

## Morphology and Chaetotaxy of Larval Hydraenidae (Coleoptera) II: The Subgenus *Ochthebius* s. str. Leach

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### Abstract

The morphology and chaetotaxy of the three larval instars of the subgenus *Ochthebius* (s. str.) of the genus *Ochthebius* LEACH are described and illustrated following the setal pattern of *Ochthebius auropallens* FAIRMAIRE. The study revealed many features on the head capsule, cephalic appendages, and the thoracic and abdominal segments that may be useful for systematic and phylogenetic comparisons.

**Key-words:** Coleoptera, Hydraenidae, *Ochthebius*, larvae, chaetotaxy.

### Résumé

La morphologie et la chétotaxie des trois stades larvaires du sous-genre *Ochthebius* (s. str.) sont décrites et caractérisées sur la base des caractères larvaires de l'espèce *Ochthebius auropallens* FAIRMAIRE. L'analyse chétotaxique de la capsule céphalique, des pièces buccales, des pattes et des segments thoraciques et abdominaux, s'est avérée d'une grande utilité pour les comparaisons taxonomiques et phylogénétiques.

**Mots clés:** Coleoptera, Hydraenidae, *Ochthebius*, larves, chétotaxie.

### Introduction

*Ochthebius* LEACH is one of the most diverse and heterogeneous genera within the family Hydraenidae. The phylogenetic relationships among the different lineages currently included in *Ochthebius* have not been studied in much detail. In fact, HANSEN (1991) in his excellent revision of the different genera of Hydraenidae observed several plesiomorphies among the diagnostic characters of *Ochthebius* and suggested that this genus is a paraphyletic group. Recent studies on larval morphology in Coleoptera (ASHE, 1986; ALARIE, 1991, 1995; BEUTEL, 1994; BOUSQUET & GOULET, 1984; DELGADO & SOLER, in press a) have revealed the value of this kind of work for phylogenetic analysis. For this reason, a study of the larval morphology of the

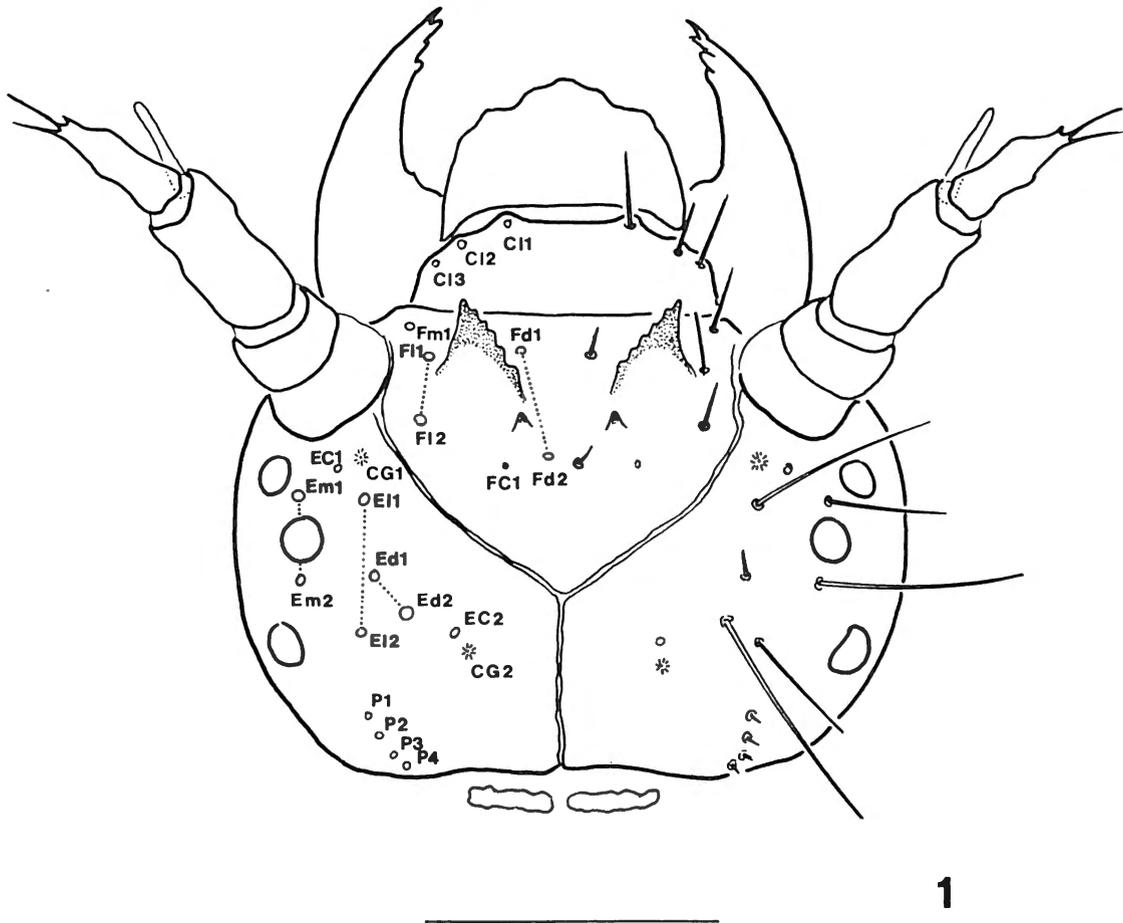
different subgenera of *Ochthebius* was thought to be of interest.

The aim of this study is to describe the morphology and chaetotaxal pattern of the larvae of the subgenus *Ochthebius* (s. str.) and to provide illustrations to facilitate the identification of all these characters. The present work, we hope, will be useful in offering new features for correctly defining the diagnostic characters of the genus *Ochthebius*. Moreover, this work will serve as a reference for intended future papers which will discuss the real position of some lineages of this genus on the basis of preimaginal characters (DELGADO & SOLER, in press a).

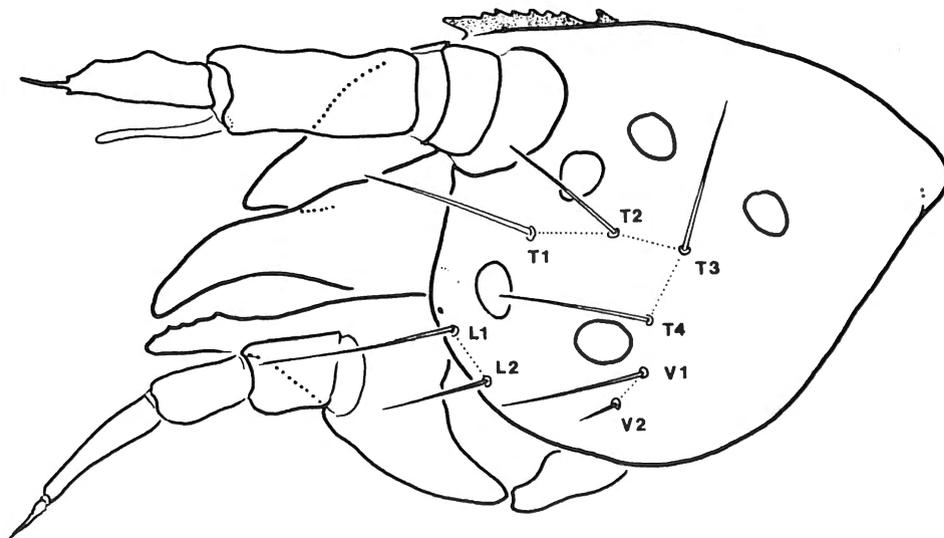
### Material and methods

**Material examined.** – The larvae used in this study were obtained by rearing in the laboratory the adults of several species of *Ochthebius* belonging to different subgenera. The rearing techniques used by us and the biology of this genus will be published in a separate paper. Some specimens found *ex societate imaginis* were also studied. The present work is based on the study of the three larval instars of *Ochthebius auropallens* FAIRMAIRE whose morphology is very similar to those other species of the subgenus *Ochthebius* (s. str.) studied by us.

