

Immatures of *Rheocricotopus (Psilocricotopus) valgus* Chaudhuri & Sinharay of Darjeeling Himalaya with notes on ecology (Diptera : Chironomidae)

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Keywords : Larva, pupa, *Rheocricotopus*, habitat, larval dwelling, seasonal emergence.

The immatures (larva and pupa) of *Rheocricotopus (Psilocricotopus) valgus* Chaudhuri & Sinharay are described for the first time. The species belongs to *chalybeatus* group. The larva is opportunistic, present in the fast-flowing streams to slow-flowing organically enriched sewage drains. It lives in tunnels made of various particles glued together by silky secretions. There are two generations a year with peak emergence in April-May and September-November. The sex ratio of females to males is 2:1.

Stades immatures de *Rheocricotopus (Psilocricotopus) valgus* Chaudhuri & Sinharay de l'Himalaya et notes sur l'écologie (Diptera : Chironomidae)

Mots clés : larve, nymphe, *Rheocricotopus*, habitats, émergence saisonnière.

Les stades immatures, larve et nymphe de *Rheocricotopus (Psilocricotopus) valgus* sont décrits pour la première fois. L'espèce appartient au groupe *chalybeatus*. La larve est opportuniste et colonise aussi bien les rivières à débit rapide que les canaux d'égouts riches en matière organique. Elle vit dans des fourreaux faits de particules variées réunies par des sécrétions soyeuses. Il y a 2 générations annuelles avec un pic d'émergence en avril-mai et septembre-novembre. Le sex-ratio femelle/mâle est 2:1.

1. Introduction

Rheocricotopus Thienemann & Harnisch is one of the best known genera of Orthoclaadiinae. The generic status of *Rheocricotopus* was ascertained by Brundin (1956) with *Chironomus effusus* Walker as type of the genus. Lehmann (1969) revised the European species of the genus along with descriptions of a few oriental species. Saether (1985) made revision of the genus and divided it into two subgenera. *Psilocricotopus* Saether and *Rheocricotopus* s.str. which are said to be distinct in the immatures stages but obscure in adults (Crans-ton et al. 1989). The genus is represented by ten spe-

cies from the Orient of which only five species are known in Indian subcontinent (Chaudhuri & Sinharay 1983, Bhattacharyay et al. 1991).

2. Material and methods

The larvae taken from the slow-flowing water of the Darjeeling Himalayas, were reared to imagines with the substrata of the natural habitat. The study material was mounted on microslides following modified methods adopted by Schlee (1966) and Pinder (1989). In describing the species, Saether (1980) mostly have been followed.

Measurements are given in millimeter (mm) with the number before the parentheses indicating average values, the ranges given within parentheses suffixed by <n> being the number of specimens measured.

Specimens will be deposited at the National Zoological Collections, Calcutta, The Natural History Museum, London, United States National Museum, Wa-

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shington D.C. and the Zoological Staatssammlung, München (Germany).

3. Description

Rheocricotopus (Psilocricotopus) valgus Chaudhuri & Sinharay

Rheocricotopus valgus Chaudhuri & Sinharay, 1983 : 402

Rheocricotopus (Psilocricotopus) valgus : Bhattacharyay, Ali & Chaudhuri, 1991 : 347.

Material : West Bengal, Darjeeling (27°03'N 88°10'E), 2042 m msl, 7 larvae, 1 ♂ pupa and 4 ♀ pupal exuviae, 2 ♂, 20.VIII.1990 ; 1 ♀ reared from larva, 4 ♀, 01.X.1991 ; 1 ♂, 19.IV.1992 ; 1 ♂ pupa, 2 ♂ reared from larva, 27.XII.1994, D.K. Som : Holotype ♂ (Type No.B.U.Ent.54), Allotype ♀, West Bengal, Darjeeling, 17.XI.1974, Coll. S.K. Das Gupta.

3.1. Fourth instar larva

Body yellow with brown thoracic striations ; head capsule yellowish brown with dark postoccipital margin ; claws of anterior and posterior parapods light brown. Exuviae light brown. Total body length 7.13 (6.99-7.26, n=7).

Head : Mandible and mentum dark brown. Ventral head capsule (Fig. 1A) 0.45-0.048 long and 0.33 (0.30-0.36, n=7). Single dorsal eye spot slightly elongated, blackish.

