

**STUDIES ON THE LIFE HISTORY OF INDIAN
DRAGONFLIES, *PSEUDAGRION RUBRICEPS* SELYS
(COENAGRIONIDAE : ODONATA)**

By

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(With 3 Text-figures and 2 Tables)

INTRODUCTION

Studies on the larval stages and life history of Indian Odonata are very meagre. Efforts made so far have generally been directed towards the study of adults only. To have a better understanding of the biology of Indian species in particular and tropical in general the author has begun a study of the life history of Indian dragonflies from various aquatic habitats. In the present paper life history of *Pseudagrion rubriceps* Selys, a species widely distributed in Oriental Regions, is described. No detailed account of the biology and larval stages of Indian species of genus *Pseudagrion* Selys are available, though brief notes on the subject are to be found by Laidlaw (1915, 1916), Fraser (1924) and Lieftinck (1934). Recently Kumar (1973) has made taxonomic descriptions of the last instar larvae of *P. rubriceps* Selys and *P. laidlawi* Fraser.

Within Indian limits *P. rubriceps* Selys is widely distributed in plains and submontane areas, W. Bengal and U. P. In western Himalaya it is recorded from Corbett National Park, Dehra Dun, Pauri, Tehri, Nainital, Almora (U. P.), Bilaspur, Hamirpur and Sirmaur (H. P.).

MATERIAL AND TECHNIQUES

Studies on the life history in the laboratory were started on 9.vi.1976 by collecting eggs laid in vegetation by a ovipositing female in tandem at a perennial pond at vill. Gorakhpur, Dehra Dun. In the laboratory vegetation with eggs was kept submerged in water in a glass vessel. Hatching started on 22.vi.76 and completed on 25.vi.76. Study on larval development was begun on 23.vi.76 by starting rearing of 6 larvae in 2nd instar. All the 6 larvae emerged into imagos from 27.

TABLE 1.—Breeding Record (1976) of 6 larvae of *Pseudagrion rubriceps* Selys

Eggs collected on 9. VI. 1976.

Eggs hatched on 22. VI. 76 - 24. VI. 76.

INSTAR	Larva	I	Larva	II	Larva	III	Larva	IV	Larva V	Larva VI		
	Date of entry	dura- tion (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dur- ation (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dura- tion (in days)
2nd	23. VI. 76	2	23. VI. 76	2	23. VI. 76	3	23. VI. 76	3	23. VI. 76	2	23. VI. 76	3
3rd	25. VI. 76	3	25. VI. 76	5	26. VI. 76	3	26. VI. 76	4	25. VI. 76	4	26. VI. 76	3
4th	28. VI. 76	5	30. VI. 76	3	29. VI. 76	2	30. VI. 76	1	1. VII. 76	2	29. VI. 76	4
5th	3. VII. 76	3	3. VII. 76	2	1 VII. 76	4	1 VII. 76	4	1. VII. 76	2	3. VII. 76	2
6th	6. VII. 76	5	5. VII. 76	5	5. VII. 76	2	5. VII. 76	4	3. VII. 76	6	5. VII. 76	4
7th	11. VII. 76	4	10. VII. 76	6	7. VII. 76	4	9. VII. 76	4	9. VII. 76	4	9. VII. 76	5
8th	15. VII. 76	6	16. VII. 76	6	11. VII. 76	6	13. VII. 76	6	13. VII. 76	6	14. VII. 76	6
9th	21. VII. 76	4	22. VII. 76	4	17. VII. 76	7	19. VII. 76	4	19. VII. 76	4	20. VII. 76	5
10th	25. VII. 76	6	26. VII. 76	6	24. VII. 76	4	23. VII. 76	4	23. VII. 76	5	25. VII. 76	5
Emergence	31. VII. 76		1. VIII. 76		28. VII. 76		27. VII. 76		28. VII. 76		30. VII. 76	
Total number of days (from oviposition to emergence)		52		53		49		48		49		51

vii.76 to 31.vii.76 after passing through 10 instars, thus taking 50-54 days respectively from oviposition to emergence. Breeding record of the larvae reared in the laboratory is tabulated in table 1. In early instars larvae were fed on *Paramaecium* and *Cyclops* and later on mosquito larvae.

