

# Morphology and chaetotaxy of the first-instar larva of *Hydraena (Phothydraena) hernandoi* FRESNEDA & LAGAR (Coleoptera: Hydraenidae)

J.A. DELGADO & A.G. SOLER

## Abstract

The first-instar larva of *Hydraena (Phothydraena) hernandoi* FRESNEDA & LAGAR recorded from the south of the Iberian Peninsula is described and illustrated. The chaetotaxal study revealed many features on the head capsule, head appendages, and the thoracic and abdominal segments that might be useful for systematic and phylogenetic comparisons.

**Key words:** Coleoptera, Hydraenidae, *Hydraena*, *Phothydraena*, larvae, chaetotaxal analysis

## Introduction

As in other families of Coleoptera, the classification and phylogeny of the family Hydraenidae is based almost exclusively on adult characters (HANSEN 1991). However, a better knowledge of the larval morphology appears to be essential for phylogenetic analysis (BEUTEL 1994). Unfortunately, the immature stages of Hydraenidae are poorly known and many characters are unavailable for phylogenetic (cladistic) studies.

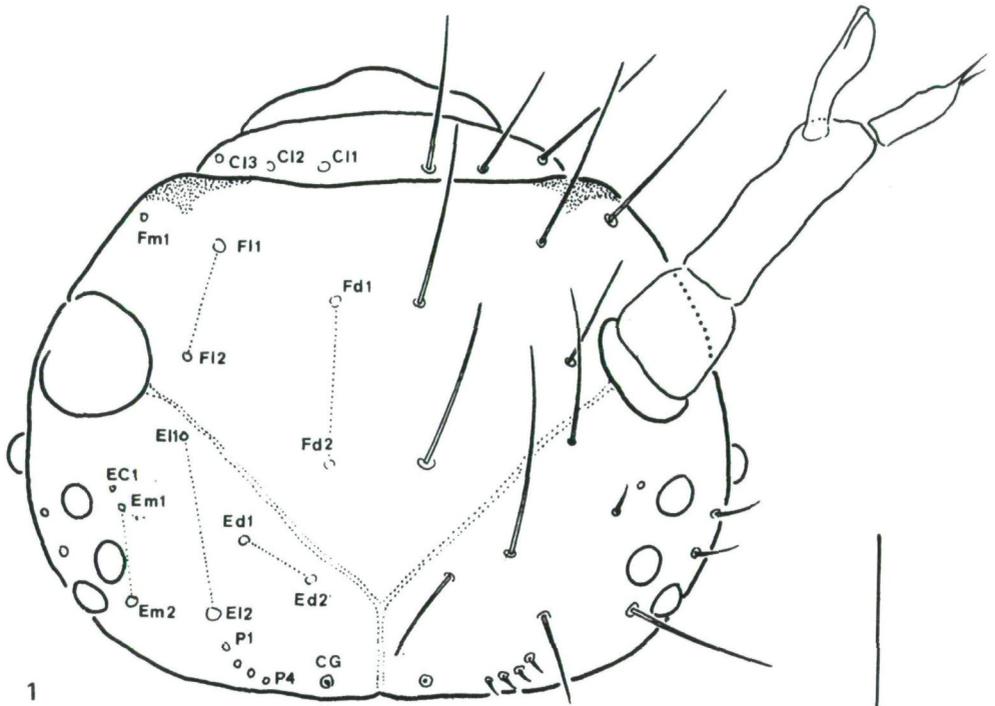
Only few larvae have been described in this family (ORCHYMONT 1913, RICHMOND 1920, BERTRAND 1972), but since some of these were identified by association with adults, the descriptions are of doubtful validity. Another problem is that only a few characters were described in these papers, whereas many important morphological features were neglected. Therefore, the chaetotaxy of these larvae is rather inadequately known. The only chaetotaxal analysis of hydraenid larvae available is that of PERKINS (1980) who studied a few characters in *Ochthebius* LEACH, *Hydraena* KUGELANN and *Limnebius* LEACH. However, despite the valuable information provided by PERKINS (1980), a complete and detailed description of larval chaetotaxy in Hydraenidae has not as yet been published.

The aim of this work, which forms part of a series of papers studying the larval chaetotaxy of Hydraenidae, is to describe the pattern of primary setae and campaniform sensilla in a species of the subgenus *Phothydraena* KUWERT of *Hydraena* and to suggest characters which might be useful for future phylogenetic studies.

