

NATURAL HYBRIDS IN EUCALYPTS, PART I.

E. X taeniola (= *E. salicifolia* X *E. sieberiana*)*

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(WITH 3 TEXT FIGURES)

ABSTRACT

Progeny tests of open pollinated seed from *E. sieberiana* F. v. M., *E. salicifolia* (Sol.), Cav. (syn. *E. amygdalina* Labill.) and the presumed hybrid form *E. X taeniola* B. & S. (pro sp.), from natural populations are described. The variation in juvenile leaf size and shape in progenies of the *taeniola* form, confirms the suggestion that this is a hybrid between the above species.

Individuals, intermediate in form between *E. sieberiana* and *E. salicifolia*, were collected by L. Irby from the slopes of St. Patrick's Head, Tasmania. These were given specific rank by Baker and Smith (1912), although affinities with the above species were recognized. Baker and Smith's ranking was recognized by Blakely (1934) in his "Key to the Eucalypts". In his survey of the Tasmanian species Brett (1937) classified *E. taeniola* as an interspecific hybrid. He stated that there was every indication that *E. taeniola* was a hybrid between *E. sieberiana* and *E. salicifolia*, adding without further qualification that the hybrid character was evident at the cotyledon stage. The specific ranking was accordingly dropped by Curtis (1956).

A study of the natural populations of *sieberiana* and *salicifolia* supports Brett's view as to the hybrid nature of the *taeniola* forms. These are found only within the limits of the *sieberiana* distribution on the East Coast, between St. Helens and Oyster Bay, extending westward to Rose's Tier. The *taeniola* form is found only as isolated trees, although the *salicifolia* within this area exhibits considerable variation.

The more important diagnostic characters of the seed parents are listed in Table I. Typical leaves and fruits are represented in fig. 2. Most *taeniola* specimens show intermediate bark characters, tending usually towards the *salicifolia* type. The mature leaves, although wider and more falcate than those in *salicifolia*, also tend towards this species rather than to *sieberiana*. In buds and fruit the *taeniola* form closely resembles *sieberiana* with pyriform fruits and sunken discs.

To establish some experimental evidence of the hybrid nature of the *taeniola* form, seedlings were raised from open pollinated mother trees from the natural population. This seed was collected by Professor H. N. Barber at Bicheno in February,

1952. The presumed parental types *E. sieberiana* and *E. salicifolia* were represented by progenies raised from parents growing in the same locality. Two seed parents of each type were used. However, the progeny size in one of the sets (set 2 below) was restricted because of limited propagation facilities.

Seed set and viability in the *taeniola* form did not differ markedly from that in the parental types. Seedlings were raised under standard conditions in the glasshouse, pricked off into 6 x 1.5 inch veneer tubes after three weeks and after six months were propagated in 6 x 6 inch cans. When the seedlings were 12 months old five leaves of average development were removed from each, where possible from the 10th to 14th nodes inclusive. These leaves were measured for size and shape while fresh. Table II shows the progeny means and an analysis of variance for leaf length, breadth, length/breadth ratio and petiole length for individual seedlings. The distribution of individual means is shown graphically in figure 1, while the range in leaf shape in the progeny of 21 plants raised from *taeniola* 1 is shown in fig. 3. In this plate leaves approximating most closely to the mean leaf for each seedling are shown together with average leaves from the two presumptive parent species.

Because of the non-orthogonal nature of the data the analysis of variance is somewhat tedious. It is here treated as a hierarchy of unequal numbers thus facilitating the grouping of components.

Leaf breadth, length/breadth ratio and petiole length are efficient classification variables. Length of leaf has a high coefficient of variation and is an unsuitable diagnostic. From the analysis of variance shown in Table II it is clear that the within-seedling variance in all progenies is small. The variance between seedlings is very much greater in the *taeniola* progenies than in the presumptive parental progenies, with the exception of the progeny *salicifolia* (2). Excluding length the variance ratios for the other three characters in the two *sieberiana* parents and *salicifolia* (1), are much lower than the variance ratios for the *taeniola* progenies and are about one-fifth those for *salicifolia* (2). The anomalous heterozygosity in *salicifolia* (2) is at once evident if the variance in parental groups is considered. With the exception of petiole length the between-parent variance and the variance ratios are disproportionately large in *salicifolia*. The variance ratios in

*Nomenclature is that of Blakely, 2nd Edition, 1955.

taeniola suggest that these parents may be grouped as presumptive F_1 hybrids although the between-parent variance indicates a considerable difference in genotype. *Salicifolia* (2) by its parental characters lies well within the *salicifolia* phenotypic range but the segregation in its progeny indicates that it should be classified as an F_2 or other close derivative. This can be confirmed to some extent by an analysis of variance after regrouping *salicifolia* (2) with *taeniola* (Table II). When this is done the homogeneity in the variance ratios between the groups is restored.

