme; filaments of stamens densely hairy. Fruit a small narrow, elliptical capsule, to 12mm. long. Bogs and wet acid heaths and moors to 1200m. July-September. Generally regarded as poisonous, especially to livestock. Generally widespread in Britain, but rare and local in the east of England.

St. Bernard's Lily, *Anthericum liliago*, Linnæus.

Rather slender short to medium, hairless perennial. Leaves linear, flat or slightly grooved, tapered to a sharp apex. Flowers glistening white, 20-35mm., starry, in simple or slightly branched lax racemes, the tepals much exceeding the stamens; style curved; bracts lanceolate, pointed, membranous. Open habitats in hills and mountains, generally over limestone, 300-1800m. May-July. France, Germany, Belgium, Denmark, S. Sweden.

B.& H. 467-468:

*Narhtecium ossifragum*, Huds.: Bog or Lancashire Asphodel

*Tofieldia palustris*, Huds.: Scottish Asphodel.

Linn.*Sp.Pl.* 310-312, 316, 324.

*Narhtecium ossifragum*:

*Anthericum foliis ensiformibus, filamentis lanatis*. Fl.suec.268.

Gmel.sibir.1.p.73.t.18.f.2.1

*Anthericum scapo folioso laxo spicato, filamentis villosis.*  
Fl.lapp.136. Roy.lugdb.45.

*Nartheceum.* Mœrh.e.n.c.1742.p.389.t.5.f.1. Wach.ultr.303.  
Gort.gelr.69.

*Pseudo-Asphodelus palustris anglicus.* Bauh.pin.29.

*Asphodelus luteus palustris.* Dod.pempt.208.

*Habitat in Europæ borealis uliginosis.*

[This appears to be the species mentioned by Ray in *Syn.Meth.St.Br.* although Linnæus does not use the name *Phalangium* for it.]

The following two plants are now St.Bernard's Lily, for which see above.

*Anthericum ramosum:*

*Anthericum foliis planis, scapo ramoso, corollis planis.*

*Anthericum foliis planis, corollis planis deciduis.* It.gotl.178.  
\*Fl.suec.267.

*Anthericum caulibus ramosis, foliis planis.* Guett.stamp.p.129.

*Phalangium, parvo flore, ramosum.* Bauh.pin.29.

*Phalangium majus.* Cam.epit.580.

*Habitat in Europæ australioribus rupibus calcareis.*

*Anthericum liliago:*

*Anthericum foliis planis, scapo simplicissimo.* Hort.ups.83.  
It.scan.

*Anthericum caulibus non ramosis, foliis planis.*  
Guett.stamp.1.p.128.

*Phalangium, parvo flore, non ramosum.* Bauh.pin.29.  
Moris.hist.2.p.333.s.4.t.1.f.10.

*Phalangium non ramosum.* Lob.ic.48.

*Habitat in Helvetia, Germania, Gallis.*

*Syn.Meth.St.Br.* 375:

*Phalangium Anglicum palustre Iridis folio* J.R.H. 368. *Pseudo-Asphodelus palustris vulgaris nostras* Syn.II.234. *primus* Clus.H.198. *palustris Anglicus* C.B.Pin.29. *luteus acorifolius palustris Anglicus Lobelii* J.B.II.633. *Asphodelus Lancastriæ verus* Ger.Em.97.descr.

**Lancashire Asphodel or Bastard Asphodel.**

*Phalangium Scoticum palustre minimum Iridis folio* J.R.H.369. *Pseudo-asphodelus palustris Scoticus minimus* Raj.H.1195. Syn.II.234. **The least Scottish [sic] Asphodel.**

H.P. 1192:

(Tr.) 'It differs from Asphodel in its fibrous roots.'

*Phalangium flore Lillii* J.B. *Allobricum* Park. *Allobricum majus* Clus. *magno flore* C.B. *Phal. Antiquorum* Ger.emac.

**Spider-wort..**

*Phalangium Virginianum Tradescanti* Ger.emac. *Ephemerum Virginianum Tradescanti* Park.parad. *Allium sive Moly Virginianum* C.B.app. **Virginian Spider-wort.**

Ray does not use *Phalangium* as one of the names for Lancashire Asphodel or Scottish Asphodel in *Historia Plantarum*.

H.P.III 563:

*Ad cap. de Phalangio*: 16 additional species given.

*Ad cap. de Phalangio Virgin.*: 2 additional species given.

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

Line 112. *Asparagus*: see above Cap.3, line 89.

Line 112. *Arum*: see above Cap.3, line 35.

Line 112. *Dracontium*: see above Cap.3, line 46.

Line 113. *Prioris generis herbæ, quæ scilicet plantulam seminalem bifoliam aut bivalvem obtinent*: for dicotyledons, see notes to Chapter 14 and for types of flower see Chapter 10.

Line 117. *πεταλώδη*: apart from the Greek words for tree, shrub, sub-shrub and herbaceous plant, given in parenthesis towards the beginning of the chapter, this is Ray's first use of Greek within the text of this chapter; he is either using Greek for emphasis as in other places or, in this case, may be using it because the word 'petal' as a technical term was still very new in botany.<sup>1883</sup>

Text page 53.

Line 118. *Ἡὸτ. Ad petalum constituendum ..... : vide supra* where he first defines a petal in Chapter 10, lines 36-48.

Lines 122-132. *Florem compositum voco ..... in ventrem plerunque extumescit*: again he summarises his earlier argument, this time from Chapter 11 *passim*.

Line 129. *Papposæ*: a pappus is the tuft of hair or bristles or homologous appendages on the small dry fruits of *Compositæ* or *Valerianaceæ*, which helps in dispersal by wind. The tuft is a modified calyx made up of hairs, scales or teeth, which persist after fertilisation.<sup>1884</sup> Ray uses the term *Papposæ* for plants with this type of fruit.

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1883 See the note on *πέταλον*, *petalum*, 'petal' at Cap.11, line 5.

1884 *Oxford Dictionary of Botany*: 295; *Penguin Dictionary of Botany*: 259.



Line 129. *Corymbiferis: Corymbiferae*: a corymb is a raceme whose lower stalks are longer than the upper ones, so that the inflorescence has a flat top. 1885 Ray uses the term *Corymbiferae* to describe plants with an inflorescence of this type.

Line 132. *Capitatae: capitatus*, capitate or having a knob-like head or tip, e.g. when many flowers are clustered together in an inflorescence. 1886 Ray uses the term to describe plants with an inflorescence of this type.

Line 132. *quia calyx earum squamosus ..... : Ray explains the term capitatus as meaning 'scaly and swelling into a stomach shape'; it does mean 'having a head', which could be described as 'stomach shaped' but does not mean squamosus or scaly.* 1887

Lines 133-175. *Quæ florem habent simplicem..... ad unguem fere pertinentes scissuras.* From line 133 to the end of the chapter Ray discusses the characteristics of fruits and seeds in relationship to their preceding flowers; he has already discussed this at length in Chapters 11, 12 and 13, for which *vide supra passim*.

Line 140. *Umbelliferae*: see above Cap. 11, line 55.

An umbel is an inflorescence in which each pedicel (the stalk of a single flower in an inflorescence) arises from the same point or common node on the main axis, the outermost flowers being borne on the longest pedicels so that the whole inflorescence is flat topped. 1888

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1885 *Oxford Dictionary of Botany*: 106; *Penguin Dictionary of Botany*: 89.

1886 *Longman Dictionary of Botany*: 81.

1887 Lewis and Short: 286 and 1749.

1888 *Penguin Dictionary of Botany*: 372.

Line 141. *Stellatae: stellatus* is an adjective used in botany for ‘stellate’ or ‘starry’, i.e. having narrow divisions radiating from a centre like the rays of a star.<sup>1889</sup> *Stellatae* is used of flowers of this shape.

Line 144. *Verticillatae: verticillatus*, ‘verticillate’ or ‘whorled’.

Line 145. *Asperifoliarum: Asperifoliae*: literally ‘rough-leaved’.

Line 150. *Nos equidem in Methodo plantarum non ita pridem edita*: Ray states here that his *Methodus* has not so far been published. As the *Methodus* was published in 1682, this could imply that the writing of *Historia Plantarum* was already well under way by this time; as we have seen in this chapter he used much of the material from the *Methodus* for the sections in this work on classification. He could on the other hand be referring to his intentions to produce an edited re-issue of *Methodus Plantarum*, which eventually appeared in 1703 as *Methodus Plantarum emendata et aucta*.

Line 150. *Verticillatarum: Verticillatae*: see above Cap.27, line 144.

Line 151. *Libanotidis cachryophoræ: Libanotis cachryophora*.

[C.T.& M. 284] *Seseli libanotis* ([L.] Koch), Moon Carrot; a species of the *Seseli* genus of the *Umbelliferæ* or Carrot family.

B.& G.-W. 274: B.& H. 191: Linn.*Sp.Pl.* 259-261 / 246:

*Syn.Meth.St.Br.* 216: *H.P.* 424: *H.P.III* 253: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 424:

4 species given, including:

*Libanotis Cachryophoros quibusdam, floribus luteis* J.B. *ferulæ*

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<sup>1889</sup> *Oxford Dictionary of Botany*: 390.

*folio, sive Cachryfera, sive Cachrys vera* Park. *Ferulae folio, semine anguloso* C.B. *Libanotis Galeni, Cachrys verior* Ger. *quoad iconem.*

Line 151. *dari nucleum*: Ray here uses nucleus for ‘embryo’ for the first time in *Historia Plantarum*. This material is again taken from his *Methodus*, in this instance from the third essay on the structure of the seed and its embryo, where he comments that, in all seeds which he has examined, the embryo or nucleus is always visible, although sometimes more so than in others.

Line 153. *Theophrastus*: see above Cap.9, line 8.

This is a reference to the discussion in Theophrastus on the differences in seeds, where he states that:

γυμνοσπέρματα δὲ τῶν τε λαχάνων πολλά,  
καθάπερ ἄνηθον κορίαννον ἄνησον κύμινον  
μάραθρον καὶ ἕτερα πλείω.<sup>1890</sup>

Line 154. *Stellatarum: Stellatae*: see above Cap.27, line 141.

Line 154. *Asperifoliarum: Asperifoliae*: see above Cap.27, line 145.

Line 154. *Polyspermων: Polyspermae*: literally ‘many-seeded’.

One Greek letter to denote the genitive plural; the whole word is a direct transliteration from the Greek,<sup>1891</sup> and one feels that perhaps Ray’s first instinct was to use the Greek alphabet and then he

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1890 Theophrastus, *Περὶ Φυτῶν Ἱστορίας*: I, xi: 2.

[While many pot herbs have their seeds naked, as dill, coriander, anise, cummin, fennel and many others.]

1891 πολύσπερμος: ‘abounding in seed’; see Theophrastus *Περὶ Φυτῶν Ἱστορίας*: VI: vii: 4; Loeb edition II: 46.

consciously transliterated into Roman script with one letter remaining in Greek.<sup>1892</sup>

Line 156. *Malvis: Malva:* see above Cap.12, line 43.

Line 161. *Pomiferæ:* literally 'apple-bearing'.

Line 162. *Bacciferæ:* literally 'berry-bearing'.

Line 164. *Multisiliquas: Multisiliquae:* literally 'with many pods' or 'capsules'.

Line 164. *Aconitum:* see above Cap.12, line 28.

Line 165. *Aquilegia:* see above Cap.10, line 149.

Line 165. *Delphinium:* see above Cap.11, line 52.

Line 167. *pro numero foliorum in flore:* Ray reverts to the use of *folium* for a floral leaf or petal as opposed to using *petalum* applied by Colonna to the 'floral leaf'.<sup>1893</sup>

Lines 167-175. *Monopetalas ..... pertinentes scissuras:* Ray gives a summary here of his arguments in Chapter 11 above.

Line 171. *Papilionaceae: papilionaceus,* butterfly-like; of plants with a corolla like that of a bean, pea etc. <sup>1894</sup> Ray uses the term for the family of plants now called *Leguminosae*.

One of the three subfamilies of *Leguminosae*, of plants in which the

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1892 As Raven points out, he had been lecturer in Greek at Cambridge from 1651 to the mid 1650s; Raven: XV-XVI.

1893 See note above at Cap.10, line 19.

1894 Stearn, *Botanical Latin:* 476.

leaves are pinnate, trifoliate, or simple. The flowers are usually zygomorphic, the sepals and petals imbricate, the lowest petal innermost in the bud, and there are usually ten stamens. There are 400-500 genera, including many temperate, herbaceous plants.<sup>1895</sup>

## Chapter Twenty-eight:

### *On the collection, drying out and preservation of plants and their parts.*

In this chapter Ray discusses the collection of plants and their parts for various purposes: fresh material - for transplantation, for culinary use, seeds for future crops and fruits for medicinal use: and the drying of various parts of plants - for medical usage, for creating an herbarium, fruit for later consumption and seeds for future germination.<sup>1896</sup>

#### Text page 53.

- Line 1. *In Plantis earumve partibus colligendis observationum cœlestium, & Astrologicarum de partibus Zodiaci .....* : Ray begins this chapter with an example of his lack of superstition, when he states that there is no point in giving credence to the signs of the zodiac when collecting plants for any purpose.
- Line 5. *At neque multum referre putamus qua Lunæ ætate collectæ fuerint plantæ:* he continues by emphasising his 'down to earth' common sense by stating that it is unnecessary to consider the phases of the moon when collecting plants.
- Line 7. *Omnes denique de modo colligendi observatiunculas superstitosæ vanitatis damnamus.* Ray finally dismisses as ridiculous all methods of collection depending on superstition for their timing. This attitude is representative of the new philosophy of the seventeenth century, which emphasised that objects [such as plants] and

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1896 Ray adds an interesting aside that dried plants cannot be relied on for identification and study purposes:

unless excellently well conserved ..... I know how apt I have been to be cozened and deceived by them: I have not known patterns of some plants dried, which growing I know as well as any.

Letter from John Ray to Tancred Robinson, dated 12th May 1685;  
*Further Correspondence:* 146-147.

phenomena [such as the weather] were ordinary things not controlled by supernatural forces.

Text page 54.

Line 8. *In genere autem colligendas censemus.....* : Ray now gives what he considers to be the correct time for the collection of plants; as Ray says, a dry day after the dew has evaporated is still considered to be the best time for collecting any part of a plant.

Line 11. *ut recte Schroderus:* Johann Schroder.<sup>1897</sup>

His *Pharmacopœia Medico-Chymica* was published at Lyons in 1649 and frequently reprinted, an English version, *The Compleat Chymical Dispensatory*, translated by William Rowland, being published in 1669. Book IV contains the *Phytologia*, an index of plants with their uses.<sup>1898</sup>

Line 15. *Usurpationis ratione colligi requirunt dum qualitates vigent medicationi aptiores.* Today this is still considered to be good advice; as Launert, agreeing with Ray, says of medicinal plants:

The active ingredients of medicinal plants vary in both quality and quantity in the course of the year.<sup>1899</sup>

Line 16. *Sed ut de partibus plantarum in specie agamus.* Ray now begins to detail the collection of the various parts of a plant.

Line 17. *Quod ad Radices attinet:* he begins with the root, giving varying opinions on times for collection with reasons:

Spring, because there is more strength and sap in the

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1897 The only work by Schroder listed in the sale catalogue of Ray's library is: *Ars Medica*, edition published in Frankfurt in 1648; British Museum: S-C 326 (6): 9, *Libri in Latine &c. in Quarto*, number 210.

1898 Raven: 157.

1899 Launert: 8.

roots then.

Summer, because the plant is then in full vigour.

Autumn for five reasons given by Lauremberg and listed by Ray below.

Line 25. *Cichorium*: see above Cap.1, line 36.

As Lauremberg says, the autumn is still considered to be the best time for the collection of the roots of Chicory.<sup>1900</sup>

Line 25. *Beta*: see above Cap.9, line 47.

It is still considered advisable to harvest beet before the severe frosts of winter; in mild areas plants may be left in well-drained soil throughout the winter but in time will become woody.<sup>1901</sup>

Line 25. *Carrota*.

[C.T.& M. 294] *Daucus carota* (L.), Wild Carrot; a species of the *Daucus* genus of the *Umbelliferæ* or Carrot family.

B.& G.-W. 286: B.& H. 200: Linn.*Sp.Pl.* 242:

*Syn.Meth.St.Br.* 218: *H.P.* 465: *H.P.III* 258: *Tri.* - no ref.:

*Cat.Angl.* - no ref.:<sup>1902</sup> *Camb.* 59.

*H.P.* 465:

*Pastinaca sativa tenuifolia* Ger. *tenuifolia sativa lutea* Park.  
*tenuifolia sativa radice lutea vel alba* C.B. *sativa sive Carota rubra, lutea & alba* J.B. **Carrots.**

*Pastinaca sylvestris sive Staphylinus Græcorum* J.B. *sylv. tenuifolia* Ger. Park. *sylv. tenuifolia Dioscoridis vel Daucus Officinarum* C.B. **Wild Carrot, or Birds-nest.**

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1900 Launert: 204.

1901 Brickell, *Gardening*:352.

1902 NB *Daucus* itself is listed in *Catalogus Angliæ* [page 88] but does not include the name *Carrota/Carota*.



*H.P.III* 258:

Listed under *Daucus* in the Index to Volume III.

*Ad cap. de Pastinaca tenuifolia*: 13 additional species given.

As Lauremberg says, it is advisable to harvest the roots of carrot before the winter frosts, although, like beet, the plants may be left in the soil in mild areas.<sup>1903</sup>

Line 29. \**P.Laurembergius*: margin reference to \**Horticult. lib.2, cap.7, sect.7*.

Line 30. *Verum rationes hæ rem non concludunt .....* : Ray now gives his comments on these observations of Lauremberg.

Lines 30- 63. *Nullus est Autumno .....* & *fibræ lignescunt*: Ray explains his conviction that most roots are best left in the ground until the spring.

Line 45. *Pastinacis latifoliis*: *Pastinaca latifolia*.

[C.T.& M. 292] *Pastinaca sativa* (L.), Wild Parsnip; a species of the *Pastinaca* genus of the *Umbelliferæ* or Carrot family.

B.& G.-W. 284: B.& H. 195: *Linn.Sp.Pl.* 262:

*Syn.Meth.St.Br.* 206: *H.P.* 409: *H.P.III* - no ref.: *Tri.* 12.141:

*Cat.Angl.* 225: *Camb.* 92.

*H.P.* 409:

*Pastinaca sylvestris latifolia* C.B. *latifolia sylvestris* Park. Ger.

*Germanica sylvestris, quibusdam Elaphoboscum* J.B.

**Wild Parsnep.**

*Tri.* 12.141:

Parsnip: *Pastinaca*, -æ, f.: Ἐλαφόβοσκον, -ου, n.<sup>1904</sup>

Ray's observations, that it is beneficial to wait until late autumn or

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1903 Brickell, *Gardening*: 354.

1904 'Deer-feeding', because allegedly eaten by deer as an antidote to snake-bite; Dioscorides 3.69, Pliny *Historia Naturalis* XXII, xxxvii: 79.

early winter (preferably after the first frosts) to harvest the roots of *Pastinaca*, are still adhered to today.<sup>1905</sup>

Line 45. *Quadragesimali*: this refers to the spring season or in ecclesiastical terms to the period of Lent, extending from Ash Wednesday to Easter.

Line 47. *Quod Radices Autumno transplantatæ facilius proveniant*: Ray is correct in stating that it is better to transplant any type of perennial in the autumn, when they have finished flowering and fruiting and are, in effect, dormant and can establish their root systems before the new growing season in spring.<sup>1906</sup>

Line 47. *eas tunc temporis vegetiores esse non convincit*: although it is better to transplant in the autumn, Ray does not believe that roots are necessarily in a prime state for harvesting then.

Line 54. *atque nonnullas autumno, alias æstate, plerasque vere*: here he states his preference for spring harvesting of roots.

Line 56. *Carotæ: Carota*: see above under *Carota* Cap.28, line 25.  
See note on harvesting at line 25 above.

Line 57. *Pastinacæ latifoliæ: Pastinaca latifolia*: see above Cap.28, line 45.  
See note on harvesting at line 45 above.

Line 58. *Rapa*: see above Cap.3, line 18.  
Ray's belief that *Brassicarapa* should be harvested before the frosts is still adhered to.<sup>1907</sup>

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1905 Launert: 104.  
1906 Brickell, *Gardening: passim*.  
1907 *ibid.*: 353.

Line 60. *Acetosæ: Acetosa:* see above Cap.8, line 37.