Antenna (Fig. 1B) : Lengths of antennal segments (I-V) : 15:5:2:2:2.3, AR 1.61. Basal antennal segment 0.022 wide, ring organ 0.0072 in diameter, distance from base to ring organ 0.004. Blade 0.040 long, accessory blade 0.020 long. Lauterborn organs 0.008 long.

Labrum : S I (Fig. 1C) palmate, apically serrated with about 13 teeth. S II (Fig. 1C) simple, other S setae simple. Pecten spipharyngis consisting of 3 smooth scales, outer scales slightly broader than inner. Pre-mandible (Fig. 1D) 0.085 long with single apical tooth, brown in colour, brush absent.

Mandible (Fig. 1E) : 0.140 long, mandible with apical 2/3 dark brown, basal 1/4 brown. Seta subdentalis 0.014 long, with apical hook. Seta interna with 5 simple branches.

Mentum (Fig. 1F) : Flattened width 0.127-0.136 : 2 median teeth 0.028-0.033 wide, apically blunt to pointed, at most with outer shoulder. Ventromental plate (Fig. 1F) broad, extending far beyond outer margin of outer mental tooth. 0.085-0.110 wide, with 16 distinct setae in beard beneath.

Maxilla (Fig. 1G) : With elongate triangular anterior lacinial chaeta. Pecten galearis present.

Body (Fig. 1H) : Yellow. Procercus 0.036 high and 0.028 wide : bearing 3 anal setae, longest anal seta 0.490 long : medioposterior procercal spur distinct, 0.016 long. Supraanal seta 0.100 long. Sa/An 0.20. Claws of anterior parapods with some inner teeth ; posterior parapods 0.51 long with 16 yellow coloured claws (Fig. 1I). Anal tubules 4, 0.255 long. Body setae 0.108 long, strong.

3.2. Pupa

Exuviae brown. Total length 4.68 (4.66-4.70, n=3) in male and 4.42 (4.38-4.46, n=5) in female. TH/AM 1.41 (1.35-1.47, n=8).

Cephalothorax : Frontal setae weak, short 0.032 long on prefrons : frontal apotome without warts, slightly wrinkled (Fig. 2A). Antennal sheath (Fig. 2C) 1.110 in male, 0.450 long in female. Ocular field with 1 Po. Median anteprenotals 0.160-1.170 and 0.119 long, lateral anteprenotal 0.020-0.028 long. Thoracic horn (Fig. 2B) club-shaped, 0.460 long, covered with extensive spinules except at extreme apex and base, ThR 3.24. Precorneal setae 3. anterior seta fine, 0.120-0.130 long, median seta fine, 0.096 long and posterior seta comparatively thicker, 0.100-0.200 long, all arranged in triangular fashion (Fig. 2B) ; of 4 dorsocentrals only Dc_{3,4} grouped together ; Dc₁ 0.084, Dc₂ 0.050-0.060, Dc₃ 0.050 and Dc₄ 0.064-0.072 long ; distance between Dc₁ and Dc₂ 0.116-0.132, between Dc₂ and Dc₃ 0.096 and between Dc₃ and Dc₄ 0.024-0.036 ; prealar absent. Thorax anteriorly wrinkled, posteriorly nearly smooth. Wing sheath smooth.

Abdomen (Figs. 2D, 3E,F) : Tergites II-III with anterior shagreen ; IV-VI with extensive shagreen ; VII-VIII with anteromedian, median and posterior shagreen of fine spinules ; IX with minute shagreen in anterior half. Sternite II with anterior and median faint shagreen ; III-VI with extensive and VII-VIII with faint shagreen. Tergite II with rows of weak less sclerotised posterior hooklets on protuberance having 80-100 hooklets both in male and female. Posterior margin of tergites II-VIII with caudal spines in male as 64-70, 74-76, 68-94, 60-65, 64-70, 26-37 and 40-41, in female as 66-69, 65-78, 57-76, 78-91, 60-68, 27-28 and 35-37. Anteriorly directed spinules present posterior to spines on tergites III-V. Conjunctives bare. Pedes spurii B absent. Pedes spurii A present on sternites IV-VI. Sternites IV-VI with postero-lateral patch of fine spines in front of pedes spurii A. Apophyses distinct on segments II-VIII, brown in colour. Setation : Lateral setae of I-VI hair and bristle-like, those of II-IV/V on prominent tubercles with anterior two on one tubercle and posterior one on a separate tubercle ; VII and VIII with all taeniate L setae. Anal lobe (Fig. 3F)

