Dacnusa cicerina (Hymenoptera: Braconidae: Alysiinae), A New Species of Endoparasitoid of Liriomyza cicerina (Diptera: Agromyzidae)

Authors: Tormos, Josep, Pardo, Xavier, Asís, Josep Daniel, and Gayubo, Severiano F.

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DACNUSA CICERINA (HYMENOPTERA: BRACONIDAE: ALYSIINAE), A NEW SPECIES OF ENDOPARASITOID OF *LIRIOMYZA CICERINA* (DIPTERA: AGROMYZIDAE)

JOSEP TORMOS[1], XAVIER PARDO[2], JOSEP DANIEL ASÍS[1] AND SEVERIANO F. GAYUBO[1]
[1]Unidad de Zoología, Facultad de Biología, Universidad de Salamanca, 37071-Salamanca, Spain
E-mail: tormos@usal.es

[2]Universitat de València. Institut Cavanilles de Biodiversitat i Biologia Evolutiva.
Apartat Oficial 2085-46071 València, Spain

ABSTRACT

The larvae, pupa, adults, and venom apparatus of *Dacnusa cicerina* **sp. n.**, an endoparasitoid of *Liriomyza cicerina* (Rondani), found on *Cicer arietinum* Linnaeus in Spain, are described, illustrated, and compared with those of allied species. The mature larva of *Eurytoma* sp., possibly a hyperparasitoid of *D. cicerina*, also is described, illustrated, and compared with those of allied species. Keys to discriminate adults are provided and morphological structures of phylogenetic value are discussed. The adults of *D. cicerina* are similar to those of *Dacnusa rodriguezi* Docavo & Tormos (1997). The immature larvae are similar to those of *Dacnusa areolaris* (Nees) and *Dacnusa dryas* (Nixon), and the mature larva is very similar to that of *D. dryas*, from which it differs in having scale-like sensilla ("setae") on the thorax and abdomen. The cast skin of the final instar, like those described for *Dacnusa* Haliday, has a pleurostoma with well differentiated mandible processes and a long stipital sclerite. The venom apparatus of this species is very similar to that of *Dacnusa flavicoxa* Thomson, differing from it in length of the reservoir and the number of gland filaments. The mature larva of *Eurytoma* Illiger described here, despite its endoparasitoid nature, has well differentiated pleural and ventral setae.

Key Words: Hymenoptera, Braconidae, new species, host, immature stages, venom apparatus, hyperparasitoid, Spain

RESUMEN

Se describen, ilustran, y comparan con las especies más próximas, las larvas, pupa, adultos y el aparato del veneno de *Dacnusa cicerina* n. sp., endoparasitoide obtenido en España a partir de *Liriomyza cicerina* (Rondani) sobre *Cicer arietinum* Linnaeus. Adicionalmente, se describe, ilustra y compara con las especies más afines, la larva madura de *Eurytoma* sp., un probable hiperparasitoide de *D. cicerina*. Se proporcionan claves dicotómicas para la separación de los imagos, a la vez que se discuten estructuras morfológicas con valor filogenético. Los imagos de *D. cicerina* son similares a los de *Dacnusa rodriguezi* Docavo & Tormos (1997). Las larvas inmaduras son similares a las de *Dacnusa areolaris* (Nees) y *Dacnusa dryas* (Nixon). La larva madura es muy similar a la de *D. dryas*, de la que se separa por presentar sensilas con forma de escama "setas" sobre el tórax y abdomen. La exuvia del último estado larvario, al igual que las descritas de *Dacnusa* Haliday, presenta un pleurostoma con procesos mandibulares bien diferenciados y un esclerito estipital largo. El aparato del veneno de esta especie es muy similar al de *Dacnusa flavicoxa* Thomson, del que se separa por la longitud del reservorio y el número de filamentos glandulares. La larva madura de *Eurytoma* Illiger descrita, a pesar de su naturaleza endoparasitoide, presenta setas pleurales y ventrales bien diferenciadas.

Translation provided by the authors.

From a study undertaken in 1987-1992 on Dacnusini (Hymenoptera: Braconidae: Alysiinae) and their agromyzid (Diptera: Agromyzidae) hosts in the Iberian Peninsula, data were gathered on the parasitoids of *Liriomyza cicerina* (Rondani), a species injurious to *Cicer arietinum* Linnaeus (chickpea) cultures. Although this species also feeds on *Ononis* and *Hymenocarpus* elsewhere, in the Mediterranean area it mainly feeds on chickpeas, for which it may be a serious pest.

In the study cited above, *Dacnusa cicerina* **sp. n.** was obtained from *L. cicerina* feeding on chickpea plants, and *Eurytoma* sp., a possible hyperparasitoid of *D. cicerina*, also was obtained. Another species of Braconidae, which has been observed parasitizing *L. cicerina* on chickpeas in

Spain, *Opius monilicornis* Fischer (Garrido et al. 1992) also was found. Detailed information on the economic importance and the biology of *L. cicerina* has been given by Spencer (1973, 1976, 1990).