**Larval study.** – The description of immature *Ochthebius* is based on material cleared, glycerolated and mounted on standard glass slides. The technique for studying larvae in glycerol has been described by BOUSQUET & GOULET (1984). For general studies under an optical microscope, the specimens were placed on a ringed slide filled with glycerine. The parts of the body to be examined under high magnification were detached and positioned on a slide with Hoyer's mounting medium and covered with a coverslip. Drawings were prepared using a microscope with a drawing mirror. When possible, at least six specimens were used to describe each character. The system for naming setae and pores used in the present article follows that employed by DELGADO & SOLER (1997).



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Figures 1-2. – *Ochthebius auropallens*, larval instar I, head. 1, dorsal view. 2, lateral view. CG: cephalic glands; Cl, clipeal setae; EC: epicranial campaniform sensilla; Ed, epicranial dorsal setae; El, epicranial lateral setae; Em, epicranial marginal setae; FC, Frontal campaniform sensilla; Fd, frontal discal setae; Fl, frontal lateral setae; Fm, frontal marginal setae; L, lateral setae; T, temporal setae; V, ventral setae. Scale= 0.1 mm.

## Results

Description of the larva of *Ochthebius auropallens* FAIRMAIRE (Figs 1-20).

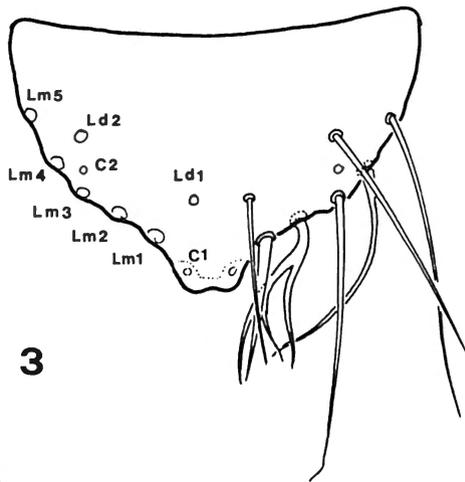
### Instar I

Total body length about 1.4 mm. Head: head capsule width:  $0.21 \pm 0.01$  mm (Mean  $\pm$  SD;  $n = 6$ ). Ecdysial sutures Y-shaped. Ocular areas with 5 stemmata. Chaetotaxy as follows and in Fig. 1 and 2. Frontal region (in each lateral half) with 2 campaniform sensilla and 5 setae arranged in 3 rows: 2 frontal dorsal setae, 2 frontal lateral setae and 1 frontal marginal seta. Epicranial regions with 2 campaniform sensilla, 2 epicranial glands and 10 setae arranged in 4 rows: 4 minute posterior setae, 2 epicranial dorsal setae, 2 epicranial lateral setae and 2 epicranial marginal setae. Temporal regions with 4 setae: T1-T4. Lateral regions with 1 campaniform sensillum and 2 setae: L1 and L2. Ventral region (in each lateral half) with 2 short setae: V1 and V2. Frontal region with 2 sclerotized, serrate and well developed egg-bursters and two small teeth behind these. Labrum (Fig. 3) markedly produced anteromedially, with 2 campaniform sensilla and 7 setae arranged in 2 rows in each lateral half: 2 labral dorsal setae and 5 labral marginal setae. Lm1, Lm3 and Lm5 arise dorsolaterally, Lm2 and Lm4 arise ventrolaterally (Fig. 4). Lm4 is a long seta and Lm2 is pectinate. Antenna (Fig. 5) with article I short and with 4 campaniform sensilla around the apex, without setae; article II about 3.9x as long as article I; article III about 0.8x as long as II. Article II with 4 long setae and 2 solenidia, one of which may be considered as a sensory appendage. Article III with 4 setae and 3 apical solenidia; IIS3 short. Mandibles (Fig. 6) right and left nearly identical in size and shape; with 2 campaniform sensilla and 2 setae. M1 long and M2 of medium length. Prosthema curved and slender; molar area well developed. Maxilla as in Fig. 7. Cardo triangular, with 1 seta. Stipes with 4 setae and 1 campaniform sensillum. Lacinia not fimbriate, with 6 developed and stout setae. Palpifer consisting of crescentic sclerite at base of maxillary palpus; with 1 seta. Maxillary palpus with 3 articles; article II 1.25x as long as article I, article III 1.5x as long as article I. Apical article with conspicuous, basal, digitiform, sensory appendage on external surface; article I with 2 campaniform sensilla, article II with 2 setae and 1 campaniform sensillum. Labium as in Fig. 8, consisting of 3 sclerites; ligula short and broad, bearing 4 papillae; palps with 2 articles, article I with 1 campaniform sensillum on mesial margin. Submentum with 1 pair of setae; mentum with 2 pairs of setae and 1 pair of campaniform sensilla. Prementum with 2 pairs of setae.

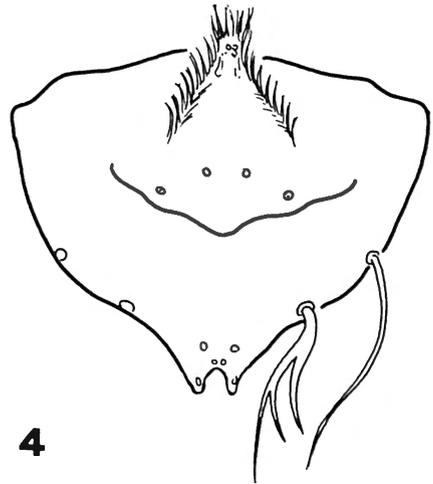
Thorax: Pronotum as in Fig. 9. Rows A with 4 setae: A1-A4; rows L with 3 setae: L1-L3; rows P with 4 setae: P1-P4; rows Da with 1 seta: Da1; rows Db with 1 seta: Db1; rows Dc with 1 seta: Dc1. Five pairs of campaniform

