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COMPARATIVE STUDY OF THE FEMALE TERMINALIA OF FULGOROIDEA.

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INTRODUCTION

The following study of the comparative morphology of female genitalia of Fulgoroidea is undertaken with a view to exploring possibilities of finding out a more practical system of classification of the famillies and also in order to discover the relationship among the different groups. The necessity for more morphological work has been stressed by Imms (1957).

A number of efforts have been made in the past to study structural features relevant to the need of taxonomic study of Fulgoroidea. In his last paper *"on the classification of Fulgoroidea"* Muir (1930) has discussed the significance of various structures which can afford a basis of classification. They include wings, hind tarsi, hind trochanter with corresponding coxae etc. Metcalf (1943) suggested a more intensive study of the wing venation. These features along with those adopted by earlier workers including Stal (1864-66), Melichar (1915) and Distant (1906) which take into account the additional features of cranial capsules consisting of clypeal suture, cephalic horn, ocelli are the only means at the disposal of the student who embarks on an attempt to classify these Fulgorid bugs.

The history of classification also tells a story of haphazard assemblage and allocation of different ranks or groups. Stal (1864-66) proposed the following thirteen subfamilies constituting the family Fulgoridae.

1. Fulgorinae
2. Cixiinae
3. Derbinae
4. Dictyopharinae
5. Issinae
6. Tropiduchinae

7. Lophopinae
8. Eurybrachidinae
9. Flatinae
10. Ricaniinae
11. Achilinae
12. Delphacinae
13. Tettigometrinae.

Schröder (1925) gave a separate rank to the family Tettigometridae. Muir (1930) raised all these above subfamilies to the rank of families and added five more, viz.,

1. Meenoplidae
2. Kinnaridae
3. Achilixidae
4. Nogodinidae
5. Acanolinidae

Since then, Fennah (1949) and China & Fennah (1952) added two more families :—Gengidae and Hypochthunidae.

DESCRIPTIONS

With the small collection at the disposal of the present authors, it is impossible to asses the suitability of this classification as well as to give an opinion on the merit of the various structures which have been adopted as criteria in the classification of this large group of more than 1200 genera. However a comparative study of the ovipositors and associated structures in the females appeared to the authors as suitable for utilizing this structure, in the taxonomic grouping of these forms. On the basis of this study the authors have so far observed five types of ovipositors and associated structurs belonging to different families. They are :—

1. Generalized type complete ovipositor as found in Delphacidae, Dictyopharidae, Flatidae, Ricanidae, Tropiduchidae and Tettigometridae.
2. Second type is found in Fulgoridae, which is represented in the author's collection by *Pyrops* sp.
3. The third type is found in Cixiidae whose type is taken here as ***Oliarus hodgarti*** Walker.

EXPLANATION OF ABBREVIATIONS USED IN TEXT FIGS.

DV	=	Dorsal Valves.
IV	=	Inner Valve.
PFR	=	Pygofer.
TP	=	Terminal Plate.
VFR	=	Valvifer.
VV	=	Ventral Valve.

4. The fourth type is found in *Messina* sp. representing Eurybrachidae.

5. The fifth type of ovipositor was found in *Pyrilla* species belonging to the family Lophopidae. Among the rest of the families some have reduced ovipositor while a few have not yet been studied.

The following representatives of the different families of Fulgoroidea were used for study :—

1. *Pyrops* sp. (Fulgoridae)
2. *Oliarus hodgarti* (Cixiidae).
3. *Sogata* sp. (Delphacidae)
4. *Nisia atrovenosa* (Meenoplidae)
5. *Dictyophara* sp. (Dictyophoridae)
6. *Paragomeda typica* (Flatidae)
7. *Caliscelis eximia* (Issidae)
8. *Ricania zebra* (Ricanidae)
9. *Pyrilla perpusilla* Walker (Lophopidae.)
10. *Messina* sp. (Eurybrachidae)
11. *Hilda bengalensis* (Tettigometridae.)
12. *Diostrombus carnosus* (Derbidae)

1. SOGATA SPP. (DELPHACIDAE)

The female terminalia of *S. furcifera* Hov. *S. pusana* Dist. and *S. Cornicaudatus* Qadri and Mirza and two other species were examined. In addition to it the Ovipositor of