The genus *Dacnusa* Haliday belongs to the subfamily Alysiinae and to the tribe Dacnusini, most of whose members attack agromyzid flies. The classification and biology of this genus, which has approximately 77 European species (Achterberg 2004), have been studied by Griffiths (1964, 1966, 1968, 1984); Tobias (1995); and Belokobylskij et al. (1998). The structures that allow characterization of the final instar have been described in depth only in *Dacnusa rodriguezi* Docavo & Tormos (Pardo et al. 2000). Detailed studies addressing the variation in gland and reservoir morphology of the venom apparatus in species of Dacnusini recently have been conducted by Quicke et al. (1997) and Tormos et al. (2003).

The genus *Eurytoma* Illiger is the largest of the family Eurytomidae (Noyes 2001), and includes species displaying diverse larval feeding habits. This study addresses the larval morphology of an undetermined species of this genus**,** probably an hyperparasitoid of the new species of *Dacnusa* described here. A recent study of the mature larvae of *Eurytoma* has been carried out by Tormos et al. (2004).

Materials and Methods

Adults and exuviae of the final instar of *D. cicerina*, and imagos of *Eurytoma* sp. were obtained in Aug 1988 from pupae of *L. cicerina* whose larvae were mining leaves of *C. arietinum* in Ayora (Valencia, Spain). To collect specimens in both cases, we picked structures from plants that were infested with larvae of the agromyzids and placed them in plastic bottles of suitable dimensions whose openings were covered with gauze held in place with a rubber band. These receptacles were kept under environmental conditions of temperature, relative humidity (RH), and photoperiod. The methodology used for opening the puparium and preparing the cast skins was that proposed by Tormos et al. (2003).

To study the different larval stages of *D. cicerina*, in Jun 1990, we collected leaves of *C. arietinum* that were mined by *L. cicerina*, and took them to the laboratory, where they were placed in the same kind of receptacle as above and kept under environmental conditions. The parasitoids that emerged from the host puparia were fed with honey impregnated on strips of blotting paper or with sugar and water. Females aged between 24 and 72 h were placed individually in Petri dishes (9 × 1.5 cm) and provided daily with leaves of *C. arietinum* infested with larvae of different stages of *L. cicerina*. To study the larval development of the parasitoid, parasitized material was kept in a chamber at 21-23°C, 60-80 RH, and a photoperiod of 16L:8D, and the hosts were periodically dissected. Where possible, these observations were complemented with the dissection of specimens of hosts parasitized in the field. These dissections allowed us to study the mature larva of an undetermined species of *Eurytoma*. All dissections were performed in 0.9% saline solution. To study the development of the larvae of *D. cicerina*, the methodology of Tormos et al. (2003) was used. For the microscopic preparation of the larval stages of both the braconid and the eurytomid, the methods of Tormos et al. (2003, 2004) were employed.

The venom apparatus was prepared and drawn according to the method described by Quicke et al. (1992, 1997) with clorazol black staining for dry museum specimens. The venom apparatus was treated with a hydroxide solution, after which the soft tissue could be removed. It was then possible to observe the characteristics of the remaining chitinous gland intima, which are not apparent from examination of an intact gland and reservoir. The material examined (adults, immature stages, and venom apparatus) is deposited at the "Torres Sala" Entomological Foundation (Valencia, Spain).

The terminology for the body morphology, biometric data, and wing venation of the adults of *Dacnusa* follows Wharton et al. (1997). The terminology used in the description of the different structures of the immature stages of the braconid and of the eurytomid is that used by Tormos et al. (2003, 2004). The terminology used for characteristics of the gland and reservoir parts of the venom apparatus follows Tormos et al. (2003).

Results and Conclusions

Dacnusa cicerina **sp. n.** (Fig. 1a-d)

Type Material. SPAIN: Valencia: Ayora (30SXJ6825), 25-VI-1988 (date of host capture)/8-11-VIII-1988 (emergence date of the parasitoids): Holotype: ♀, from puparium of *L. cicerina* (host)/on *C. arietinum* (host's food plant). Paratypes: 1 ♀, 1 ♂, ditto.

Holotype, length of body 1.7 mm.

Head—Width of head 2.0 times its length, 1.9 times distance between eyes. Height of head 1.3-1.5 times its length. Antenna with 23 antennomeres; maxillary palpi moderately long; length of eye in dorsal view 0.8 times temple; fairly smooth medially and finely setose towards sides and at center of its foremost part; clypeus width 0.70 times distance between eyes; mandible three-toothed, expanded apically, 0.5 times length of head, with middle tooth long and pointed. *Mesosoma*—Length of mesosoma 1.3 times its height, 1.9 times its width; pronotum with a median pit; sternaulus smooth, weak, short; metapleuron setose towards the posterior coxae; notauli weakly