sensilla are present: C1-C5. One pair of tergal gland is present in the disc of the pronotum. Mesonotum as in Fig. 10; rows A with 4 minute setae; rows L with 3 setae: L1-L3; rows P with 4 setae: P1-P4; rows Da, Db and Dc each with 1 setae: Da1, Db1 and Dc1, respectively. Da1 and Dc1 frequently with apex pectinate. Campaniform sensilla C1 and C2 absent. Two pairs of tergal glands are present in the mesonotum. Metanotum similar to mesonotum. Prosternum as in Fig. 11; presternum divided into 2 lateral regions, each with 2 setae; eusterium consisting of central sclerotized area with 1 pair of setae; sternum indistinctly sclerotized and with 1 pair of setae. Laterosternum fused to prehypopleuron forming a sclerotized lobe anterior to coxa, with 3 setae. Posthypopleuron consisting of slightly sclerotized lobe posterolaterad to coxa, with associated denticles or minute spines. Mesosternum (Fig. 11) differs from prosternum as follows: sternum with 2 pairs of setae; presternal region with only 1 seta and prehypopleuron with 2 setae. Mesothoracic spiracles present, annular and associated to 1 seta. Metasternum similar to mesosternum. Metathoracic spiracles vestigial, without setae. Legs: Prothoracic leg as in Fig. 12. Coxa with 1 campaniform sensillum and 15 setae: 1 D, 2 Ad, 4 Al, 1 Av, 2 Pd, 4 Pl and 1 Pv. Trochanter with 7 campaniform sensilla and 8 setae: 1 Ad, 2 Al, 2 Av, 1 Pl, 1 Pv and 1 V. Femur with 2 campaniform sensilla and 8 setae: 1 D, 1 Ad, 1 Al, 2 Av, 1 Pd, 1 Pl and 1 V. Tibia with 1 campaniform sensillum and 9 setae: 2 D, 1 Ad, 1 Al, 1 Av, 2 Pd, 1 Pl and 1 Pv. Tarsungulus with 2 minute setae.

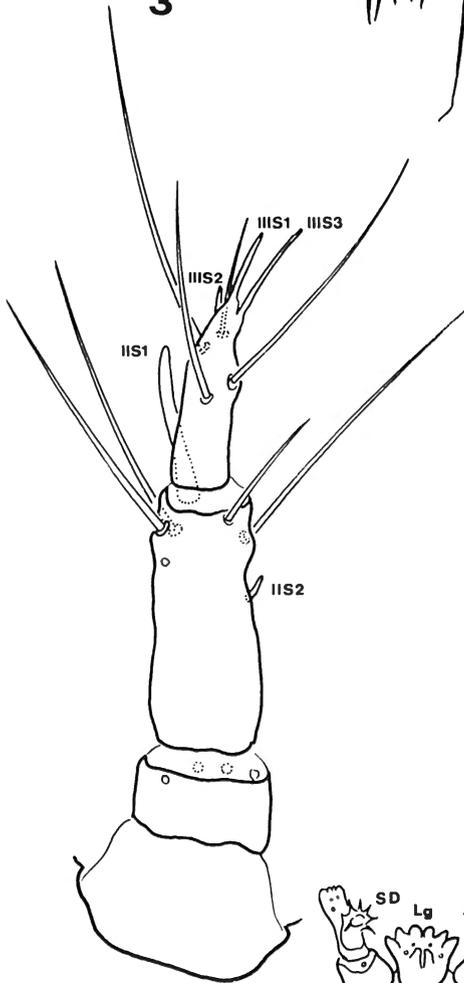
Abdomen: Tergum I as in Fig. 13. Seta P2 absent; setae Db1 and Dc1 absent; campaniform sensillum C4 absent. Directly below the posterolateral region of tergum I there is a pair of lateral sclerites or pleurites. The dorsopleural sclerite is located between the tergum I and the ventropleural sclerite. One spiracle and 2 setae are on this sclerite. The ventropleural sclerite is located between the sternum I and the dorsopleural sclerite. Only 1 seta is on this sclerite. Sternum I as in Fig. 14. Posterior row with 2 setae, although near P2 there is a distinct scar that might indicate the presence of a miscarried seta. Abdominal terga II-VIII similar to tergum I. Differs mainly by the progressive loss of setae A. Abdominal terga VI to VIII only with A1. Dorsopleural and ventropleural sclerites of the abdominal segments II to VIII each with 2 setae. Abdominal sterna II-VIII similar to sternum I except for the addition of seta D2 (Fig. 14). Setal homologies on segments IX and X are difficult to establish. Tergum IX as in Figs. 15 and 16, with 4 pairs of setae and 1 pair of pretergal glands; no spiracles detectable. Urogomphus as in Fig. 17, long, with 2 articles; basal article (URI) not fused to tergum IX, with 6 setae and 4 pores or campaniform sensilla. Article II (URII) short and slender, 0.45x as long as article I. URII with a long seta: AE, arising from apex. Abdominal segment X as in Fig. 15 and 16. Anal vesicle or pygopod bearing a pair of stout hooks, and a slightly sclerotized area with 3 pairs



