

COMPARATIVE STUDIES ON THE LARVAL
FORMS OF ODONATA, HEAD AND ITS APPENDAGES

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(With 36 Text-figures.)

INTRODUCTION

The structure of head and its appendages in Odonata has been studied in a number of species by various workers (Butler, 1904; Corbet, 1953; Fraser, 1933; Kumar, 1972; Mathur, 1956). These accounts do not give detailed information on the degree of differentiation and limits of head sclerites. In view of this, it is difficult to judge on the basis of available information how far the different larval forms resemble or differ from one another with respect to the head and its appendages. An attempt has been made to elucidate this aspect in six species of larval Odonata and the observations are presented here.

MATERIAL AND METHOD

Six species of dragonfly larvae belonging to different sub-groups were examined. These are as follows :

SUBORDER : ZYGOPTERA

Family : COENAGRIIDAE

Subfamily : OENAGRIINAE

Pseudagrion decorum (Rambur)

Ceriagrion coromandelianum (Fabr.)

Ischnura senegalensis (Rambur)

Ischnura delicata (Hagen)

Family : PLATYCNEMIDIDAE

Subfamily : PLATYCNEMINAE

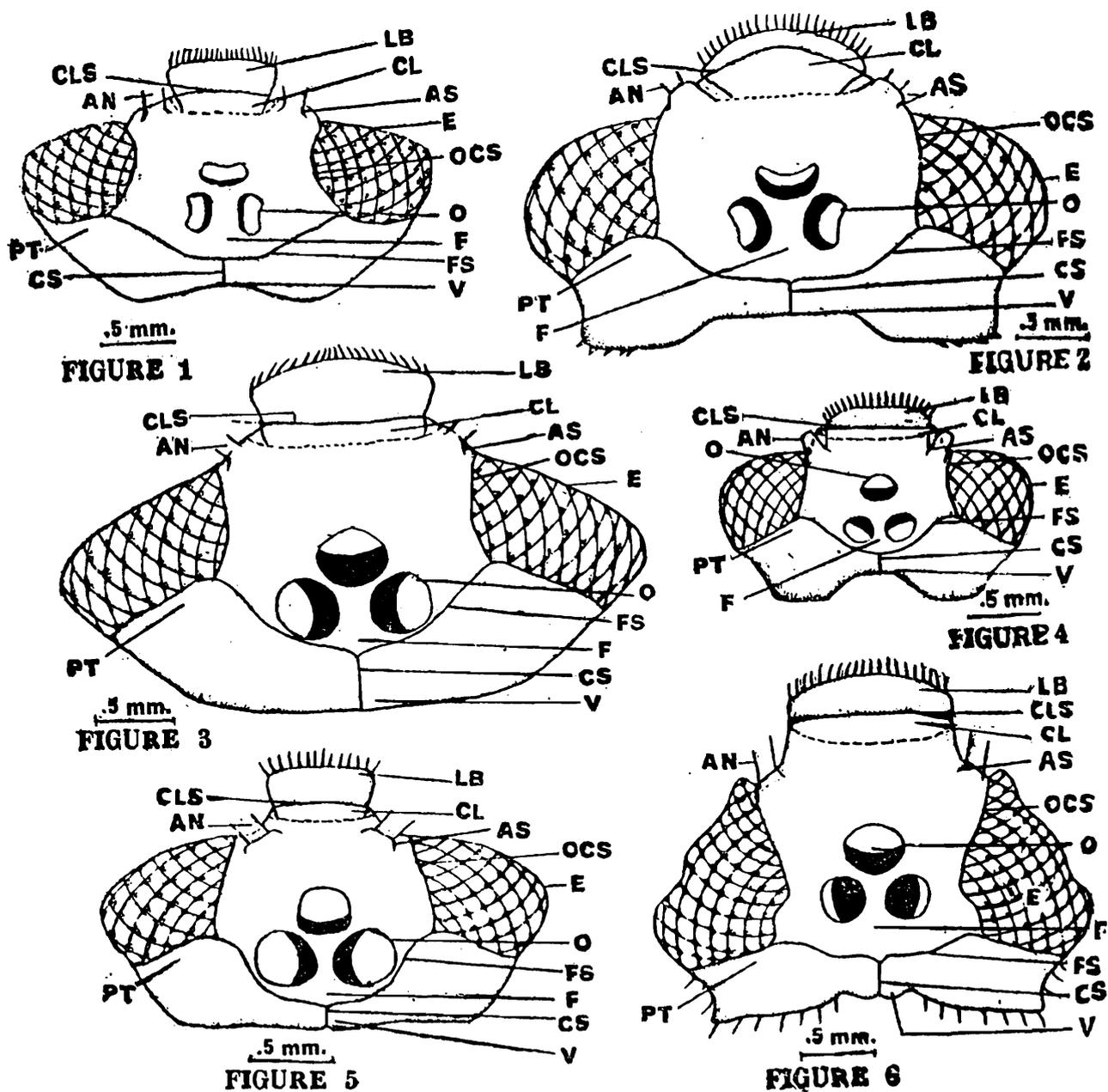
Copera marginipes (Rambur)

Family : CHOLOROCYPHIDAE

Subfamily : LIBELLAGINAE

Libellago lineata lineata (Burmeister)

The larvae were collected from different localities in Rewa (M. P., India) and were identified through British Museum Natural History, London. They were examined fresh as well as after preserving in the mixture of 70 per cent alcohol and Glycertne (10 : 1). For the study of sclerites, the insects were treated with 10 per cent hot solution of KOH for a few minutes and then washed in water. Specimens were then dissected and examined under a dissecting binocular microscope. They were also examined without treatment with KOH solution.



Text-figs. 1-6. Head of the larvae (Dorsal view) :

1. *Copera marginipes*, 2. *Pseudagrion decorum*, 3. *Ceriagrion coromandelianum*,
4. *Ischnura delicata*, 5. *Ischnura senegalensis*, 6. *Libellago lineata*.

