BULLETIN DE L'INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE
BULLETIN VAN HET KONINKLIJK BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN
ENTOMOLOGIE, 71: 37-44, 2001
ENTOMOLOGIE, 71: 37-44, 2001

The larva of *Castrida granatense* (GÉHIN, 1885) (Coleoptera, Carabidae) from the Galápagos Islands (Ecuador)

by Enrico BUSATO, Konjev DESENDER & Pier Mauro GIACHINO

Abstract

The morphological features of the larva of *Castrida granatense* (GÉHIN, 1885) are described. Some distinctive characters of the larval chaetotaxy of this species are provided, according to the models proposed by BOUSQUET & GOULET (1984) and by MAKAROV (1993).

Key words: Carabidae, larval description, *Castrida granatense*, Galápagos Islands

Résumé

Nous décrivons les caractéristiques morphologiques larvaires de *Castrida granatense* (GÉHIN, 1885). Nous indiquons quelques caractères typiques de la chaetotaxie larvaire de cette espèce, suivant les modèles proposés par BOUSQUET & GOULET (1984) et MAKAROV (1993).

Mots-clefs: Carabidae, description larvaire, *Castrida granatense,* Iles Galápagos

Introduction

During a research mission in the Galápagos Archipelago, invited by the Charles Darwin Research Station, Prof. Massimo Olmi of the Department of Agricultural Entomology of the University of Tuscia, Italy, collected, together with several adult specimens of *Castrida granatense* (GÉHIN, 1885) (*Calosoma* subgenus *Castrida* of authors: see GIDASPOW, 1963), also a larva of this species, the description of which was the subject of a first draft of this short communication. Then, K. Desender, who has been studying the carabid fauna of the Galápagos Isles for several years, sent us some other remarkable material originating also from another island.

Material and Methods

The above-mentioned larva of *C. granatense*, collected by M. Olmi, probably a third instar considering its size, was found on 15.01.1989 at 800-900 m on Volcan Sierra Negra of Isabela Island (Galápagos Archipelago). The other specimens (18), collected by K. Desender, and belonging to all three instars, come from the Isle of Isabela (9) and from the Isle of Santa Cruz (9).

The determination was made "ex societate imaginis" and seems reasonably certain since *C. granatense* is, as far as known (BASILEWSKY, 1968; DESENDER & DE DIJN, 1989; DESENDER *et al.*, 1991), the only Carabine species on the Isle of Isabela. *C. leleuporum* BASILEWSKY, 1968 is also present on the Isle of Santa Cruz, but it occurs only at the summit of the island in the pampa-fern-sedge zone, whereas the larvae, studied here, were collected in the lower arid and transition zone, where only *C. granatense* can be found (DESENDER & DE DIJN, 1989; 1990).