Usually it is the leaves of Sorrels, which are harvested, rather than the root as mentioned here by Ray .<sup>1908</sup>

Line 60. *Althææ: Althæa:* see above Cap.9, line 132.

It is now suggested that the roots of Mallow be collected in the autumn, rather than any time but winter as suggested by Ray.<sup>1909</sup>

Line 60. *Asari: Asarum:* see above Cap.12, line 33.

It is now suggested that the plant is harvested when in flower, which ever part is to be used.<sup>1910</sup>

Line 60. *Buglossi: Buglossus:* see above Cap.9, line 61.

Modern herbals recommend the use of leaves and seeds, rather than the roots.

Line 60. *Cyclamen:* see above Cap.11, line 32.

The root is to be harvested when the plant is in flower, that is, in September.<sup>1911</sup>

Line 60. *Dracunculi: Dracunculus.*

Ray may be referring to *Dracunculus vulgaris* (Schott) [*Arum*

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1908 Grieve, *A Modern Herbal*: 752-754.

1909 Launert: 50.

1910 *ibid.*: 110.

1911 Grieve, *A Modern Herbal*: 245.

*dracunculus*], Dragon Arum,<sup>1912</sup> or to *Achillea ptarmica* (L.), Sneezewort,<sup>1913</sup> or most probably to *Artemisia dracunculus* (L.), Tarragon.

B.& G.-W. 412: *Artemisia dracunculus* (L.), Tarragon; a species of the *Artemisia* genus of the *Compositæ* or Daisy family.

C.T.& M. - no ref.: B.& H. 241: Linn.*Sp.Pl.* 849:

*Syn.Meth.St.Br.* - no ref.: *H.P.* 373: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 373:

*Draco herba* Ger. *Dracunculus hortensis* C.B. *Dracunculus hortensis sive Tarchon* J.B. *Draco herba sive Tarchon & Dracunculus hortensis* Park. **Tarragon.**

Leyel gives the derivation of its name thus:

The name Tarragon is a corruption of the French *Esdragon*, derived from the Latin *Dracunculus* (a little dragon), which also serves as its specific name. It was sometimes called little Dragon Mugwort and in French has also the name *Herbe au Dragon*.<sup>1914</sup>

Leyel also says that 'the root of Tarragon was formerly used to cure

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- 1912 Polunin 509: *Dracunculus vulgaris* (Schott), Dragon Arum; a species of the *Dracunculus* genus of the *Araceae* or Arum family.  
C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 420: Linn.*Sp.Pl.* 967-968:  
*Syn.Meth.St.Br.* - no ref.: *H.P.* 1211: *H.P.III* - no ref.: *Tri.* 10.64: *Camb.* - no ref.  
*H.P.* 1211: *Dracontium majus* Ger. *Dracunculus major vulgaris* J.B. Park.  
*polyphyllos* C.B. **Dragons.**  
*Tri.* 10.64: Dragons: *Dracontium*, -ii, n.: *Δρακόντιον*, -ίου, n.  
Arum roots are poisonous and not generally harvested for any practical purposes.
- 1913 C.T.& M. 472: *Achillea ptarmica*, (L.), Sneezewort; a species of the *Achillea* genus of the *Compositae* or Daisy family.  
B.& G.-W. 408: B.& H. 239: Linn.*Sp.Pl.* 898: *Syn.Meth.St.Br.* 183: *H.P.* 344:  
*H.P.III* 218: *Tri.* - no ref.: *Camb.* - no ref.  
*H.P.* 344: *Ptarmica* Ger. *vulgaris* Park. *vulgaris, folio longo serrato, flore albo* J.B.  
*Dracunculus serrato folio pratensis* C.B. **Sneezewort, Bastard Pellitory:**  
*nonnullis Goose-tongue, id est Lingua anserina.*  
*H.P.III* 218: *Ad cap. de Ptarmica*: 11 additional species given.  
Geoffrey Grigson states that the root 'tastes sharp and hot, and causes a flow of saliva': 378.
- 1914 Grieve, *A Modern Herbal*: 791.

toothache',<sup>1915</sup> although she gives no indication of the season for harvesting.

Line 65. *Rosæ: Rosa:* see above Cap.9, line 22.

As Ray says, Roses should be collected when in bud.

Line 65. *Jasmini: Jasminum.*

[Mac.Enc. 643] *Jasminum* (L.), Jasmine; a shrub of the genus *Jasminum* of the *Oleaceæ* or Olive family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 297:

Linn.*Sp.Pl.* 7: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1599-1600:

*H.P.III D.* 62: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1599-1600:

13 species given, including:

*Jasminum album* Ger. Park.parad. *vulgatius flore albo* C.B.

*Jasminum sive Gelseminum flore albo* J.B.

***White Jasmine or Jessima.***

*H.P.III D.* 62:

4 main species are described here, which 'are described earlier in Our History' (i.e. in the earlier volumes of *Historia Plantarum*).

Ray goes on to subdivide species number 3 into 11 subspecies.

Line 66. *Herbæ & folia cum odore, colore, sapore, cacumineque superbiunt, & florescentiæ appropinquant:* Ray continues with the correct time for harvesting of herbs and leaves. Modern advice for such harvesting would be:

Herbs should be harvested on a fine, dry day after the dew has dried but before the plants are exposed to hot sunshine, which evaporates the essential oils. ....

Leaves and shoots may be picked at any time during the

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1915 Grieve, *A Modern Herbal*: 792.

growing season but are at their best before flowering [as  
Ray says].<sup>1916</sup>

Line 75. *dum tenere adhuc recens natæ*: as Ray says, Asparagus, Lettuce and Purslane should be harvested early in the season.

Line 76. *Asparagis: Asparagus*: see above Cap.3, line 89.  
It is now recommended that Asparagus is harvested in mid spring, after it has grown into a strong but not woody plant.<sup>1917</sup>

Line 76. *Lactucis: Lactuca*: see above Cap.4, line 46.  
Lettuces should be harvested before they bolt (i.e. flower and seed).<sup>1918</sup>

Line 76. *Portulacā: Portulaca*.  
[C.T.& M. 153] *Portulaca oleracea* (L.), Purslane; a species of the *Portulaca* genus of the *Portulacaceæ* or Purslane family.  
B.& G.-W. 80: B.& H. 76: Linn.*Sp.Pl.* 445-446:  
*Syn.Meth.St.Br.* 368: *H.P.* 1035 (the index to *H.P.* gives incorrectly 238-239): *H.P.III* 504: *Tri.* 13.154:  
*Cat.Angl.* - only *marina* and *aquatica* 241: *Camb.* 97.  
*H.P.* 1035:  
*Alsine rotundifolia sive Portulaca aquatica* Ger.emac. *aquatica minor folio oblongo, sive Portulaca aquatica* Park.  
**Water Purslane, or round-leaved Water-Chickweed.**  
*Anagallis Serpyllifolia aquatuca* J.B.  
*H.P.III* 504:  
18 additional species given.

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1916 Brickell, *Gardening*: 302.

1917 *ibid.*: 350.

1918 *ibid.*: 329.

Tri. 13.154:

Purslane: *Portulaca*, -æ, f.: Ἀνδράχνη, -ης, f.

Line 77. *Herbæ, ut plurimum ad usum medicum cum floribus asservantur:*

Ray, citing Schroder, now recommends that plants for medicinal use be harvested when their flowers are at their best. This is still the modern practice.

Line 78. *Calamintha.*

[C.T.& M. 408-409] *Calamintha* (Miller), Calamint; a genus of the *Labiatae* or Mint family.

B.& G.-W. 340-342: B.& H. 349: Linn.*Sp.Pl.* 593:

*Syn.Meth.St.Br.* 243: *H.P.* 568-569: *H.P.III* 309: *Tri.* 9.31:

*Cat.Angl.* 48-49: *Camb.* 49-50.

*H.P.* 568-569:

5 species given, including:

*Calamintha vulgaris* Park. *vulgaris Officinarum* Ger. *vulgaris vel Officinarum Germanicæ* C.B. *flore magno vulgaris* J.B.

**Common Calamint.**

*H.P.III* 309:

8 additional species given.

*Tri.* 9.31:

Calamint: *Calamintha*, -æ, f.: Καλαμίνθη, -ης, f.

Line 78. *Centaurium.*

[C.T.& M. 352-353] *Centaurium erythræa* (Rafn.), [*Erythræa centaurium* (auct.): *Centaurium umbellatum* (auct.): *Centaurium minus* (auct.): *Centaurium capitatum* ([Willd.] Borbás)], Common Centaury; a species of the *Centaurium* genus of the *Gentianaceæ* or *Gentian* family.

B.& G.-W. 304: B.& H. 300: Linn.*Sp.Pl.* 910:

*Syn.Meth.St.Br.* 198 / 286 / 287 / 341: *H.P.* 329: *H.P.III* - no ref.:

*Tri.* 9.37: *Cat.Angl.* 59-61: *Camb.* 52.

*H.P.* 329:

6 species given, including:

*Centaurium magnum* Ger. *majus vulgare* Park. *majus Juglandis folio* J.B. *majus folio in laciniis plures diviso* C.B.

**Great Centory.**

*Tri.* 9.37:

Centory: *Centaurium*, -ii, n.: *Κενταύριον*, -ίου, n.

Line 78. *Chamædrys*.

[C.T.& M. 379] *Veronica chamædrys* (L.), Germander Speedwell; a species of the *Veronica* genus of the *Scrophulariaceæ* or Figwort family.

B.& G.-W. 362: B.& H. 336: Linn.*Sp.Pl.* 13:

*Syn.Meth.St.Br.* 231: *H.P.* 527-528: *H.P.III* 282: *Tri.* 10.79:

*Cat.Angl.* 64-65: *Camb.* 53.

*H.P.* 527-528:

5 species given, including:

*Chamædrys vulgaris* Park. *vulgo vera existimata* J.B. *minor* Ger. *minor repens* C.B. **Common Germander.**

*H.P.III* 282:

18 additional species given.

*Tri.* 10.79:

Germander: *Chamædrys*, -yos, f.: *Χαμαΐδρις*, -υας, f.



Line 78. *Chamæpitys.*

[C.T.& M. 419] *Ajuga chamepitys* ([L.] Schreber), Ground-Pine;  
a species of the *Ajuga* genus of the *Labiatae* or Mint family.

B.& G.-W. 332: B.& H. 362: Linn.*Sp.Pl.* 562:

*Syn.Meth.St.Br.* 244: *H.P.* 573-574: *H.P.III* 309: *Tri.* - no ref.:  
*Cat.Angl.* 67-68: *Camb.* 53.

*H.P.* 573-574:

5 species given, including:

*Chamæpitys vulgaris* Park. *vulgaris odorata flore luteo* J.B.

*lutea vulgaris, sive folio trifido* C.B. *Cham. mas* Ger.

**Common Ground-Pine.**

*H.P.III* 309:

2 additional species given.

Line 78. *Daucus.* See above under *Carrota* (*Daucus carota*), Cap.28, line 25.

Line 78. *Fumaria:* see above Cap.7, line 55.

Line 79. *Majorana.*

[C.T.& M. 407] *Origanum vulgare* (L.), Marjoram; a species of  
the *Origanum* genus of the *Labiatae* or Mint family.

B.& G.-W. 342: B.& H. 349: Linn.*Sp.Pl.* 588-590:

*Syn.Meth.St.Br.* 236: *H.P.* 539-540: *H.P.III* 289: *Tri.* 11.117:

*Cat.Angl.* - no ref. but see under *Origanum* 218-219: *Camb.* 90.

*H.P.* 539-540:

11 species given, including:

*Majoranavulgaris* C.B. *vulgaris æstiva* Park. *major* Ger. *majori*  
*folio, ex semine nata* J.B. **Sweet Marjoram.**

*Origanum vulgare spontaneum* J.B. *Anglicum* Ger. *sylvestre*,

*Cunila bubula Plinii* C.B. *Majorana sylvestris* Park.

**Wild Marjoram.**

*H.P.III* 289:

*Ad cap. de Majorana & Origano*: 3 additional species of *Majorana* given and 8 additional species of *Origanum*.

*Tri.* 11.117:

Marjoram: *Majorana*, -æ, f.: Σάμψυχον, -ύχου, n.

Line 79. *Origanum*.

[C.T.& M. 406-407] *Origanum* (L.); a genus of the *Labiatae* or Mint family.

B. & G.-W. 342: B.& H. 349: *Linn.Sp.Pl.* 588-590:

*Syn.Meth.St.Br.* 236: *H.P.* 539-540: *H.P.III* 289: *Tri* - no ref.:

*Cat.Angl.* 218-219: *Camb.* 90.

*H.P.* 539-540:

11 species given, including:

*Origanum vulgare spontaneum* J.B. *Anglicum* Ger. *sylvestre*,  
*Cunila bubula Plinii* C.B. *Majorana sylvestris* Park.

**Wild Marjoram.**

*H.P.III* 289:

*Ad cap. de Majorana & Origano*: 3 additional species of *Majorana* given and 8 additional species of *Origanum*.

Line 79. *Polium*.

[Flowers G.& B. 388.1097],<sup>1919</sup> *Teucrium polium* (L.), Felty Germander; a species of the *Teucrium* genus of the *Labiatae* or Mint family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 563 / 565 / 566: *Syn.Meth.St.Br.* - no ref.: *H.P.* 524:

*H.P.III* 379 (incorrect reference in the Index to Volume III - it should read 279): *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

H.P. 524:

11 species given, including:

*Polium maritimum erectum Monspeliacum* C.B. Ger.  
*Monspessulanum* J.B. *montanum minus* Park. *epitheta hujus &*  
*sequentis speciei apud Parkins. permutata videatur.*

**Poley Mountain.**

H.P.III 279:

31 additional species given.

Line 79. *Pulegium*: see above Cap.17, line 36.

Line 79. *Serpyllum*: see above Cap.21, line 10.

Line 79. *Thymus*.

[C.T.& M. 407-408] *Thymus* (L.), Thyme; a genus of the *Labiatae*  
or Mint family.

B.& G.-W. 342: B.& H. 348: Linn.*Sp.Pl.* 590-592:

*Syn.Meth.St.Br.* - no reference other than as *Serpyllum*, pp.230-

231: H.P. 519-523: H.P.III 277: *Tri.* 14.190:

*Cat.Angl.* - no ref. but see under *Serpyllum* 271-272:

*Camb.* - no reference but see under *Serpyllum*.113.

H.P. 519-523:

14 species given, including:

*Thymus capitatus, qui Dioscoridis* C.B. *Thymum legitimum*  
*capitatum* Park. *Thymum Creticum, sive Antiquorum* J.B.  
*Thymum Creticum* Ger. **The true Thyme of the Ancients.**

H.P.III 277:

12 additional species given.

*Tri.* 14.190:1920

Thyme: *Thymus*, -i, m.: Θύμος, -ύμου, m.

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1920 NB The number given in *Trilingue* is 14.190 but should read 14.200.

Text page 55.

Line 80. *Semina colligenda sunt cum bene matura fuerint* ..... : Ray now gives the sensible advice that seeds are to be collected when mature and before they have fallen. Seed should be collected ‘by cutting off whole seedheads in summer or early autumn as they turn brown but before they are completely ripe and starting to shed’.<sup>1921</sup>

Line 81. *Idem*: that is Schroder, the last author referred to.

Line 82. *Fructus ad medicinam cum bene maturuerunt*: Schroder recommends that fruit for medicinal purposes be well ripened, whereas for preserving (presumably drying or preservation by cooking) they must be less ripe.

Line 82. *ad asservationem*..... : Schroder’s statement that fruit for preserving should be less ripe agrees with the modern theory that:  
Fruits for storing are usually harvested slightly earlier, however, when they are mature but not yet completely ripe and still firm.<sup>1922</sup>

Line 85. *Verum nos eorum potius consilium probamus qui non ante plenam maturitatem fructus colligendos monent*. Ray prefers the theory that fruit should be picked when fully ripe; this agrees with the modern theory that fruit should be ripe when it is to be used fresh, but not when it is to be preserved.<sup>1923</sup>

Line 90. *EXSICCATIO*: margin sub-heading.

*De exsiccatione plantarum, earumque partium ambigitur*. Ray next discusses the various methods of drying plant material.

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1921 Brickell, *Gardening*: 302.

1922 *ibid.*: 371.

1923 *ibid.*: 302.

- Line 90. *Plerique enim medici præcipiunt ut in umbra siccentur*: ‘the majority of the medical profession appear to prefer drying in the shade’. This agrees with modern theories. that plants should generally be dried in a dark place, which is cool and dry.<sup>1924</sup>
- Line 91. *Nos potius iis assentimur, qui cito & in Sole siccari jubent*: Ray himself prefers plant material to be dried in the sun. This is contrary to modern opinions, which indicate that ‘exposure to light speeds the deterioration of their aromas’ and other properties.<sup>1925</sup>
- Line 92. *Quo enim citius exsiccantur eo melius*. Ray’s idea that plant material should be dried as quickly as possible is good, but not necessarily in the sun, as speedy drying avoids fermentation and the development of moulds.<sup>1926</sup>
- Line 92. *Nam quæ in umbra siccantur ..... facile situm & rubiginem contrahunt*: he correctly says that drying can produce mould and rust, but this is not due to drying in the shade, rather to being placed too close together and in a damp environment. Plant material must be dried quickly and in thin layers or bunches with plenty of circulating fresh air.
- Line 94. *Quod si velles ut flores & folia colores nativos diutius retineant*: Ray does, however, believe that flowers and leaves keep their colour better when dried in a dark place; this certainly prevents early fading of the colours.

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1924 Brickell, *Gardening*: 302; Launert: 8.

1925 Brickell, *Gardening*: 302.

1926 Launert: 8.

Line 95. *Cum autem folia, flores & summitates plantarum in sole siccandos dico..... donec probe exsiccata fuerint.* In effect Ray, despite his statement at line 91, is saying here that he does not believe in drying individual plants in full sunlight, as placing the plants in heaps, which are to be regularly turned, means that for much of the time they are in shade.

Line 98. *Fructus pulpa molli constantes quales sunt Pruna & Uvæ in sole aut in furno exsiccari requirunt:* as Ray says soft fruit, such as plums and grapes (*Pruna & Uvæ*), need drying in full sun or even in an oven, although now it is considered that the oven would best be used for finishing off the drying process, and never at a temperature of more than 60°C.<sup>1927</sup>

Line 100. *Pro Herbario sicco efficiendo:* Ray now gives instructions for making an Herbarium, instructions which would still largely be followed today.

An Herbarium or Hortus Siccus is a collection of dried pressed plants mounted on sheets of card or paper, or, as Ray suggests, interleaved between sheets without glueing.

Line 101. *nam si nimis comprimantur:* Ray cautions against initially pressing specimens too hard; this is only a problem with thick or succulent material, where bruising releases the essential oils and causes discoloration.

Line 105. *ASSERVATIO:* margin sub-heading.

*Asservanda sunt herbarum folia, flores & summitates:* the advice given here by Ray is very sensible; we would now perhaps use paper packets, as recommended by Ray, or darkened glass or

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1927 Launert: 8.

ceramic, or even metal, containers. Whatever container is used it should be absolutely dry and not liable to sweating.

Line 106. *inque loco sicco & frigido potius quam calido repositis*: once dry, a cool, dry place will maintain a plant's qualities for longer than a warm one.<sup>1928</sup>

Line 112. *Quod si hoc non esset.....* : Ray believes that the exclusion of air will improve the lasting qualities of dried plant material. It is rather the exclusion of light and maintenance of the dry state in an enclosed vessel, which will ensure longevity.

Line 115. *Hinc morem illum improbamus herbas in fasciculos colligandi.....* : he disapproves of hanging bunches of herbs from ceilings. It is, however, not the surrounding air which may provoke deterioration, but rather fluctuating humidity and light.

Line 117. *Fructus qui exsiccari non desiderant, ut Mala & Pyra, .....* : Ray turns next to the preservation of fruits such as apples and pears, which he maintains may be kept in heaps in a dry and cool place. Modern advice is that they should be kept in slatted trays or boxes rather than in heaps, as Ray suggests, and in 'cool dark and slightly damp' conditions.<sup>1929</sup>

Line 118. *nam si locus calidior sit succo exinanitos contrahi & corrugari experientia didicimus*. Ray believes it is heat which causes such fruit to shrivel; this is more probably due to dryness than heat, although heat in itself would evaporate moisture in the air. 'Some apple and pear cultivars, however, tend to shrivel and are better kept in clear

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1928 Brickell, *Gardening*:302.

