

SYSTEMATICS AND BIONOMICS OF *PHYSOMELOE* REITTER, 1911, WITH DESCRIPTION OF THE FIRST INSTAR LARVA (COLEOPTERA, MELOIDAE)

M. A. Bologna y G. Aloisi *

ABSTRACT

Meloe (*Physomeloe*) *corallifer* Germar, 1818, an Iberian species of blister beetle, is referred to the Lyttini tribe on the basis of triungulin morphology, and the monotypic subgenus is elevated to generic status. *Physomeloe* Reitter, 1911 differs from the two other wingless and brachyelytrous Mediterranean genera of Lyttini, *Berberomeloe* Bologna, 1988 and *Trichomeloe* Reitter, 1911, in the shape of the adult pronotum, antennae, male genitalia and pubescence. Among the Lyttini, only these three wingless genera have first instar larvae with well sclerotized abdominal sternites, but in addition the dorsal setae and abdominal spiracle I in *Physomeloe* are highly modified. Adult and larval morphology are described and illustrated, and the geographical distribution and bionomics of *P. corallifer* are summarized. A preliminary key to the triungulin of lyttine genera and subgenera is proposed.

Key words: *Coleoptera*, *Meloidae*, *Physomeloe*, *systematics*, *new status*, *larval morphology*, *bionomics*.

RESUMEN

Sistemática y biología de *Physomeloe* Reitter, 1911, con descripción de la larva de primera fase (*Coleoptera*, *Meloidae*).

Se atribuye *Meloe* (*Physomeloe*) *corallifer* Germar, 1818, una especie ibérica de carrajea, a la tribu Lyttini basándose en la morfología del triungulino y se eleva el subgénero monotípico a la categoría de género. *Physomeloe* Reitter, 1911 difiere de los otros dos géneros ápteros y braquélitros mediterráneos, *Berberomeloe* Bologna, 1988 y *Trichomeloe* Reitter, 1911, por la forma del pronoto, las antenas, la genitalia masculina y la pubescencia del adulto. Entre los Lyttini, sólo estos tres géneros ápteros tienen larvas de primera fase con esternitos abdominales bien esclerotizados, pero, además, en *Physomeloe* las sedas dorsales y el espiráculo abdominal I están fuertemente modificados. Se describe e ilustra tanto la morfología del adulto como la larvaria y se comenta la distribución geográfica y la biología de *P. corallifer*. Se propone una clave preliminar para los triungulinos de los géneros y subgéneros de Lyttini.

Palabras clave: *Coleoptera*, *Meloidae*, *Physomeloe*, *sistemática*, *nueva categoría*, *morfología larvaria*, *biología*.

INTRODUCTION

In his arrangement of the genus *Meloe* Linnaeus, 1758, REITTER (1911) described many subgenera on the basis of some differences in adult morphology, particularly in the shape of the pronotum and antennae. Whilst some specialists accepted the traditional inclusion of all the Old World wingless and brachyelytrous species under the genus *Meloe* in the Me-

loini tribe (KASZAB, 1969), it was rejected by others on the basis of the morphology of the first larval instar of certain taxa. CROS (1934, 1940) referred *Meloe majalis* Linnaeus, 1767 and *Meloe chrysocomus* Miller, 1861 to the Lyttini tribe but did not assign them to any particular genus. MACSWAIN (1956) and PINTO & SELANDER (1970) included both these species, together with a few others, in the distinct genus *Trichomeloe* Reitter, 1911, of the Lyttini. More re-

* Dipartimento di Scienze Ambientali, Università degli Studi della Tuscia, 01100 Viterbo, Italia.

cently, BOLOGNA (1988b, 1991, in prep.) referred *M. majalis* to the new West Mediterranean genus *Berberomeloe* Bologna, 1988, and a few other Anatolian and Palestinian species to *Trichomeloe*, both included in the Lyttini tribe.

The Meloini tribe, and particularly the genus *Meloe*, is currently under extensive revision, based on the larval morphology of several genera and subgenera (SELANDER, 1985, 1987, 1988, 1989; BOLOGNA, 1988a, 1988b, 1991; BOLOGNA, ALOISI & MARANGONI, 1989; BOLOGNA, ALOISI & VIGNA TAGLIANTI, 1990; BOLOGNA & PINTO, 1992, in prep.; PINTO & BOLOGNA, 1993). The monophyly of the Meloini tribe is doubted by BOLOGNA & PINTO (1992).

Recently, we managed to obtain the first instar larva of *M. corallifer* Germar, 1818, a species endemic to the Iberian peninsula and until now referred to the monotypic subgenus *Physomeloe* Reitter, 1911. This triungulin clearly has lyttine rather than meloine characters and consequently we consider *Physomeloe* to be a distinct genus of the Lyttini tribe, with well differentiated larval and adult autapomorphies.

MATERIAL EXAMINED AND METHODS

Egg. Two eggs masses, of approximately 100 and 70 eggs each. The first was oviposited in the field in Spain, Avila province, 5 km North of Venta del Obispo, 1300 m a.s.l., 9-V-1989, M. Bologna & G. Aloisi leg., in an open reforestation of *Pinus nigra* Arnold subsp. *salzmannii* (Dunal) Franco. The second was laid in captivity on 10-V-1989, by another female collected on the same day from the same locality.

First instar larva. A single specimen, slightly damaged by fungi, hatched from the larger egg mass on 7-VII-1989.

Adult. 126 specimens were examined from the following European collections, which are given with the abbreviations used in the faunistical catalogue: M. A. Bologna, c/o Università della Tuscia, Viterbo (CB); Departamento de Biología Animal, Universidad de León (UL); Istituto di Entomologia Agraria, Università di Bologna (EB); Museo di Zoologia, Università di Bologna (MB); Museo civico di Storia Naturale G. Doria, Genova (MG); Museo civico di Storia Naturale, Venezia (MVE); Museo civico di Storia Naturale, Verona (MV); Museo civico di Zoologia, Roma (MZR); Museo Nacional de Ciencias Naturales, Madrid (MM); Museo regionale di Scienze Naturali, Torino (MRT); Museo di Zoologia, Università di Torino (MT); Museo Tridentino di Storia Naturale, Trento (MTR); Museo di Zoologia, Università di Roma (MR); Muséum d'Histoire Naturelle, Genève (MGE); Muséum national d'Histoire Na-

turelle, Paris (MP); Osservatorio per le malattie delle piante, Bologna (OB).

Morphological analysis and illustrations were performed on dried adults under a Wild M5 stereomicroscope. The single triungulin was studied under a Zeiss Axioplan (equipped with a photcamera) and Leitz Ortholux microscopes. Some bionomic observations were carried out in the field in five localities in West Spain, May 1989. The eggs were preserved in alcohol (70°), and the triungulin mounted on a slide with Canadian Balsam. They are deposited in the collection of M. A. Bologna, University of Viterbo.

Physomeloe Reitter, 1911 stat. nov.

Meloe (Physomeloe) REITTER, 1911: 388; PORTA, 1934: 35; PINTO & SELANDER, 1970: 7; BOLOGNA, 1991: 286.

Physomeloe, BOLOGNA, 1991: addenda 529.

Diagnosis

Monotypic genus of Meloidae Meloinae, tribe Lyttini (sensu BOLOGNA, 1991). Adult: wingless, elytra abbreviated and imbricate at base; pronotum subrectangular with two large, shiny red tubercles on each side; antennae short, evenly moniliform, the last segment subconical at apex; body setation short and black. First instar larva: lyttine type; abdominal sternites well sclerotized; head narrowing at base; dorsal setae on head, base of thorax and abdominal tergites greatly modified (figs. 4, 7), longer and more robust, enlarged at tip, abruptly truncate and with 4 spini-form protuberances; abdominal spiracle I (figs. 1, 6) placed dorsally, much enlarged and slightly protruding, spiracles II-VII placed ventrally.

Type species. *Physomeloe corallifer* (Germar, 1818).

Distribution. Portugal, West and Central Spain.