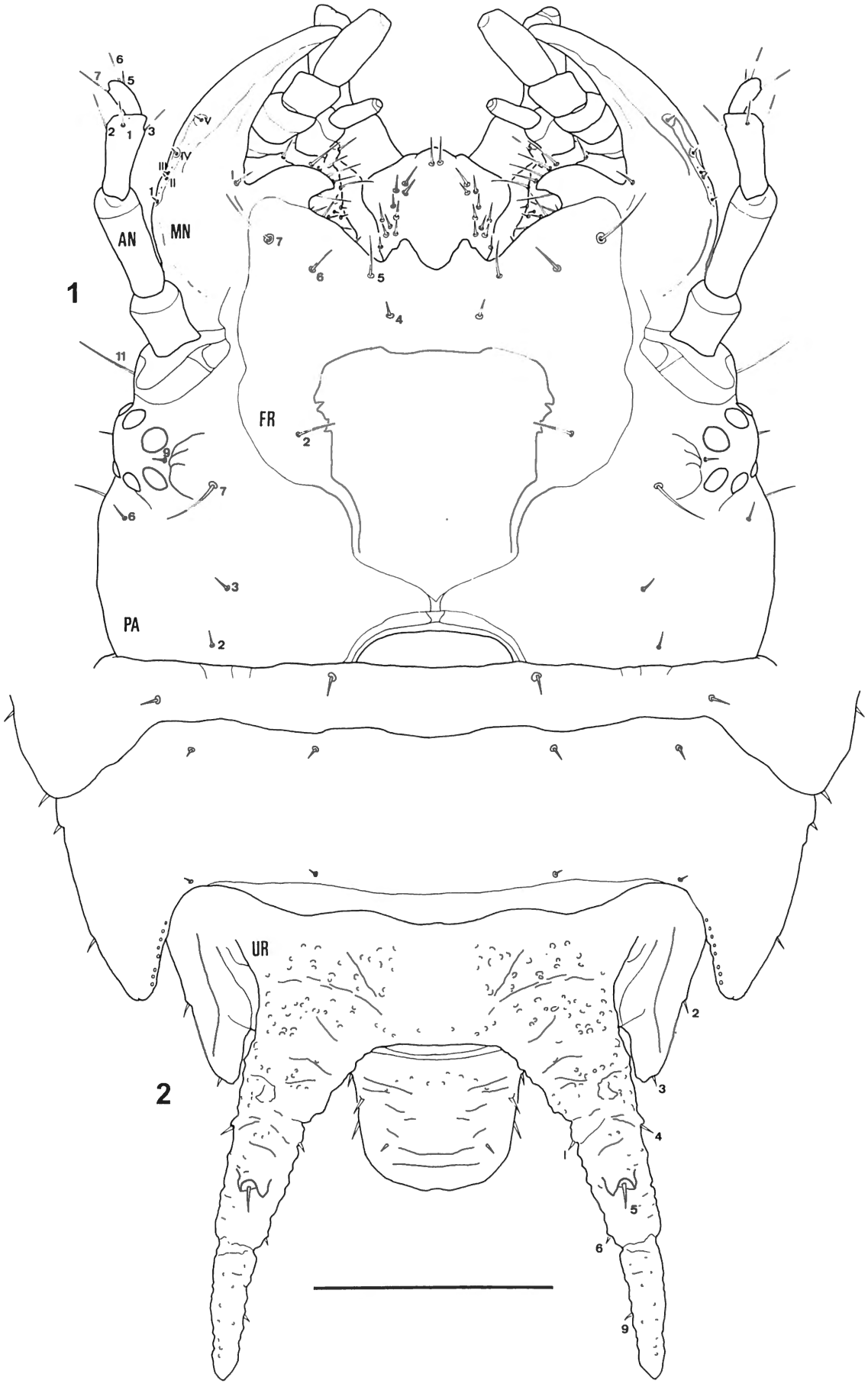
Some specimens were dry-prepared, according to the method described by GIACHINO (1985b), some others drawn and preserved in alcohol. The terminology adopted in this description is that by BÖVING (1911), JEANNEL (1920), CASALE *et al.* (1982), BOUSQUET & GOULET (1984), and GIACHINO (1985a, 1989).

