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Comparative morphology of structures associated with metathoracic scent glands in Heteroptera

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Contents

Included papers and submitted manuscripts

[1] KMENT P. & DAVIDOVÁ-VILÍMOVÁ J.: The external structures associated with the metapleural scent glands in the family Tessaratomidae (Hemiptera: Heteroptera: Pentatomoidea). *Zootaxa* (submitted).

[2] KMENT P. 2005: Revision of the genus Mahea Distant, 1909 (Insecta: Heteroptera: Acanthosomatidae), with review of the Acanthosomatidae of Madagascar and Seychelles. *Acta Entomologica Musei Nationalis Pragae* **45**: 21–50.

[3] KMENT P. 2008b: A revision of the endemic Madagascan genus Triplatyx (Hemiptera: Heteroptera: Pentatomidae). *Acta Entomologica Musei Nationalis Pragae* **48**: 543–582.

[4] KMENT P. & JINDRA Z. 2009: A revision of Tripanda and Tenerva (Hemiptera: Heteroptera: Pentatomidae: Pentatominae). *Zootaxa* **1979**: 1–47.

1. Introduction

The production of a smelling defensive secretion is certainly the best known feature of the true bugs (Heteroptera) which which is known to common public, and gave them their common name in several languages, such as ‘stink bug’ in English (e.g., AHMAD 1996, MALOUF 1932, SAILER 1952), or ‘Stinkwanze’ in German (e.g., REMOLD 1962).

The true bugs (Heteroptera), with ca. 40,000 described species, are currently classified in the order Hemiptera together with Sternorrhyncha, Cicadomorpha, Fulguromorpha, and Coleorrhyncha (see SCHUH & SLATER (1995), GRIMALDI & ENGEL (2005), FORERO (2008) for further references). Heteroptera are generally accepted as monophyletic taxon, which is further divided into seven infraorders – Enicocephalomorpha, Dipsocoromorpha, Gerromorpha, Nepomorpha, Leptopodomorpha, Cimicomorpha, and Pentatomomorpha (ŠTYS & KERZHNER 1975, WHEELER et al. 1993, SCHUH & SLATER 1995). The Enicocephalomorpha and Dipsocoromorpha include probably the most ‘primitive’ heteropterans which live mostly semiedafic. The semiaquatic Gerromorpha and aquatic Nepomorpha represent the so-called water bugs, while Leptopodomorpha is a small group of riparian and terrestrial bugs. All members of these five infraorders are predators. However, the majority of heteropteran taxa belongs to two the most derived infraorders – Cimicomorpha and Pentatomomorpha – which species are terrestrial and include predators as well as numerous herbivores and also few blood-sucking ectoparasites (e.g., SCHUH & SLATER 1995).

The submitted thesis is focused on the superfamily Pentatomoidea, from the infraorder Pentatomomorpha. The Pentatomomorpha includes six generally accepted superfamilies, Aradoidea, Pentatomoidea, Idiostoloidea, Lygaeoidea, Pyrrhocoroidea, and Coreoidea, the last five of them being grouped into so-called Trichophora, a clade defined by the presence and specific pattern of abdominal trichobothria. All recent phylogenetic analyses based on both the morphological and DNA characters seem to confirm monophyly of the Pentatomomorpha, its sister-group relationship with the Cimicomorpha, and position of the Aradoidea as a sister group of monophyletic Trichophora, and monophyletic Pentatomoidea. However, the relationships of family-group taxa within Pentatomoidea remain confused (GAPUD 1991; WHEELER et al. 1993; HENRY 1997a; DAI & ZHENG 2004; LI et al. 2005, 2006a,b; XIE et al. 2005, 2008; GRAZIA et al. 2008; SCHUH et al. 2009). From 1950s, when the group Pentatomomorpha was proposed (LESTON et al.

