The diploid chromosome number in Crysomelid ranges from 12 to 59 having representatives of almost all the numerals in between but $2n = 24$ seems to be most frequent and is suggestive of modal number. The Xy_p sex mechanism is highly prevalent though almost all other Coleopteran sex mechanisms are also found.

TABLE I

Species (♂)	Chromosome number 2n	Chromosome number n	Chromosome formula (1st div.)
Family ——Chrysomelidae			
Subfamily——Eumolpinae			
Colasposoma rufipes Jacoby ..	16	8	7 AA+Xy_p
Colasposoma sp. ..	16	8	7 AA+Xy_p
Subfamily ——Galerucinae			
Aulacophora cincta (Fabr.) ..	30	15	14 AA+Xy
Subfamily——Cassidinae			
Chirida bipunctata (Linn.) ..	18	9	8 AA+Xy_p
Aspidomorpha furcata (Thunb.)	18	9	8 AA+Xy_p
Subfamily——Clytrinae			
Merilia lunulata (Fabr.) ..	22	12	10 AA+X+y

It is very difficult to suggest any primitive Eumolpinae condition as the chromosome number and the sex chromosome mechanisms are not at all rigidly fixed. A high degree of intra-generic chromosomal polymorphism with its basis on morphological and numerical variation and modes of sex mechanism are encountered. In Galerucinae the diploid number seems highly variable with a slight prevalence of XO mechanism. Little known subfamily Cassidinae show $2n = 20$ with Xy_p sex mechanism, a common Cyrambicid feature. As regards Clytrinae the present study is the first and only species so far noted cytologically and the subfamily needs further investigation for any comment.

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Dept. of Biology, J. DASGUPTA.
Jawaharlal Institute of
Postgraduate Medical
Education and Research,
and
Dept. of Life Science, Miss AMITA CHAKRAVARTI.
Sri Aurobindo
International Centre of Education,
Pondicherry-6, *February* 28, 1972.

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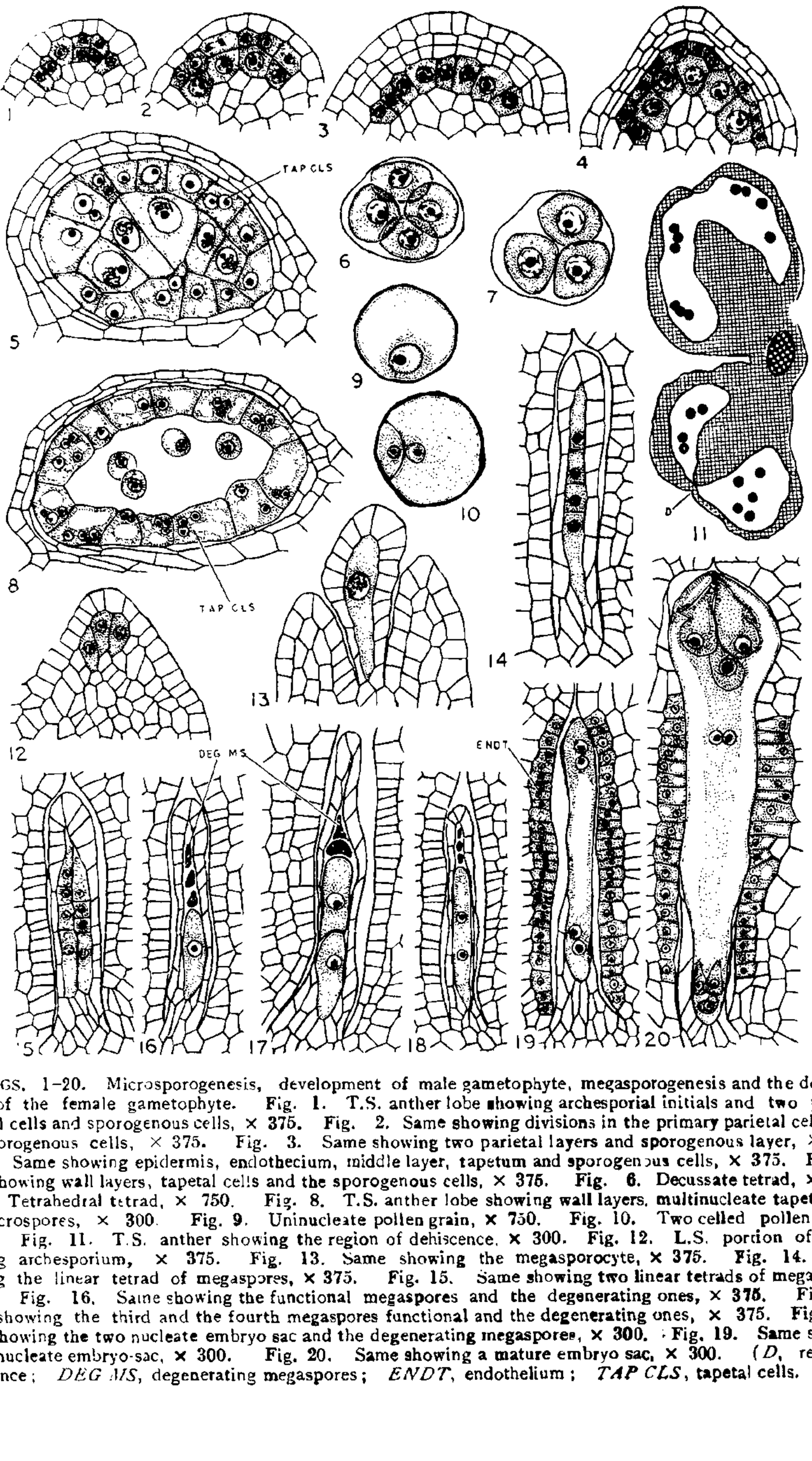
EMBRYOLOGY OF *LANTANA ACULEATA* LINN. VAR. *NIVEA* BAILEY