Physomeloe corallifer (Germar, 1818) comb. nov.

Meloe corallifera GERMAR, 1818: 259; GERMAR, 1824: 7.

Meloe corallifer; BRANDT & ERICHSON, 1832: 138; BRANDT & RATZBURG, 1833, 2: 110, pl. 16, fig. 9; GÓRRIZ Y MUÑOZ, 1882: 38; MULSANT, 1857: 62; PARDO ALCAIDE, 1950: 40, fig. 1.

Meloe (Meloe) corallifer; REITTER, 1895: 5.

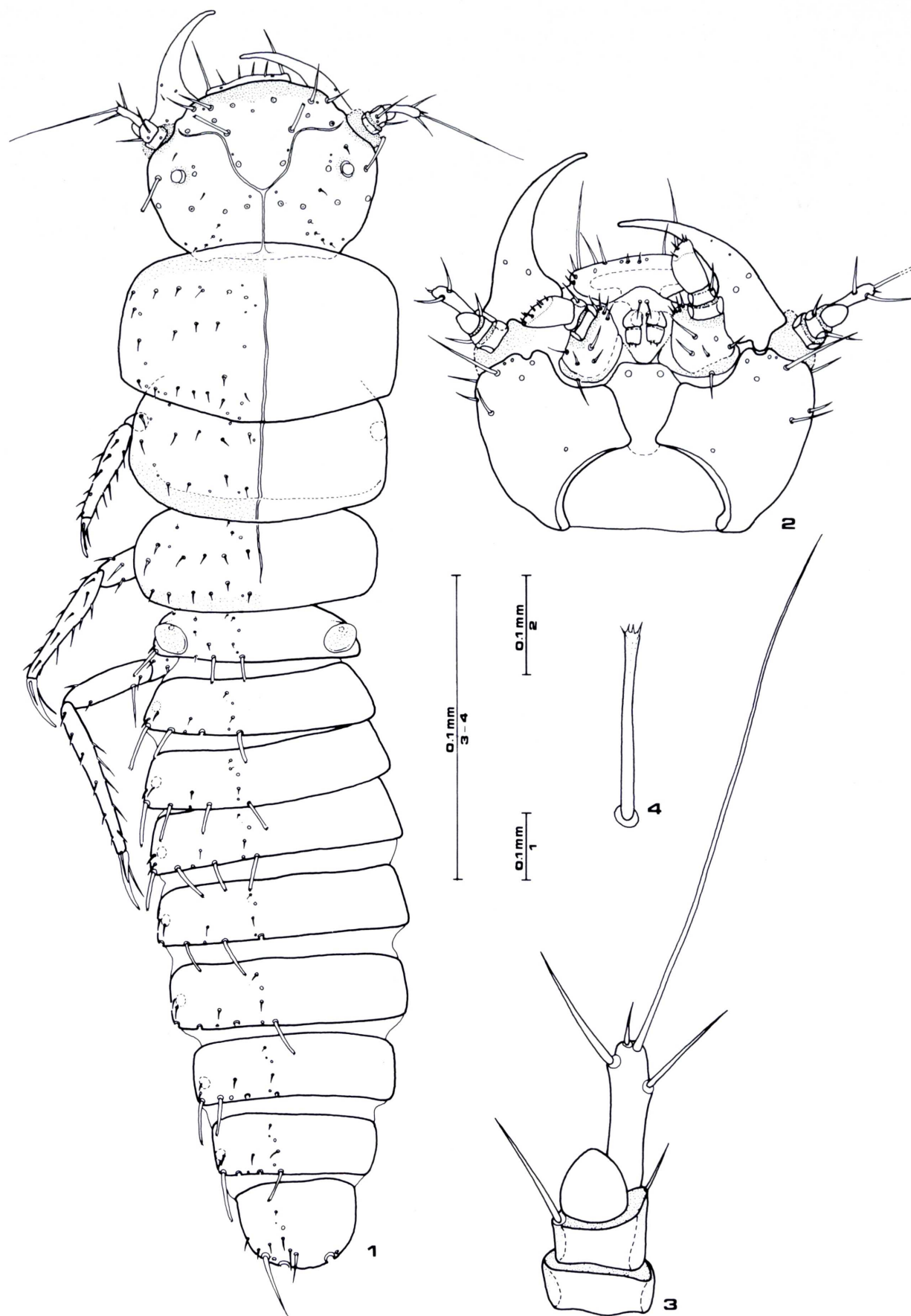
Meloe corallifer var. *evae* FLACH, 1907: 19.

Meloe (Physomeloe) corallifer; REITTER, 1911: 388; PORTA, 1934: 35; PINTO & SELANDER, 1970: 7; VALLADARES & SALGADO, 1983: 93; VALLADARES, 1984: 68, fig. 38; BOLOGNA, 1991: 286.

Physomeloe corallifer; BOLOGNA, 1991: addenda 529.

Meloe corallina Motschulsky i.l., in PLIGINSKIY, 1914: 257.

Type locality: «Lusitania».



Figs. 1-4.—First instar larva of *Physomeloe corallifer* (Germar). 1) Habitus, dorsal view. 2) Head, dorsal view. 3) Antenna, ventral view. 4) Modified dorsal seta of abdominal tergites.

DESCRIPTION

Egg. Pale yellow, elongated, suboval, considerably rounded at both ends, a little wider at one apex; surface smooth, length 1.1 mm, maximum width 0.34 mm.

First instar larva. Colour dark brown, thoracic and abdominal segments I-II slightly paler. Cuticle reticulate; reticulae of various shapes, usually transverse, subhexagonal on anterior portion of head. Dehiscence line on pro- and mesonotum. Body (fig. 1) length: 1.8 mm; head length: 0.28 mm, maximum width: 0.35 mm; antennal length: 0.1 mm, terminal seta length: 0.17 mm; prothorax length: 0.55 mm, maximum width: 0.42 mm. Setation composed of normal setae, slender and tapering to tip, and some modified setae (figs. 4, 7) larger, cylindrical, abruptly truncate and with a crown of 4 spiniform protuberances at apex.

Head (fig. 1) broader than long, widest at point between the eyes and base of antennae; sides narrowing considerably forwards but more gradually behind the antennae; anterior margin of head truncate, slightly rounded, slightly sclerotized. Epicranial suture Y shaped, lateral arms diverging widely at base, frontal sutures markedly curved laterally an extending perpendicularly to the external margin of head, anterior to the base of the antennae. Eye small, placed dorsally, slightly convex. Epicranial setation as in figure 1; some normal or modified setae lacking because of fungal damage; 4 modified setae, 2 of which anterior to the frontal suture, and 2 larger ones between the eyes and external margin of the head. Labrum distinct from clypeus, transverse, rectangular, visible dorsally, with 6 setae on anterior margin. Antennae (fig. 3) short, inserted latero-ventrally on the head, consisting of three cylindrical segments; I broader and approximately 0.75 times length of segment II; II about 0.33 times length of III, but over twice the width of III, asymmetrical, longer along dorsal margin, apex oblique; III elongate and narrow, slightly enlarged at tip, apical seta about twice total length of antenna, three additional setae of different lengths on apex; sensory organ on segment II (figs. 3, 5) broad, conical, hyaline, positioned at apex, ventral to insertion of segment III. Gula well differentiated, anterior margin subrectilinear, two larger setigerous pits on anterior margin. Mandible conico-falcate (fig. 2), base broad and progressively narrowing forwards, inner margin smooth. Maxilla with simple mala, stipes with one longer middle and three lesser setae; maxillary palpi segments (fig. 2) large, simple and cylindrical: I and II short, subequal in length, I broader than II; II with one long lateral seta; III narrower and approximately three times as long as II, apex of III truncate obliquely with a pro-

minent 2-segmented sensory appendix and several shorter setae. Labial palpi segments short and cylindrical, subequal in length, II with several short setae on apex.