1929 *ibid.*: 371.

plastic bags'.<sup>1930</sup>

Line 120. *P.Laurembergium Horticult. lib.2, cap.3.§ v.*

Line 121. *Semina in conceptaculis suis optime servantur loco frigidiore & sicco*: good advice. Although seeds for sowing should be kept in a warm, dry place to ripen, they should be stored, as Ray says, in cool, dry conditions.<sup>1931</sup>

Line 124. *Semina nonnulla si probe asservata fuerint per decennium integrum fœcunditatem suam custodiunt & sata germinant*. Ray reiterates his claims made above in Chapter 13, lines 58-75, that seeds can remain capable of germination for many years.

Line 126. *Et tamen (quod mirum est) terræ gremio excepta .....*: he ends the chapter on a note of wonder that seeds, after dispersal from their parent plant and lying in wet ground throughout the winter, will germinate successfully in the following spring.

Line 128. *ut superius innuimus*: this is a reference to his comments at Cap.13, line 70.

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1930 Brickell, *Gardening*: 371.

1931 *ibid.*: 302.



**Chapter Twenty-nine:**  
*On the chemical analysis of plants,  
and the use of their dissolved parts.*

For this chapter Ray is indebted to his friend Dr. Tancred Robinson, whom he considers to be an expert on the chemistry of plants and the uses of the various substances.<sup>1932</sup>

Interest in the chemical analysis of plants was increasing by Ray's time; this was due to a large extent to the conflict between Galenists, believing in the Aristotelian four element theory of earth, air, fire and water, and Paracelsians, who believed in other constituent elements for the universe such as sulphur, mercury and salt and who had also introduced mineral drugs. This interest in medical chemistry and chemical drugs had developed throughout the seventeenth century, so that by the time he was writing the *Historia Plantarum* Ray would perhaps have felt that a section on the chemical analysis and usage of plant material to be necessary. Much experimental work had been done by people such as Nicolas Lemery (1645-1715) and by Nicolas le Fèvre (died 1669), who, in his *Compleat Body of Chymistry* of 1664, listed the general principles of pharmaceutical preparations from animal, vegetable and mineral *materia medica*. The third edition of the *London Pharmacopœia* had been published in 1677, also containing animal, vegetable and mineral preparations and would have been known to Ray; he himself had in his possession a copy of the 1650 edition.<sup>1933</sup> Grew had proposed in his *Idea of a Philosophical History of Plants*<sup>1934</sup> published in 1682 that attention should be paid to the chemistry of plants. He believed that, since all plants consist of two types of organic part, the parenchyma and the ligneous vessels, it should be possible to test each type to see 'in some good measure if not perfectly what principles and proportion of

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1932 There is a lengthy discussion entitled 'The Archetypal Plant Constituents' in Simon Mills work, *Out of the Earth, the Essential Book of Herbal Medicine*: 265-331.

1933 *Pharmacopœia Londoniensis*, London 1650, is listed in the sale catalogue of Ray's library contents as item 179 of the folio editions: British Museum S-C 326.

1934 Nehemiah Grew, *The Anatomy of Plants, with an Idea of a Philosophical History of Plants*, Rawlins for the author, London 1682.

principle concur to specify their substantial forms'.<sup>1935</sup>

There is a lengthy correspondence between Ray and Robinson on this subject, from which I quote in the commentary on this chapter.<sup>1936</sup>

In a letter written by Ray to Robinson on April 29th 1685, Ray writes:

Your chapter *de Chymica Plantarum Analysi* I have read over with much pleasure and satisfaction; in the title before *Usu*, I think it will be necessary to add *Resolutarum*, or *Partium Resolutarum*.<sup>1937</sup>

Ray's second emendation was added to the title of this essay when it was incorporated as Chapter 29 of Book 1 of *Historia Plantarum*. Later in the year, after their lengthy correspondence on the content of this chapter, Ray wrote to Robinson that:

because I can find no fault with the matter, give me leave to carp at the orthography and grammar ..... [!]<sup>1938</sup>

In this chapter Robinson lists the various methods of preparation; modern medicinal types of herbal preparations include, in liquid form, for internal use: elixirs, liquid extracts, glycerins, linctuses, mels, spirits, syrups, tinctures, vinegars and wines; in solid form, for internal use: capsules, lozenges, pastilles, pills, powders solid extracts and tablets. For external use, they are prepared in liquid form as: baths, douches, ear-drops, enemas, eye-drops, gargles, inhalants (or vapours), liniments (and embrocations) and lotions; for external use as semi-solids as: creams, jellies, ointments (or unguents), pastes, pessaries, plasters, poultices, powders and suppositories.<sup>1939</sup>

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1935 Morton: 194.

1936 *Further Correspondence*: 165-171.

1937 *ibid.*: 166.

1938 Letter from John Ray to Tancred Robinson, dated 14th September 1685; *Further Correspondence*: 152.

1939 Mills: 375-387.

Text page 55.

Line 1. *Misa controversa illa inter Chymicos & Philosophos tantopere celebrata, an Ignis sit verus corporum Analysta:* an acknowledgement of the disputes of the seventeenth century between chemists and philosophers or natural scientists such as Ray. Fire was thought to reduce plant material to its component parts. Assuming that Robinson is responsible for the whole of this chapter, he seems unwilling to enter into this argument, preferring to concentrate on the active constituent parts of a plant. Ray himself stated in a letter to Robinson that he approved of most of his ideas except:

only in a particular or two, wherein you are positive I am somewhat doubtful, as whether all the parts into which a plant is separable by fire, be transmutable one into another.<sup>1940</sup>

Robert Boyle did not believe that nature could be improved upon: there may be sometimes greater virtues in a Simple, such as Nature affords it ..... than almost anything that the fire can separate from it.<sup>1941</sup>

NB The English terms 'analysis' and 'analyst' and the Latin *analysta* are derived from the Greek ἀναλύω, 'to break up' or 'dissolve' (of matter into its elements).<sup>1942</sup>

Line 2. *vulgo notum est, constitutiva vegetabilium principia esse spiritum, sal, phlegma, oleum, & terram.* In the seventeenth century, these constituent parts of vegetables were all thought to derive from the nutritional processes of plants. as Sachs says:

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1940 *Further Correspondence:* 166.

1941 Van Helmont, *Pharmaco & Dispensat.:* 458, cited Needham, *Medela Medicinæ:* 498.

1942 Liddell and Scott: 112.

Mariotte<sup>1943</sup> endeavoured to give such information as could be obtained from the chemistry of his day; and he has the merit of having shown that plants convert the food-material which they derive from the ground into new chemical combinations, while the earth and the water supply the same elements of nutrition to the most different kinds of plants. .... Van Helmont in the first half of the 17th century had shown ..... that plants were able to produce both the combustible and incombustible parts of their substance from water.<sup>1944</sup>

Robert Boyle's conclusions agreed with Ray's introductory remarks to this chapter, except for the omission of phlegm, that:

I may deduce from what I have tried concerning the growth of vegetables, nourished with water ..... that salt, spirit, earth, and even oyl ( ..... of all bodies most opposite to water) may be produced out of water.<sup>1945</sup>

In similar vein, Peter Aram, in his essay *Of Odor, or Smell in Plants and Flowers*, states that:

the Original Principles of Plants are these four, Earth, Water, Acid, and Oyl.<sup>1946</sup>

Line 4. *Spiritus Vegetabiles sunt vel Vinosi, vel Urinosi*: Robinson in this paragraph gives a brief breakdown of the active chemical properties of plant material.

He describes the vinous ones as vinegary or sulphurous, and the

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1943 Edmé Mariotte's essay *De la végétation* had been published in 1679 and attempted to investigate the chemical properties of plants. He believed that the different plant substances were created by a 'transformation within the plant of water taken in by the roots, and could not have been present, already formed, in the earth' Morton: 230, note 53.

1944 Sachs: 446.

1945 Robert Boyle, *The Sceptical Chymiste*, 1661.

1946 Aram: *A Practical Treatise of Flowers*: 69.

urinous ones as volatile salts dissolved in phlegm.

Line 5. *Salia dividantur in volatilia & fixa .....* : Robinson describes elsewhere the variations possible in salts:

I grant that salt, water, or any other purified element, may contain many corpuscles of the same kind; yet these same particles, by various transpositions, divisions, motions, or any other new modifications, may put on different faces and shapes, and raise in us various perceptions of different qualities and accidents. If this philosophy be true, then fixed salts themselves may differ from each other in sensible qualities, or accidents, according to the operations or other circumstances, though they be carefully purified.<sup>1947</sup>

This letter continues with examples of salt variations and ends with Robinson politely voicing his disagreement with Ray :

I do conclude, therefore, against you and Mr. Daniel Cox, that fixed salts do really differ in qualities and accidents. However, I submit to your excellent judgment, and I will not be positive in this or the other controversy.<sup>1948</sup>

Line 7. *Phlegma prout magis vel minus participat de sale ..... phlegma per se proprie loquendo est humiditas elementaris*: Robinson is here subscribing to the views of Galenical medicine, based on the theory of the four humours, where phlegm is associated with the water element and thought to be cold and damp.

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<sup>1947</sup> *Further Correspondence*: 167.

<sup>1948</sup> *ibid.*:168.

Line 9. *Olea sunt vel distillata, vel expressa, eaque odorifera, balsamica, fætida, inodora, inflammabilia, ætherea, crassa &c.:* that Robinson is expressing current chemical views is demonstrated by the slightly later parallel with Aram's quotation from John Harris' *Lexicon Technicum*, published in 1704:<sup>1949</sup>

Oyl, which the Chymists call Sulphur, is the second of their Hypostatical & of y<sup>e</sup> true 5 Chymical Principles.

'Tis an inflameable, unctuous, subtile Substance, wch usually arises after y<sup>e</sup> Spirit.<sup>1950</sup>

Line 12. *Hæc principia Vegetabilium in se invicem transmutentur ..... :*

Robinson's belief that all plant material is interchangeable seems to stem from the belief that, if it is all formed originally from the same substance as by-products of the nutritional processes, then it must be possible for it to be mutually interchangeable. In their correspondence on this, both Ray and Robinson are inclined to be persuaded to the other's opinion.

Ray, preferring the evidence of personal experience to theory, expresses his doubts in the letter cited above at line 5:

For though I am of your opinion, that their immediate component particles are not primary and indivisible elements, yet do they contain so many such of one kind, that I doubt whether the whole body of one (for example fixed salt) be transmutable into the whole body of the other (for example water); for if it may, then these being the most simple bodies we know, one would think that *quodlibet* may be made *ex quolibet*, and that there are no fixed and indissoluble principles in nature, which I think is otherwise demonstrable.

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1949 John Harris, *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences*; 2 volumes, 1704, 1710: Vol. I unnumbered pages - entry under 'Oyl'.

1950 Aram: *A Practical Treatise of Flowers*: 69.

I grant that the component particles may be separated from each other, and some of them mutually transmuted as inflammable spirits and oils, they, after the separation made by fire remaining still mixed; but from argumentation we must appeal to experience. Another thing I suspect is, that fixed salts of plants, were they perfectly freed from all adherent heterogeneous particles, would not be found to differ from each other in any sensible quality or accident; but neither do you affirm so much of fixed salts so freed, but of them such as we have them, wherein I do fully agree with you.<sup>1951</sup>

Robinson replied to Ray's doubts in a letter written on May 9th 1685:

As for the transmutation of secondary principles, or elements, one into another, I was tempted to believe it practicable, upon discoursing several times with Mr. Boyle upon that subject, and upon reading his new Appendixes to the 'Sceptical Chemist,' and to the 'Aery and Icy Noctiluca,' where he affirms that oils and water may be wholly changed into earth, though never so well purified before; and that salt and sulphur are transmutable into insipid water, which also Tachenius demonstrates, and salt into earth; and this not by the addition of any new parts, but by mere transposition, division, or some new modification of the constituent parts, which, making a different impression upon our senses, may produce new qualities or accidents; ..... I always fancied that there were no fixed or immutable principles (I mean elements) in nature, as she stands at present, but what may be subject to changes upon new

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1951 *Further Correspondence*: 166.

motions, or modifications, unless we suppose pure atoms without concretions, and them too under the same constant laws of motion.<sup>1952</sup>

However, Ray remains unconvinced:

But that there are fixed and physically indivisible principles in nature I thus argue:

If there be no such, but bodies are infinitely divisible, how can there be any constancy in generations or productions?

Why are there not infinite new concrete and mixed bodies daily produced, and as many lost?

For if bodies be infinitely divisible, figures being infinite, the particles whereunto they are divided must probably be of infinite figures, and few alike; and why should those of the same figure convene?

How come bodies to be divisible, even by fire, into great numbers of parts, either really homogeneous, or seemingly so, and not rather into infinite varieties of particles; as when a man, with the forcible stroke of a hammer, breaks, for example, a brick, it flies into innumerable parts, of different figures, perhaps scarce any two like?

How come there to be such great aggregates of bodies of the same kind, as water, earth, air?

Whereas you say the same particles, by various transpositions, divisions, motions, &c. may put on different faces, and stir up in us various perceptions, I answer, that I cannot imagine any other difference of bodies but what proceeds from the motions of figures of their component particles.

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<sup>1952</sup> *Further Correspondence*: 167.



From the motions of them can come nothing but a greater or less measure of fluidity; therefore all other varieties must arise from their figures. From the figures of homogeneous particles, or such as are of the same shape, no considerable varieties can proceed .....

..... were bodies infinitely divisible, and consequently of no certain figure (the minima I mean), I do not see how we could ever come to such regular concretions, at least to such multitudes and masses of them, but that the world must have continued, as the poets first fancied it, a chaos.<sup>1953</sup>

Robinson finally comes round to Ray's way of thinking, although perhaps somewhat reluctantly:

I received yours of the 12th instant, and am sufficiently convinced that there are fixed and certain principles in nature, and settled laws of motion; yet I have some reason to believe that they are not immutable, but that some outward violence and preternatural causes may alter them, though they are seldom or never mutable in the ordinary course of things. If you please, the transmutation of the parts of analysed bodies shall be struck out of the chapter *de Chym. Plant. Analysis partiumque resolutarum Usu*.<sup>1954</sup>

The correspondence on this matter ends with the first few words of Ray's next letter to Robinson, in which he says it is unnecessary to remove the section on the transmutation of plant material, since, as Ray explains, it does not altogether run counter to Ray's own opinion:

Last post brought me yours of May 19. In answer whereto, seeing what you assert concerning the

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1953 Letter dated May 12th 1685, *Further Correspondence*: 169-170.

1954 Letter dated May 19th 1685, *ibid.*: 170.

transmutation mentioned may be true, and is supported by good authority, and your opinion, I see no reason it should be struck out; for those principles into which bodies are immediately resoluble by fire, being not primary but compound bodies, it may consist with my opinion of certain and fixed first principles well enough.<sup>1955</sup>

Line 14. *Modi eliciendi & præparandi hæc principia .....*: in this paragraph Robinson lists the various methods of producing the separate plant substances but believes that the actual methods of production are too well known to need description here. He lists putrefaction, fermentation, division, distillation, separation, rectification, incineration, boiling, filtration, evaporation and crystallisation.

This new chemical approach to medicine had begun in the sixteenth century with the publication in 1527 of *The Vertuose Boke of Distyllacion* by Hieronymous Brunschweig.<sup>1956</sup> This was followed in 1559 by Conrad Gesner's *The Treasure of Euonymous*, in which he gave instructions for the preparation of medicines from metals such as lead and antimony, where :

al the vertue ... is separated from the substance of the medicine, so that ... the more pure and subtil part of every remedy or medicine, maye be ... drawn out from the grosse and erthy part.<sup>1957</sup>

As Griggs says:

Such techniques liberated their [i.e the minerals'] hidden therapeutic potential to act directly and powerfully upon the body of the patient.<sup>1958</sup>

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1955 Letter dated May 22nd 1685, *ibid.*: 171.

1956 Cited by Kocher, *Journal of the History of Medicine* 1947: 453.

1957 *ibid.*: 458.

1958 Griggs: 69.

Plant material too was subjected to these complex procedures in order to rid it of harmful side effects; these refined oils and distillations took the place of the earlier Galenic compounds.

Text page 56.

Line 20. *Antimonio, Saturno, Helleboro, Opio, Aro &c.*: a list of known poisons, whose effects were believed to be rendered less so by various chemical techniques such as those mentioned here, where the ‘vinegary spirits’ are believed to counteract the violent effects of the drugs. For example, the surgeon George Baker, in the 1570s, stated that:

by Distillation are corrected the malignitie or venomous qualities thereof, as in oyles of Quicksilver, of oyle of Vitrioll, Antimonie ..... 1959

Line 20. *Antimonio: Antimonium*: Antimony, a brittle metallic element, bluish-white, of flaky crystalline texture, used in alloys especially with lead, and in medicine; symbol SB. The term was originally applied to the native trisulphide, known as stibnite, the στίμμυ of Greece, *stibium* of Rome or *al-kuhl* (hence alcohol) of Arabia.<sup>1960</sup> In the seventeenth century Antimony was used for cleaning open wounds<sup>1961</sup> and even administered intravenously.<sup>1962</sup>

As Robinson says here, such preparations were frequently mixed with a ‘vinegary spirit’; the Arabs and later the Paracelsians had prepared a violent purge by standing wine in a cup made from antimony, so that some of the metal was absorbed by the wine.<sup>1963</sup>

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1959 Griggs: 69.  
1960 OED: 82.  
1961 Griggs: 70.  
1962 Matthews: 304.  
1963 Griggs:81.

Line 20. *Saturno: Saturnum*: Saturn, which in alchemy, was the name for Lead.<sup>1964</sup> Plasters of lead were applied to ulcers and sores.<sup>1965</sup>

Line 20. *Helleboro: Helleborus*.

[C.T.& M. 33-34] *Helleborus* (L.), Hellebore; a genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 106: B.& H. 12: Linn.*Sp.Pl.* 557-558:

*Syn.Meth.St.Br.* 271: *H.P. albus* 168 / *niger* 697-698:

*H.P.III* - no ref.: *Tri.* 10.89: *Cat.Angl.* 158: *Camb.* 73.

*H.P. albus* 168:

(Tr.) *Helleborus*, in the author's etymology, is so-called by the Greeks παρά τὸ ἐλεῖν τὰ βροά because it ruins food.

Also it is written Ἐλλέβορος without the aspirate.

There are two kinds, white and black.

These, although they agree in name and even somewhat in their powers, in external appearance they agree very little, whence we regard them as totally different genera.

*H.P.* 697-698:

4 species given, including:

*Helleborus maximus* Ger. *maximus sive Consiligo* Park.

*Helleborus niger fætibus*, *Consiligo Plinii lib.27. cap.9.* C.B.

*Elleborus niger sylvestris adulterinus, etiam hyeme virens* J.B.

*App.tom.3.*

*Tri.* 10.89:

Hellebore: *Helleborus*, -i, f.: Ἐλλέβορος, -ου, m.

Both *Helleborus fætibus* and *Helleborus viridis* are very poisonous and were grown partly against boils and spots (so the

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1964 OED: 1889.

1965 John Banister, *A Storehouse of Physicall and Philosophicall Secrets*, London 1583: 43.

Westmorland name of Fellon-grass), partly against worms in children - a violent remedy, as Gilbert White recognised:

The good women give the leaves powdered to children troubled with worms; but it is a violent remedy, and ought to be administered with caution.<sup>1966</sup>

In the eighteenth century a large quantity came from the country to Guy's Hospital.<sup>1967</sup>

Line 21. *Opio: Opium:* the dried juice obtained from the seed capsule of the Opium Poppy, *Papaver somniferum*. A narcotic drug, opium has been used for centuries in medicine for the relief of pain, although its alkaloids were not fully distinguished until 1842.<sup>1968</sup>

Line 21. *Aro: Arum:* see above Cap.3, line 35.

*Arum* has a very acrid taste and as such is not attractive to animals, but if eaten causes a burning sensation in the mouth and throat. Children, who have died from eating the berries, usually suffer from cramp and convulsions before death.

However, like many other poisonous plants, *Arum* can be used for medicinal purposes. If the tubers are to be used thus, they should be dug up when not in full leaf, and may be stored either in sand or dried for later use. *Arum*, like other acrid and poisonous plants, once had a great reputation as a drug. The dried root was recommended as a diuretic and 'the *British Domestic Herbal* describes a case of alarming dropsy with great constitutional exhaustion treated most successfully with a medicine composed of *Arum* and *Angelica*, which cured in about three weeks'.<sup>1969</sup>

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1966 Letter written on 3rd July 1778 to Daines Barrington; Gilbert White, *The Natural History and Antiquities of Selborne*, 1813 edition (reprinted 1993 by the Ray Society): 233-234.

