

RESULTS OF THE AUSTRIAN-CEYLONESE HYDROBIOLOGICAL MISSION 1970 OF THE  
IST ZOOLOGICAL INSTITUTE OF THE UNIVERSITY OF VIENNA (AUSTRIA) AND THE  
DEPARTMENT OF ZOOLOGY OF THE UNIVERSITY OF CEYLON VIDYALANKARA CAMPUS,  
KELANIYA

## Part XII: Contributions to the Ecology of the Larvae of some Odonata from Ceylon

by

DOUGLAS ST. QUENTIN\*

Professor Dr. F. Starmühlner and Prof. Dr. H. H. Costa kindly sent me for study a fine collection of larvae of Odonata made by the Austrian-Ceylonese Hydrobiological Mission 1970. This material is particularly interesting because it is accompanied by detailed notes concerning the habitats.

Suborder Zygoptera

Superfamily Calopterygoidea

Family Epallagidae

Genus *Euphaea* Selys

*Euphaea splendens* SELYS 1853

The species occurs only in Ceylon ; a description and a sketch of the larva are given in FRASER (1929, p. 291, pl. IVA) ; descriptions and detailed figures of the nearly related form, *E. variegata*, are found in RIS (1912, p. 168, Pl. 6, fig. 9, Pl. 7, fig. 10–12) and LIEFTINCK (1960, p. 274, fig. 1–8).

There are about 100 larvae from 16 biotopes (Nr. 1, 3, 6–11, 13–15, 17, 21, 24, 34, 35) ; for the characters of the biotopes see COSTA and STARMÜHLNER (1972). The larvae are of various sizes ; total length (without caudal gills) 4–18 mm ; the dominant length is 9–12 mm ; larvae of 18 mm, are no more than 10 per ct. (fig. 1 and 2).

The labial mask agrees well with the fig. of RIS ; the distal margin of the median lobe shows a little median cleft ; the setae on the median lobe figured by Lieftinck (l.c. fig. 2) are wanting ; the lateral lobes show (fig. 3) a slender movable hook” of moderate length, two short hooks and, on the place of the “end hook”, an oblique truncated rudiment.

The antennae are short (shorter than the diameter of the head) ; some morphological characters of the body may be interpreted as adaptations to a life in fast running water ; such characters are : the compound eyes are large, the head is (figs. 1 and 2) wider than the thorax ; the body is compact

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\* Natural History Museum, Vienna, Austria.

(the proportion length : breadth is like 6 : 1) ; the legs are short, the femora markedly flattened ; the abdomen is short as compared with the rest of the body ; on the head there are two rows of spines (fig. 4), one beneath the compound eyes and a second on the outermargin of the mandibles.

Such spines on the head have been described by RIS (l.c.) for *E. variegata* (RAMBUR), by FRASER (1938, p. 140, fig. 2b) for *Philoganga montana* (SELYS), by ASAHINA (1967, fig. 3) for *Philoganga vetusta* RIS, by NEEDHAM (1930 pl. XVII. fig., 1, 7) for *Anisopleura comes* SELYS and *Bayadera indica* SELYS. Interpretations concerning the purpose of this modification are hitherto wanting. Since the row on the mandibles is movable, both rows may act together as a gripping mechanism in order to cling the body to the ground.

The abdominal gills are (see RIS l.c. nad LIEFTINCK l.c.) additional organs for respiration : the meaning of FRASER (1933-36, I, p. 10) they are "employed solely for the purpose of anchoring" is hardly correct.

Many specimens of the larvae has been collected on the underside of stones ; LIEFTINCK (1950, p. 661) gives a similar habitant ("Clinging to rocks and hiding under stones") for *Euphaea variegata* (RAMBUR) ; such an environment is without doubt low in oxygen ; in order to supply this need the caudal gills have been enlarged und the abdominal gills adapted for respiration.



Fig. 1. Dorsal view of larva of *Euphaea splendens*.



Fig. 2. Ventral view of larva of *Euphaea splendens*.

The ecological data are very interesting. Table I shows, that *E. splendens* occurs also in higher altitudes than the two others Calopterygoidae. in Ceylon ; the habitats are fast running brooks ; the bottoms of these brooks are stony or rooky ; the larvae are wanting in waters with sandy or gravelly bottoms, in waters widers than 10 m and deeper than 1 m.