HEAD

1. EXTERNAL STRUCTURE OF THE HEAD

The head (Text-figs. 1 to 12) is *prognathus* and is firmly attached to the prothorax by a small cervix. It is rather elongate and forms a kind of dorso-ventrally flattened cone. In facial view, it is pear shaped having a semicircular outline narrowing towards the apex. A pair of *compound eyes* (E) are located on the dorso-lateral sides. In addition to the compound eyes, there are three *ocelli* (O) which are situated symmetrically on the dorsal surface of the head. The *antennae* (AN) are situated on the upper part of the face. The posterior surface of the head is occupied by an opening from the head into the neck. The opening is a large aperture and is known as the *occipital foramen* (OCF). On the under surface of the head the *mandibles* (MD) and *maxillae* (MX) occupy the lateral regions ; the *labrum* (LB) projects from the anterior margins of the cranium. The base of the labium lies transversely below the occipital foramen. Thus the true ventral area is between the base of the appendages, median part of which forms the *hypopharynx* (HY). Anterior to it and immediately behind the base of the labrum is the mouth. The space enclosed by mouth appendages, which lies entirely outside the body and is merely an intergnathal space and is known as the preoral cavity.

2. SUTURES OF THE CRANIUM

Following sutures are evident in the cranium, they are the grooves on the surface of the head marking its endoskeletal ridges.

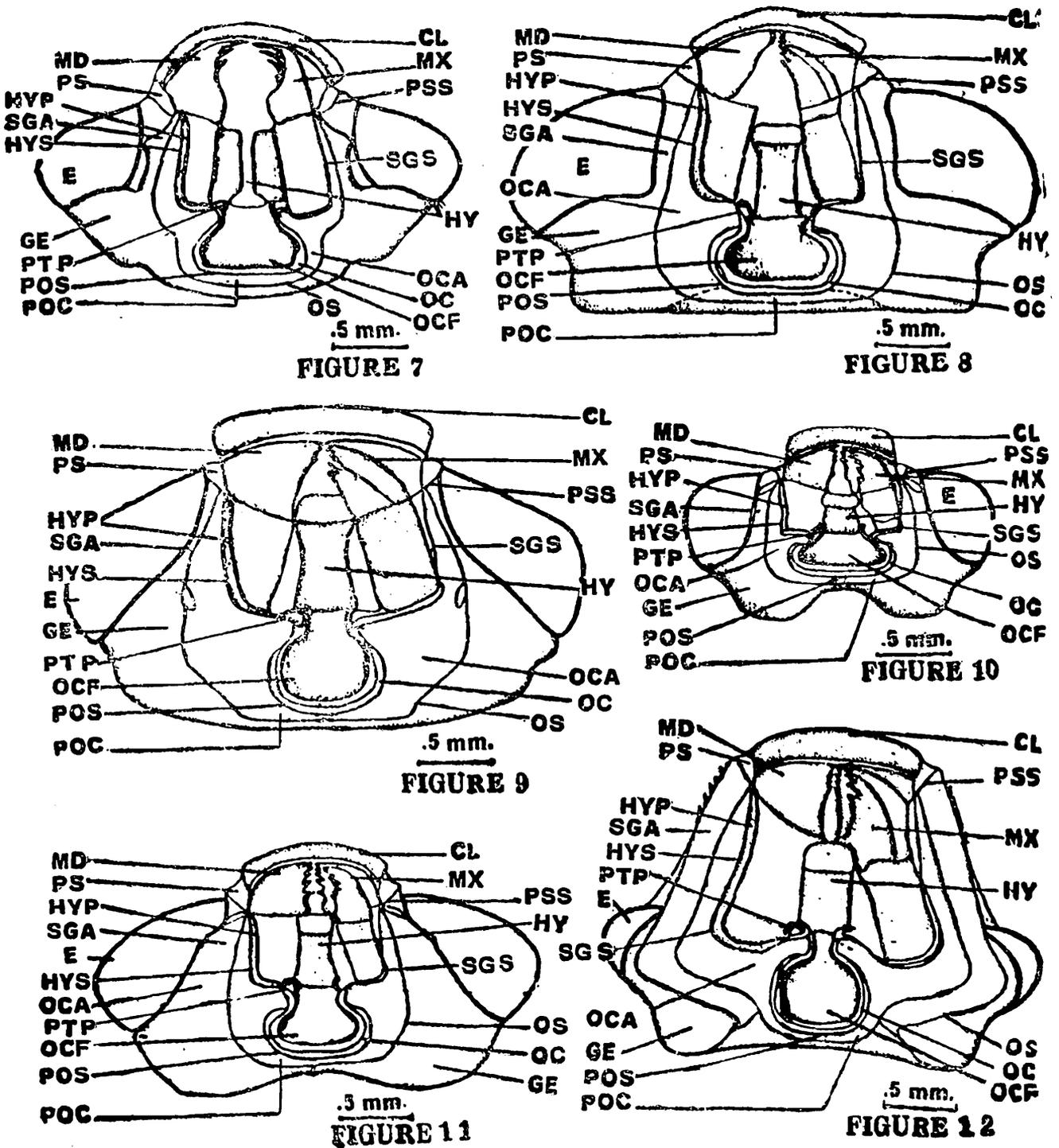
(a) *Epicranial suture* (Text-figs. 1 to 6). The epicranial suture is well marked being a 'Y' shaped groove on the dorsal surface of the head. Its mesial dorsal arm the *coronal suture* (CS) extends from posterior part of the head upto the level of the lateral ocelli, where it branches into anterior forks, the *frontal sutures* (FS). The two sutures diverge from the coronal suture near the lateral ocelli, run towards and along their lateral margins and extend laterally and anteriorly on the face towards ocular sutures (OCS).

(b) *The antennal suture* (Text-figs. 1 to 6). The antennal suture (AS) surround the antennal base.

(c) *The occipital suture* (Text-figs. 7 to 12). The occipital suture (OS) is horseshoe shaped and runs on the ventral surface of the head. Each of its arms, starting from a point slightly posterior to the ventral articulation of the mandible of its side, traverses the cranial wall in

an antero-posterior direction to meet the other, posteriorly behind the occipital foramen (OCF).

(d) *Post occipital suture* (Text-figs. 7 to 12). The post occipital suture (POS) lies on the extreme posterior part of the cranium where it closely surrounds the occipital foramen dorsally and laterally. Each lower end of the suture has a pit (PTP) which is the point of invagination of each posterior tentorial arm.



Text-figs. 7-12. Ventral view of the head with right maxillae removed showing position of the mandibles in different larval forms :

- 7. *Copera margiuiipes*, 8. *Pseudagrion decorum*, 9. *Ceriagrion coromandelianum*,
- 10. *Ischnura delicata*, 11. *Ischnura senegalensis*, 12. *Libellago lineata*.