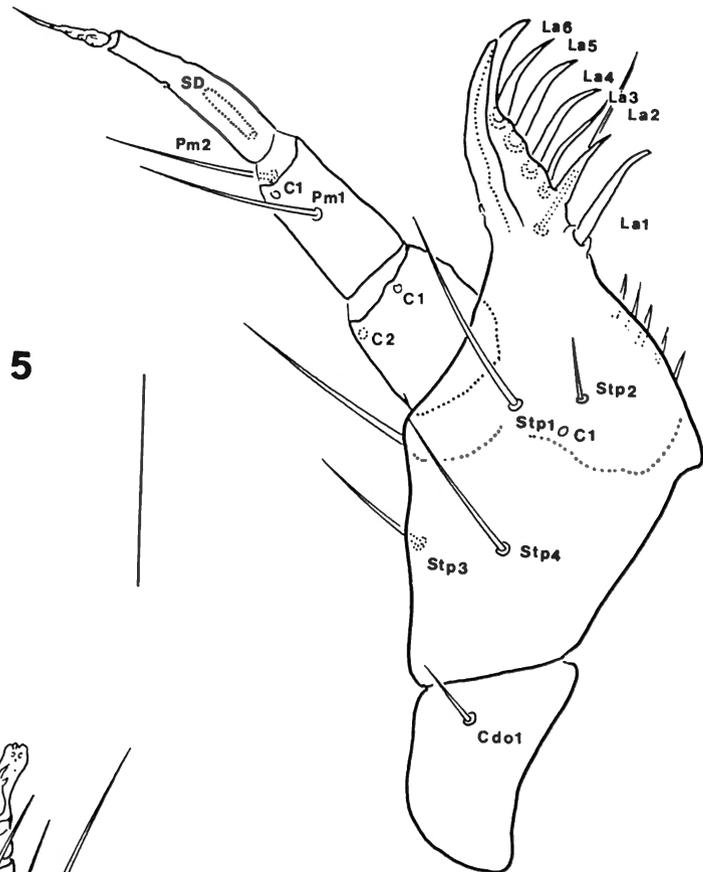
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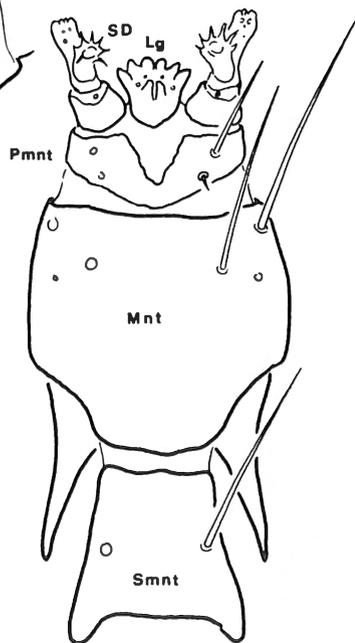
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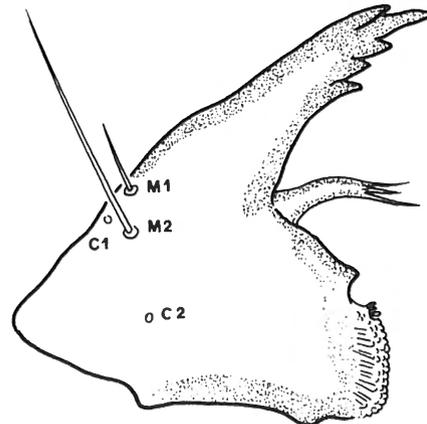
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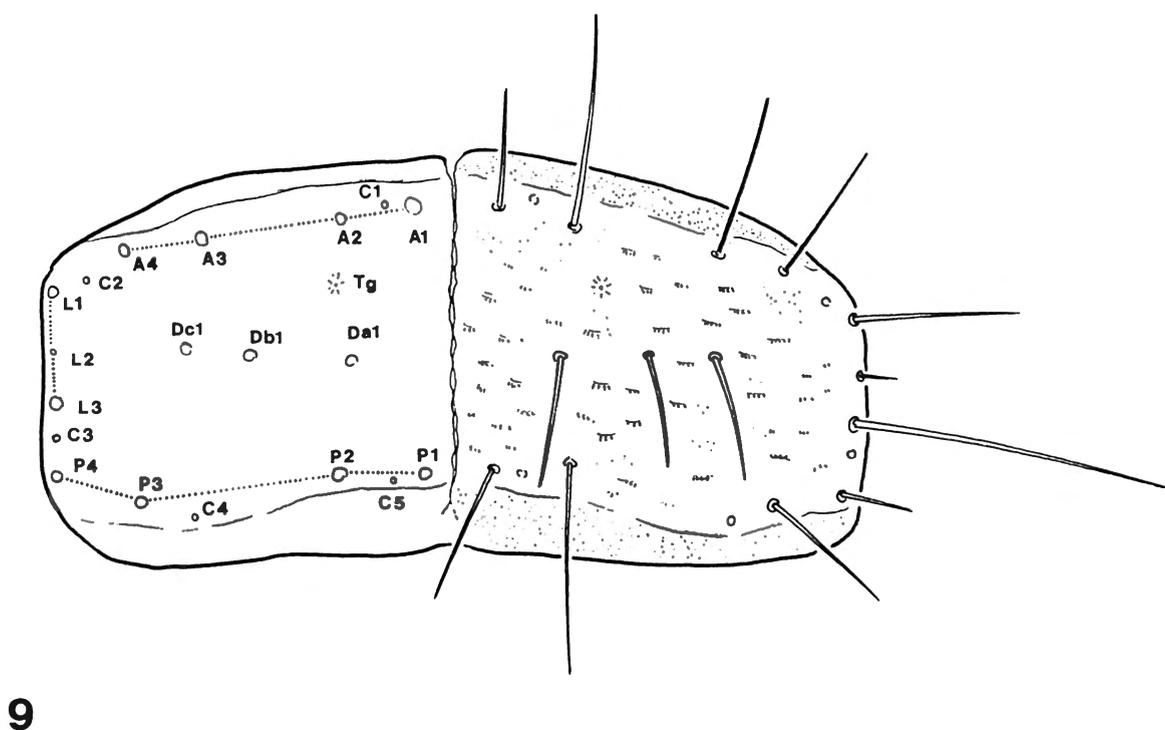
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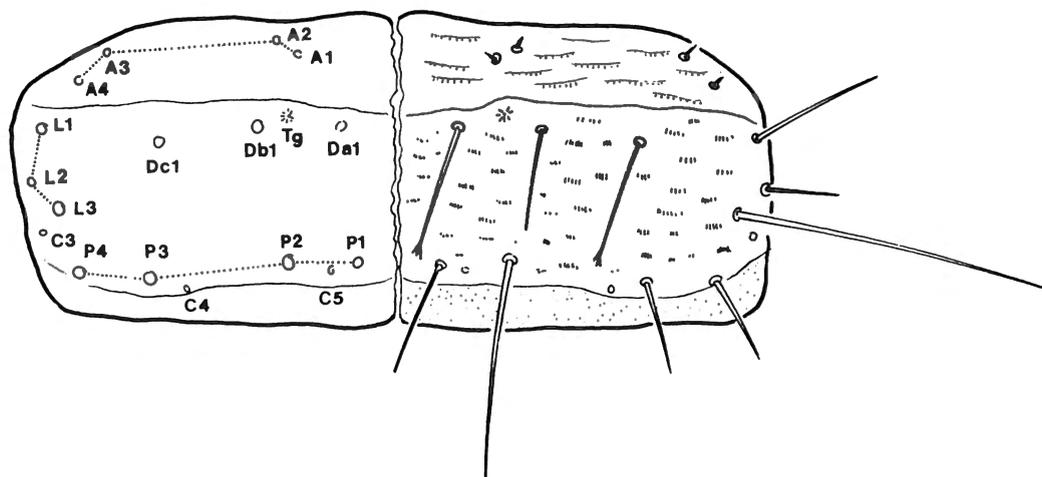
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Figures 9-10. – *Ochthebius auropallens*, larval instar I. 9, pronotum. 10, mesonotum. A, anterior setae, C, campaniform sensilla; Da, Db and Dc, discal setae; L, lateral setae; P, posterior setae; PG, pretergal gland. Scale = 0.1 mm.

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Figures 3-8. – *Ochthebius auropallens*, larval instar I. 3, labrum, dorsal view. 4, epypharinx. 5, antenna, dorsal view. 6, mandible, dorsal view. 7, maxilla, ventral view. 8, labium, ventral view. C, campaniform sensilla; La, lacinial setae; Ld, labral dorsal setae; Lg, ligula; Lm, labral marginal setae; M, mandibular setae; Mnt, mentum; Pf, palpiferal setae; Pm, palpal setae; Pmnt, prementum; SD, sensorial digitiform appendage; Smnt, submentum; Stp, setae of the stipes; IIS (1-3), antennal solenidia of article II; IIIS (1-3), antennal solenidia of article III. Scale = 0.05 mm.

