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FURTHER STUDIES IN THE POLLINATION OF SOME INDIAN ASCLEPIADS

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ABSTRACT

Mechanism of pollination, attachment of pollinia with various body parts of insect visitors of order hymenoptera and lepidoptera and their role in pollination of a few asclepiads, viz., *Asclepias curassavica* L., *Calotropis procera* (Ait.) R.Br , *Wattakaka volubilis* (L.) Stapf., *Leptadenia reticulata* R.Br., *Sarcostemma (Oxystelma) secamone* (L.) Bennett. and *Pergularia daemia* (Forsk) Blatt. has been discussed. However, autophily by *in situ* germination of Pollinia in three genera, viz., *Hemidesmus indicus* Br. *Gymnema sylvestre* Br. and *Tylophora hirsuta* (Burm f.) Merr. has been reported for the first time in family Asclepiadaceae.

INTRODUCTION

Mechanisms of pollination in some Indian asclepiads have been described by Bhatnagar (1975), Dnyansagar & Tijare (1979), Ramkrishna & Govindappa (1979) and Pant, Nautiyal & Chaturvedi (1982), Pant, Nautiyal & Chaturvedi (1982) have reported entomophily as a regular process and germination of pollinium as basal, apical and Unilateral in some Indian asclepiads. However, the present investigation deals with the mechanism of insertion of pollinium into the stigmatic notches of *C. procera, L. reticulata, S. secamone, W. volubilis, Asclepias curassavica* and *Pergularia daemia.*

The factors which involve to direct the pollinium for insertion into the stigmatic notch through the site of its germination have also been investigated.

A new phenomenon of *in situ* germination of pollinium in some other genera, viz., *Gymnema sylvestre, Hemidesmus indicus,* and *Tylophora hirsuta* which leads to successful pollination has also been reported for the first time.

MATERIAL AND METHOD

All the investigated genera were observed at their natural localities as well as in the cultivation for their pollination i.e. *Gymnema sylvestre* and *Hemidesmus indicus* at Pratappur (Dist. Allahabad), *Tylophora hirsuta* at districts Almora and Allahabad, *Asclepias curassavica* at Kathgodam (Dist. Nainital) and Allahabad, *Pergularia daemia* at districts Sidhi, Banda and Allahabad, *Leptadenia reticulata* and *Wattakaka volubilis* at district Allahabad and *Sarcostema (oxystelma) secamone* at Sirathu (Dist . Allahabad).

Insect visitors were engaged in the glass test-tubes and instantly killed with the help of xylene soaked cotton plug.

Structure of flowers and attachment of pollinia with the body parts of various insects visitors have been studied under stereobinocular. Microphotographs have been taken under Axiomat microscope. Tissue paper bags have been used for bagging the inflorescences.

OBSERVATIONS

Pollinia of *Calotropis procera, Sarcostemma (oxystelma) secamone, Asclepias curassavica* and *Pergularia daemia* have retinacula which are considerably longer than the half length of their pollinia. These pollinia were carried horizontally by the insect visitors (Plate 2, Figs. 1, 2 & 4; Plate 3;