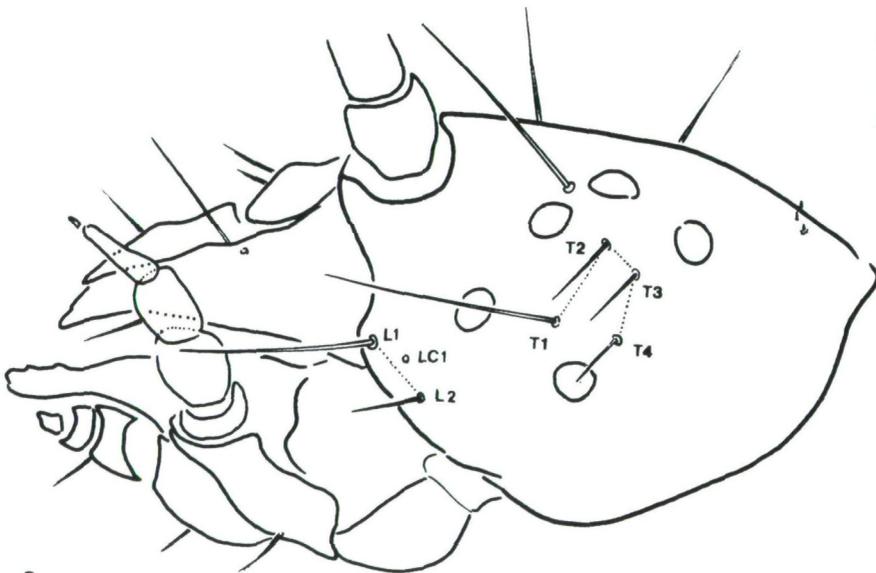
## Material and methods

The larvae used in this study were obtained by rearing adults of *Hydraena (Phothydraena) hernandoi* FRESNEDA & LAGAR in the laboratory. The description of instar I of this species is based on specimens cleared and glycerinated following the technique described by BOUSQUET & GOULET (1984). Eventually, the larvae were disarticulated and mounted on glass slides in Hoyer's medium. Drawings were made using a microscope with a drawing mirror.

The terminology used herein for the setae and campaniform sensilla follows DELGADO & SOLER (in press), which is a modified version of the terminology used by ASHE & WATROUS (1984) for aleocharine larvae (Staphylinidae).



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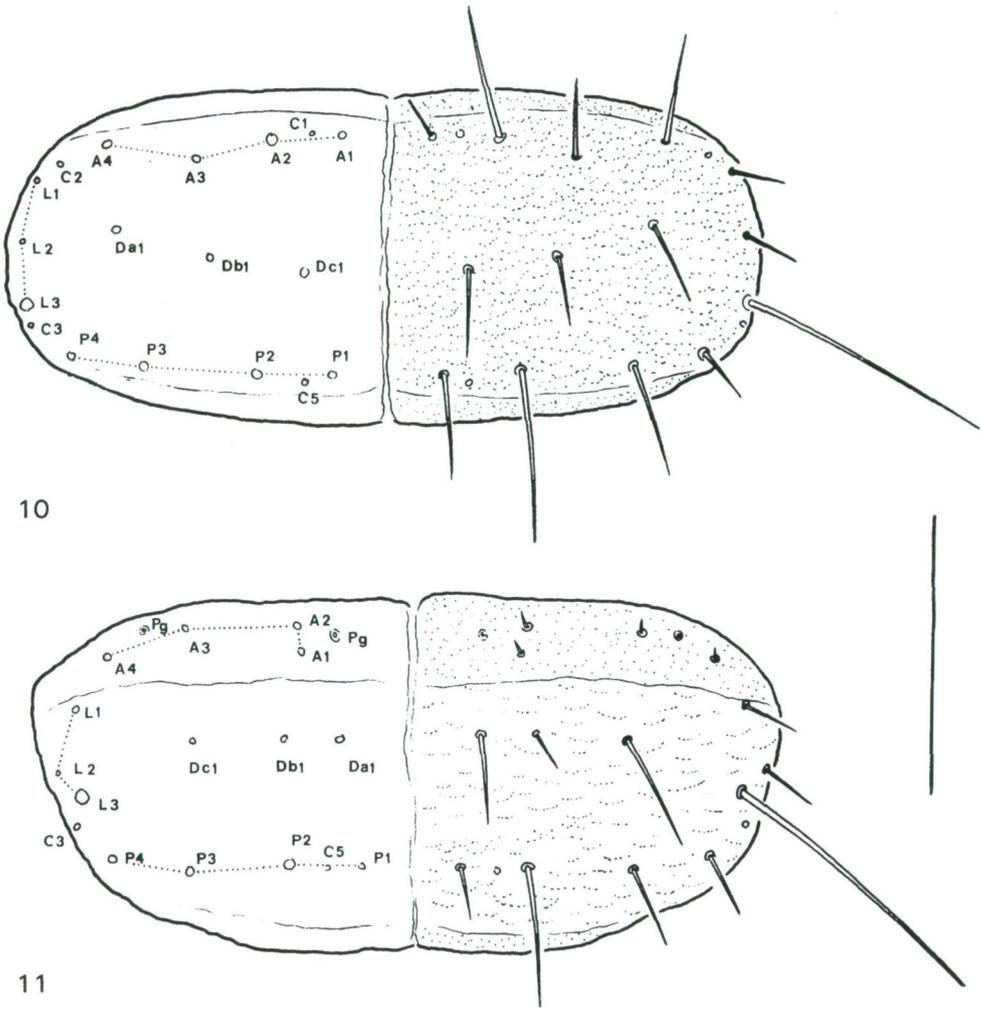


