

Notes on two species of *Dinotrema* Foerster (Hym., Braconidae, Alysiniinae) with observations on the hymenopterous parasite-complex of *Spiniphora dorsalis* Becker (Dipt., Phoridae) in dead *Helix* spp. (Mollusca)

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ABSTRACT. — Two species of *Dinotrema* Foerster, 1862, *D. amplisignata* (Fischer, 1973) comb. nov. and *D. phoridarum* (Goidanich, 1936) comb. nov. are redescribed and compared; both are associated with Phoridae in dead Mollusca.

The hymenopterous parasite-complex of *Spiniphora dorsalis* Becker (Diptera, Phoridae), which consists of *Dinotrema amplisignata* (Fischer) (Braconidae), *Basalys helicicola* (Kieffer) (Diapriidae) and an *Eupteromalus* spec. (Pteromalidae), is examined, and the most probable relationships are depicted. Some remarks are made on the evolutionary significance of the absence or presence of the "horns" on the puparia for the host-selection by the pupal parasites.

INTRODUCTION

During the research on the parasites of *Spiniphora dorsalis* Becker (Diptera, Phoridae) in shells of decaying *Helix*-specimens, the second author discovered three species of hymenopterous parasites. One of these, *Basalys helicicola* (Kieffer, 1911) belonging to the Proctotrupeoidea, Diapriidae, could be definitely identified (Bin, 1972). Of the two remaining species, one is described in this paper by the first author as *Dinotrema amplisignata* (Fischer) (Braconidae) and is compared with the only other known species of *Dinotrema*, *D. phoridarum* (Goidanich, 1936) comb. nov., associated with Phoridae in dead Mollusca. The relationship of the third species is still uncertain; however, some circumstantial evidence favours the idea that this species, an *Eupteromalus* spec. (Chalcidoidea, Pteromalidae), is a hyperparasite of *Dinotrema amplisignata* (Fischer). For the terminology used in this paper, see Van Achterberg, 1979.

Genus *Dinotrema* Foerster, 1862

Diagnosis. — Anterior tentorial pits large, deep, not touching eyes (fig. 2); malar suture absent, but an oblique, long submalar depression present (fig. 16); malar space distinctly developed (fig. 1); mandible without transverse carina or ventral protuberance (fig. 6); 3rd antennal segment longer than 4th segment; pronope absent; pterostigma linear (fig. 4); vein m+ cu of fore wing postfurcal; vein M+CU of hind wing longer than 1-M; vein CU1b of fore wing shorter than vein 3-CU1; dorsope deep and large (fig. 8); 2nd tergite smooth; ovipositor apically slender and more or less upcurved.

Dinotrema amplisignata (Fischer) comb. nov.
(figs. 1-12)

Aspilota amplisignata Fischer, 1973: 244-347, figs. 3-4.

Redescribed from the figured ♀ from Italy, Cortemilia, length of fore wing 2.7 mm, of body 2.6 mm.

Head. — Antennal segments 23, length of 3rd segment 1.5 times 4th segment, length of 3rd and 4th segments 3.5 and 2.3 times their width, respectively, penultimate segment 2.0 times its width, and apical segment with no spine (fig. 3); length of maxillary palp 1.1 times height of head; dorsal length of eye equal to length of temple (fig. 12); temple is subparallel-sided; POL: \emptyset ocellus: OOL = 10 : 5 : 18; frons flat and smooth; vertex, face, and clypeus convex and smooth; width of anterior tentorial pit 2.7 times distance from pit to eye (fig. 2); length of malar space 0.6 times basal width of mandible; mandible slender, its medial length about 1.5 times its apical width, rather flat, subparallel-sided, and 2nd tooth somewhat longer than both (more lobe-shaped) lateral teeth (figs. 6, 7).