1954), many studies were conducted to find out new characters helpfull for a phylogeny reconstruction of Pentatomoidea, as the structure of male and female genitalia, pretarsal structures, wing venation, stridulatory devices, intestinal tract, salivary and scent glands, eggs, and karyotypes (reviewed e.g. by SCHAEFER (1993), KERZHNER et al. (2004), and GRAZIA et al. (2008)). Despite all the effort of previous workers, their results based on particular characters only contributed to a puzzle of apomorphies and homoplasies which support a hypothesis of mosaic evolution within Pentatomoidea but cannot give us a clear answer about phylogeny. The paper by GRAZIA et al. (2008) using the total evidence analysis of combined morphological and molecular data sets for the phylogenetic reconstruction of Pentatomoidea is the first attempt of more integrative approach in this subject.

DUFOUR (1833) was the first student who identified the metathoracic scent producing glands of the adult true bugs. He was followed by other authors who contributed substantially to our knowledge of a structure and function of imaginal scent glands (see reviews by BRINDLEY (1930), GUPTA (1961), CARAYON (1971), COBBEN (1978), DAZZINI VALCURONE & PAVAN (1978), STADDON (1979, 1986), PAVIS (1987), ALDRICH (1988) and MORAES et al. (2008)).

The occurrence of a characteristic combination of the adult metathoracic scent glands and larval dorso-abdominal scent glands represents an autapomorphy of the Heteroptera, distinguishing them from the remaining Hemiptera (e.g., SCHAEFER 1972, WHEELER at al. 1993, SCHUH & SLATER 1995, WEIRAUCH 2006a,b, FORERO 2008). The complex metathoracic scent apparatus consists of the principal gland(s), which is accompanied with the reservoir(s) and its duct(s), the closing valvular apparatus, and the thoracic scent efferent system conducting the gland secretion onto the external body surface. The thoracic scent efferent system consists of the complex internal and external structures of metathorax, some of them occasionally surpassing on meso- or even prothorax surface (see the Terminology chapter for detailed account).

The principal glands originated as integumentary invaginations. There may be a single gland opening with a single orifice, a single gland opening into a pair of orifices, or paired glands opening into two closely or widely spaced orifices. The glands themselves can consist of a single cuticle-lined corpus that produces and stores the scent fluid. The gland is frequently accompanied by a reservoir and sometimes also by an accessory gland attached to the reservoir (e.g., CARAYON 1971; COBBEN 1968, 1978; STADDON 1979;

SCHUH & SLATER 1995). A single gland with a single ventral opening is generally accepted as plesiomorphic condition within the Heteroptera since CARAYON (1971). On the contrary, ŠTYS (1996) doubted this hypothesis based on the presence of paired basiabdominal openings and evaporatoria in some plesiomorphic Enicocephalomorpha. Unfortunatelly, an evidence supporting the ŠTYS's (1996) hypothesis remains so far unpublished. An anatomy and histology of the principal and accessory glands and their reservoirs were studied by several authors, e.g. BRINDLEY (1929, 1930), CARAYON (1948, 1955, 1962, 1971), CALAM & SCOTT (1969), FARINE (1988), FILSHIE & WATERHAUS (1968), HASAN (1991a), HENRICI (1940), JOHANSSON (1957), LUCCHI (1996), NAGNAN et al. (1994), RAMAMURTY & KRISHNANANDAM (1969), SCHUMACHER (1971), SCHUMACHER & STEIN (1971), STADDON et al. (1985) and WATERHOUSE & GILBY (1969) (see also STADDON 1979). The absence of metathoracic scent gland apparatus in various groups of Heteroptera (Belostomatidae: Belostomatinae, Nepidae, Aphelocheiridae, Notonectidae: Anisopinae, Gelastocoridae: Nerthrinae, several taxa of the families Hydrometridae, Gerridae, Reduviidae, Scutelleridae, and Pentatomidae) represents secondary independent reductions (e.g., COBBEN 1978, STADDON & THORNE 1979, HASAN & KITCHING 1993, WEIRAUCH 2006a).