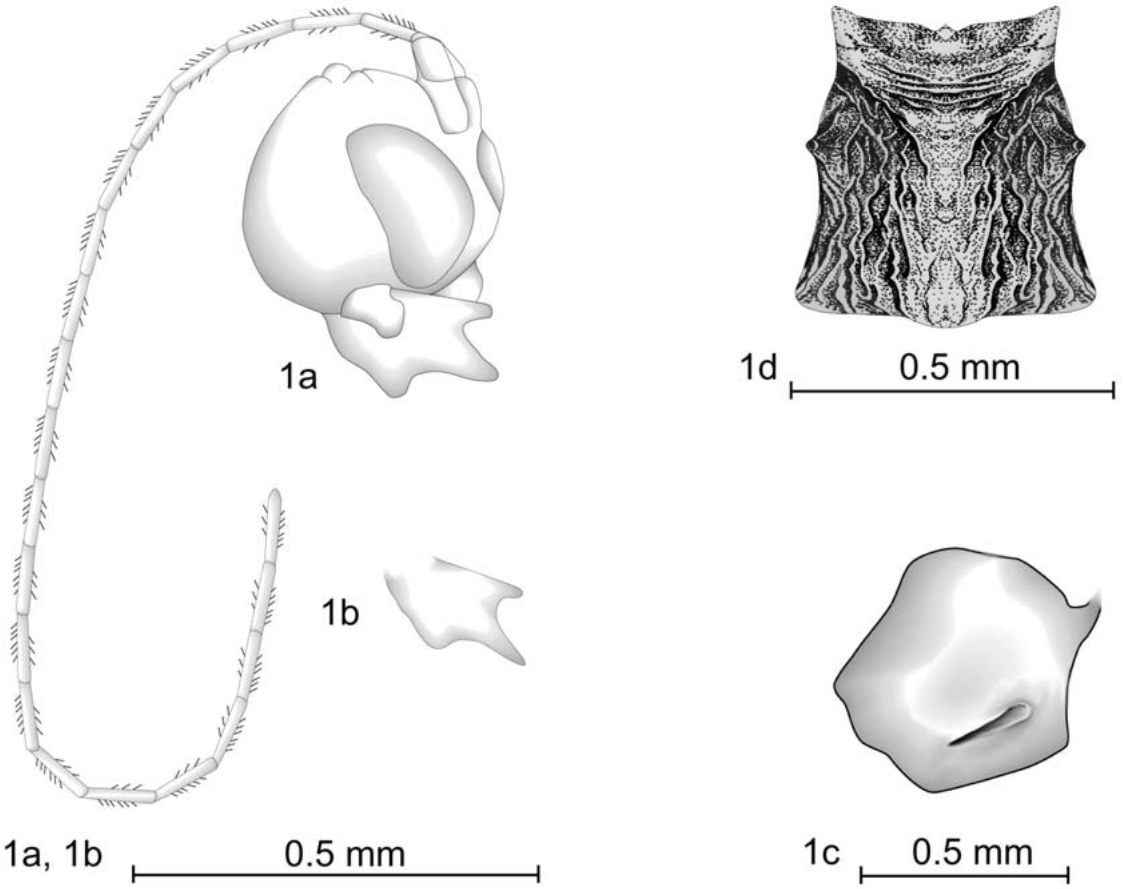


Fig. 1. *Dacnusa cicerina* **sp. n.** (♀): a—head in lateral view; c—detail of mesopleuron showing the sternaulus; d—petiole in dorsal view. *Dacnusa cicerina* **sp. n.** (♂): b—left mandible.

impressed; mesoscutum with dorsal pit, largely smooth, shiny, setose, with setae longer in its middle–posterior part, covering all its surface; scutellar sulcus simple; surface of propodeum wrinkled and finely setose. *Wings*—Pterostigma moderately wide and dark, 2.0 times longer than R1; 3Rsb sinuate; m-cu antefurcal. *Legs*—Hind tarsus shorter than hind tibia. *Metasoma*—Petiole glabrous, as long as wide apically, with large dorsope; third tergite smooth, without setae on its base; ovipositor sheath not extending beyond apical tergite in retracted position. *Color*—Head and mesosoma black; face black; clypeus dark brown; labrum and palpi yellow; antennae dark brown, centre of mandibles orange-yellow; legs pale yellow, with slightly darkened tarsi; wings hyaline, with dark pterostigma; metasoma brownish, becoming darker apically.

Allotype—Similar to ♀, but pterostigma wider and dark.

Differential Diagnosis. This new species is similar to *D. rodriguezi*, from which it is distinguished by the following character states: (a) mandibles expanded, with middle tooth pointed; (b) sternaulus smooth; and (c) first metasomal tergite brownish, glabrous, as long as wide apically.

Etymology: The specific name of this species refers to *Liriomyza cicerina*, of which it is a parasitoid.

This species can be identified with the keys provided by Docavo & Tormos (1997, page 387) modified as follows:

Males

159 (144) Antennae 22-23 segmented. Mandibles three-toothed, not expanded. First metasomal tergite dark brownish red, 1.7 times longer than wide apically. Pterostigma narrower than in *Dacnusa melicerta* (Nixon) (Fig.

4). Sternaulus absent. Body 1.3 mm. Parasitoid of *Liriomyza dracunculi* Hering, *L. artemisicola* de Meijere. Center, Central Ural; East Germany; Austria . . . . . *D. austriaca* Fischer

159' (215) Antennae 20-23 segmented. Mandibles three-toothed, expanded. First metasomal tergite 1.3 times, or less, longer than wide apically. Pterostigma much longer than the R1 (Fig. 4b, see Docavo & Tormos 1997). Sternaulus present . . . . . 159"

159" (144) Antennae 20-22 segmented. Mandibles weakly expanded, with middle tooth blunt (Fig. 2). First metasomal tergite black, 1.3 times longer than wide apically. Sternaulus weakly crenulate. Body 1.5 mm. Parasitoid of *Chromatomyia horticola* (Goureau). Spain. . . . . *D. rodriguezi* Docavo & Tormos

159" (144) Antennae 23 segmented. Mandibles expanded, with middle tooth long and pointed (Fig. 1b). First metasomal tergite brownish, glabrous, as long as wide apically. Sternaulus smooth. Body 1.7 mm. Parasitoid of *Liriomyza cicerina* (Rondani). Spain . . . . . .*D. cicerina* **sp. n**.