Thorax segments (fig. 1) broader than head, transverse, decreasing in size, sternites well sclerotized. Pronotum subrectangular, clearly broader than head, membranous apically, with front angles rounded. Dorsal chaetotaxy as in figure 1, with short setae distributed on three parallel rows: 8 setae on front margin, two more on sides plus 8 additional pits; second row with 8 unaligned setae and 2 pits; basally 16 setae on two parallel rows with 10 pits. Mesonotum (fig. 1) narrower than pronotum and approximately $\frac{2}{3}$ its length, with anterior and posterior angles rounded; posterior and anterior margins membranous. Principal dorsal chaetotaxy (fig. 1) on three parallel rows of setae: 6 very short setae on anterior margin, 12 on second and third rows with some additional pits. Metanotum (fig. 1) narrower than other thoracic segments, subequal in length, setae similar in number and position to those on mesonotum.

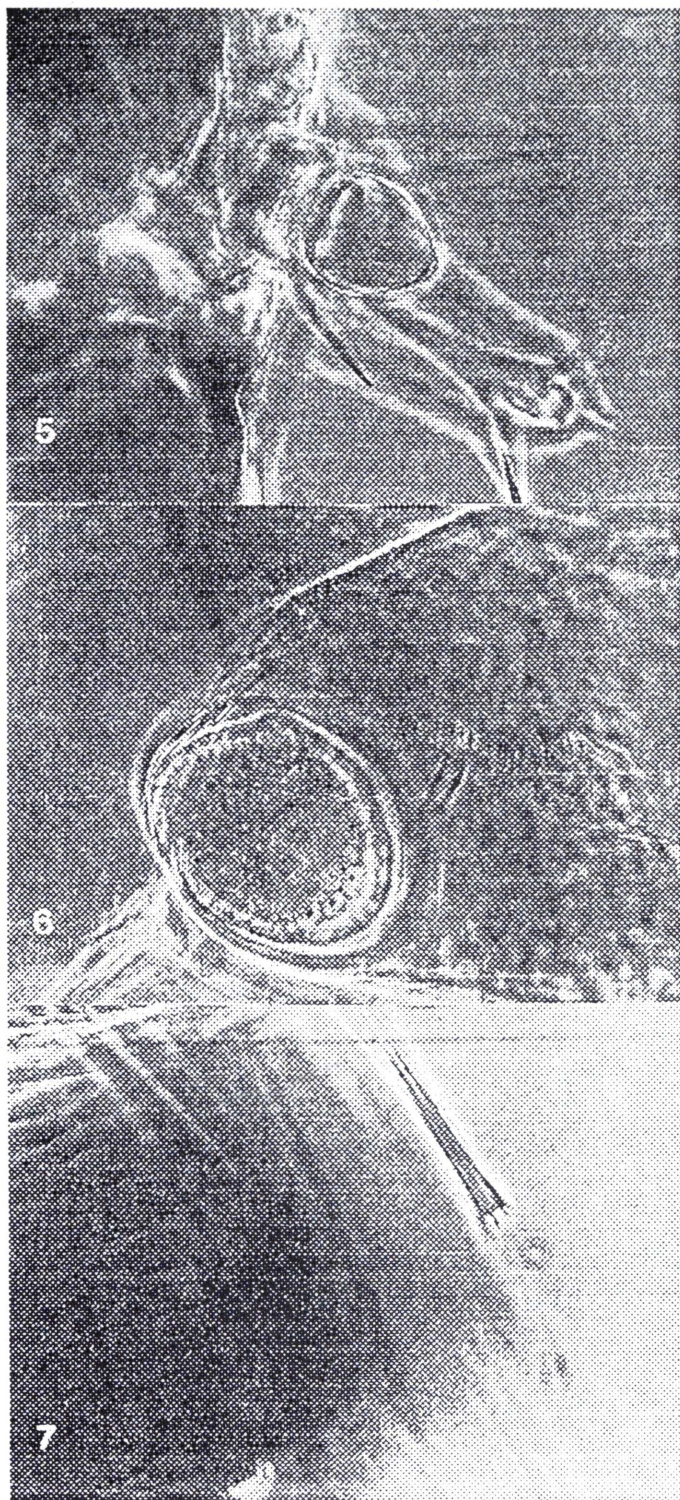
Legs tapered, femur not enlarged in the middle, shorter than tibia, fore femur larger than middle and posterior ones; tarsungulus conico-falcate, slightly curved only at apex, with two sub-basal unguiform setae of different lengths. Principal chaetotaxy as in figure 1.

Abdomen fusiform (fig. 1), approximately one and a half times the length of the thorax; tergites rather uniform in length, becoming progressively larger from I to III, then smaller again to the last. Urites I and II less sclerotized than the others. Principal dorsal chaetotaxy as in figure 1. Tergite I with 24 setae, 8 of which modified on basal row (the most external seta in the middle row is differently positioned on the hemi-tergites than in the other two rows); tergites II-VIII with 16 setae, 8 of which are modified on basal row. Abdominal pleurites well sclerotized, distinctly separated from tergites. Sternites subrectangular, heavily sclerotized, all undivided, with 2 rows of 4 anterior setae, and 8 larger setae behind (only 6 on the first sternite and 10 on the last). Two long caudal setae lost during preparation due to fungal damage.

Mesothoracic spiracle suboval, large, placed laterally on the pleurite, about 0.5 times as wide as abdominal I, but approximately twice as wide as abdominal spiracle II. Abdominal spiracle I (figs. 1, 6) much enlarged, positioned dorsally on tergite, protruding slightly from dorsal surface, four times as wide as spiracle II; II-VIII rounded, smaller and all similar in size, placed ventrally on pleurites.

Subsequent larval instars and pupa unknown.

Adult. Body black subopaque, head and prothorax rather shiny, with two prominent, coccineous red tu-



Figs. 5-7.—First instar larva of *Physomeloe corallifer* (Germar). 5) Sensory appendix of antenna, ventral view. 6) Abdominal spiracle I. 7) Modified seta of abdominal tergite II.

bercles on both sides of prothorax (fig. 8). Body length variable: 11-32 mm; maximum elytra width: 6-10 mm.

Head subtrapezoidal, frons convex, vertex strongly canaliculate with a longitudinal furrow running from

the frontal suture to the occiput; a little depression near the inner margin of the eye. Punctures deep and rugose on frons, more scattered and shallower elsewhere, intermediate integuments microshagreened; setation short and very scattered. Frontal suture extremely angulated, clypeus finely punctate, depressed anteriorly, labrum subrectilinear on anterior margin, scarcely punctate, shagreened. Eye slightly convex. Mandibles dentate at apex; maxillary palpi with segment III shorter than IV, the last subsecuriform. Antennae (fig. 9) filiform, reaching base of pronotum, segments I-V shiny and hairy, particularly I-II, segments VI-XI progressively more opaque with short, and appressed microsetae; segment III-X longer than wide; I twice as long as wide, II very short, subrounded, III twice as long as wide, subcylindrical, IV-V of similar length and shorter than III, VI-VIII shorter and moniliform, only slightly enlarged at tip, IX-X slightly longer than VIII, XI one and a half times as long as X, narrowing in the anterior third.

Prothorax (fig. 10) transverse, one time and half as wide as long, almost flat and only slightly convex, longitudinally canaliculate, anteriorly truncate, depressed in front of the base and between the tubercles laterally; base very emarginate and slightly bordered, forming two very prominent tubercles on both angles laterally; surface rugose and punctuated. Elytra abbreviated and imbricate at base, strongly dehiscent, almost completely covering first tergite and partially the second and third; surface with fine longitudinal wrinkles. Legs weak, lightly haired; inner spur of metatibiae slender, dilated apically, spathulate, concave dorsally; fore tarsi segments I and II in male slightly enlarged at apex, with thick pad of black bristles below, absent in female.