Results

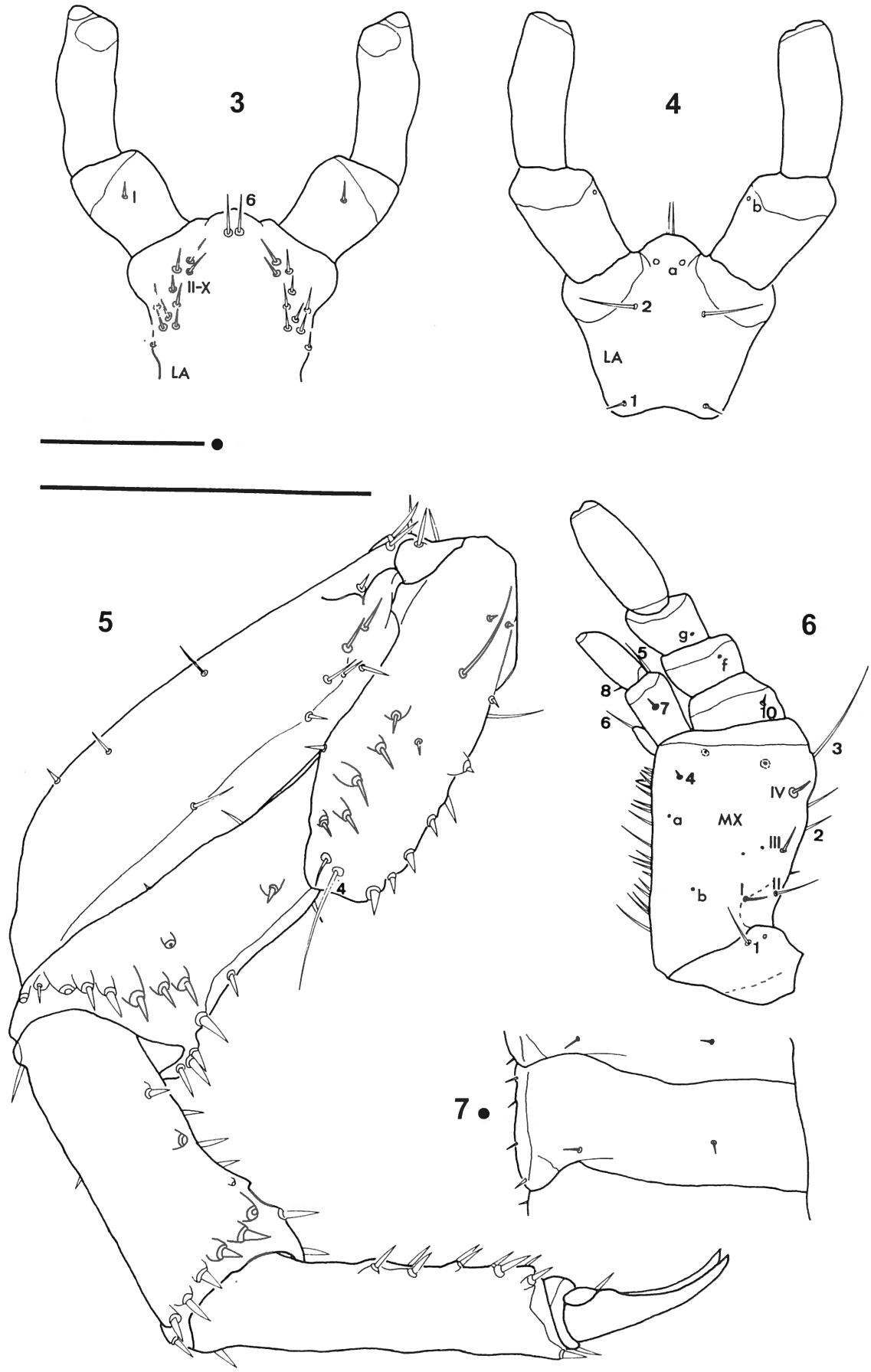
1. *Castrida granatense* (Géhin, 1885): larval morphology

Elongated bicuspidate larva, brownish-black. Max. length, from mandible apex to tip of urogomphi (excluding macrochetae): first instar mm 9.5 - 11.5; second instar mm 13.0 - 15.5; third instar mm 15.0 - 24.0. Head width [mean(min-max)]: first instar mm 1.60 (1.41-1.70); second instar 2.18 (2.04-2.39); third instar 2.93 (2.51-3.06).

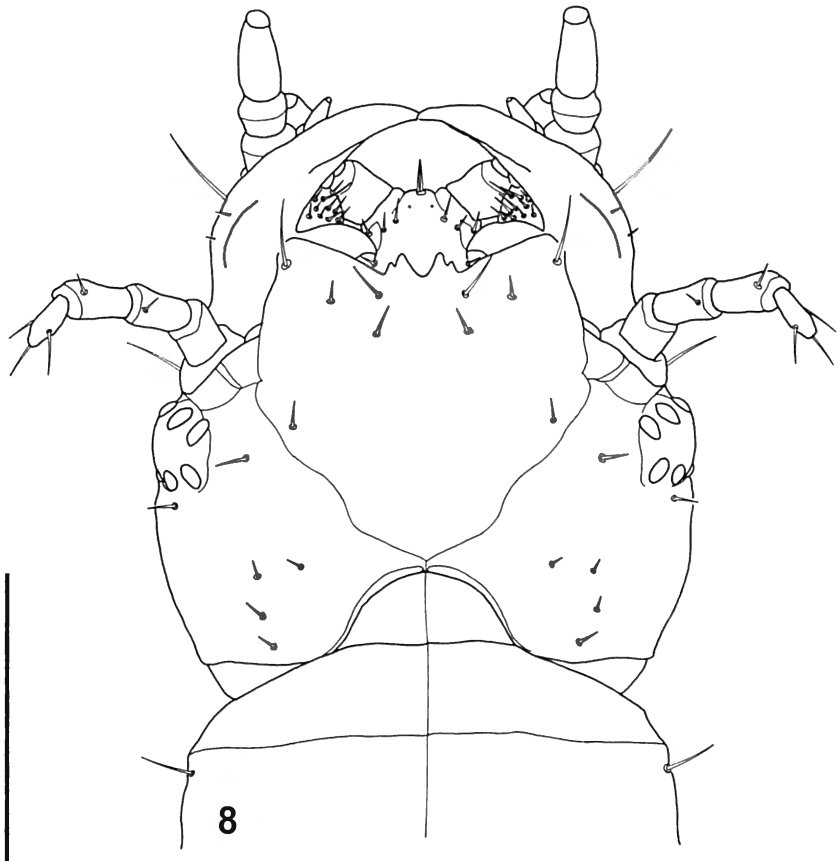
Head subquadrate, L/l ratio: first instar 0.69; second instar 0.63; third instar 0.60. Frontal sutures well visible, deeply sinuous in the rear part, very short metopical suture, long about 1/30 of the clipeo-cervical distance. Chaetotaxy of the cephalic region as in Fig. 1; FR_2 and FR_4 setae in normal position, while the FR_6 seta appears more internal (between FR_7 and FR_5) with respect to what is suggested by BOUSQUET & GOULET (1984) and MAKAROV (1993). Anterior margin of (nasal) epistome (Figs. 1, 8-12) distinctly trilobate; lateral lobes prominent with respect to central lobe, shape of a rectangular triangle with anterior angles blunted and anterior margin slightly bulging and sinuous. Central lobe bilobate, with two teeth having rounded tips and external margin remarkably