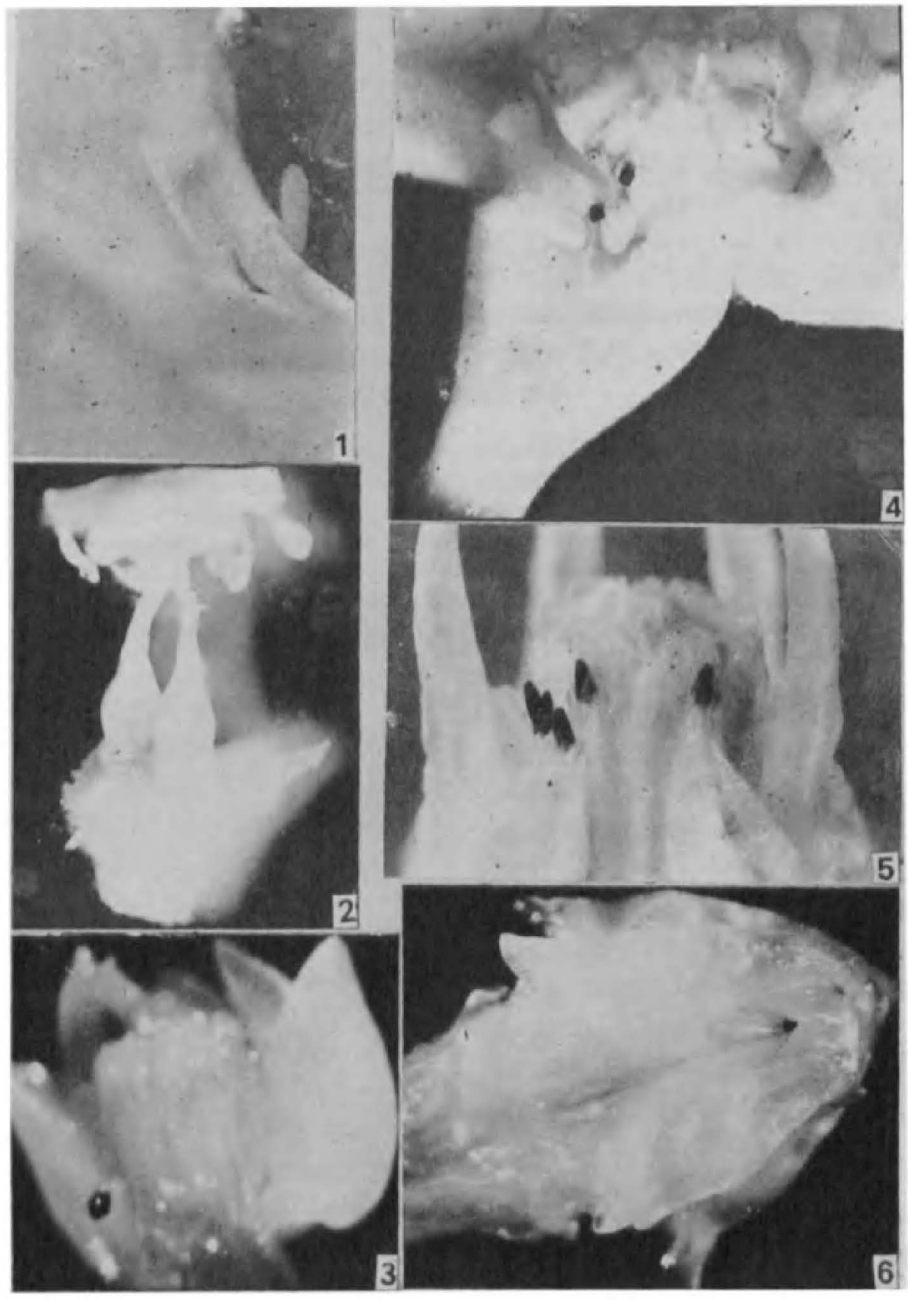

Plate 1, Figs. 1-6 1 *Wattakaka volubilis* pollinium inserted inside the stigmatic notch with the basal end downwards × 24.2 2. *Calotropis procera* gynostegium exposed to show unilaterally germinating pollinium × 2.2. 3. *Asclepias curassavica* gynostegium showing laterally opened stigmatic notch × 13. 4. *Leptadenia reticulata* top view of flower showing pollinium vertically inserted in stigmatic notch × 18.5. 5. *Sarcostemma (Oxystelma) secamone* showing unilateral insertion of pollinium into the stigmatic notch × 11.9. 6. *Pergularia daemia* gynostegium exposed to show lateral insertion of pollinium into the stigmatic notch × 13.

