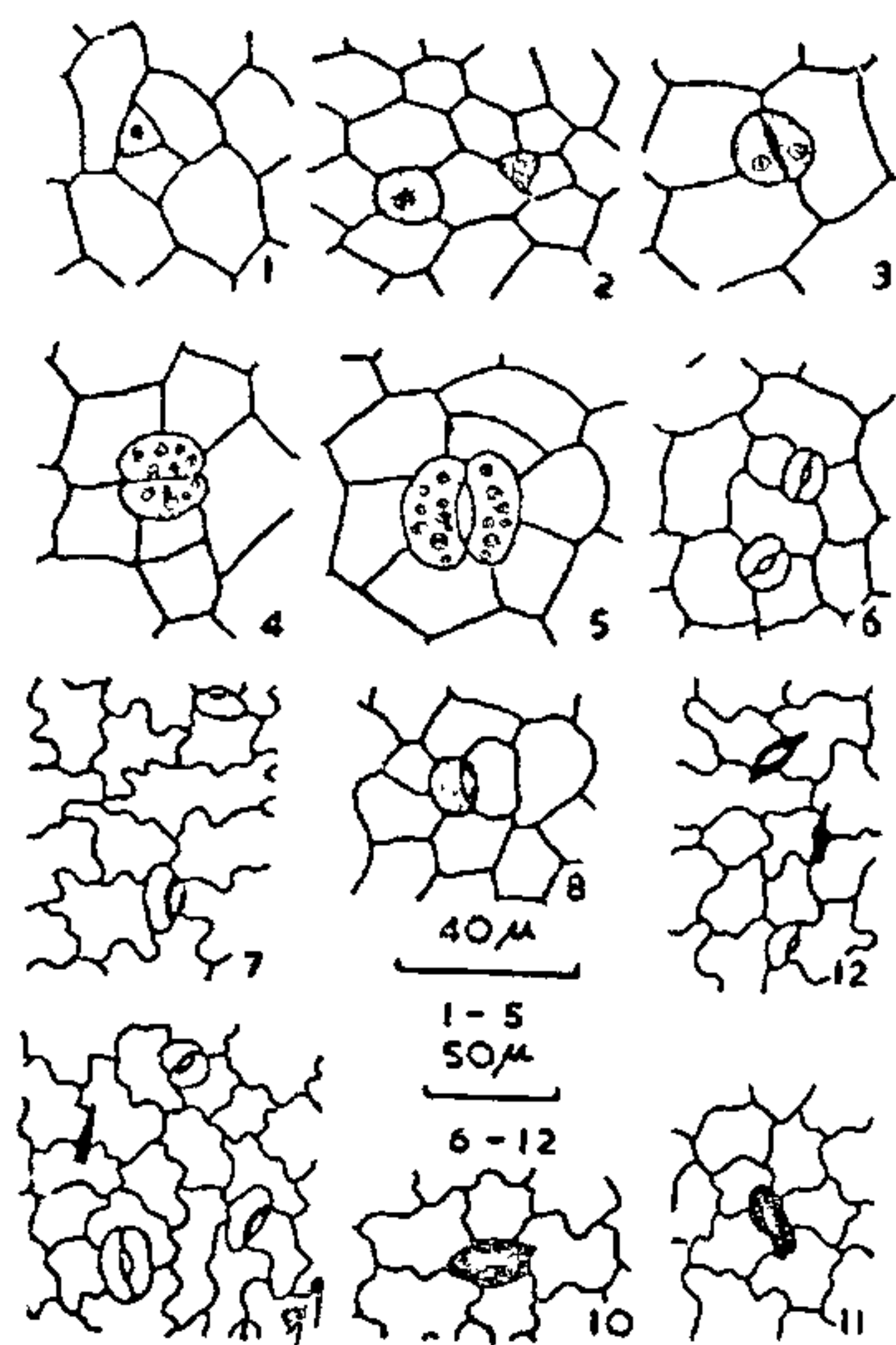


tangentially with the result one or two of them may look smaller (Figs. 4, 5).



FIGS. 1-12. *Clerodendrum phlomidis*. Figs. 1-5. Ontogeny of stomata. Fig. 1. A meristemoid cutting off from the protodermal cell. Fig. 2. Enlarged and spherical meristemoid. Fig. 3. Vertical division of the meristemoid producing two guard cells. Figs. 4, 5. Perigenous neighbouring cells of the stomata showing radial and tangential divisions. Fig. 6. Mature stomata of upper epidermis. Fig. 7. Abnormal stoma of lower epidermis with two epidermal cells replacing a guard cell. Figs. 8, 9. Stomata flanked by a single guard cell and a large cell. Figs. 9-12. Lower epidermis showing abnormal stomata with thick-walled abortive pores.

Evidently the meristemoids directly act as guard cell mother cells and the neighbouring cells are derived from the other protodermal cells. Hence these stomata are regarded as aperiogenous type following the recent classification proposed by Fryns-Claessens and Van Cotthem³. The present study also supports the view of the previous workers^{3,5} that the meristemoid is the smaller meristematic daughter cell formed as a result of the division of the protodermal cell.