The chemical dat are rather rather low ; pH reached the limit where it tends to be alkaline ; the larvae are wanting in waters with the higher than 1.5 and con higher than 41.

## Family Calopterygidae

Genus *Vestalis* Selys*Vestalis apicalis nigrescens* FRASER 1929

This subspecies or species is restricted to Ceylon (SEE FRASER 1929) ; a description of the larval form is hitherto wanting ; the larvae conform closely to the description and figures of *V. luctuosa* (BURMEISTER) from Sumatra given by LIEFTINCK (1965 fig. 11b), and RIS (l.c.p. 177-80).

There are 21 larvae from 8 biotopes (Nr. 6, 7, 15, 26, 27, 34, 35, 37) ; in two of these biotopes no other Odonata has been observed. The larvae measure (body+caudal gills) from 7+3 to 22+7 ; the larvae of 22 mm length belong probably to the last instar, the wing-sheets reach back to the segment 5, the ovipositor of ♀♀ to the half of segment 10.

The labial mask agrees well with the fig. by *Lieftinck* (l.c.) and shows the two setae on the lateral lobe (fig. 5) wanting in fig. 23 by RIS (l.c.). The "movable hook" is four times longer than the other hooks ; the "end hook" is short.

Many of the larvae have been collected on banks, and nearly all from stony bottoms ; the ecology of *V. nigrescens* seems to be somewhat different from the ecology of *E. splendens* ; *V. nigrescens* has been collected, as table 1 shows, not higher than 700 m and in not cooler waters than 21°C ; the chemical data, compared with those of *E. splendens*, of CaO, MO, Cl are remarkably higher, No<sub>3</sub> and P<sub>2</sub>O<sub>5</sub> are not very different, NH<sub>4</sub> is a little lower.

Genus *Neurobasis* Selys*Neurobasis chinensis chinensis* (LINNAEUS 1758)

The species is widely distributed in the Oriental Region ; the larval form has been described by NEEDHAM (1911, p. 147, fig. 1-4) and by LIEFTINCK (1965 l.c. fig. 11a).

There are 9 larvae from 6 biotopes (Nr. 16. 23. 24. 30. 34. 35) ; they measure in length (without caudal gills) from 18 to 30 mm ; the general shape of the larvae represents in many respects a type opposite to *E. splendens* ; the larvae are exceedingly long and slender (length : width like 24 : 1) ; legs and caudal gills are very long, the antennae more than 3 times longer than the diameter of the head ; the labial mask is long, the "movable hook" 2 times longer than the other hooks (fig. 6).

*N. chinensis* and *E. splendens* have been collected in fast running waters, both seem to be obliged to avoid the current, both have tried to solve the problem ; *E. splendens* by living under stones, *N. chinensis* by living as plant-dweller in vegetation.

The larvae have been collected for the most part on banks of waters no wider than 10 m. and no deeper than 1m. ; the chemical data are lower than those of *V. nigrescens* and higher than those of *E. splendens*, only SiO<sub>2</sub> is remarkably high.

TABLE I  
Some physical and chemical data of the biotopes

	all 36 biotopes	<i>E. splendens</i> 16 biotopes	<i>V. nigrescens</i> 8 biotopes	<i>N. chinensis</i> 6 biotopes	<i>Drepanosticta</i> 4 biotopes
a	50-2000 m.	100-2000 m	50-700 m	550-1800 m	100-700 m
br	50 cm-50 m	50 c.-10 m	1-30 m	1-10 m	20 cm-30 m
d	1 cm-3 m	5 cm-1 m	5 cm-1 m	20 cm-1 m	3-50 cm
c	0-1m/sec	50 cm-1 m	50 cm-1 m	0-75 cm	75 cm
te	14-27°C	14-27	21-26	18-25	24-26
pH	5.6-8.2	5.8-7.2	5.8-7.7	5.8-7.2	5.8-7.2
th	0.13-12.9	0.2-1.5	0.5-9.2	0.5-2.3	0.7-1.2
ch	0.2-1.1	0.2-1.1	0.5-0.8	0.5	0.56
alk	0.03-4.7	0.05-0.3	0.2-3.5	0.2-0.12	0.1-0.4
con	8.8-605	8.8-41	25-295	23-89	18-41
CaO	0.7-59	1.1-5.1	2.-52	2-15	0.8-6.3
MgO	0.37-56	0.4-3.6	1.8-28.9	1-5.7	0.8-3.6
SiO <sub>2</sub>	1.9-54	2.6-13.3	6.5-13.3	6.5-28	4.9-9.7
Cl	1.1-145	1.1-2.8	1.6-7.1	1.4-4.8	1.9-2.8
NO <sub>3</sub>	0.04-0.7	0.04-0.1	0.04-0.1	0.04-0.1	0.09-0.2
P <sub>2</sub> O <sub>5</sub>	0.01-0.18	0.-0.18	0.-0.18	0-0.8	0.1
NH <sub>4</sub>	0.02-0.2	0.03-0.2	0.04-0.08	0.03-0.04	0.08-0.1

