

Nomen.

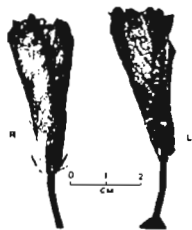


Fig. 1. Right- and left-handed flowers of Malvaceae (*Hibiscus rosasinensis*)



Fig. 2. Left- and right-handed flowers of Bombacaceae (*Salvadora malabaricum*)

twisted aestivation\*. When viewed apically, the flower is considered left-handed (clockwise contorted aestivation) if the inner margin of a petal curves clockwise towards the periphery, and right-handed if it curves counter-clockwise (Figs. 1 and 2). In some species (for example, *Hibiscus rosasinensis*) the staminal tube also twists; clockwise in a left-handed flower, counter-clockwise in a right-handed flower. In some others such as *Theophrasta populnea*, the end of the stigma is conspicuously twisted.

75,907 flowers of 31 species from 12 genera of Malvaceae were examined mostly by me in and around Calcutta and in Ceylon. Some data were supplied from Coimbatore (South India) by Cyril Selvaraj. Additional data were obtained from Sussex.

Of the 31 species examined, 17 have an excess of left-handed flowers, and of these, the  $\chi^2$  values for only three species show significant difference from the expected. One of these, *Pavonia odorata*, has only 16 flowers. The  $\chi^2$  value for the overall population shows a significant difference from the expected. This is mostly due to the conspicuous left-handedness found in *Abutilon indicum* and *Hibiscus rosasinensis*. The figures received from Coimbatore for *Abutilon indicum* were very different (87.1 per cent left). The data for *H. rosasinensis* relate to 48 bushes observed for a three-month period in 1961, 5 bushes for the year 1962, and 4 bushes from Coimbatore observed for two months in 1962. It may be mentioned that in all these populations the left-handed flowers were slightly in excess of the right-handed flowers, the mean on the total flowers being 51.25  $\pm$  0.28 per cent lefts. *H. rosasinensis* alone accounts for 43.4 per cent of the total flowers examined, and the  $\chi^2$  value for this species largely affects the entire population, leading to a significant excess for the lefts, although the lefts account for only 50.54 per cent of the entire flowers examined from India and Ceylon. Ignoring this species, equality may be expected for the rest of the species. In the case of *H. rosasinensis*

### Aestivation in Malvaceae

THE aestivation of the corolla of a flower of the family Malvaceae is distinctly twisted (contorted) in bud, the condition generally persisting even after the opening of the flower. A striking peculiarity of the aestivation is that in about half the number of flowers of any plant of any species of this family, the petals are twisted clockwise and the rest in a counter-clockwise fashion. The family comprises 1,200 species<sup>1</sup> or more<sup>2</sup>.

A malvaceous flower is pentamerous and the five twisted petals are free to the base where they are attached to the monadelphous staminal tube. The petals are shed with the tube when the flower withers. The individual petals are asymmetrical, a character correlated with

the excess of lefts over rights is persisting even with the large samples and in different seasons, and as such, detailed investigation will be taken up with this species. In *Cocos nucifera* where the leaves are arranged in five spirals in a right-handed or left-handed manner, the foliar asymmetry was found to be non-inherited<sup>4</sup>. But the left-handedness in a population gave 20.9 per cent more nuts than their counterpart<sup>5</sup>.

Seasonal variations do not seem to alter the proportion of the lefts and rights, as is evident from the data collected throughout 1962 on five bushes of *H. rosasinensis*. Estivation differences are also found in some species of Bombacaceae, a family formerly included under Malvaceae<sup>6</sup>. All the flowers from three trees of *Salmania malabaricum* (Bombacaceae) were examined in 1962 and it was found that the right- and left-handed flowers are produced in the same proportion throughout the flowering season. The data on one of them are represented by the graphs in Fig. 3.

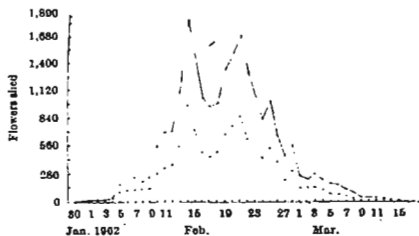


Fig. 3. Daily shedding of flowers in a *Salmania malabaricum* tree. —, Total flowers; ---, left-hand flowers

At my request, observations were made on the following malvaceous species at the Stonehurst Estates, Ardingly, Sussex, by G. R. Wakefield. *Abutilon vitifolium*, *A. sauvitzi*, *A. thomsonii*, *A. megapotanicum*, *Hibiscus syriacus*, *Hoheria lyalii*, *H. galabrata*, *Malva sylvestris* and *M. rotundifolia*. The following is the summary of his observations: "Flowers on trusses of identical stages of growth do not appear to have the same opening pattern (twist); they do not seem to open alternately one way or the other. Flowers opening at different times of the year, consequently under different climatic conditions and light densities, do not show any regularity either one way or the other (right or left); likewise there seems to be no difference between flowers opening on the sunny side of the bush or the shaded side. Altogether I seem to be able to prove no pattern of regularity and the numbers seem to be roughly equal for either direction".

The leaves of Malvaceae and Bombacaceae are alternate, and an examination of the flowers of consecutive leaf axils in some shoots of a few species did not show that alternate leaves bear in their axils flowers of the same petal-twist. The two types of flowers are randomly distributed on every shoot. Eichler<sup>7</sup>, however, seems to have recorded in *Malva sylvestris* a regular pattern in the asymmetry as adjacent flowers showed different direction of twisting. No significant difference in the number of stamens was noticed between the two types of flowers in *Hibiscus rosasinensis*, *Salmania malabaricum* and *Cedra pentandra*. In *Salmania*, the capsules of both types of flowers were weighed, and no significant difference noticed between them.

Malvaceae and Bombacaceae are not the only families which exhibit this peculiar estivation of their corolla. Some or most species of Palmae, Caricaceae, Linaeaceae, Sterculiaceae and perhaps a few others may exhibit this phenomenon. The full data collected on *Hibiscus rosasinensis* and others will be published elsewhere.

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<sup>1</sup> Porter, C. L., *Taxonomy of Flowering Plants* (W. H. Freeman and Co., San Francisco, 1959).

<sup>2</sup> Lawrence, G. H. M., *Taxonomy of Vascular Plants* (Macmillan Co., New York, 1963).

<sup>3</sup> Rendle, A. B., *The Classification of Flowering Plants*, 2, *Dicotyledons* (Camb. Univ. Press, 1909).

<sup>4</sup> Davis, T. A., *J. Genet.*, 58, 42 (1962).

<sup>5</sup> Davis, T. A., *J. Genet.*, 58, 180 (1962).

<sup>6</sup> Hooker, J. D., *Flora of British India*, 1 (L. Reeve and Co., London, 1872).

<sup>7</sup> Eichler, *Dieltendiagramm*, 2, Fig. 115 A, 1872 (original not seen).

### Shedding of *Eichhornia crassipes*: a Possible Complication to Control Measures in the