interest since methyl blue is used as a counterstain for fixed material and does not wash out in alcohol.

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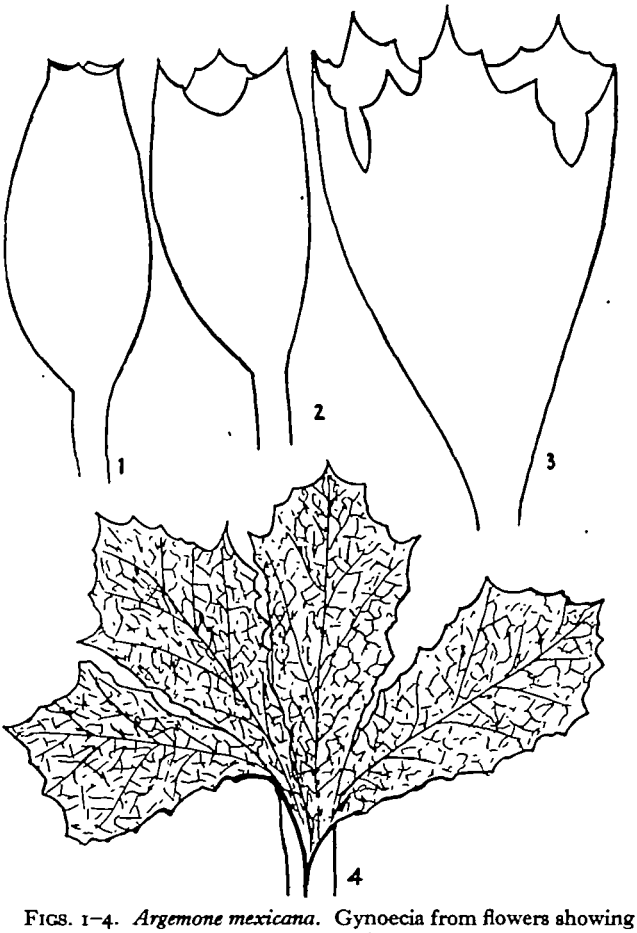
SOME ABNORMAL FLOWERS OF ARGEMONE MEXICANA AND THEIR BEARING ON THE MORPHOLOGY OF THE GYNOECIUM OF PAPAVERACEAE.—The morphology of the gynoecium of the Papaveraceae has been the subject of much controversy in recent years as has that of the related family Cruciferae. The generally accepted view that the carpels form one whorl of similar members and the placentae are joint outgrowths from their united margins has been attacked by Saunders (New Phytologist, xxix. 44, 1930) and Dickson (Journal of the Linnean Society, Bot. l. 175, 1935). From studies of vascular supply they have revived, in slightly different form, the old view of Kerner von Marilaun (The Natural History of Plants, Eng. trans, London, 1895), according to which the carpels in the Papaveraceae are of two types, an outer whorl of sterile carpels forming the wall of the ovary and an inner whorl of fertile carpels forming the placentae. Arber (Annals of Botany, N.S., ii. 649, 1938), on the other hand, from similar evidence supports the current view.

It might be possible to test these divergent views if by chance flowers could be found in some member of the family showing transformation of the gynoecium into leafy structures. The value of such teratological evidence in the solution of morphological problems has been a subject for much discussion among botanists. Its use, therefore, must be made with great discretion, but as Arber (*Biological Review*, xii. 157, 1937) says: 'It is an undeniable truth—indeed a truism—that aberrant forms, since they show what an organ can do, may sometimes throw light upon what it is.' Thus a syncarpous gynoecium completely modified into free leaves may not be of much value in deciding the nature of the carpels, but is certainly useful in deciding the number of the carpels which compose it.

Five years ago, the author (Joshi, Journal of Indian Botanical Society, xii. 255, 1933) described some flowers of *Argemone mexicana* L. from the Punjab showing partial phyllody. Both Saunders (loc. cit.) and Dickson (loc. cit.) postulate for this genus twice as many carpels as are generally accepted by systematists. A careful examination of that material, however, did not reveal any flowers in which the gynoecium had separated into its constituent carpels. No evidence therefore could be obtained concerning the composition of the gynoecium. Recently I have been fortunate in receiving material from South India, collected by Mr. J. Venkateswarlu of Andhra University in Cocanada during the summer of 1934, which helps in the solution of the problem.