The range of variation in the characters on this grouping leaves no doubt as to the hybrid nature of the *taeniola* form. The range is transitional between the two parental types although it is weighted towards *salicifolia*. This gradation in segregating leaf characters is to be expected on the basis of a polygenic inheritance of leaf size and shape. The marked correlations evident in figure 1 indicate a strong dependence between these characters; a relationship which doubtless has its origins in the common members of the polygenic systems governing cell number and size.

The progeny testing of open pollinated parents thus provides reasonable justification for regarding the *taeniola* type as an interspecific hybrid between *E. sieberiana* and *E. salicifolia*. The fact that the *taeniola* form is restricted to the limited *sieberiana* distribution and that it occurs only as isolated trees is itself strong evidence for the classification of the form as a hybrid between these species.

REFERENCES

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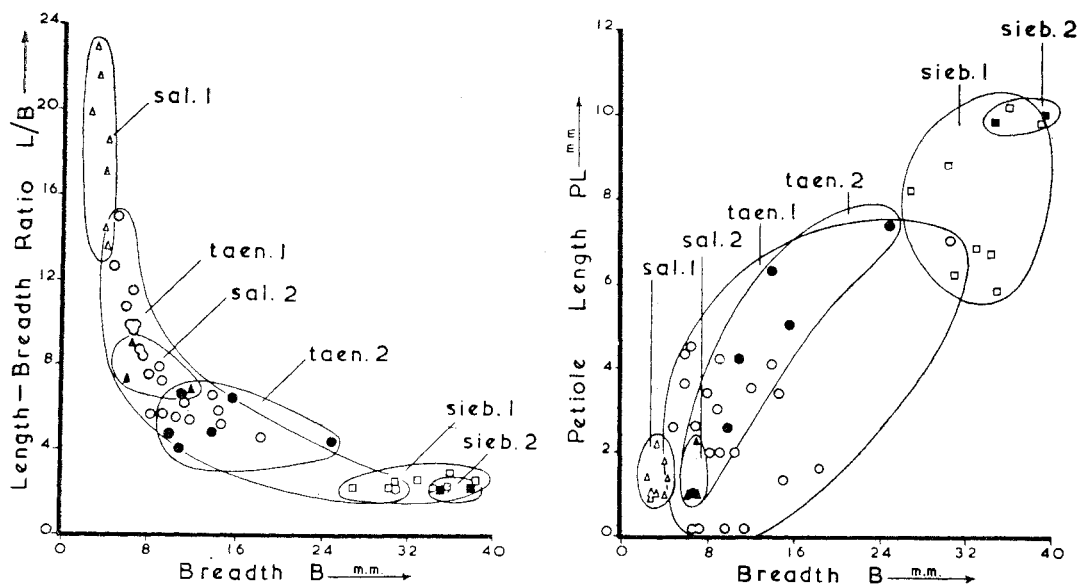


FIG. 1.—Scatter diagrams showing the relationship between juvenile leaf characters in progenies from parental and presumptive F_1 types. Each point represents the mean value for a seedling of measurements of leaves from the 10th to the 14th nodes inclusive.

TABLE I
Parental Characters

Parent	Bole bark	Limb bark	leaf length in cm.	leaf breadth in cm.	petiole length in cm.	fruit length in cm.	fruit diam. in cm.	carpel number x
Sieb. 1	deep fissured fibrous	clean gummy	20.1	1.8	1.9	11.4	7.7	3.0
Sieb. 2	deep fissured fibrous	clean gummy	18.7	2.4	1.7	12.4	7.8	3.1
Taen. 1	fissured flaky fibrous	clean gummy	13.2	1.0	1.4	10.2	6.4	3.5
Taen. 2	fissured flaky fibrous	clean gummy	17.2	1.6	1.1	9.3	5.8	3.1
Sal. 1	flaky fibrous	clean gummy	8.9	0.5	0.3	6.3	6.8	4.0
Sal. 2	flaky fibrous	thin flaky	9.1	0.8	0.8	6.9	5.7	4.7

TABLE II

Means, standard errors of means and the analysis of variance for the juvenile leaf characters, length L, breadth B, length/breadth ratio L/B and petiole length PL.