Studies on various instars are based on laboratory reared material. Regular sampling from various aquatic habitats and field studies were carried out, in the years 1975-76, in order to study the seasonal regulation of the species.

The terminology used for the labium is that of Corbet (1953), for tibial comb and tarsi that of Mac Neill (1967), and for the anal appendages those of Snodgrass (1954) and Mac Neill (1960).

OVIPOSITION AND EGGS

Oviposition is endophytic and occurs in tandem. The pair flies lazily amidst the vegetation at the banks of water bodies. Egg may be laid above water level or in submerged vegetation. The pair moves from one twig to another while ovipositing. Eggs are laid in oblique transverse rows in cortex of twigs or at the lower surface of leaves.

Eggs are elongated and some what cylindrical (measuring 0.96-1.02 mm.), with narrow anterior pole (Text-fig. 1A). When freshly laid yellowish, soon become darker.

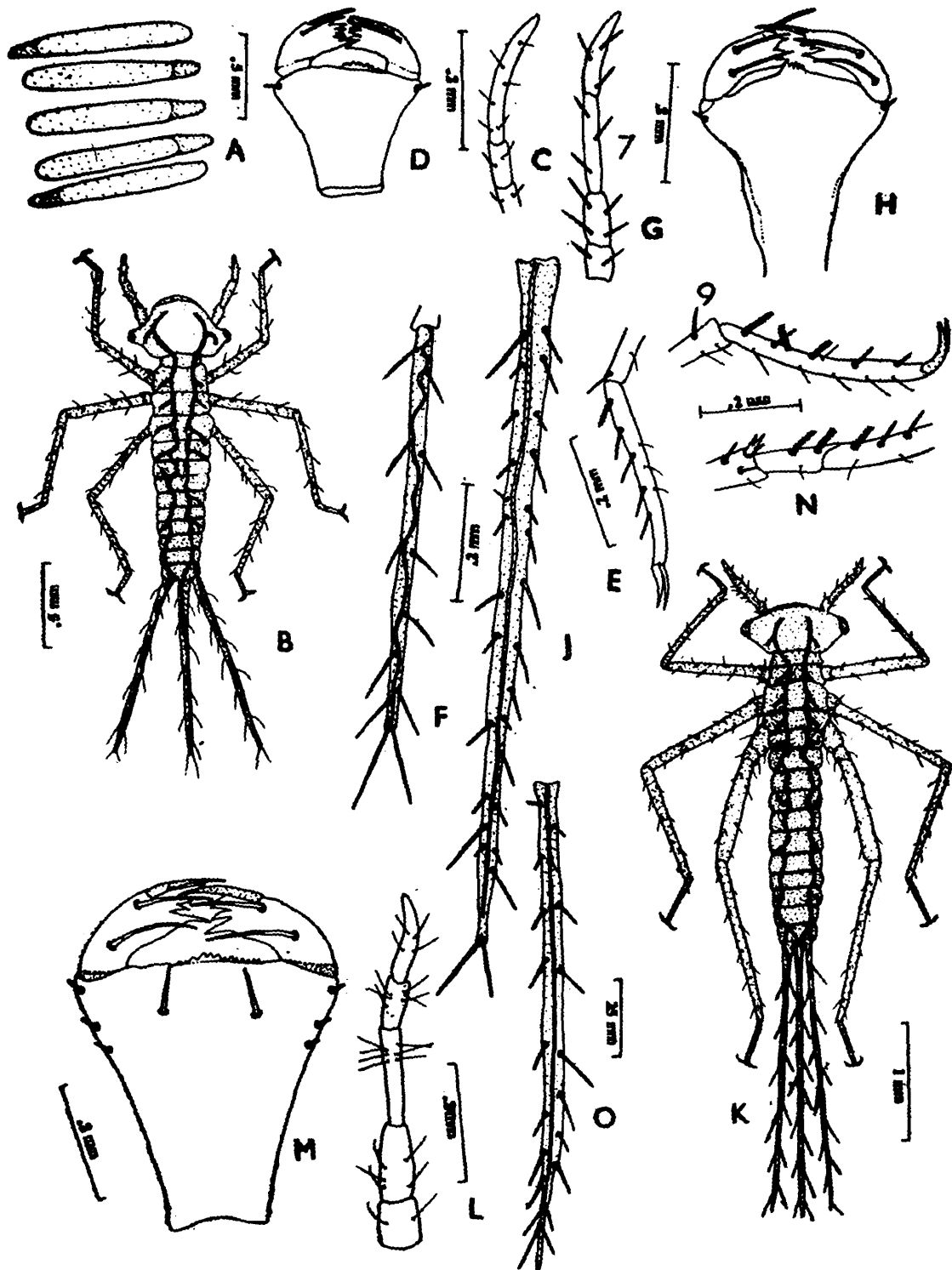
LARVAL STAGES

1st Instar or Prolarva: Hatching takes place through the rupture end of the egg and is of very short duration. Head somewhat squarish, abdomen elongated, narrowing posteriorly; legs folded ventrally over the abdomen; caudal lamellae thin, elongated.