(e) *Subgenal suture* (Text-figs. 7 to 12). The subgenal suture (SGS) is present on each side of the head close to the posterior edge of the lateral cranial wall, it extends from the *posterior tentorial pit* (PTP) to a point, just above the anterior articulation of the mandible and thus it arches upward over the mandible. The part of the subgenal suture which arches over the mandible is called the *pleuro-stomal suture* (PSS) and the part posterior the mandible is known as the *hypostomal suture* (HYS).

(f) *Ocular Suture* (Text-figs. 1 to 6). Each eye is externally surrounded by distinct circular groove, the *ocular suture* (OCS).

3. AREAS OF THE CRANIUM

The principal areas (Text-figs. 1 to 12) set off in the cranium by the cranial sutures are the *fronto-clypeal area*, this area is bounded by the frontal sutures (FS) dorsally, antennal bases and by the clypeo-labral sutures (CLS) ventrally. As the epistomal suture is absent, this area is not clearly demarcated into frons and the clypeus. The limits of the clypeus may be marked out by an imaginary line joining the two anterior tentorial pits. The *clypeus* (CL) is distinguishable into a dorsal heavily chitinised and pigmented area the post clypeus and a weakly chitinised non pigmented area the anticlypeus. Each dorso-lateral corner of the postclypeus bears a "U" like depression the *pricoila* into which is received the anterior articulatory condyle of the mandible.

The parietals (Text-figs. 1 to 6). The lateral areas separated by the coronal suture (CS) are the *parietals* (PT). They are bounded dorsally and ventrally by frontal (FS) and occipital sutures (OS) respectively. The dorsal surface of the two parietals forming the top of the head constitutes the *vertex* (V). The lateral parts of the parietals beneath the eyes are *genae*. Each *gena* (GE) is limited anteriorly by the pleuro-stomal suture (PSS) ventrally and posteriorly by the occipital suture (OS). The *occipital arch* (OCA) is a horse-shoe shaped sclerite on the posterior surface of the head between the occipital (OS) and post occipital sutures (POS). It is distinguishable into a narrow, posterior median strip, the *occiput* (POC), the area of the occipital arch between the occipital and post occipital sutures and the post gena. The post-gena areas are the lateral extensions of the occipital arch. Each post gena lies between the subgenal and the occipital sutures of its side. It starts behind the ventral articulation of the respective mandible as a narrow space and becomes broader and broader while approaching the occiput near the foramen. At its inner margin it possesses a cup

to receive the condyle of juxtacardo. Ventral to articulation point of maxilla there is another cup to receive the condyle of the mandible. The *post occiput* (POC) is narrow posterior rim of the cranium set off from the occipital arch by the post occipital suture (POS) and to which the neck membrane is attached. Laterally the posterior margin of the post occiput (POC) is produced on each side in small process, the *occipital condyle* (OC) to which is articulated the lateral cervical sclerite. The *sub genal areas* (SGA) are the two narrow marginal areas on each side of the cranium. Inner to the sub genal area and above the mandible is distinguishable the *pleurostoma* (PS), and the part behind the mandible as the *hypostoma* (HYP).

Position of ocelli differs from species to species (Text-figs. 1 to 6). The lateral ocelli in *Ceriagrion coromandelianum*, *Ischnura delicata* and *Ischnura senegalensis* are situated nearer to the frontal sutures, in *Copera marginipis*, *Pseudagrion decorum* and in *Libellago lineata* they are situated farther from it.

ANTENNAE

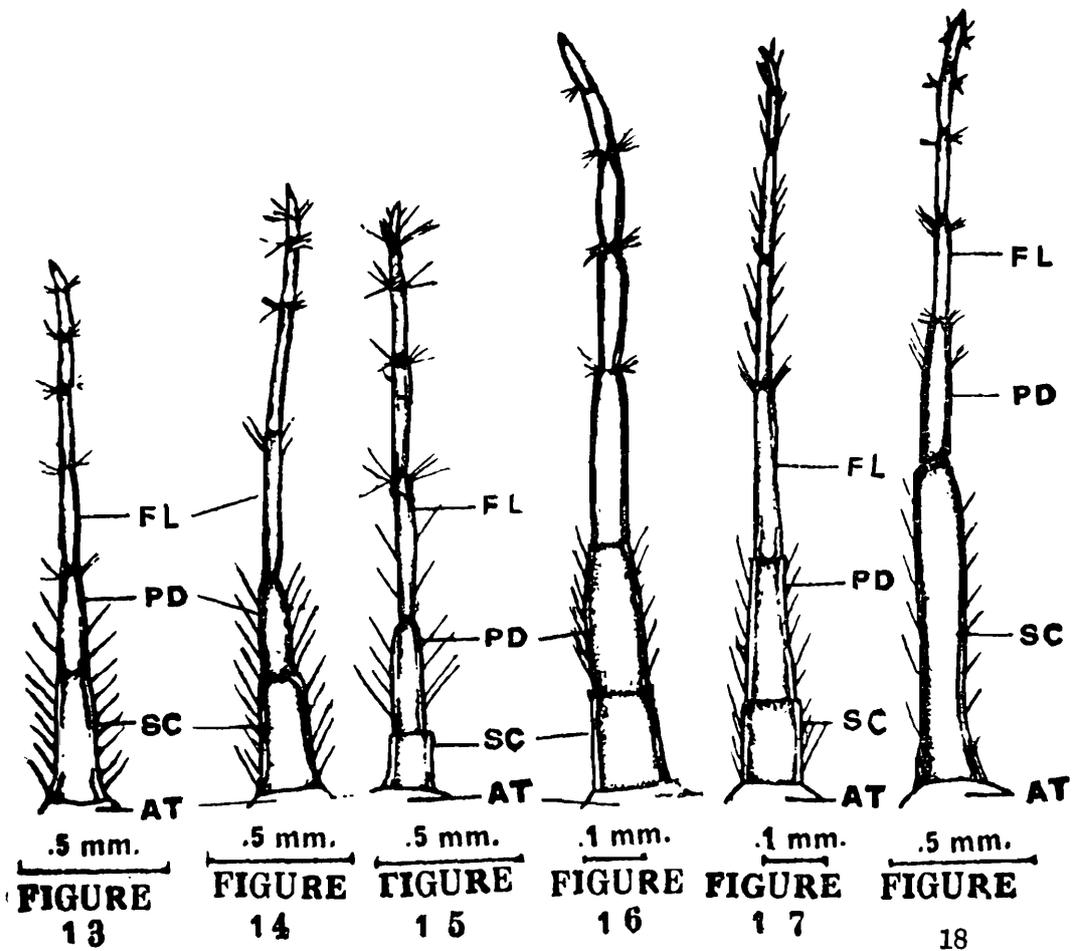
The antennae (Text-figs. 13 to 18) are filiform and are situated one on either side of the fronto clypeal area, between the anterior tentorial pits and the anteromesial margins of the compound eye ; each of them is set on a ridge. Each antennae is beset with hair-like process and consists of (i) a basal segment the scape (SC) (ii) a pedicel (PD) and (iii) a flagellum (FL).