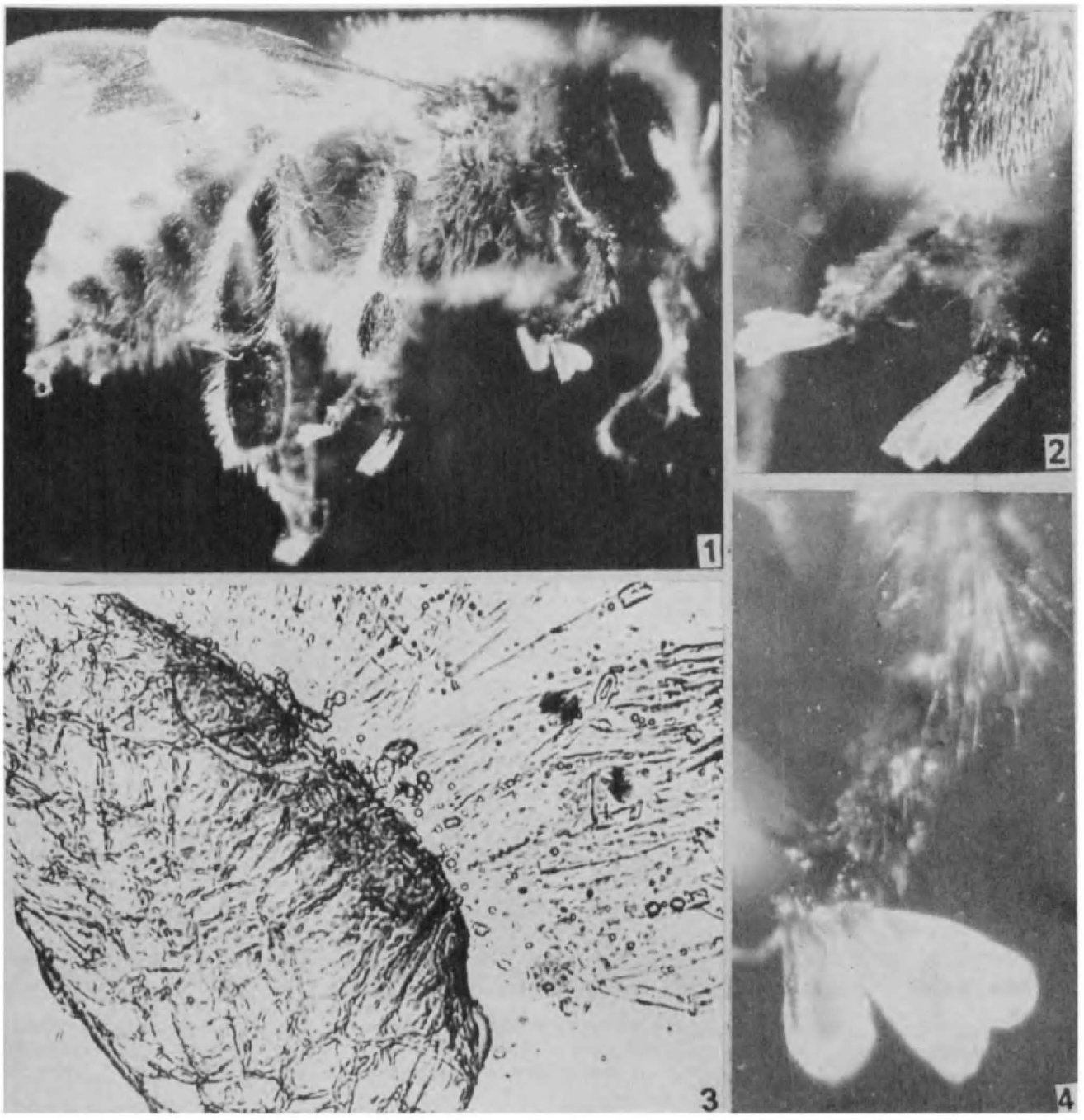

Plate 2. Figs. 1-4 : 1. *Apis indica* showing attachment of pollinia on legs after visiting the flowers of *Pergularia daemia* × 7.6. 2. 2 & 4 Legs of *A. indica* magnified to show attachment of pollinium with the hairs of legs × 20.9 and 28.8 respectively. 3. *Pergularia daemia*, a germinating pollinium × 102.