2nd Instar (Text-fig. 1, B-F) : Elongated and slim in appearance with almost transparent body; tracheae distinctly visible in abdominal region (Fig. 1B); *Antennae* (Fig. 1C) 3-segmented, sparsely beset with setae; *labium* (Fig. 1D) small, flat, squarish; premental setae absent, a lateral spiniform seta present near the base of palpus, distal margin of prementum straight but with a few mesial crenations; palpal setae 1+1, distal margin of palpus formed into a number of crenulations; *tarsi* (Fig. 1E) single-segmented, beset with few spiniform setae; *Caudal lamellae* thin, ribbon-like long processes, almost transparent with a distinct undulating trachea traversing its full length (Fig. 1F). Length 2.2 mm.

3rd Instar (Text-fig. 1, G-J) : Larvae increasing in size with paired tracheae distinct in thoracic and abdominal region. *Antennae* (Fig. 1G) 4-segmented, the flagellar segment having divided into two; on

labium (Fig. 1H) premental setae still absent, crenations at distal margin of prementum beset with a claviform seta each; palpal setae 2+2, last one added at base, distal margin of palpus still deeply crenulated; *tarsi* single-segmented, beset with a few pectinate setae (Fig. 1I); *caudal*



Text-fig. 1.—(A-O) Life history of *P. rubriceps* Selys: (A) The eggs; (B-F) 2nd Instar (B. larva, C. antenna, D. labium, E. tibial comb and tarsi, F. epiproct); (G-J) 3rd Instar (G. antenna, H. labium, I. tibial comb and tarsi, J. epiproct); (K-O) 4th Instar (K. larva, L. antenna, M. labium, N. tibial comb and tarsi, O. epiproct).