Females

214 (215) Antennae 21-24 segmented. Mandibles three-toothed, not expanded. First metasomal tergite reddish dark brown, slightly pubescent, 1.7 times longer than wide apically. Pterostigma yellowish dark brown, parallel-sided, few longer than R1. Sternaulus absent. Body 1.3 mm . . . . . *D. austriaca* Fischer

214' (215) Antennae 20-23 segmented. Mandibles three-toothed, expanded. First metasomal tergite 1.3 times, or less, longer than wide apically. Pterostigma much longer than the R1 (Fig. 4a, to see Docavo & Tormos 1997). Sternaulus present . . . . . 214"

214" (215) Antennae 20-22 segmented. Mandibles weakly expanded, with middle tooth blunt. First metasomal tergite (petiole) black, fairly glabrous, 1.3 times longer than wide apically (Fig. 3). Pterostigma dark brown, much longer than the R1. Sternaulus crenulated (Fig. 2, see Docavo & Tormos 1997). Body 1.5 mm . . . . . *D. rodriguezi* Docavo & Tormos

214" (215) Antennae 23 segmented. Mandibles expanded, with middle tooth long and pointed (Fig. 1a). First metasomal tergite (petiole) brownish, glabrous, as long as wide apically (Fig. 1d). Pterostigma dark brown, much longer than the R1. Sternaulus smooth (Fig. 1c). Body 1.7 mm . . . . . .*D. cicerina* **sp. n.**

Females and males of *D. cicerina* can be also distinguished from those of *D. basirufa* Tobias, in Belokobylskij et al. (1998: 339, 340, 353) after the following modifications:

Males

56 (55) 1st-3rd metasomal tergite brownish-yellow 57

—First tergite black. Antennal segments more than 24 58

57 (56) Radial cell almost not shortened. Pterostigma long, narrow, yellowish. 1st–3rd flagellar segments yellow. Antenna 25-segmented; median segments about twice as long as wide. 1.7 mm (Fig. 128, 5, see Belokobylskij et al. (1998)). Primorskiy Territory. . . . . .*D. (P.) basirufa* Tobias

—Radial cell shortened. Pterostigma wider, brown. Antenna 20-23-segmented, dark; median segments 2-2.5 times as long as wide. . . . . 57'

57'(57) Antennae 22-23 segmented. Mandibles three-toothed, not expanded. First metasomal tergite dark brownish red, 1.7 times longer than wide apically. Pterostigma narrower than in *Dacnusa melicerta* (Nixon) (Fig. 4). Sternaulus absent. Body 1.1-1.5 mm. Magadan Province, Primorskiy Kray. . . . . *D. (P.) austriaca* Fischer

—Antennae 20-23 segmented. Mandibles three-toothed, expanded. First metasomal tergite 1.3 times, or less, longer than wide apically. Pterostigma much longer than the R1 (Fig. 4b, see Docavo & Tormos 1997). Sternaulus present . . . . . 57"

57" (57') Antennae 20-22 segmented. Mandibles weakly expanded, with middle tooth blunt (Fig. 2). First metasomal tergite black, 1.3 times longer than wide apically. Sternaulus weakly crenulate. Body 1.5 mm. Parasitoid of *Chromatomyia horticola* (Goureau). Spain . . . . . *D. rodriguezi* Docavo & Tormos

—Antennae 23 segmented. Mandibles expanded, with middle tooth long and pointed (Fig. 1b). First metasomal tergite brownish, glabrous, as long as wide apically. Sternaulus smooth. Body 1.7 mm. Parasitoid of *Liriomyza cicerina* (Rondani). Spain . . . . . .*D. cicerina* **sp. n.**

Females

114 (106) Mesosoma entirely dark colored 115

—First metasomal tergite yellowish brown 117

117 (114) Sternauli absent . . . . . 117'

—Sternauli present . . . . . 117"

(117') (114) Median segments of antenna 2.5 times as long as wide; basal segments of antenna dark. Pterostigma weakly wedge-shaped. Antenna 21-24-segmented. Only first metasomal tergite pale colored, but infuscate medially. 1.3-1.4 mm . . . . . *D. (P.) austriaca* Fischer

—Median segments of antenna 1.5-1.8 times as long as wide; four basal segments of antenna yellow. Pterostigma lineal (in male elongate wedge-shaped and as in female pale colored). Antenna 21-22-segmented. First-third metasomal tergite pale yellowish brown. 1.1-1.4 mm . . . . . *D. (P.) basirufa* Tobias