Abdomen extremely voluminous. All terga sclerotized mostly on a medial transverse area with slight sheen and lightly haired; in the caudal terga the sclerotization is almost complete. Apical margin of sternite VII arcuate in male, almost angulate in middle, subrectilinear in female; last visible sternite in male broadly emarginate, depressed in middle of apical margin and protruding laterally, subrounded with a little medial incision in female. Tegmen in lateral view (fig. 11) with parameres narrowing apically, depressed and finely setated on both sides, tegmen in dorsal view as in figure 12, ventral view as in figure 13; penis hooks (fig. 14) well spaced, proximal hook curved, uncus of endophallus falciform at tip; spiculum gastrale (fig. 15) not Y shaped, heavily sclerotized and furrowed ventrally along the middle. Female valvifer and stylus as in figure 16.

Variability. Sexual dimorphism and body length as described above. In a few specimens, the red tubercles on the pronotum can be brownish black, as des-



Fig. 8.—Adult of *Physomeloe corallifer* (Germar) feeding on the leaves of a young unidentified species of thistle (Spain, Salamanca).

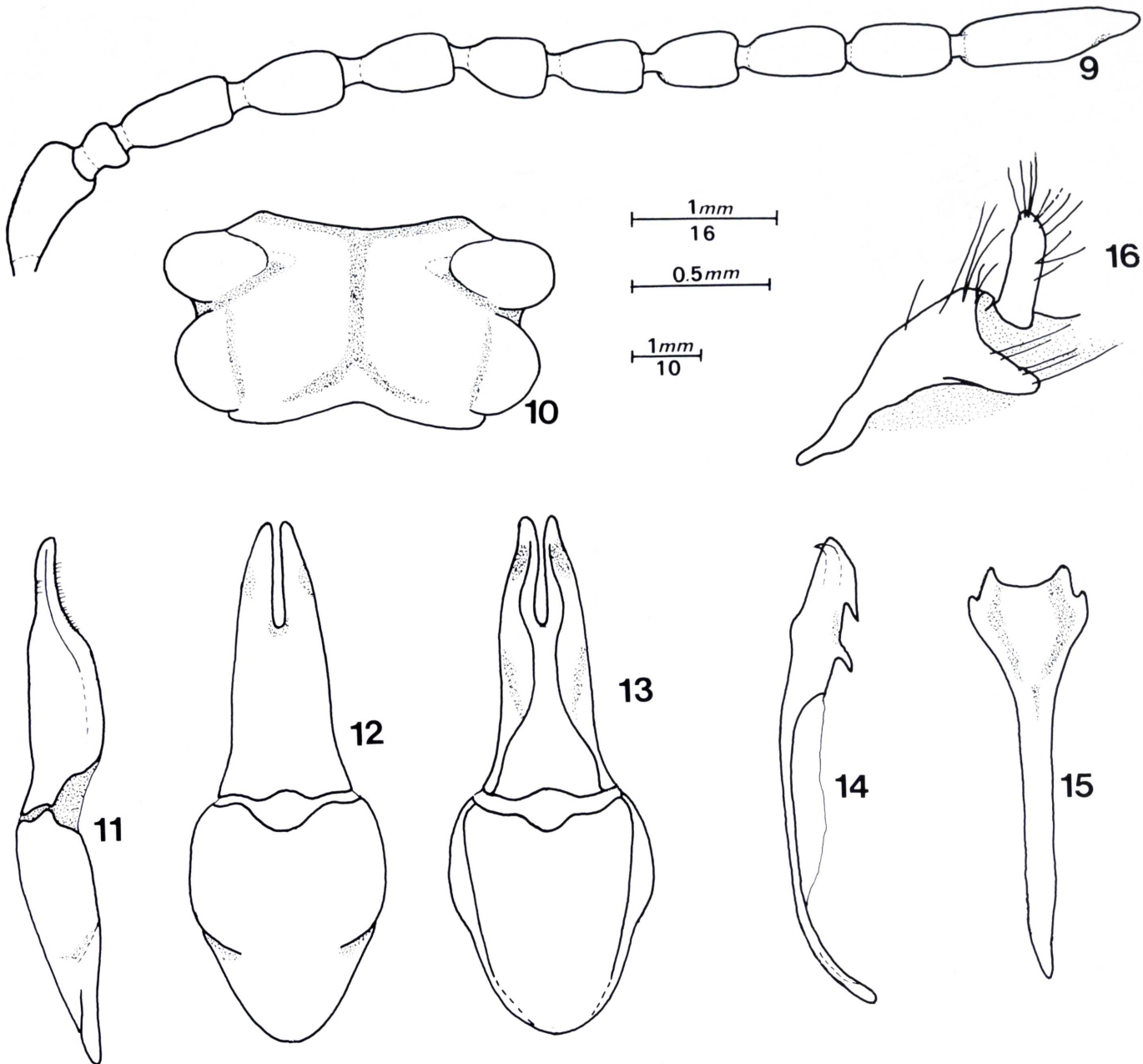
cribed by FLACH (1907); the head and pronotum punctures can be more rugose. The apex of the penis illustrated by VALLADARES & SALGADO (1983) is less blunt than in the specimens we examined, and the parameres also differ slightly.

GEOGRAPHICAL DISTRIBUTION

Iberian endemism, widespread throughout Portugal, West and Central Spain, with some apparently isolated populations also in East and South Spain. The localities recorded in literature and the new records are listed below and summarized in figure 17, divided into provinces or more generically into regional areas. Records from the literature which have been confirmed by our own or museal material are marked !, while new records are marked with an asterisk *; in both cases the abbreviation for the collection of provenance, already specified above, is given for each record.

PORTUGAL: Portugal ! (GERMAR, 1824; BRANDT & ERICHSON, 1832; BRANDT & RATZBURG, 1833; Mulsant, 1857; KATER, 1883; HEYDEN, REITTER & WEISE, 1891; REITTER, 1895; OLIVEIRA, 1899; BORCHMANN, 1917; PORTA, 1934; MG, MP). COIMBRA: Coimbra (FUENTE, 1933), Oliveira do Hospital (OLIVEIRA, 1893; FUENTE, 1933). GUARDA: Freinada, Guarda, Serra da Estrela !, Vale de Azores (OLIVEIRA, 1893; FUENTE, 1933; MG, MM). One other locality was not identified: Serra de Montesinho (OLIVEIRA, 1893; FUENTE, 1933).

SPAIN: Spain ! (DEJEAN, 1837; Mulsant, 1857; GEMMINGER & HAROLD, 1870; GÓRRIZ Y MUÑOZ, 1882; BEAUREGARD, 1890; HEYDEN, REITTER & WEISE, 1891; REITTER, 1895; PLIGINSKIJ, 1914; MADER & WINKLER, 1927; PORTA, 1934; EB, MB, MG, MGE, MRT, MT, MV, MZR). AVILA: Avila * (CB), El Tiemblo * (CB), Gredos * (MM), Madrigal de las Altas Torres * (MM), 15 km SW of Navacepeda de Tormes * (CB), Poyales del Hoyo * (MM), Sotillo de la Adrada * (MM), 5 km N of Venta del Obispo * (CB). BURGOS: Aranda de Duero (GÓRRIZ Y MUÑOZ, 1883), Burgos (GÓRRIZ Y MUÑOZ, 1882; FUENTE, 1933; VALLADARES, 1984), Lerma (GÓRRIZ Y MUÑOZ, 1882). CÁCERES: Torrequemada * (MM). CIUDAD REAL: Ciudad Real (FUENTE, 1933; VALLADARES, 1984). CÓRDOBA: Córdoba ? (GÓRRIZ Y MUÑOZ, 1882; FUENTE, 1933; VALLADARES, 1984). GRANADA: Motril * (MM). LEÓN: Astorga ! (VALLADARES & SALGADO, 1983, UL), Irede * (UL), Las Médulas !, León !, Mora de Luna ! (VALLADARES & SALGADO, 1983; VALLADARES, 1984; UL), Valdeiras * (UL). MADRID: Cercedilla * (MM), El Escorial * (MG, MM), Guadarrama * (CB, MRT), Lozoya * (MM), Madrid !



Figs. 9-16.—Adult of *Physomeloe corallifer* (Gemar). 9) Male antenna. 10) Pronotum. 11) Tegmen, lateral view. 12) Tegmen, dorsal view. 13) Tegmen, ventral view. 14) Penis. 15) Spiculum gastrale. 16) Valvifer and stylus.