Abbreviations: —a : altitude ; br : breadth ; d : deep ; c : current (in cm or m/sec.) ; gr. : ground ; te : temperature ; pH : hydrogen ion concentration ; th : total hardness (in German hardness degree) ; ch : carbonat hardness ; alc : alcality ; con : conductivity (in Micro-Siemens at 20°C).

### Superfamily Coenagrionoidea

#### Family Lestidae

#### Genus *Lestes* Leach

In Ceylon occur 5 species of this genus, no larval forms have been described. There are 10 larvae from 2 biotopes (Nr. 17, 21).

The larvae have been collected on banks of two rather small and shallow brooks with stony bottom and moderate temperature ; the data of the two biotopes are : a. : 2000m, br. : 1-5m : d. : 1-50 cm ; c. : 10-50 cm/sec ; gr. stony ; te. : 14.9-17.2° C ; con. : 8.8-26 ; pH : 5.6-6.9 ; alc : 0.05-0.2 ; CaO : 0.2-2.6 ; MgO : 0.4-2.7 ; SiO<sub>2</sub> : 4.4-13.3 ; Cl : 1.1-2.5 ; NO<sub>2</sub> : 0.04-0.6 ; P<sub>2</sub>O<sub>5</sub> ; 0.02-0.17 ; NH<sub>4</sub> : 0.1-0.2.

#### Family Platycnemididae

#### Genus *Copera* Kirby

#### *Copera marginipes* RAMBUR

The larval form of this species has been described and figured by FRASER (1919 pl. XXXV, fig. 3, pl. XXXVII, fig. 6) NEEDHAM (1930. pl. XVIII, fig. 2) and LIEFTINCK (1940, fig. 3 fig. 5).