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Figs. 1 - 2: *Hydraena hernandoi*, larval instar I; 1) head, dorsal view. CG: cephalic gland; CI: clypeal setae; EC: epicranial campaniform sensilla; Ed: epicranial dorsal setae; El: epicranial lateral setae; Em: epicranial marginal setae; Fd: frontal discal setae; Fl: frontal lateral setae; Fm: frontal marginal seta; 2) Head, lateral view. L: lateral setae; LC: lateral campaniform sensillum; T: temporal setae. Scale: 0.1 mm.

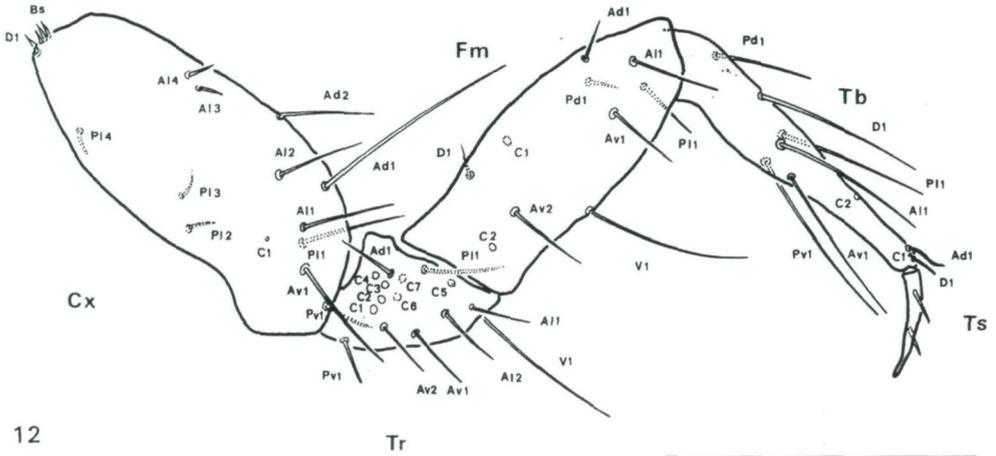


Figs. 3 - 9: *Hydraena hernandoi*, larval instar I: 3) Head, ventral view. V: ventral setae. Scale: 0.1 mm; 4) labrum, dorsal view. Ld: labral dorsal setae; Lm: labral marginal setae. Scale: 0.05 mm; 5) epipharynx. Scale: 0.05 mm; 6) mandible, dorsal view. M: mandibular setae. Scale: 0.05 mm; 7) maxilla, ventral view. Cdo: seta of the cardo; C: campaniform sensilla; M: mandibular setae. Scale: 0.05 mm; 8) antenna, ventral view. IIS (1-3): solenidia of segment II; IIS (1-3): solenidia of segment III. Scale: 0.05 mm; 9) labrum, ventral view; Cdo: seta of the cardo; La: setae of the stipes. Scale: 0.05 mm.