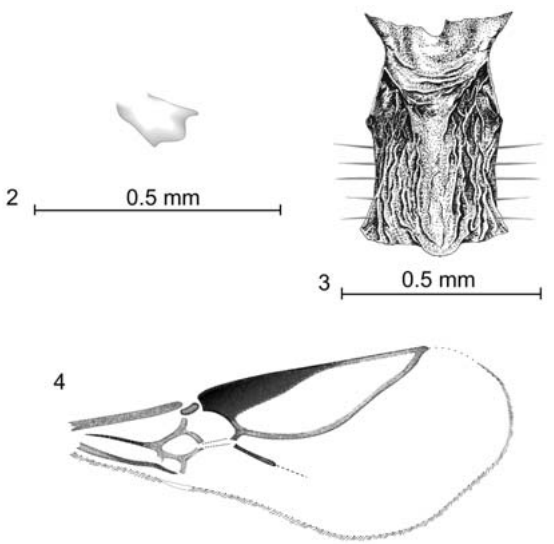
117"(114) Antennae 20-22 segmented. Mandibles weakly expanded, with middle tooth blunt. First metasomal tergite (petiole) black, fairly glabrous, 1.3 times longer than wide apically (Fig. 3). Stigma dark brown, much longer than the R1. Sternaulus crenulated (Fig. 2, see Docavo & Tormos 1997). Body 1.5 mm . . . . . *D. rodriguezi* Docavo & Tormos

—Antennae 23 segmented. Mandibles expanded, with middle tooth long and pointed (Fig. 1a). First metasomal tergite (petiole) brownish, glabrous, as long as wide apically (Fig. 1d). Stigma dark brown, much longer than the R1. Sternaulus smooth (Fig. 1c). Body 1.7 mm . . . . . *D. cicerina* **sp. n.**

Immature Stages of ***D. cicerina*** **sp. n.** (Figs. 5a-d, 6a, b)

The first instar was found in different larval stages of the host; second and third instars were only found in host pupae.

Larva. 1st instar. General Aspect (Fig. 5a). *Body* [length (l) and width (w) (at the level of the mesothoracic segment): 0.5 × 0.15 mm] with head well defined and 13 body segments, caudate, vermiform, transparent, curved to the ventral side. Last abdominal segment slightly modified into a short blunt, rounded organ in the form of a tail (l = 80-85 µm, number of specimens = 3), with 25 setae (l = 50-70 µm) distributed in a fan around the anus. Segments 2-12 with a row of short setae (l = 7-12 µm) on their posterodorsal part, the numbers corresponding to 8 (mesothorax), 12 (metathorax), and between 17 and 35 (abdominal segments). *Cranium* (Fig. 5b) (length and width: 160 × 170 µm) with sclerites strongly sclerotized with the exception of the epistoma (weakly sclerotized). *Mouthparts*: Mandibles well defined, with an oblong molar lobe and one blade (l = 32 µm) sharp, curved, and well sclerotized.



Figs. 2-4. 2—*Dacnusa rodriguezi* (♂): mandible in lateral view. 3—*D. rodriguezi* (♀): a—petiole in dorsal view; 4—*Dacnusa austriaca* (♀): anterior wing according Tobias (1995).

2nd instar. General Aspect (5c). *Body* [l = 1 mm; w (at the level of the mesothoracic segment) = 0.20 mm] cylindrical, long with respect to mesothoracic width, slightly spindle-shaped at ends. Integument bare. Without cephalic sclerites or mouthparts.

3rd instar. General Aspect (5d). Typical Hymenopteriform (l = 1.70, w = 0.60 mm), with head, thoracic and abdominal segments well defined; yellowish. Integument with scale-like sensilla ("setae") (l = 3 µm) covering the thoracic and abdominal segments, except the intersegmental zones and around the spiracles and anus. Nine pairs of spiracles (diameter (di) = 8 µm), with the atrium and closing apparatus well differentiated, one pair on the prothorax and another on the anterior edge of each of the first eight abdominal segments.

Pupa. Exarate. Without cocoon.

Exuvia of Final Instar. Of the 2 exuviae available for study only 1 was measured. General aspect. Tegument weakly sclerotized, except spiracles and scale like sensilla (setae) [l = 3 µm]. Spiracles (Fig. 6a) situated on prothorax and first 8 abdominal segments; atrium (atr) [di = 6 µm] sparingly developed, round, unarmed, separated from the closing apparatus (ca) [l = 11 µm, w = 9 µm] by a section of the trachea (t) [l = 52 µm, a = 5-7 µm]. *Cranium* (Fig. 6b) [w (maximum) = 0.50 mm, h (taken from the base of the mandibles) = 0.20 mm] reduced; weakly sclerotized; with sen-