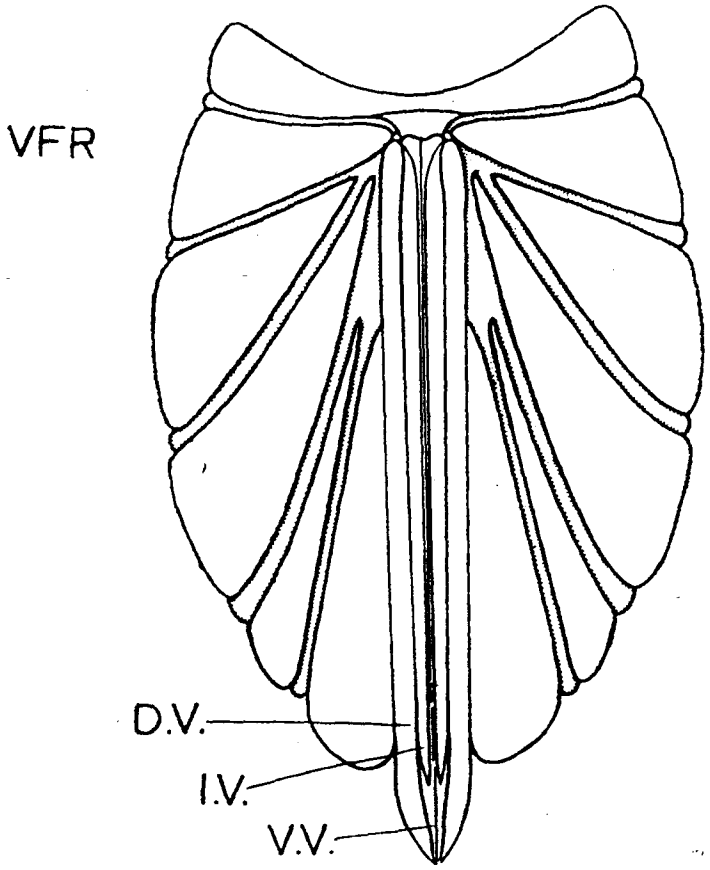

Fig. 1. *Sogata Cornicaudatus*

Sardia rostarata Melich and *Areopus sp.* were examined. The ovipositor of Delphacidae is complete and resembles the Cicadallid type. It issues very much from the anterior end of the abdomen due to the telescoping of sternites of the abdomen. All the three pairs of valves are very well-developed. The drosal valves are pointed and sclerotized at their apices. The inner valves are also elongated and reach as far as the apex of the abdomen. The pygofer is minute and conical.

2. PYROPS SP. (FULGORIDAE)

The female terminalia of *Pyrops* are peculiar and different from any other Fulgoroid family. The tenth tergum continues below in the form of short sclerotized plates meeting in the middle by narrow tips. At the point of this junction and dorsal to it is a small pygofer. The dorsal valves are bilobed sheathing plate and cover the ventral and median valves from the lower side. Both the ventral as well as inner pairs of valves are fully developed. The ventral valves have also well defined valvifers.

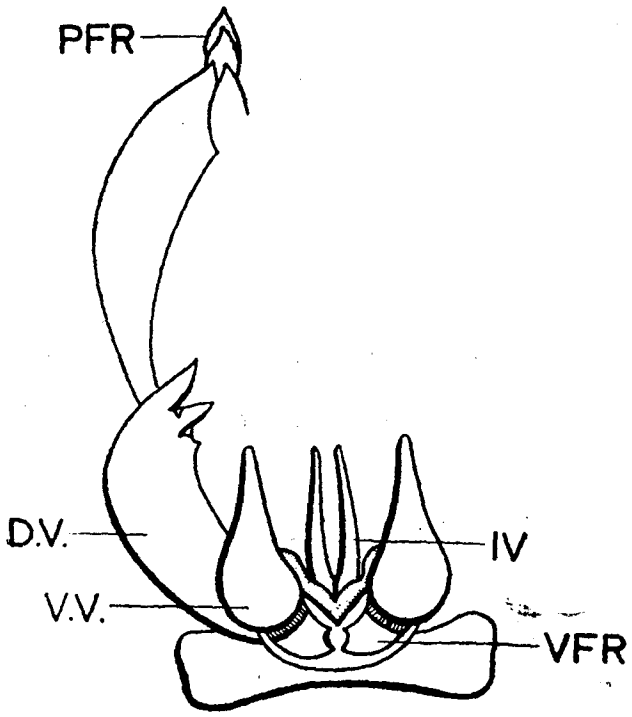

Fig. 2. *Pyrops sp.*

3. OLIARUS HODGARTI WALKER (CIXIIDAE)

The female terminalia of *Oliarus* are characterized by a broad plate at the end of the abdomen carrying a minute pygofer. This plate appears to have been formed by the fusion of the two dorsal valves, it is beset with pores of wax glands. Below this plate there are well developed inner valves which are attached to this plate by a flexible membrane. The ventral or anterior valves are also well developed and are carried on distinct valvifers.

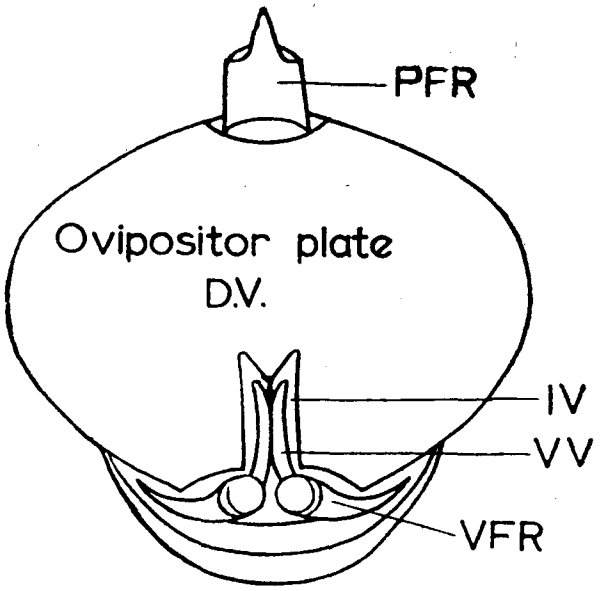

Fig. 3. *Oliarus hodgarti*

4. MESSINA SP. (EURYBRACHIDAE)

The female genitalia is remarkable for enormous development of the dorsal ovipositor valve which is elongated, oval plate and pinched in the middle. The posterior end of the plate is much narrower than the anterior. The two dorsal valves conceal the minute inner or median valves which are probably the main organs for the deposition of eggs. The anterior valves consist of highly sclerotized valvifer without any valve. They lie below the dorsal valves. The pygofer is extremely elongated and curved ventrally.