(FLACH, 1907; BORCHMANN, 1917; FUENTE, 1933; VALLADARES & SALGADO, 1983; EB, MG, MM), Madrid Collado mediano * (MM), Madrid province (GÓRRIZ Y MUÑOZ, 1882), Miraflores de la Sierra * (MM), Navacerrada * (MM), Rivas near Madrid (TRAI-ZET, 1896), Sierra de Guadarrama Puerto de la Morcuera * (MV), Vicálvaro near Madrid (SOUMACOV, 1934). PALENCIA: Palencia ! (FUENTE, 1933; VALLADARES, 1984; CB, MG, MVE). SALAMANCA: Candelario * (CB), Negrilla * (MM), 10 km N of Salamanca * (CB), Salamanca (FUENTE, 1933; VALLADARES, 1984). SEGOVIA: San Rafael * (MM), Segovia (FUENTE, 1933; VALLADARES, 1984), Sierra de Guadarrama * (MRZ). TERUEL: Montalbán * (MM). TOLEDO: Illescas * (UL), Toledo * (UL). VALLADOLID: Granja Muedra near Valoria la Buena * (CB), Tordesillas * (UL), Valladolid La Unión * (UL). Generically recorded also from Andalusia (PLIGINSKIJ, 1914; LÓPEZ NEYRA, 1914; VALLADARES & SALGADO, 1983), Castilla la Nueva and la Vieja (GÓRRIZ Y MUÑOZ, 1882; LÓPEZ NEYRA, 1914), Extremadura (LÓPEZ NEYRA,

1914; FUENTE, 1933; VALLADARES & SALGADO, 1983; VALLADARES, 1984), and from both Mesetas (VALLADARES & SALGADO, 1983). Three other localities were not identified: Cienvallejos * (MM), San Udefo * (MM), Tadajos (GÓRRIZ Y MUÑOZ, 1882).

This species was erroneously recorded from Algeria (BORCHMANN, 1917; MADER & WINKLER, 1927; VALLADARES, 1984), South France (BORCHMANN, 1917; MADER & WINKLER, 1927), and from Germany (KRAATZ, in KATTER, 1883); no museal specimens confirm these records. We examined in the Gressler collection (MTR) one specimen erroneously labelled «Italia».

AUTOECOLOGICAL REMARKS

Physomeloe corallifer is a diurnal element, inhabiting the Iberian mesetas, highlands and mountains, from about 700 to 1,400 metres in steppic or mountainous mediterranean habitats. No ecological records have been published. We collected this species in: a) Avila, 1100 m, steppe with unidentified Gramineae (*Bromus* sp. ?) and synanthropic Cruciferae of the genus *Sinapis* along the borders of the biotope; b) 5 km N of Venta del Obispo, 1300 m, open reforestation of *Pinus nigra* Arnold subsp. *salzmannii* (Dunal) Franco, with *Adenocarpus* sp. and *Helichrysum* sp. in herbaceous belt; c) 15 km SW of Nava-cepada de Tormes, 1300 m, steppic glades in an open forest of *Pinus nigra* Arnold subsp. *salzmannii* (Dunal) Franco; d) 3 km SE of Candelario, 1200 m, substeppic glades with *Lavandula stoechas* L. in mediterranean mountain *Quercus* sp. woodland; e) 10 km N of Salamanca, 850 m, margin of relict hygrophylous pastures with *Juncus* sp., in extensive grain cultivations; f) Granja Muedra, 750 m, xeric steppic highlands, with rare specimens of *Calycotome* sp.

No data are available in literature on the host plants. In the Salamanca biotope we collected one specimen feeding on the leaves of a young unidentified species of thistle (Compositae) (fig. 8).

The adults are active from February to May. GÓRRIZ Y MUÑOZ (1882) reported adults as active from February-April, and probably May in Madrid Province (GÓRRIZ Y MUÑOZ, 1882); SOUMACOV (1934) indicated the first days of April in the same area; VALLADARES & SALGADO (1983) and VALLADARES (1984) reported a few sightings in March, April and May. Our own and museum records cover the period from 2nd March to 2nd June, with most data reported from the last days of March to the first days of May, and a single record on 8th July.

Nothing is known about the pre-imaginal biology. BEDEL (1892, from a note after Ch. Brisout de Barneville) reported that the species was very common in Madrid in the old walls where some wild bees were nesting, probably parasitized by *Physomeloe*. This biological record, although never confirmed directly, is congruent with other data on Lyttini biology.

As in some other Meloidae (see BOLOGNA & HAVELKA, 1985), the cantharidin produced by *Physomeloe* attracts Anthicidae beetles. SANZ DE DIEGO (1880) signalized some records of *Anthicus insignis* Lucas, 1843, found on the body of *Physomeloe*. BOLÍVAR Y URRUTIA (1896; see also CHOBOUT, 1897; PIC, 1897; GORNITZ, 1937; ABDULLAH, 1964) reported the presence of the same *Anthicus* on the integuments. In all probability, these records must be re-

ferred to *Anthicus venator* Dufour, 1849, which has been recorded from Spain, whilst *A. insignis* is diffused in Algeria (CHOBOUT, 1897, after M. Pic *in litteris*). Moreover, a miscellaneous collection of *Physomeloe corallifer*, *Berberomeloe majalis* (Linnaeus, 1767) and *Meloe tucius* Rossi, 1792, preserved in alcohol for one year, still attracted more than 500 specimens of *Notoxus monoceros* (Linnaeus, 1758) (TRAIZET, 1896; CHOBOUT, 1897). The vesicatory properties of the cantharidin stored in the body of *Physomeloe*, and used in traditional medicine, were first described by CORNALIA (1865) and GÓRRIZ Y MUÑOZ (1882).

ETHOLOGICAL REMARKS

In the field we observed defence and oviposition behaviours. Unlike species of *Meloe*, the adult of the genus *Physomeloe* walks swiftly on the ground, in a similar manner to *Berberomeloe majalis*, another apterous lyttine with a voluminous abdomen. Similar to other Meloidae, *P. corallifer* exhibits a defensive behaviour resembling thanatosis, with autohaemorrhage from the leg joints (BOLOGNA & MARANGONI, 1986; BOLOGNA, 1988b), but we also observed a true lateral thanatosis. In our opinion, the red tubercles on the pronotum have an aposematic function: these tubercles are very similar to the red drops of haemolymph containing cantharidin which is exuded during thanatosis, as we observed in the field.

Sexual behaviour is unknown. One complete sequence of oviposition in the field was observed and photographed in the afternoon (5-6 p.m.) at Venta del Obispo. The female dug an oblique hole with her fore legs and mandibles. Once it was excavated, she introduced her abdomen into the hole but kept her head, thorax and legs on the outside, then laid an egg mass whilst simultaneously pulsating her abdomen. She emerged after one hour and covered the hole with soil using her legs. Another female oviposited in the collecting box during the night.

AFFINITIES

On the basis of adult morphology, we can delineate at least two phenetic groups in the Lyttini tribe (BOLOGNA, 1991). The first, extremely heterogeneous group, includes those genera with non-serrate claws; we refer *Physomeloe* to this lineage. The second group comprises 7 genera with the synapomorphic character of a serrate upper blade on the tarsal claws in the adult, but the triangulin is scarcely differentiated from the first group, except for the subparallel sides of the head.