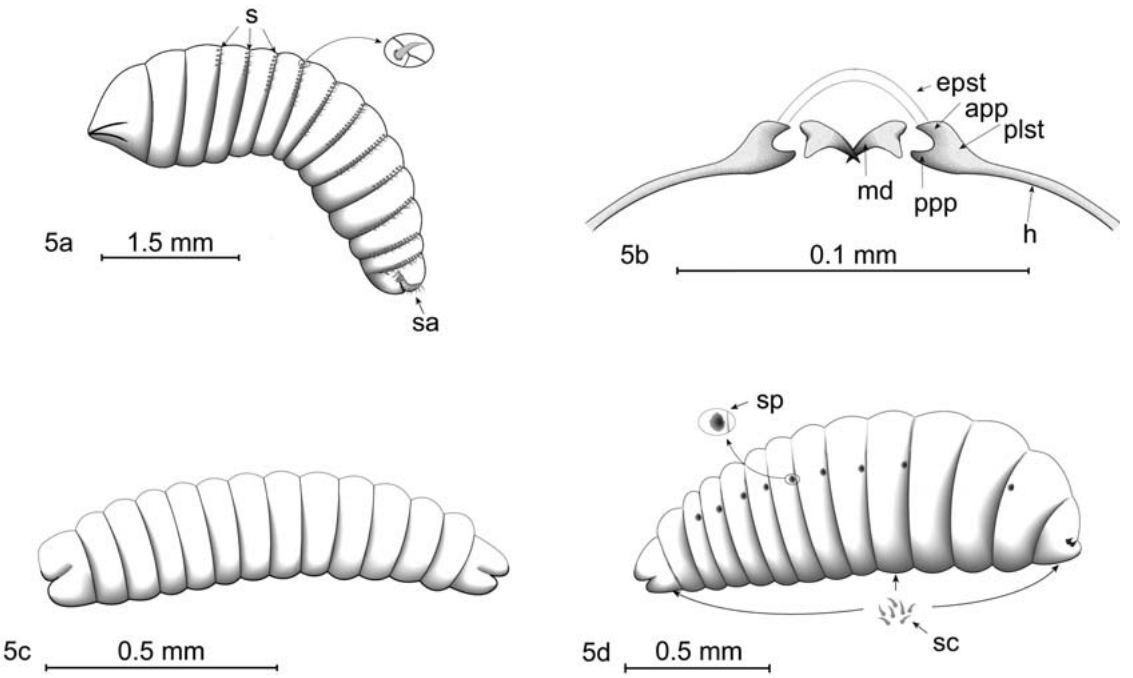


Fig. 5. *Dacnusa cicerina* **sp. n.**: 5—Larval phase: a—1st instar (lateral view); b—mandibles and head sclerites; c—2nd instar (lateral view); d—3rd instar (general aspect).

silla (se) [di = 3 µm] and setae (st) [l = 3 µm]; orbital antennal circular (a) [di = 0.08 mm], weakly protuberant; pleurostoma (plst), superior (app) and inferior (ppp) mandible processes, hypostoma (h) and stipital sclerite (sl) well differentiated and sclerotized; the latter joined to the labial sclerite (ls), which is weakly sclerotized. *Mouthparts*. Mandibles (md) [l = 0.06 mm] with broad base and relatively long blade, curved, thin, unarmed (smooth) unidentate, sclerotized; maxillary (mp) and labial (lp) palpi circular, slightly protuberant, with a highly developed sensilla [di = 6 µm] in the case of the labial palpi, and with two sensilla, one of them highly developed [di = 5 µm] and the other minute [di = 2 µm] in the case of the maxillary palpi; salivary orifice well defined (so) (l = 12 µm).

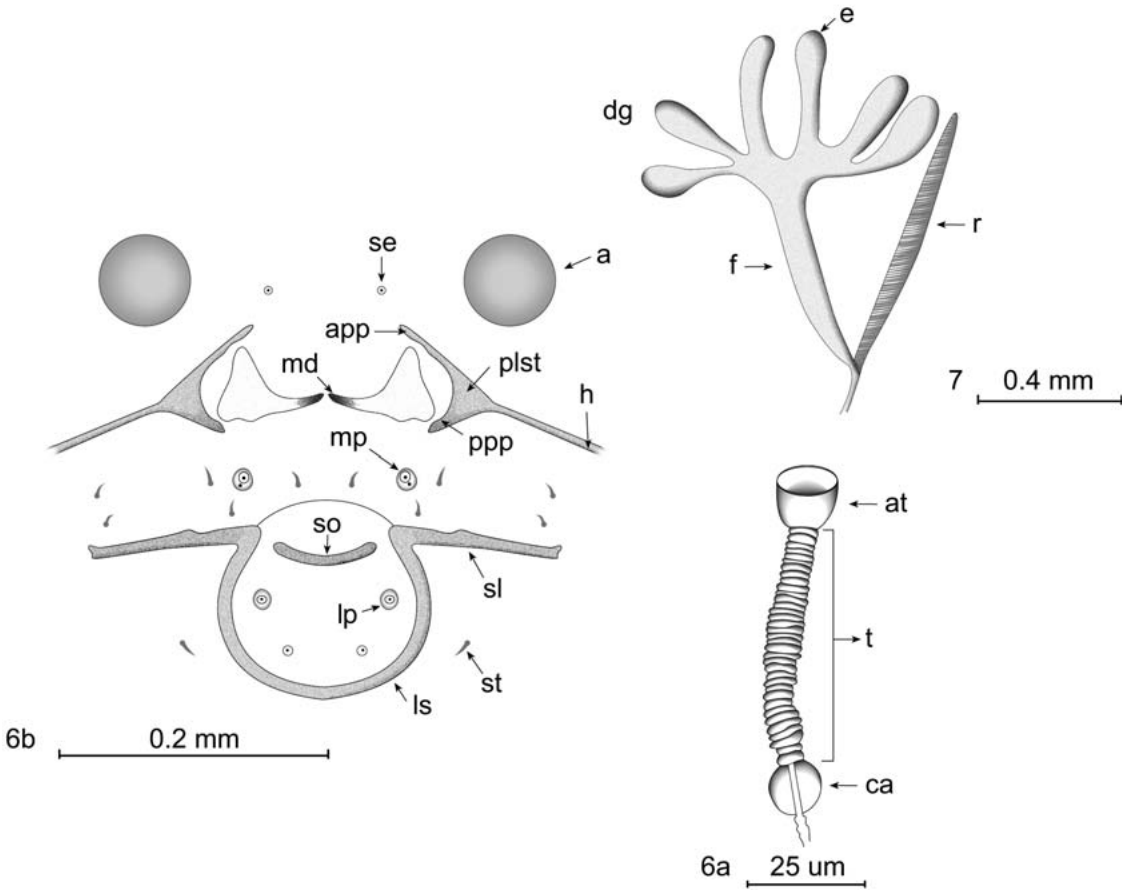
Description and Comments of Venom Apparatus (Fig. 7)