Mesosoma. — Length of mesosoma 1.3 times its height; side of pronotum smooth, except for some crenulae anteriorly and posteriorly (fig. 1); precoxal suture smooth, only medial part distinct and narrowly crenulate (fig. 1); rest of mesopleuron smooth; pleural suture largely smooth, narrow; metapleural flange rather small, sharp apically; metapleuron dorsally largely smooth, ventrally rugose; notauli absent, except for a short and smooth anterior part (fig. 1); lateral lobes of mesoscutum largely glabrous, convex; medio-posterior pit of mesoscutum shallow, narrow and small (fig. 10); scutellar suture wide and deep, with one short carina; scutellum convex and smooth; side of scutellum shortly crenulate; metanotum not protruding dorsally, with a short medial carina (fig. 10); dorso-anterior part of propodeum short (fig. 1), with a short medial carina and rather weak complete costulae, rest of surface smooth; posterior part of propodeum differentiated, with a weak areola, and some rugulae, rest smooth; propodeal spiracle rather large, round, somewhat protruding, and distinctly removed from anterior margin of propodeum (fig. 1).

Wings. — Fore wing: SR1 straight; r : 3-SR : SR1 = 9 : 29 : 62; cu-a short, interstitial, straight (fig. 4); 2-SR : 3-SR : r-m = 13 : 29 : 8. Hind wing: m-cu scarcely visible, unsclerotized; M+CU : 1-M = 24 : 13.

Legs. — Tarsal claws slender (fig. 9); length of femur, tibia, and basitarsus of hind leg 4.6, 7.6, and 8.7 times their width, respectively; length of hind tibial spurs 0.1 and 0.2 times hind basitarsus.

Metasoma. — Length of 1st tergite 1.5 times its apical width, surface largely smooth, except for some rugae (fig. 8), medio-basally convex, and behind spiracles strongly convex (fig. 1); dorsal carinae of 1st tergite present in basal half of tergite; laterope deep, medium-sized; length of ovipositor sheath 0.15 times fore wing, somewhat protruding above 6th tergite (fig. 1).

Colour. — Blackish-brown; clypeus, scapus, pedicellus, annellus, propleuron, tegulae, mandibles, metasoma baso-ventrally, and legs, brownish-yellow; hind telotarsus somewhat infuscated; 1st tergite and base of 2nd tergite, reddish-brown; pterostigma and wing veins, brown.

Figured specimen in the Rijksmuseum van Natuurlijke Historie, Leiden: "N. Italy, Cortemilia, prov. Asti, II.1971, F. Bin", "ex *Spiniphora dorsalis* Beck. in dead *Helix* sp.". Total of other specimens 29, of which 21 topotypic (13 ♀♀ and 8 ♂♂), deposited in the Rijksmuseum van Natuurlijke Historie, and in the Istituto di Entomologia Agraria, Perugia. The other specimens (6 ♀♀ and 2 ♂♂) are deposited in the Rijksmuseum van Natuurlijke Historie: "Museum Leiden, Corsica, Calcatoggio-Orcino, 8-18.V.1968, v. Ooststroem", "uit [= from] Mollusca" and Naturhistorisches Museum Wien (♀, holotype of *Aspilota amplisignata* Fischer: "Salzburg-Parsch, 2. Juli 1966, P. P. Babiy leg., an Fenster", "*Aspilota amplisignata* n. sp., ♀, Holotype, det. Fischer", "Holotype"). Variation: Medio-posterior pit of mesoscutum completely absent (in one specimen), slightly impressed (frequently), weakly developed (as figured), or deep (holotype and some specimens from Corsica); medial carina of propodeum absent or complete, intermediates are frequent; width of anterior tentorial pit 2.0-2.7 times distance from pit to eye; antennal segments of ♀ 20-24, of ♂ 23-26; length of fore wing 2.2-2.8 mm; length of ovipositor sheath 0.11-0.18 times fore wing; length of 1st tergite 1.3-1.9 times its apical width; 1st tergite and clypeus sometimes rather dark (especially in series from



Calcatoggio), however still lighter than the surrounding parts.

Notes. — This species is difficult to insert in Fischer's keys (1972, 1976), because he uses in the first couplet the presence or absence of the mesoscutal pit. Other characters are also extremely variable in this species, which keys out in existing keys as a new species because of the reduced mesoscutal pit and medial carina of propodeum. However, examination of the holotype of *Dinotrema amplisignata* (Fischer) (kindly provided by Dr. Max. Fischer) showed that this species falls just within the variation limits. The most reliable characters for recognizing *amplisignata* are the convex and yellowish 1st tergite, the large anterior tentorial pits, the yellowish or brownish clypeus, the shape of the mandible and of the antennal segments, and the length of the ovipositor sheath.