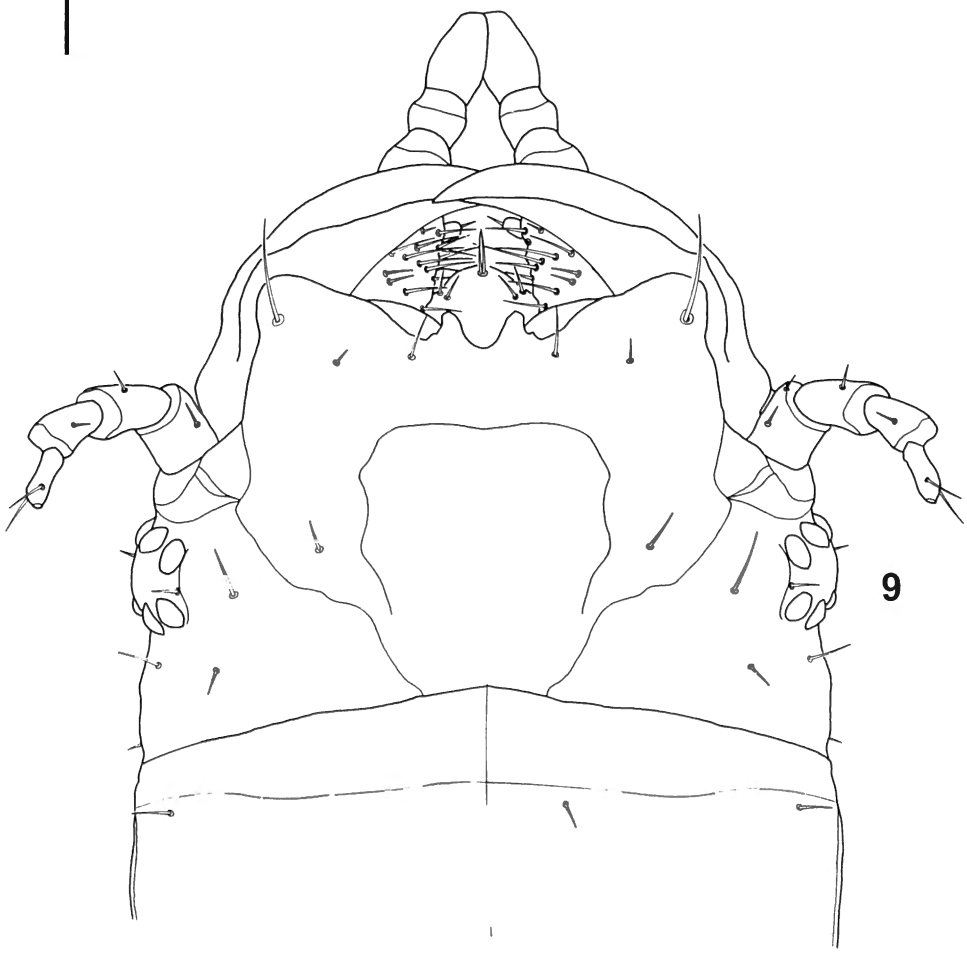


Figs. 1-2 — Third instar larva of *Castrida granatense* (GÉHIN) from Sierra Negra of Isabela Island: head dorsal view (1); dorsal view of urogomphi and anal tube (2). Scale mm 1.