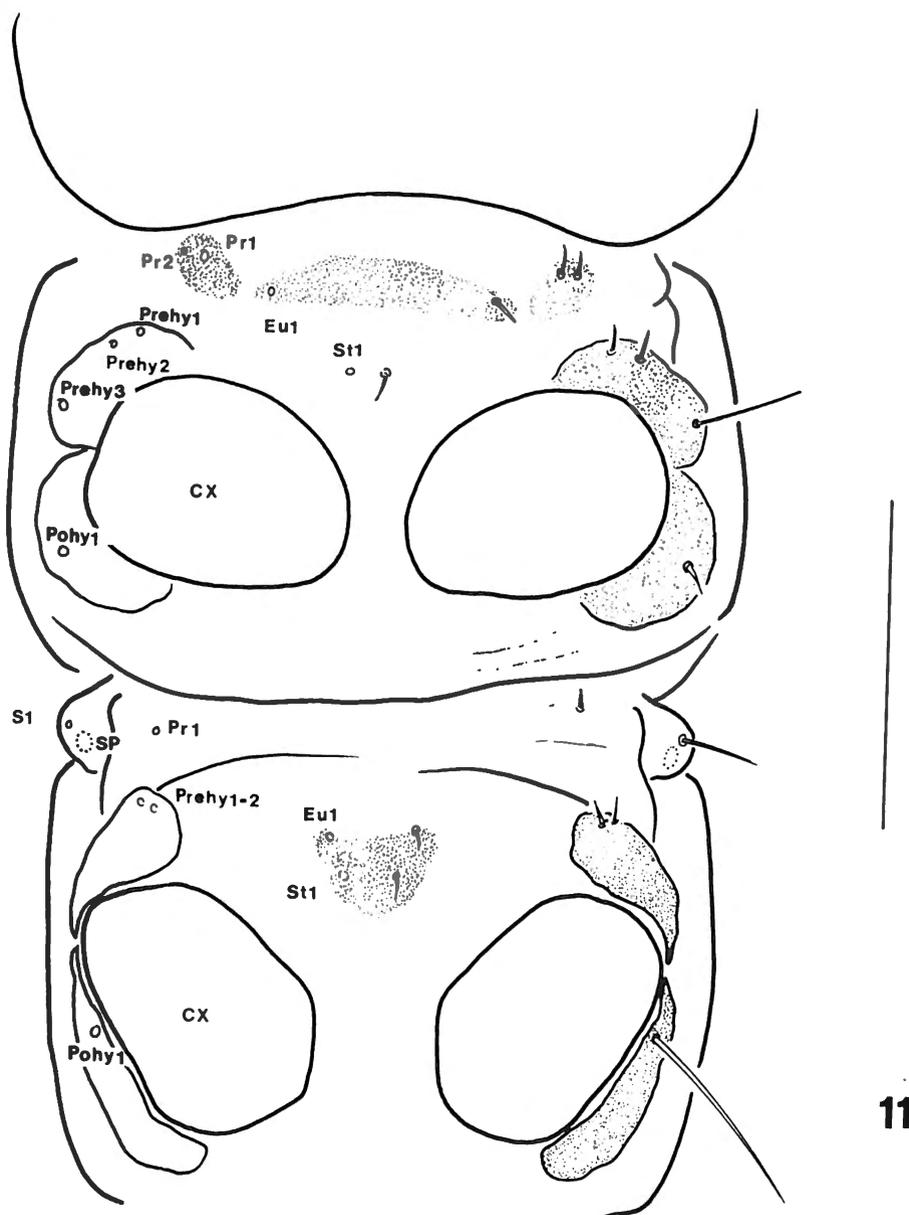


Figure 11. – *Ochthebius auropallens*, larval instar I. Prothorax and mesothorax. CX, coxal cavity; Eu, eusternal setae; Pr, presternal setae; Prehy, prehypopleural setae; Pohy, posthypopleural setae; S, spiracular setae, Sp, spiracle; St, sternal setae. Scale: 0.1 mm.

of small setae and 1 pair of campaniform sensilla. The central pair of setae slightly more developed than the others.

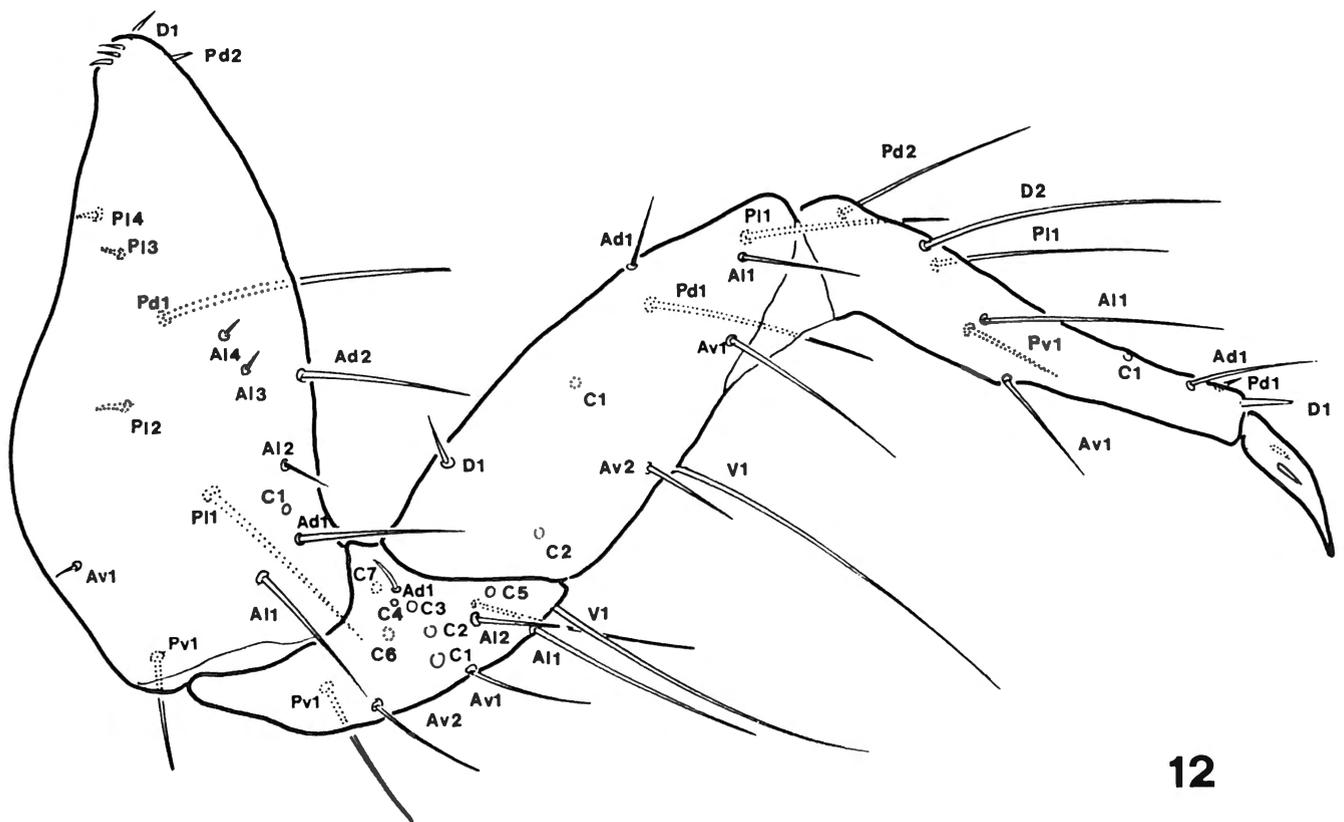
#### *Instar II*

Total body length about 1.9 mm. Head capsule width:  $0.27 \pm 0.01$  (Mean  $\pm$  SD;  $n = 6$ ). Differs from instar I by absence of the egg-bursters in the head. Chaetotaxy similar to instar III and characterized by the addition of subprimary setae. Pronotum as in Fig. 18, with 6 pairs of new discal (subprimary) setae: Da', Da'', Db', Db'', Dc' and Dc''. Differs from third instar by the presence

of the dorsopleural and ventropleural sclerites in the abdomen. These sclerotized areas are distinct and not fused with the tergal or sternal abdominal regions. Dorsopleural sclerites with 3 setae: DP1, DP2 and a new subprimary setae, DP' (Fig. 19). Abdominal sterna II-VIII with 2 pairs of new discal (subprimary) setae: D' and D''.