Key to *Dinotrema* species associated with Phoridae in decaying Mollusca

1. First tergite strongly convex (fig. 1), and brownish-yellow or reddish-brown, more or less contrasting with the darker 3rd tergite; medio-posterior pit of mesoscutum often comparatively narrow, or (virtually) absent (fig. 10); hind tarsus (except for telotarsus) brownish-yellow; ovipositor sheath longer, in undisturbed position somewhat protruding above 6th tergite (fig. 1); clypeus brownish-yellow or reddish-brown, contrasting with dark face
.....*amplisignata* (Fischer)
- First tergite comparatively flat (fig. 13), and more or less dark brown, if rather yellowish or reddish then similar in colour to 3rd tergite; medio-posterior pit of mesoscutum somewhat wider (fig. 21); hind tarsus infuscated; ovipositor sheath shorter, in undisturbed position not protruding above 6th tergite (fig. 13); clypeus dark-brown, similar in colour to face
.....*phoridarum* (Goidanich)

Dinotrema phoridarum (Goidanich) comb. nov. (figs. 13-24)

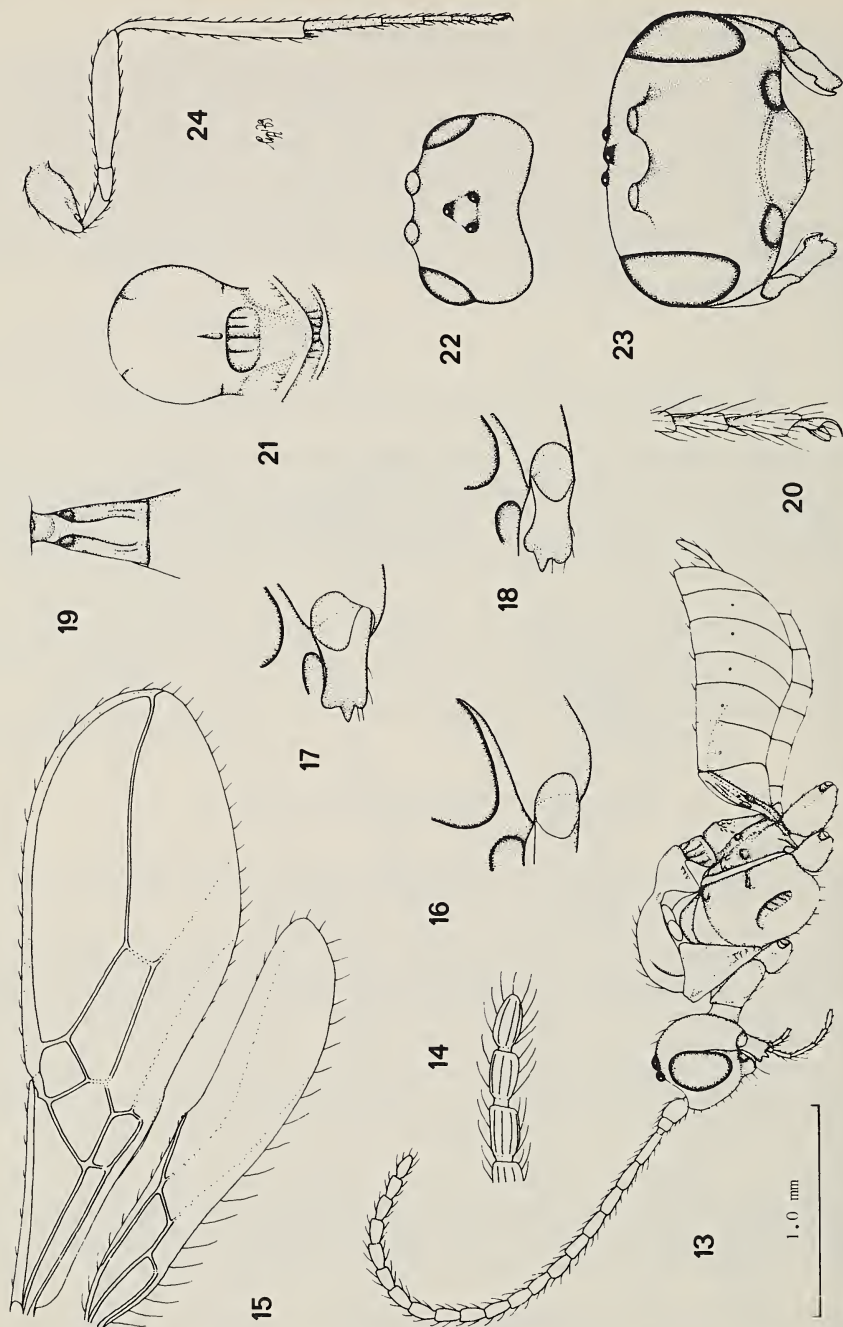
Aspilota phoridarum Goidanich, 1936: 201-205, 2 pls; Fischer, 1972: 427-430, figs. 111-122.