The flowers in the South Indian material show all stages of phyllody. Those in an incipient stage agree with the flowers described previously (Joshi, loc. cit.) from the Punjab. They differ from the normal flowers in possessing persistent sepals, petals, and stamens. The petals are green to a varying degree. The stamens are further characterized by broader filaments and connectives, by the development of bristles on the filaments and of stomata and chlorenchymatous tissue in both, by the absence of the fibrous endothecium and of dehiscence of the anthers, and by abortive pollen. The gynoecium shows the development of a gynophore below the ovary, a

comparatively long style, freedom of the integuments of the ovules from each other and from the nucellus, a long micropyle, development of stomata on the integuments and of chloroplasts both in the cells of the integuments and of the outer layers of the nucellus, and the branching of the vascular trace of the ovules in the chalazal region.



FIGS. 1–4. *Argemone mexicana*. Gynoecia from flowers showing phyllody. Figs. 1–3, three cup-shaped gynoecia as seen from outside. Fig. 4, a gynoecium completely transformed into free leaves spread out in one plane. × 5.

In more advanced cases of phyllody the stamens are completely modified into leaves and the gynoecium begins to open out; the style and the stigmas disappear and the ovary forms a cup-shaped structure with a lobed margin (Figs. 1–3). The lobing in the early stages is only slight (Fig. 1); in flowers showing more advanced stages of phyllody this lobing is deeper and the lobes themselves are toothed (Figs. 2–3). In still more advanced cases, the gynoecium splits up into completely free leaf-like carpels (Fig. 4), and in these cases the ovules completely disappear.

The number of main lobes in these cup-shaped gynoecia is found to vary from

three to five. It is three in Fig. 2 and four in Figs. 1 and 3. The number of leafy carpels in gynoecia which had become completely foliar is also found to vary from three to five (Fig. 4). According to the theory generally adopted by the systematists the gynoecium of *Argemone mexicana* ordinarily consists of three to five united carpels. According to Saunders and Dickson, it consists of six to ten carpels. The evidence from the structure of the gynoecium of flowers showing complete phyllody thus supports the view generally held by systematists. It is against the views of Saunders and Dickson.

SUMMARY

Abnormal flowers of *Argemone mexicana* are described in which the gynoecium has been transformed into a cup with lobed margin or into free leafy carpels. The number of lobes or leafy carpels in such gynoecia is found to vary from three to five. This agrees with the general view of systematists regarding the number of carpels composing the gynoecium in this species, and is against the views of Saunders and Dickson who postulate twice as many carpels.

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A SIMPLE METHOD FOR OBTAINING PERMANENT DOUBLE-STAINED PREPARATIONS OF STARCH GRAINS AND THEIR ASSOCIATED PLASTIDS.—Four years ago Professor R. C. McLean (New Phytologist, xxxiii. 316, 1934) called attention to the xylol-soluble free-acid or free-base preparations of dyes such as eosin, methylene blue, &c., for use in anatomical staining. With the water-soluble and alcohol-soluble dyes now available reasonably good double-stained anatomical preparations can be obtained with so little practice that most botanists may not have felt the need of themselves employing or of instructing their students in the use of this alternative technique.

The present note is written to draw attention to the great value of one of these xylol-soluble dyes in a special case, that of obtaining permanent double-stained preparations of starch grains and their associated plastids. In the experience of the writer, the methods usually suggested are troublesome and, in the hands of students almost always unsuccessful. On the other hand, the method described below is simple, rapid and almost fool-proof, giving a sharp colour differentiation between plastid and starch grain, even more evident by artificial light than by daylight.

The method is as follows. Sections of the material, e.g., stem of *Pellionia Daveauana*, fixed in chrom-acetic or other suitable fixative, is stained for five to ten minutes in 0·1–0·2 per cent. methyl violet in water. Wash out excess stain in absolute alcohol until the starch grains are pale mauve. This takes five to ten minutes, so that differentiation is easily controlled. Transfer the sections to xylol to remove the alcohol and then place for a few minutes in xylol-soluble nile blue solution. (For method of preparation see McLean, loc. cit.) Rinse the sections in xylol to remove the surplus stain and mount in Canada balsam. The resulting preparation shows starch grains mauve and plastids gentian blue.

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