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A Distinctive Seed Coat Pattern in the Vicieae (Papilionoideae; Leguminosae)

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A distinctive seed coat pattern, which contrasts with that of about 200 other genera of papilionoid legumes, is evident in 47 species of 4 genera of tribe Vicieae. A conspicuous papillose pattern, seen at magnifications of 50X or higher, is caused by protrusions from the tips of malpighian cells of the epidermis. The hilar rim is quite reduced, a rare feature elsewhere in the subfamily. These two characters, and the elongate hilum noted by others, strengthen the definition of this tribe.
INDEX DESCRIPTORS: Leguminosae, Papilionoideae, Vicieae, seed coat anatomy, papillose seed coat.

Seeds of most Leguminosae are smooth and featureless at low magnification. Topography of the seed surface has, therefore, been ignored in past taxonomic studies. Scanning electron microscopy (SEM), however, has revealed new features.

Brisson and Peterson (1976) reported that only 9 published studies of legume seeds contained SEM photos, and none of them concerned taxonomy. Since Brisson and Peterson's review, some taxonomic work using SEM has been published. Heyn and Herrnstadt (1977) used SEM to reveal some differences in surface patterns of *Lupinus* seeds that proved to be of taxonomic significance. Newell and Hymowitz (1978) examined seeds of *Glycine* subg. *Glycine* of the Phaseoleae by SEM and concluded that surface patterns, particularly of the perisperm (inner pod wall remnants which adhere to the seed), provided useful taxonomic characters. Also in Phaseoleae, Sharma *et al* (1977) used SEM of seed coat patterns to attempt to distinguish taxa in a species complex within *Phaseolus*. La Sota's unpublished dissertation (1978) and earlier work by Gutterman and Heydecker (1973) show that surface features of *Ononis* seeds seen by SEM are clearly of taxonomic value. Gunn and La Sota (1978) included a key to 5 *Ononis* species based on SEM characters. Polhill (1976) used both light microscopy and SEM to show that distinctive seed coat patterns may occur in certain groups of genera within the tribe Genisteae.

I am conducting a survey of seed coat anatomy in the legume subfamily Papilionoideae, which includes about 440 genera and 12,000 species. Among approximately 200 genera I have examined to date, representing all but one of the tribes, the singular papillose pattern in the tribe Vicieae differs strikingly from all others encountered. A preliminary report on this previously undescribed seed coat pattern is presented here.

MATERIALS AND METHODS

This report is based on observations of seeds of representatives of 4 of the 5 genera currently recognized in the Vicieae: *Pisum sativum*, *Lens culinaris*, 19 species of *Lathyrus*, and 26 species of *Vicia*. The names of the species will be included in a later report. Seeds of the monotypic *Vavilovia* were not available. Seeds were obtained from the U.S. National Seed Herbarium of the U.S. Department of Agriculture, Beltsville, MD, and secondarily from European botanical gardens and the Seed Testing Laboratory of Iowa State University.

Whole seeds, or portions of seeds, were dipped in absolute ethanol and mounted in silver paste on standard brass discs. The specimens were coated with carbon and gold in a vacuum evaporator and viewed in a JEOL JSM-35 scanning electron microscope. Photographs were taken with Polaroid type 665 film.

RESULTS AND DISCUSSION

Kupicha (1977) described seeds of the Vicieae as generally spherical or oblong, with a more or less linear hilum. She did not mention that the hilar rim is quite reduced, a feature I have not seen in other tribes. Figure 1 illustrates these features, as well as the often elongate micropyle. The papillose topography can also be discerned even at this rather low magnification. At higher magnification (Fig. 2), the papillose pattern shows clearly. The abrupt boundary between hilum and adjacent seed coat is also apparent. As in other tribes, the micropyle in mature seeds is closed and covered with a cuticle.

Figures 3, 4 show the seed coat in detail. The papillae are seen to be domed protrusions from the tip of individual malpighian cells. The almost complete lack of a hilar rim is also evident (Fig. 3).