The broad strongly built *scape* (SC) forms the first antennal segment and at its base it articulates latero-ventrally by means of its peg-like process within the head. The peg like process is known as *antartia* (AT).

The *pedicel* (PD) is a cylindrical structure, it proximally articulates with the scape and distally with the flagellum.

The *flagellum* (FL) follows the pedicel and consists of almost similarly formed segments, each joint has developed a convexity at its proximal, and a concavity at its distal end respectively, the convexity of a joint setting into the concavity of the preceding one so that all the joints of the flagellum are immovably articulated with each other. The size of the flagellar segments decreases towards the antennal tip.

The antennae (Text-figs. 13 to 18) consist of seven segments. Total length of the antenna is 4.5 mm. in *Copera marginipes*, *Pseudagrion decorum* and *Ceriagrion coromandelianum* ; where as it is only 2 m. m. in *Ischnura delicata*, 2.5 m. m. in *Ischnura senegalensis* and 4 m. m. in *Libellago lineata*.



Text-figs. 13-18. Antennae of the larvae :

13. *Copera marginipes*, 14. *Pseudagrion decorum*, 15. *Ceriagrion coromandelianum*,
 16. *Ischnura delicata*, 17. *Ischnura senegalensis*, 18. *Libellago lineata*.

THE MOUTH PARTS

The mouth parts consist of a labrum, a pair of mandibles, maxillae and the labium.

1. LABRUM

The *labrum* (LB) is a cuticular structure, convex dorsally and more or less concave ventrally (Text-figs 1 to 6). It projects anteriorly from the fronto-clypeal region. The concave ventral portion of the clypeus covers the toothed margin of the mandible. The clypeus remains separated from the fronto-clypeal area by clypeo-labral suture (CLS).

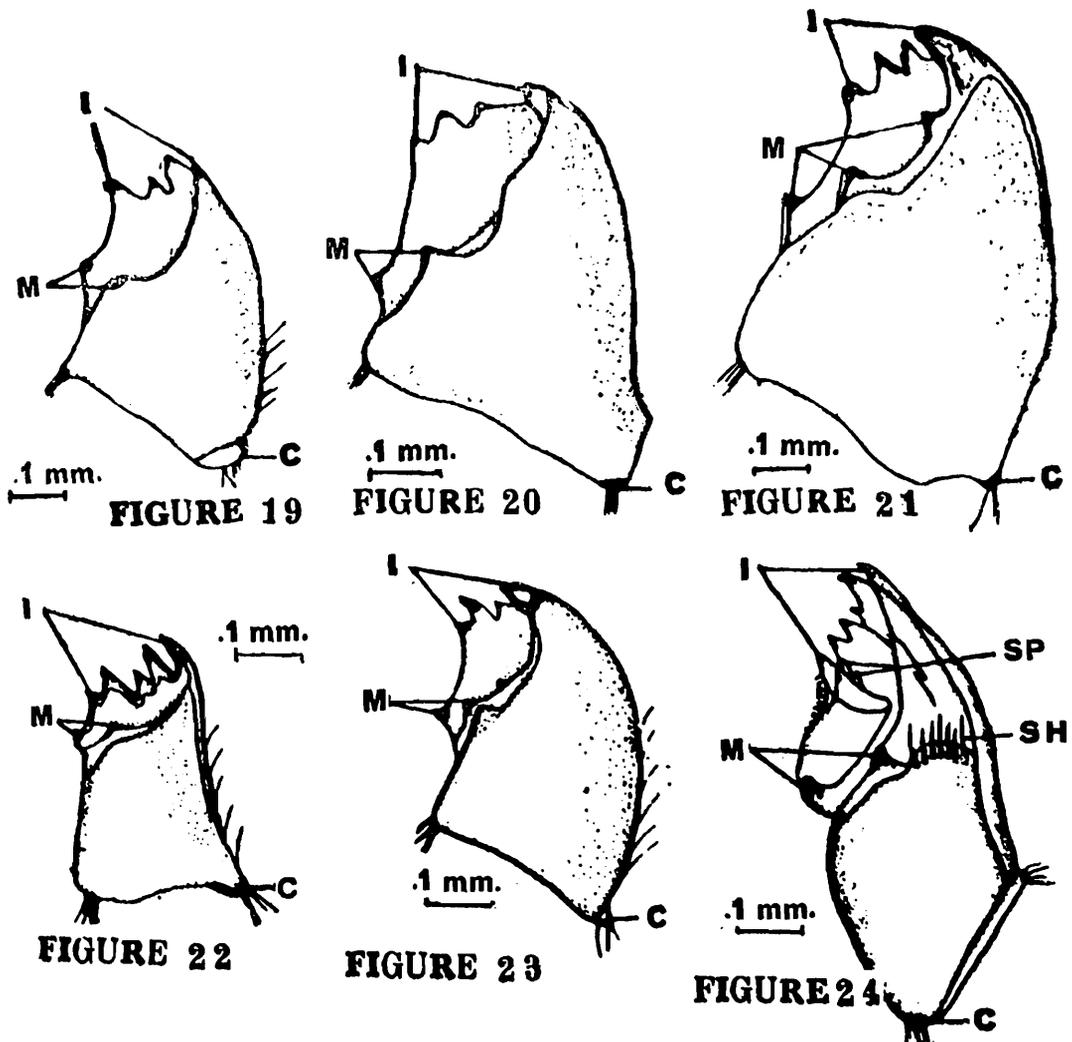
2. MANDIBLES

The *mandibles* (Text-figs. 19 to 24) are situated ventrally to the clypeus, one on each side of the middle line. Each mandible (MD) is a strongly sclerotised, subconical structure with triangular base and a broad cutting margin along its inner edge. The cutting edge is produced into strongly sclerotised structures these are differentiated into anterior *incisor* (I) and posterior *molar* (M) teeth.

