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IMMATURE STAGES OF THE MEDITERRANEAN KNAPWEED BORER, *PTEROLONCHE INSPERSA* (LEPIDOPTERA: PTEROLONCHIDAE)

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ABSTRACT.– Immature stages of the knapweed root borer, *Pterolonche inspersa* (Pterolonchidae), from the Mediterranean region, are described for the first time in detail.

KEY WORDS: Africa, Agonoxenidae, Albania, *Anathyrsa*, Asia, Austria, biological control, Bosnia, Bulgaria, chaetotaxy, Compositae, Copromorphoidea, Cosmopterigidae, Cossidae, Croatia, *Crossotocera*, egg, Elachistidae, Europe, France, Gelechiidae, Gelechioidea, Greece, Hungary, Italy, larvae, Macedonia, Mediterranean, Moldova, Morocco, Nearctic, North America, Oecophoridae, Palearctic, pupae, Pyraloidea, Romania, Russia, Serbia, Slovenia, South Africa, Spain, Tunisia, Ukraine, Yponomeutoidea, Yugoslavia.

Among Lepidoptera there remain several, mostly rare and exotic families for which no biological information is known. The lack of data and morphological characters for their immature stages greatly hinders the proper placement of some of these families within the order Lepidoptera. Surprisingly, included among these families has been a family of small moths mostly from Europe, a relatively well-known area of the world: the Pterolonchidae (Gelechioidea), from the Mediterranean region and South Africa. Only 10 species are now known in the family, following recent studies by A. Vives-Moreno (1987; pers. comm.): 8 sp. are in the genus *Pterolonche* (European and North African, except for 1 sp. in South Africa), 1 sp. is in the genus *Crossotocera* from Turkey, and 1 sp. is in the genus *Anathyrsa* from South Africa. The species have been obscure and little documented other than in their original descriptions and brief mentions in regional works on European moths (Hartmann, 1880; Spuler, 1910), and their hostplants and biologies have remained unknown until recently.

Recent studies for the biological control of European knapweeds (*Centaurea* spp., Compositae), accidentally introduced into parts of western North America, have resulted in the discovery that one species of *Pterolonche* feeds on the roots of several knapweeds in southern Europe (Harris and Cranston, 1979). Studies to possibly introduce *Pterolonche inspersa* Staudinger into the USA as a biological control agent for the knapweed plant pests have resulted in the first biological information for the family (Campobasso *et al.*, 1994; Dunn *et al.*, 1989). These studies on *P. inspersa* have also provided the first larval specimens for detailed morphological study. Previously, cast pupal skins and some larval specimens of another species, *Pterolonche pulverulenta* Zeller, from Tunisia, were available for study, which Minet (1988) briefly reported on in terms of family characters of Pterolonchidae in relation to their position within the superfamily Gelechioidea, but no detailed larval description was included.

Fig. 1. *Pterolonche inspersa* adult (Spain) (photo courtesy of A. Vives-Moreno).

The following report documents the first detailed morphological study of Pterolonchidae immatures, based on samples of larvae and pupae of *P. inspersa* kindly provided from the knapweed biological control project, headquartered in the Rome (Italy) and Montpellier (France) offices of the U. S. Dept. of Agriculture, Agricultural Research Service (Campobasso *et al.*, 1994; Dunn *et al.*, 1989). The specimens were collected in Hungary.