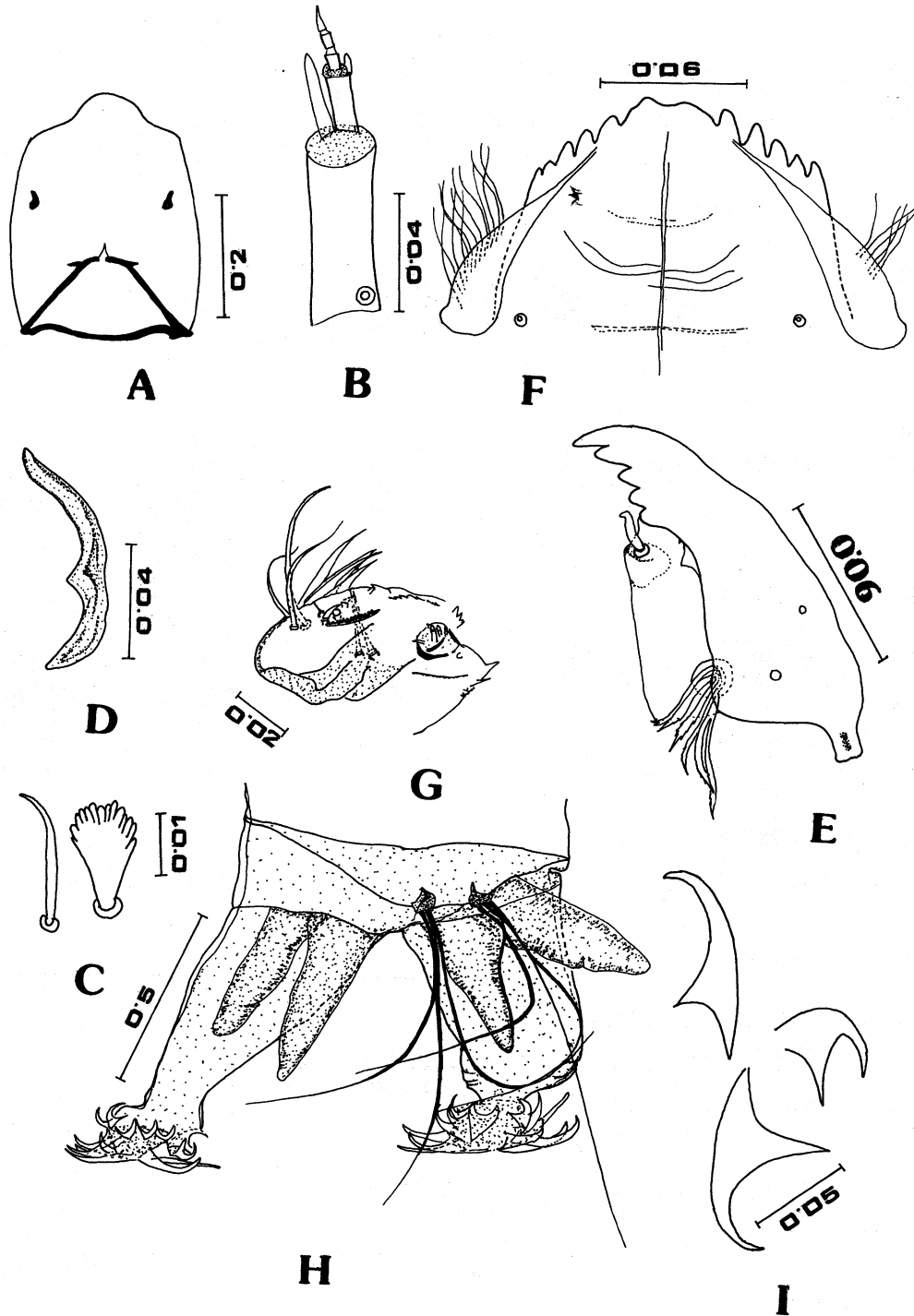


Fig. 1. Larva of *Rheocricotopus valgus* Chaudhuri & Sinharay : A. Head capsule (ventral view) ; B. Antenna ; C. S I and S II ; D. Premandible ; E. Mandible ; F. Mentum and ventro-mental plate ; G. Maxilla ; H. Posterior abdominal segments ; I. Claws of posterior parapods.