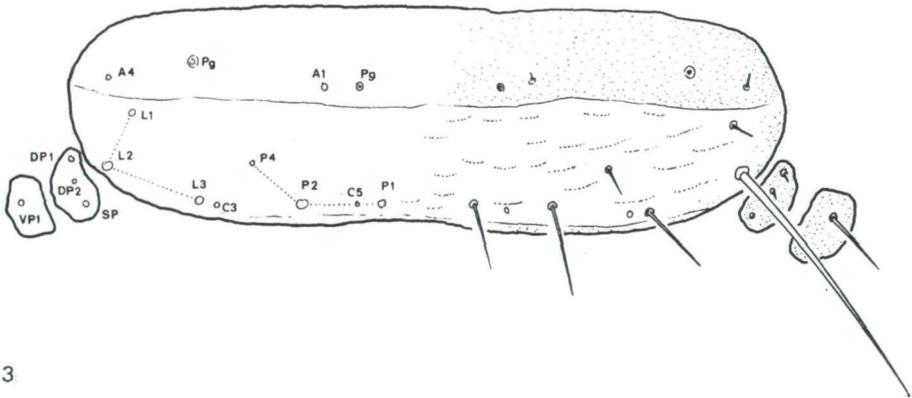
Figs. 10 - 11: *Hydraena hernandoi*, larval instar I; 10) pronotum, 11) mesonotum. - A: anterior setae; C: campaniform sensilla; Da, Db and Dc: discal setae; L: lateral setae; P: posterior setae; Pg: pretergal gland. Scale: 0.1 mm.

For chaetotaxal analysis we used first-instar larvae because the last instars show a modified pattern in which primary and secondary setae are mixed. Therefore, no attempt was made to homologize setae between third-instar larvae of Aleocharinae (Staphylinidae) and the first-instar larva of *Phothydraena* (Hydraenidae). Thus, the use of the same abbreviations or acronyms does not necessarily mean a direct homology.



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Fig. 12 - 13: *Hydraena hernandoi*, larval instar I; 12) front leg, anterior view. Ad: antero-dorsal setae; Al: antero-lateral setae; Av: antero-ventral setae; Bs: basal setae; C: campaniform sensilla; Cx: coxa; D: dorsal setae; Fm: femur; Pd: postero-dorsal setae; Pl: postero-lateral setae; Pv: postero-ventral setae; Tb: tibia; Tr: trochanter; Ts: tarsungulus; V: ventral setae; 13) abdominal tergum I. A: anterior setae; C: campaniform sensilla; DP: dorso-pleural setae; L: lateral setae; P: posterior setae; Pg: pretergal gland; Sp: spiracle; VP: ventro-pleural seta. Scale: 0.1 mm.

### *Hydraena (Phothydraena) hernandoi* FRESNEDA & LAGAR

#### Description of the first-instar larva:

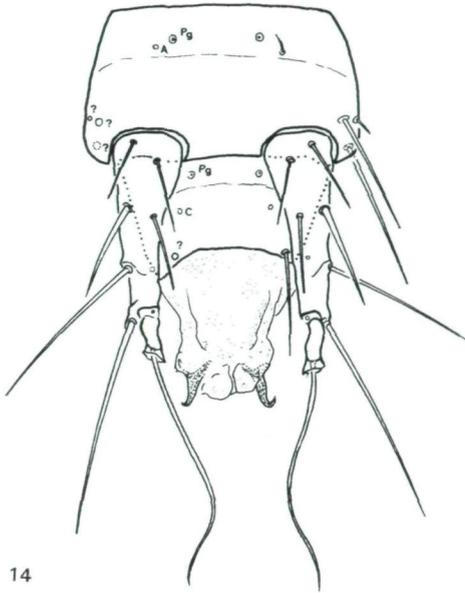
Total body length about 1.1 mm. **Head** (Figs. 1 - 9): Head capsule width:  $0.26 \pm 0.01$  mm ( $X \pm SD$ ;  $n = 4$ ). Ecdysial sutures distinct and Y-shaped. Ocular area with 5 stemmata subdivided into 2 oblique rows. Frontal region (Fig. 1) without campaniform sensilla and (in each lateral half) with 5 setae arranged in 3 rows: 2 frontal dorsal setae, 2 frontal lateral setae and 1 frontal marginal seta. Epicranial region (Fig. 1) (in each lateral half) with 1 campaniform sensillum, 1 epicranial gland 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 (Fig. 2) with 4 setae: T1 - T4; T2 to T4 short and T1 long. Lateral regions (Fig. 2) with 1 campaniform

