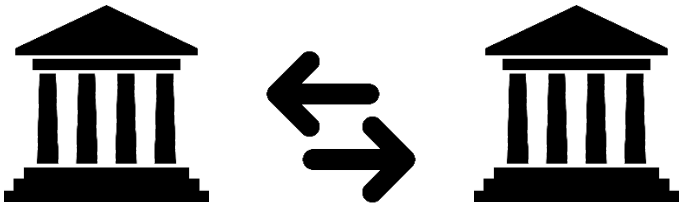

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STUDIES ON INDIAN ARAEOPIDAE[=DELPHACIDAE] (HOMOPTERA, FULGOROIDEA.)*

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Araeopidae is one of the most neglected families of Homoptera. From time to time the students of Fulgoroidea, Distant (1906), Lefroy (1909), Muir (1915) and Metcalf (1943), have pointed out the necessity of a detailed study of these insects. Very little is known regarding the morphology of araeopids save for the recent publications of Mathur and Joseph (1961) and Joseph (1961). The need for the study of systematics of Indian Araeopidae is easily conceivable from the fact that many of our common species belonging to this family are unrecorded. Hence the author has taken up the studies of the morphology and systematics of these insects. Some of the salient features of these studies are illustrated below.

Araeopids are small, delicate insects never measuring more than a centimetre in length from the vertex to the tip of the tegmina, although some forms measure even less than two millimetres. They can be easily identified from other members of the superfamily Fulgoroidea by a large mobile spur borne on the inner side of the apex of the hind tibiae. The most striking feature of the family as a whole is its great homogeneity in general aspect and appearence. They are polymorphic, their tegmina are found to occur in three different forms, *viz.*, brachypterous—very short with reduced venation covering only the basal segments of the abdomen; koelopterous—moderate length covering most part of the abdomen with fairly developed venation; macropterous—longer than the abdomen with well developed venation. Of the many collections made during the course of this study the author has got only one species of dimorphic araeopid, *Delphacodes propinqua*, which occurs in koelopterous as well as macropterous forms.

The head is generally simple, relatively small, but in a few genera it is extremely developed, *e.g.*, *Embalophora* and *Pseudoembalophora*, and is opisthognathous. It is decorated with keels, the keels varying in number, extent and prominence. The compound eyes are reniform occupying considerable area of head and surround the posterior part of antennae. The antennae are usually simple with a short basal segment, a short sometimes elongate second segment and a terminal flagellum. Occasionally either the first or second or both the segments are greatly elongated and considerably flattened, (*e.g.*, *Perkinsiella*) or the basal segment is triangular in cross-section with its length

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considerably exceeding the next segment (*e. g.*, *Purohita*). There are two ocelli, each on either side between the compound eye and the lateral carina.

Three species of araeopids belonging to two tribes—*Liburnia pallescens*, *Delphacodes propinqua* (tribe Delphacini) and *Purohita cervina* (tribe Tropidocephalini)—were selected for detailed morphological studies. The head capsule is devoid of clypeolabral and epicranial sutures. The epistomal suture is well developed bearing a highly developed epistomal ridge. The occipital suture is intercepted at the dorsolateral sides by the compound eyes. The mandibular plates are homologised to the pleurostoma of generalised insect cranium. The anterior pair of arms of tentorium exhibits varying degrees of reduction, whereas the posterior as well as the dorsal pairs are well developed. The anterior arms are atrophied in the tribe Delphacini; in the tribe Tropidocephalini they are complete but are much reduced. It is interesting to observe the fate of the anterior arms in these two tribes under study as they are either atrophied or reduced but at the same time the dorsal arms are well developed. The normal function of the anterior arms is the strengthening of the facial region in insects which is secondarily taken up by the highly developed epistomal ridge in araeopids and consequently this reduction. The musculature of the head capsule follows the general pattern of Fulgoroidea.

The mouth parts are of typical hemipterous type. There is no distinction between the lever and the inner arm of the mandibular stylet. The maxillary stylet is devoid of a maxillary lever. The labium is four segmented and extends beyond the forecoxae. The apex of the fourth segment has undergone special modifications to form a temporary ring around the stylets when the intrinsic muscles of the labium contract. The chaetotaxy and apical clamp are similar in Delphacini and Tropidocephalini. The lora of hypopharynx show variation in size from species to species. The membrane connecting the labium with the maxillary plates, designed here as the labiomaxillary membrane, is homologised with the hypostomal bridge of Heteroptera.