Fig. 1. Larve de *Rheocricotopus valgus* Chaudhuri & Sinharay : A. Capsule céphalique (vue ventrale) ; B. Antenne ; C. S I et S II ; D. Prémandibule ; E. Mandibule ; F. Mentum ; G. Maxille ; H. Segments abdominaux postérieurs ; I. Crochets des parapodes postérieurs.

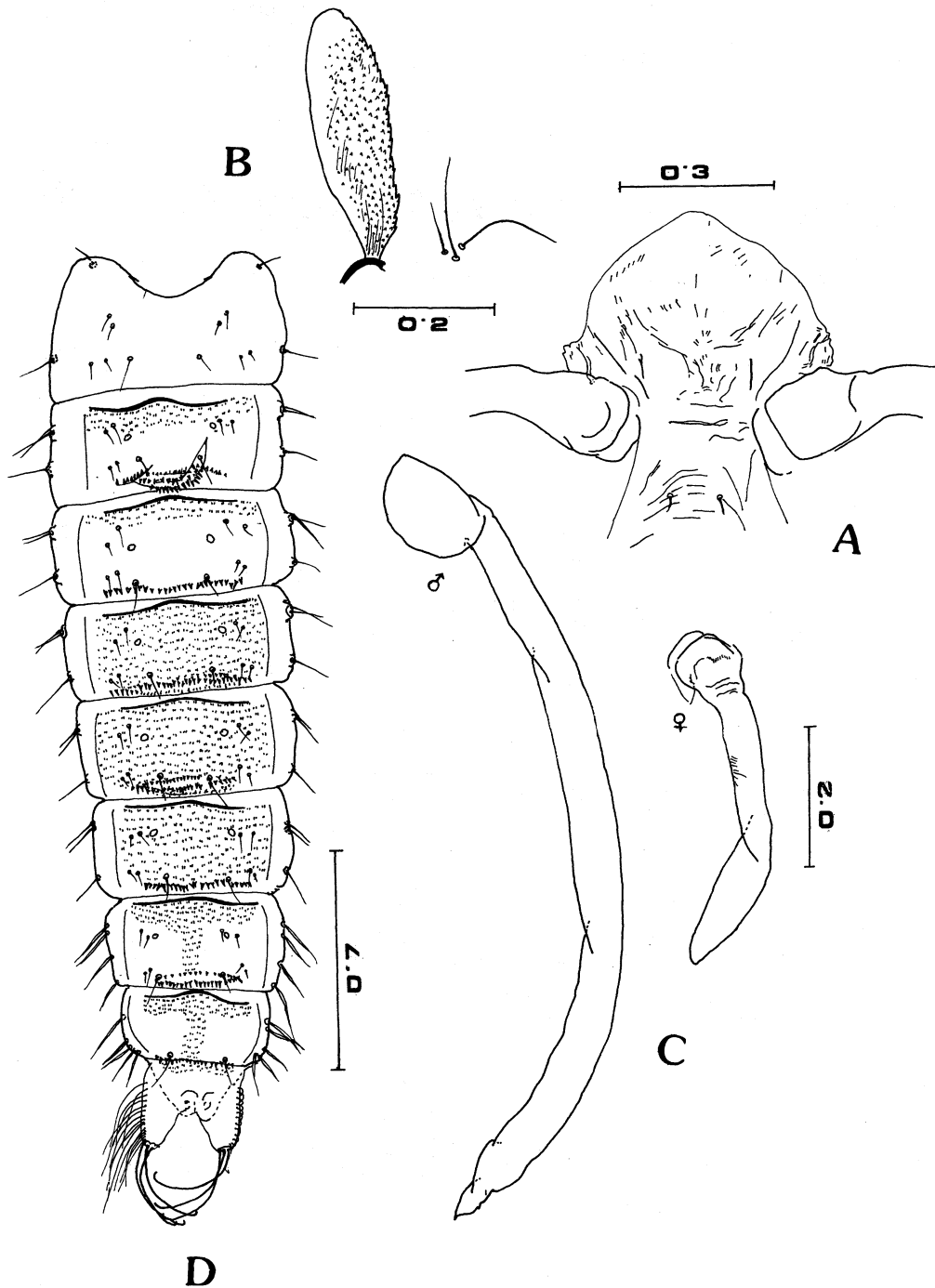


Fig. 2. Pupa of *Rheoricotopus valgus* Chaudhuri & Sinharay : A. Frontal apotome with prefrons ; B. Thoracic horn and precorneal seta ; C. Antennal sheath (male and female) ; D. Abdomen (tergites).