Figs. 3-7 — Third instar larva of *Castrida granatense* (GÉHIN) from Sierra Negra of Isabela Island: dorsal view (3) and ventral view of labium (4); dorsal view of right metathoracic leg (5); dorsal view of right maxilla (6); left lateral view of IV urite (7). Scale mm 1.





Figs. 8-9 — Castrida granatense (GÉHIN) from Santa Cruz Island: head dorsal view of first instar larva (8); head dorsal view of second instar larva (9). Scale mm 1.

irregular centrally. Hypodon not visible dorsally. Eye area little prominent, provided with six stemmata and two setae (PA_7 and PA_9); setae PA_4, PA_5 and PA_8 absent.

Antennae shorter than mandibles: ratio a/M: first instar 0.82; second instar 0.81; third instar 0.84. First segment subcylindrical, second and third subcylindrical, slightly dilated apically; fourth segment cylindroconic with three diverging setae (AN_5, AN_6 and AN_7). Second segment long about twice the first one and slightly longer than the third one; third segment with three setae and seta AN_1 placed remarkably forwards, at the same level of setae AN_2 and AN_3.

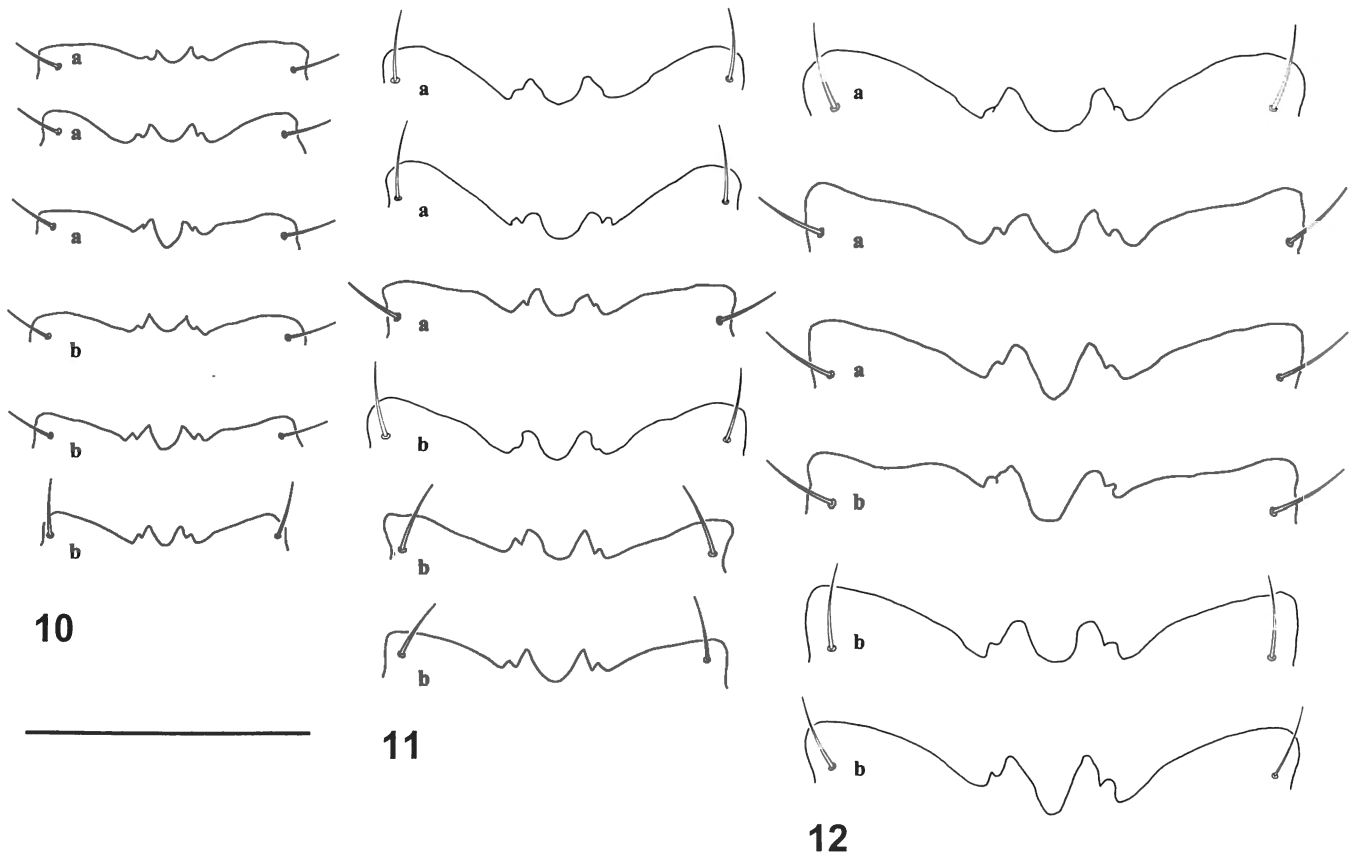
Mandibles falcate and arcuate, inner margin smooth and retinacle robust. Chaetotaxy as in Fig. 1, with four supernumerary setae on the external margin (MN_{II}, MN_{III}, MN_{IV} and MN_V) and one on the internal margin near to the attachment of the retinacle (MN_I); pores MN_b and MN_c absent, while two supernumerary pores are present along the external margin (MN_α and MN_β).