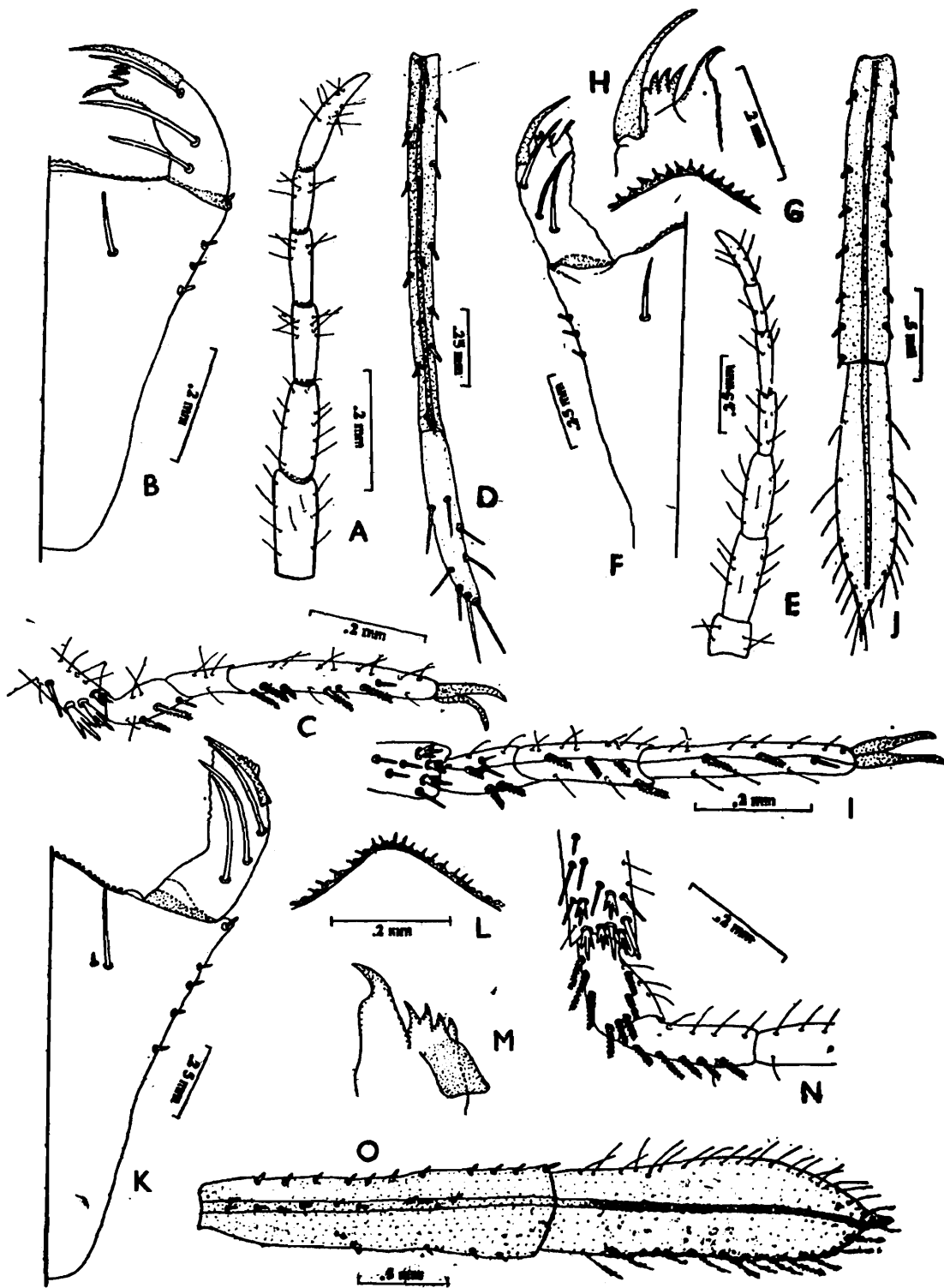
lamellae (Fig. 1J) increase in size, uniformly beset with long setae laterally, a median trachea traverses through its length. Length 4.5 mm.

4th Instar (Text-fig. 1, K-O): Larvae with caudal lamellae almost as long as body. *Antenna* (Fig. 1L) 5-segmented, 1st flagellar segment having divided into two, uniformly beset with setae; *labium* (Fig. 1M) still flat and squarish, premental setae 1+1, crenations at distal margin of prementum increasing in number; palpal setae 2+2, distal margin of palpus starts forming an outer and inner lobe; movable hook medium-sized; *tarsi* (Fig. 1N) 2-segmented, the distal one largest, tibial comb comprises a single tridentate seta; *tarsi* beset with pectinate setae; *caudal lamellae* (Fig. 1,O) becoming broader with short blunt setae proximally, narrowing distally. Length 6 mm.

5th Instar (Text-fig. 2,A-D) : Caudal lamellae shorter than body. *Antennae* (Fig. 2A) 6- Segmented, basal flageller segment again having divided into two; *labium* (Fig.2B) premental setae 1+1, laterally beset with a few spiniform setae; palpal setae 3+3, last seta added in inter-polar position; distal margin of palpus formed into two distinct lobes, the outer comprising 5-6 teeth, the inner forming a hook; *tarsi* 3-segmented, beset with a few pectinate setae; tibial comb comprise sa few tridentate setae (Fig. 2C). *Caudal lamellae* (Fig. 2D) now differentiated into ante-and post-nodal regions, antenodal region narrower with densely arranged rows of short spiniform setae, while the postnodal region has a few widely placed, long simple setae. Length 8.7 mm.