#### *Instar III*

Total body length about 2.6 mm. Head capsule width:  $0.35 \pm 0.01$  (Mean  $\pm$  SD;  $n = 6$ ). with following differences to instar II: Abdominal terga I-VIII, in each



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Figure 12. – *Ochthebius auropallens*, larval instar I. proleg, anterior view. Ad, anterodorsal setae; Al, anterolateral setae; Av, anteroventral setae; C, campaniform sensilla; D, dorsal setae; Pd, posterodorsal setae; Pl, posterolateral setae; Pv, posteroventral setae; V, ventral setae. Scale = 0.1 mm.

lateral half, with 3 additional lateral setae (Fig. 20). We interpret the 3 new setae as DP1, DP2 and DP' located in the dorsolateral sclerite of instar II. The loss of dorsolateral sclerites in instar III is clearly connected with the appearance of spiracles and setae DP1, DP2 and DP' attached to tergal region of the abdomen. Abdominal sternum I, in each lateral half, with 1 additional lateral seta. We interpret this seta as VP1 of instar I and II. Abdominal sterna II-VIII, in each lateral half, with 2 additional lateral setae: the setae VP1 and VP2 of instar II.

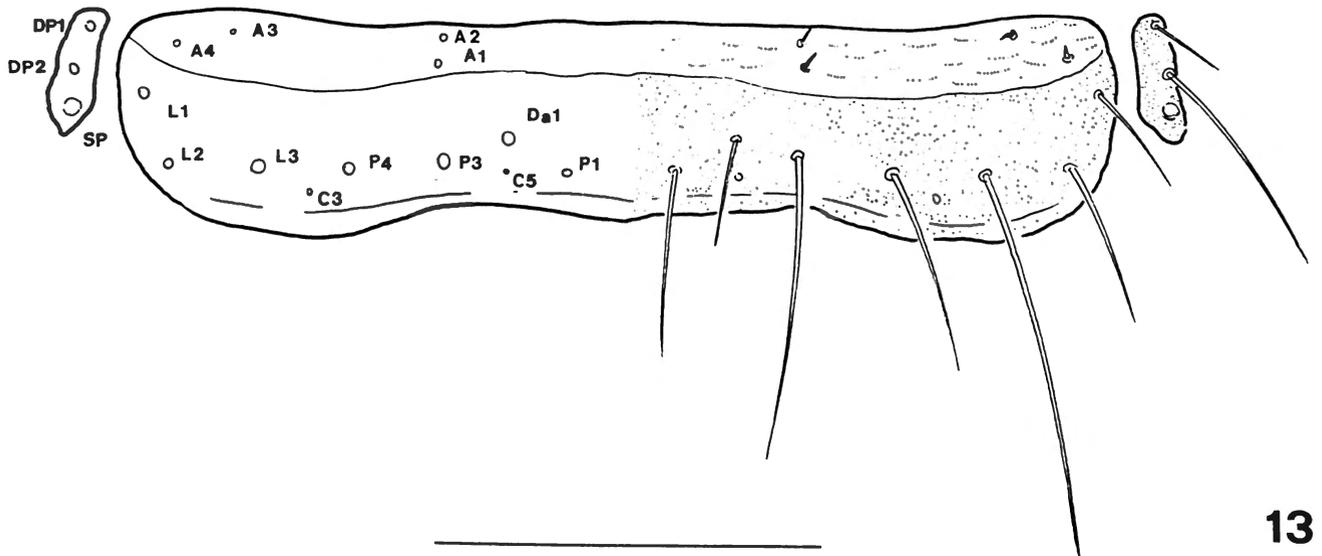
In some examined species of *Ochthebius* (s. str.) more variability was observed. We have found several cases of secondary setae in instars II and III.

## Discussion

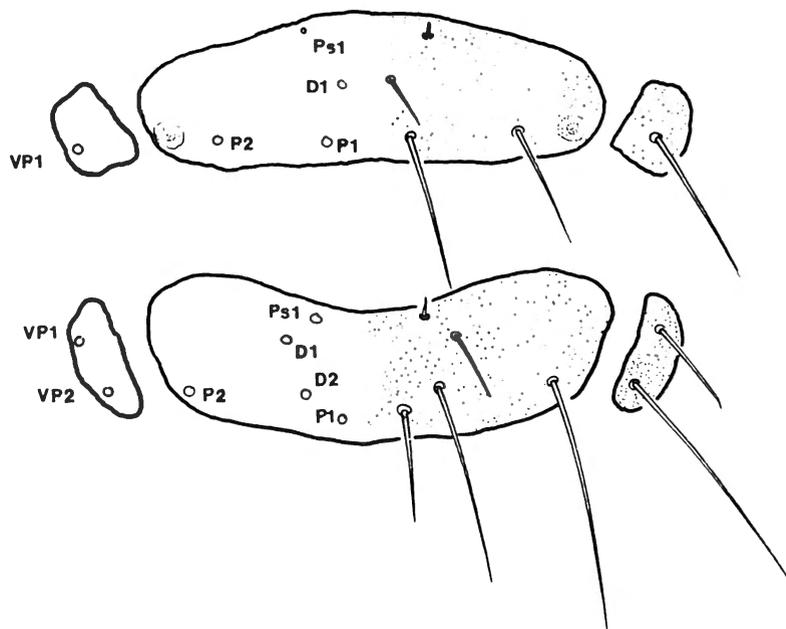
In this paper we have studied the morphology and chaetotaxal pattern of the three larval instar of the subgenus *Ochthebius* (s. str.) of the genus *Ochthebius*. We decided to study the larval morphology and chaetotaxy of the different subgenera of *Ochthebius* in separate works

because, at the present level of knowledge, a representative model cannot be selected within their different subgenera.