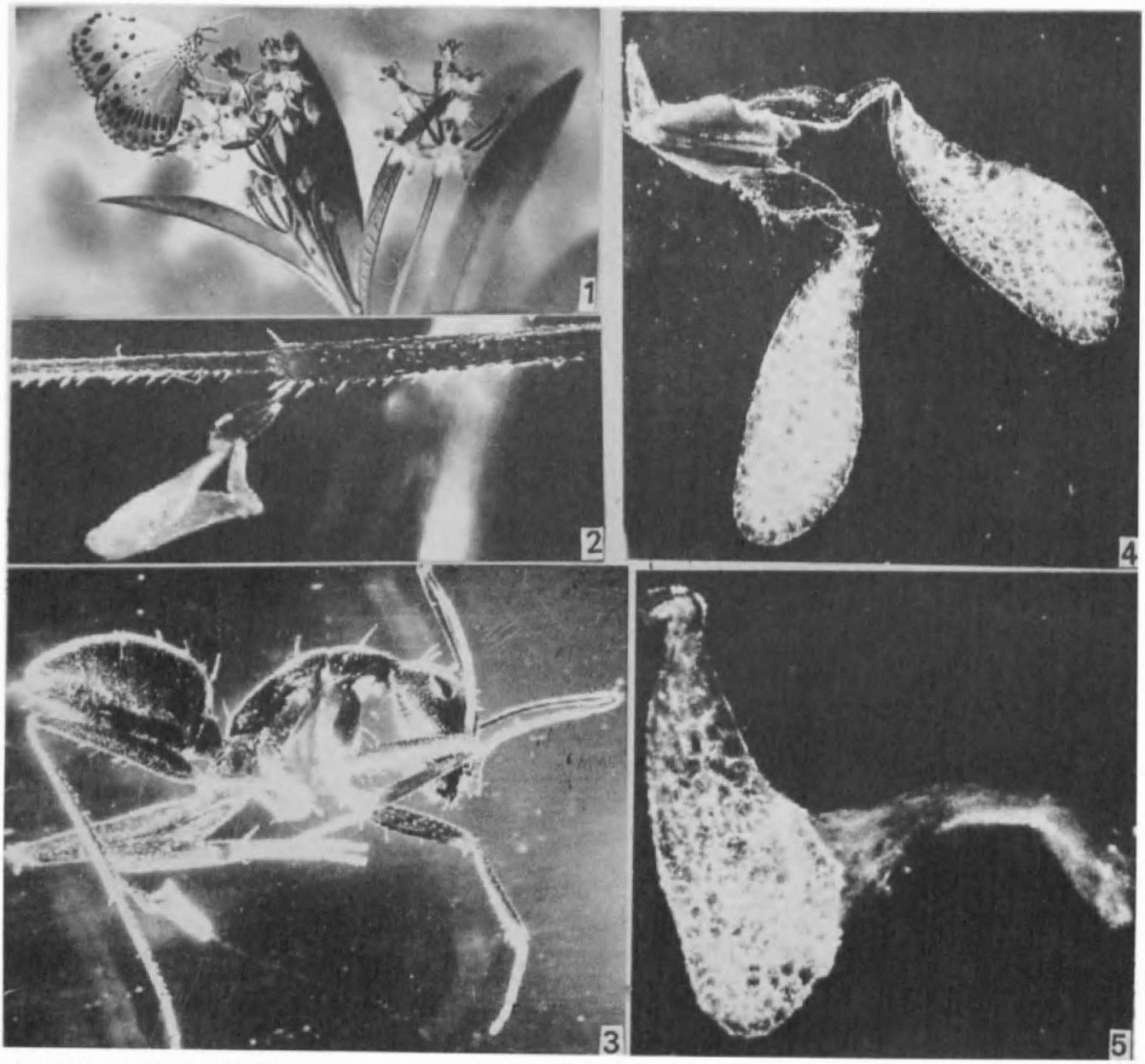

Plate 3. Figs 1 5 1 *Asclepias curassavica*, butterfly of *Euploea core* Cramer foraging the flowers 2 Magnified leg of *Monomonum* sp showing attachment of pollinia × 21 3 *Monomorium* sp showing pollinia attached to it's hind leg × 8 12 4 Pollinia with broken leg of *Monomorium* sp × 48 004 5 Germination of pollinium from lateral side × 36 6