Maxillae (Fig. 6) longer than mandibles, ratio m/M: first instar 1.13; second instar 1.15; third instar 0.11. Stipes short and robust, markedly dilated apically and with four supernumerary setae on the external edge of the ventral side (MX_I, MX_{II}, MX_{III} and MX_{IV}). Galea with two articles of subequal length, the first subcylindrical and the second cylindroconical; chaetotaxy according to the model proposed by BOUSQUET & GOULET (1984). Maxillary palps with first article subcylindrical and slightly enlarged at the base; second and third almost as long as the first, subcylindrical and slightly dilated apically; fourth cylindroconic, long about twice the third. Labium (Figs. 3 - 4) supplied with two pairs of ventral setae (LA_1 and LA_2) and a series of 9 dorsal setae (LA_{II}-LA_X); ligula with a pair of setae (LA_6). Labial palps of two segments, subcylindrical and slightly curved, first article supplied with a dorsal seta at the distal third (LA_I) corresponding, probably, with the pore LA_b described by BOUSQUET & GOULET (1984); second segment about ¼ longer than the first and slightly bilobate apically.

Chaetotaxy of the thoracic region corresponding to the model proposed by MAKAROV (1993).

Urotergits (Fig. 7) with relatively small and rounded lobes. Telson (Fig. 2) with two conical, robust and decidedly rugose urogomphi, not articulated and well separated basally. Lateral spine just outlined, upper spine bifurcate with internal margin diverging and central macrochaeta; UR_5 about twice as long as UR_4.

Legs relatively long and robust, with trochanter, femur, tibia and tarsus provided with spines in longitudinal rows. Chaetotaxy reconductable to the model proposed by MAKAROV (1993), the right metathoracic leg of the third instar (Fig. 5) has the following ratios T/C = 0.68; F/C = 0.71; t/C = 0.58; ta/C = 0.63.



Figs. 10-12 — Larva of *Castrida granatense* (GÉHIN) from Sierra Negra of Isabela Island (a) and Santa Cruz Island (b). Anterior margin of (nasal) epistome: first instar (10); second instar (11); third instar (12). Scale mm 1.

2. *Variability*

The examination of a sufficiently large number of specimens of the different larval instars, originating from two different islands (Isabela and Santa Cruz) has not pointed out significant differences, neither between the larval instars (except for normal size differences), nor between the populations of the two islands. Besides small variations in the shape of the anterior margin of the epistome (Figs. 10-12), slight differences were observed in the position of the setae FR_4 and FR_6 or the sporadical presence of supranumerary setae on the frontal area.