The larval morphology described in *O. auropallens* is very similar in other studied larvae belonging to the subgenus *Ochthebius*. Specific variations with respect to the described characters mainly affect the shape of egg-bursters, the size and shape of the articles of the urogomphi and head appendages and the size and shape of the setae. The presence of cephalic egg-bursters in the first instar larvae of Hydraenoidea (sensu CROWSON, 1955) has been considered by BEUTEL (1994) as a possible autapomorphy of this superfamily as well as a groundplan feature of Hydraenidae. However, this character is present in all the lineages of the subfamily Ochthebiinae studied by us (see DELGADO & SOLER, in press a and b), but not in the subfamily Hydraeninae (DELGADO & SOLER, 1996; DELGADO & SOLER, 1997; DELGADO et al., in press). In contrast with BEUTEL (1994) we consider the presence of cephalic egg-bursters in Hydraenidae not as a groundplan of this family but as an autapomorphy of the derived subfamily Ochthebiinae. In this sense, the presence of egg-bursters in some larvae



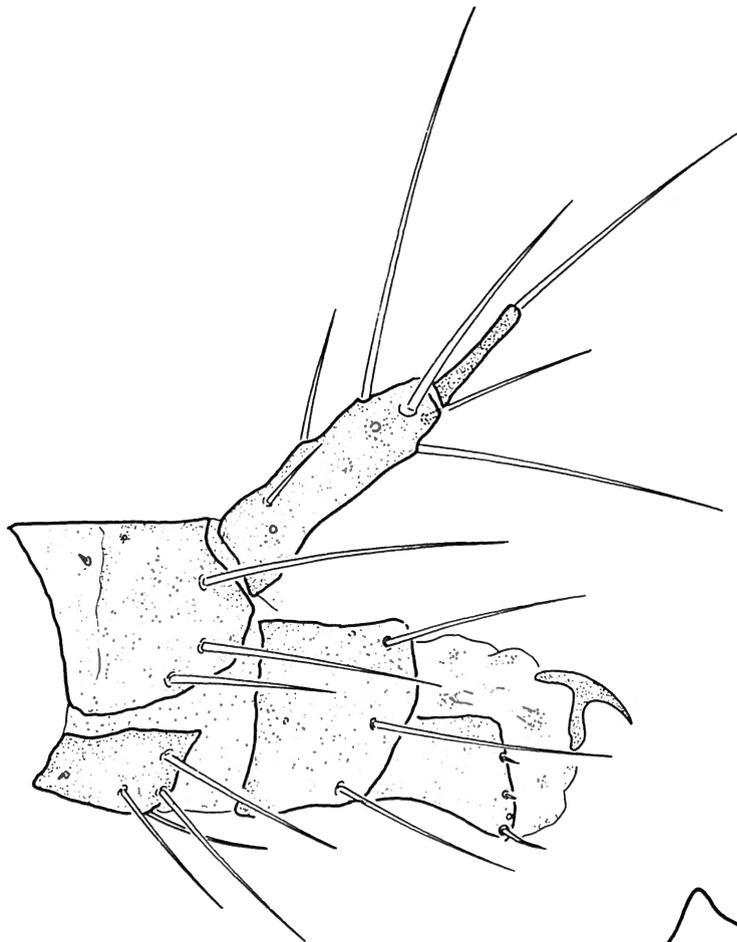
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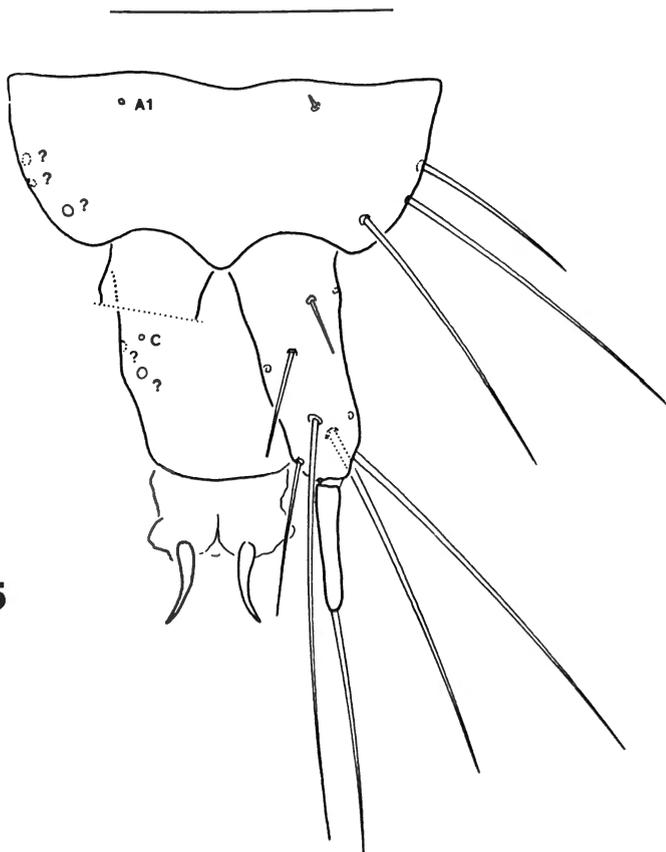
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Figures 13-14. – *Ochthebius auropallens*, larval instar I. 13, abdominal tergum I. 14, abdominal sterna I and II. A, anterior setae; C, campaniform sensilla; L, lateral setae; P, posterior setae; Ps, presternal setae; D, sternal discal setae; Da, discal setae; DP, dorsopleural setae; Sp, spiracle; VP, ventropleural setae. Scale = 0.1 mm.

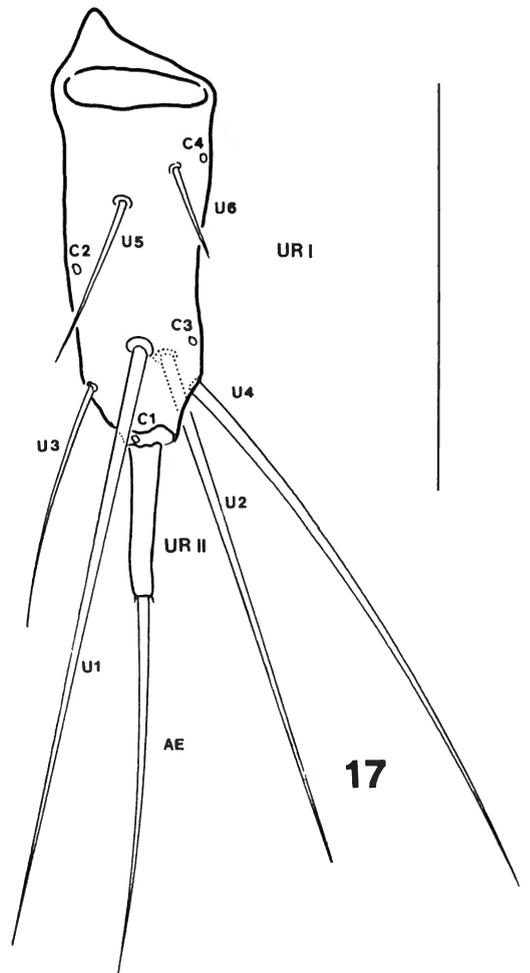
Figures 15-17. – *Ochthebius auropallens*, larval instar I. Segments IX and X. 15, dorsal view. 16, lateral view. 17, urogomphus. A, anterior setae; AE, apical stilus; C, campaniform sensilla; U, urogomphal setae of article I; URI, urogomphal basal article; URII, urogomphal apical article; ?, uncoded setae. Scales = 0.1mm.