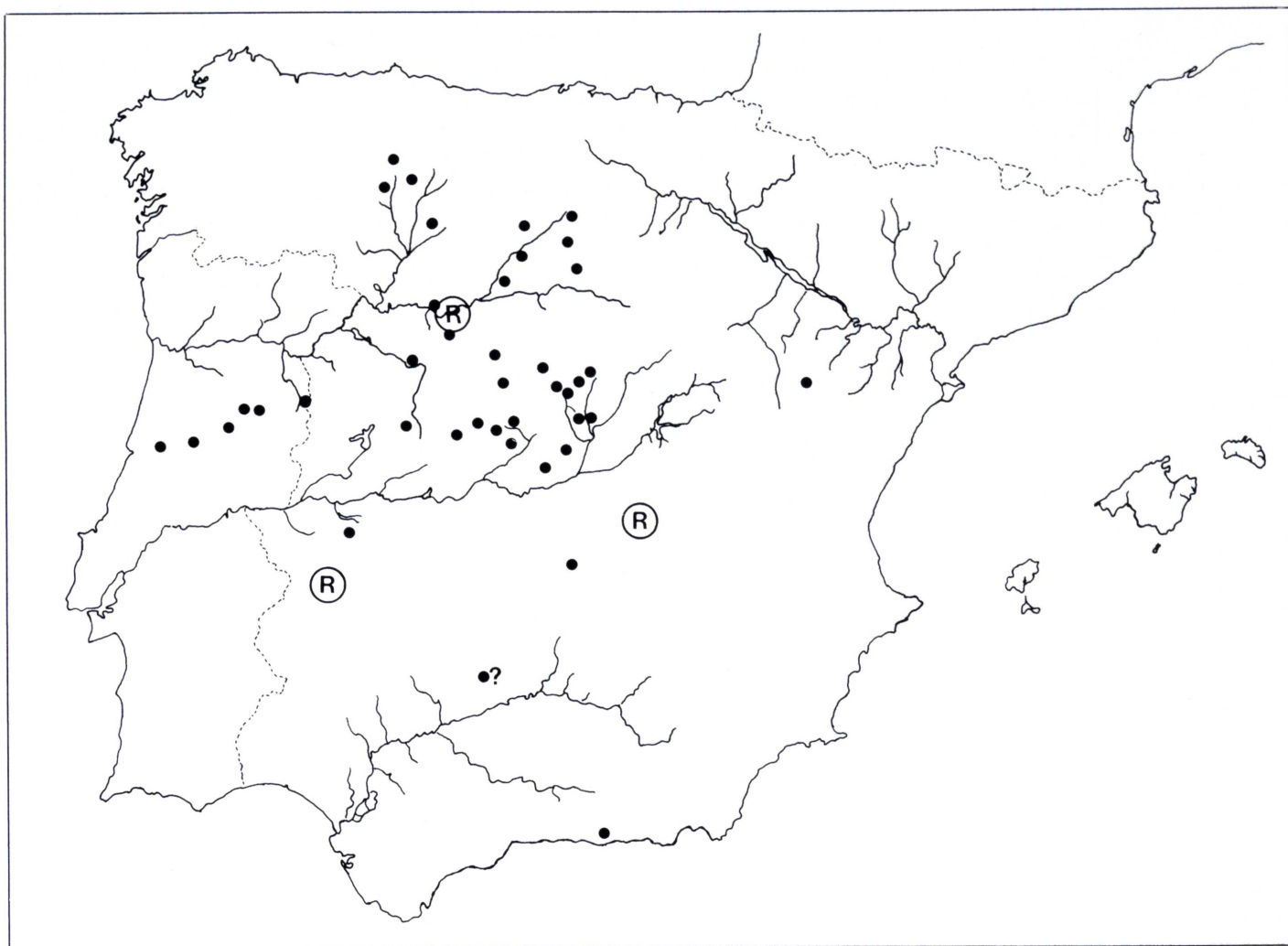


Fig. 17.—Distribution of *Physomeloe corallifer* (Germar) (R: regional records; ?: uncertain records).

In the first group, *Physomeloe* Reitter, 1911, *Berberomeloe* Bologna, 1988, both West Mediterranean, and *Trichomeloe* Reitter, 1911, from the East Mediterranean, are all wingless and brachyelytrous. These apotypic conditions also occur in some other genera in all the subfamilies, particularly in several tribes of Meloinae, e.g. in one species of *Lytta* Fabricius, 1775, in *Gynapteryx* Fairmaire & Germain, 1863, in a few *Epicauta* Dejean, 1837, and in all *Cysteodemus* Leconte, 1851, *Megetra* Leconte, 1859, *Pseudomeloe* Fairmaire & Germain, 1863, and *Meloe* Linnaeus, 1758. In our opinion, the brachyelytrous and wingless conditions in the lyttine genera are probably only homoplastic rather than synapomorphic characters; the three Mediterranean genera are already well differentiated in many of their adult and larval features (BOLOGNA, 1988, 1991, *h. op.*). The adult of *Physomeloe*, *Berberomeloe* and *Trichomeloe* are particularly different in the shape of the pronotum, antennae, male genitalia and setation.

On the basis of larval characters, such as the clypeus, labrum, antennae, tarsungulus, etc., the genus *Physomeloe* could be referred to the Lyttini tribe, as defined by MACSWAIN (1956) and BOLOGNA (1991). The triungulin of many lyttines is still unknown, and the affinities between the genera remain obscure. In fact, the first instar larvae of only 11 out of 31 lyttine genera, listed in the subsequent key and briefly discussed by BOLOGNA & ALOISI (1992), have been described. Present knowledge does not permit us to deduce the Lyttini affinities, due to the lack of synapomorphies among the taxa and also on account of the probable polyphyletic condition of some taxa. *Physomeloe*, *Berberomeloe* and *Trichomeloe* share the apotypic condition of the strongly sclerotized abdominal sternites, but differ in their setation and in the position and shape of the spiracles, which are particularly modified in *Physomeloe*. In common with *Trichomeloe*, the posterior part of the head in *Physomeloe* is extremely curved and narrow

(more so than in *Trichomeloe*), and the line of dehiscence is limited to the pro- and mesonotum.

The main morphological differences found in lyttine triungulins are summarized in the following original key. We examined the first instar larvae of all listed genera and subgenera (BOLOGNA & PINTO, in prep.), excluding *Lagorina*; some characters of these larvae, described in a large literature, are summarized by MACSWAIN (1956), BOLOGNA (1991) and BOLOGNA & ALOISI (1992). The characters of *Teratolytta* Semenow, 1894 triungulin are based on unpublished data (Bologna, in preparation).