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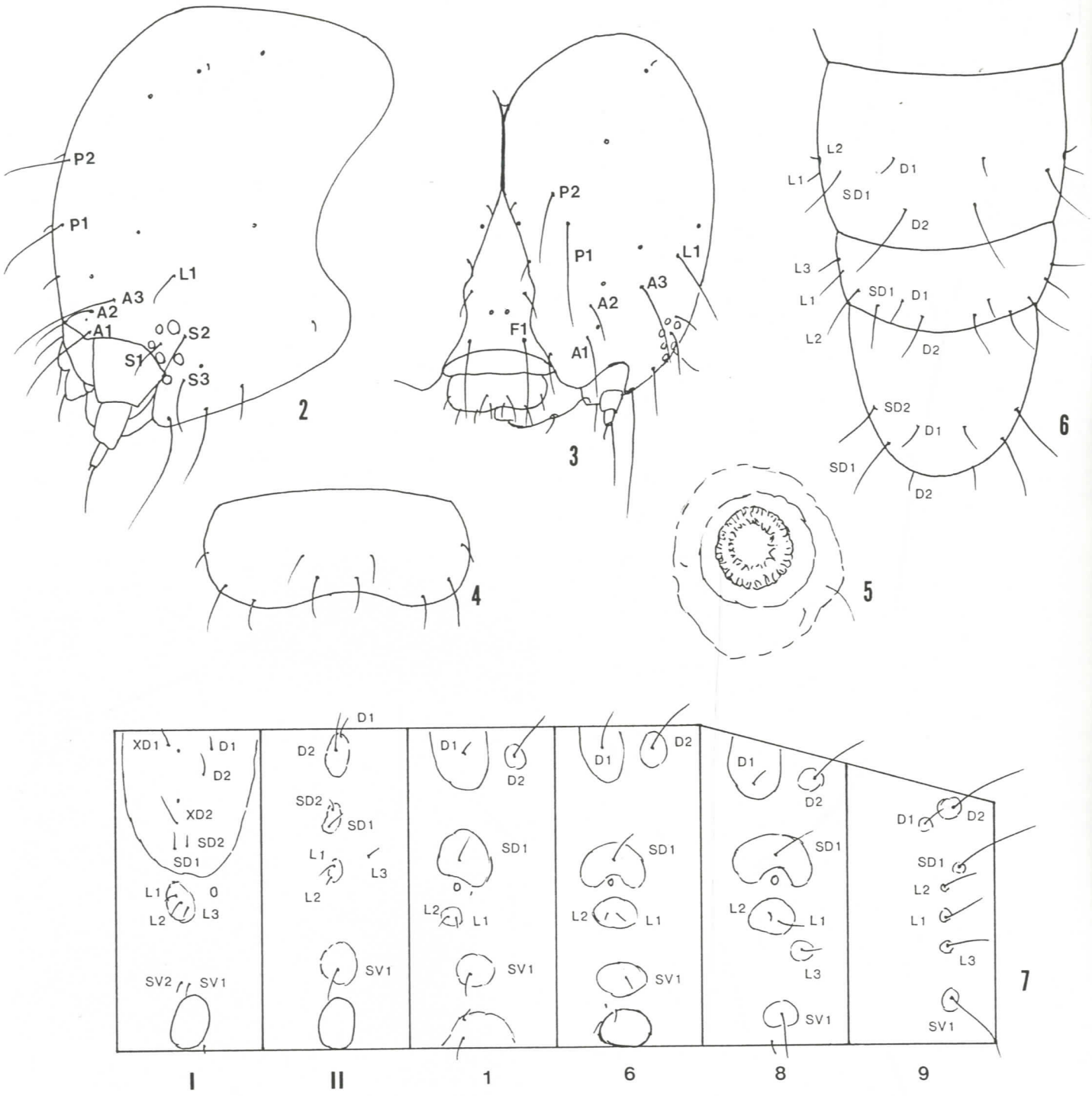

Fig. 2-7. Larval morphology of *Pterolonche inspersa* (Hungary): 2-3) Head capsule chaetotaxy (lateral and frontal views); 4) Detail of labrum (enlarged); 5) Detail of a proleg (A6, ventral view, mesal side left); 6) Detail of abdomen, segments A8-10 (dorsal view); 7) chaetotaxic map of thorax (T1-T2) and abdominal segments A1, 6, 8-9 (lateral schematic view).

DESCRIPTION OF IMMATURE STAGES

Egg

The black eggs are oval and slightly depressed middorsally, with a reticulated surface texture (summarized from Campobasso *et al.*, 1994).

Larva

Larvae are white, slender, with an amber head capsule; size range for last instars is ca. 22-25mm long; body integument is sculptured with minute white spicules; setae reduced and only primary; general appearance is typical for larvae that feed as borers.

Head (Fig. 2-4): hypognathous, with 6 stemmata in a circular pattern; seta A2 closer to A1 than A3; P1 and P2 relatively close together.

Prothorax (Fig. 7): dorsal plate with D1 and D2 closer together than distance to XD1; SD1 and SD2 approximate, with XD2 slightly further away than the distance between SD1 and SD2; L1-L3 approximate on

one pinaculum and nearly in a straight oblique line, with L3 closest to spiracle; SV1 and SV2 approximate; legs normal.

Metathorax (Fig. 7): D1 and D2, SD1 and SD2, and L1 and L2 each approximate pairs; L3 distant from L1 and L2; SV1 present on single pinaculum; legs normal.

Abdomen (Fig. 6-7): Segment A1 with setae D1 and D2 nearly equally distant from dorsal midline (D2 about 3x longer than D1); SD1 on large pinaculum dorsad of spiracle; L1 and L2 approximate; L3 not evident (although minute seta is present ventrad of spiracle); SV1 on single pinaculum. A2-7 similar to segment A1, except SD1 pinacula nearly surround dorsal half of spiracular area. Segment A8 like A6 but L3 present, separate from L1 and L2. Segment A9 with D1 half again as distant from dorsal midline as D2 (D2 about 4x longer than D1); SD1 dorsoventral of L2; L1-L3 nearly equally spaced and in vertical line; SV1 on single pinaculum. Prolegs (Fig. 5) short and stubby, with round, sucker-like fleshy soles; crochets not evident.

Pupa

Size ca. 12-14mm, golden-brown in color; elongate and dorsoventrally slender, or slightly flattened compared to lateral dimension (Fig. 9-10). Pupal abdomen with 2 pairs of dorsal setae each segment on A1-8; segment 10 with spined termen, with no distinct cremaster. Head without distinct fronto-clypeal suture; segments A4-6 movable; maxillary and labial palpi large; legs long (metathoracic legs slightly free near ends); antennae long.