Paratype, ♀, length of fore wing 3.0 mm. length of body 2.5 mm.

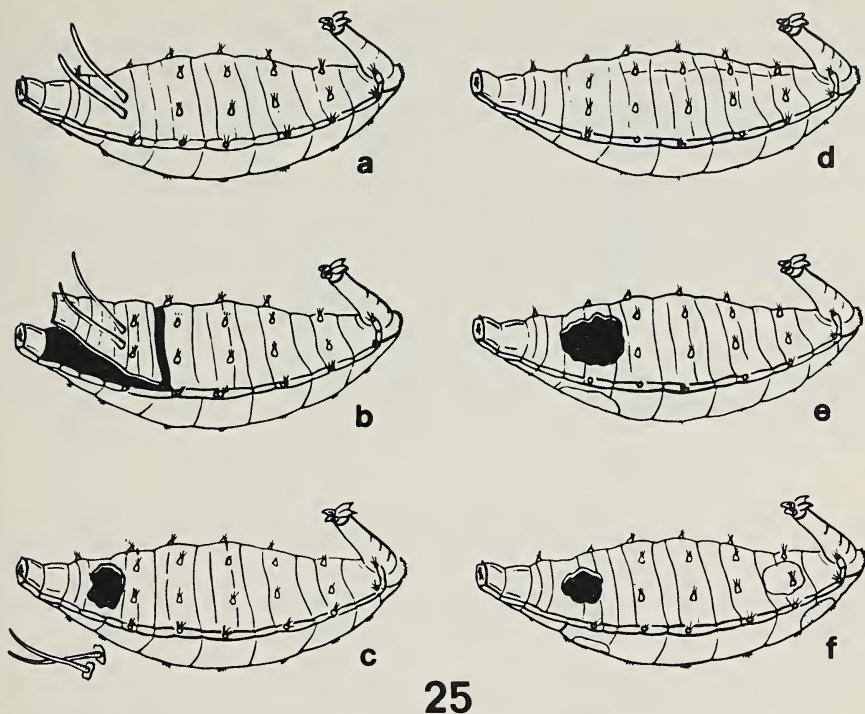
Head. — Antennal segments 21 (according to the original description ♀: 21-22, and ♂: 22-26), length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3.2 and 2.2 times their width, respectively, length of penultimate segment 2.0 times its width, and apical segment with no spine (fig. 14); length of maxillary palp 0.9 times height of head; dorsal length of eye 0.9 times temple (fig. 22); POL: Ø ocellus : OOL = 4 : 2 : 8; length of malar space 0.8 times basal width of mandible; temple, frons, vertex, face, and clypeus as in *amplisignata*; mandible rather flat, its medial length about 1.5 times its apical width, slightly widened dorsally (fig. 18), and medial tooth somewhat longer than both (more lobe-shaped) lateral teeth (fig. 17).

Mesosoma. — Length of mesosoma 1.2 times its height; side of pronotum smooth, except for some crenulae posteriorly; precoxal suture only medially present, deep, crenulate (fig. 13); rest of mesopleuron and pleural suture smooth; metapleural flange medium-sized and sharp apically (fig. 13); metapleuron largely smooth; notauli, scutellum and lateral lobes of

Figs. 1-12. *Dinotrema amplisignata* (Fischer), ♀, Cortemilia. 1. habitus, lateral aspect; 2. head, frontal aspect; 3. apex of antenna; 4. wings; 5. submalar depression; 6. mandible, full sight on 1st tooth; 7. mandible, full sight on 3rd tooth; 8. 1st tergite, dorsal aspect; 9. inner hind claw; 10. mesonotum and metanotum, dorsal aspect; 11. hind leg; 12. head, dorsal aspect. 1, 2, 4, 8, 10-12: scale-line, 1×; 3, 5-7, 9: 2.5×.