Though the leaves are amphistomatic, only the lower epidermis show the abnormal stomata as frequently as the normal ones. Rarely do they also occur on the upper surface. Similar stomatal anomalies were observed on the lower epidermis of several members of Solanaceae⁶ and *Nelumbo nucifera*⁵. The stomatal abnormalities include the stomata with a single guard cell and the degenerated stomata. In the first type, either one of the guard

cells is transformed into a large thin-walled cell (Figs. 8, 9) or the two neighbouring cells crush one of the guard cells completely. In the latter case the stomatal pore is flanked by a single guard cell on one side and two ordinary epidermal cells on the other (Fig. 7). The second type is caused by the obliteration of the two guard cells by the encircling cells (Figs. 10, 11). They, however, do not disappear altogether as reported in the leaves of *Nelumbo nucifera*⁵. On the contrary, these abnormal stomata are represented by close or open, abortive thick-walled pores encircled by 3-5 neighbouring cells (Figs. 9-12) as what has been observed in some members of Solanaceae⁶ and Rubiaceae⁷. Previous workers² could not find the abnormal stomata in this species. This may be due to the fact that the materials, they studied, were young. In the present study also, no abnormal stomata could be seen in the young and developing leaves. This observation confirms the contention of Ahmad⁶ that these anomalous stomata are formed as a result of the degeneration of mature stomata rather than due to developmental disturbances.

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INHERITANCE STUDIES ON CERTAIN PEA MUTANTS *

KALLOO¹ isolated several chlorophyll mutants induced through gamma irradiation of dry pea seeds. This communication deals with a study of the manner of inheritance of four of the above chlorophyll mutants, viz., light yellow, light green, white spotted leaves and orange-yellow spotted leaves. A spontaneous mutant, yellow pollen, was also studied.

TABLE I
Segregation of certain mutants in F₂

Culture number	Name of mutant	F ₂ Segregation No. of plants		Expected ratio	χ^2 value 1 d.f.	P Value
		Normal	Mutant			
61	Light yellow	105	30	3:1	0.556	>0.30
62	Light green	61	19	3:1	0.067	0.80
63	White spotted leaves	219	15	15:1	0.026	>0.80
64	Orange-yellow spotted leaves	73	21	3:1	0.355	>0.50
65	Yellow pollen	56	19	3:1	0.004	0.95

Each mutant was crossed reciprocally with a normal plant during 1969-70. In 1970-71, the seeds of parents and F₁ including reciprocals were grown in the field. F₁ plants were selfed to get seeds for raising F₂ population next year. F₂ plants were classified into different phenotypes. F₁ plants were all normal; reciprocal crosses showed absence of any maternal effect. The F₂ data presented in Table I showed that all the mutants were recessive and showed a monogenic segregation of 3 : 1 except the white spotted leaves which showed a duplicate ratio of 15 : 1.

Blixt² showed that the chlorophyll mutants occurred not only in different forms but their expression also varied in different degrees due to multiple allelism. Light yellow and light green mutants could be grouped under *flavo-viridis* while the other could be grouped as *vario-maculata*—also a recessive mutant².

Spontaneous occurrence of yellow pollen in pea was earlier reported by Murfet³. A similar mutant was observed in the present study also. Murfet³ designated the allele for yellow pollen by *yp*.

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REPLICATION OF SURFACE FEATURES OF SAND GRAINS OF SIZES 0.5 TO 4.0 MM FOR ELECTRON MICROSCOPY

KNOWLEDGE of size, shape and external features of minerals, rocks and sands is sometimes needed for determining the crystal structure, nature of origin, growth, and also the reaction of minerals to physical and chemical forces imposed by man or nature^{1,2,4}.

There is no universally correct method of producing surface replicas for electron microscopy since different specimens require variations of one or two basic techniques to be developed for it. Carbon is the most popular replicating material but simultaneous rotation of specimen during carbon evaporation has been known to yield tougher films. Moreover carbon films are unaffected by strong acids and almost all solvents.

In an attempt to replicate the surface features of sand grains of sizes 0.5-4 mm disaggregated from the friable sandstones from the tertiary sediments around Kotdwara Garhwal, Himalaya, various usually followed methods¹⁻³ were tried. Unusual large size with sharp contour elevations of the sand grains would rupture the replica film and no worthwhile features could be replicated. A slightly modified attempt was therefore made as follows.

Cellulose acetate replicating tape was softened in acetone and mounted on a clean glass slide, cut to 2 cm squares earlier. Sand grains were then placed on this soft tape and pressed gently with another glass slide to obtain their surface impressions on the tape. On drying, the sand grains could be easily removed with a slight pressure by a needle or can just be picked up with a pointed

* Part of a Ph.D. Thesis submitted to the Banaras Hindu University, Varanasi, in 1973 by the second author.

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