1967 William Curtis, *Flora Londiniensis*, 1777-1791.

1968 Matthews: 329.

1969 Grieve, *A Modern Herbal*: 237.

The juice of the tuber is purgative but extremely risky. A homeopathic tincture is prepared from *Arum*, which is used in a diluted form for sore throats etc. An ointment made from the tubers is recommended for ringworm, although it may cause blistering.<sup>1970</sup>

To reduce the bitterness of *Arum* the North American Indians roasted or boiled the root and used it for coughs, fevers and stomach complaints.<sup>1971</sup>

Line 22. *Spiritus sulphurei* ..... : sulphur has always been believed to be associated with the fires of hell and devils, and with thunder and lightning and in alchemy was supposed to be one of the ultimate elements of all substances.<sup>1972</sup> As Robinson says, it has many medicinal uses:

In a refined state, e.g. as flowers of sulphur, it is used medicinally as a laxative, a resolvent, and a sudorific, and as an ingredient of various ointments, esp. for skin diseases.<sup>1973</sup>

Line 27. *Spiritus urinosi* ..... : the spirits suggestive of urine, according to Robinson, cause sweating and the passage of urine; both were considered to be methods of freeing the body of waste products. The qualities attributed here to 'urinous spirits' are still by and large considered to be accurate; a modern textbook on herbal medicine states that:

Even so their use should be watched in cases where dehydration might be a possibility (some otherwise inexplicable cases of heat symptoms may simply be due

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1970 Grieve, *A Modern Herbal*: 237-238.

1971 Griggs: 135.

1972 *OED*: 2184.

1973 *ibid.*

to dehydration ... [Robinson's sweating after the use of 'urinous spirits'?]) .....

Diuretics should be considered particularly applicable to oedematous conditions, especially connected with heart failure and ascites, and also to 'catarrhal' conditions, as these affect the respiratory and digestive functions.

They may also be usefully applied in urinary infections, and as components of prescriptions for scrofulous skin diseases and jaundice.<sup>1974</sup>

See also the notes at lines 36 and 42 on volatile oils.

Line 28. *Armoniaco simile*: does Robinson mean Ammoniaco here?

This would make sense as he states that the 'urinous vegetable spirits and volatile salts' destroy acid and result in 'something like Armoniacum', presumably Sal Ammoniac, which is an alkaline crystalline salt.<sup>1975</sup>

Line 36. *Salia volatilia* ..... : as Robinson says, volatile oils are not visible but easily vaporize from the plant material.

Generally speaking volatile oils are mixtures of hydrocarbons and oxygenated compounds derived therefrom. As the oxygenated form is more soluble in both water and alcohol, it is this form that on the whole determines the taste and smell of the mixture.<sup>1976</sup>

Line 38. *cum spiritu ... vitrioli*: vitriol is defined as 'one or other of various native or artificial sulphates of metals used in the arts or medicinally'.<sup>1977</sup> Spirits of vitriol are defined as 'a distilled essence

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1974 Mills: 464.

1975 OED: 60.

1976 Mills: 294.

1977 OED: 2484.

of vitriol'.<sup>1978</sup>

Line 41. *Aromaticis, aut vulgo dictis antiscorbuticis, cephalicis, & Stomachis:*  
Robinson now gives a list of plants with 'urinous spirits or volatile salts' from two categories of plant, the warm and aromatic plants and also from colder and more tasteless plants.

Line 42. *Cinnamomo, Galanga, Zingibere; Cochlearia, Aro, Nasturtio, Lepidio, Beccabunga, Raphano; Rosmarino, Majorana, Salvia, Ruta, Lavendula, Thymo; Mentha, Absynthio, Chelidonio, &c.*  
This list of plants with volatile oils is descriptive of those which will take over from nature rather than allowing it to take its course; that is, they are circulatory stimulants, with a tendency to provoke vasodilation, which will literally raise the body temperature. They are now sometimes referred to as 'aromatic digestives and expectorants';<sup>1979</sup> Galen, translated by Culpeper, describes this in terms of degree [first, second and third], for example:

Such as are hot in the third degree, are more powerful in heating, because they tend to inflame and cause fevers. Their use is to promote perspiration extremely, and soften tough humours, and therefore all of them resist poison.<sup>1980</sup>

As well as having an irritant action, as described above, volatile oils can react in a relaxant or tranquillizing way; tensions in the central nervous system may be relieved at the same time as visceral relaxation.<sup>1981</sup> Thus the combined effect of volatile remedies may be described as:

'hotter', up to 'third degree', yet with their relaxant

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1978 OED: 2484.

1979 Mills: 177, 302-303.

1980 *ibid.*: 177.

1981 *ibid.*: 303.



properties their stimulant effect is often held in check.<sup>1982</sup>

The monoterpenes are by far the most numerous of the volatile oils; they include menthol, camphor and thujone, derived from *Mentha*, *Cinnamomum* and *Salvia*,<sup>1983</sup> mentioned by Robinson in his first group, and also from plants such as *Lactuca*<sup>1984</sup> mentioned in his list of colder plants.

Line 42. *Cinnamomo*: *Cinnamomum*: see above Cap.5, line 142.

Line 42. *Galangā*: *Galanga*: see above Cap.24, line 183.

Line 42. *Zingibere*: *Zingiber*.

[Mac.Enc. 505] *Zingiber officinale* (L.), Ginger; a species of the *Zingiber* genus of the *Zingiberaceæ* or Ginger family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1314: *H.P.III* 645:

*Tri.* 19.118: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1314:

*Zingiber fuscum* C.B. *Zingiberis species Mechinum dicta* J.B.

*H.P.III* 645:

5 additional species given, including:

*Zingiber sylvestre minus, fructu e caulium summitate exeunte*

Slon.Cat.Jamaic. *An Coapatlis Asphodelina* Hernandez? *An*

*Paco-caatingæ 2<sup>dam</sup> species* Marcgrav?

*Tri.* 19.118:

Ginger: *Zingiber*, -*eris*, n.: *Ζιγγίβερις*, -*έρεως*, n.

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1982 Mills: 304.

1983 *ibid.*: 295-297.

1984 *ibid.*: 321.

Line 42. *Cochleariā: Cochlearia.*

[C.T.& M. 85] *Cochlearia* (L.), Scurvy-grasses; a genus of the *Cruciferæ* or Cress family.

B.& G.-W. 150: B.& H. 38: Linn.*Sp.Pl.* 647-648:

*Syn.Meth.St.Br.* 302-303: *H.P.* 822-823: *H.P.III* 415:

*Tri.* 13.176: *Cat.Angl.* 73-74: *Camb.* - no ref.

*H.P.* 822-823:

6 species given, including:

*Cochlearia* J.B. *rotundifolia* Ger. *major rotundifolia sive Batavorum* Park. *folio subrotundo* C.B.

***Common round-leaved Scurvy-Grass or Garden Scurvy-Grass.***

*H.P.III* 415:

1 additional species given:

*Cochlearia major Batavica erecta, folio oblongo*  
H.Lugd.Bot.Herman.

*Tri.* 13.176:

Scurvy Grass: *Cochlearia, -æ, f.:* [No Greek].

Line 42. *Aro: Arum:* see above Cap.3, line 35 and Cap.29, line 21.

Line 42. *Nasturtio: Nasturtium:* see above Cap.24, line 70.

Line 43. *Lepidio: Lepidium.*

[C.T.& M. 79-85] *Lepidium* (L.), Pepperworts; a genus of the *Cruciferæ* or Cress family.

B.& G.-W. 154: B.& H. 45: Linn.*Sp.Pl.* 643-645:

*Syn.Meth.St.Br.* 3-4: *H.P.* 828: *H.P.III* 416: *Tri.* - no ref.:

*Cat.Angl.* 183-184: *Camb.* - no ref.

H.P. 828:

(Tr.) Λεπίδιον is so-called by Dioscorides, 1.2. cap.205, because it can destroy λεπίδας or scales and spots on the face; or ἀπὸ τοῦ λεπίζειν, that is εκδειρῆν, because it can ulcerate and strip off the skin by its bitterness, or because it can destroy the marks burned by iron on the foreheads of slaves, about which, for example, see Columella lib.10. *Lepidium*, Pliny lib.20, cap. 17.<sup>1985</sup> C.B.

3 species given, including:

*Lepidium latifolium* C.B. *Lep. Pauli* J.B. *Piperitis sive Lepidium vulgare* Park. *Raphanus sylvestris Officinarum*, *Lepidium Aeginetæ Lobelio* Ger. **Dittander, Pepper-wort.**

H.P.III 416:

2 additional species given.

Line 43. *Beccabungā: Beccabunga:* see under *Beccabunga* Cap.17, line 37.

Line 43. *Raphano: Raphanus:* see above Cap.14, line 11.

Line 43. *Rosmarino: Rosmarinus:* see above Cap.20, line 103.

Line 43. *Majoranā: Majorana:* see above Cap.28, line 79.

Line 43. *Salviā: Salvia:* see above Cap.7, line 44.

Line 43. *Rutā: Ruta:* see above Cap.9, line 32.

Line 43. *Lavendulā: Lavendula:* see above Cap.27, line 12.

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1985 Pliny, *Historia Naturalis* XX, lxvi: 174; Loeb edition VI: 102.

- Line 43. *Thymo: Thymus:* see above Cap.28, line 79.
- Line 43. *Menthā: Mentha:* see above Cap.3, line 25.
- Line 44. *Absinthio: Absynthium.*  
See above under *Absinthium* Cap.4, line 143.
- Line 44. *Chelidonio: Chelidonium:* see above Cap.9, line 90.
- Line 44. *gramine, papavere, lactuca, portulaca, endivia, acetosa, sempervivo, melissa, musco, Nymphæa, lenticula palustri, &c.:*  
see note at line 42. above.
- Line 44. *gramine: Gramen:* see above Cap.7, line 51.
- Line 44. *Papavere: Papaver:* see above Cap.10, line 30.
- Line 44. *Lactucā: Lactuca:* see above Cap.4, line 46.
- Line 45. *Portulacā: Portulaca:* see above Cap.28, line 76.
- Line 45. *Endiviā: Endivia:* see above Cap.9, line 115.
- Line 45. *Acetosā: Acetosa:* see above Cap.8, line 37.
- Line 45. *Sempervivo: Sempervivum:* see above Cap.27, line 57.

Line 45. *Melissā: Melissa.*

[C.T.& M. 409] *Melissa* (L.), Balm; a genus of the *Labiatae* or Mint family.

B.& G.-W. 340: B.& H. 344: Linn.*Sp.Pl.* 592-593:

*Syn.Meth.St.Br.* 242: *H.P.* 570 according to the Index, but this page is actually numbered as 554: *H.P.III* 308: *Tri.* - no ref.:

*Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 570 (554):

3 species given, including:

*Melissa* Ger. *hortensis* C.B. *vulgare* Park. *vulgaris odore citri*

J.B. *unde Citrago Gesnero dicitur. Common Baulm.*

*H.P.III* 308:

6 additional species given.

Line 45. *Musco: Muscus:* see above Cap.18, line 181.

Line 45. *Nymphæā: Nymphæa:* see above Cap.7, line 11.

Line 45. *Lenticulāpalustri: Lenticula palustris.*

[C.T.& M. 44] *Ranunculus sceleratus* (L.), Celery-leaved Crowfoot; a species of the *Ranunculus* genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 116: B.& H. 8-9: Linn.*Sp.Pl.* 551:

*Syn.Meth.St.Br.* 129: *H.P.* 117: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 183: *Camb.* 100.

*H.P.* 117:

*Lens palustris* Ger. J.B. *palustris sive aquatica vulgaris* Park.

*Lenticula palustris vulgaris* C.B. *Duck's meat.*

Line 45. *quod experimenta & argumenta D. Wedelii, & Coxi extra dubium posuerunt.* Experiments on the volatile salts of plants had also been carried out by Robert Boyle, who on distilling a plant

found that several volatile substances came off leaving a coal-like residue of “salt and earth”.<sup>1986</sup>

Both Van Helmont and Boyle concluded that water has been transmuted into the various substances of the plant body and could not therefore be a simple element.<sup>1987</sup>

Line 46. *D. Wedelii:* Dr. Georg Wolfgang Wedel, 1645-1721.

His main interests lay in medicine and chemistry. After early schooling with his father and at the school in Schulpforta, Wedel went to the university at Jena, where he studied philosophy and medicine. He took his M.D. in 1669. In 1673 he became Professor of Anatomy, Surgery and Botany and, after the death of his mentor Rolfinck, Professor of Theoretical Medicine. After the death of another colleague, who was its incumbent, he went on to hold the chair of Practical Medicine and Chemistry. He was given state honours including becoming Count Palatinate in 1694, and, after fifty years of teaching and writing, he died as the senior member of Jena’s entire faculty.<sup>1988</sup>

As a scholar he stood midway between the mediæval world and the modern as a supporter of astrology and alchemy but also a proponent of iatrochemistry. He was a prolific author but is perhaps best remembered as a teacher. <sup>1989</sup>

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1986 Robert Boyle, *The Sceptical Chymiste*, 1661.

1987 Morton: 176-177.

1988 *DSB XIV*: 212-213.

1989 *ibid.*

Line 46. *Coxii*: I have been unable to identify Ray's Dr. Cox; there are, for instance, no letters to or from him in Ray's correspondence.  
One possibility is Thomas Cox, whose *A Topographical, Ecclesiastical and Natural History of Great Britain* was published by Nutt in London in 1700.<sup>1990</sup>

Line 49. *Phlegma maxime* ..... : for phlegm see note at line 7 above.  
Robinson uses the term here almost as a synonym for 'liquid'.

Line 49. *Julapiis*: julep is a sweet drink used as a vehicle for medicine.<sup>1991</sup>  
Culpeper in his *Complete Herbal* of 1653 describes the preparation and use of julep as follows:

Now-a-day it is commonly used,

1. To prepare the body for purgation.
2. To open obstructions and the pores.
3. To digest tough humours.
4. To qualify hot distempers, &c.

Simples, juleps ... are thus made: Take a pint of such distilled water as conduces to the cure of your distemper ... to which add two ounces of syrup conducing to the same effect ... If you love tart things, add ten drops of oil of vitrol to your pint, and shake it together, and it will have a fine grateful taste.<sup>1992</sup>

Line 49. *Laudana*: originally used of preparations in which opium was the main ingredient.<sup>1993</sup> As Robinson says, preparations such as Laudanum, according to The British Pharmacopœia need a suitable

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1990 R.B.Freeman, *British Natural History Books, 1495-1900*, Wm. Dawson & Sons Ltd., Folkestone 1980: 96.

1991 *OED*: 1141.

1992 Culpeper: 407.

1993 *OED*: 1183.

vehicle; the tincture of Opium, known as Laudanum, 'is made with 3 oz. of Opium and equal parts of distilled water and alcohol, and for immediate effects is usually preferable to solid Opium'.<sup>1994</sup>

Line 49. *Spiritus*: a spirit, as indicated here, was a liquid obtained by distillation, especially of an alcoholic nature; a solution in alcohol of some essential or volatile principle [first used in English in this way in 1610].<sup>1995</sup> The term is now used for 'solutions of volatile substances (such as oil of peppermint) in alcohol'.<sup>1996</sup>

Line 49. *tincturæ*: the term 'tincture' was used of 'the (supposed) essential principle of any substance obtained in solution. Also, the extraction of this essential principle.' [Like 'spirit', first used in English in this way in 1610.]<sup>1997</sup> Although alcohol is the basis of the modern preparation of tinctures, water, or phlegm, is still an essential part. As Mills says:

The concentration of herb to fluid is generally higher than that in infusions or decoctions ..... The strength of alcohol also varies, depending on the type of constituent that needs to be extracted, with 25% alcohol used for most simple extractions ..... and 90% used where volatile oils, alkaloids and resins ... are to be extracted.<sup>1998</sup>

See also note at line 76 below.

Line 50. *Olea*: Culpeper gives instructions for preparing medicinal oils and lists their uses - see note at line 51 below.

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1994 Grieve, *A Modern Herbal*: 652.

1995 *OED*: 2078.

1996 Mills: 377.

1997 *OED*: 2310.

1998 Mills: 377.



Line 51. *Olea destillata* ..... : Robinson next describes oils and their uses, citing Wedel. Culpeper's instructions, mentioned in the note above, are as follows:

The general use of these oils is for pains in the limbs, roughness in the skin, the itch, &c. as also for ointments and plaisters.

If you have occasion to use it for wounds or ulcers, in two ounces of oil, dissolve half an ounce of turpentine, the heat of the fire will quickly do it; for oil itself is offensive to wounds, and turpentine qualifies it.<sup>1999</sup>

Line 57. *Salia fixa* ..... : the medicinal uses of fixed salts in Robinson's description resembles those attributed to bitter tasting alkaloids in modern herbal medicine. These are used for cooling the heat of fevers and many react on the nervous system by blocking nerve activity.<sup>2000</sup>

Line 61. *D. Lewenhoek*: Antonie van Leeuwenhoek, 1632-1723.

Leeuwenhoek, born in Delft, came from a prosperous middle class background, attending the grammar school in Warmond near Leiden. He was then apprenticed to a cloth merchant, and after his return to Delft he became a shop keeper. In 1654 he married an Englishwoman and they had five children. In 1660 he changed his career and became a prosperous civil servant, in which career he prospered; his wife died in 1666 and he remarried in 1671.<sup>2001</sup>

Leeuwenhoek's main scientific interests were in natural sciences and microscopy. His interest in science began about 1671

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1999 Culpeper: 409.

2000 Mills: 327-331.

2001 *DSB VIII*: 126-130.

when he constructed his first simple microscope; the lenses and instruments he made were not surpassed until the nineteenth century. Despite his lack of formal scientific education he read widely in Dutch and translations into Dutch and also, although he could not read the texts, he studied the illustrations in the works of Hooke on microscopy, Grew on plant anatomy and Redi on insects. He also corresponded with the Royal Society, although translations had to be made for him. He added a few details on plant structure to those observed by Malpighi and Grew in various reports to the Royal Society between 1678 and his death in 1723, but produced no significant advances.<sup>2002</sup>

Morton says that:

Leeuwenhoek's discovery of micro-organisms, infusoria, rotifers and of spermatozoa had more impact on biology than his botanical observations..... although he did make a few new observations, such as crystalline inclusions in cells, pitted vessels in secondary wood, and possibly nuclei, but without linking them to existing knowledge by interpreting them.<sup>2003</sup>

Ray doubted Leeuwenhoek's ability because he was unsure about his microscopic work, where he had found 'insects' in semen. In a letter to Robinson he discusses the errors in Leeuwenhoek's work on seeds:

I doubt whether Mr. Lewenhoeck's observations be exact; for in those of the seeds of plants I find him mistaken in some, v.g. [*sic*] radish, turnips, and others of that kind, which I have forty times dissected and opened with my hands, and seen clearly with my naked eyes. He saith they have four leaves, and figures them accordingly; whereas they have but two only, with a

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2002 Morton: 180.

2003 *ibid.*: 225-226, note 22.

notch or crena at the top, but that not very deep, so as to  
make any show or appearance of two leaves.<sup>2004</sup>

Line 66. *Salia essentialia, & marina e lixiviiis Crystallisata*: a distinction  
between the effects of types of salt. Robinson refers the reader to the  
works of Grew, who had 'extracted various kinds of "saline" from  
plants, and got crystals from the extracts'.<sup>2005</sup>

Many alkaloids have a toxic as well as a depressive effect,<sup>2006</sup>  
whereas, according to Chinese herbal medicine:

Salty remedies are used for 'dry, hard' pathologies, such  
as tumours, fibroses (e.g. liver cirrhosis), constipation  
and other abdominal swellings.<sup>2007</sup>

Line 69. *Fraxini: Fraxinus*: see above Cap.4, line 144.

Line 69. *Aceris majoris: Acer major*: see above Cap.5, line 26.

Line 69. *Cannæ Indicæ: Canna Indica*: see above Cap.4, line 122.

Line 70. *Arboris Coco: Arbor Coco*.

[Mac.Enc. 291] *Cocos nucifera* (L.), Coconut; a species of the  
*Cocos* genus of the *Palmæ* or Palm family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1188: *Syn.Meth.St.Br.* - no ref.: *H.P.* 1356:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 1356:

*Palma Indica coccifera angulosa* C.B. *Palma Indica nucifera*

J.B. *Palma sive Nux Indica vulgo, ferens Coccus* Park. *Inaia*

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2004 Letter dated 3rd March 1691; *Correspondence*: 245-246.