The number and arrangement of teeth is similar on the right and the left mandibles, the left one is produced a little forward than the right one.

At the time of biting the cutting margin of the left mandible covers that of the right. Each mandible has two articular points at its proximal end, a dorsal and a ventral, the dorsal bearing a *condyle* (C) and a cavity both of which interlock with the corresponding notch and condyle of the clypeus. The ventral articular point, has a condyle which fits into the concavity on the ventral margin of the postgena. Both articulating points lie on the outer side of the base of the mandibles.

The number and arrangement of maxillary and mandibular teeth is specific in different species. The mandibles (Text-figs. 19 to 24) of *Copera marginipes*, *Ischnura senegalensis* and *Pseudagrion decorum* bear four incisors and two molars, *Ceriagrion coromandelianum* bears four incisors and three molars, *Ischnura delicata* bears five incisors and two molars, *Libellago lineata* bears six incisors and two molars. In *Copera marginipes*,



Text-figs. 19-24. Mandibles of larvae ;

19. *Copera marginipes*, 20. *Pseudagrion decorum*, 21. *Ceriagrion coromandelianum*,
22. *Ischnura delicata*, 23. *Ischnura senegalensis*, 24. *Libellago lineata*.

Pseudagrion decorum, *Ceriagrion coromandelianum*, *Ischnura senegalensis* and *Ischnura delicata* incisors are arranged in a single row. In *Libellago lineata* they are arranged in two rows. In *Copera marginipes*, *Pseudagrion decorum* and *Libellago lineata* the two molars form two apices. In *Ceriagrion coromandelianum*, *Ischnura delicata* and *Ischnura senegalensis* molar teeth are situated in two rows out of which one is dorsal and the other is ventral in position. In *Copera marginipes*, out of four incisors three are large and one is small. Incisors of *Pseudagrion decorum* and *Ceriagrion coromandelianum* are similar in shape. In *Ischnura delicata* all five incisors are arranged in a single row, out of which first, second and fourth are larger, third and fifth are smaller in size. In *Ischnura senegalensis*, first and third incisors are large, second and fourth are smaller. In *Libellago lineata*, incisors are arranged in two rows; the distal row contains five incisors out of which the first is the largest and the rest of them are smaller in size. The proximal row consists of only one broad incisor tooth.

3. MAXILLAE

The *maxillae* (Text-figs. 25 to 30) lie behind the mandibles laterally to the labium, one on either side of it. Each maxillae articulates with the lower margins of the post gena by means of single process at its inner most end, and consists of two pieces; (i) the proximal one is the cardo and (ii) the distal one the stipes, the two being hinged with each other by means of *Cardostipetal suture* (CDS).

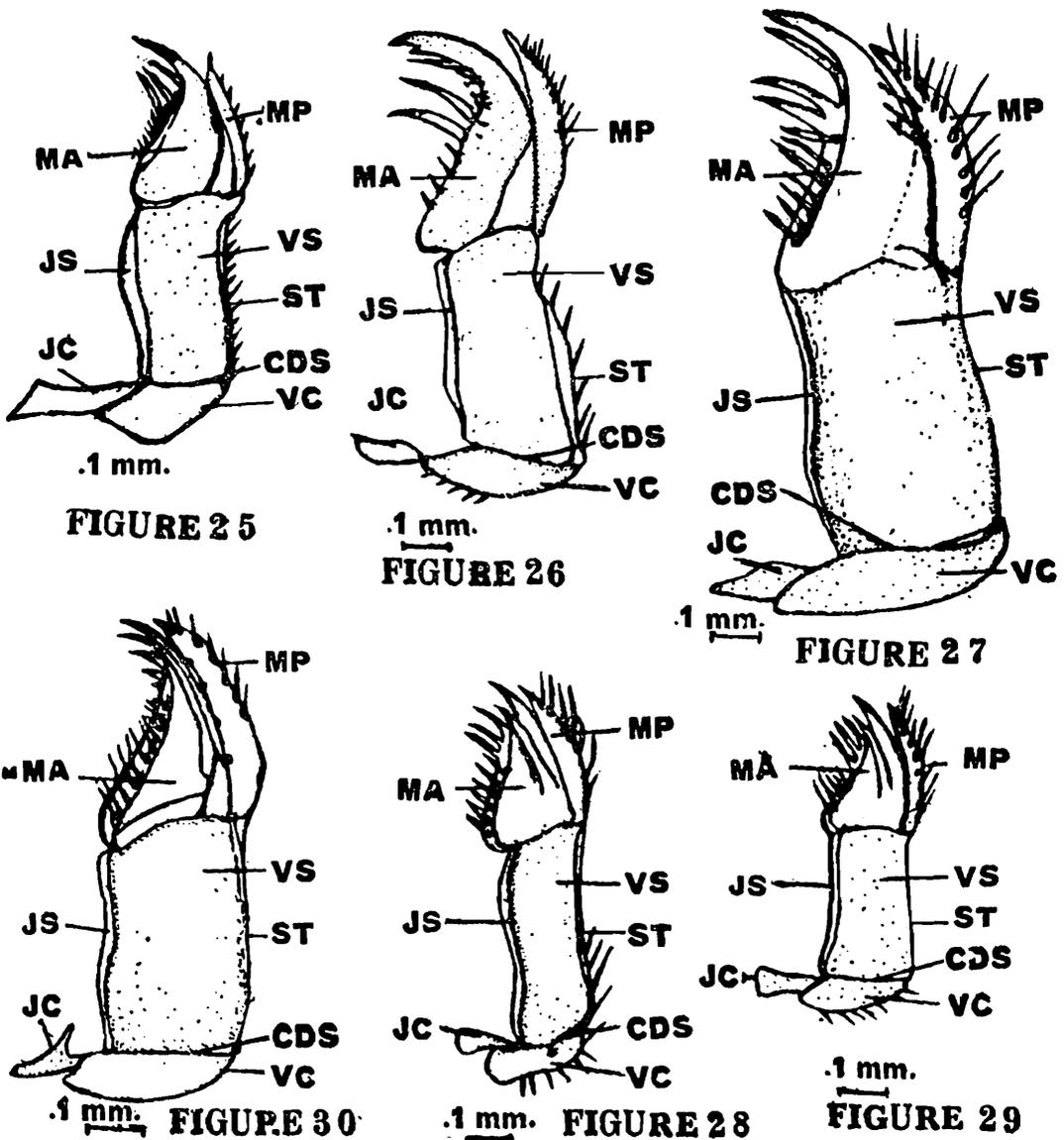
The *cardo* consists of a broad outer piece, the *veracordo*, and an inner piece the *Juxtacordo*. The *veracordo* (VC) is scooped on its dorsal surface to form a deep concavity, thus forming more or less cupshaped structure. The *Juxtacordo* (JC) is a short thinly sclerotised ventral process. This bears a condyle which articulates with the interior margin of the post gena outside the attachment of the labium.