sensillum and 2 setae: L1 - L2. Ventral region (Fig. 3) (in each lateral half) with 2 short setae: V1 - V2. No egg bursters are present on the head capsule, although the marginal edge of the frontal region is strongly sclerotized and might be used to break the chorion. Clypeal region (Fig. 1) (in each lateral half) with 3 setae: C11 - C13. Labrum (Fig. 4) (in each lateral half) with 2 campaniform sensilla and 7 setae arranged in 2 rows: 2 labral dorsal setae and 5 labral marginal setae. The setae Lm1, Lm3 and Lm5 arise dorso-laterally, the setae Lm2 and Lm4 arise ventro-laterally (Fig. 5). Lm4 is a very long seta and Lm2 is pectinate. Epipharynx as in Fig. 5. Antenna (Fig. 8) with segment I short, and with 4 campaniform sensilla around the apex; segment II about 2.3x as long as segment I; segment III as long as segment I. Segment II with 3 long setae and 3 solenidia. Solenidium IIS1 (digitiform organ or sensory appendage) well developed, curved and irregular at apex; solenidium IIS2 short and rounded at apex; solenidium IIS3 long, slender and acuminate at apex. Segment III with 4 setae and 3 apical solenidia. Solenidium IIIS3 very long. Mandibles (Fig. 6) right and left nearly identical in size and shape; with 2 campaniform sensilla and 2 setae. Seta M1 very long and M2 short; protheca wide; molar area well developed. Maxilla as in Fig. 7. Cardo triangular, with a short seta; stipes with 4 setae and 1 campaniform sensillum, seta Stp2 minute; galea slightly fimbriate, lacinia fimbriate, palpifer with 1 seta. Maxillary palpus with 3 segments; apical segment with a conspicuous, digitiform sensory appendage; segment I with 2 campaniform sensilla and segment II with 2 setae. Labium as in Fig. 9, consisting of 3 sclerites; ligula short and broad, bearing papillae; palpi with 2 segments, segment I with 1 campaniform sensillum and a very elongate papilla. **Thorax** (Figs. 10 - 12): Pronotum as in Fig. 10. Row A with 4 setae: A1 - A4; row L with 3 setae: L1 - L3, L1 and L2 short; row P with 4 setae: P1 - P4; rows Da, Db and Dc, each with 1 seta. 4 campaniform sensilla are present: C1, C2, C3 and C4; C5 absent. Mesonotum as in Fig. 11. Row A with 4 minute setae; row L with 3 setae; row P with 4 setae and rows Da, Db and Dc each with 1 seta. Campaniform sensilla C1 and C2 absent. Metanotum similar to mesonotum. Front leg as in Fig. 12. Coxa with 1 campaniform sensillum and 13 setae: 1 D, 2 Ad, 4 Al, 1 Av, 4 Pl and 1 Pv. Trochanter with 7 campaniform sensilla and 8 setae: 1 D, 1Ad, 1Al, 2 Av, 1 Pd, 1Pl and 1 V. Tibia with 2 campaniform sensilla and 8 setae: 2 D, 1 Ad, 1 Al, 1 Av, 1 Pd, 1 Pl and 1 Pv. Tarsungulus with 2 minute setae. **Abdomen** (Figs. 13 - 15): Tergum I as in Fig. 13. Seta P3 absent; setae Da1, Db1 and Dc1 absent; anterior setae A2 and A3 absent. Lateral setae L1 and L3 short, seta L2 long. Directly below the postero-lateral region of tergum I there is a pair of lateral sclerites. Dorso-pleural sclerite with 2 minute setae and 1 spiracle; ventro-pleural sclerite with 1 seta of normal length. Segments II - VIII nearly identical to segment I, differs only in that the ventro-pleural sclerite has 2 setae. Abdominal segments IX and X as in Figs. 14 and 15. Tergum IX with 4 pairs of setae and 1 pair of pretergal glands; without spiracles. Sternum IX with 4 pairs of setae. Urogomphus as in Fig. 16, long and with 2 segments; basal segment (URI) not fused to tergum IX, with 4 campaniform sensilla and 6 setae: U1 - U6, setae U5 and U6 short. Segment II (URII) 0.25x as long as URI and cup-shaped at the apex. Abdominal segment X dorsally with 1 pair of pretergal glands, 1 pair of campaniform sensilla and 1 pair of setae; ventrally with 2 pairs of setae. Pygopod with a pair of stout hooks and a narrow sclerotized area with 3 pairs of small setae and 1 pair of campaniform sensilla; the setae of the central pair long.