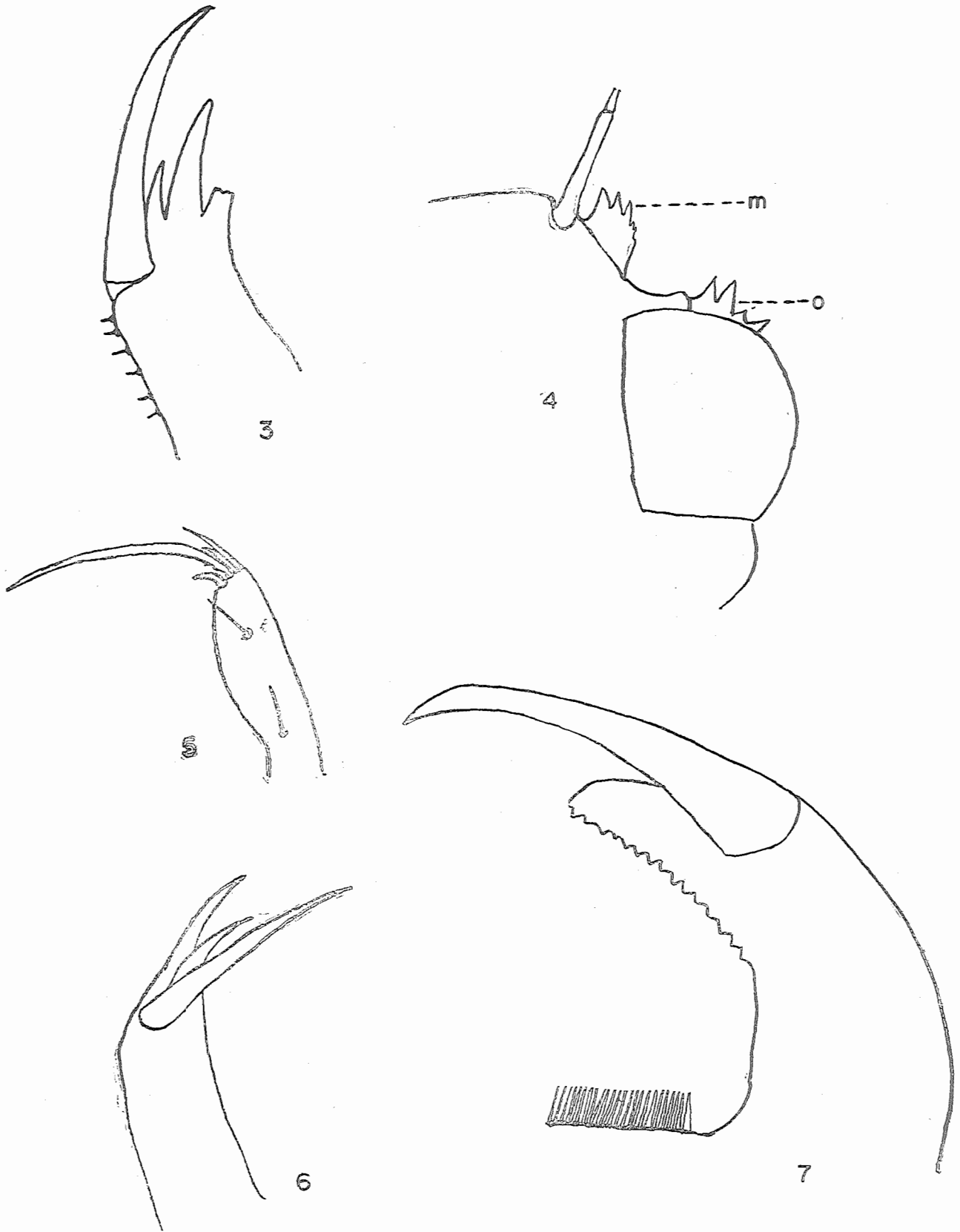


Fig. 3. Apex of left lateral lobe of *Euphaea splendens*. Fig. 4. Mandibular (m) and orbital (o) row of spines on the head of *E. splendens*. Fig. 5. Right lateral lobe of *Vestalis apicalis migrescens*. Fig. 6. Left lateral lobe of *Neurobasis chinensis*. Fig. 7. Apex of the right lateral lobe of *Heliogomphus*.

There is one larva from biotope Nr. 27 ; the data are : a.: plain ; br. :10-15 m ; d. : 20cm more than 1m ; c. : 30-50 cm/sec ; gr. gravelly and sandy ; te. : 25.3 ; con : 295 ; pH : 7.7 ; 9.2 ; alc. : 3.55 ; CaO : 52 ; Mg. : 28.9 ; SiO<sub>2</sub> : 28.8 ; Cl: 7.1 ; NO<sub>3</sub> : 0.108 ; P<sub>2</sub>O<sub>5</sub> : 0.11 ; NH<sub>4</sub> : 0.02. The rate of conductivity is remarkably high, of NH<sub>4</sub> remarkably low.

#### Family Platystictidae

#### Genus *Drepanosticta* Laidlaw

The genus is represented in Ceylon by 14 species ; the larval forms of these species are undescribed ; only the larvae of *D. sundana* (KRÜGER) from Java has been described by LIEFTINCK (1934, p. 464-468, pl. 9 fig. 1-6). There are 4 larvae from 4 biotopes (Nr. 5, 11, 13, 37) ; the larvae fit more or less the description of *sundana*, only the setae on the median lobe of the labial mask are wanting.

The larvae have been collected on stones of the banks of brooks and some also from the middle of brooks ; as table I shows are biotopes not very high situated, and rather warm.

#### Sub-order Anisoptera

#### family Gomphidae

#### Subfamily Epigomphinae

#### Genus *Microgomphus* Selys

#### *Microgomphus wijaya* LIEFTINCK, 1940

The species is restricted to Ceylon ; the larval form has been described by LIEFTINCK (1940 lc. p. 101-4. fig. 5, 6) after an exuvium of 17.8 length.

There are two larvae from two biotopes (Nr. 12, 13) ; they measure 10 and 13 mm, are not full grown, and agree in every respect with the figures of LIEFTINCK. The larvae have been collected in brooks in the plains ; after Table II there are rather large, deep and fast-running waters ; the temperatures of this brooks are remarkably high, the chemical dates, with exception of ch and alc, rather low.