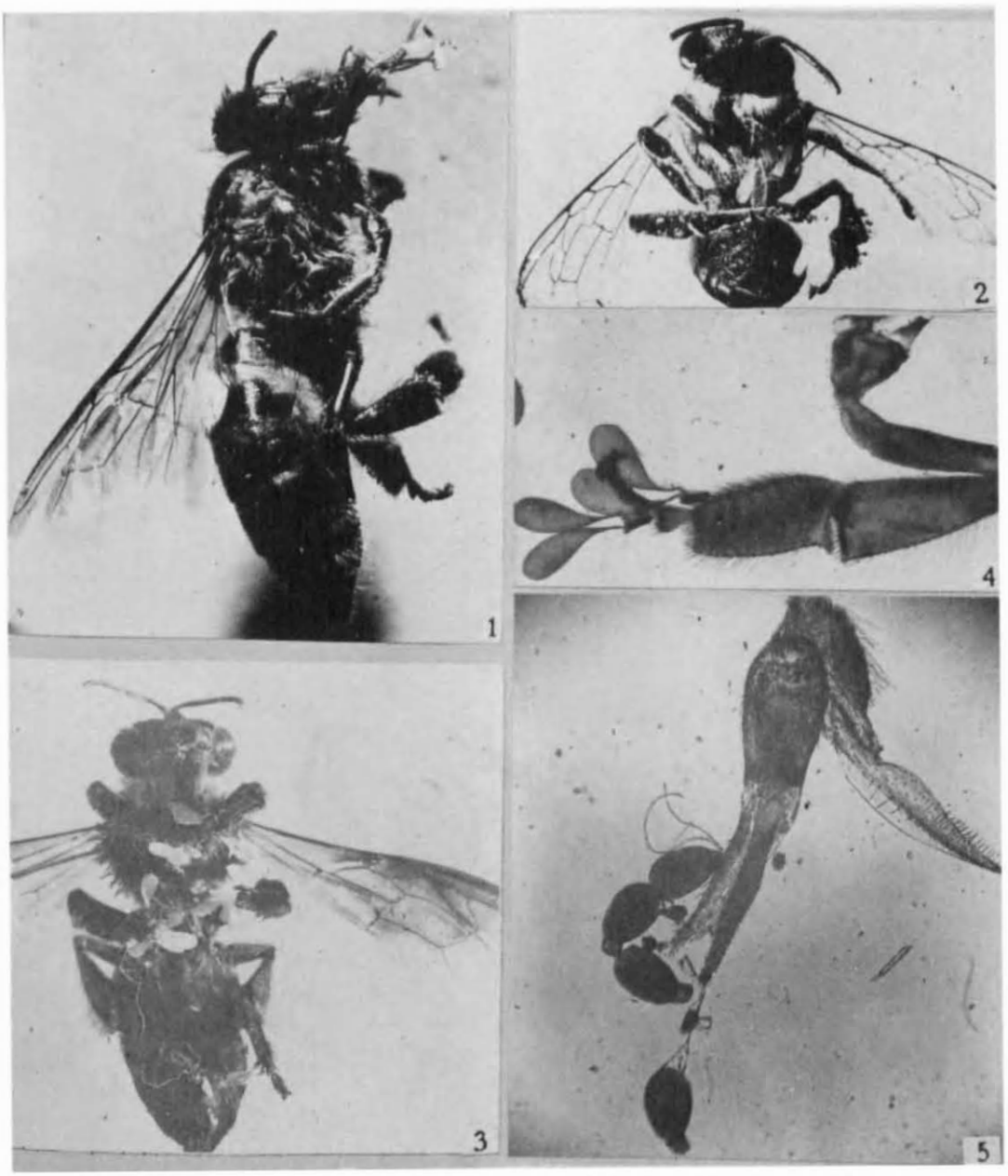

Plate 4, Figs. 1-5 : Showing attachment of pollinia with the different body parts of insect visitors : 1. *Apis indica* with pollinia of *Wattakaka volubilis* attached to proboscis × 11.5. 2. *Apis indica* with pollinia of *Sarcostemma secomone* attached to the fore legs × 3.4. 3. *Scolia* sp. with pollinia of *Calotropis procera* on fore legs as well as on middle legs × 4. 4. Hind leg of *Apis indica* with pollinia of *C. procera* × 8.3. 5. Mouth parts of *Micrapis florea* showing distal and basal attachment of pollinia of *Leptadenia reticulata* × 8.5.