The venom apparatus exhibits the characters specified by Quicke et al. (1997) for *Dacnusa*: (a) an undivided reservoir; (b) a reservoir neck region without narrowing; (c) a reservoir more than six times longer than maximally wide; (d) a secondary venom duct absent; (e) an extensively branched venom gland; (f) a venom gland inserted at the extreme posterior end of the reservoir; and (g) a secondary venom duct that is not narrow. The venom apparatus of *Dacnusa cicerina* is very similar to that of *D. flavicoxa* Thomson (both species are included in the subgenus *Pachysema* Foerster), the morphological differences being that the reservoir length is more than 12 times longer than maximally wide in *D. cicerina* (less than 12 times in *D. flavicoxa*) and that the number of gland filaments is 6 in *D. cicerina*, while *D. flavicoxa* has 8 filaments (Fig. 7).

Notes on the Hyperparasitoid ***Eurytoma*** sp. (Fig. 8a, b)

A mature larva of this genus was collected, together with a second larval instar of *D. cicerina*, from a puparium of *L. cicerina* at Ayora (Valencia, Spain) on 10-VI-1989. This appears to indicate that *Eurytoma* sp. probably oviposits into the phytophagous host, representing then a hyperparasitoid of *D. cicerina* (Sullivan 1999). An adult male *Eurytoma* sp. was obtained on 15-VIII-1988, from the same locality, from a puparium of *L. cicerina* that was originally collected on 6-VI-1988.

General aspect (Fig. 8a). *Body* (l = 2.2 mm, w = 0.61 mm), shape varying between barrel-shaped and cylindrical, anterodorsal protuberances present on thoracic segment 3 (th3) and first nine abdominal segments (a1-a9), with three thoracic



Figs. 6-7. *Dacnusa cicerina* **sp. n.**: 6—Larval phase: exuvia of final instar: a—spiracle; b—cephalic structures 7. Venom apparatus of *D. cicerina* **sp. n.** showing the terminology used for the venom gland and reservoir parts. Lettering: antennal orbit (a), anterior pleurostomal process (app), atrium (at), closing apparatus (ca), venom gland (dg), secondary venom duct (f), gland filament (sack) (e), epistoma (epst), hypostoma (h), labial palpi (lp), labial sclerite (ls), mandible (md), maxillary palpi (mp), pleurostoma (plst), posterior pleurostomal process (ppp), reservoir with spiral sculture (r), mesothoracic, metathoracic and abdominal setae (s), anal setae (sa), scale like setae ("setae") (sc), sensilla (se), stipital sclerite (sl), salivary orifice (so), spiracle (sp), setae (st), trachea (t).

and ten abdominal segments. Color yellowish. Weakly sclerotized, except for mandibles (md), spiracles (sp) and setae. Anus small, subterminal, transverse. Pleural lobes scarcely developed. Tegument setose, with: (a) dorsal setae (l = 62-120 µm): two pairs of setae on (th1-a7), a pair on the (a8) and (a9); (b) dorsal terminal setae (l = 30 µm): one pair; (c) pleural setae (l = 55-110 µm): four pairs on (th1-a2); two pairs on (a3-a9); (d) ventral setae (l = 150-420 µm): one pair on (th1-a9), (sp) on (th2), (th3), and on (a1-a7); atrium of spiracle (l = 20 µm, d maximum = 10 µm) funnel-shaped, with approximately twelve chambers; closing apparatus of spiracle (l = 7 µm; w = 3 µm) adjacent to atrium. *Cranium* (Fig. 8b). Wider than high (w = 210 µm, height (from apex of cranium to base of (md)) = 105 µm), narrower than (th1), weakly sclerotized, with two pairs of setae (l = 4-5 µm): superior frontal setae (l = 4 µm), hypostomal setae (l = 5 µm). antenna approximately 2.5 times as long as broad, located below middle of cranium, with two small sensilla on apex. Clypeus and labrum without setae or sensilla; epipharynx with a pair of small sensilla (a). Tentorium with the pleurostoma and its anterior and posterior pleurostomal processes sclerotized and differentiated. Epistoma almost indistinct, and very weakly sclerotized. *Mouthparts.* (md) (l = 5 µm, w = 3 µm) sclerotized, more heavily sclerotized at their blade, unidentate, with a wide base; maxillae (mx) and labium (lum) completely fused: (mx) with a pair of maxillary setae (l = 4 µm) and a protuberant maxillary papilla (4 × 2 µm); (lum) without setae, with a pair of small prelabial sensilla.