The structures of the thoracic scent efferent system enable the basic function of the scent glands, a rapid ejection or evaporation of the secretion and meanwhile the protection of the specimen against toxicity of its own secret (REMOLD 1962, 1963; FILSHIE & WATERHOUSE 1969; STADDON 1979, 1986; ALDRICH 1988; CARVER 1990). CARAYON (1971) supposed that the external scent efferent system of the metathoracic scent apparatus differentiated more recently and thus it is much more variable than the internal elements (proper glands and reservoirs). SCHAEFER (1972) used species of the trichophoran taxa to explain and suggest an anagenesis of elements of the external scent efferent system during evolution of this group, with an influence of different habitats and particularly a pressure of predators.

Features of the metathoracic scent apparatus were sporadically used to discuss and hypothesize the phylogeny of the families, e.g., Nabidae (CARAYON 1950) and Aradidae (CARAYON 1955), and all the Heteroptera (BRINDLEY 1930; COBBEN 1968, 1978). GAPUD (1991) and HASAN & KITCHING (1993) used several characters, especially of the external scent efferent system, in their cladistic analyses of the Pentatomoidea. Similarly, various features of metathoracic scent apparatus were used in phylogenetic hypotheses of the infraorders Gerromorpha (ANDERSEN 1982, DAMGAARD 2008) and Cimicomorpha (SCHUH

& Štys 1991, Schuh et al. 2009) or the superfamily Reduvioidea (Weirauch 2008). On the other hand, no such a character was included in the analyses of Pentatomomorpha by Henry (1997a) and Grazia et al. (2008). More generally, the structures of the external scent efferent system have been used as the important diagnostic characters for various families within the Pentatomomorpha (e.g., Stål 1870, 1873; Uhler 1877; Signoret 1881; Horváth 1900; Distant 1902; Froeschner 1960; Rolston & Kumar 1975; Slater 1979; Rolston et al. 1980; Rolston & McDonald 1981, 1984; Schaefer 1981; Thomas 1994a; Lis 1994; Henry 1997b). An anagenesis of these structures was marginally touched in studies concerning particular family- or genus-group taxa within Pentatomomorpha and Pentatomoidea (e.g., Schaefer 1968, Slater 1979, Linnavuori 1982, Ashlock 1985, Vasárhelyi 1987, Grozeva & Kerzhner 1992, Lis 1999a, Kocorek & Lis 2000, Kment & Vilímová in press). However, no detailed study, which should compare these structutes among families, has been published..

The basic components of the adult metathoracic scent gland secretion are unsaturated aliphatic aldehydes (e.g., *trans*-hex-2-enal, *trans*-oct-2-enal), esters (e.g., *trans*-hex-2-enyl acetate, *trans*-hex-2-enyl butyrate), and alcanes (mainly n-tridecane) (e.g., Waterhouse et al. 1961; Baggini et al. 1966; Dazzini Valcurone & Pavan 1978; Staddon 1979, 1986; Pavis 1987; Aldrich 1988; Moraes et al. 2008). The main functions of the metathoracic scent gland secretion are repugnatorial and defensive (e.g., Falkenstein 1931; Remold 1962, 1963; Janaiah et al. 1979; Cant et al. 1996). However, the bactericid and fungicid activity of the secretion was also proved (e.g., Roth 1961; Surender et al. 1987, 1988; Ravinder et al. 1992) and can be its most important function in the aquatic bugs (Maschwitz 1971, Kovac & Maschwitz 1989). Some of the scent components have an alarm, aggregation, and epigamic function (Staddon 1979, 1986; Aldrich 1988; Aldrich et al. 2000; Zhang & Aldrich 2003a,b; Moraes et al. 2008; Raška 2009) but may be also utilized as kairomones by the true bug parasitoids (e.g., Tachinidae) (Aldrich et al. 2006). The mite genus *Coreitarsonemus* Fain, 1970 (Acari: Tromdidiformes: Tarsonemidae) represents a curiosity, this parasite lives in the vestibule of large Afrotropical Coreidae (Fain 1970).