6th Instar (Text-fig. 2, E-J) : *Antenna* (Fig. 2E) 7- segmented, basal flagellar segment again dividing into two. *Labium* (Fig. 2F) becoming a bit elongated and narrower; premental setae 1+1, distal margin of prementum now having well formed crenations, each beset with a seta (Fig. 2G) palpal setae 3+3; outer lobe at distal margin of palpus with 4 teeth while the inner forms a curved end hook (Fig. 2H); *tarsi* 3-segmented beset with pectinate and spiniform setae, *tibial comb* comprises a number of tridentate setae (Fig. 2I); wing buds appear as rudiments and cover 1st abdominal segment. Female gonapophyses appear as triangular paired structures mid-ventrally on 9th abdominal segment; *caudal lamellae* with postnodal region becoming foliaceous and broader distally, antenodal region longer than postnodal (Fig. 2J). Length 10.4 mm.

7th Instar (Text-fig. 2 K-O) : *Antenna* 7-segmented, uniformly beset with setae. Premental setae 1_1+1^1 , setulae added mesally; number of lateral spiniform setae increasing, a few spiniform setae present mid-apically; palpal setae 3+3 (Figs. 2 K-M) : *tarsi* 3-segmented, tibial comb comprises a number of irregularly arranged tridentate setae, *tarsi* beset with paired row of pectinate setae (Fig. 2N); wing buds



Text-fig. 2.—(A-O) Life history of *P. rubriceps* Selys: (A-D) 5th Instar (A. antenna, B. labium, C. tibial comb and tarsi, D. epiproct); (E-J) 6th Instar (E. antenna, F. labium, G. enlarged view distal margin of prementum, H. enlarged view distal margin of palpus, I. tibial comb and tarsi, J. epiproct); (K-O) 7th Instar (K. labium, L. enlarged view distal margin of prementum, M. enlarged view distal margin of palpus, N. tibial comb and tarsi, O. epiproct).

increasing in size and extend up to middle of 2nd abdominal segment. Female gonapophyses further increasing in size, paired processes extend up to anterior side of 9th segment; *caudal lamellae* have acquired the