THE family Verbenaceae has been of interest for its special morphological and embryological features besides being particularly significant for including a score of genera used in horticulture, medicine or their economic importance. The genus *Lantana* despite its colourful blooms forms one of the most troublesome parts of vegetation. This genus is represented by about five species in South India (Gamble, 1928), of which *Lantana aculeata* Linn., with varying flower colour is most common. Although the details of development of female gametophyte, endosperm and embryo have been worked out for several species of this genus (Junell, 1934; Padmanabhan, 1959; Paterman, 1935; Thathachar, 1940), the microsporogenesis and the development of male gametophyte have received less attention and details on these aspects are wanting. The present investigation, therefore, deals with the microsporogenesis, development of anther, megasporogenesis and the development of female gametophyte in a white-flowered variety of *Lantana aculeata* Linn. var., *nivea* Bailey.

Lantana aculeata Linn. var. nivea Bailey is an aromatic straggling shrub with recurved prickles on the stem. The leaves are short petioled, oblong-ovate and scabrous above. The bracteate flowers are white in colour and occur in dense heads. The calyx is membranous and the corolla is four to five lobed. The stamens are four and didynamous. The superior ovary is bicarpellary, bilocular and syncarpous. Occasionally abnormal flowers showing two gynoecia are also seen. The fruit is drupaceous. The percentage of fruit-set is very low amounting to about 0·7%. The flowers wither and fall off after opening. Since the pollen does not germinate on agar-sucrose or agar-glucose media with varying concentrations of boric acid, it is likely that there is self-incompatibility in this variety which ultimately results in such a low percentage of fruit-set.



FIGS. 1–20. Microsporogenesis, development of male gametophyte, megasporogenesis and the development of the female gametophyte. Fig. 1. T.S. anther lobe showing archesporial initials and two primary parietal cells and sporogenous cells, × 375. Fig. 2. Same showing divisions in the primary parietal cells, and the sporogenous cells, × 375. Fig. 3. Same showing two parietal layers and sporogenous layer, × 375. Fig. 4. Same showing epidermis, endothecium, middle layer, tapetum and sporogenous cells, × 375. Fig. 5. Same showing wall layers, tapetal cells and the sporogenous cells, × 375. Fig. 6. Decussate tetrad, × 750. Fig. 7. Tetrahedral tetrad, × 750. Fig. 8. T.S. anther lobe showing wall layers, multinucleate tapetal cells and microspores, × 300. Fig. 9. Uninucleate pollen grain, × 750. Fig. 10. Two celled pollen grain, × 750. Fig. 11. T.S. anther showing the region of dehiscence, × 300. Fig. 12. L.S. portion of ovule showing archesporium, × 375. Fig. 13. Same showing the megasporocyte, × 375. Fig. 14. Same showing the linear tetrad of megaspores, × 375. Fig. 15. Same showing two linear tetrads of megaspores, × 375. Fig. 16. Same showing the functional megaspores and the degenerating ones, × 375. Fig. 17. Same showing the third and the fourth megaspores functional and the degenerating ones, × 375. Fig. 18. Same showing the two nucleate embryo sac and the degenerating megaspores, × 300. Fig. 19. Same showing a four-nucleate embryo-sac, × 300. Fig. 20. Same showing a mature embryo sac, × 300. (*D*, region of debiscence; *DEG MS*, degenerating megaspores; *ENDT*, endothelium; *TAP CLS*, tapetal cells.