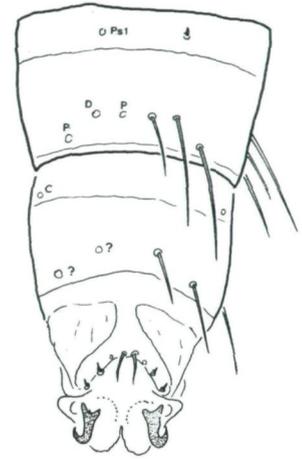
### Discussion

As we pointed out in the introduction, larval chaetotaxy has been largely neglected hitherto. Thus, only limited comparison of *H. hernandoi* with other larvae is possible.

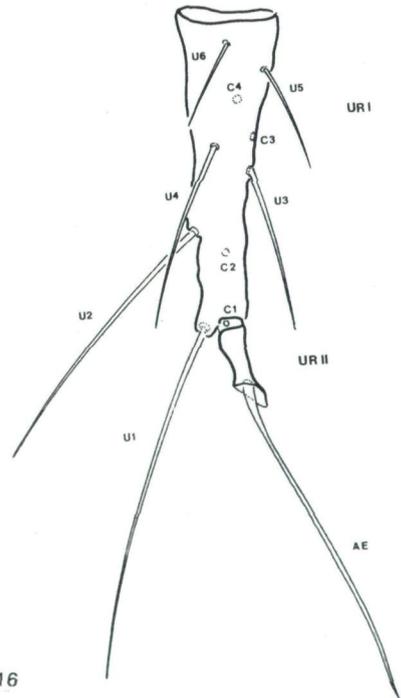
*Hydraena* (*Phothydraena*) *hernandoi* and the American *Hydraena* (*Hydraena*) *circulata* PERKINS (described by PERKINS 1980) share an identical chaetotaxal pattern of the labrum, the antenna and the urogomphi. The conspicuous teeth of the anterior margin of the labrum of *H. hernandoi* are absent in the American species. Since the description of PERKINS (1980) does not allow detailed comparison of any other body parts we are at present unable to work out more differences between these 2 species.



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Fig. 14 - 16: *Hydraena hernandoi*, larval instar I; 14) segments IX and X, dorsal view. A: anterior seta; C: campaniform sensillum; Pg: pretergal gland; ?: uncoded setae. Scale: 0.1 mm; 15) segments IX and X, ventral view. C: campaniform sensilla; D?: indetermined discal seta; P: indetermined posterior setae; Ps: pleurosternal seta; ?: uncoded setae. Scale: 0.1 mm; 16) urogomphus. AE: apical stylus; C: campaniform sensilla; U: setae of segment I; URI: basal segment; URII: apical segment. Scale: 0.1 mm.

The antennal solenidium IIIS3 is very long in both species, and the shape of the solenidia IIS2 and IIS3 is also similar in both. IIIS3 is long in larval *Limnebius* (PERKINS 1980, DELGADO & SOLER in press) as well as in larvae of Ptiliidae (DYBAS 1976: Fig. 24d), a presumed sister-group of Hydraenidae. Thus, an elongate IIIS3 should be regarded as a plesiomorphic character within Hydraenidae.

An interesting feature shared by *H. hernandoi* and *H. circulata* is the shape of the antennal solenidium IIS1. This character is, as far as we know, somewhat variable among *Hydraena* so that, while in these two species IIS1 is curved and well developed, it is straight and short in other larvae.

Unfortunately, with the present level of knowledge it is impossible to decide about the polarity of these two character states.

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