Fig. 2. Nymphe de *Rheoricotopus valgus* Chaudhuri & Sinharay : A. Apotome frontal et prefrons ; B. Corne thoracique et soies précornéales ; C. Fourreaux antennaires ♂ et ♀ ; D. Tergites abdominaux.

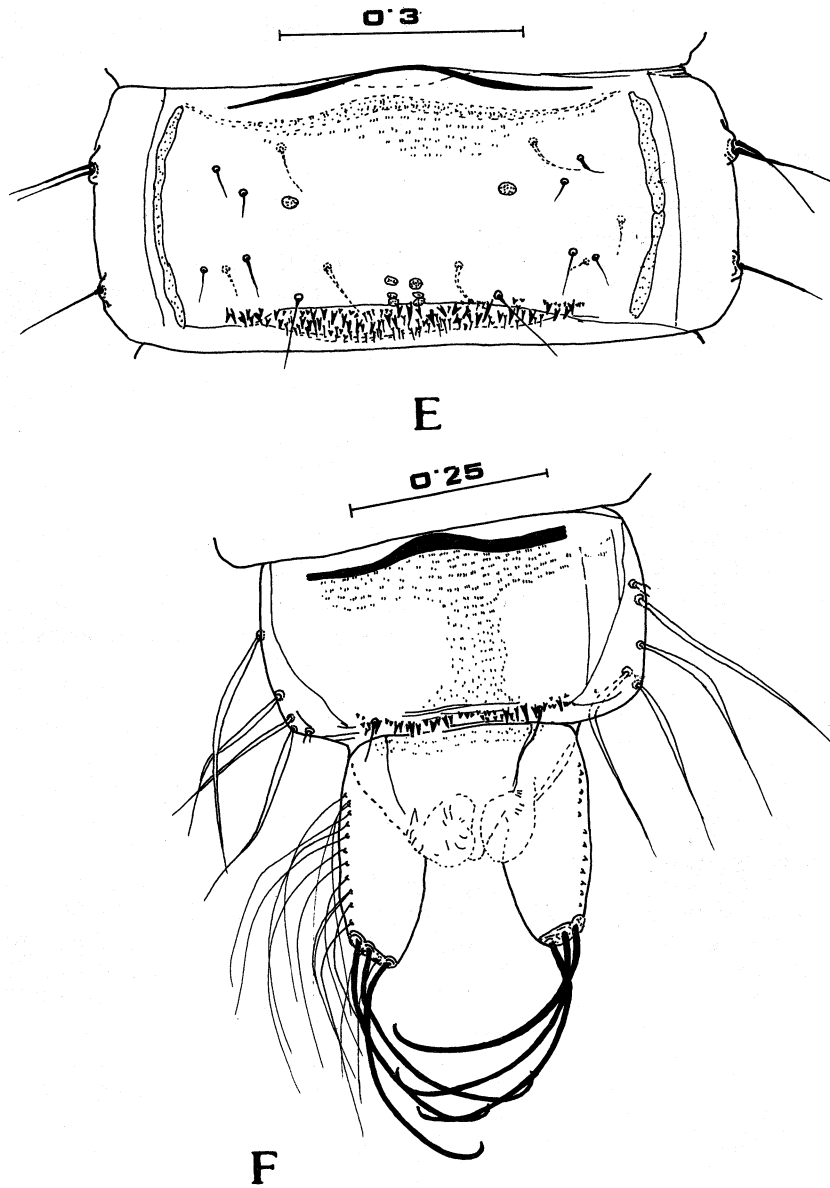


Fig. 3. Pupa of *Rheocricotopus valgus* Chaudhuri & Sinharay : E. Tergite III ; F. Tergites VIII and IX.

Fig. 3. Nymphe de *Rheocricotopus valgus* Chaudhuri & Sinharay : E. Tergite III ; F. Tergites VIII et IX.

elongated, rectangular, 0.374 long, 0.323 wide ; with 18-20 taeniae in fringe ; with 3 sub-equal, apically hooked. 0.320 (0.320-0.340, n=3) long anal macrosetae. Genital sac in male 0.230, in female 0.195 (0.190-0.200, n=3) long, in both sexes not overreaching anal lobe. G/F 0.62 in male, 0.65 in female. ALR 2.31 in male and 2.07 in female.