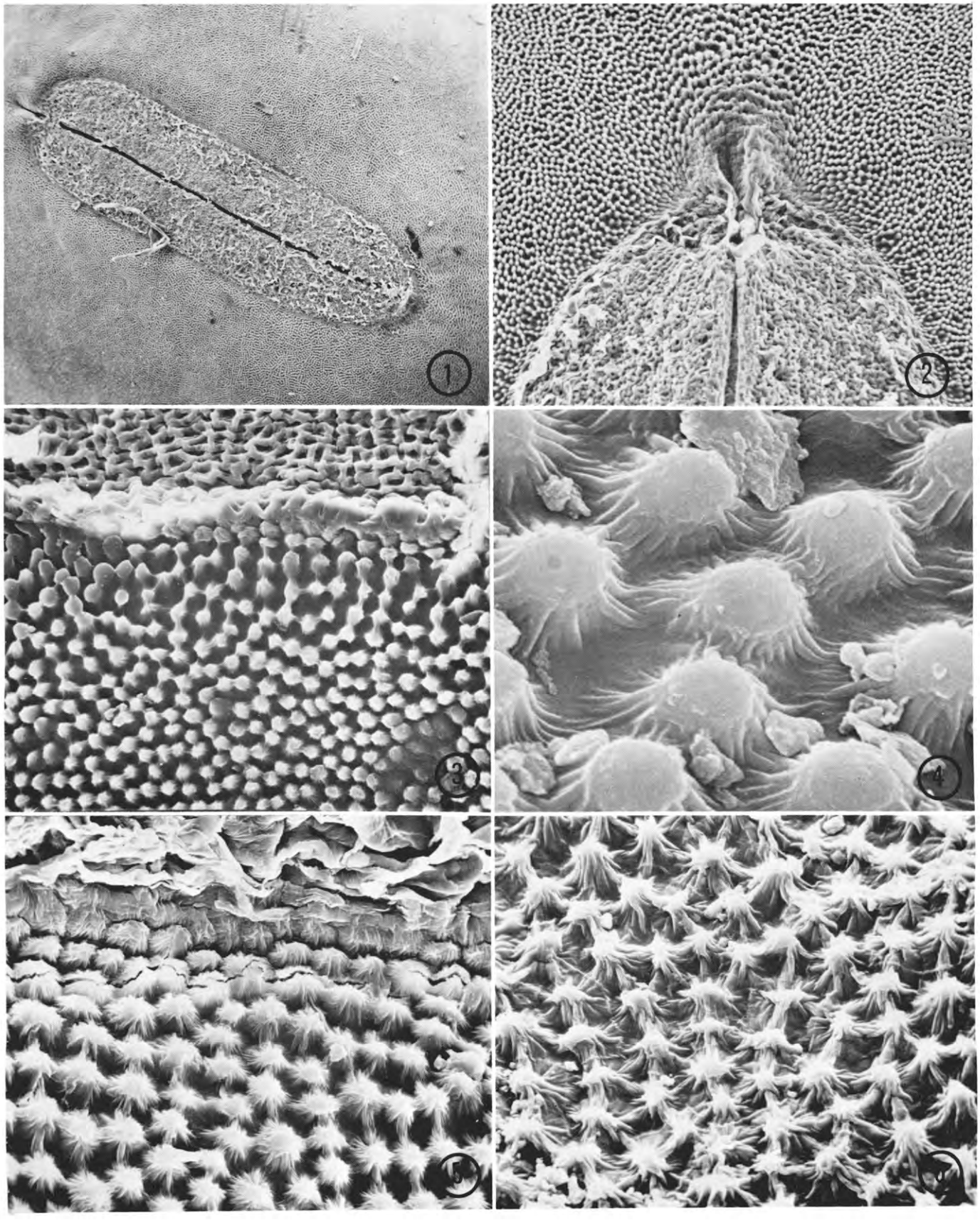
The papillose pattern was evident in all species examined, e.g. *Vicia*, Fig. 1-4; *Lathyrus*, Fig. 5; *Pisum*, Fig. 6. Seeds of *Lens* (not illustrated) are similar. Marbach and Mayer (1974) showed an identical pattern in *Pisum elatius* but made no comment about it.

In seeds sectioned with a razor blade, coated, and viewed by SEM, the palisadelike malpighian layer characteristic of all papilionoid tribes can be seen (Fig. 7). Figure 8 shows the tips of some malpighian cells in detail. Because seeds shrink during maturation and drying, the malpighian cells become compressed, and only a vertical line is left to suggest the lumen.

The elongate hilum, reduced hilar rim, and especially the papillose surface caused by protrusion of individual malpighian cells, appears to form a trio of seed characters that help to define the tribe Vicieae. None of these features is present in seeds of *Abrus*, a genus once placed in Vicieae, or in *Cicer* (Lersten, unpublished), a genus excluded from the Vicieae by Kupicha (1977). My observations on 47 species support Kupicha's delimitation of the tribe.