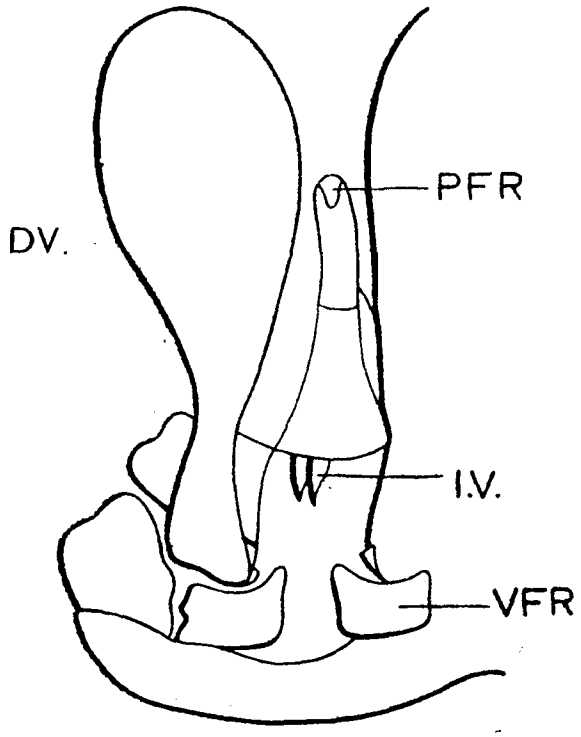

Fig. 4. *Messina sp.*

5. PYRILLA PERPUSILLA WALKER (LOPHOPIDAE)

In case of *Pyrilla* the pygofer is minute, the 10th tergum at its extreme end bears a pair of large oval plates which produce waxy threads for covering the eggs. The sternum of the 8th segment is membranous. The valvifers of the ventral valves are well-developed, while the valves themselves are reduced to more conical rods which are immovably attached to valvifers. The median or the inner valves are smaller in size while the dorsal pair of valves are large and elongated plates.

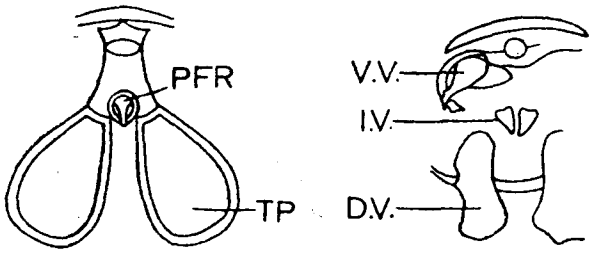

Fig. 5. *Pyrilla perpusilla*

CONCLUSIONS

On the basis of the above five distinct types of ovipositors and pygofers it can easily be concluded that in the super family Fulgoroidea at least five groups do justify a status of families, as has been recognised in case of Orthoptera

or Hymenoptera. With the study of the remaining families including Kinnaridae, Achilixidae, Nogodinidae, Tropiduchidae, Achilidae, Gengidae and Acanolinidae it might be possible to distinguish more basic types of ovipositors. This basis will then necessitate a regrouping of the existing twenty families into as many families as have distinctive ovipositors. The rest of the families will either be relegated to the rank of sub-families as for example Flatidae, Ricaniidae and Dictyopharidae which should easily form one single family with Delphacidae or will have to be further studied for fundamental morphological characteristics. This will be needed specially in families like Derbidae and Issidae in which ovipositor is extremely reduced.

A more fruitful and correct study of relationship of different groups of Fulgoroidea shall have to follow the complete study of the ovipositors of all of them.

SUMMARY

Female terminalia of representatives of the 12 families of Fulgoroidea, Homoptera were studied. The following five types were marked out as distinctive of the groups which they belong.

(i) They are generalized complete type found in Delphacidae, Dictyopharidae, Tropiduchidae, Flatidae, Ricaniidae, and Tettigometridae.

(ii) Second type was found in (Fulgoridae) in *Pyrops*.

(iii) Third type in *Oliarus* family (Cixiidae).

(iv) The fourth type was found in *Messina*. (Eurybrachidae).

(v) The fifth type was described in *Pyrilla*. (Lophopidae).

The family Fulgoridae has been raised to the rank of super family Fulgoroidea. The authors have suggested a review of the status of these twenty family on the same basis. A more correct picture of the relationship of these groups will emerge following a thorough and more comprehensive study of female genitalia of different representatives of the groups included in the super family Fulgoroidea.

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