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# ON THE HISTOLOGY OF THE POISON APPARATUS OF CERTAIN APOCRITAN HYMENOPTERA

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The histological details of 3 main components of the apocritan poison apparatus varies considerably in the representatives of the families like Eumenidae, Vespidae, Sphecidae and Xylocopidae. Excepting the size of lumen and shape of the glandular cells, all the remaining details of the poison gland are similar in the families studied. The poison sac in Eumenidae and Vespidae consists of muscles arranged in bundles and the glandular epithelium is syncytial followed by thick intima. Muscle bundles are absent in Sphecidae and Xylocopidae and at the same time the glandular epithelium is of columnar type in Sphecidae and syncytial in Xylocopidae. Intima is thin in both the cases. The alkaline gland possesses a syncytial epithelium in Eumenidae and Vespidae, columnar in Sphecidae and partially syncytial and convoluted in Xylocopidae. Intima is quite thick in Eumenidae. Outer circular muscles are present only in Sphecidae and Xylocopidae.

## INTRODUCTION

Available literature is devoid of studies having been made on the taxonomic significance of the variations of poison apparatus in Hymenoptera. Robertson's (1968) comparative account of the apocritan poison apparatus does not provide an analysis of these variations throwing light on either their taxonomic significance or their phylogenetic importance.

Numerous accounts are otherwise available which deal with the hymenopteran poison apparatus on an ontological background. Some important works are those of Snodgrass (1925), Hermann & Blum (1966 & 1967), Kanwar & Sethi (1967 a & b), Lello (1971 a, b & 1976) and Barr-Nea *et al.* (1976). The present work that covers 4 families of Hymenoptera Apocrita, is comparative in nature and tries to high light the variations which could provide information on their taxonomic importance.

## MATERIAL AND METHODS

Four individuals, one each from families Eumenidae, Sphecidae, Vespidae and Xylocopidae of Apocrita discussed in the present study were collected from Punjab and Himachal Pradesh during the months of September and October, 1978. The live specimens were vivisected in 0.7% saline water and the entire poison

apparatus was fixed in Zanker's fixative. Xylene was used as the clearing agent. The sections cut at 6 $\mu$ were stained in Ehrlic haemotoxylene using eosine as a counter stain. The diagrams are drawn at the same scale with the aid of a camera lucida.

## RESULTS AND DISCUSSION

Comparative histology of different soft parts of hymenopterous poison apparatus *viz.* the acid glands, the poison sac, and the alkaline gland, in different families of Hymenoptera Apocrita, showed certain differences in the present study.

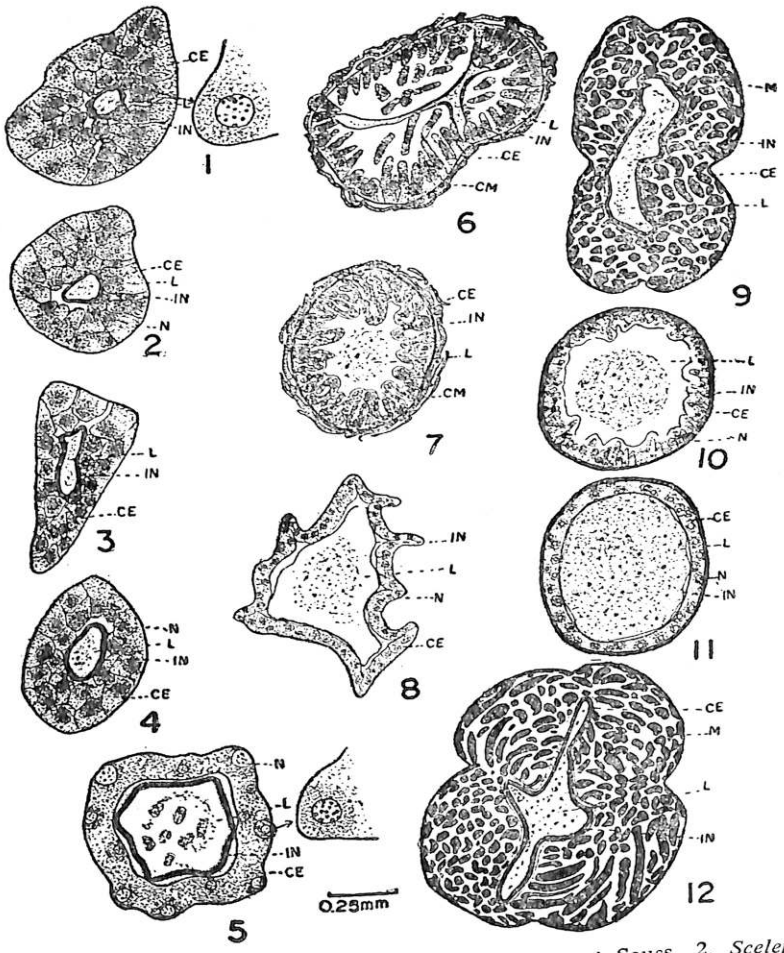
**Acid glands**

The acid gland in general consists of an outermost thin layer of the circular muscles (CM) which is followed internally by a layer of epithelium (CE). The cells of the epithelium are with definite cell boundaries, rounded granular nuclei (N) and granular cytoplasm. The epithelium is lined by a thin intima (IN). Except the nature of the epithelium and shape of the gland's in cross section, the structure of acid glands is almost similar in all the four individuals studied (Figs. 1–4).