2005 Morton: 193.

2006 Mills: 327-331.

2007 *ibid.*: 188.

*guacuiba, vulgo Cocos Pisoni & Marcgravio. Nux Indica & Cocciq. Coyolli Mexicanis Hernandez. Tenga Hort.Malib.*  
***The Coco, or Coker-nut Tree.***

Line 70. *pro conficiendis syrupis, conservis, electuariis, conditis, &c. variisque usibus domesticis*: Robinson lists the various uses of salty and sugary preparations. For a more comprehensive list of the various modern herbal preparations, see the introductory paragraphs to this chapter.

Line 71. *Willisius*: Thomas Willis, 1621-1675.

Thomas Willis grew up near Oxford and attended the university there; he had intended to go into the church but his service in the army on the losing royalist side prevented this. He then turned to medicine and gained his licence to practise in 1646. He became increasingly interested in chemistry and anatomy and formed a 'Clubb' at Oxford together with such eminent scientists as Wilkins, Boyle, Wren, Millington and Hooke to perform dissections. He published many works, including *De febribus*, On fevers, in which he showed his use of clinical observations as well as theory.<sup>2008</sup>

After the restoration of Charles II in 1660, several of his friends moved to London and, although Willis remained in Oxford, his loyalty to king and church were rewarded by his appointment as Sedleian professor of natural philosophy.

He left Oxford in 1667 to set up a practice in London and, although he continued to publish, he seemed to be too busy with his practice to attend the Royal Society meetings and to enjoy the acclaim his work brought. He saw himself as a working physician, whose clinical practice led him to make interesting

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2008 That Ray owned a copy of this work is indicated in the sale catalogue of his library: *de Fermentatione & Febribus*, edition published in London in 1669; British Museum: S-C 326 (6): 12, *Libri in Latine &c. in Octavo*, number 136.

discoveries; his speculations on the ‘intercostal’ and ‘vagal’ nerves gave us the foundation for our knowledge of the autonomic nervous system.<sup>2009</sup>

Robinson and Ray would have been conversant with the works of Willis and the reviews published in the *Philosophical Transactions of the Royal Society*.<sup>2010</sup> In 1667 Willis had published *Pathologiæ cerebri et nervosi generis specimen in quo agitur de morbis convulsis, et scorbuto*;<sup>2011</sup> in this work he explains his theory that scurvy is the result of humoral disturbances of salt and sulphur in the blood, which often result in convulsions. He believes that this is caused by the consumption of salt and smoked meat, wine and ‘burning waters’ (*aquas ardentis*).<sup>2012</sup> As listed here by Robinson, Willis included among convulsive disorders:

a wide variety of affections ranging from epilepsy through the convulsive diseases of children, convulsive states originating from the roots, the plexus, the processes of the nerves, from disorders of the nervous juice, and from scorbutic disposition, to hysteria, convulsive cough, and asthma.<sup>2013</sup>

Willis’ last work *Pharmaceutice Rationalis* is also of interest here; it was published in two parts (1674 and 1675) in Oxford shortly before his death. As Isler says,

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2009 DSB XIV: 404-409; also Hansruedi Isler, *Thomas Willis, 1621-1675, Doctor and Scientist*, Hafner Publishing Company, New York 1968.

2010 Among the works of Willis owned by Ray, as indicated by the sale catalogue of his library, are:

*de Anima Brutorum*, edition published in Oxford in 1672; British Museum: S-C 326 (6): 9, *Libri in Latine &c. in Quarto*, number 202.

*Anatomia cerebri*, edition published in Amsterdam in 1665; *ibid.*:12, *Libri in Latine &c. in Octavo*, number 135.

*contra Highmorum*, edition published in Leiden in 1671; *ibid.*: 15, *Libri in Latine &c. in Duodecimo*, number 278.

2011 ‘*Specimen of the pathology of the brain and nervous system, in which the convulsive diseases and scurvy are discussed.*’

2012 Isler, *Thomas Willis*: 112-115.

2013 *ibid.*: 114.

In “Pharmaceutice” Willis attempted to put medical practice on the basis of research; in a last mighty effort he tried to fulfil his dream of a scientific medicine, and failed; but the book became a textbook both of medicine and pharmacology.<sup>2014</sup>

Line 71. *S.Paulus*: St. Paul, c.3-64 A.D. Christian apostle, born Saul of Tarsus, who spread Christianity among the Gentiles; the 13 *Epistles* attributed to him form a major part of the *New Testament*. The son of a Pharisee and a Roman citizen, he was educated at Jerusalem and was initially anti-Christian, having participated in the martyrdom of St Stephen. While travelling to Damascus, he had a vision that led to his conversion to Christianity. He began his activity as an apostle in Damascus, later joining the other apostles in Jerusalem. His important missionary work consisted of three journeys in which he travelled to Asia Minor, Cyprus, Macedonia, Greece, Ephesus and elsewhere, establishing churches or bringing support to previously established Christian communities. After his third journey, he returned to Jerusalem and was arrested by Roman soldiers in order to protect him from the hostility of the mob, who attacked him for teaching transgression of the Mosaic Law. He eventually appealed to Caesar and, as a Roman citizen, was taken to Rome for trial. He was imprisoned for two years; here the *New Testament* account (in *Acts*) ends. It appears that he may have been released before being arrested a final time under Nero. Paul’s influence was decisive in extending Christianity beyond the Jewish context of the Church at Jerusalem and the Pauline *Epistles* formed the basis of all subsequent Christian

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2014 Isler, *Thomas Willis*: 182.  
That Ray owned a copy of *Pharmaceutice Rationalis* is indicated in the sale catalogue of his library;  
*Pharmaceutice Rationalis*, 2 vol., edition published in Oxford in 1674; British Museum: S-C 326 (6): 15, *Libri in Latine &c. in Duodecimo*, number 277.

Line 75. *Decocta plantarum* .....: as Robinson implies here, a decoction contains a single part of a plant. A decoction is prepared 'by pouring cold water on the finely divided botanical drug and then allowing the mixture to simmer. This method is used for hard materials such as roots and barks',<sup>2016</sup>

Line 76. *tincturæ*: Robinson compares the efficacy of tinctures favourably with decoctions.

Tinctures are spiritous preparations, which use differing strengths of alcohol as their solvent for extracting the botanical drugs to be converted into tinctures. .... They are particularly suitable for extracting drugs containing resinous and volatile principles.<sup>2017</sup>

See also note at line 49 above.

Line 76. *extracta*: in modern herbal medicine there are three types of preparation known as extract. These are liquid extracts, solid or soft extracts and dry extracts; a liquid extract is prepared 'by percolating or macerating the comminuted drug with sufficient of the solvent best suited for the extraction of the drug constituents. This may be water or a mixture of water and alcohol': a soft extract is prepared 'by evaporating down (to the consistency of a paste) the fresh expressed juices, or the liquors used as extractives of a vegetable drug': a dry extract is prepared 'by removing the remaining water in the solid or soft extract by drying under vacuum. Solid extracts and dry extracts represent a much larger quantity of the drug from which they are prepared than do liquid extracts, tinctures, or

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2015 *Mac.Enc.:* 932.

2016 *Potter's Cyclopædia of Botanical Drugs:* 296.

2017 *ibid.:* 297.

infusions',2018

- Line 77. *pulveres*: Robinson may be referring to dry extracts here - see note at line 76 above. Powders are not usually recommended in modern herbal medicine as herbal material does not keep well in powdered form and 'is difficult to disperse in water'.<sup>2019</sup>
- Line 80. *Succi vegetabiles fermentati dant omnia genera Vinorum & liquorum inebriantium*: Robinson now briefly mentions alcoholic drinks, adding a caution as to their consumption.
- Line 83. *Succi inspissati dicuntur Rob*: he continues with a description of Rob, which is 'the juice of a fruit, reduced by boiling to the consistency of a syrup and preserved with sugar'. The term was first used in English in 1578.<sup>2020</sup>
- Line 85. *Gummi seu Resinæ*: Robinson equates gums (the viscid secretion of trees and shrubs, soluble in water) and resins (also secretions of plants, but insoluble in water) with cooked and reduced vegetable saps.
- Line 87. *Terebinthina*: turpentine, the 'semi-fluid resin of the Terebinth tree, *Pistacia terebinthus*'.<sup>2021</sup>
- Line 87. *Gummi Gotta*: this is from the Gamboge tree [*Garcinia Hanburyi* (Hook)]; the plant is also known as Gutta gamba, Gummigutta etc. An almost identical gum may be obtained from St. John's Wort [*Hypericum*], which would have been more available in the

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2018 *Potter's Cyclopædia of Botanical Drugs*: 296-297.

2019 Mills: 379-380.

2020 *OED*: 1839.

2021 *ibid.*: 2386.



seventeenth century. The name derives from the method of extracting the gum, by tapping the tree and collecting the drops of gum. As Robinson says it is used as a purgative.<sup>2022</sup>

Line 87. *Opium*: the name opium is derived from the Greek ὀπός ‘juice’. The unripe fruit capsule of the Opium Poppy [*Papaver somniferum*] after incision, exudes a juice which, when partially dried, is scraped off the fruit capsule. As Robinson says it can be narcotic, but is usually used as a pain killer (in the form of morphine and codeine) and sedative.<sup>2023</sup>

Text page 57.

Line 88. *Meliora & nobiliora sunt medicamenta* .....: Robinson adds that better and more efficacious medicines are produced by mixing various substances into a compound; this was a common practice in early pharmacology; presumably the hope was that some part of the medicine would be effective!

Line 94. *Colores seu laccæ eliciantur* .....: he concludes with instructions for obtaining pigments or varnishes for both decorative and medicinal purposes.<sup>2024</sup> It is perhaps interesting to note that Grew had ‘also found that the green pigment of leaves could be dissolved by olive oil and that the extract showed what is now called fluorescence’.<sup>2025</sup> Dyes are today usually obtained from herbs by

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<sup>2022</sup> Grieve *A Modern Herbal*: 342.

<sup>2023</sup> *ibid.*: 652.

<sup>2024</sup> A slightly later work ‘intended to bring into one general view all the vegetable substances ..... used in the art of dyeing’ was E. Jorlin’s *Plantæ Tinctoriæ*, published in 1759. This work contains lists of plants and the colours they yield and also the methods of extracting them; it is listed in Pulteney’s *Linnæus* as being number 93 of *Amœnitates Academicæ*, Volume V, published in 1760. Pulteney, Richard. *A General View of the Writings of Linnæus*; T. Payne and B. White, London 1731: 307-310.

<sup>2025</sup> Morton: 193.

boiling or soaking without resource to Robinson's lemon juice or alkaline material in the actual process of extraction. However, the dye-bath itself should contain together with the dye a mordant, which is a chemical used for fixing a dye; these may be acid or alkaline - perhaps Robinson's 'lemon juice or alkali'.<sup>2026</sup>

Line 100. *D. Tancredus Robinson, M.D.*:<sup>2027</sup> Dr. Tancred Robinson (died 1748), a physician, was a friend of Ray's, who wrote this chapter on the chemistry of plants for Book I of *Historia Plantarum*.

Robinson was the second son of a well-to-do turkey merchant from Yorkshire and was at school in York, where he met Martin Lister, who had set up practice there in 1670. He went up to St. John's College, Cambridge, in 1673, took his M.B. in 1679 and then went to Paris, where he attended the botany lectures of Tournefort and the anatomy lectures of Duverney.<sup>2028</sup> In 1681 he seems to have sent his first letter to Ray, although we only have Derham's epitome now.<sup>2029</sup> In 1683 Ray sent him a list of queries to Paris and in July received a long reply.<sup>2030</sup> he soon moved to Montpellier for further study, and then to Bologna, where he met Malpighi, then to Rome and to Naples. In 1684 he went to Venice and then on to Geneva and Leiden, where he found the *Hortus Malabaricus* in the process of production. By 1st August he was back in London and he invited Ray to visit him any time.<sup>2031</sup> He

<sup>2026</sup> Malcolm Stuart (Ed.), *The Encyclopedia of Herbs and Herbalism*, Orbis Publishing, London 1979 : 99.

<sup>2027</sup> Biographical details taken from: Britten and Boulger 259; also from Raven: 207- 209 *et passim*.

<sup>2028</sup> Raven: 207.

<sup>2029</sup> Section on the lost letters of Ray to Tancred Robinson, *Further Correspondence*: 286; Derham's epitome reads:

Nov. 29. Books recd. *Syn[opsis]* with vertues. Cat[alogue] of Gen[era]. Dr. Morison no grammarian and full of errors.

<sup>2030</sup> Letter written from Paris and dated 12 July 1683; *Correspondence*: 132-133.

<sup>2031</sup> Raven: 208.

was then elected to the Royal Society and in February 1685 persuaded it to publish the *Historia Piscium*, which Ray had completed several years before. He became Secretary to the Royal Society later that year, but, after Aston's quarrel and violent resignation, led the Society to dispense with a paid secretary and so Sir John Hoskyns and Thomas Gale became the Honorary Secretaries; this shortly preceded the temporary suspension of the publication of the *Philosophical Transactions* in December 1687. However Robinson kept in touch with various scientists and was the link between them and Ray. He visited Black Notley in May 1686,<sup>2032</sup> and Ray stayed with him in London in September 1687.<sup>2033</sup> Robinson was knighted in 1714.

As Raven says:

For Ray, who in the Preface to the second edition of the *Synopsis Britannicarum* called him [Robinson] 'Amicorum Alpha', wrote more fully and on a wider range of subjects to him than to any other of his correspondents.<sup>2034</sup>

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2032 Section on the lost letters of Ray to Tancred Robinson, *Further Correspondence*: 289; Derham's epitome reads:

May. Expectation of his comp[any]. Postages offered. Motte & Faith[orne].

2033 Section on the lost letters of Ray to Tancred Robinson, *Further Correspondence*: 291; Derham's epitome of these two entries read as follows:

1. Sept. 7. Comes to London.
2. Sept. 19. Thanks for Lond. visit (?). Querys of things he saw at Mr. Charletons and Fulham.

2034 Raven: 208.

### Chapter Thirty:

#### *On the diseases of plants and their remedies.*

From this chapter one senses that Ray is tired and eager to complete this first book of *Historia Plantarum*; despite his initial comments that he does not intend merely to quote from the works of others and that the reader may seek information on the diseases of plants in their works, he does quote at length from Pliny and Malpighi. The bulk of the chapter is taken up with what is virtually a digression on the reproductive pattern of insects and their development, included here because they cause diseases when laying their eggs on plant material.<sup>2035</sup>

Despite the lengthy and careful quotations from Pliny and Malpighi, one feels that Ray's heart was not in his subject at this point. There are many possible reasons; either he was not particularly interested in the subject (hence its position at the end of the work), was suffering from ill health,<sup>2036</sup> or was just eager to complete the book - perhaps the Royal Society had given him a deadline.<sup>2037</sup>

#### Text page 57.

Line 1. *Quamvis de morbis Plantarum . . . . .* : Ray begins by saying that the observations of practical gardeners can add useful information to those written by scholars.

Line 3. *Me tamen, cui aliud est quod agam . . . . .* : he goes on to say that he has other things to do, studying plants 'only for the sake of his soul'; this seems to imply that he is interested only in the appearance and inherent characteristics of plants and not in their diseases.

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2035 Ray was perhaps developing his interest in insects at this time; he began collecting insects in 1690 and published his *Methodus Insectorum* in 1704; Raven xviii-xix.

2036 There is evidence that Ray was suffering from diarrhoea in the later months of 1685, when he would have been writing *Historia Plantarum*; epitome of a letter to Tancred Robinson, *Further Correspondence*: 288.

2037 There are indeed two uncharacteristic grammatical mistakes in this chapter at lines 17 and 49, which are perhaps indicative of Ray's state of mind and/or health at this time.

- Line 3. ὡς ἐν πάροδοι: Ray is again using Greek for emphasis.
- Line 5. *ad quos Lectorem remittere mallet, quam eorum commentarios exscribendi tædium devorare*: his lack of interest in plant diseases is shown again here, where he says, ‘than tediously waste my time writing out their commentaries’. He has been quite happy to quote at length from other sources earlier in the book!
- Line 9. *Internos voco qui a succo nutritio intus suscepto originem ducunt*: he blames ‘internal’ diseases on the plant’s own sap He believes that lack of it or too great an abundance can kill the plant; up to a point he is correct as lack of water can kill a plant by wilting and too much water at the roots, causing lack of oxygen, can also kill.<sup>2038</sup>

We would now use the term disorder for Ray’s internal disease; a modern gardening book defines plant disorders as follows:

Plant disorders usually result from nutritional deficiencies or from unsuitable growing or storage conditions. An inappropriate temperature range, inadequate or erratic water or food supply, poor light, or unsatisfactory atmospheric conditions may all lead to physiological disorders. Problems may also be caused by deficiencies of the mineral salts that are essential for healthy plant growth.

Weather, cultural, or soil conditions may lead to a range of plants being affected. The problems become apparent through symptoms such as discoloured leaves or stem wilt. A plant that lacks water, food, or the appropriate environmental conditions will not only

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<sup>2038</sup> See note below at line 18.

appear unhealthy but will also be far less able to resist attack from either insect pests or diseases caused by fungi, viruses, or bacteria. Unless problems are correctly diagnosed and treated, affected plants may die.<sup>2039</sup>

Line 11. *Fame plantas*: Ray is describing deprivation of nutritional sap, but in effect he means lack of water. Plant growth is slowed down by wilting and eventually such a plant could die.

Line 12. *Nonnullæ ex nimio alimento obesitate laborant .....*: an odd theory here that plants can suffer from ‘obesity’, which can then kill. Too much fertiliser can cause excessive soft stem and leaf growth and the production of fewer flowers and fruits, so in a sense can cause the death of the plant.

Line 13. *omnia quæ resinam ferunt .....* *ut animalia nimio adipe, autore Plinio*: although Ray cites this as coming from Pliny, I have been unable to trace the reference; he seems to have taken this material from Book XVI, xvi-xxiii: 38-61.<sup>2040</sup>

Line 15. *Φυλλομανίαν*: ‘running to leaf without seeding’.

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2039 Brickell, *Gardening*: 545.

2040 Pliny, *Historia Naturalis* XVI, xvi-xxiii: 38-61; Loeb edition IV: 412-426.

Line 16. \* *Luxuria hæc in segetibus castigatur* ..... :margin reference to *Plin. lib.18, cap.17*; a quotation from book XVIII of Pliny as Ray says.<sup>2041</sup>

Line 18. *Ab humore nimio radices perpetuo alluente aut inundante pleræque plantæ præcipue læduntur*: see note at line 9 above.

As Ray says, waterlogged soil is harmful to plants; roots are unable to function properly in waterlogged soil, being unable to take up oxygen and nutrients, such as nitrogen, which are often deficient in very wet soil. He is also correct in saying that wet soil is often cold and so plant growth may be slow in spring.<sup>2042</sup>

Line 21. *ubi solum palustre rarum & fungosum Spongiæ instar aquam imbibit & retinet*: Ray is describing the moorland areas of northern Britain.

A moor is defined as:

A region of land that is found in wet exposed conditions where the soil water can seep laterally very slowly but is not stagnant as in bogs. .... The top soil loses water in summer but the subsoil is permanently waterlogged.<sup>2043</sup>

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2041 In my text this reference is: Pliny, *Historia Naturalis* XVIII, xlv: 161; Loeb edition V: 290.

The Latin of the Loeb text differs somewhat from that used by Ray:

*luxuria segetum castigatur dente pecoris in herba duntaxat, et depastæ*

*quidem vel sæpius nullam in spica iniuriam sentiunt.*

Note that there is a mistake in Ray's (or his typesetter's) Latin construction here in line 17: he has *nullam in spicæ injuriam*; it should either read *nullam spicæ injuriam* ['no injury of the ear'] or *nullam in spica injuriam* ['no injury in the ear'], as in the Loeb text.

2042 Brickell, *Gardening*: 529.

2043 *Penguin Dictionary of Botany*: 234.

Line 22. *Ericæ: Erica.*

[C.T.& M. 336-337] *Erica* (L.), Heather; a genus of the *Ericaceæ* or Heather family.

B.& G.-W. 290: B.& H. 282: Linn.*Sp.Pl.* 352-356:

*Syn.Meth.St.Br.* 470-471: *H.P.* 1713-1716: *H.P.III D.* 97:

*Tri.* 16.41: *Cat.Angl.* 97-99: *Camb.* 62.