Figs. 13-24. *Dinotrema phoridarum* (Goidanich), paratype. 13. habitus, lateral aspect; 14. apex of antenna; 15. wings; 16. submalar depression; 17. mandible, full sight on 1st tooth; 18. mandible, full sight on 3rd tooth; 19. 1st tergite, dorsal aspect; 20. inner hind claw; 21. mesonotum and metanotum, dorsal aspect; 22. head, dorsal aspect; 23. head, frontal aspect; 24. hind leg. 13, 15, 24: scale-line, 1×; 14, 16-18, 20: 2.5×; 23: 2.0×; 19, 21, 22: 1.5×.



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Fig. 25. Puparia of *Spiniphora dorsalis* Becker with (a) and without horns (d), and showing the different places of emergence holes: *Spiniphora dorsalis* Becker (b), *Basalys helicicola* (Kieffer) (c), *Dinotrema amplisignata* (Fischer) (e), *Eupteromalus* spec. (f). The dotted areas show the other (less frequently used) places of emergence holes through which the parasite may escape (after Bin, 1972).

mesoscutum as in *amplisignata*; medio-posterior pit of mesoscutum comparatively deep and somewhat wider than in *amplisignata* (fig. 21); scutellar suture with one long and three shorter carinae (fig. 21); metanotum and dorso-anterior part of propodeum as in *amplisignata*, except for the incomplete costulae; posterior part of propodeum without areola; propodeal spiracle as in *amplisignata*.

Wings. — Fore wing: SR1 somewhat curved (fig. 15); $r : 2\text{-SR} : \text{SR1} = 5 : 22 : 51$; cu-a short, postfurcal, straight (fig. 15); $1\text{-CU1} : 2\text{-CU1} = 1 : 11$; $2\text{-SR} : 3\text{-SR r-m} = 8 : 22 : 6$. Hind wing: m-cu absent; $M+\text{CU} : 1\text{-M} = 17 : 7$.

Legs. — Tarsal claws (very) slender (fig. 20), basally somewhat widened; length of femur, tibia, and basitarsus of hind leg 4.5, 10.1, and 7.0 times their width, respectively; length of hind tibial spurs 0.15 and 0.20 times hind basitarsus.

Metasoma. — Length of 1st tergite 1.9 times its apical width, its surface largely smooth, with some striae, rather flat (fig. 13), medio-basally convex; dorsal carinae distinct in basal 0.8 of tergite; laterope rather small and shallow, elliptical; length of ovipositor sheath 0.08 times fore wing, sheath not protruding above 6th tergite (fig. 13).

Colour. — Dark brown (blackish according to the original description); scapus, pedicellus, annellus, and mandibles, yellowish-brown; tegulae and pterostigma, brown; palpi, and legs, brownish-yellow, but hind tarsus infuscated.

Redescribed from a ♀ paratype in the collection of the Istituto di Entomologia Agraria e Apicoltura, Torino. The holotype should be in the Istituto di Entomologia, Bologna, howev-