COMMENTS ON THE IMMATURE STAGES

The characters detailed above indicate relationships more to Elachistidae and some Oecophoridae, than to Gelechiidae, supporting the present classification of Gelechioidea where the Pterolonchidae are placed near the Elachistidae. Larvae have unusual characters, with the absence of crochets and some unusual setal patterns (e.g., the nearly linear L-group setal arrangement of the prothorax; likewise for abdominal segment A9), providing distinctions that support the adult taxonomy as a separate family of Gelechioidea. The prothoracic L-group is particularly distinct, being in a nearly vertical line in Pterolonchidae, versus Oecophoridae with the L-group in a the horizontal line; and likewise horizontal for Elachistidae and most other Gelechioidea (Agonoxenidae, Cosmopterigidae, and some Gelechiidae have the L-group in a circular arrangement). The only larvae that show such a vertical or oblique prothoracic L-group are in Cossidae and in the bisetose L-group families of Copromorphoidea and Pyraloidea.

The flattened pupa of Pterolonchidae, with large maxillary palpi, is typical also for Oecophoridae, but not for most Gelechiidae.

BIOLOGY

A study area in northern Greece showed *P. inspersa* to be univoltine, with adults active during July (Campobasso *et al.*, 1994). Adult longevity is about 9-18 days. with males living fewer days than females on average. Oviposition occurs from late afternoon until midnight, with eggs laid at the base of the leaf rosette just above the ground surface, singly or in groups of 5-6 eggs. Females lay from 89-191 eggs each (Dunn *et al.*, 1989). After eggs are laid, larvae hatch in about 7-16 days and penetrate the root crown from the leaf rosette base. Larvae feed for about 11 months of the year, September to June. Larval feeding is in the root core and under the cortex. The number of larval instars remains uncertain. Larvae pupate within a silken gallery formed along the roots, near the upper end just at ground surface, with the silken tube extended above ground about 1 cm. The pupal stage lasts 5-19 days.

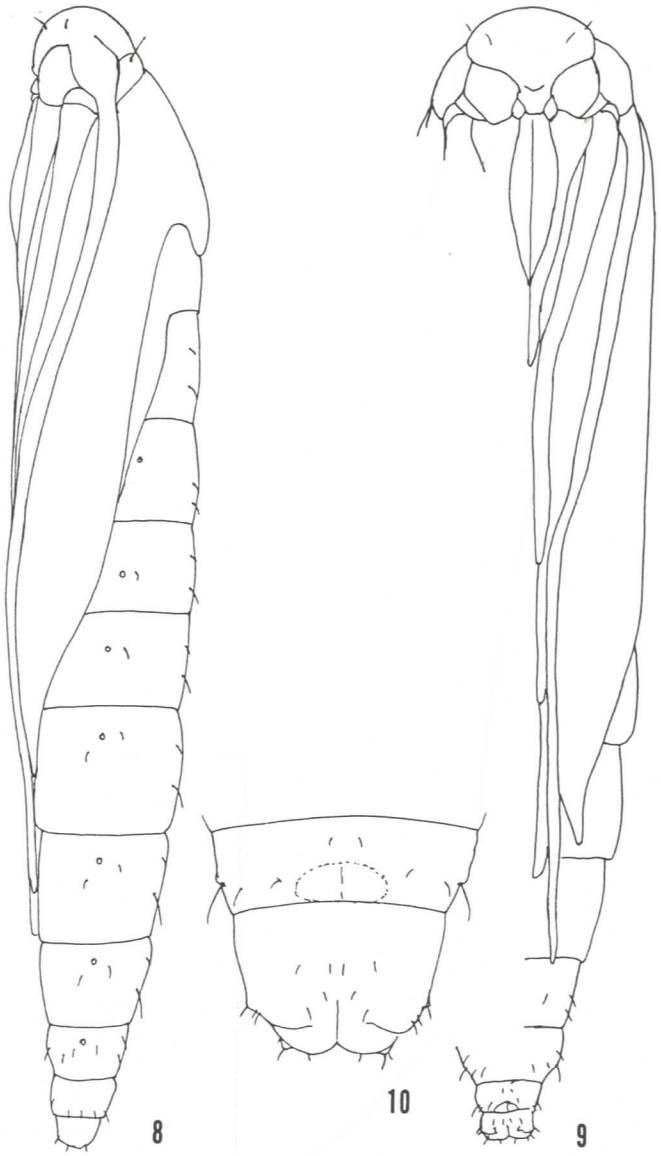

Fig. 8-10. Pupa of *Pterolonche inspersa* (Hungary): 8-9) sketch of pupal characters (lateral and ventral views); 10) Detail of cremaster area (ventral view).

The known distribution of *P. inspersa* includes Morocco, Spain, southern France, Italy, southern Austria, Hungary, Romania, Bulgaria, Greece, Turkey, and parts of the former CIS (Moldova, southern European Russia, and southern Ukraine). It should also be found in Albania and states of the former Yugoslavia (Bosnia, Croatia, Macedonia, Serbia, and Slovenia).

Hostplants of *P. inspersa* include only species of *Centaurea*: *C. cineraria, C. diffusa, C. friderici, C. maculosa,* and *C. vallesiaca*. Larvae are root borers of these knapweeds, making a silken webbing along the roots where feeding occurs.

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