Discussion

Species of *Castrida* MOTSCHULSKY, 1865 (*Calosoma* subg. *Castrida* of authors: see GIDASPOW, 1963) of the Galápagos have been the subject of several papers, dealing with their imaginal morphology and systematics (BAILEWSKY, 1968; DESENDER & DE DIJN, 1989, 1990) and with their distribution (DESENDER *et al.*, 1989, 1990, 1991). In spite of these contributions, larval morphology was until now unknown even at the (sub)genus level. Among the Calosomini, in fact, the larval morphology of *Calosoma sycophanta* (LINNAEUS, 1758), *Calosoma inquisitor* (LINNAEUS, 1758), *Campalita maderae* (FABRIUS, 1775), *Campalita denticolle* (GEBLER, 1833), *Charmosta investigator* (ILLIGER, 1798), and *Callisthenes reticulatus* (FABRICIUS, 1787), is known (SHAROVA, 1957; CASALE *et al.*, 1982; LUFF, 1969; 1993), but not that of species of the (sub)genus *Castrida*.

There are some morphological peculiarities to point out, particularly concerning the chaetotaxy of the larva of *C. granatense,* with respect to the Calosomini larvae known so far, such as the presence of the seta LA_I placed dorsally at the level of the first segment of the labial palps. This seta, existing in several larvae of *Carabus s.l.*, such as *C. violaceus* (LINNAEUS, 1758), *C. problematicus* HERBST, 1786, *C. granulatus* (LINNAEUS, 1758), *C. nemoralis* O.F.MÜLLER, 1764, *C. arvensis* HERBST, 1784, *C. latreilleanus* CSIKI, 1927, and in *Cychrus caraboides* (LINNAEUS, 1758) (LUFF, 1969; BUSATO & GIACHINO, 1993), is absent in *Calosoma inquisitor* (LINNAEUS, 1758) (LUFF, 1969) and, according to our observations, also in *Calosoma sycophanta* (LINNAEUS, 1758).

Similarly interesting seems the chaetotaxy of mandibles, which presents even four supernumerary setae on the external margin (MN_{II}-MN_V) and one on the internal margin (MN_I), besides the absence of the pores MN_b and Mn_c, and the presence of the supernumerary pores MN_α and MN_β.

In spite of the differences pointed out in the chaetotaxy, it is necessary to be careful not to overemphasize these features because of the relatively small sample size. A definition of discriminant larval characters of the (sub)genus *Castrida* in comparison with the other (sub)genera of Calosomini will be possible only after the study of the pre-imaginal morphology of other species belonging to this (sub)genus.

Acknowledgements

We thank Prof. Massimo Olmi of the Institute of Agricultural Entomology of the University of Tuscia (Viterbo, Italy) for having generously given us one of the larvae of *C. granatense,* subject of this paper. Dr. Léon Baert, Dr. Jean-Pierre Maelfait and Dr. Peter Verdyck are acknowledged for their continued help in Galápagos studies and field work (Dept. Entomol., RBINSc, Brussels). The Belgian DWTC (former Ministry of Education), the Leopold III foundation and the Fund for Scientific Research - Flanders gave financial support. Excellent cooperation and field logistic support was provided to the Belgian team (RBINSc) by the Charles Darwin Research Station (CDRS, Santa Cruz, Galápagos), G. Reck, C. Blanton and R. Bensted-Smith, Directors and their staff, and the Galápagos National Park Service, F. Cepeda, A. Izurieta and E. Cruz, Superintendents (Dept. of Forestry, Ministry of Agriculture, Ecuador). TAME airline kindly issued reduced travel tickets. We are also indebted to Dr. Peter John Mazzoglio of Di.Va.-P.R.A of the University of Turin (Italy) for the English version of the text and to Prof. Achille Casale of the Dipartimento di Zoologia e Antropologia of the University of Sassari (Italy) for critical revision of the manuscript.

References

BASILEWSKY, P., 1968. Les Calosomes des îles Galápagos (Caleoptera: Carabidae). *Mission zoologique belge aux îles Galápagos et en Equateur*, 1: 179-207.

BOUSQUET, Y. & GOULET, H., 1984. Notation of primary setae and pores on larvae of Carabidae (Coleoptera: Adephaga). *Canadian Journal of Zoology*, 62: 573-588.

BÖVING, A., 1911. Nye Bidrag til Carabernes Udviklingshistorie. II. *Entomologiske Meddelelser*, 2: 129-180.

BUSATO, E., & GIACHINO, P.M., 1993. Contributo alla conoscenza della morfologia larvale del genere *Carabus*. La larva di *Carabus* (*Orinocarabus*) *latreilleanus* Csiki, 1927 (Coleoptera, Carabidae). *Riv. Piem. St. Nat.,* 14, 1993: 185-193.