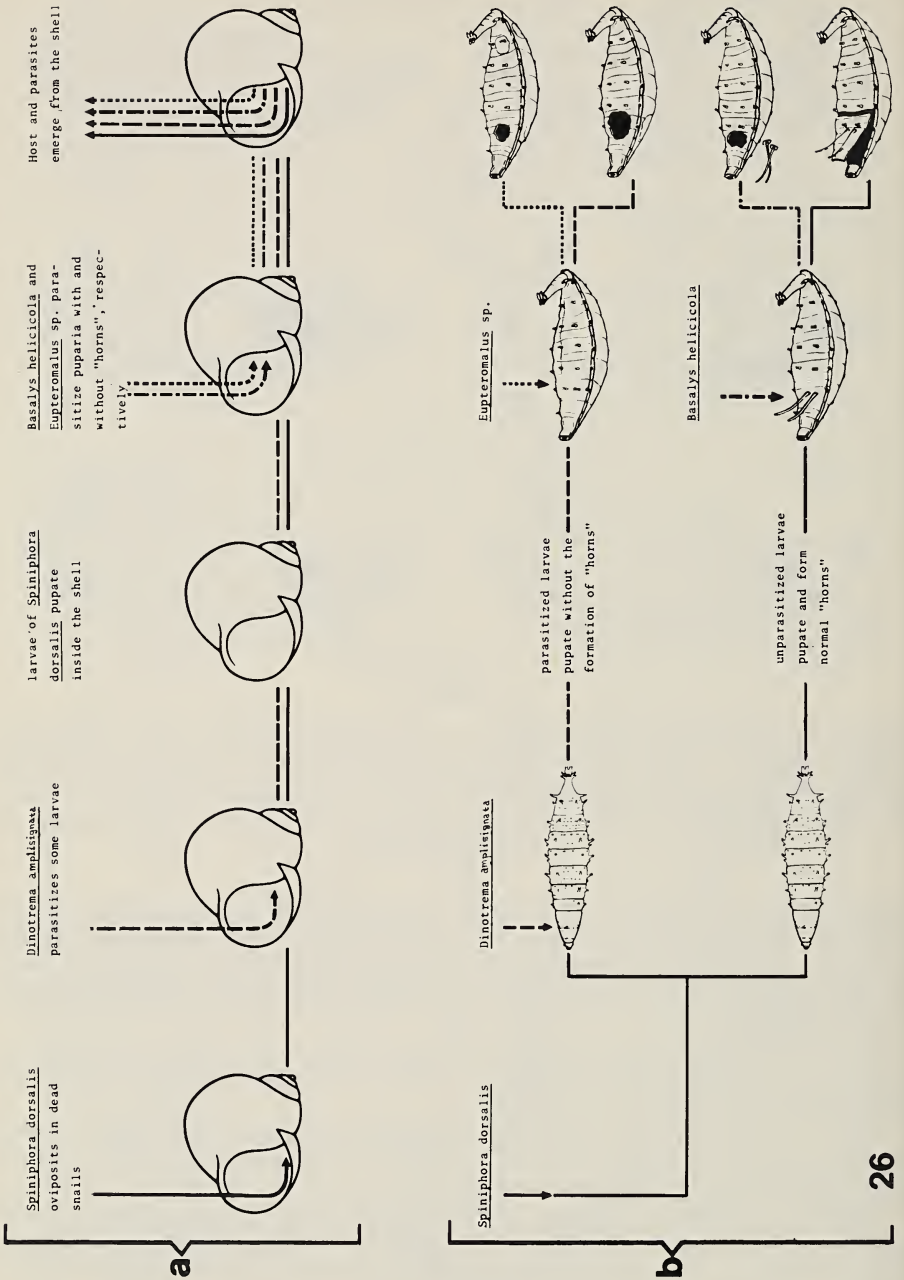


Fig. 26. The host-parasite relationships are illustrated: a) chronically, depicting the possible sequence of events; b) the larvae and puparia inside the shell, corresponding the events depicted above. For further details is referred to the text.

er Prof. Dr. M. Principi kindly informed the first author that it could not be found. Labels of the redescribed specimen: „S. Remo, 2.1935, pupar: *Paraspiniphora* sp.”, and „*Aspilota phoridarum* m. n. sp., det. A. Goidanich”. Additional paratypes examined: 6 ♂♂ and 2 heavily damaged specimens; they are essentially as the redescribed specimen, only sometimes the 1st tergite is brown instead of dark brown, not contrasting with the 3rd tergite however.

Note. — The species is incorrectly placed in Fischer's keys (1972, 1976). It should be compared with *Dinotrema nigricornis* (Thomson, 1895) comb. nov. *Dinotrema phoridarum* differs from *nigricornis* by the shorter ovipositor sheath (as long as 1st tergite or shorter, not protruding above 6th tergite, in *nigricornis* somewhat longer than 1st tergite and protruding above 6th tergite) and mandibles somewhat more slender (its medial length ca. 1.5 times the apical width, in *nigricornis* ca. 1.3 times the apical width).

The type-series was reared from *Paraspiniphora signata* Schmitz, 1935 (Diptera, Phoridae) living in decaying snails, especially *Helix aspersa* Müller. It also depresses the development of the horns of the prothoracic stigmata (Goidanich, 1936: 204) as *D. amplisignata* does.