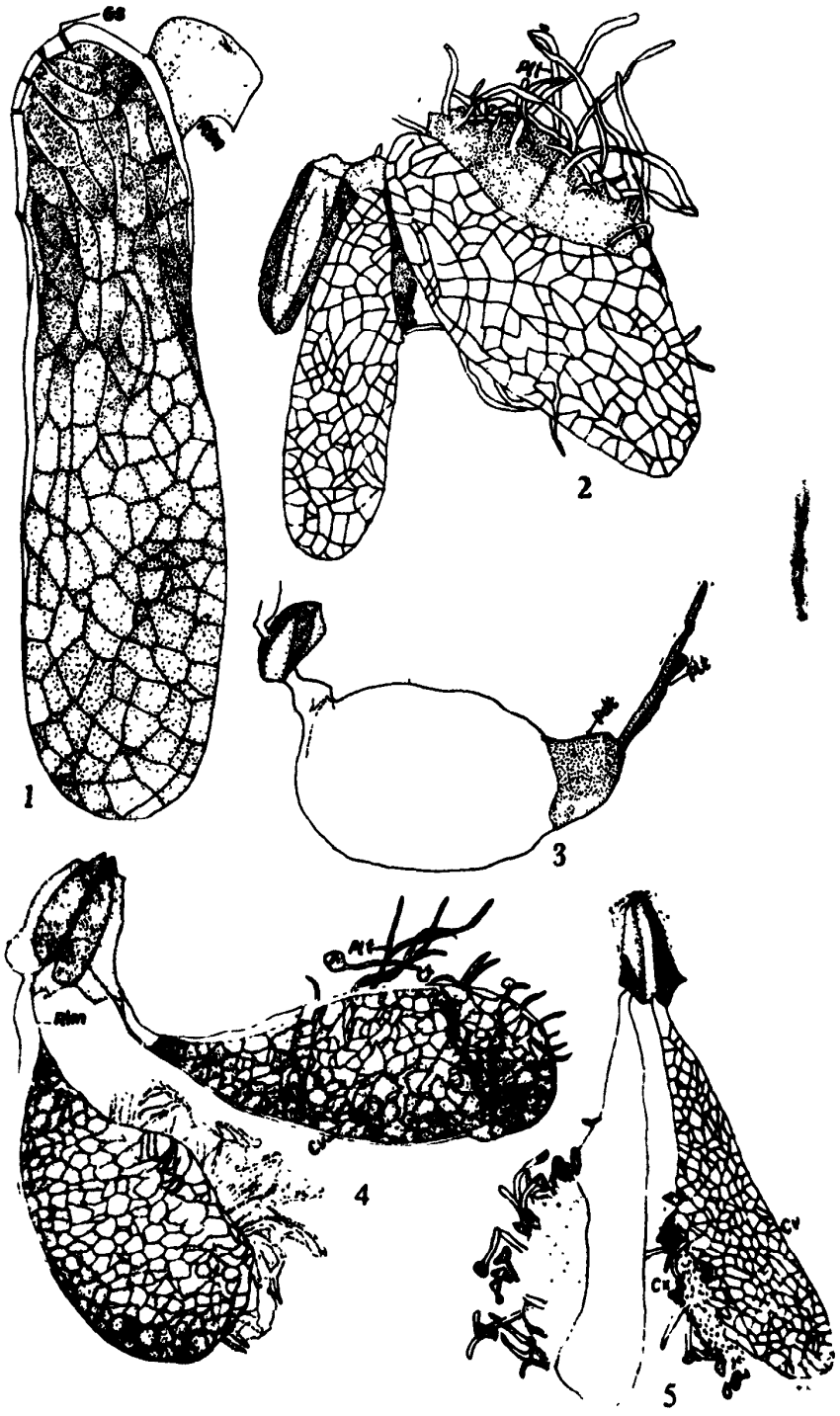

Plate 5. Figs. 1-5 : .Showing germination of pollinia of different genera : 1. Pollinium of *Wattakaka volubilis* showing germinal slits at basal end × 142.5. 2. Pollinium of *W. volubilis* showing basal germination × 73.6. 3. Pollinium of *Leptadenia reticulata* showing apical germination through the pellucid tip × 73.6. 4. Pollinia of *C. procera* showing unilateral germination × 16.9. 5. Pollinia of *Sarcostemma (oxystelma) secamone* showing unilateral germination × 8.45