The *stipes* is an elongated more or less a quadrate, structure and consists of two pieces, a narrow inner piece, the *Juxtastipes* (JS) and an outer rectangular piece, the *Verastipes* (VS) the two are separated from each other by a sutural groove which forms internally a sub-marginal ridge for articulation of the muscles. From the distal end of *vera stipes* arises the mala. The *mala* (MA) is strongly sclerotised and ends in an incisor point provided with two apical teeth and a row of hair, its inner curved margin bears stout bristles. The mala is movable on the end of the stipes and can be flexed mesally. The *maxillary palp* (MP) consists of a single segment. It is hinged poste-

riorly with the stripes and is long, cylindrical structure which bears stiff sensory setae.

The Juxtacardo (Text-figs. 25 to 30) is dumbbell shaped in *Copera marginipes*, spear-shaped in *Pseudagrion decorum* and *Ceriagrion coromandelianum*. It bears a protuberance in *Libellago lineata*. In *Ischnura delicata* and *Ischnura senegalensis*, it is club-shaped. The vera cardo is boat-shaped in all the larval forms.

In all the six species (Text-figs. 25-30) mala a constituent of verastipes ends in an incisor point provided with two apical teeth. Mala of *Libellago lineata*, *Ischnura delicata* and *Ischnura senegalensis* bears extra incisor at its mid length.

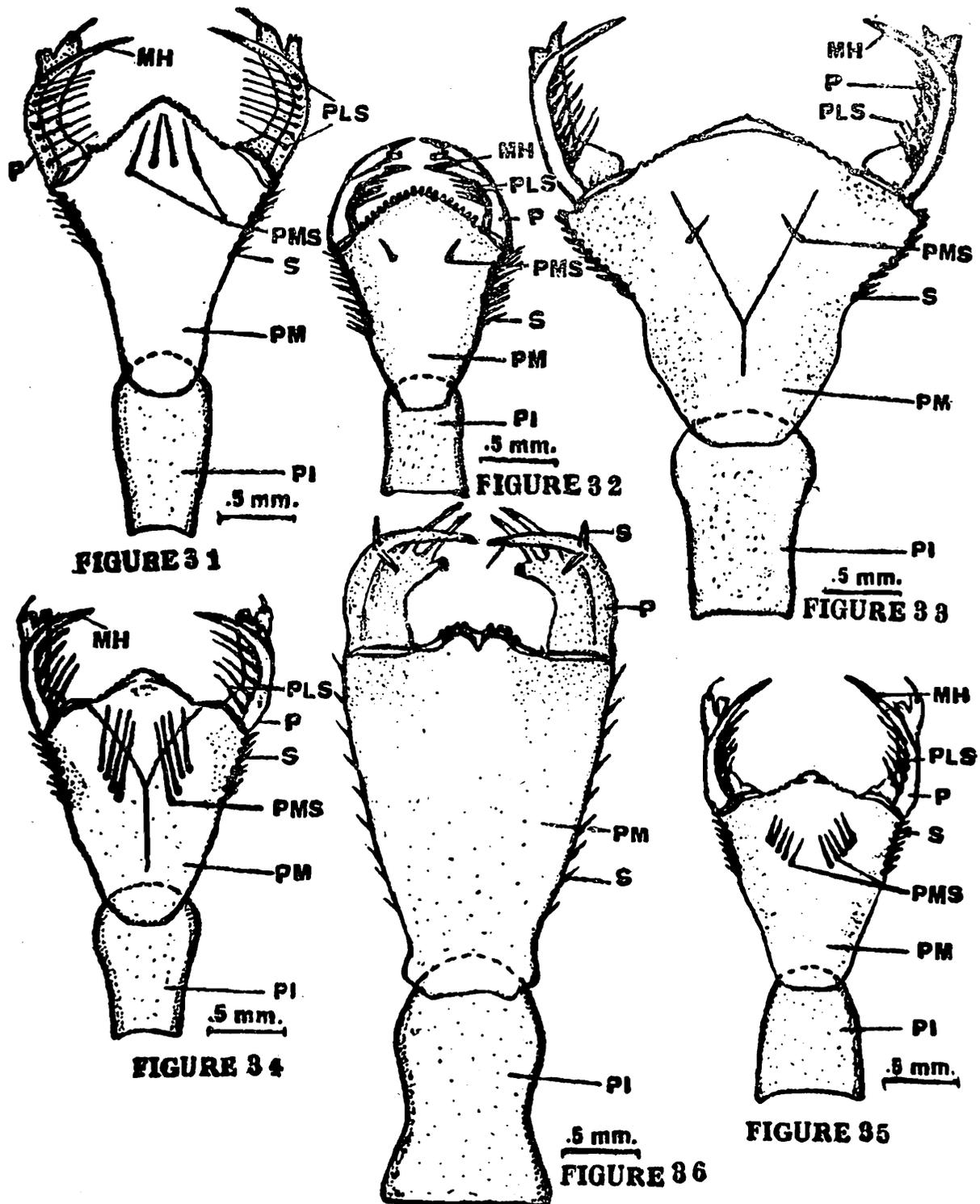


Text-figs. 25-30. Maxillae of the larvae :

25. *Copera marginipes*, 26. *Pseudagrion decorum*, 27. *Ceriagrion coromandelianum*,
28. *Ischnura delicata*, 29. *Ischnura senegalensis*, 30. *Libellago lineata*.