	L	B	L/B	PL	d.f.		L	B	L/B	PL	d.f.		L	B	L/B	PL	d.f.	
		sieberiana 1						taeniola 1						salicifolia 1				
Progeny means	82.2	33.3	2.45	7.7	8		69.2	10.6	7.73	2.6	21		61.1	3.5	17.73	1.4	8	
S.E. of means	12.6	2.1	0.55	0.1	...		5.7	0.7	0.61	0.1	...		2.7	0.7	1.49	0.4	...	
Variance																		
between seedlings	1281.1	72.8	0.35	16.6	7		634.4	169.8	47.18	18.9	20		419.2	1.5	79.03	0.9	7	
within seedlings	74.9	21.8	0.08	6.6	32		93.2	3.0	1.59	0.8	84		41.1	0.5	11.65	0.1	32	
Ratio F	17.1	3.3	4.4	2.5	...		6.8	56.8	29.7	23.4	...		10.2	3.2	6.8	6.3	...	
		sieberiana 2						taeniola 2						salicifolia 2				
Progeny means	86.9	35.9	2.36	9.9	2		70.8	13.7	5.54	4.5	6		63.0	8.2	7.34	1.4	3	
S.E. of means	10.5	4.2	0.00	0.0	...		24.0	5.7	1.83	2.2	...		48.6	4.3	2.24	1.6	...	
Variance																		
between seedlings	220.9	36.0	0.00	0.1	1		3458.0	202.8	20.17	29.9	5		1567.8	54.2	15.09	8.1	2	
within seedlings	99.0	19.9	0.03	0.4	8		24.9	2.6	1.16	1.7	24		106.0	1.5	0.51	0.6	12	
Ratio F	2.2	1.8	0.00	0.3	...		138.8	78.0	17.38	17.9	...		14.8	*36.1	*29.6	14.1	...	
		sieberiana 1 and 2						taeniola 1 and 2						salicifolia 1 and 2				
Variance																		
between parents	176.8	102.3	0.10	28.1	1		170.9	225.6	117.77	77.8	1		79571.0	238.4	1166.5	2.1	1	
within parents	257.9	29.2	0.11	6.9	48		288.8	35.5	9.07	4.8	133		163.4	2.9	18.16	1.0	53	
Ratio F	0.7	3.5	0.9	4.1	...		0.6	6.4	12.98	16.3	...		*487.1	*83.0	*64.2	2.2	...	
		sieberiana 1 and 2						taeniola-salicifolia 2						salicifolia 1				
Variance																		
between groups	176.8	102.3	0.10	28.1	1		12649.5	128.2	4.88	61.7	1		419.2	1.5	79.03	0.9	7	
within groups	257.9	29.2	0.11	6.9	48		856.1	34.3	9.19	5.0	148		41.1	0.5	11.65	0.1	32	
Ratio F	0.7	3.5	0.9	4.1	...		14.78	3.7	0.5	12.4	...		10.2	3.2	6.8	6.3	...	