PRELIMINARY KEY TO THE FIRST INSTAR LARVAE OF GENERA AND SUBGENERA OF LYTTINI

1. Abdominal sternites largely sclerotized 2
— Abdominal sternites largely unsclerotized ... 4
2. Head and abdominal dorsal setae normally pointed. Abdominal spiracle I similar in size to II or only slightly larger. Abdominal spiracles II-VIII always dorsal 3
— Some setae on head, on posterior margin of abdominal tergites larger, cylindrical, abruptly truncate and apex with crown of 4 spiniform protuberances. Abdominal spiracle I on tergite, larger than the others (over 2.5 times as long and over 3 times as wide). Abdominal spiracles II-VIII on pleura, placed ventrally. Length 1.8 mm *Physomeloe* Reitter
3. Frontal sutures not largely extended laterally. Abdominal spiracles II-VIII on pleurites, placed dorsally. Antennal segments I-II cylindrical, subequal in length, about two thirds the length of segment III; sensory appendix smaller. Body bicoloured, dark brown with prothorax and abdominal segments I-III and IX orange. Line of dehiscence also partially on metanotum. Length 2 mm *Berberomeloe* Bologna
— Frontal suture extended laterally as far as base of antenna. Abdominal spiracles II-VIII on tergites, dorsal, spiracle I on tergite, placed dorso-laterally. Antennal segments I-II short and disk-like, I longer than II, III about three times longer and slender, sensory appendix on segment II larger. Body unicoloured, brown. Line of dehiscence only on pro- and mesonotum. Length 1.8 mm *Trichomeloe* Reitter
4. Mandibles with outer margin sharply incurved. Head with lateral margins subparallel 5
— Mandibles usually with outer margin evenly convex. Head with lateral margins broadly rounded 7
5. Spiracles similar in size, all large and evident. Body uniform brown. Length 1.5-2.5 mm *Lydtus* Latreille
— Mesothoracic and abdominal spiracle I larger than other abdominal spiracles 6
6. Body uniform brown. Mesothoracic and abdominal spiracle I about twice as large as other abdominal spiracles. Length 1.0-1.5 mm *Oenas* Latreille
— Body brown and pale yellow. Mesothoracic and abdominal spiracles one third larger than other abdominal spiracles. Length 1.0-1.8 mm *Alosimus* Mulsant
7. Mandibles more or less serrate 8
— Mandibles smooth 11
8. Thorax with line of dehiscence limited to pro- and mesonotum. Length 2.4 mm *Lytta (Pomphopoea)* LeConte
— Thorax with line of dehiscence usually on all segments 9
9. Maxillary palpus with three or more long setae on anterior dorsal margin of second segment, setae longer than third segment; if there are only one or two shorter setae, the lateral margins of the third segment of the maxillary palpi diverge slightly towards the apex. Length 2.0-3.5 mm *Lytta (Lytta)* Fabricius, and *Lytta (Paralytta)* Selander (excluding *nitidicollis* (LeConte), which has smooth mandibles)
— Maxillary palpus with one or two setae on anterior dorsal margin of second segment, these setae shorter than segment III, which has lateral margins parallel or converging towards apex. 10
10. Head, thorax and abdominal tergites well sclerotized. Sensory appendix of antennal segment II usually considerably shorter than segment III. Length 1.8-3.2 mm *Lytta (Poreospasta)* Horn pars (several species)
— Body scarcely sclerotized, except for mandibles. Sensory appendix of antennal segment II only a little shorter than segment III. Length 1.65-1.85 mm *Teratolytta* Semenow
11. Antennal segment II clearly longer than I ... 12
— Antennal segment II as long as I 13
12. Abdominal spiracles VII-VIII larger than I-VI, I similar in size to II. Antennal segment II twice as long as I, about four-fifths as long as segment III. Claws slender, similar in length to unguiform la-

teral setae, the latter placed near base of claw. Length 2.9 mm

..... *Lytta (Adicolytta) eucera* (Chevrolat)
— Abdominal spiracles VII-VIII similar in size to II-VI, I larger than II. Antennal segment II four times as long as I, III slightly shorter than II. Claw robust and very long, longer than unguiform lateral setae of tarsi, these placed well away from claw base. Length 1.2 mm. *Cabalia* Mulsant & Rey

13. Head longer than wide, a little longer than prothorax. Line of dehiscence partially also on abdominal tergite I. Spiracles large, mesothoracic and first abdominal spiracles slightly smaller than others. Body dorsally uniform shiny black. Length 1.8 mm

..... *Lagorina* Mulsant & Rey
— Head wider than long, or as wide as long 14

14. Line of dehiscence present on first abdominal tergite 15
— Line of dehiscence absent from first abdominal tergite. Mesothoracic and abdominal spiracles III-VIII placed ventrally, abdominal spiracle I placed dorsally, II placed dorso-laterally. Length 1.7 mm

..... *Lydomorphus* Fairmaire

15. Third segment of maxillary palpus with lateral margins parallel or converging toward apex. Length 1.40-1.95 mm

..... *Lytta (Poreospasta)*
pars [*auriculata* (Horn), *aeneipennis* LeConte, *crotchi* Horn]

— Third segment of maxillary palpus with lateral margins diverging slightly toward apex. Length 2.1 mm *Lytta (Adicolytta) mutilata* (Horn)

ACKNOWLEDGEMENTS

This research was financed by the Consiglio Nazionale delle Ricerche (Italia/USA «Sistematica filogenetica dei Coleotteri Meloidae» project) and by the Ministero della Università e della Ricerca Scientifica e Tecnologica (40 and 60 % grants). We wish to thank all our colleagues who collected the specimens, particularly P. Audisio and M. Biondi (Roma, L'Aquila), who collaborated in the field work, and A. Vigna Taglianti (Roma). We are very grateful to the following entomologists for the loan of specimens or for their permission to examine their collections: C. Besuchet (Genève), A. Casale (formerly of Torino), C. Chemini (Trento), C. Girard (Paris), I. Izquierdo (Madrid), M. Marini (Bologna), B. Osella (formerly of Verona), P. Passerin d'Entrèves (Torino), R. Poggi (Genova), M. Principi (Bologna), E. Ratti (Venezia), J. A. Régil Cueto (León), V. Vomero (Roma), A. Vigna Taglianti (Roma). We also wish to thank Maurizio Mei (Roma) for his help with the illustrations, our colleagues B. Osella and M. Biondi (L'Aquila) for their criticism, and J. D. Pinto (Riverside, California) for his suggestions on Meloini and Lyttini phylogeny.

REFERENCES

- ABDULLAH, M. 1964. *Protomeloe argentinensis*, a new genus and species of Meloidae (Coleoptera), with remarks on the significance of cantharidin and the phylogeny of the families Pyrochroidae, Anthicidae, Meloidae and Cephaloidae. *Ann. Mag. Nat. Hist.*, 7: 247-254.
- BEAUREGARD, H. 1890. *Les Insectes Vésicants*. Alcan, Paris, XVI+544 pp., 34 pls.
- BEDEL, L. 1892. Reinsegnements sur les moeurs et le développement des Meloidae. *Abeille*, 27: 235-250, 304.
- BOLÍVAR Y URRUTIA, D. I. 1896. (Meeting report on *Meloe corallifer*). *Ann. Soc. Esp. Hist. Nat.*, 60: 182-184.
- BOLOGNA, M. A. 1988a. Note su *Eurymeloe* e revisione delle specie euromediterranee del gruppo *rugosus* (Coleoptera, Meloidae). *Fragm. Entomol.*, 20: 233-301.
- BOLOGNA, M. A. 1988b. *Berberomeloe*, a new West Mediterranean genus of Lyttini for *Meloe majalis* Linnaeus (Coleoptera, Meloidae). *Systematics and bionomics. Boll. Zool.*, 55: 359-366.
- BOLOGNA, M. A. 1991. Coleoptera Meloidae. *Fauna d'Italia*, 28. Calderini, Bologna; IV+541 pp.
- BOLOGNA, M. A. & ALOISI, G. 1992. Systematics of *Lydomorphus* Fairmaire, 1882, with a description of the first instar larva of *L. dusaulti* (Dufour, 1821) (Coleoptera Meloidae). *Tropic. Zool.*, 5: 55-71.
- BOLOGNA, M. A., ALOISI, G. & MARANGONI, C. 1988. Nuove osservazioni su *Eurymeloe* Reitter e descrizione di larve di I stadio (Coleoptera, Meloidae). *Bull. Ann. Soc. R. Belge Entomol.*, 125: 67-75.
- BOLOGNA, M. A., ALOISI, G. & VIGNA TAGLIANTI, A. 1991. Phoretic association of some African *Cyaneolytta* Péringuey 1909 with carabids, and morphology of first instar larvae in Meloini (Coleoptera Meloidae). *Tropic. Zool.*, 2: 159-180.
- BOLOGNA, M. A. & HAVELKA, P. 1985. Nuove segnalazioni di attrazione della cantaridina dei Meloidae su Coleotteri e Ditteri. *Boll. Ass. Romana Entomol.*, 39 (1984): 77-82.
- BOLOGNA, M. A. & MARANGONI, C. 1986. Sexual behaviour in some Palaearctic species of *Meloe* (Coleoptera Meloidae). *Boll. Soc. Entomol. It.*, 118: 65-82.
- BOLOGNA, M. A. & PINTO, J. D. 1992. A review of *Meloe* (*Taphromeloe*), including a description of the first instar larva of *M. (T.) erythrocnemus* and comments on the classification of the tribe Meloini (Coleoptera: Meloidae). *Proc. Entomol. Soc. Wash.*, 94: 299-308.
- BORCHMANN, F. 1917. Meloidae, Cephaloidae. *Coleopterorum Catalogus*, 69. Junk, Berlin; 208 pp.
- BRANDT, J. F. & ERICHSON, W. F. 1832. Monographia generis *Meloes*. *Nova Acta Phys.-Med. Acad. Caes. Leopold.-Carol. Nat. Curios.*, 16: 101-142, 1 pl.
- BRANDT, J. F. & RATZEBURG, J. T. C. 1833. *Medizinische Zoologie oder getreue Darstellung und Beschreibung der Thiere die in der Arzneimittellehere in Betracht kommen, in systematischer folge herausgegeben*. Vol. 2 (1830-3). Hirschwald, Berlin; 364 pp., 39 pls.
- CHOBOUT, A. 1897. Nouvelles observations sur les relations biologiques des Anthicidae avec les Vésicants. *Bull. Soc. Entomol. France*, 1897: 74-78.
- CORNALIA, E. 1865. Sopra i caratteri microscopici offerti dalle Cantaridi e da altri Coleotteri facili a confondersi con esse. Studj di Zoologia legale fatti nell'occasione del processo Galavresi. *Mem. Soc. Ital. Sci. Nat.*, 1(10): 1-39, 1 pl.