4. LABIUM

The *labium* (Text-figs. 31 to 36) is situated between the two maxillae. It is movably articulated to the head capsule in the ventromesal corner of the postgena, a little anterior to the pits of the posterior tectorial arms (PTP). It is modified for prehensile purposes and is known as the mask from the fact that it conceals the other mouth parts. The prementum and



Text-figs. 31-36. Labia of the larvae :

31. *Coper marginipes*, 32. *Pseudagrion decorum*, 33. *Ceriagrion coromandelianum*,
34. *Ischnura delicata*, 35. *Ischnura senegalensis*, 36. *Libellago lineata*.

postmentum are markedly lengthened and there is great freedom of movement between two parts. The postmentum (PI) is cylindrical and its dorsal surface is hollow in which in infolded position the prementum fits. The proximal end of postmentum articulates with the postgena, its distal part articulates with the prementum. *Prementum* (PM) is triangular in shape its narrower end articulates with the postmentum. The broader end of the prementum is directed anteriorly both in the folded as well as in the extended condition. Lateral sides of broader end bear the palpus its median part is convex and bears seta. The *palpus* (P) fits into the cup-shaped concavities of the prementum. These cavities are situated on the broader lateral sides of the prementum. Each palpus is a curved structure, broader at the base and narrower towards the apex, it bears *movable hook* (MH) and seta. Details of the premental seta (PMS), palpal seta (PLS) and shape of the prementum differs in various species and are as shown below :

The premental seta (Text-figs 31 to 36) are 2+2 in *Copera marginipes*, 1+1 in *Pseudagrion decorum* and *Ceriagrion coromandelianum*, 4+4 in *Ischnura delicata* and 5+5 in *Ischnura senegalensis*. In *Libellago lineata* premental seta are absent. The distal margin of prementum in *Copera marginipes* is serrated whereas serrations bear spiny projections in case of *Pseudagrion decorum*. The formation is wavy with small denticles in *Ceriagrion coromandelianum* and wavy with small serrations in *Ischnura delicata* and *Ischnura senegalensis*. In *Libellago lineata* it is bilobed and crenated.

Palpal seta (Text-figs. 31 to 36) are 8 & 8 in *Ceriagrion coromandelianum*, 5 & 5 in *Copera marginipes*, 4 & 4 in *Ischnura delicata*, *Ischnura galensis* and *Pseudagrion decorum*. Palpal seta are absent in *Libellago senelineata*. In all the larval forms the distal margin of the palpus is produced in two lobes. In *Ceriagrion coromandelianum* the outer lobe bears a curved-end hook : the inner lobe is produced into a number of denticles. In *Pseudagrion decorum* the outer lobe projects into a prominent curved-end hook, whereas the inner lobe is produced into short blunt teeth. In *Ischnura delicata*, and *Ischnura senegalensis* the outer lobe is produced into fine denticles, while the inner lobe bears a short-end hook. In *Ceriagrion coromandelianum* outer lobe is produced into curved-end hook : the inner lobe bears a number of denticles. In *Libellago lineata* the outer lobe consists of two parts : outer short conical tooth and an inner curved hook : inner lobe is serrated messaly forming long-end hook. In *Copera marginipes*, *Ischnura delicata*, *Ischnura senegalensis* the movable hook is half of the length of palpus. In *Ceriagrion coromandelianum* and *Libellago lineata* it is less than half of

its length whereas in *Pseudagrion decorum* it is two-third of the length of the palpus. Basal parts of movable hooks in *Libellago lineata* bear a pair of spines.

5. HYPOPHARYNX

The *hypopharynx* is a thick more or less irregular lobe, lying like trough in the preoral cavity, where it is attached to the head between the mouth and the labium. Its ventral wall is deflected into the adoral wall of the labium at the base of the prementum. The adoral surface of the hypopharynx is differentiated into a distal sclerotised area and a proximal more membranous part. The proximal part has a depression. The floor of the hypopharynx is continuous through the mouth with the ventral wall of the stomodium and it self forms the floor of the preoral chamber. The wall of the hypopharynx are strengthened by a group of sclerites, its distal end forms a beak like projection the salibos.

DISCUSSION

The discussion is mainly based on comparison with *Brachythemis contaminata* worked out by Mathur (1956) and *Lestes praemrosa* described by Kumar (1972). Works of Imhof (1910), Butler (1904), Corbet (1953) and Fraser (1933) are worth mentioning in this context.

The head is situated at the anterior end of the body carrying the eyes, antenna and the feeding organs. It is prognathus and ocelli are of equal size in all the larval forms. In *Brachythemis* (Mathur 1956) the head is hypognathus and ocelli are not of equal size.

In larval forms cranial suture forms U shaped frontal suture as mentioned by Duporte (1946). Antennal and subgenal sutures are as in *Brachythemis*. The two ocular sutures converge in *Brachythemis*, whereas these are situated away from each other in the larval forms.

In larval forms the vertex is divided by a clypeal suture, it is undivided in *Brachythemis* (Mathur 1956). Similar to *Brachythemis* epistomal sutures are absent in the larval forms ; hence frons and clypeus are not clearly demarcated. In larval forms, the lateral areas separated by coronal sutures form parietals. These are absent in *Brachythemis*. In last instar nymphs described the genal regions have descended to the level of the mouth bringing the primary mandibular articulation to the same level as the secondary ones. Between the two articulation, the base of the mandible is attached by membrane to the ventral edge of the gena. A narrow sclerite, the pleurostoma (PS), is developed between edges of gena and the base of the mandible and a pleurostomal sulcus in between gena and pleurostoma, as described by Duporte (1946).

Duporte's concept of the fronto parietal region, is that of a single sclerotised plate whose ventral region is partially divided by the fronto-genal inflections into a median and two lateral lobes. He defines the median lobe as frons, the lateral lobes as genae and dorsal region as vertex. These terms have the same morphological significance in different larval forms.

In larval forms the post occiput is narrow posterior rim of the cranium set off from occipital arch by post-occipital suture to which neck membrane is attached. Laterally the postocciput is produced in occipital condyle to which articulates the lateral cervical sclerite as in *Gryllotalpa* (Rakshpal 1972). In *Libellago lineata* the occipital condyle does not articulate with cervical sclerite as in *Brachythemis*.