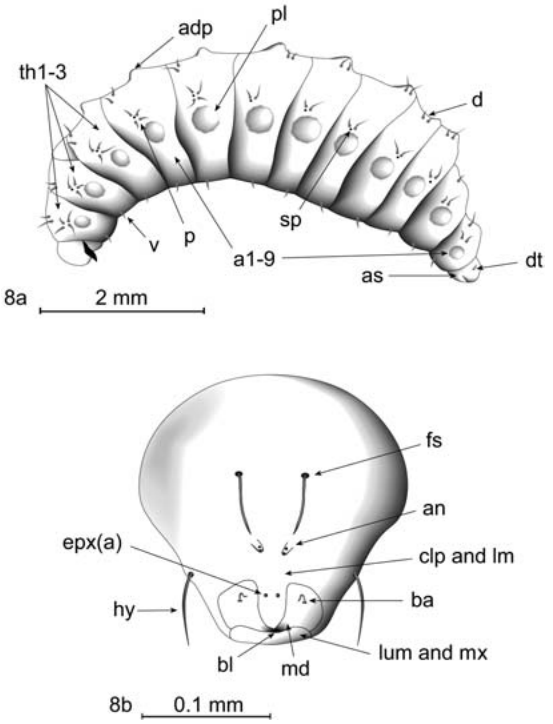


Fig. 8. *Eurytoma* sp.: a—mature larva in lateral view; b—cranium. Lettering: abdominal segments (a1-9), antenna (an), anal segment (as), anterodorsal protuberances (adp), base of mandibles (ba), blade of mandible (bl), clypeus (clp), dorsal setae (d), dorsal terminal seta (dt), sensilla of the epipharynx (epx): a), superior frontal setae (fs), hypostomal setae (hy), labrum (lm), labium (lum), mandibles (md), maxillae (mx), pleural setae (p), pleural lobes (pl), spiracles (sp), thoracic segments (th1-3), ventral setae (v).

Discussion

The first instar of *D. cicerina* can be considered of the caudate-mandibulate type, according to the classifications of Clausen (1962) and Hagen (1964). Its larva is similar to the first instar of *Dacnusa areolaris* (Nees) (Haviland, 1922) and *Dacnusa dryas* (Nixon) (Guppy & Meloche 1987). Like *D. areolaris*, it has a semicircle of stouter setae arranged fanwise round the anus. Like *D. dryas*, it has rows of setae on the posterodorsal part of several body segments. The strongly sclerotized mandibles of this first instar could serve to break the chorion; alternatively, they could contribute to preventing super- or multiparasitoidism, as has been indicated for the caudate-mandibulate larvae of Alysiinae (Tormos et al. 2003).

The second instar is fairly similar to the mature larva, having lost the tail, tegumental differentiations, cephalic sclerites and mouthparts; it is very similar to those of *D. dryas* (Guppy & Meloche 1987) and *Dacnusa sibirica* Telenga (Croft & Copland 1994).

The mature larva is very similar to that described for *D. dryas* (Guppy & Meloche 1987), from which it differs by having scale-like sensilla ("setae") on the thorax and abdomen. Differences in the cephalic sclerites are addressed in the discussion of the exuviae. The description of *D. areolaris* (Haviland 1922) does not allow comparative studies to be carried out.

The cast skin of the final instar of *D. cicerina*, like those described for Dacnusini, displays simple, unarmed mandibles and a reduction in the labial sclerite (Čapek 1970, 1973). It shares a pleurostoma with well-differentiated mandible processes and a long stipital sclerite with those of the genus *Dacnusa*. The only appreciable differences from *D. rodriguezi* and *D. dryas* (species whose mature larvae have been adequately described) lie in the presence/absence, type, number and arrangements of tegumental differentiations: spinules, setae, and sensilla. Unlike *D. rodriguezi*, *D. cicerina* does not have spinules on the tegument; the tegumental sensilla are scale-like (not bluntly pointed) and the labial palpi only have 1 sensillum. Unlike those of *D. dryas*, the tegumental, thoracic, and abdominal sensilla are scale-like (not bluntly pointed) and the maxillary palpi have 2 sensilla.

The mature larva of *Eurytoma* sp. shares the following character states with other known *Eurytoma* spp.: (a) body mainly barrel-shaped, broader in mid-region; (b) head hemispherical, without pronounced clypeus, with hypostomal setae longer or about as long as half the width of the labrum, and with inconspicuous and unpigmented craneal sclerites; (c) integument with setae arranged in distinct rows along all body segments, and with ventral setae arranged in paired rows; (d) atrium of spiracle long. Like *E. nodularis* Boheman, this larva has the antennae located below the middle of the cranium and more than 2 dorsal setae present on abdominal segments A6-7; the cranium, without FI setae, is similar to that of *E. heriadi* Zerova.

This mature larva can be characterized and distinguished from the similar mature larvae of *Eurytoma*: *E. nodularis* and *E. heriadi*, by the combination of the following character states: (a) tegument with two pairs of setae on (th1-a7); (b) cranium without inferior frontal setae or setae on genae; and (c) epipharynx with a pair of small sensilla. Additionally, it has an atrium with 12 chambers, an intermediate number between those of *E. nodularis* (14) and *E. heriadi* (10). The smaller size of this larva may represent a morpho-functional adaptation to its possible nature as hyperparasitoid.

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