*H.P.* 1713-1716:

16 species given, including:

*Erica vulgaris* Park. *vulgaris sive pumila* Ger.emac. *folio*

*Myricæ I, seu vulgaris glabra & albo* J.B.

***Common Heath, or Ling.***

*H.P.III D.* 97:

10 additional species given.

*Tri.* 16.41:

Heath: *Erica*, -æ, f.: Ἐρεΐκη, -ης, f.

Line 24. *in his fortasse etiam aqua stagnans computrescat*: the term 'stagnant' is first recorded in English for 'water, which was not running, and included an element of unwholesomeness' in 1699,<sup>2044</sup> but no doubt this usage was known to Ray.

Line 25. *Hinc, ni fallor, corticis in arboribus nimia constrictio & densitas...*: Ray has the theory that a too dense bark on a tree can impede the flow of sap.

Line 26. *cui malo hortulani nostri subveniunt cortice secundum longitudinem lineis aliquot ductis inciso*: he next gives a practical solution to this problem employed by contemporary gardeners, who make longitudinal cuts in the bark to release the flow of the sap. This is reminiscent of a similar solution mentioned by Pliny, although Ray

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<sup>2044</sup> OED: 2101.



does not refer to it:

*interim est et scariphatio quædam in remediis, cum macie corticis ex ægritudine adstringente se iustoque plus vitalia arborum conprimente exacutam falcis aciem utraque manu inprimentes perpetuis incisuris deducunt ac veluti cutem laxant. salutare id fuisse argumento sunt dilatatae cicatrices et internato corpore expletæ.*<sup>2045</sup>

Line 27. *hinc denique arbores musco infestantur, qui ab humore crudo & frigido ortum ducit:* an odd statement that mosses originate from ‘raw, cold water’. Perhaps Ray was thinking of *Sphagnum* moss, which is characteristic of waterlogged places and ‘has a peculiarity in its leaf structure, which contains many dead porous cells that act as water reservoirs’.<sup>2046</sup>

Line 28. *Ustilago frumentorum & graminum:* next Ray mentions ‘rust’. Rusts are ‘plant diseases caused by fungi of the order Uredinales’.<sup>2047</sup> Such rusts, although caused by Fungi, are ‘encouraged by high humidity. The spores are spread by rain splash and air currents’<sup>2048</sup> so one can see why Ray was confused as to whether they were ‘internal’ or ‘external’ diseases. Ray also discusses rust in his *Cambridge Catalogue*, citing his evidence as coming from Jean Bauhin [*tom.2, p.404*] and Theophrastus [*de causis plant. lib.3. cap.27*] where he cites *Ustilago* as Burnt, blasted or smutted Corn:

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<sup>2045</sup> Pliny, *Historia Naturalis* XVII, xlii: 251; Loeb edition V: 172-174.

[In the meantime the list of remedies includes a sort of scarification. The bark when rendered meagre by disease shrinks up and exerts an undue amount of compression on the vital parts of the tree; for this the vine-dressers holding a pruning knife with a very sharp edge in both hands press it into the trunk and make long incisions downwards, and as it were loosen its skin. It proves that this treatment has been beneficial if the scars widen out and fill up with new wood growing between their edges.]

<sup>2046</sup> *Penguin Dictionary of Botany*: 236.

<sup>2047</sup> *ibid.*: 319.

<sup>2048</sup> Brickell, *Gardening*: 552.

Wheat, Oats, Rie and Barley.<sup>2049</sup> The type of rust indicated here is *Puccinia graminis*, the black stem rust affecting cereals.<sup>2050</sup>

Line 32. *Externos morbos voco qui ab externa causa inducuntur*: for the rest of this chapter Ray concentrates on 'external diseases', that is, those caused by an outside agent, such as the weather but especially insects.

A modern gardening book separates such external diseases into damage (caused by pests, such as slugs, snails, rabbits and especially, as here, insects) and diseases as follows:

Pests [insects] may damage or destroy any part of a plant or, in some cases, even the whole plant. ....  
Sometimes they cause abnormal growths known as galls. Some pests also indirectly damage plants by spreading viral or fungal diseases, while others coat plants with a sugary excrement that encourages the growth of sooty moulds.

A plant disease is any pathological condition caused by other organisms, such as bacteria, fungi, or viruses. Fungal diseases are commonest; bacterial diseases relatively rare. The symptoms that these organisms produce vary considerably in appearance and severity, but the growth or health of the plant is almost always affected, and, in severe attacks, the plant may even be killed. The rate of infection is affected by factors such as weather and growing conditions. In some cases, the disease-causing organism (pathogen) is spread by a carrier, such as an aphid. The pathogen is sometimes visible as a discoloration on the plant, as with rusts. Symptoms such as discoloration, distortion, or wilting

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2049 *Camb.*: 127.

2050 *Penguin Dictionary of Botany*: 319.

are typical signs of disease infection.<sup>2051</sup>

Line 34. *Cæleste malum (ut cum Plinio: loquar) & maxima segetum pestis  
Rubigo est, Anglice Mildew vocamus.*

Ray begins by paraphrasing Pliny, who says:

*cæleste frugum vinearumque malum nullo minus noxium  
est robigo.*<sup>2052</sup>

He continues with a direct quotation:

*frequentissima hæc in roscido tractu convallibusque ac  
perflatum non habentibus; e diverso carent ea ventosa et  
excelsa.*<sup>2053</sup>

Note the unusual use of the word ‘Mildew’ in English here; as with Greek, Ray uses it only occasionally and for emphasis or extra clarification.

There are two types of Mildew, both caused by fungi, now recognised: Powdery Mildew, thriving on plants growing in dry soil, and Downy Mildew, as mentioned here by Ray, which is encouraged by humid conditions such as he describes. It is caused by *Peronospora* and *Bremia* fungi and appears as ‘a fluffy or mealy, white, fungal growth on the lower surface of the foliage, while the upper surface is blotched either yellow or brown’.<sup>2054</sup>

Line 36. *Hujus remedium superstisiosum & magicum proponit Plinius.*

Ray cites Pliny’s recommendation for ‘a superstitious and magical remedy’, but rejects it and the festivals of the Robigalia, instituted for averting the disease, because they are not dedicated to ‘a true divine power’, but to the Roman goddess, Robigo. ‘Her festivals,

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2051 Brickell, *Gardening*: 545.

2052 Pliny, *Historia Naturalis* XVII, xliv: 154; Loeb edition V: 284.

[One of the most harmful climatic maladies of corn crops and vines is rust.]

2053 *ibid.*

2054 Brickell, *Gardening*: 550.

called Robigalia, were celebrated on 25th April, and incense was offered to her, as also the entrails of a sheep, and of a dog. She was entreated to preserve the corn from blights.’<sup>2055</sup>

Ray again paraphrases rather than quotes Pliny, who says:

*rubigo quidem, maxima segetum pestis, lauri ramis in arvo defixis transit in ea folia ex arvis.*<sup>2056</sup>

Line 37. *Lauri: Laurus:* see above Cap.10, line 67.

Line 40. *Insectorum punctionibus ..... Vir Marcellus Malpighius ..... exsequitur Anatomes Plantarum parte altera.*

Ray now turns to Malpighi’s work on galls and gall flies. As Ray says, Malpighi has a lengthy and detailed chapter, *De Gallis*, in his second volume of *Anatome Plantarum*.<sup>2057</sup> Ray, himself, possessed copies of both volumes of Malpighi’s *Anatome Plantarum*; although the sale catalogue of his library does not give the year of publication of the copies in his possession,<sup>2058</sup> he does say earlier in Book I<sup>2059</sup> that he had recently obtained the second part, which had been published in 1679.

Line 40. *aut etiam afflatibus noxiis originem debent:* Malpighi believes that some galls are caused by ‘noxious breezes’. Some galls, such as the Azalea gall, are caused by the fungus, *Exobasidium japonicum*, which is either insect- or air-borne,<sup>2060</sup> that is, transmitted by a ‘noxious breeze’.

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2055 Lemprière: 547.

2056 Pliny, *Historia Naturalis* XVII, xlv: 161; Loeb edition V: 290.

2057 Malpighi, *Anatomes Plantarum Pars Altera*: 22-50.

2058 Item 33 of the folio editions; British Museum S-C 326 (6).

2059 See *Historia Plantarum*, Book I, Cap. XV, line 126.

2060 Brickell, *Gardening*: 556.

Line 41. *Gallarum*: see above Cap.24, line 106.

There are many types of gall, some caused by insects and others by fungi or bacteria;<sup>2061</sup> Malpighi and Ray believe them to be caused by ‘the punctures of insects, erosions or even noxious breezes’.

Line 43. *Erunt ergo Gallæ & reliqui plantarum tumores ..... quasi exoriantur novam exoptantia auram*. Apart from a single word - Ray has *ergo* and Malpighi has *itaque* - this is a direct quotation.<sup>2062</sup>

Line 43. *Gallis*: see above Cap.24, line 106.

As Malpighi says many insects produce galls in which their larvæ may develop. Examples of such galls are those created for the larvæ of the gall midges (*Dasineura affinis*, *D. gleditchiæ* and *D.tetensi*) on such plants as Blackcurrants: for the larvæ of gall wasps, or cynipid wasps, on Oaks and Roses, which, as Malpighi says (see line 65), are formed on the surface of the leaf.

Line 43. *Gallæ*: see above Cap.24, line 106.

Line 49. *Plura enim (inquit) insecta sua edunt ova ..... quacunque parte jam tabefacta opportune custodiuntur*. Again a direct quotation from Malpighi,<sup>2063</sup> although Ray (or perhaps his typesetter) makes a slight mistake when transcribing Malpighi’s Latin. Malpighi has the correct genitive neuter plural form of the relative pronoun [*qui*, that is *quorum*], whereas Ray’s text incorrectly has the feminine form [*quarum*] There is also a slight difference in word order in the quotation at one point, where Malpighi has *vel saltem ipsius*

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2061 Brickell, *Gardening*: 556-565.

2062 Malpighi, *Anatomes Plantarum pars altera*: 50.

2063 *ibid.*: 46-47.

*vicariam opem exigit* and Ray has *vel saltem vicariam ipsius opem exigit*.

Text page 58.

Line 56. *Quæ vero molliora sunt ..... qua Gallarum muscæ præ cæteris pollent*. Again a direct quotation from the same section of Malpighi, although Ray has omitted the preceding sentence of Malpighi's text.<sup>2064</sup>

Line 58. *Gallarum: Galla*: see above Cap.24, line 106.

Line 59. *Terebræ enim quam diximus radix ovario nectitur ..... fidem addere liceat*. Here Ray paraphrases Malpighi's text, which goes into great detail on the function of the ovipositor.<sup>2065</sup>

Line 61. *Semel prope Junii finem vidi muscam ..... quæ adhuc in tubis supererant*. Ray again quotes directly from Malpighi,<sup>2066</sup> although he carefully changes Malpighi's first person aside into the third person and his reference to a section of the work 'above' to 'elsewhere'. Malpighi has *qualem superius delineavi* and Ray has *qualem alibi delineavit*.

Line 62. *Quercinæ: Quercus*: see above Cap.4, line 145.

Line 65. *In folio igitur avulsa musca minima & diaphana reperi ejecta ova*: for these 'eggs' see note on *Gallis* at line 43 above.

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2064 Malpighi, *Anatomes Plantarum pars altera*: 47.

2065 *ibid.*: 47-48.

2066 *ibid.*: 47.

Line 66. *Tam ferax itaque muscarum familia e Gallis erumpentium ..... & subinde infuso ichore experimur.* Ray omits thirteen lines of Malpighi's text and then continues the quotation.<sup>2067</sup>

Line 66. *Gallis: Galla:* see above Cap.24, line 106.

Line 72. *sanguineis perfectis Animalibus:* Ray omits a word from Malpighi's text in this part of the quotation. Malpighi has *sanguineis quibusdam perfectis animalibus*,<sup>2068</sup> implying that only 'some' blood-bearing animals suffer swellings after being stung, whereas Ray's text would imply that they all do.<sup>2069</sup>

Line 73. *At non ex vulnere tantum ..... contabescunt plantarum partes:* Ray is summarising Malpighi here almost as continuity between quotations.

Line 74. *Mirabilius est (inquit idem Clariss. Malpighius) quod passim ..... summa colorum jactura exarescit.* Ray returns to the earlier part of Malpighi's chapter on Galls for this quotation;<sup>2070</sup> apart from the last word, where Ray has *exarescit* and Malpighi has *arescat*, they are identical.

Line 76. *Vitis:* see above Cap.5, line 26.

Line 76. *Quercûs: Quercus:* see above Cap.4, line 145.

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2067 Malpighi, *Anatomes Plantarum pars altera*: 47.

2068 *ibid.*

2069 Is this another indication of Ray's ill health and tiredness again? See introductory paragraphs and notes at lines 16 and 49.

2070 Malpighi, *Anatomes Plantarum pars altera*: 23.

- Line 76. *convulsis enim fibris totum folium circa expositum ovum in spiram contortum contabescit*: Malpighi, although he gives as his examples, the Vine and the Oak, seems to be describing the type of damage done by insects such as the Rose leaf-rolling sawfly, which lays its 'eggs in the leaflets, secreting chemicals that cause the rolling' into 'tight tubes during spring and early summer'.<sup>2071</sup>
- Line 79. *Hæc omnia D. Malpighius*: again Ray acknowledges his debt to Malpighi and in this instance to his chapter *De Gallis*.<sup>2072</sup>
- Line 80. *Notandum autem non omnes Plantarum tumores .....*: Ray concludes with a repetition of his earlier statement that plant diseases can be caused by both internal and external factors. Malpighi has a separate chapter *De Variis Plantarum Tumoribus et Excrescentiis* in the second part of his *Anatome Plantarum*.<sup>2073</sup>  
Possibly Malpighi and Ray are describing soil-borne bacterial diseases here, such as Leafy gall and Crown gall, which enter the host plants through surface wounds.<sup>2074</sup>
- Line 85. *Verum de his consulatur Clariss. Malpighii liber modo laudatus*: even in his conclusions he refers the reader to Malpighi.

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2071 Brickell, *Gardening* 556.

2072 Malpighi, *Anatomes Plantarum pars altera*: 22-50.

2073 *ibid.*: 51-54.

2074 Brickell, *Gardening*: 559.



General table of herbaceous plants showing the main types.

In this and the following two tables, Ray summarises his divisions of plants as exemplified in the remaining text of *Historia Plantarum*. In this first general table he gives references to the relevant books of Volume I. These tables were inserted at the suggestion of Dr. Tancred Robinson, then Secretary to The Royal Society, the publishers of *Historia Plantarum*:

I think you ought to have given us a general characteristic table of plants, viz. herbs, shrubs, and trees, comprehending a general scheme of the whole work, immediately after your general part, before you entered upon particulars, as the submarine plants: if you think this proper it may be done still in a single sheet with a reference to the page where it ought to be inserted.<sup>2075</sup>

Text page (59).<sup>2076</sup>

Line 2. *FUNGI: Fungus*: see above Cap.18, line 181.

Line 2. *ALGÆ:Alga*: see above Cap.18, line 182.

Line 2. *MUSCI:Muscus*: see above Cap.18, line 181.

Line 3. *LIBER II*: Ray's title for Book II is *De Plantis Imperfectis*; that is 'concerning imperfect plants'.

Line 6. *CAPILLARES*: literally 'thread-like', 'hair-like' or 'capillary'. *Capillares* are Ray's Mosses and ferns.

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2075 Letter from Tancred Robinson to John Ray, dated 8th September 1685; *Further Correspondence*: 150.

Ray agreed to the insertion of a Table of Herbs in a letter to Robinson, dated 14th September 1685; *Further Correspondence*: 152.

2076 In the text the pages for the tables are numbered (59) to (62), i.e. in brackets, therefore I have given these page numbers in parenthesis in the commentary. There is also a note at the bottom of this page in the text *Inserere inter pag. 58 & 59*, an instruction to 'insert between pages 58 and 59'. See also the introduction to this chapter of the commentary.

- Line 7. *LIB.III*: the title of Book III is *De Herbis semine minutissimo, flore vel nullo, vel imperfecto*’; that is ‘concerning plants with a very small seed and having either no flower or only an imperfect one’.
- Line 14. *LIB.IV*: the title of Book IV is *De Herbis flore imperfecto, seu apetalo stamineove*’; that is ‘concerning plants with an imperfect flower, either lacking petals or having only a stamen’.
- Line 19. *LIB.V*: the title of Book V is *De Herbis flore Composito planifolio, natura plerunque pleno, lactescentibus*; that is ‘concerning plants with a flat-leaved composite flower, by nature usually full, and producing milky sap’.
- Line 23. *PAPPOSIS*: *Papposæ*: see above Cap.27, line 129.  
*LIB.VI*: the title of Book VI is *De Herbis flore Composito discoide papposis, non lactescentibus*; that is ‘concerning plants with a composite discoid flower bearing a pappus, which does not produce milky sap’.
- Line 24. *CORYMBIFERIS*: *Corymbiferæ*: see above cap.20, line 49.  
*LIB.VIII*: the title of Book VIII is *De Herbis flore composito non papposis seu CORYMBIFERIS*; that is ‘concerning plants with a composite flower without a pappus, and which are called *Corymbiferæ*’.<sup>2077</sup>
- Line 27. *CAPITATÆ*: see above Cap.27, line 132.  
*LIB.VII*: the title of Book VII is *De Herbis cum flore ex flosculis fistularibus composito CAPITATIS dictis*; that is ‘concerning plants

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<sup>2077</sup> *Corymbiferæ* = ‘bearing a corymb’.

with a composite flower made up of small pipe-like florets, and called *Capitatae*'.<sup>2078</sup>

Line 32. *LIB.IX.PAR.I*: the title of Book IX, part I, is *De Plantis flore perfecto seminibus nudis solitariis: deque UMBELLIFERIS*; that is 'concerning plants with a perfect flower producing single bare seeds: and finally<sup>2079</sup> the *Umbelliferæ*'.<sup>2080</sup>

Line 34. *UMBELLIFERÆ*: see above Cap.11, line 55.

*LIB.IX.PAR.II*: the title of Book IX, part II, is *De Plantis Umbelliferis semine tumidiore & minus compresso donatis, eoque majore*; that is 'concerning umbel-bearing plants with a rather swollen and less compressed seed, which is also larger'.

Line 37. *STELLATÆ*: see above Cap.27, line 141.

*LIB.X.PAR.I*: the title of Book X, part I, is *De Herbis Stellatis*; that is 'concerning plants with leaves arranged in a star pattern around the stem'.

Line 38. *Nasturtium Indicum*: see above Cap.7, line 54.

Line 41. *VERTICILLATÆ*: see above Cap.11, Table 113.

*LIB.XI*: the title of Book XI is *De Plantis Verticillatis*; that is 'concerning plants with the flowers growing round the stem in the manner of a whorl'.

Line 44. *ASPERIFOLIÆ*: see above Cap.14, line 16.

*LIB.X.PAR.II*: the title of Book X, part II, is *De Herbis γυμνοσπέρμοις, in quibus quatuor singulis floribus succedunt*

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2078 *Capitatae* = 'headed'.

2079 Ray has *deque* here = 'downwards', but presumably he means *denique* = 'finally'.

2080 *Umbelliferæ* = 'umbel-bearing'.

*semine, Asperifoliis dictis*; that is ‘concerning plants with bare seeds, in which four seeds follow individual flowers, and which are called *Asperifoliæ*’.<sup>2081</sup>

Line 45. *Gymnospermas polyspermas*: *Gymnospermæ polyspermæ*: literally ‘naked-seeded many-seeded’.

*LIB.XII*: the title of Book XII is *De Herbis semine nudo Polyspermis, hoc est, in quibus singulis floribus plura quatuor succedunt semina, nullo certo aut definito numero*; that is ‘concerning plants with many but bare seeds, that is, in which more than four seeds follow each individual flower, in no certain or definite number’.

Text page (60).

Line 51. *POMIFERÆ*: see above Cap.27, line 161.

*LIB.XIII.PAR.I*: the title of Book XIII, part I, is *De Herbis Pomiferis*; that is ‘concerning plants which produce apples’.

Line 54. *BACCIFERÆ*: see above Cap.27, line 162.

*LIB.XIII.PAR.II*: the title of Book XIII, part II, is *De Herbis Bacciferis*; that is ‘concerning plants which produce berries’.