* anomalous variance ratios

d.f. = degrees of freedom

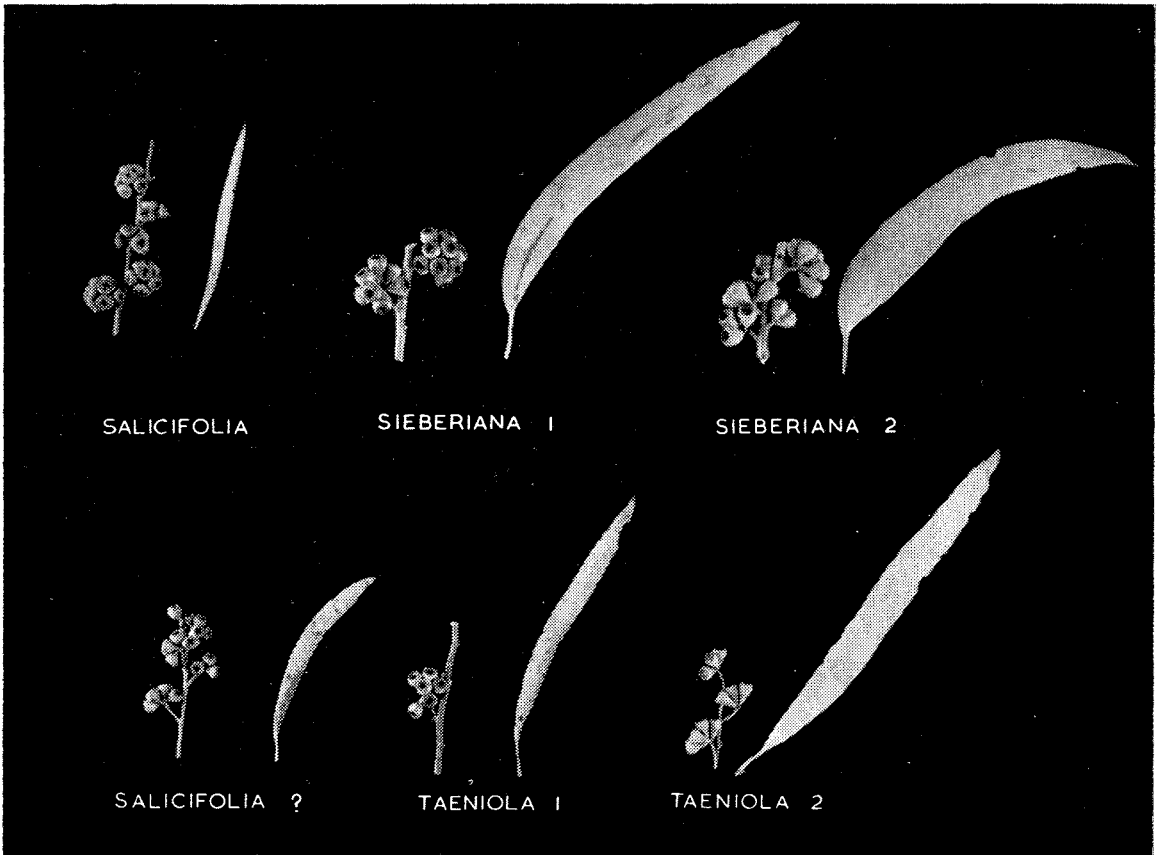


FIG. 2.—Leaves and umbels of fruit from the open pollinated seed parents used in the progeny tests.

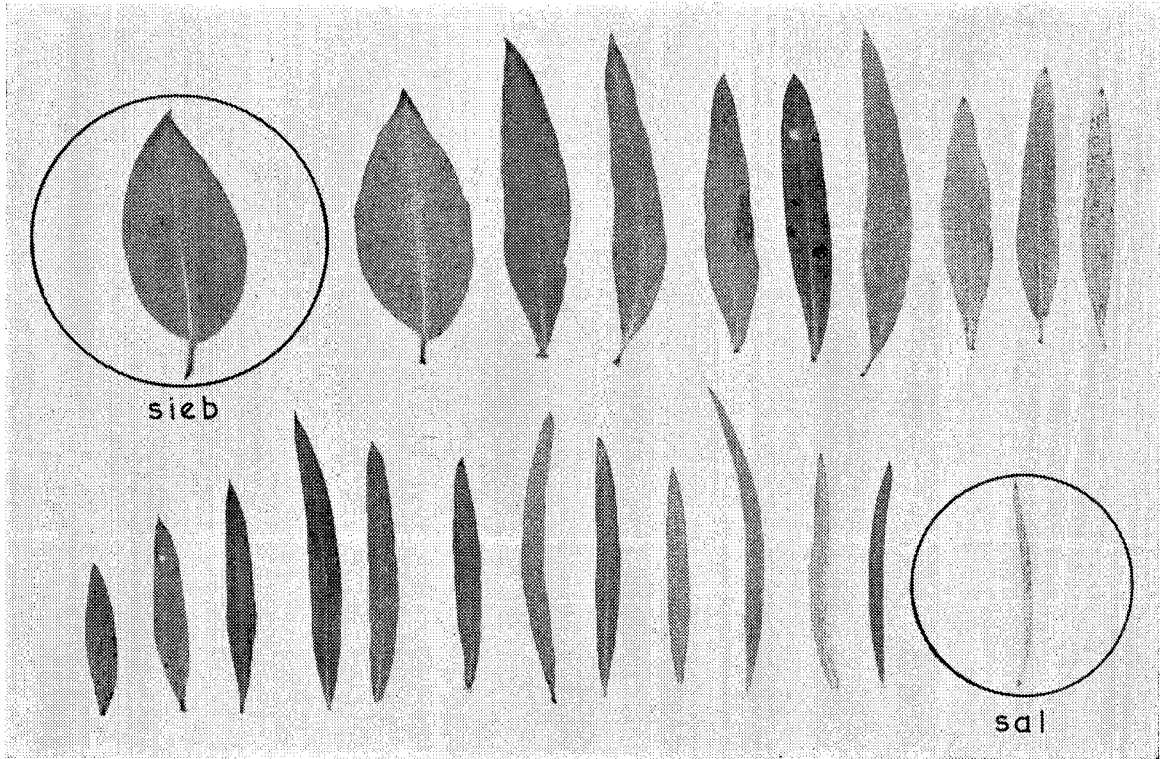


FIG. 3.—Representative leaves from each of the 21 seedlings of the progeny from the presumptive hybrid, *taeniola* 1, showing the transition between the parental types *sieberiana* and *salicifolia*, typical representatives of which are shown in circles. Each leaf is that closest to the mean of five leaves from the 10th to 14th nodes inclusive.