A young anther in transection shows an undifferentiated mass of cells. It soon becomes four-lobed and a plate of six to nine archesporial initials with conspicuous nuclei and dense cytoplasm differentiates in each of the four lobes (Fig. 1). A periclinal division in these cells results in an outer layer of primary parietal cells and an inner layer of primary sporogenous cells (Fig. 2). The cells of the parietal layer divide both anticlinally and periclinally ultimately resulting in three layers of cells (Figs. 2-4). The outermost of these becomes the endothecium. The fibrillar thickenings so characteristic of this layer, however, never develop in this species (Fig. 8). The innermost layer forms the tapetum. The tapetal cells are uninucleate in the beginning but become conspicuously enlarged, highly vacuolated and three to four-nucleate as the microsporocytes undergo meiosis (Figs. 4, 5, 8). At later stages these cells look practically empty and are finally obliterated. The middle layer gets highly compressed and degenerates. Thus the development of the anther wall conforms to the Dicotyledonous type (Davis, 1966).

The primary sporogenous cells enlarge enormously and function as the microsporocytes. They undergo meiosis resulting in decussate and tetrahedral microspore tetrads (Figs. 6, 7). The divisions are simultaneous. The microspores separate from the special mucilaginous wall secreted during meiosis and develop a thick wall. The centrally placed nucleus undergoes a meiotic division after migrating to a side of the pollen grain, resulting in a small lenticular generative cell and a large vegetative cell (Figs. 8-10). The pollen grains are tricolpate with a smooth, thick exine and are shed at the two-celled stage. A large number of pollen grains, however, remains uninucleate. Dehiscence of the anther takes place at the junction of the microsporangia. The epidermal cells at this region are smaller in size. A regular stomium is absent. The two adjacent microsporangia coalesce before dehiscence (Fig. 11).

The unitegminal and tenuinucellar ovules are anatropous and supplied with a single vascular strand which stops at the base of the embryo sac. The archesporium is hypodermal and one to three-celled (Fig. 12). However, only one of these cells is functional and the others degenerate. Occasionally, two archesporial initials function simultaneously and result in twin megaspore tetrads (Fig. 15). The archesporial initials show dense cytoplasm and conspicuous nuclei. The functional initial directly functions as the megasporocyte after considerable elongation (Fig. 13). Meiotic divisions result in a linear tetrad of megaspores of which usually the chalazal megaspore is functional (Figs. 14, 16). Occasionally the third megaspore may also develop further and result in an eight-nucleate embryo sac (Fig. 17). Hence twin embryo sacs resulting from the functioning of two megaspores either from the same tetrad or two tetrads are sometimes seen.

The nucleus of the functional megaspore undergoes a mitotic division resulting in two nuclei which are pushed to the opposite poles by the appearance of a central vacuole (Fig. 18). These divide to form a four-nucleate embryo sac and subsequently an eight-nucleate one after undergoing one more division (Figs. 19, 20). A mature embryo sac is broader at the micropylar region and tapers towards the chalazal end. The egg apparatus consists of a pair of beaked and prominently hooked synergids and an egg. The antipodals are small and uninucleate unlike the other species of *Lantana* where they enlarge and become multinucleate (Padmanabhan, 1959). The two polar nuclei lie towards the egg apparatus (Fig. 20).