**Poison sac or reservoir**

The sac possesses an outermost layer of striated muscle fibres (M), supported an epithelium to interior. A thick layer of intima protects the epithelium. The spacious lumen (L) receives and stores the secretions of poison glands. The following variations in the histology of the poison sac have been observed in the individuals of each family.

In *Eumenes dimidiatepennis* Sauss (Eumenidae) the muscles are arranged in four bundles suggesting that this arrangement may offer powerful compression to the sac. The epithelium is thin and syncytial with perceptible nuclei under high magnifications (Fig. 9). An almost similar epithelium has also been reported by Alum (1953) in the poison sac *Stenobracon deesae*, by Saksena (1960) in *Polistes hebraeus*, by Hermann & Blum (1966) in *Paraponera clavata*, and by Hunt & Hermann (1970) in *Polistes annularis*. *Scelephron intrudens* Smith (Sphecidae) is different from *E. dimidiatepennis* where the columnar epithelium of the former was characterized with distinct cell boundaries rounded and granular nuclei, and granular cytoplasm (Fig. 10). The secretion appears to be of holocrine type. A distinct basement membrane is present beneath a fine layer of compact circular muscles. The intima is relatively less thick and the lumen is conspicuously filled with the secretions. Thus, the poison sac in this species is secretory in nature. In *Vespa auraria* Smith (Vespidae) except the shape of the luman and the arrangement of the muscle bundles, the entire histology is almost similar to that of *E. dimidiatepennis* (Fig. 12).




Figs. 1–4. 1. T.S. of the acid gland of *Eumenes dimidiatepennis* Sauss. 2. *Scelephron intrudens* Smith. 3 *Vespa auraria* Smith. 4. *Xylocopa lemuiscapa* Westw.
Figs. 5–8. 5 T.S. of the alkaline gland of *Eumenes dimidiatepennis* Sauss. 6. *Scelephron intrudens* Smith. 7. *Vespa auraria* Smith. 8. *Xylocopa lemuiscapa* Westw.
Figs. 9–12. 9. T.S. of the poison sac of *Eumenes dimidiatepennis* Sauss. 10. *Scelephron intrudens* Smith, 11. *Xylocopa lemuiscapa* Westw. 12. *Vespa auraria* Smith, (Abbreuiations wlth the text)

bundles, the entire histology is almost similar to that of *E. dimidiatepennis* (Fig. 12) Similar histological details have also been given by Crouch & Smith (1958) in *Polistes exclamous*. In *Xylocopa lemuiscapa* Westw. (Xylocopidae) the conditions are different from those described in the above three families (Fig. 11). The epithelium is relatively more thick and syncytial in nature. The nuclei are quite distinct, large and granular. Externally, the epithelium is enveloped by a uniformly thin layer of the circular muscles. However, the muscles are too weak and not capable of powerful compression. The intima is relatively thin and the lumen is wide and circular containing the secretions of the poison glands and the epithelium of the reservoir itself.

**Alkaline gland**

The alkaline or Dufour's gland is found to be generally of either syncytial type or with distinct cells having centrally placed nuclei and granular cytoplasm. The basament membrane is inconspicuous. The circular muscles are simple and the intima presents variable thickness in different species and at different regions of the alkaline gland in the same species. Familywise comparative study of the alkaline gland is as follows :

In *E. dimidiatepennis*, the epithelium is syncytial in nature having extraordinarily large nuclei scattered here and there (Fig. 5). The basement membrane is inconspicuous. No muscle fibres are distinctly visible. The intima lining the lumen is thick and regular. The lumen contains the secretions. In *S. intrudens* unlike *E dimidiatepennis* the epithelium is columnar type, having large granular nuclei and granular cytoplasm (Fig. 6). Some detached cells indicate holocrine mode of secretion. The epithelium rests on a thin but distinct basement membrane. The muscle layer is represented by an outer layer of longitudinal muscles followed by an inner discontinuous layer of circular muscles. At places, the intima is pushed inward giving the lumen an irregular shape. In *V. auraria* (Fig. 7), while the histology of the poison sac is similar to that of *E. dimidiatepennis* Eumenidae), marked differences are found in the histology of the alkaline gland. Here, the cellular epithelium, though appeared to be syncytial, the cell boundaries are faint and thrown into irregular folds. The nuclei are large and granular. The cytoplasm too is granular. The entire epithelium externally rests on a distinct basement membrane. There is no trace of distinct muscle fibres and in this respect the family Vespidae closely resembles Eumenidae However, unlike Eumenidae. there is a thin layer of intima lining the irregular lumen. *X. lemuiscapa* manifests a different picture where apparently syncytial epithelium is thrown into numerous irregular folds. The cell boundaries are very faintly marked and the nuclei are distinct. The basement membrane is distinctly

visible. The arrangement of the muscles is quite similar to that of *S. intrudens* (Fig. 6). The intimal lining of the irregular lumen is thin, discontinuous and inconspicuous. Therefore, in certain respects family Xylocopidae can be bracketed with that of Sphecidae.

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