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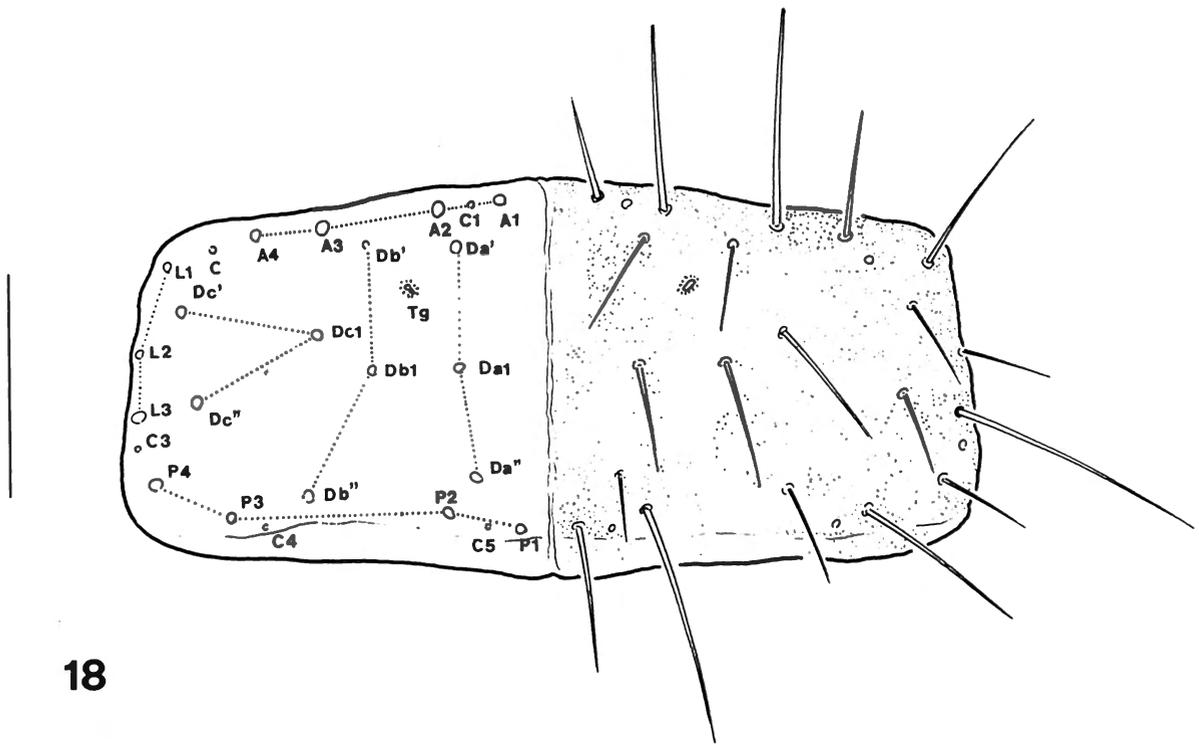


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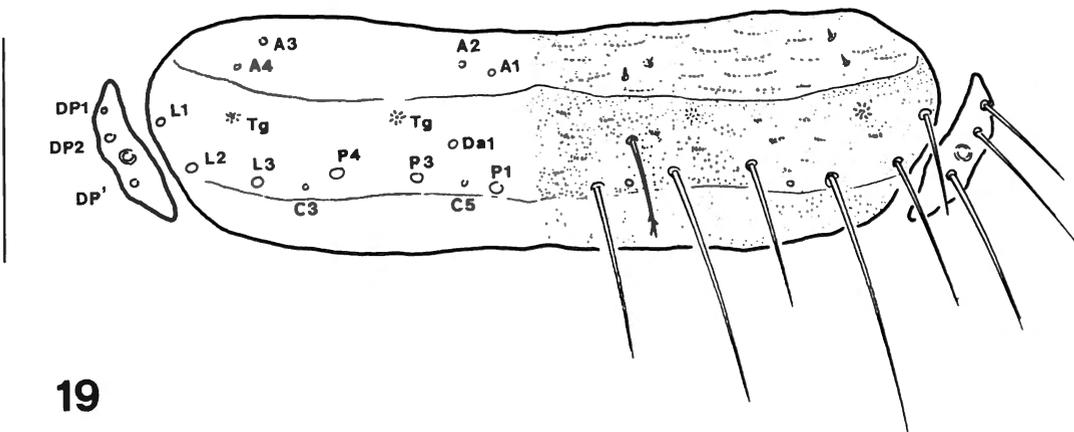


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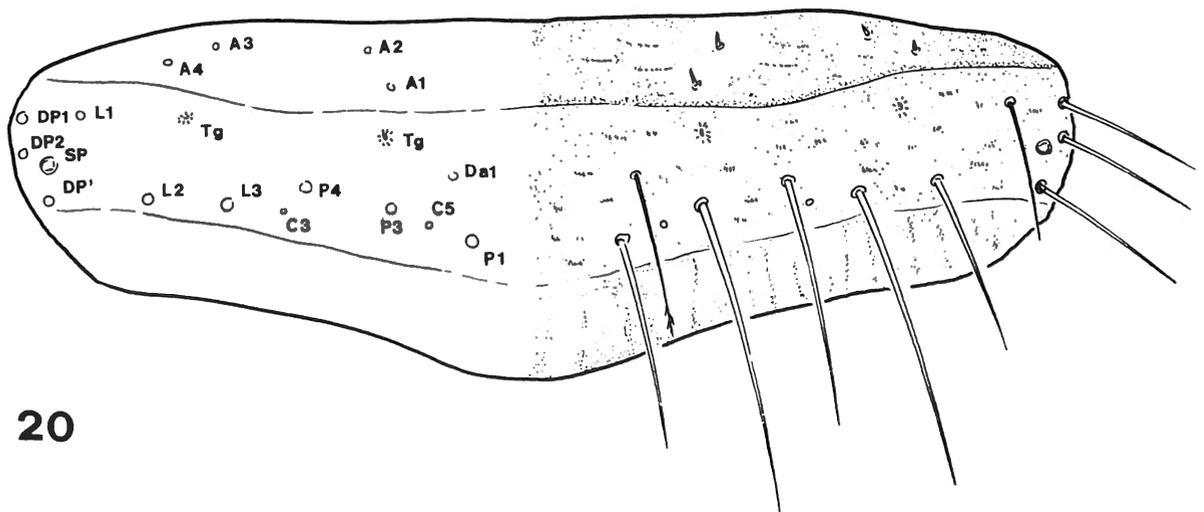
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of Hydrophiloidea (sensu NEWTON & THAYER, 1992) should be considered as a case of convergency. In fact, BEUTEL (1994) suggested that this character have probably evolved independently in several polyphagan groups.

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Figures 18-20. – *Ochthebius auropallens*. 18, larval instar II: Pronotum. 19, larval instar II: abdominal tergum I. 20: larval instar III: Abdominal tergum I. A, anterior setae, C, campaniform sensilla; Da, Db and Dc, discal setae; Da', Da'', Db', Db'', Dc' and Dc'', subprimary setae; DP, dorsopleural setae; DP', dorsopleural subprimary seta; L, lateral setae; P, posterior setae; Tg, tergal glands; Sp, spiracles. Scales = 0.1 mm.