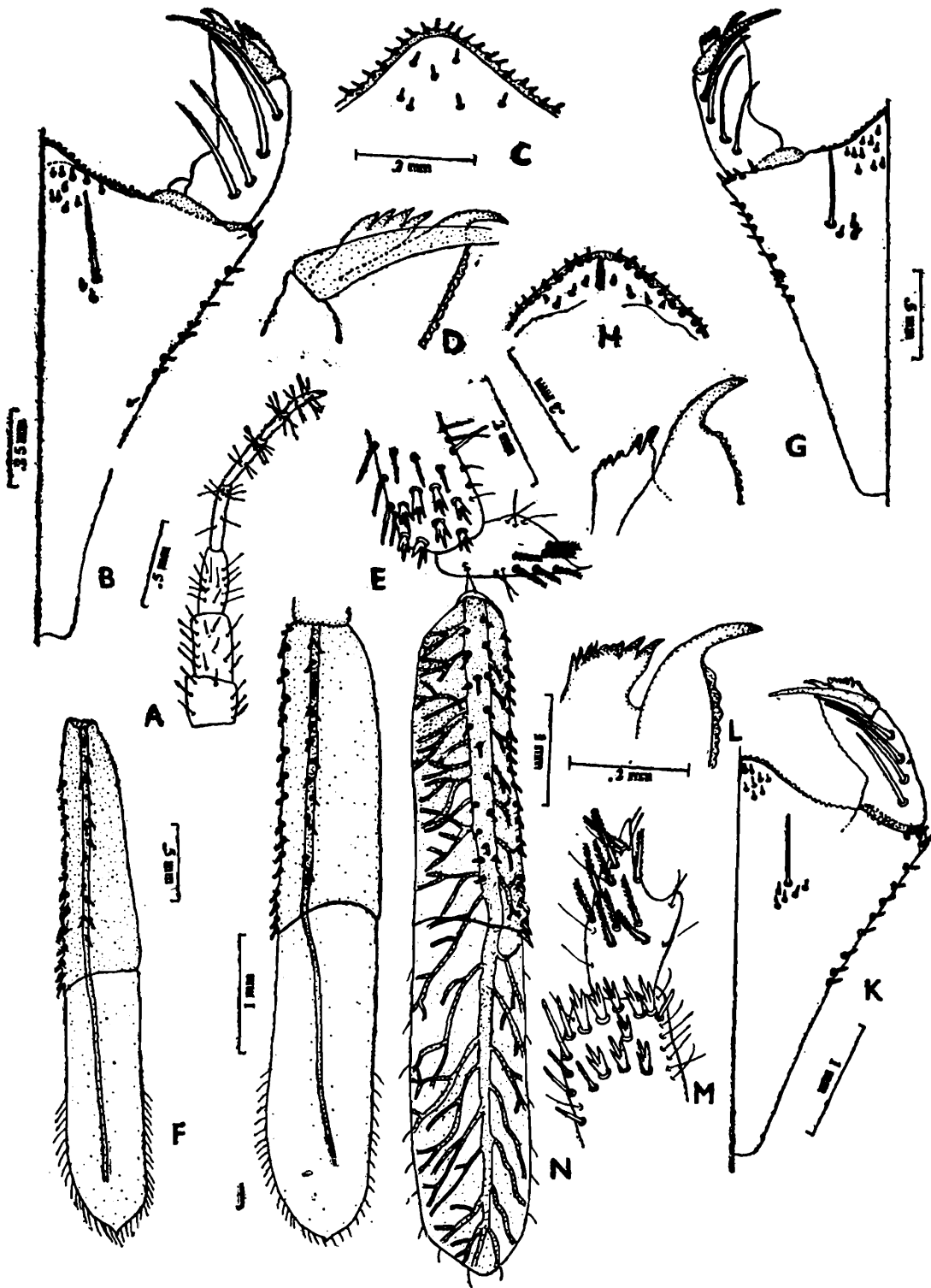
characteristic shape of the genus *Pseudagrion*, ante-and postnodal regions of almost same size, a median trachea distinct through whole length of lamella, antenodal region beset with rows of densely arranged spiniform setae; postnodal region bearing a few fine lateral setae, apex napiform (Fig. 2, O). Length 13. 1 mm.

8th Instar (Text-fig. 3, A-F) : Larvae have acquired the characteristic *Pseudagrion* appearance. *Colour*-yellowish green with dark brown markings dorsally, lamellae slightly darker in antenodal region.

Antennae (Fig. 3A) : 7-segmented, densely beset with setae; **labium** (Figs. 3, B-D) - premental setae 1_2+2^1 , Mid-apical spiniform setae on prementum further increasing in number; palpal setae 4+4, last seta being added at base, movable hook long, narrow outer lobe at distal margin of palpus with 4 teeth, narrow at base, inner lobe larger, pointed and curved, hook-like at apex (Fig. 3-D); number of setae on tibial and tarsi increasing further (Fig. 3E), paired female gonapophyses extend up to 10th abdominal segment; hind wing buds extend as far as end of 2nd abdominal segment; **caudal lamellae** further increasing in size with apex of postnodal half becoming rounded, a row of spiniform setae present on median tracheae in antenodal region (Fig.3F). Length 16.5 mm.

9th Instar (Text-fig. 3, G-J): Larvae further increasing in length and becoming darker. Premental setae 1_3+_31 , a row of lateral and a few spiniform setae present near the base of palpus (Fig. 3 G), palpal setae 4+4; tibial comb comprises a number of densely arranged tridentate setae, tarsi with paired rows of pectinate setae; paired female gonapophyses extend as far as 10th segment; **caudal lamellae** (Fig. 3J) of almost uniform width, ante-and postnodal regions of same size, apex of postnodal region almost rounded. Length 19.2 mm.