Relations within the parasite-complex of *Spiniphora dorsalis*

The relations reported are mainly based on the observations published by the second author (Bin, 1972). About 600 puparia of *Spiniphora dorsalis* were collected inside several shells of *Helix* spp., dead for unknown reasons, in a snail-nursery in North Italy. All the puparia were isolated one by one and sorted into two groups according to the presence or absence of a pair of „horns”; properly called „prothoracic stigmatic horns” because of the spiracles located at the tips of the protrusions (figs. 25: a & d).

In this way three species of Hymenoptera, belonging to three different superfamilies, have been reared and their percentages were calculated. From puparia with horns *Spiniphora dorsalis* emerged at a percentage of 78, whereas from the remaining puparia *Basalys helicicola* emerged. From the puparia without horns two other species were obtained; viz., *Dinotrema amplisignata* with a percentage of 83 and an *Eupteromalus* spec. from the remaining puparia.

From these data it seems possible to deduce the part of the food chain in which these species are involved (fig. 26). The larvae of *Spiniphora dorsalis* are parasitized by *Dinotrema amplisignata*, and because of this reason, they form puparia without „horns”. Unparasitized larvae exhibit the normal horns, which most probably are used by the later involved (pupal) parasites to distinguish parasitized from unparasitized puparia.

In fact *Basalys helicicola* and *Eupteromalus* spec. have been reared from puparia with and without horns, respectively, and no exception to this rule has been observed. Therefore *Eupteromalus* spec., also because of its low percentage of parasitization, is involved in a late phase of the food chain, and most likely it seems to be a parasite of *Dinotrema amplisignata*. This does not contradict what is known about the biology of other *Eupteromalus* spp., some of which are known to be hyperparasites of parasitic Hymenoptera. Finally after the emergence the identity of the parasites can be easily deduced from the characteristic position and dimension of the emergence holes (fig. 25: c, e, f; 26: b).

The selection of the „hornless” puparia by the (hyperparasitic) *Eupteromalus* spec. may be because it is from an evolutionary view-point more profitable to be a hyperparasite of a larval parasite in the puparium than to be a hyperparasite of a pupal parasite in the „horned” puparia. The pupal parasites are less developed and contain less food for the secondary parasite than is offered by the larval parasite at the same age of the puparia. The selection of the „horned” puparia by the primary parasite *Basalys helicicola* is from an evolutionary view-point profitable because the „hornless” puparia are already parasitized by a primary (larval) parasite and the selection of the „horned” puparia avoid the competition with the larval parasite *Dinotrema amplisignata*.

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BOUDREAUX, H. BRUCE, 1979. ARTHROPOD PHYLOGENY; with special reference to insects. pp. VIII, 320, ca. 130 refs, index ca. 27 kolommen. John Wiley & Sons, Chichester etc. ISBN 0-471-04290-0. Prijs (gebonden) £ 15.00.

De auteur vermeldt in het voorwoord dat de voornaamste stelling van het boek het eenmalig ontstaan betreft van het fyllum Arthropoda. Deze, door anderen zeer omstreden, conclusie werd bereikt door consequente toepassing van de cladistische methode, een methodiek die ook de gehele verdere taxonomische onderverdelingen en de zakelijke indeling en inhoud van het boek bepaalt.

De eerste 138 pagina's behandelen de fylogenie van de hoofdgroepen der geleedpotigen, de overige betreffen de indeling van de insekten. In feite is dit tweede deel een meer apodictische voortzetting van het werk van Hennig „Die Stammesgeschichte der Insekten” (1969). De fylogenetische methode heeft nu geleid tot een verdere fractionering en hergroepering van een toegenomen aantal orden, geklassificeerd in hiërarchische categorieën van verschillende gelaagdheid: subklassen, infraklassen, subterklassen, supersecties, secties, subsecties, infrasecties, supercohorten, cohorten, subcohorten, infracohorten, subtercohorten. Per categorie worden de kenmerken opgesomd in hun plesiomorfe en apomorfe toestanden. Ik er voer het doornemen van dit boek zoals een van de recensenten het uitdrukte: „the whole organization of these pages, category by category, is so ponderous that at time I thought I was reading a telephone book rather than a stimulating treatise. Much useful and informative material is in these chapters but it takes persistence to ferret it out”.

Hiermee is tevens aangegeven dat dit geen boek is voor normale insektencurricula, ofschoon het een neerslag is van een in Amerika door de auteur gegeven cursus. De ontworpen systematiek is zeker geen eindpunt. — R. H. Cobben.