#### -Genus *Heliogomphus* LAIDLAW

In Ceylon occur 4 species (*ceylonicus*, *lyratus*, *nietneri*, *walli*) of *Heliogomphus* ; the larval forms are hitherto unknown ; there is only a description of *kelantanensis* from Malaya by LIEFTINCK (1933, p. 109-13, fig. 2, pl. 2, fig. 6 and pl. 4, fig. 1-4).

There are 3 larvae from 3 biotopes (Nr. 13, 24, 25) ; two of the larvae measure 20 mm (total length), the length of abdomen is 14 mm, greatest width of the same 5 mm ; width of the head across the eyes) 4.5 mm ; length of the posterior femur 6 mm ; the wing-sheats reach the 5, segment ; the larvae are probably full-grown ; the 3. larvae measures 15 mm in length.

The three larvae agree more or less with the description of *kelantanensis* ; different is the colour, not sandy " -yellow " but dark brown, only the tarsi are yellow. The wing-sheats lie parallel, are not divergent as like *kelantanensis*. The median lobe of the labial mask is slightly convex and shows (fig. 7) a dense fringe of short yellow bristles ; the lateral lobes are wide basally and diminishing apically, the inner margin slightly curved and armed with 16-18 denticles ; the " movable hook " is long and slender, his length compared with the breadth on his basis like  $4\frac{1}{2} : 1$  (*kelantanensis*  $3\frac{1}{2} : 1$ ) ; distal end of lateral lobe roundet, " end hook " blunt.

Antennae typical for the genus : first and second joint small, cylindrical, the third plate-shaped, enlarged ; one larva shows the right antenna farther developed than the left (fig. 8).

Abdomen oval, dorso-ventrally flattened, segment 2-7 more or less parallel-sided, 8 and 9 diminishing, 10 very short. Segment 5-9 with robust dorsal hooks, 6-9 with lateral spines. Legs short and vigorous.

The larvae have been collected, as table II shows, in moderate altitudes, in very shallow waters with rocky and stony bottom and fast running current ; the chemical dates are rather low.

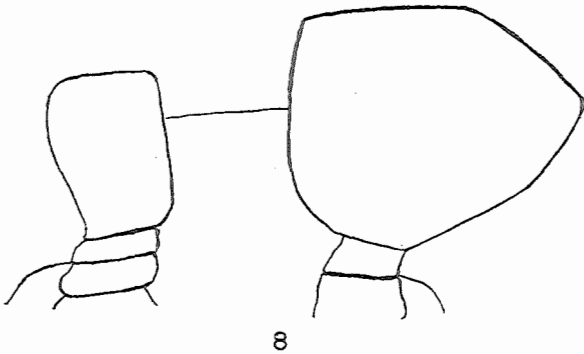


Fig. 8. Antennae of *Heliogomphus* sp.

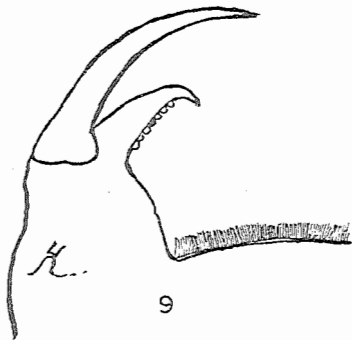


Fig. 9. Apex of the left lateral lobe of *Megalogomphus ceylonicus*.

#### Sub-family Gomphinae

#### Genus *Megalogomphus* CAMPION

#### *Megalogomphus ceylonicus* (LAIDLAW, 1922)

A sketch after an exuvium of this species has given FRASER (1933, p. 24, fig. 1) ; a detailed description with good figures of the related species *icterops* has given LIEFTINCK (1941, p. 236 fig. 1-7).

There are two larvae, total length : 32 and 15 mm from two biotopes (Nr. 9.13) ; the larva of larger size accords well to the exuvium of FRASER and may belong to the last instar : the labium see on fig. 9 ; the meaning of FRASER, that the apex of the lateral lobes is bifid, is hardly correct.

The two biotopes are situated in the plain, the waters flow partly open through plantations, are rather shallow, with an fast running current and rather high temperatures ; the chemical dates are low.

Gen. *Paragomphus* COWLEY*Paragomphus henryi* (LAIDLAW 1928)

The larval form of this species has been described by LIEFTINCK (1940, p. 112-14, fig. 10. pl. 1, fig. 5).