Remarks

The adult male and female of *Rheocricotopus valgus* were described by Chaudhuri & Sinharay (1983) from hilly regions of North-East India. Bhattacharyay et al. (1991) keyed the males of this species under the subgenus *Psilocricotopus* Saether. Adults conform to the description of Chaudhuri & Sinharay (1983). The pupa resembles *R. (P.) glabricollis* (Meigen) in respect to the thoracic horn, and in having taeniate L setae on T VII and VIII. The species also bears affinity to *R. (P.) chalybeatus* (Edwards) in possessing a similar number of L setae on tergites I-VIII. The presence of large oval humeral pit. arrangement of pupal L setae on segments V-VIII as 3:3:4:5, absence of pedes spurii B and with slightly broader outer scales (than median scale) of pecten epipharyngis aligns it strongly with the *chalybeatus*-group of Saether (1985).

The following combination of characters of adults and immature will distinguish *Rheocricotopus (P.) valgus* from all other members of the subgenus *Psilocricotopus* Saether :

Adult i) AR 1.22 in male and 0.55-0.59 in female, ii) squama with 7-10 setae, iii) abdomen in male bicoloured, iv) femur of fore leg in both sexes with dark coloured band at the distal onethird, v) anal point with 4 setae on each side with a blackish spot at the pointed tip, vi) gonocoxite IX of female with 22-23 setae and vii) tergite IX of female undivided, with little caudo-median prominence and with 7-14 setae.

Pupa i) Thoracic horn club-shaped, 0.460 long, covered with extensive spinules, ii) Dc_3 and Dc_4 grouped together, iii) pedes spurii A present on segments IV-VI, iv) L setae of segments V-VIII as 3:3:4:5, v) all L setae of segments VII and taeniate, vi) anal lobe fringe with 10-20 taeniae and vii) genital sac in both sexes not overreaching anal lobe.

Larva i) AR 1.61, ii) basal antennal segment 0.072 long, iii) S I palmate, apically serrated with 13 teeth. iv) pecten epipharyngis with outer scales slightly broader than the inner scale, v) median teeth of mentum, without accessory tooth, at most with weak outer shoulder and vi) ventromental beard with 16 setae.

4. Ecology

4.1. Habitat

Slow flowing perennial spring ; found in a variety of substrata e.g. rocky surface, submerged wood, leaves of aquatic macrophytes, dead leaves, domestic wastes ; rheophilous ; mesoxyphilous ; acidophilous ; organically enriched lotic water, larval movement quick.

4.2. Larval dwelling

The larvae of *Rheocricotopus valgus* are capable of using a variety of substrata viz. rock, gravel, submerged wood, leaves of aquatic herbs, waste papers, polyethylene packets etc. for its tube formation. They generally live in tunnels made of a loose mass of clay and detritus particles glued together by silky secretion. The mode of their tube building on various aquatic macrophytes have been extensively studied in the laboratory, which show parity with the field observations. They are noted to live in cases of debris on shredded leaves of surrounding trees such as *Sambucus nigra* (Caprifoliaceae). The larvae also mine tunnels in leaves of various submerged plants viz. *Rumex nepaiensis*, *Nasturtium nepalensis*, *Cestrum orientalis* and *Polygonum runcianatum*. These tunnels extend during ingestion of leaf tissue and are lined with silky secretion. The larvae are very quick to respond in constructing tunnels in the laboratory with fresh leaves if supplied. When put in laboratory rearing container with clay and detritus, they make their attachment to the petridish first and then start forming flimsy tubes with the help of available materials by cementing them with salivary secretion.

4.3. Seasonal emergence, sex ratio and life span of the adult

Data on seasonal emergence of *R. valgus* studied through bimonthly sampling, with the aid of light traps at the study sites indicate distinct peak emergences during April-May and September-November (Fig. 4). It appears to be the dominant species in 1990-91. The summer generation of the species slumps during the rainy season, but the autumn generation is most striking and emergence continues up to the winter months.

Studies of the sex-ratio of the species throughout the period show that the number of females outnumbered that of males during the summer and autumn generations. The data obtained from light-traps suggest that the sex-ratio of females : males is 2:1.

The life span of the adult of the species, as observed in the laboratory, seems to be 4-5 days in the male, the female lives one day longer.