10th or last Instar (Text-fig. 3, K-N) : Yellowish-green to yellowish-brown, mottled with brown dorsally. Premental setae 1_5+_51 , spiniform setae also present mid-apically on prementum, and also a row laterally, palpal setae 4+4, distal end of palpus distinct in two lobes (Fig. 3L), movable hook about two-third of the palpus. **Tibial comb** (Fig. 3M): comprises a large number of tridentate setae; tarsi beset with pectinate setae. **Caudal lamellae** (Fig. 3N) flat, duplex with almost rounded apex: ante nodal region darker than postnodal region and is beset with spiniform setae. The thick median trachea traverse all along the length of caudal lamellae, from it branch off a number of lateral oblique secondary and tertiary tracheae; length-epiproct 4.62 mm, paraprocts 5.37 mm. Total length 21.5 mm.



Text-fig. 3.—(A-N) Life history of *P. rubricaps* Selys. (A-F) 8th Instar (A. antenna, B. labium, C. enlarged view distal margin prementum, D. enlarged view distal margin palpus, E. tibial comb and tarsi, F. epiproct); (G-J) 9th Instar (G. labium, H. enlarged view distal margin of prementum, I. enlarged view distal margin of palpus, J. epiproct); (K-N) 10th Instar (K. labium, L. enlarged view distal margin of palpus, M. tibial comb and tarsi, N. epiproct).

BIOLOGY

P. rubricaps Selys is another multivoltine species occurring at Dehra Dun. Adults are common on the wing almost throughout the

year around temporary and perennial ponds and at slow running marshy streams in thick jungles of submontane tracks. Adults generally confine themselves around aquatic biotopes and fly low amidst the vegetation.

Seasonal regulation of *P. rubriceps* is almost identical to that of *Ceriagrion coromandelianum* (Fab.) (Kumar, in press) and a small number of other multivoltine species occurring at Dehra Dun. Larvae are found in temporary and perennial ponds, slow running marshy streams and sometimes amidst shallower water of rivers in plain areas of the valley.

Larval development is rapid and with slight overlapping of broods the species is able to complete at least 3 larval generations in a year. The summer larval broods (i.e., March-April to May-June and June-July to August-September) are completed rapidly in about 2 months time each (*cf.* the breeding record presented in this paper, table 1), thus the first batch of adult emergence in a year occurs in March-April from perennial ponds, oviposition takes place soon after and the 2nd batch of emergence occurs in June-July. A number of ephemeral monsoon ponds are formed during this period as a result of S. W. monsoons and these too are now used for oviposition and development of one larval generation. The 2nd larval brood is again completed rapidly like the preceding summer brood and the 3rd batch of adults emerge in September-October. Adults remain on the wing for a while and shortly oviposit either in perennial ponds or in slow running marshy streams. However, with the advent of winter the larval development is slowed down and is completed in about 5-6 months (*cf.* Kumar, in press), the emergence occurs in following March-April thus completing 3 larval generations in a year at Dehra Dun.

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SUMMARY

Life history of *Pseudagrion rubriceps* Selys has been studied in the field and the laboratory. Specimens were reared from egg to adult. The principal changes in external morphology in different instars and the characters which are helpful in distinguishing various instars are described in detail. The seasonal regulation of the species has also been studied in the field.

TABLE 2.—Summary of larval changes in *Pseudagrion rubriceps* Selys

Instar	1	2	3	4	5	6	7	8	9	10
Antennal Segments		3	4	5	6	7	7	7	7	7
Premental Setae	—	—	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1
Palpal Setae		1 & 1	2 & 2	2 & 2	3 & 3	3 & 3	3 & 3	4 & 4	4 & 4	4 & 4
Tarsal segments	Pro-larva	1	1	2	3	3	3	3	3	3
Abdominal Segments covered with Wing buds	—	—	—	—	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	4
Female gonapophyses		—	—	—	—	r	i	i	i	i
Body length (in mm) including the caudal lamellae		2.2	4.5	6.9	8.7	10.4	13.1	16.5	19.2	21.5

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