- CROS, A. 1934. Le *Meloe chrysocomus* Miller: sa larve primaire. *Bull. Soc. R. Entomol. Egypte*, 1934: 427-435.
- CROS, A. 1940. Essai de classification des Meloidae algériens. *VI Congr. Int. Entomol.*, Madrid, 1935: 312-338.
- DEJEAN, P. F. 1837. *Catalogue des Coléoptères de la collection de M. le Comte Dejean*. Troisième édition. Méquignon-Marvis, Paris, 503 pp.
- FLACH, K. 1907. Beiträge zur Käferfauna der Iberische Halbinsel. *Wien. Entomol. Zeit.*, 26: 17-19.
- FUENTE, J. M. DE LA. 1933. Catálogo sistemático geográfico de los Coleópteros observados en la Península Ibérica, Pirineos propiamente dichos y Baleares. Fam. Meloidae. *Bol. Soc. Entomol. Esp.*, 16: 18-32, 45-49.
- GEMMINGER, M. & HAROLD, B. 1870. *Catalogus Coleopterorum hucusque descriptorum synonymicus et systematicus*. Vol. 7. Gummi, Monachi; 1801-2180.
- GERMAR, E. F. 1818. Vermischte Bemerkungen über einige Käferarten. *Magazin der Entomologie*, 3: 228-260.
- GERMAR, E. F. 1824. *Fauna Insectorum Europae*. Vol. 10. Kummel, Halae; 25 nrs.
- GORNITZ, K. 1937. Cantharidin als Gift und Anlockungsmittel für Insekten. *Arb. Phys. Angew. Entomol. Berlin-Dahlem*, 4: 116-157.
- GÓRRIZ Y MUÑOZ, R. J. 1882. *Ensayo para la Monografía de los Coleópteros Meloideos indígenas con aplicación a las Ciencias médicas*. Sanz y Navarro, Zaragoza, 201 pp., 2 pls.
- HEYDEN, L. VON, REITTER, E. & WEISE, J. 1891. *Catalogus Coleopterorum Europae, Caucasi et Armeniae rossicae*. Reitter, Mödling; 420 pp.
- KASZAB, Z. 1969. The system of the Meloidae (Coleoptera). *Mem. Soc. Entomol. It.*, 48: 241-248.
- KATTER, F. 1883. *Monographie der europäischen Arten der Gattung Meloë mit besonderer Berücksichtigung der Biologie dieser Insekten*. Dose, Putbus, 61 pp.
- LÓPEZ NEYRA, C. 1914. Claves dicotómicas para la determinación de los Meloidos indígenas. *Bol. R. Soc. Esp. Hist. Nat.*, 14: 461-475.
- MACSWAIN, J. W. 1956. A classification of the first instar larvae of the Meloidae (Coleoptera). *Univ. Calif. Publ. Entomol.*, 12: I-IV, 1-182.
- MADER, L. & WINKLER, A. 1927. Meloidae. In WINKLER, A. ed.: *Catalogus Coleopterorum Regionis Palaearcticae*. Winkler, Wien, 2: 851-888.
- MULSANT, E. 1857. *Histoire naturelle des Coléoptères de France. Vésicants*. Magnin, Blanchard & Cie, Paris, 201 pp., 1 pl.
- OLIVEIRA, M. P. DE. 1894. *Catalogue des Insectes du Portugal. Coléoptères*. Imprensa de Universidade, Coimbra, 393 pp.
- OLIVEIRA, M. P. DE. 1899. *Catalogue des Coléoptères du Portugal de la collection du Dr. Paulino de Oliveira*. Imprensa Academica, Coimbra, 93 pp.
- PARDO ALCAIDE, A. 1950. Los géneros de Meloidae de la fauna hespérica. *Graellsia*, 8: 39-79.
- PIC, M. 1897. Moeurs des *Anthicus* (Col.), note rectificative et observations. *Bull. Soc. Entomol. France*, 1897: 124.
- PINTO, J. D. & BOLOGNA, M. A. 1993. The first instar larvae of *Meloe afer* and *M. occultus*, with a clarification of antennal structure in larval *Meloe* (Coleoptera: Meloidae). *Col. Bull.*, 47: 340-348.
- PINTO, J. D. & SELANDER, R. B. 1970. The bionomics of the blister beetles of the genus *Meloe* and a classification of the New World species. *Illin. Biol. Monogr.*, 42: 1-222.
- PLIGINSKI, V. 1914. Les Méloines (Coleoptera, Meloidae) de la collection de V. Motschulsky. *Rev. Russe Entomol.*, 14: 254-261.
- PORTA, A. 1934. *Fauna Coleopterorum italica*. Vol. 4. Stab. Piacentino, Piacenza; 415 pp.
- REITTER, E. 1895. *Bestimmungs-tabelle der europäischen Coleopteren Meloidae. 1. Theil: Meloini*. 32. Ver. Verfassers, Paskau; 13 pp.
- REITTER, E. 1911. *Fauna Germanica. Die Käfer des deutschen Reiches. Nach der analytischen Methode bearbeitet*. Vol. 3. Lutz, Stuttgart; 436 pp., 48 pls.
- SANZ DE DIEGO, M. 1880. (Note on Spanish insects). *Actas Soc. Esp. Hist. Nat.*, 9: 38-39.
- SELANDER, R. B. 1985. *Spastomeloe*, a new genus of Meloini from Peru (Coleoptera: Meloidae). *J. Kans. Entomol. Soc.*, 58: 668-685.
- SELANDER, R. B. 1987. Behavioral observations in *Cyaneolytta* and description of the triungulin larva of *C. fryi* (Coleoptera: Meloidae). *J. Kans. Entomol. Soc.*, 60: 288-304.
- SELANDER, R. B. 1988. Blister beetles of the genus *Lyttemeloe* (Coleoptera: Meloidae). *J. Kans. Entomol. Soc.*, 61: 80-101.
- SELANDER, R. B. 1989. The triungulin larva of *Meloe cicatricosus* Leach (Col. Meloidae). *Deuts. Entomol. Zeits. (N.F.)*, 36: 401-407.
- SOUMACOV, G. 1934. Inventa entomologica itineris hispanici et maroccani, quod a 1926 fecerunt Harald et Hakan Lindberg. XXI. Méloides du Bassin Méditerranéen et du Maroc. *Comment. Biol. Soc. Sci. Fenn.*, 4(13): 1-6.
- TRAIZET, E. 1896. Observations biologiques sur le *Notoxus monoceros* (Col.). *Bull. Soc. Entomol. France*, 1896: 104.
- VALLADARES, L. F. 1984. *Estudio de los Coleópteros Vésicantes de la provincia de León (Coleoptera, Meloidae)*. Celarayn, León; 156 pp.
- VALLADARES, L. F. & SALGADO, J. M. 1983. Contribución al conocimiento de los Meloidae (Col.) en la provincia de León. *Bol. Asoc. Esp. Entomol.*, 7: 79-100.

Recibido el 27 de febrero de 1992
Aceptado el 3 de noviembre de 1993