A more comprehensive study is in preparation by Lersten and

Fig. 1-8. *SEM views of the seed coat of members of the Vicieae.* Fig. 1. Vicia pannonica. *Note the elongate hilum, greatly reduced hilar rim, and elongate micropyle (upper left). Papillose seed coat is barely visible. X48.* Fig. 2. Vicia sativa. *Micropyle, part of hilum, and adjacent seed coat. Papillose seed coat is apparent. X200.* Fig. 3. Vicia pannonica. *Papillae of seed coat are clearly visible at high magnification. Seed coat abuts abruptly on hilum at top with hilar rim virtually lacking. X1000.* Fig. 4. Vicia atropurpureus. *Highly magnified view of papillae, each of which is protruding tip of an epidermal cell. Note ridged cuticle between but not on the papillae. X6000.* Fig. 5. Lathyrus hirsutus. *Papillose pattern as in* Vicia. *Hilar rim is reduced but evident (arrow). X480.* Fig. 6. Pisum sativum. *Papillose seed coat as in* Vicia *and* Lathyrus. *X1000.*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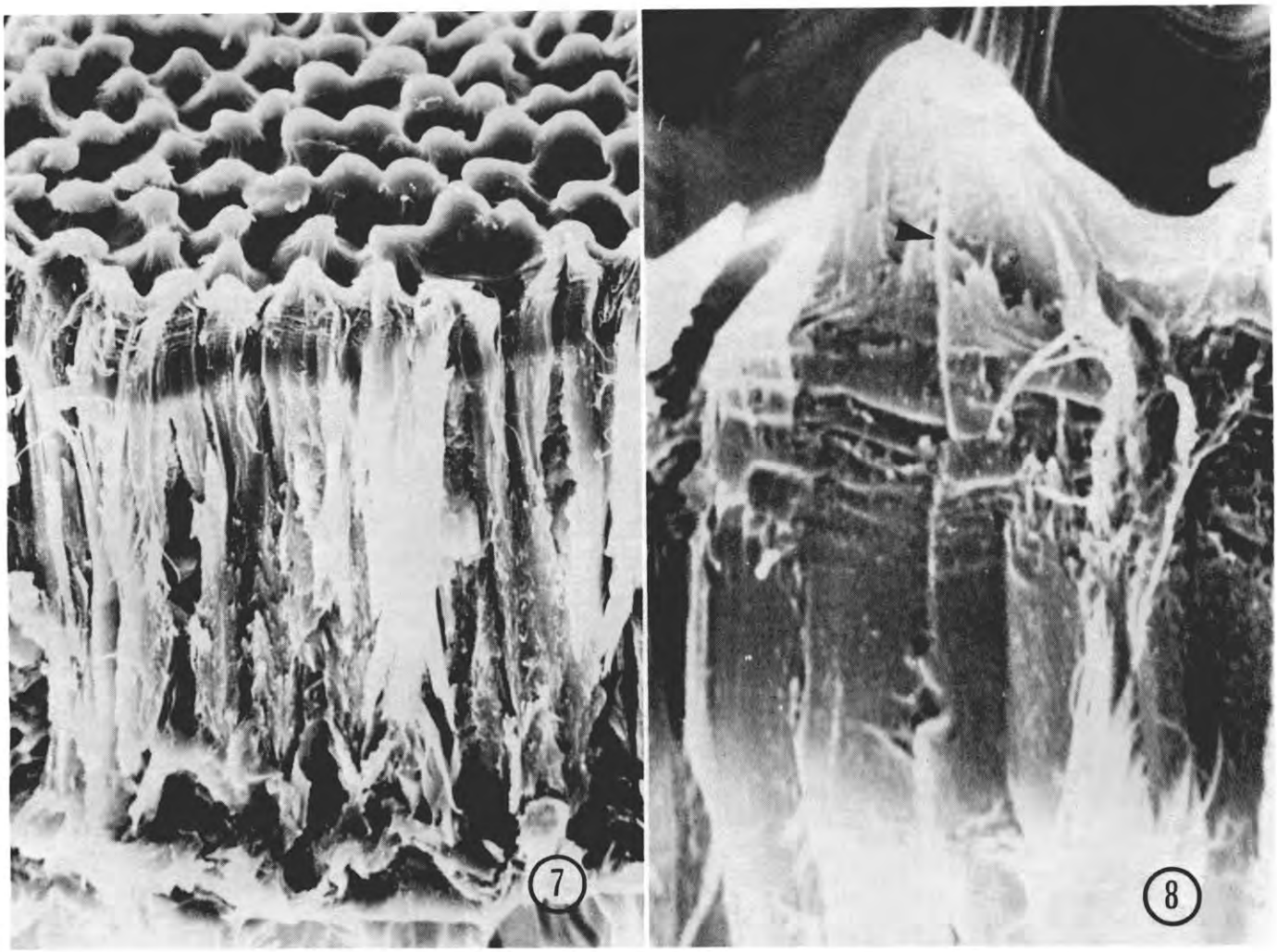

Fig. 7. *SEM of sectioned seed coat of* Lathyrus latifolius. *Elongate epidermal (malpighian) cells each end in a rounded papilla. X660.* Fig. 8. *Enlargement of part of Fig. 7 to show detail. Arrow indicates reduced cell lumen in papillose cell that is probably in median longitudinal view. X2000.*

Gunn, which will deal with seeds of Vicieae and their bearing on taxonomic relations and evolution of this tribe.

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