CASALE, A., STURANI, M., & VIGNA TAGLIANT, A., 1982. Coleoptera, Carabidae. I. Introduzione, Paussinae, Carabinae. Fauna d'Italia, 18, Calderini, Bologna, 499 pp.

DESENDER, K., & DE DIJN, B., 1989. The *Calosoma* species of the Galápagos archipelago. I. Redescriptions and distribution of the species. *Bulletin de l'Institut Royale des Sciences naturelles de Belgique, Entomologie*, 59: 131-144.

DESENDER, K., & DE DIJN, B., 1990. The *Calosoma* species (Coleoptera, Carabidae) of the Galápagos archipelago. II. Discriminant analyses and species indentification key. *Bulletin de l'Institut Royale des Sciences naturelles de Belgique, Entomologie,* 60: 55-68.

DESENDER, K., BAERT, L. & MAELFAIT, J.-P., 1989. Contribution to the knowledge of the Carabid beetles of Galápagos (Ecuator). *Bulletin de l'Institut Royale des Sciences naturelles de Belgique, Entomologie,* 58: 55-65.

DESENDER, K., BAERT, L. & MAELFAIT, J.-P., 1990. Carabid beetles of Galápagos (Ecuator) collected during the Belgian

1988-expedition. *Bulletin de l'Institut Royale des Sciences naturelles de Belgique, Entomologie,* 60: 49-54.

DESENDER, K., BAERT, L. & MAELFAIT, J.-P., 1991. Evolutionary systematics of *Calosoma* Weber carabid beetles of the Galápagos Archipelago, Ecuador (Coleoptera: Carabidae). 193-200. In: ZUNINO M., BELLES X. & BLAS M. [eds]. Advances in Coleopterology. Asociation Europea de Coleopterologia, Barcelona. 1-323.

GIACHINO, P.M., 1985a. Morfologia larvale di alcuni *Trechus* alticoli delle Alpi Lepontine. (Coleoptera, Carabidae). *Boll. Soc. ent. Ital., Genova*, 117(8-10): 161-171.

GIACHINO, P.M., 1985b. Contributo alla conoscenza della morfologia larvale del genere *Nebria*. Le larve di *Nebria orsinii* Villa, *N. apuana* Busi e Rivalta, *N. lareyniei* Fairmaire e *N. posthuma* K. e J. Daniel. (Coleoptera, Carabidae). *Boll. Ass. Romana Entomol.,* 39(1984): 63-76.

GIACHINO, P.M., 1989. Contributo alla conoscenza della morfologia larvale del genere *Trechus*. La larva di *Trechus schatzmayri* Focarile, 1949 (Coleoptera, Carabidae). *Riv. Piem. St. nat.,* 10: 131-135.

GIDASPOW, T., 1963. The genus *Calosoma* in Central America, the Antilles, and South America (Coleoptera Carabidae). *Bulletin of the American Museum of Natural History*, 124(7): 279 - 313.

JEANNEL, R., 1920. Les larves des Trechini. *Archives de Zoologie Expérimentale et Générale,* 59: 509-542.

LUFF, M.L., 1969. The larvae of the British Carabidae (Coleoptera). 1. Carabini and Cychrini. *Entomologist*, 102: 245-263.

LUFF, M.L., 1993. The Carabidae (Coleoptera) larvae of Fennoscandia and Denmark. *Fauna Entomologica Scandinava*, 27: 1-187.

MAKAROV, K.V., 1993. Larvae of Ground Beetles of the genus *Carabus* L. (Coleoptera, Carabidae) of the Fauna of Russia and Neighboring Countries. *Entomol. Rev.,* 72(4): 92-117.

SHAROVA, I.K., 1957. Licinki Zukov-Krasotelov (*Calosoma*, Carabidae). *Zoologichesky Zhurnal*, 36: 873-884.

Enrico BUSATO
Di.Va.P.R.A.
Entomologia e Zoologia applicate all'Ambiente
"Carlo Vidano"
Via Leonardo da Vinci, 44
I-10095 Grugliasco (Turin).

Konjev DESENDER
Department Entomology
Royal Belgian Institute of Natural Sciences
Vautierstr. 29 B-1000 Brussel
(e-mail: Konjev.Desender@naturalsciences.be)

Pier mauro GIACHINO
Museo Regionale di Scienze Naturali,
Via Giolitti, 36 - I-10123 Turin.
(e-mail: PierMauro.Giachino@regione.piemonte.it)