Line 57. *MULTISILIQUEAS*: *Multisiliquæ*: literally ‘multi-podded’.

*LIB.XIV*: the title of Book XIV is *De Plantis multisiliquis seu corniculatis*; that is ‘concerning plants with many pods or little horns’.

Line 68. *PAPILIONACEAS*: *Papilionaceæ*: see above Cap.10, line 62.

Line 79. *CULMIFERÆ*: see above Cap.27, line 104.

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<sup>2081</sup> *Asperifoliæ* = ‘rough-leaved’.

Line 81. *FRUMENTA: Frumentum:* see above Cap.7, line 50.

Line 81. *CEREALIA:* see above Cap.27, line 107.

Line 83. *GRAMINA: Gramen:* see above Cap.7, line 51.

Line 84. *Graminifoliae:* literally 'grass-leaved'.

Ray could be referring to grass-leaved plants in general or to either of the following:

1. C.T.& M. 87: *Subularia aquatica* (L.), Awlwort; a species of the *Subularia* genus of the *Cruciferae* or Cress family.

B.& G.-W. 156: *Subularia aquatica* (L.), Awlwort.

B.& H. - no ref.

Linn.*Sp.Pl.* 642:

*Subularia aquatica:*

*Subularia* Fl.lapp.253. Fl.suec.527.

*Alyssum palustre, folio junci.* Buxb.act.2.p.369.t.23.f.1.

*Graminifolia aquatica, thlaspeos capitulis rotundis: sepimento siliculam dirimente.* Pluk.alm.180.t.188.f.5.

*Habitat in Europæ borealis inundatis lacustribus fluviis.*

*Syn.Meth.St.Br.* - no ref.: *H.P.* - no ref.: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

2. C.T. & M. 24: *Pilularia globulifera*, (L.), Pillwort; a species of the *Pilularia* genus of the *Marsiliaceae* family.

B.& G.-W. - no ref.

B.& H. - no ref.

Linn.*Sp.Pl.* 1100:

*Pilularia globulifera:*

*Pilularia palustris juncifolia.* Vaill.paris.159.t.15.f.6.

Dill.musc.538.t.79.f.1. Juss.act.1739.p.240.t.11.

*Graminifolia palustris repens, vasculis granorum piperis*

*æmulis*. Raj.hist.1325.angl.3.p.136.

Moris.hist.3.p.608.s.15.t.7.f.49.

*Gramen piperinum*. Pet.herb.t.19.f.8.

*Muscus aureus capillaris palustris, inter folia folliculis rotundis quadripartitis*. Pluk.alm.246.t.48.f.1.

*Habitat in Europæ inundatis*.

*Syn.Meth.St.Br.* 136:

*Graminifolia palustris repens, vasculis granorum Piperis æmulis*

*Syn.II.281. Muscus aureus capillaris palustris inter foliola folliculis rotundis (ex sententia D.Doody) quadripartitis*

Pluk.Alm.256.T.48.f.1. *Gramen piperinum* Merr.Pin.

[There are two sub-headings in *Syn.Meth.St.Br.* to *Graminifolia*:

1. *Herbæ graminifoliæ non culmiferæ flore imperfecto seu stamineo.*

2. *Graminifoliæ non culmiferæ singulares et sui generis.*

*H.P.*1325:

*Graminifolia palustris repens vasculis granorum piperis æmulis.*

***Pepper-grass.***

*H.P.III* - no ref: *Tri.* - no ref.: *Cat.Angl.* 153: *Camb.* - no ref.

*Cat.Angl.*153:

*Graminifolia repens palustris vasculis granorum piperis æmulis.*

***Pepper-grass.*** *Perexigua hæc planta per terram repit foliis tenuissimis. In alis foliorum globulos sessiles profert granorum Piperis magnitudine fere, seminibus albis refertos.*

Line 89. *Arum*: see above Cap.3, line 35.

Line 89. *Dracontium*: see above Cap.3, line 46.

Line 89. *Bacciferas*: *Bacciferæ*: see above Cap.27, line 162.

### **Table One:**

#### ***Imperfect plants.***

In this table Ray lists what he recognised as the smaller forms of plant, such as Corals, Sea-weeds, Fungi, Lichen and Mosses, which he calls 'imperfect'; at this time he knew very little about such plants, as is evident from the first three books of *Historia Plantarum*, which are rather sketchy. As Raven says, 'hardly any serious work had been done and large tracts of vegetable life were almost unexplored'.<sup>2082</sup> Raven's comments on Ray's earlier work the *Methodus Plantarum* of 1682 are still applicable to this later work:

It is clear that marine studies have hardly yet begun. Ray collected a number of Algæ and recognised that they stand apart from all 'true' plants: but though he mentioned the animal affinities of zoophytes he counts corals, 'seaweeds with hard and stony structure', as plants and regards the sponges as a sort of fungoid algæ. Here, as also among the Cryptogams, on which he did much work later, he has few data available.<sup>2083</sup>

Ray's 'imperfect' plants include those known as cryptogams, which are plants whose reproductive method is 'not immediately apparent, i.e. a plant in which the reproductive structures are not borne in conspicuous flowers or cones. Cryptogams thus included the algæ, fungi, bryophytes,<sup>2084</sup> and most pteridophytes<sup>2085</sup> '.<sup>2086</sup>

Text page (61).

Line 5. *CORALIUM: Coraliu*m: see above under *Corallium* Cap.18, line 183. See also introductory note to this chapter.

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2082 Raven: 224.

2083 *ibid.*: 198.

2084 The class of *Bryophyta* includes *Hepaticæ* (Liverworts), *Musci* (Mosses) and *Anthocerotæ* (Hornworts); *Penguin Dictionary of Botany*: 49-50.

2085 *Pteridophyta* include all the 'nonseed-bearing vascular plants'; they include 'the subdivisions or classes *Psilopsida*, *Lycopsidea*, *Sphenopsida*, and *Pteropsida*'; *ibid.*: 300.

2086 *ibid.*: 92.

Line 5. *Corallina*.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1166-1167: *Syn.Meth.St.Br.* 33.7: *H.P.* 65-66:

*H.P.III* 4-7: *Tri.* - no ref.: *Cat.Angl.* 78-79 *Camb.* - no ref.

Linn.*Sp.Pl.* 1166-1167:

Linnæus uses the name *Corallina* for some species of *Conferva*: see below Table I, line 12.

*H.P.* 65-66:

This section is on Stony mosses or *Corallina*.

5 species given, including:

*Corallina* J.B. *Muscus maritimus sive Corallina Officinarum*

C.B. *Musc. mar. sive Corallina alba Officinarum* Park.

*Corallina Anglica* Ger.

*H.P.III* 4-7:

Several additional species given.

*Cat.Angl.* 78-79:

Ray gives the same Latin names as in the later *Historia Plantarum* [for which see above] but with the addition of the English name 'Sea-Corallina'.

Line 5. *Porus*.

No reference to this as a plant in any of the sources. Ray includes it here with *Coralium* and *Corallina*, as he does in the main text of *Historia Plantarum*; therefore it appears to be either a synonym for them or similar to them - that is, a porous or coral-like structure. *Porus* is used by Pliny for 'tufa'.<sup>2087</sup>

*H.P.* 63-64:

*De Poris dictis*:

10 species given, including:

*Porus tubularis* J.B. C.B. Imp.

<sup>2087</sup> Pliny, *Historia Naturalis* XXXVI, xxviii: 132 (Loeb edition X: 106); XXXVI, ix: 53 (Loeb edition X: 42).



H.P.III3-4:

*Lithophyta: Ad cap. secundum de Poris dictis. Pro speciei  
decimae Synon.* Here Ray gives synonyms for the tenth species.

Line 8. *Fucus*: see above Cap.18, line 182.

Line 9. *ALGA*: see above Cap.18, line 182.  
See introductory note to this chapter.

Line 10. *SPONGIA*: see under *Alcyonium* Cap.18, line 183.  
See introductory note to this chapter.

Line 12. *CONFERVA*.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 545 - incorrect  
reference given in the index here: Linn.*Sp.Pl.* 1164-1167:  
*Syn.Meth.St.Br.* 58: *H.P.* 118: *H.P.III* - no ref.: *Tri.* - no ref.:  
*Cat.Angl.* 75: *Camb.* 55.

*H.P.* 118:

2 species given, including:

*Conferva Plinii* Ger.emac. *Linum aquaticum* Imper. *Alga viridis  
capillaceo folio* C.B. *Alga aquatilis capillacea sive Conferva  
Plinii, aliis Linum aquaticum* Park.

***Hairy Riverweed, Crow-silk.***

Pliny describes this plant as follows:

*Peculiaris est Alpinis maxime fluminibus conferva  
appellata a conferuminando, spongea aquarum dulcium  
verius quam muscus aut herba, villosæ densitatis atque  
fistulosæ. curatum ea scio omnibus fere ossibus  
confractis prolapsum ex arbore alta putatorem,  
circumdata universo corpori, aquam suam  
adspergentibus quotiens inaresceret, raroque nec nisi*

*deficientem herbam mutationis causa resolventibus,  
convalesse vix credibili celeritate.*<sup>2088</sup>

Line 13. *LENS PALUSTRIS.*

[C.T.& M. 583-584] *Lemna* (L.), Duckweed; a genus of the *Lemnaceæ* or Duckweed family.

B.& G.-W. 470: B.& H. 421: Linn.*Sp.Pl.* 970:

*Syn.Meth.St.Br.* 129: *H.P.* 117-118: *H.P.III* 48: *Tri.* - no ref.:  
*Cat.Angl.* 183: *Camb.* 79.

*H.P.* 117-118:

3 species given, including:

*Lens palustris* Ger. J.B. *palustris sive aquatica vulgaris* Park.

*Lenticula palustris vulgaris* C.B. *Ducks meat.*

*H.P.III* 48:

*Ad Lentem palustrem* J.B.:

(Tr.) 'Dr. Sherard saw this plant in August and September in Holland shedding its seeds. It fruits in the same way as *Lenticula palustris latifolia punctata.*'

Line 13. *Lenticula.*

[C.T.& M. 45] *Ranunculus hederaceus* (L.), Ivy-leaved Crowfoot; a species of the *Ranunculus* genus of the *Ranunculaceæ* or Buttercup family.

B.& G.-W. 120: B.& H. 7: Linn.*Sp.Pl.* 556: *Syn.Meth.St.Br.* 129:

*H.P.* 118: *H.P.III* 14: *Tri.* - no ref.:

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2088 Pliny, *Historia Naturalis* XXVII, xlv: 69; Loeb edition VII: 430.

[Conferva is peculiar to running streams, Alpine in particular, so named from *conferuminare*, to solder together. It is more like a fresh-water sponge than a moss or vascular plant, being a hairy, dense and porous mass. To my knowledge a man who, pruning a very high tree, fell and broke nearly all his bones, was treated with this plant. His entire body was enveloped in it; whenever it dried it was sprinkled with its native water but rarely taken off, only in fact for renewals when the plant lost its strength. The patient recovered in an almost incredibly short time.]

*Cat.Angl.* 183 with a ref. to see *Hederulaaquatica* 157: *Camb.* 101.

*H.P.* 118:

*Lenticula aquatica trisulca* J.B. C.B. *Hederulaaquatica* Ger.

*Ranunculus hederaceus aquaticus* Park.

***Ivy-leaved Duckmeat.***

*H.P.III* 14:

*Lenticula marina* i.e. *Saragazo*: ad finem *Capitis III* adde, pro  
specietertia:

*Lenticula marina foliis latis, brevibus, serratis.* *Slon.Cat.Jamaic.*

*Lenticula marina foliis latis brevissimisque* *Slon.Cat.Jamaic.*

Line 17. *FUNGI*: see above *Cap.18*, line 181.

Line 19. *Fungus Laricis AGARICUM*: *Fungus Laricis Agaricum dictus.*

For *Fungus* see above *Cap.18*, line 181.

[*Fungi* 145-148]<sup>2089</sup> *Agaricaceæ*, a family of *Fungi*: 26 species  
given here, including *Agaricus campestris*, the Field Mushroom.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 1171-1176: *Syn.Meth.St.Br.* 21: *H.P.* 107:

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* - no ref.: *Camb.* - no ref.

*H.P.* 107:

*Agaricum* J.B. *Agaricus sive Fungus Laricis* C.B. *Agaricus ex*

*Larice* Park. *Agarick.*

Line 19. *Fungus Sambuci Auriculæ Judæ*:

For *Fungus* see above *Cap.18*, line 181.

[*Fungi* 191]<sup>2090</sup> *Hirneola*(=*Auricularia*)*auricula-judæ*, Jew's Ear; a  
species of the *Hirneola* genus of the *Auriculariaceæ* family.

C.T.& M. - no ref.: B.& G.W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 1181-1182: *Syn.Meth.St.Br.* 18: *H.P.* 106:

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2089 Buczacki: 145-148.

2090 *ibid.*: 191.

*H.P.III* - no ref.: *Tri.* - no ref.: *Cat.Angl.* 121-122: *Camb.* - no ref.

*H.P.* 106:

*Fungus membranaceus auriculam referens sive Sambucinus*  
*C.B. F. Auriculæ Judæ, coloris ex cineraceo nigricantis,*  
*perniciosus, in Sambuci caudice nascens* J.B. *F. Sambucinus*  
*sive Auricula Judæ* Ger. Park. **Jew's-ear.**

Line 24. *Fungus porosus.*

For *Fungus* see above Cap.18, line 181.

[*Fungi* 49]<sup>2091</sup> *Suillus luteus*, Slippery Jack and *Suillus flavidus*;

both are species of the *Suillus* genus of the *Boletaceæ* family.

*C.T.& M.* - no ref.: *B.& G.-W.* - no ref.: *B.& H.* - no ref.:

*Linn.Sp.Pl.* 1177: *Syn.Meth.St.Br.* 23: *H.P.* 100: *H.P.III* - no ref.:

*Tri.* - no ref.: *Cat.Angl.* 120: *Camb.* - no ref.

*Linn.Sp.Pl.* 1177:

*Boletus luteus*:

*Boletus stipitatus, pileo pulvinato subviscido, poris rotundatis*  
*convexis flavissimis, stipite albido.*

*Boletus caulescens, pileo livido subviscido, poris flavis*  
*convexis, stipite albido.* Fl.suec.1088. Dalib.paris.381.

*Suillus annulatus terreus, inferne flavescens.* Hall.helv.29.

*Fungus porosus autumnalis viscidus.* Baxb.cent.5.p.7.t.14.

*Habitat in sylvis.*

*H.P.* 100:

*Fungus porosus magnus crassus* J.B. *An fungi esculenti* 16.

*Clusii tertia species? Fungus Augusti mensis* C.B.

Line 26. *Fungus OPHIOGLOSSOIDES, Digitell.I.*

For *Fungus* see above Cap.18, line 181.

[Fungi 162-165]<sup>2092</sup> *Clavaria*; a genus of the *Clavariaceæ* family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.*Sp.Pl.* 1182: *Syn.Meth.St.Br.* 14: *H.P.* 104: *H.P.III* 17-25:

*Tri.* - no ref.: *Cat.Angl.* 122: *Camb.* - no ref.

Linn.*Sp.Pl.* 1182:

*Clavaria ophioglossoides*:

*Clavaria clavata integerrima compressa obtusa.*

Guett.stamp.1.p.8. Dalib.paris.386.

*Clavaria ophioglossoides nigra.* Vaill.paris.39.t.7.f.3.

*Habitat in sylvis australibus.*

*H.P.* 104:

*Fungus ophioglossoides niger.*

*H.P.III* 17-25:

24 additional species given.

Line 27. *Fungus RAMOSUS.*

For *Fungus* see above Cap.18, line 181.

C.T.& M. - no ref.: B.& G.-W. - no ref.: *Fungi* - no ref.:

B.& H. - no ref: Linn.*Sp.Pl.* 1182-1183: *Syn.Meth.St.Br.* 15-16:

*H.P.* 103: *H.P.III* 17-25: *Tri.* - no ref.: *Cat.Angl.* 121:

*Camb.* - no ref.

Linn.*Sp.Pl.* 1182-1183:

*Clavaria coralloides*:

*Clavaria ramis confertsi ramosissimis inæqualibus.*

Fl.Suec.1106. Dalib.paris.386.

*Clavariaramosissima.* Roy.lugdb.518.

*Corallo-fungus flavus.* Vaill.paris.41.t.8.f.4.

*Coralloides flava & albida.* Tourne.inst.564.t.332.f.B.

*Barba caprina*. Sterh.fung.96.97.t.11.f.A.B.C.D.

*Habitat in Sylvis opacis.*

*Syn.Meth.St.Br.* 15-16:

9 species given, including:

*Fungus ramosus flavus & albidus* J.B.III 837. *ramosus & Imperati* C.B.Pin.371.29. *Barba caprina* Sterh.p.96.97.98.T.11.C.D. *Coralloides flava & albida* Inst.R.H.564.T.332.B.

*H.P.* 103:

*Fungus ramosus flavus & albidus* J.B. *ramosus, & Imperati* C.B. *Fung. escul.* 19. genus Clus. *An F. digitatus major atque etiam minor* C.B?

*H.P.III* 17-25:

21 additional species given.

Line 29. *PEZICÆ Plinii*

[Fungi 217-219]<sup>2093</sup> *Peziza*; a genus of the *Pezizaceæ* family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

Linn.Sp.Pl. 1180-1182: *Syn.Meth.St.Br.* 17: *H.P.* 106:

*H.P.III* - no ref.: Tri. - no ref.: *Cat.Angl.* 118: Camb. - no ref.

Linn.*Sp.Pl.* 1180-1182:

*Peziza*: 8 species given, including:

*Peziza Acetabulum*:

*Peziza cyathiformibus extus angulata venis ramosis.*

*Fungoides fuscum acetabuliforme: externe ramificatum.*

Vaill.paris.57.t.13.f.1.

*Fungoides fuscum majus.* Buxb.act.4.p.283.t.29.f.1.2.

*Fungoides maximum vasis fusorii forma.*

Mich.gen.206.t.8.6.f.1.

*Habitat in Europa australi.*

*Syn.Meth.St.Br.* 17:

*Peziza*: 22 species given, including:

*Fungi Pezizæ Plinii* Col.Ec.I.335. *ic. & descr.* *Syn.II.17.23.*

*Fungus noxius 5, seu acetabulorum modo cavus, radice carens*  
C.B.Pin.372. **Cup Mushroom.**

*H.P.* 106:

*Fungi Pezicæ Plinii* Col. *Fungus acetabulorum modo cavus,*  
*radicecarens* C.B.

*Fungi Pezicæ altera species* Col. *Fungus Hepaticæ saxatilis*  
*forma* C.B.

Ray describes this as the '*Pezicæ* of Pliny'; Pliny describes it as:

*Sunt et in fungorum genere Græcis dicti pezicæ, qui sine*  
*radice aut pediculo nascuntur.*<sup>2094</sup>

NB Although Ramsbottom says that '*pezica* of Pliny, πέζις of Theophrastus, is *Lycoperdon giganteum*',<sup>2095</sup> this seems unlikely because Pliny describes it as *sine radice aut pediculo nascuntur* ['being born without root or foot']; this description fits that of the *Pezizaceæ*<sup>2096</sup> rather than the *Lycoperdaceæ*, which all have a stem.<sup>2097</sup>

Line 30. *Fungus PULVERULENTUS.*

For *Fungus* see above Cap.18, line 181.

[*Fungi* 193-195]<sup>2098</sup> *Gæstrum*; a genus of the *Gæstraceæ* or Earthstar family.

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 1184: *Syn.Meth.St.Br.* 26: *H.P.* 104: *H.P.III* 17-25:

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2094 Pliny, *Historia Naturalis* XIX, xiv: 38; Loeb edition V: 444.

[The fungus class also includes those called by the Greeks *pezicæ*, which grow without root or stalk.]

2095 Ramsbottom : 6.

2096 Buczacki: 217-218.

2097 *ibid.*: 195-196.

2098 *ibid.*: 193-195.

*Tri.* - no ref.: *Cat.Angl.* 121: *Camb.* 65.

*Linn.Sp.Pl.* 1184:

*Lycoperdon stellatum:*

*Lycoperdon volva multifida patente, capitulo glabro: ore acuminato dentato.* Hort.cliff.479. Fl.suec.1113. Dalib.paris.390. Roy.lugdb.519.

*Lycoperdon stellatum, calyce inverso.*

Buxb.cent.2.p.45.t.49.f.3.