5. Discussion

The genus *Rheocricotopus*, being one of the best known orthoclad genera, shows many erroneous descriptions and nomenclatural confusion in the literature. Saether (1985) has revised the genus and unveiled most of the problems. Two previous species-groups were upgraded into two clearly monophyletic subgenera, *Psilocricotopus* Saether and *Rheocricotopus*

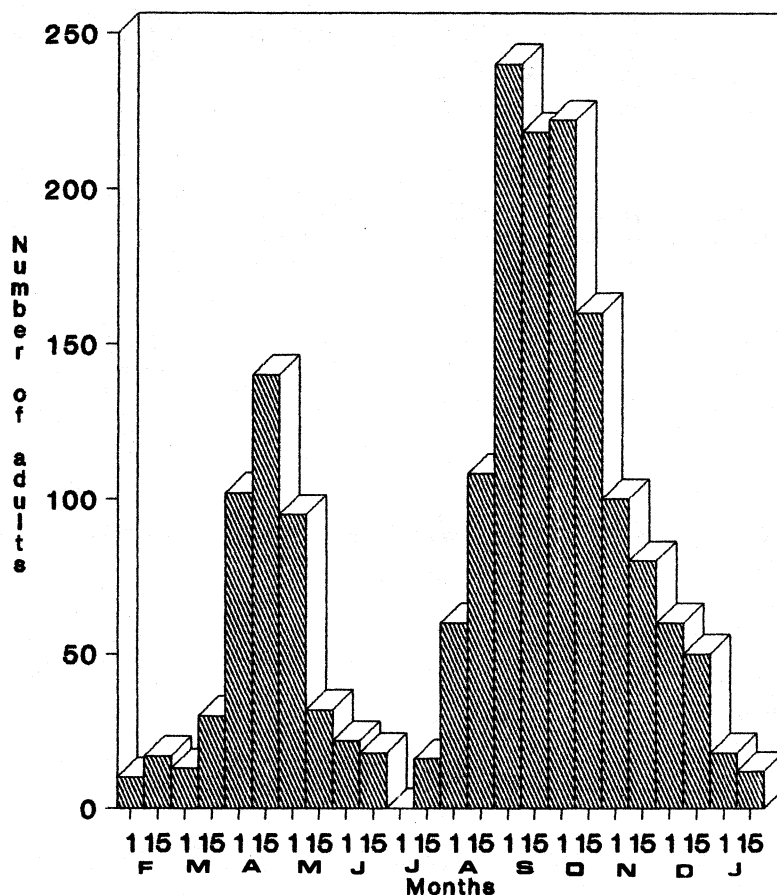
Fig. 4. Seasonal emergence of *R. valgus*

Fig. 4. Emergences saisonnière des imagos.

s.str. Bhattacharyay et al. (1991) keyed the adult males of Indian species of the subgenus *Psilocricotopus*. *R. (P.) valgus* Chaudhuri & Sinharay may be assigned to the *chalybeatus*-group of Saether (1985). From critical examination of the cladogram of the genus *Rheocricotopus* as erected by Saether (1985), it may be ascertained that *R. (P.) valgus* is synapomorphic for the trend 33 and 27 and may easily be considered to form a group with *R. (P.) chapmani* (Edw.) and *R. (P.) tirolus* Lehmann. However, the presence of pupal anal fringe (plesiomorphic for trend 25) may put in a trend between trends 26 and 25. Nevertheless, the correct designation of the trend will require proper elucidation of the species *R. (P.) chapmani*. It is interesting to note that the nominal subgenus *Rheocricotopus* includes members only from the Holarctic region with a very

few species on its margin, while the species belonging to subgenus *Psilocricotopus* enjoy a wider distribution in Afrotropical and Oriental realms in addition to the Holarctic region. Thus, the distribution of *Psilocricotopus* appears to confirm Saether's view that it is the more plesiomorphic subgenus.

The larva is very adaptable and opportunistic, being present in a fast flowing-stream to slow flowing-organically rich sewage drain. The species shows a wide range of substratum preference whereas other species exhibit a distinct preference for a particular type of substratum. The larvae have been observed to colonize litter, leaves and rotting wood of nearby macroflora viz., *Sambucus nigra*, *Notocheatus wallichii*, *Polygonum runcianatum*, *Hypestis triflora*, *Cestrum orientalis*, *Rumes nepalensis* and *Stellaria media* bordering

the spring in order to utilise them as substrata for tube formation which partially supports Fittkau (1977). Mechanism of construction of tubes in this larva appear to be similar to that described by LeSage & Harrison (1980).

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