Simultaneous with these changes, the cells of the nucellar epidermis get crushed up as the four-nucleate embryo sac is formed and disorganise. Thus the embryo sac comes in direct contact with the innermost layer of the integument which develops into an endothelium at this stage.

Frequently the embryo sac degenerates at the eight-nucleate stage which partly accounts for the low percentage of fruit-set.

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Dept. of Botany,
Univ. of Agricl. Sciences,
Bangalore-24,
January 20, 1972.

TASNEEM FATHIMA KHALEEL.
A. S. NALINI.

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* Not seen in original.

ANATOMY OF *SCIRPUS SQUARROSUS* L.

METCALFE[3] has summarized the existing knowledge on the anatomy of Cyperaceae including *Scirpus*. *S. squarrosus* has some unique features in its anatomy, which is presented here. It is an annual, 7-15 cm high, having a tuft of stems with a cluster of fibrous adventitious roots at the base. Each stem has two leaves at its base. The leaf consists of a closed sheath and a blade, but the first leaf is often relegated to a sheath. The conspicuous part of the stem is an elongated internode.

The material was collected from Jawalamukhi (altitude 500 m) in Himachal Pradesh. Fresh pieces of root, stem and leaf were fixed in formalin-acetic acid-alcohol. After passing through various grades of alcohol and xylol, they were embedded in paraffin for microtome sectioning. A few pieces of stem and leaf were treated with 20% hydrofluoric acid for 6–8 hours prior to embedding. Free-hand sections were also cut. Both paraffin-embedded and free-hand sections were stained in safranin and fast green and mounted in Canada balsam. Epidermal preparations for surface-view study were made by scraping away the underlying tissues. They were stained in safranin and mounted in 50% glycerine. Macerations were done in a mixture of 5% nitric acid and 5% chromium trioxide in water. Lignin was tested with phloroglucinol and hydrochloric acid.

Epidermis in surface view.—The stem epidermis consists of rectangular cells, arranged in longitudinal files with their long axes parallel to the stem (Fig. 1). Their longitudinally oriented walls are sinuate. The epidermis is divisible into costal and intercostal regions (Fig. 1). The cells in the costal regions are narrow and each contains 4-11 uniseriately arranged silica bodies with satellites (Fig. 1). The stomata are arranged in a row in the intercostal region. They are paracytic with dome-shaped subsidiary cells (Fig. 1). The abaxial leaf-blade epidermis (Fig. 2) is similar, but the cells are shorter and costal regions are narrower. The adaxial epidermis lacks stomata in the median region (Fig. 3), but they are present along the blade margin. The prickle hairs occur only at the blade apex.

T. S. root (0·23 *mm diameter*).—The epidermis is sloughed off in mature root. The exodermis is 1-2-layered and the cortex has lacunae formed by the breakdown of its cells (Fig. 4), but the young cortex consists of 4-5 concentric layers of parenchyma cells combined with radial alignment and having conspicuous intercellular spaces. The endodermis (Fig. 4) consists of thick-walled cells, whose walls are lignified and also impregnated with a reddish-brown substance. The thickening is in a U-form. In the vascular cylinder (Fig. 4), the pericycle is 1-layered, but interrupted at the protoxylem poles. There are five xylem strands alternating with phloem strands. The centre is occupied by a large metaxylem vessel (Fig. 4) common to all the xylem strands, each one of which also contains a single protoxylem element.

T. S. stem (0·63 *mm diameter*).—It is oval to circular in outline with distinct ridges and grooves (Fig. 5). The epidermis consists of small shallow cells in the costal regions and large deep cells in the intercostal regions, that correspond to the ridges (Figs. 5-6). The cells in the costal regions contain silicified processes (Fig. 6). Each silicified process consists of a lignified projection of the inner cell wall with a hollow conical body of silica fitted on it. The subepidermal fibre strands occur below the grooves and opposite to the vascular bundles (Figs. 5-6). There are 15 collateral vascular bundles, disposed in two series with the larger ones projecting into the colourless region. There are two bundle sheaths (Fig. 6), inner of parenchyma cells containing densely packed chloroplasts, and outer endodermoid consisting of small slightly to conspicuously thick-walled cells. Both the sheaths are complete in small bundles, but in large bundles the inner sheath is inter-