*Gæster major, umbilico fimbriato.* Mich.gen.220.t.100.f.1.2.3.

*Fungus pulverulentus, Crepitus lupi dictus, coronatus & inferne stellatus.* Raj.angl.3.p.27.t.1.f.1.

*Fungus stellatus.* Bocc.mus.1.t.305.

*Habitat in collibus.*

*Syn.Meth.St.Br.* 26:

13 species given, including:

*Crepitus Lupi sive Fungus ovatus* Park.1323. *Fungus pulverulentus dictus Crepitus Lupi* J.B.III 848. *rotundus orbicularis* C.B.Pin.374.42. *tertius seu orbicularis* Ger.1385. *F. noxiorum* 26, *Generis I Species* Clus.Sterh.p.273.T.29.F.

***Puff-balls, dusty Mushrooms, Bull-fists.***

*H.P.* 104:

*Fungus pulverulentus dictus Crepitus Lupi* J.B. *Crepitus Lupi sive Fungus ovatus* Park. F.3. *sive orbicularis* Ger. *F. noxius* 42, *sive rotundus orbicularis* C.B. *F.nox.* XXVI, *prima species* Clus.

***Puff-balls or dusty Mushrome, Bul (?) fists.***<sup>2099</sup>

*H.P.III* 17-25:

19 additional species given.

Line 30. *Crepitus lupi* [literally 'the growling of a wolf']:

<sup>2099</sup> 'Bul (?) sists' or 'Bul (?) fists'; the text is indistinct here, but reads 'Bull-fists' in *Syn.Meth.St.Br.*: 26 - see immediately above.



see entry for *Fungus pulverulentus* above line 30.

Line 31. *TUBERA terræ.*

In this case Ray is not meaning the swollen stem or root such as the potato tuber, but rather 'the genus of fungi [from the order *Pezizales*] in which the fruit bodies occur underground. .... The fruit bodies of Tuber species are edible and highly prized as truffles'.<sup>2100</sup>

Line 33. *MUSCI: muscus:* see above Cap.18, line 181.

Line 35. *LICHEN arboreus & terrestris.*

[G.F.M.& L. 10]<sup>2101</sup> *Cryptogamia.*

Lichen plants consist of a fungus growing in close association (symbiosis) with an alga. They are commonly reproduced by vegetative means, fragments, usually specialised structures, dropping off and forming new plants. These fragments contain cells of both the fungal and algal partners. The fungal partner may sometimes produce spores in structures, called asocarps, which may often be most noticeable on the surface of the plant. These spores contain only fungal cells, and it is believed that if they are to reproduce the lichen they must encounter cells of the algae wherever they land. The process is a complex one and not yet fully understood.<sup>2102</sup>

Most lichens are sensitive to air pollution and to levels of sulphur dioxide in particular.<sup>2103</sup>

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2100 *Oxford Dictionary of Botany:* 419.

2101 Phillips, *Grasses:* 10.

2102 *ibid.*

2103 *ibid.*

There are five groups:

1. The crust-like lichens, which form flat patches on rocks and trees.
2. Flat, lobed lichens.
3. *Cladonia* and *Sterocaulon*, which are generally composed of scale-like structures giving rise to upright stems which may be branched or unbranched and often are swollen or cup-shaped towards the tips.
4. The semi-erect, shrubby lichens with branched stems and no basal scales.
5. The erect or hanging, shrubby lichens with branched stems but no basal scales.

Nearly 1400 lichens have been recognized in the British Isles.<sup>2104</sup>

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. 547 - passing reference only: *Linn.Sp.Pl.* 1140-1156: *Syn.Meth.St.Br.* 114-116: *H.P.* 124: *H.P.III* 47: *Tri.* - no ref.: *Cat.Angl.* 184-186: *Camb.* 79. *Linn.Sp.Pl.* 1140-1156:

No specific mention of *arboreus* or *terrestris*: 80 species given, divided into 8 groups.

*Syn.Meth.St.Br.* 114-116:

5 species given, divided into 2 groups: plus 2, about whose nature Ray is doubtful.

*H.P.* 124:

(Tr.) Lichen is so-called by the Greeks and Romans because it cures scaly conditions of the skin, that is, impetigo. Pliny, lib.26, cap.4, says "The herb Lichen is used as a remedy for all scaly skin conditions from which it acquired its name".

The herb Lichen always grows on the surface of the ground or attaches itself to the bark of

trees.

Here it is of two types, either 1. sterile, at least as far as has been observed so far: or 2. fertile, or bearing seed.

7 species given, including:

*Lichen sive Hepatica vulgaris* Park. *Lichen sive Hepatica fontana* J.B. *Hepatica terrestris* Ger. *Lichen petræus latifolius sive Hepatica fontana* C.B. **Liverwort.**

*H.P.III* 47:

Many additional species given.

*Camb.* 79:

*Lichen. Liverwort, or common ground Liverwort.*

In shady moist places.

Ray's note here reads:

The larger and more succulent leaves of this plant have a gummy flavour when tasted; the smaller less developed are bitter. J. Bauhin attributes to this plant a juice in some degree aromatic and bitter, but sometimes acid. We have to leave to learned doctors the task of deciding what ought to be collected for a correct understanding of the properties of this plant, since by many *Hepatica* has been regarded without reason as cold, and it is thought that cold should be avoided in cases of ill health.

*Lichen arborum, Tree Lungwort.*

It grows on trees, particularly on Oak.

In the *Cambridge Catalogue* Ray defines Liverwort as Lichen, whereas we now include Liverwort in the *Bryophyta*, along with Mosses.

Liverworts are either flat-lobed structures or have small leaves in rows of three. These have a similar life-cycle to mosses and the male and female structures are often quite obvious on the lobed types.

The capsules differ from moss capsules by breaking open into four flaps, releasing the ripe spores.<sup>2105</sup>

Line 36. *Fuci: Fucus:* see above Cap.18, line 182.

Line 36. *Algæ: alga:* see above Cap.18, line 182.

Line 38. *Musci marini: Muscus marinus.*

For *Muscus* see above Cap.18, line 181.

*H.P. 66:*

*Corallinae affinis sive Muscus marinus tenui capillo* J.B.

*Muscus marinus albidus* Ger. *capillaceus multifido folio albidus*

C.B. *marinus sive Corallina rubens* Park.

Line 38. *Algæ: Alga:* see above Cap.18, line 182.

**Table Two:**

*Herbaceous plants with very small seed, which is scarcely visible to the naked eye are as follows:*

In this table Ray lists his various types of Lichen and Mosses.

Text page (62).

Line 5. LICHEN *terrestris*: see above Table I, line 35.

Line 8. *Abietiformis*: Ray uses this term as descriptive of *Lycopodium* following. In the section on mosses in *Catalogus Angliæ* he has one species described as *abietiformis*, although it is not *Lycopodium*.  
*Cat.Angl.* 204:  
*Muscus erectus abietiformis. Muscus terrestris rectus J.B.*  
*Upright Firre-mosse.*

Line 8. LYCOPODIUM.  
[C.T.& M. 1-2] *Lycopodium* (L.), Clubmoss; a genus of the *Lycopodiaceæ* or Clubmoss family.  
B.& G.-W. - no ref.: G.F.M.& L. 115-117:2106 B.& H. 547:  
Linn.*Sp.Pl.* 1100-1106: *Syn.Meth.St.Br.* 1-7/8: *H.P.* 120:  
*H.P.III* 32: *Tri.* - no ref.: *Cat.Angl.* 203-204:2107 *Camb.* - no ref.  
*H.P.* 120:

(Tr.) We call Club Moss the one, which, in addition to short-stemmed leafy flat pedicels creeping along the ground, puts out bare clubs at the tips, or with clubs in pairs, imitating catkins, which are long, rounded, and

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2106 Phillips, *Grasses*: 115-117.

2107 N.B. Ray does not describe *Lycopodium* as *Abietiformis*; see note above.

bearing very fine yellow dust.<sup>2108</sup>

*Muscus clavatus sive Lycopodium* Ger. Park. *terrestris repens sive clavatus* C.B. *terrestris repens a Trago pictus* J.B. *Plicaria & cingularia Polonis*. *Club-moss, or Wolf's-claw.*

H.P.III 32:

Referred to only in passing, where Ray says that Terrestrial Moss is like the common *Lycopodium*.

Line 9. *Cupressiformis*: as with *abietiformis* in line 8, Ray is using this term to describe a moss, in this case *Sabina sylvestris*. In both *Historia Plantarum* and *Catalogus Angliæ* uses the term of *Sabina sylvestris*. See the note at line 9 immediately below.

Line 9. *SABINA SYLVEST.*: *Sabina sylvestris*.

Phillips 149:

*Hypnum cupressiforme* (Hedw.). Common on rocks, walls, tree bases, wood and soil, particularly in acidic areas. It grows in dense mats of regularly branched stems, with concave overlapping leaves not unlike those of a Cypress (*Cupressus*) tree.<sup>2109</sup>

C.T.& M. - no ref.: B.& G.-W. - no ref.: Phillips 149:

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2108 One of the difficulties in the acceptance by Ray and his contemporaries of the sexual theory in plants was the apparent existence of plants such as *Lycopodium* (club mosses) and *Equisetum* (horsetails) with 'anthers' but no obvious flowers followed by seed.

The sporophores of these plants produce microsporangia which split open like anthers and liberate masses of spores consisting of globules, blown about by the wind, and exactly resembling pollen. Camerarius discusses this problem frankly, and suggests that such plants be temporarily excluded from consideration since they are "imperfect" forms without distinct flowers and seeds, whose origin and reproduction is therefore still obscure. He makes clear that the situation in these plants should not affect the proofs that have been offered of the existence of sexual fertilisation in flowering plants. Morton: 219.

For further discussion on the sexual theory in plants, see above Cap.10, introduction and lines 121 and 135-136.

2109 Phillips, *Grasses*: 149.

B.& H. - no ref.: Linn.*Sp.Pl.* 1039: *Syn.Meth.St.Br.* - no ref.:

*H.P.* 120: *H.P.III* - no ref.: *Tri.* 17.76: *Cat.Angl.* 204:

*Camb.* - no ref.

*H.P.* 120:

*Muscus clavatus foliis Cupressi* C.B. *Ger.emac. clavatus cupressiformis* Park. *terrestris ramosus pulcher* J.B. *Sabina Sylvestris* Trag. ***The Cypress-moss or Heath-cypress.***

*Cat.Angl.* 204:

*Muscus clavatus foliis cupressi* C.B. *Ger.emac. clavatus cupressiformis* Park. *terrestris ramosus pulcher* J.B. *Sabina sylvestris* Trag. ***Cypress-mosse, or Heath-Cypress.***<sup>2110</sup>

Line 10. *Muscus seu abietiformis, seu Polyspermos*: for *Muscus* see above

Cap.18, line 181.

Linn.*Sp.Pl.* 1126: *Hypnum abietinus*.

*H.P.* 121:

*Muscus erectus abietiformis. An Muscus terrestris rectus* J.B.  
***Upright Firr-moss.***

*H.P.* 112:

*Muscus terrestris erectus polyspermos.*  
***Seeding Mountain-moss.***

*H.P.* 112:

Among the four species of *Muscus terrestris* observed by C. Bauhin is the following:

*Muscus Abietis facie* C.B.

*H.P.III* 26 / 44:

Many additional species given.

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2110 NB. The only modern plant of similar name is the following tree:  
[Mac.Enc. 1081] *Juniperus sabina* (L.), Savin; a species of the *Juniperus* genus of the *Cupressaceae* or Cypress family. Ray describes the moss *Sabina sylvestris* as having Cypress-like leaves.

In *Trilingue* he is referring to the tree not the moss:

*Tri.* 17.76:

Savin: *Sabina*, -æ, f. *Βρόθους*, -ους, f.

*Cat.Angl.* 206 (wrongly numbered 207 in the 1677 edition):

*Muscus terrestris polyspermos. Seeding Mountain-mosse.*  
*Cum prioribus. Hic minor est multo abietiformi musco, alioqui*  
*non ita ei dissimilis, vix se sustentans. Semine majusculo*  
*cinereo in alis foliorum nascente abundat.*

Line 12. *ADIANTHUM AUREUM.*

[G.F.M.& L. 118]<sup>2111</sup> *Polytrichum commune* (Hedw.); a species  
of the *Polytrichum* genus of the *Bryophyta* (Mosses and  
Liverworts).

C.T.& M. - no ref.: B.& G.-W. - no ref.: B.& H. - no ref.:

*Linn.Sp.Pl.* 1112: *Syn.Meth.St.Br.* 91: *H.P.* 123: *H.P.III* 34-35:

*Tri.* 11.115: *Cat.Angl.* 7-8: *Camb.* 38.

*H.P.* 123:

*Adiantum aureum majus* Ger. *Polytrichum aureum majus* Park.

C.B. *Polytrichum Apuleii & majus quibusdam* J.B.

**Great Golden Maiden-hair.**

*H.P.III* 34-35:

*Musci capillares majores & minores pileolis villosis.*

*Adiantum aureum pileolo villoso medium.*

*Adiantum pileolo villoso minimum.*

*Adiantum aureum minus foliis, rigidis, capitulis coronatis*

*Mus.Pet.n.22. Small Heath-Goldilocks.*

*Adiantum aureum minimum pediculis brevibus, foliis capillaceis*

*Mus.Pet.n.25.*

*Adiantum aureum minus, palustre, capitulis erectis coronatis*

D.Sherard.

*Tri.* 11.115:

Maiden-hair: *Adiantum*, -i, n.: Ἀδίαντον, -ου, n.



Line 13. *Muscus terrestris*: for *Muscus* see above Cap.18, line 181.

H.P. 112:

*De muscis terrestribus nobis observatis.*

Ray lists 10 species here, which he has observed himself, including:

*Muscus filicinus* J.B. Ger. Park. *filicinus major* C.B. **Fern-  
moss.**

He then lists 4 species observed by C. Bauhin.

Line 16. **OPHIOGLOSSUM.**

[C.T.& M. 7] *Ophioglossum vulgatum* (L.), Adder's Tongue; a species of the *Ophioglossum* genus of the *Ophioglossaceæ* family, of the *Filicopsida* or Ferns.

B.& G.-W. - no ref.: B.& H. 557: Linn.*Sp.Pl.* 1062-1063:

*Syn.Meth.St.Br.* 128: H.P. 126: H.P.III - no ref.: *Tri.* 8.1:

*Cat.Angl.* 214: *Camb.* 88.

H.P. 126:

*Ophioglossum* J.B. Ger. *Ophiog. sive Lingua serpentina* Park.

*Ophioglos. I sive vulgatum* C.B. **Adder's-tongue.**

*Tri.* 8.1:

Adder's Tongue: *Ophioglossum*, -i, n.:

'Οφιόγλωσσον, -ον, n.

Line 17. **LUNARIA.**

Today the plant known as *Lunaria* is the following: [C.T.& M. 87-88] *Lunaria* (L.), Honesty; a genus of the *Cruciferae* or Cress family. However, Ray includes *Lunaria* with Lichens and Mosses and therefore is indicating the following plant:

[C.T.& M. 7] *Botrychium lunaria* ([L.] Swartz), Moonwort; a species of the *Botrychium* genus of the *Ophioglossaceæ* family of

the *Filicopsida* or Ferns.<sup>2112</sup>

B.& G.-W. - no ref.: B.& H. 557-558: Linn.*Sp.Pl.* 1064:

*Syn.Meth.St.Br.* 128: *H.P.* 126: *H.P.III* - no ref.: *Tri.* - no ref.:

*Cat.Angl.* 190-191: *Camb.* - no ref.

*H.P.* 126:

4 species given, including:

*Lunaria minor* Ger. Park. *L.botrytis* J.B. *racemosa minor vel vulgaris* C.B. **Moon-wort**.<sup>2113</sup>

Line 19. *EQUISETUM*.

[C.T.& M. 4-6] *Equisetum* (L.), Horsetails; the only genus of the *Equisetaceæ* or Equisetum family.

B.& G.-W. - no ref.: B.& H. 551: Linn.*Sp.Pl.* 1061-1062:

*Syn.Meth.St.Br.* 130-132: *H.P.* 127-128: *H.P.III* 103:

*Tri.* - no ref.: *Cat.Angl.* 96-97: *Camb.* 61-62.

*H.P.* 127-128:

(Tr.) *Equisetum* is given its name in Latin from the coarse hair of a horse. It is given its name by the Greeks from its likeness to ἵππουρος, that is the tail of a horse, because it has leaves like coarse hair springing from its central stem.

The plant is unique and *sui generis*, both in its central stem and in its leaves, which are jointed in a box-like way, (if they can be called leaves). Properly speaking it does not have leaves, for what are called leaves have no distinction of upper and lower part.

11 species given, including:

*Equisetum majus* Ger. *majus palustre* Park. *majus aquaticum* J.B. *palustre longioribus setis* C.B.

2112 See footnote at Cap.12, line 170.

2113 See above Cap. 8, line 65 for *Lunaria minor*.

***Great Marsh or Water Horse-tail.***

H.P.III 103:

*Ad cap. de Equiseto: post speciem septimam pro 8<sup>vo</sup>:*

*Equisetum nudum lævius nostras.*

***English smooth naked Horse-tail.***

*Post nonam. quae jam decima est, pro undecima &c. adde:*

*Equisetum palustre, Linariae scopariae foliis* C.B. Park.

***Broad leav'd Horse-tail*** etc. to No.18: i.e. 9 new species  
given.<sup>2114</sup>

Line 20. *Muscus*: see above Cap.18, line 181.

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<sup>2114</sup> For a discussion on the reproduction of *Equisetum*, see footnote above at line 8 on *Lycopodium*.

As Ray says at the end of Chapter 30:

*Nos his contenti hunc librum finiemus.*

## Appendix

### Table of authors etc.<sup>2115</sup> cited by Ray in *Historia Plantarum*, Book I.

<u>Name:</u>	<u>First occurrence:</u>		<u>Number of occasions cited:</u>
	<u>Chapter</u>	<u>Line</u>	
Alpino	1	74	2
Aristotle	1	82	1
Bauhin (Caspar)	5	131	1
Bellon	27	33	6
<i>The Bible</i>	20	20	2
Bobert	21	61	2
Boccone	20	98	1
Boyle <sup>2116</sup>	17	64	2
Brown	22	66	1
Camerer	12	146	1
Cato	19	166	1
Cesalpino	9	182	6
Colonna	8	65	7
Columella	18	23	2
Cornut	1	50	1
Corvinus	18	144	1
Cox	29	46	2
Davison	24	31	1

<sup>2115</sup> Biographical details, where known, are given for each person where first mentioned in the text.

<sup>2116</sup> Biographical details of Robert Boyle are given at Cap.3, line 84, in the section on microscopes.

<u>Name:</u>	<u>First occurrence:</u>		<u>Number of occasions</u>
	<u>Chapter</u>	<u>Line</u>	<u>cited:</u>
Dent	20	99	1
Dioscorides	1	73	3
Dodoens	11	158	1
de l'Écluse	11	77	4
Evelyn	22	39	1
Fernel	24	87	2
Ferrari	18	135	3
Galen	2	24	4
Gassendi	6	13	1
Gerard	21	66	1
Goodyer	21	67	1
Grew	3	16	44
Harley	22	127	2
Hatton	20	100	1
Hoier	13	17	1
Hooke	25	33	1
<i>Hort. Malabar.</i>	22	31	1
Johnson	21	66	1
Josephus	23	35	2
Josselin	13	115	1
Jung	1	1	24
Kircher	22	62	1
Langford	19	27	3
Lauremberg	12	142	11
Lawson	23	37	1
Lewenhoeck	29	61	1
Licetus	18	229	1

<u>Name:</u>	<u>First occurrence:</u>		<u>Number of occasions cited:</u>
	<u>Chapter</u>	<u>Line</u>	
Malpighi	3	100	67
Matthioli	22	46	1
Morison	13	59	4
Murray	23	56	1
de l'Obel	27	35	1
Palladius	18	17	1
Parkinson	10	77	2
Pliny	6	28	35
Plot	22	89	3
Robinson	29	100	1
Santorio	17	32	1
Scaliger	7	32	2
<i>Schola.Salernitana</i>	24	84	1
Schroder	28	11	5
Sennert	2	4	3
Sharrock	9	136	9
Spieghel	10	49	1
à Stapel	18	45	5
Theophrastus	9	8	4
Toll	13	63	1
Varro	18	4	2
Vergil	18	198	2
Vesling	1	75	1
Wedel	13	56	4
Willisius	29	71	1
Worms	21	64	1

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