As in *Brachythemis* the antennal sclerite and the antacorium are absent in various larval forms. Antennae are situated away from the median ocelli and not near to it as in *Brachythemis*. Antennal bases are bounded by antennal sutures as in *Brachythemis*. Antenna consists of scape, pedicel and flagellum as described by Imhof (1901).

In larval forms labrum hangs hinged from the clypeus through clypeo-labral suture similar to *Brachythemis* and *Gryllotalpa*.

In *Brachythemis* each mandible contains three incisors and molars bear four cusps. In larval forms the number of incisors and molar teeth is specific in different species as described earlier.

Veracardo of maxilla is boat-shaped in larval forms as in *Brachythemis*. Juxtacardo is strip-like in *Brachythemis*, whereas it is dumbbell-shaped in *Copera marginipes*, spear-shaped in *Pseudagrion decorum*, *Ceriagrion coromandelianum*, club-shaped in *Ischnura delicata* and *Ischnura senegalensis*. It bears a protuberance in *Libellago lineata*. In *Brachythemis* the distal end of mala possesses two small and four large incurved spines. In larval forms each mala contains an apical incisor teeth. Mala of *Libellago lineata*, *Ischnura delicata* and *Ischnura senegalensis* bear an extra incisor at the mid-length.

The larval labium is modified for prehensile purposes and is known as mask from the fact that it conceals the other mouth parts (Butler 1904) and consists of postmentum and prementum (Corbet 1953). In *Brachythemis* it consists of proximal and distal parts. The proximal part has submentum and mentum, the distal part is formed of squama. Postmentum is elongated and cylindrical in the larval forms, it bears a furrow in which prementum rests in the infolded condition. In *Brachythemis* the distal part of mentum bears paired squamae, median and lateral lobes, in larval forms mentum consists of a triangular plate bearing palpus on its lateral sides.

Premental seta are 6+6 in *Lestes* (Kumar 1972), they are 2+2 in *Copera marginipes*, 1+1 in *Pseudagrion decorum*, *Ceriagrion coromandelianum*, 4+4 in *Ischnura delicata* and 5+5 in *Ischnura senegalensis*. In *Libellago lineata* premental seta are absent.

In *Lestes* (Kumar 1972) the distal margin of prementum is serrated, in *Copera marginipes* serrations are small, whereas serrations bear spiny projections in *Pseudagrion decorum*. This formation is wavy with small denticles in *Ceriagrion coromandelianum* and wavy with small serrations in *Ischnura delicata* and *Ischnura senegalensis*. In *Libellago lineata* the same is crenated. In *Rhinocypha* (Fraser 1934) the distal margin of prementum is deeply bifid and edges of the fissure overlap to enclose a small foramen. In *Libellago lineata* as well the prementum is bifid but edges of the fissure do not overlap to enclose a foramen.

In *Lestes* palpal setae are 3 & 3, they are 8 & 8 in *Ceriagrion coromandelianum*, 5 & 5 in *Copera marginipes*, 4 & 4 in *Ischnura delicata*, *Ischnura senegalensis* and *Pseudagrion decorum*. Palpal seta are absent in *Libellago lineata*.

Similar to *Lestes* in larval forms the distal end of palpus is produced into two lobes. In *Lestes* the outer lobe consists of three parts : outer curved hook, short middle serrated part and an inner terminal lobe. The outer lobe in *Copera marginipes*, *Ceriagrion coromandelianum* and *Pseudagrion decorum* bears a curved end hook. In *Ischnura delicata* and *Ischnura senegalensis* it is produced into fine denticles, In *Libellago lineata* the outer lobe consist of two parts : outer short conical tooth and an inner curved hook. In *Lestes* the inner lobe is serrated mesally forming long hook. In *Ceriagrion coromandelianum* and *Copera marginipes* it is produced into fine denticles, in *Pseudagrion decorum* it forms a blunt teeth, in *Ischnura delicata* and *Ischnura senegalensis* it bears a curved hook while in *Libellago lineata* it terminates into a long end hook. In *Lestes* movable hook is long and slender, in *Copera marginipes*, *Ischnura delicata*, *Ischnura senegalensis* the movable hook is half the length of the palpus. In *Ceriagrion coromandelianum* and *Libellago lineata* it is less than half of its length, whereas in *Pseudagrion decorum* it is two-third of the length of palpus.

The ligula is undivided and is represented by a median lobe which is fused with the prementum.

SUMMARY

Head and mouth parts of six Zygopterous species of dragonfly larvae namely *Pseudagrion decorum*, *Copera marginipes*, *Ischnura deli-*

cata, *Ischnura senegalensis*, *Libellago lineata* and *ceriagrion coromandelianum* have been described.

The position of various sutures and areas of the head have been studied. Structure, shape and size of antennae and location of ocelli in various species have been noted and their interspecific variations discussed.

The number and arrangement of incisors and molar teeth on the mandibles are variable. The shape of Juxta-Cardo and constituents of stipes, the mala and maxillary palp differ in different species. Arrangement and number of pre-mental and palpal setae on the labium of different species as well are variable but there is no intraspecific variation of these characters.

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ABBREVIATIONS

AN—Antenna, AS—Antennal suture, AT—Antartis, C—Condyle, CDS—Cardo-stipital suture, CL—Clypeus, CLS—Clypeo-labral suture, CS—Coronal suture, E—Eye, F—Frons, FL—Flagellum, ES—Frontal suture, GE—Gena, HY—Hypopharynx, HYP—Hypostoma, HYS—Hypostomal suture, JC—Juxtacardo, JS—Juxtastipes, I—Incisor, LB—Labrum, M—Molar, MA—Mala, MD—Mandible, MH—Movable hook, MP—Maxillary palp, MX—Maxilla, O—Ocelli, OC—Occipital condyle, OCA—Occipital arch, OCF—Occipital foramen, OCS—Ocular suture, OS—Occipital suture, P—Palpus, PD—Pedicel, PI—Postmentum, PLS—Palpal seta, PM—Prementum, POC—Postocciput, POS—Postoccipital suture, PMS—Premental seta, PSS—Pleurostomal suture, PS—Pleurostoma, PT—Parietal, PTP—Posterior tentorial pit, SC—Scape, SGA—Subgenal area, SGS—Subgenal suture, SP—Spine, ST—Stipes, V—Vertex, VC—Vera-Cardo, VS—Vera-stipes.

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