

NEW THINKING IN PUNT MORPHOLOGY

W. A. van Heel

Ri.jskherbarium, Leiden

This note is to reflect the thoughts, practical work and hopes of two workers in the Netherlands who are engaged in this branch of science, Dr. B.M. Moeliono of the Botanical laboratory at Groningen, and myself at the Rijskherbarium at Leiden,

Roughly stated Morphology is somewhere in between Systematics and Physiology, that is up till now it is definitely closer to the former than to the latter. In the following we shall consider the border-lines between the three, border-lines that are vague and to be crossed.

When we take up the Compendium by Pullewe can learn, for instance, that there are simple and compound leaves, that the compound leaves are pinnate or palmate or mixed, that they have leaf-stipules, stipules, stipulules, auricles etc., etc. And that the shapes of all these parts vary in related or unrelated plants. Is this Morphology? More than once it is called so. We may also ask in how far this is Morphology? In trying to find the answer to that question it appears that we have to distinguish sharply between the objects and methods we choose for our various sub-sciences. Doing so the so-called

Morphology referred to above is rather an art serving the goal of Systematics of creating a more or less natural system. It is Phytography, not Morphology. This art has a connection with Morphology only in so far as it should employ terms that in the best possible way are based on the result of Morphology,

In the case of the leaf-terms cited above many difficulties do not seem to arise. However, difficulties do generally arise. You may learn from Phytography that a stamen consists of a filament and an anther - except in some groups where they are laminose - , that the anthers have two thecae of two cells, each that they may be adnate or versatile etc., etc. All seem to be quite simple and in common practice they are applicable to all angiospermous plants. However, from the reality of Morphology, as a separate subsience, a dim sign is warning that the stamens might be most astonishingly convergent structures. The consequence being that in the end when this stamen-riddle is going to be solved, a new set of descriptive terms for stamens is needed for the Systematist, based on the latest results of Morphology. I tried to contribute into this field by working in the Malvales. I also made start in Magnoliales, plants covered in this respect by many an American author already. However, in Victoria we found out that the stamens are flattened three-dimensional structures rather than the flat two-dimensional ones represented by the American authors, I could check that result on the flowers of Victoria as they are cultivated in

the Kebun Raya, In Malvales stamens like those of Ceiba for instance., which would conform perfectly to the usual descriptive terms, are not fully comparable with stamens of other Malvales. *And how* could we dare to compare them with similar looking stamens in Ranales ?

Consulting Pulle's Compendium further, we arrive at the pistil. The pistil is composed of 1) carpels, which bear 2) ovules on the margins, and 3) do so in all Angiosperms. I may ask you again whether this is Morphology or not. This three-point creed has been accepted for at least 150 years as unshakable, and up till now it is thought to be corroborated by every critical morphological study. Yet Moeliono and I consider that exactly here — where most important taxonomic characters are at stake deciding on the relations of large Systematic affinities — we may expect the toughest resistance of Systematics against morphology and its disturbance. The source of resistance lies in the belief granting that the pistils in all Angiosperms must be comparable. Are not then the Angiosperms a natural group ? sure, as regards the triploid endosperm. But also as regards other important characters ? At least we should be cautious.

So provisionally we introduced the very possibility that *the* pistils - and stamens for that matter - are not fully comparable for several large taxonomic groups, for instance for "marietales", malvales, Ranales. Or, stated more cautiously, we thought that we might as well start from an - equally pre-conceived idea that they are not. And in that case we are

up to reconsider humbly all facts and start anew a lot of work, like monks, in definite pertinent groups of plants.

Thus Moeliono started some time ago to work on the pistil-morphology of Centrospermae, and wrote a thesis in Dutch that will be followed by an extended version in English this year. The subject is extremely complicated! I could go into details only if I were to deliver a whole series of lectures on Plant Morphology. Anyway the result of his minute histogenetical as well as vascular anatomical research is the proof that, the ovules are not produced on the "carpels" that constitute the pistil wall, They are produced by the floral growing tip around which the "carpels" are situated as sterile protective coverings, stegophylls.. In that floral tip we may - in complete cases - distinguish two alternating sets of five regions - "placentae" - bearing the ovules. So the outcome defies strongly the ancient rule. The impact on Systematics, of course, must be enormous when affinities of larger groups are considered.

Much the same thoughts apply to ovule structure, which might be studied in relation with arilloid structures,, I was happy to collect some valuable material in the Kebun Raya that shall enable me to start some investigation into that field.

Consequently, whereas Systematics must make use of the results of Morphology for its fundamental system, Morphology at its base must depend on the practical system. Comparative morphology will only work safely in groups of plants that are systematically well known through the computing of the largest possible number of characters from all fields. Such is the interrelation between Systematics and Morphology. However, whereas formerly Morphology was in slavery with Systematics, it now must stand part.

This brings us to the problem of the definition of Plant Morphology. what are its objects and methods ? In our opinion Morphology must be that branch of Botany that deals with structure under every aspect and through every method. This subsience is defined by its object structure. Structure means more than form, which is external appearance, to be studied by external observation. For about 150 years that has been called Morphology on its own, chiefly under the influence of Systematics. Opposed to it was Anatomy, the subsience of internal structure. It is from this distinction that we want strongly to withdraw. Outside form is also conditioned by underlying structures. Structure is the object of Morphology (or rather of 'Structurology¹'), and anatomy is one of the methods, equally valid as external observation, ontogeny, embiyogeny, organogeny, vascular

anatomy, teratology/ (deviations), palaeobotany.

It also includes the functional aspect as practised in the so-called floral biology. And the causal aspect, which is still largely buried in the future.

Let me repeat our outlook. Now Morphology is a subs- science of its own, comparatively dealing with the hology of structure, using all methods in mutual relation. It is the feeling of independence - a freeing of the thoughts prevalent in Systematics -, together with the need felt for a reconciliation of the different methods, that make us do our work in Plant Morphology with a renewed interest. The goal is to unravel the extent of comparability, viz, of the likenesses or differences between structures, so that we can draw up a better system and at the same time draw up hypotheses on the causation leading to the differences. One of the important techniques by which to unravel compound structures may be won by a better insight in the process of 'fusion', a process with which we are both very much concerned.

If ontogeny, histogeny and other genetic processes sre also adduced to reach morphological results, we probably may get nearer to an understanding of the mechanisms of the changes leading to gradual structural differences. Then in the future we may use it in our approach to Physiology.

Up till now the Physiology of structure is in its infancy, However, it is our feeling that Morphology and Physiology must go hand in hand. The field of experimentally produced deviations is probably promising. Finally a synthesis between systematics, Morphology and Physiology must come out. They all must be able to reflect one and the same reality in harmony.