There are 12 larvae from 5 biotopes (Nr. 4, 5, 7, 24, 25), the abdomen is torpedo-shaped, shows no dorsal hooks, the labial mask corresponds with fig. 10 of LIEFTINCK. The larvae have been collected in small cascades of fast running waters with stony bottom; the chemical dates are low.

## Family Aeschnidae

## Sub-family Anactinae

Genus *Anax* LEACH*Anax immaculifrons* (RAMBUR, 1842)

The larval form of this species has been described and figured by LIEFTINCK (1940, p. 115, fig. 11) and FRASER (1943, p. 91, fig. 7).

There are 5 larvae from 3 biotopes (Nr. 4, 16, 20); in Nr. 16 no other dragonflies have been observed; the larvae measure total length 47, 45, 28 mm; the dates are: a. 800-1800m, br.: 2-20m; d. 0.5-50 cm; c.: 30 cm-1m/sec; te: 18-27°C; pH: 5.8-6.1; th: 0.1-0.6; alc: 0.07-0.12; con: 25; CaO: 0.8-2.5; MgO: 0.4-1.3; SiO<sub>2</sub>: 3.15-4.4; Cl: 1.7-2.8; NO<sub>3</sub>: 0.04-0.2; P<sub>2</sub>O<sub>5</sub>: 0.1; NH<sub>4</sub>: 0.1.

TABLE II  
(for abbreviations see table I)

	All 36 biotopes	<i>M. wijaya</i> 2 biotopes	<i>M. ceylonicus</i> 2 biotopes	<i>P. henryi</i> 5 biotopes	<i>Heliogomphus</i> 3 biotopes
a	50-2000 m	50-100 m	100-500 m	600-800m	100-700m
br	50 cm-50 m	20-30 m	5-20 m.	3-20 m.	5-20 m
d	1 cm-3m	50 c,m-3 m	20-50 cm	50 cm-1 m	20-50cm
c	30 cm-1 m	30-75 cm	75 cm	75cm-1 m	75 cm-1 m
te	14-27°C	24-27°C	26-27°C	18-27°C	17-26°C
pH	5.6-8.3	6.5-7	6-7.2	5.8-7.1	6.6-7.1
th	0.13-12.9	1.1-1.2	1.1	0.5-1	0.5-1
ch	0.2-1.1	1.1	0.8	0.5-0.8	?
alc	0.03-4.7	0.4	0.3	0.2-0.4	0.1-0.4
con	8-605	41-46	35-41	31-34	23-41
CaO	0.7-9	6-6.3	2-6.3	2-4.7	6.3
MgO	0.37-56	3.6	3.6	2.3-3.8	0.9-3.8
SiO <sub>2</sub>	1.9-54	9.7	9.7	9-11	9-11
Cl	1.1-145	1.9	1.9	1.4	1.6-2.3
NO <sub>3</sub>	0.04-0.7	0.09	0.09	0.07-0.12	0.9-0.1
P <sub>2</sub> O <sub>5</sub>	0-0.18	0.12	0.12	0.14-0.17	0.1
NH <sub>4</sub>	0.02-0.24	0.16	0.16	0.13	0.03-0.16

The Gomphidae have been collected from the banks of rather large brooks with stony bottom and fast running current; in waters higher situated than 800 altitude and cooler than 17°C no Gomphidae have been found. The chemical dates are remarkably low.



Family Corduliidae  
 Sub-family Epophthalmiinae  
 Genus *Macromia* RAMBUR

*Macromia zeylanica* FRASER 1927

The species occurs only in Ceylon ; the larval form has been described and figured by LIEFTINCK 1940 (p. 93-96, fig. 3, pl. 1 fig. 1).



Fig. 10. Dorsal view of larva of *Zygonyx iris ceylonica*.

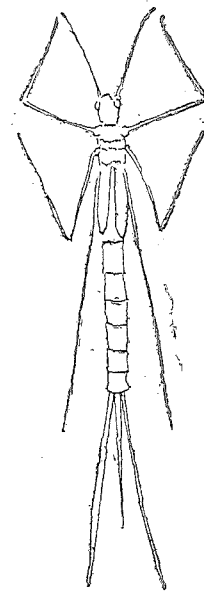


Fig. 13. Sketches of *Neurobasis chinensis* to demonstrate a type of plant dweller.