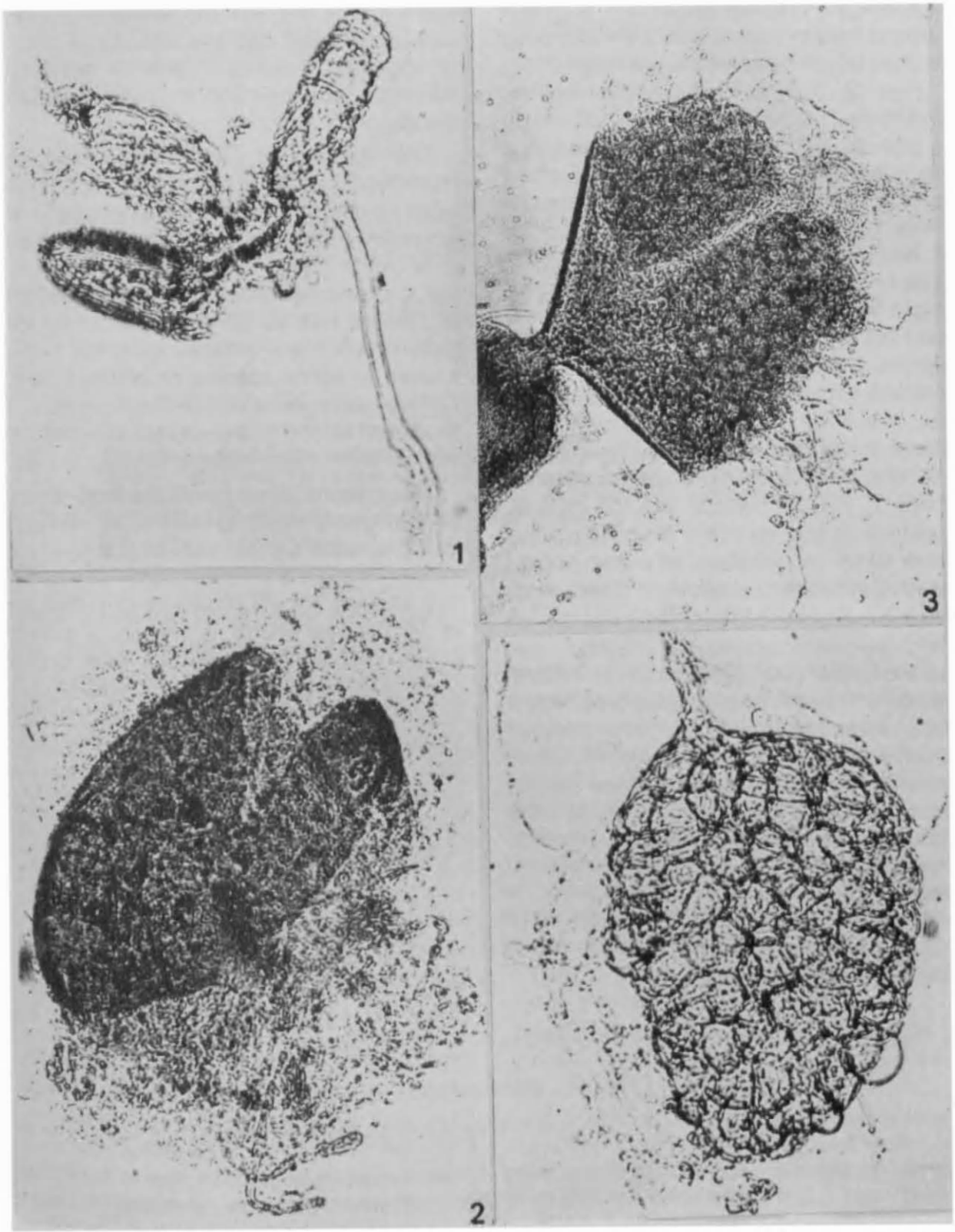

Plate 6, Figs. 1-4 : *In-situ* germinated pollinia : 1. *Gymnema sylvestre* × 565.95. 2. *Tylophora hirsuta* × 356.6. 3. *Hemidesmus indicus* × 154. 4. Single pollen mass showing pollen tubes emerging out from all sides × 315.

Figs. 2 & 3, Plate 4, Figs. 2, 3, 4 & 5) and they get inserted laterally into the stigmatic notches which have lateral openings (Plate 1, Figs. 2, 3, 5 & 6) but similar pollinia with retinacula longer than the half length of pollinia become vertically inserted if the stigmatic notches have vertical openings, e.g. as in *Leptadenia reticulata* (Plate 1, Fig. 4). On the contrary pollinia of *Wattakaka volubilis* which have considerably shorter retinaculum (less than half length of the pollinia) are carried almost inverted by the mouth parts of insect visitors (Plate 4, Fig. 1) and they are inserted with their retinacula downwards into the stigmatic notches which have lateral openings (Plate 1, Fig. 1). Laterally inserted pollinia show unilateral germination (Plate 2, Fig. 3; Plate 3, Fig. 5; Plate 5, Figs.14 & 5) but vertically inserted pollinia show apical germination, whereas, pollinia inserted with their retinaculum downwards show basal germination (Plate 5, Figs.1 & 2).

The flowers of *Gymnema sylvestre, Hemidesmus indicus* and *Tylophora hirsuta* show less developed stigmatic notches and the pollinia are much reduced. These flowers were never found visited by any insert visitors and pollinia germinate while still lying over the gynostegium (Plate 6, Figs. 1-4). Such *in situ* germination of pollinium in these three genera leads to successful autophily (A phenomenon which has, so far, not been reported in family Asclepiadaceae).

CONCLUSION

The above observations clearly indicate that the ratio between the length of retinacula and pollinia and the site of openings of stigmatic notches (lateral or vertical) influence the insertion of pollinia inside the stigmatic notches.

The flowers of *Gymnema sylvestre, Hemidesmus indicus* and *Tylophora hirsuta* were found self pollinated where pollinia or pollen masses germinate even when they were lying over the gynostegium. Such phenomenon of *in situ* germination of pollinia has so far not been reported earlier, in the family Asclepiadaceae but is known in some species of orchids, viz., *Catlleya aurantiaca* where the digestion of rostellum by the flower causes self-pollination (Sheehan & Sheehan 1979).

The present paper forms the first report of autogamy in *G. sylvestre, H. indicus* and *T. hirsuta*. Occurrence of autogamy is supposed to be a primitive mode of pollination and the simple structure of pollinium in *H. indicus* which is merely a pollen mass, and pollinium with a few pollen masses in *G. sylvestre* and *T. hirsuta* may indicate that these genera form the starting steps in the evolutionary ladder of pollination mechanisms in the Asclepiadaceae which otherwise possess an advanced type of pollinium which has a specific mode of insertion and germination.

ACKNOWLEDGEMENT

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