Araeopids exhibit great morphological modifications in the thorax and particularly marked in the metathorax. The pro- and mesothorax very much resemble those of other fulgoroids except for a number of sutures in the latter. The development of the sutures in the thorax of these insects is interesting as it follows a similar course in the araeopids suggesting similar lines of evolution. In araeopids a jumping mechanism is developed in connection with the hind legs, although curiously enough, the metathorax lacks furca. In order to compensate this loss, the metathorax has developed a complicated system of ridges to form an internal skeletal frame work at the lateral sides to withstand the extra stresses and strains shouldered by it. The hind legs are remarkable for their large size in comparison to the pro- and mesothoracic legs and also for the development of the spur on the hind tibiae. From the ventral side of the trochanter arises an apodeme projecting into the metathorax through the coxa for the insertion of muscles coming from the thorax. This is a

new development come across in connection with the jumping mechanism. The wing venation is comparatively well developed. Unlike that of certain Fulgoroidea, such as the members of the families Flatidae and Ricaniidae etc., there is no precostal region in araeopids. In the tegmen all along the course of veins are provided with macrotrichiae except second cubitus.

The abdomen is composed of eleven segments, the eighth and ninth in female and the ninth alone in the male represent the genital segments. The tenth and eleventh are fused together. In male the tenth segment bears a pair of anteriorly directed processes, the anal processes, which are absent in *Peregrinus maidis*. The females are devoid of them.

The alimentary canal is an almost straight tube with the crop arising from the stomodaeum as a sideways diverticulum. It is similar in histology to that of other Homoptera. The mesenteron is simple and without filter chamber. The malpighian tubules are four in number, the two of each side join together before opening into the alimentary tract. There is a pair of well developed salivary glands, whose principal glands are lobulated.

The respiratory system consists of two pairs of thoracic and eight pairs of abdominal spiracles. The thoracic spiracles and the first two pairs of abdominal spiracles have an external closing apparatus; the remaining have an internal closing type. There is no transverse commissure in the abdomen except for the eighth in female.

The female reproductive organs show some interesting modifications in the position of common oviduct and vagina. The vagina is deflected to the left side and due to this deflection the region immediately anterior to it, namely the common oviduct, comes to occupy the left side. The number of ovarioles constituting the ovary vary not only from species to species but also within the species. The egg tube is acrotropic type. The spermatheca and the accessory gland open almost at the same level to the vagina. The ovipositor is well developed and of typical homopterous type. The first pair of valvulae themselves and these and the second pair of valvulae are articulated by ridge-and-groove method.

The internal male reproductive organs are of generalised insect type. Each testis is composed of two sperm tubes in the two species under ovservation namely *Delphacodes propinqua* and *Liburnia pallescens*. The sperm tube has a number of apical cells. The vas deferens is devoid of a distinct seminal vesicle. The ejaculatory duct has one median and two lateral parts. The 'sheath', 'chamber' and part of the basal plate bridge are variously modified regions of the ejaculatory duct. The pygofer or ninth segment in araeopids is ring-shaped and is without any distinction into tergum, laterotergites or pleurosternite. The length and breadth of the opening of pygofer, the outgrowth of its ventral margin, the anal angles and the development of the

diaphragm etc., vary with the species. The parameres vary in shape and size in different species. The aedeagus periandrum may be entire or may be decorated with spines.

During the course of the study of systematics, it has been observed that the external male genitalia is the most reliable specific character. They help not only for specific identification but also afford generic criteria. The characters of female genitalia can be utilised with advantage as has been done by Hassan (1948) and is followed here. In the present study, the author has followed the general trend of notable araeopidan systematists for the sake of convenience. However, he feels that since the male and female genitalia form the chief basis of reliable specific characters they would gain preference over other characters, *viz.*, vertex, carination, spur and colouration etc. It would, therefore, be advisable to arrive at specific identification on the basis of genitalia and confirm the same by other subsidiary characters.

Collections of araeopids were made from various parts of India—Uttar Pradesh, Rajasthan, Delhi, Orissa, Maharashtra, Madras and Kerala. Of the twentyone species collected, twelve—*Tropidocephala signata* (Distant), *Purohita cervina* Distant, *Perkinsiella insignis* (Distant), *Perkinsiella sinensis* Kirkaldy, *Delphacodes propinqua* Fieber, *Phyllodinus pulchellus* (Distant), *Liburnia pallescens* (Distant) *Liburnia furcifera* (Horvath), *Liburnia pusana* (Distant), *Peregrinus maidis* (Ashmead), *Sardia rostrata* Melichar and *Nilaparvata lugens* (Stal)—are already reported, eight species—*Sogata rhodesi* Muir, *Chloriona paludum* (Kirkaldy), *Coronacella krikaldyi* (Muir), *Delphacodes albovitta* (Matsmura), *Delphacodes crawfordi* Muir and Giffard, *Phyllodinus sauteri* Muir, *Dicranotropis muiri* Kirkaldy and *Dicranotropis cognata* Muir—are reported here for the first time from India and the remaining one—*Stenocranus ajmerensis*—is a new species. A key to the identification is given wherever more than one species is described in a single genus.

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