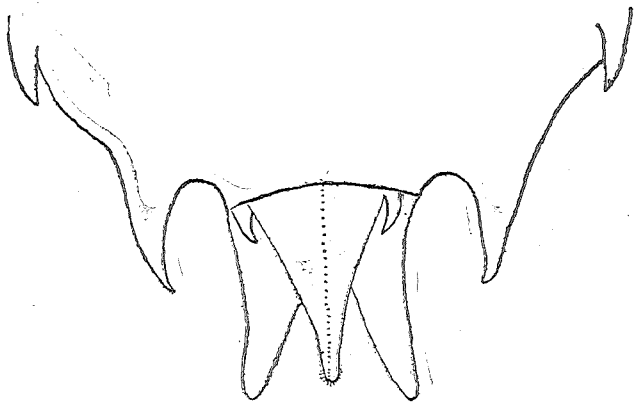


Fig. 11. Left lateral lobe of *Zygonyx iris ceylonica*.

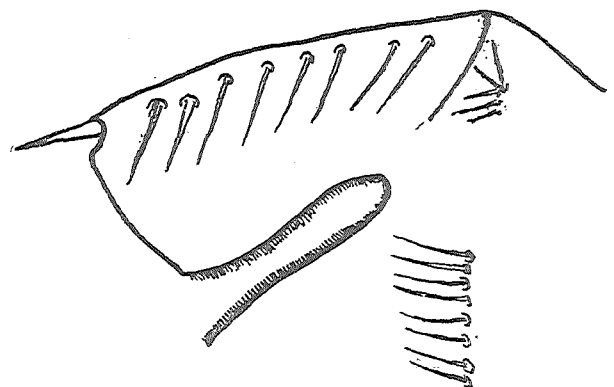


Fig. 12. Dorsal view of apex of abdomen of *Zygonyx iris ceylonica*.

There are 5 larvae from 3 biotopes (Nr. 7, 24, 27) ; the largest of the larvae measures total length of 20mm, abdomen 12 mm, hindfemora 8 mm, they accord well with the measurements given by LIEFTINCK and may belong to the ultimate instar.

The median lobe of the labial mask shows  $2 \times 5$  mental setae ; the lateral lobes show 6 crenations and 5-6 lateral setae ; the "movable hook" is slender, half as long as the lateral lobe.

The colour of the body is dirty-yellow ; the hindfemora reached the 8 segment ; the trasal claws are remarkably long and slender like the tarsal claws of *Macromia gerstäckeri* KRUGER (see LIEFTINCK 1950, 672).

The larvae have been collected on the banks of little streams ; the dates are ; a. not higher than 700 m ; br : 3-15 m ; d : 20 cm-1 m ; C : 50 cm-1m/sec ; te : 18-27°C ; pH : 6-7 ; th : 0.5-9.2 ; ch : 0.8 ; alc : 0.5-3.5 ; con ; 20-295 ; Ca0 : 2-52 ; Mg0 : 2-3.6 ; SiO<sub>2</sub> : 9-28 ; Cl : 1.2-7 ; NO<sub>3</sub> : 0.1 ; P<sub>2</sub>O<sub>5</sub> : 0.1 ; NH<sub>4</sub> : 0.03.

The species occurs in habitats of moderate altitudes, in small brooks of fast running current ; the dates of con, Ca0 and SiO<sub>2</sub>, are remarkably high.

### Family Libellulidae

#### Sub-family Zygonictinae

Genus *Zygonyx* Selys

*Zygonyx iris ceylanica* (KIRBY 1905)

The larval form of this species has not been described till now.

There are 23 larvae from 6 biotopes (Nr. 5, 6, 7, 10, 11, 25) ; The larvae are of various sizes, the largest (fig. 10) measures total length 24 mm, abdomen 15 mm, the width of the same across segment 67 mm, hindfemora 5 mm, the wing-sheets reach segment 7. This larvae may belong to the last instar. The smallest larva measures 4 mm (total length).

The head is about two times wider than long, the sides behind the compound eyes are strongly convergent ; the antennae are shorter than the distance between their bases.

The labial mask is short, in repose extending back to the coxae of fore legs : the median lobe (fig. 11) is slightly projected, the anterior margin densely fringed with short bristles ; the median lobe shows a group of  $2 \times 8-10$  mental setae and a second group of short setae near the joint of the lateral lobe. The lateral lobes are almost rectangular, on the end only a little wider than on the base, they show 8-9 setae, the "movable hook" is rather short.

The abdomen (fig. 12) is oblong, segments 3-9 with keeled dorsal hooks ; segment 8 and 8 with acute, slightly inwards directed lateral spines ; the epiproct is a little shorter than the praaproct ; the cerci measure 1/3 of the paraproct.

The dates are : a : 500-700 m ; br : 50 cm-10 m ; d : 1cm-1m ; c 50 cm ; te : 18-27 ; Ph ; 5.8-7 ; th ; 0.6-1 ; ch : 0.5-0.8 ; alc ; 0.2-0.4 ; con : 29-35 ; Ca0 : 2-4.7 ; Mg0 : 3.8 ; SiO<sub>2</sub> : 11 ; Cl : 1.4 ; NO<sub>3</sub> : 0.07 ; P<sub>2</sub>O<sub>5</sub> : 0.1 ; NH<sub>4</sub> : 0.03.

The habitats are rather small brooks with fast running waters in the South of the island ; The larvae have been collected on the banks of cascades, under grubbles and from stones.

### SUMMARY

The Austrian-Ceylonese Hydrobiological Mission studied 38 biotopes ; 28 of which contain Odonate (Nr. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 23, 24, 25, 26, 27, 30, 34, 35, 37) ; 10 biotopes (Nr. 2, 18, 19, 22, 28, 29, 31, 32, 33, 36, 38) were without Odonata.

From the Zygoptera the Calopterygoidea seem to be the dominant form (22 habitats), the Coenagrionoidea are scarcer (11 habitats). The most frequent species was *E. splendens* (16 habitats) followed by *Vnigrescens* (8 habitats) and *N. chinensis* (6 habitats).

From the Anisoptera *Z. ceylanica*, was the dominant form (8 habitats), but some Libellulinae remain undescribed.

The number of species in the different biotopes was very different ; Nr. 7 contains 6 species (*E. splendens*, *V. nigrescens*, *P. henryi*, *M. zeylanica*, *Z. iris ceylanica*, bibellulinae) ; Nr. 13 contains 5 species (*E. splendens*, *Drepanosticta* spec., *M. wijaya*, *M. ceylonicus*, *Heliogomphus* spec.) ; some biotopes contain only one species such as Nr. 8 (*E. splendens*) or Nr. 14 (*E. splendens*).

The biotopes containing Odonata are rather small brooks ; in waters larger than 30m. and deeper than 3m. no Odonata have been collected. The temperatures in the biotopes extend from 14-27°C ; a form with a large range seems to be *E. splendens* (14-27°C) ; a form with a rather small range in cool water is *Lestes* spec. (14-17°C), with a rather small range in warm water in *M. ceylonicus* (26-27°C).

The chemical data are rather low ; pH was mostly on the limit between acid and alkaline reaction ; in waters with pH higher than 7.7, th higher than 9.2, alc higher than 3.5, can higher than 259, CaO higher than 52, MgO higher than 28.9, SiO<sub>2</sub> higher than 28.8, Cl higher than 7, no Odonata have been found.

The biotopes containing Odonata are fast running waters ; they are situated in the most cases on lower or middle elevations, only 3 species, *E. splendens*, *N. chinensis*, *Lestes* spec., have also been found in higher elevations (1800-2000m).

Some species have developed adaptations in order to avoid the current ; these are :

(a) *Current evading*

*Euphaea splendens*: current evading by living under stones ; adaptations : body compact, legs short, antennae short, development of gripping mechanism, additional gills, eyes large. (fig. 1)

*Neurobasis chinensis*: current evading by living among submerged vegetation ; adaptations : body slender, legs long, antennae long, caudal gills long, eyes small. (fig. 3)

*Macromia zeylanica*: current evading by living buried in sandy bottom ; adaptations: body ovate, dorsoventrally flattened, antennae short, legs long, claws long.

(b) *Current resisting* :

*Mogalogomphus ceylonicus* : current resisting living among stones ; adaptations : body streamlined, burrowing hooks on the tibiae.

*Zygonyx ceylanica*: current resisting by living on the margins of cascades (waterfalls?) adaptations : body very broad, dorsoventrally flattened, legs short, antennae short.

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