2. Material and methods

Material examined. During the preparation of this thesis I have an opportunity to examine representatives of ca. 500 genera and more than 1000 species of Pentatomoidea classified in all families and subfamilies of this taxon (except of Pentatomidae: Stirotarsinae). The specimens used for the line drawings and SEM photographs presented in this thesis are listed in Appendix 1 (p. 147), accompanied with their exact systematic placement. Most of the examined specimens originated from the collections of National Museum (Prague, Czech Republic), Naturhistorisches Museum (Vienna, Austria), and in minor extent also from the additional collections listed in particular published papers (KMENT 2005, 2008; KMENT & JINDRA 2009), the included manuscript (KMENT & VILÍMOVÁ in press), and in Appendix 1. The higher classification of Pentatomoidea follows mainly AUKEMA & RIEGER (2006) and GRAZIA et al. (2008).

Dissections and illustrations. The line drawings of the thoracic pleura were made using stereomicroscopes with either an ocular drawing grid or a camera lucida. Scanning electron microscope (= SEM) photographs were prepared in the Laboratory of Electron Microscopy, Biological Section, Charles University in Prague, using JEOL 6380 LV scanning electron microscope. Prior to photographing, specimens were dissected, cleaned in ultrasonic bath (water + detergent), dryed, and coated with gold. For examination of the microsculpture inside vestibules, the thorax was cleared in hot 10% KOH solution, both pleura were separated by sharp scissors and the vestibule was bisected sagittally from an ostiole towards the internal orifice using a shaving-blade, thus dividing the vestibule to ca. anterior and posterior part.

3. Terminology

A high confusion in the terminology exists due to a use of either different terms for one structure, or the same term for different structures (i.e., synonyms and homonyms) of the thoracic scent efferent system, even by the same author in a single paper. Prior to selecting the most suitable terms for particular structures, I went through several hundreds either of papers dealing with a scent gland morphology in general, or papers describing and identifying various taxa of Pentatomoidea; for selected bibliography see the References section. Only selected papers are listed for the authors with numerous publications (e.g., I. Ahmad, M. Ghauri, J. Grazia, J. A. Lis, F. McDonald, D. Rider, L. Rolston, H. Ruckes). The complete list of excerpted synonyms and references is presented in Appendices 2 (macrosculpture) and 3 (microsculpture), in the following text only the basic papers are mentioned. Shortest terms (uninominal if possible) are mostly preferred. The term *macrosculpture* refers to a sculpture well-visible under the stereomicroscope, while the *microsculpture* is precisely recognizable under the scanning electron microscope only.

3.1. Macrosculpture

3.1.1. Scent gland system

Several terms were suggested to describe the complex of all scent, or even all exocrine glands in the Heteroptera. The term *scent gland system* was used by several authors for the complex of all heteropteran scent glands or at least some of them (i.e. metathoracic scent glands [= MTG(s)], dorso-abdominal scent glands [= DAG(s)], Brindley’s glands, ventral and abdominal glands of Reduviidae, abdominal unicellular glands of Pentatomidae) (STADDON 1979, STADDON et al. 1987, CARVER 1990, CARVER et al. 1991, LUCCHI 1996, LUCCHI & SOLINAS 1990). CARAYON (1962) used two different French terms, *appareil odorifique imaginal* and *système odorifique imaginal*, to mark MTGs, Brindley’s glands, and the ventral glands in thoracico-abdominal junction of Tingidae. DAZZINI VALCURONE & PAVAN (1978) defined the *scent system* as consisting of the DAGs, MTGs, ventral glands, and Brindley’s glands, while COBBEN (1968) used the term *scent apparatus* for the same set of glands. The definition of *exocrine glandular system* of Pyrrhocoridae by FARINE (1988) is even more inclusive, consisting of the DAGs, MTGs, pygidial glands, male sternal gland, a pair of accessory glands opening into the genital chambre in male, and a pair of uradenia in female.

3.1.2. Metathoracic scent apparatus

NICHOLS & SCHUH (1989) defined the term *scent gland apparatus* as ‘metathoracic scent glands + evaporatoria’. HEPBURN & YONKE (1971) provided the following definition: ‘The terms *metathoracic scent gland* and *metathoracic scent apparatus* are used herein to refer to the metathoracic scent complex, while the term primary scent gland is used to refer specifically to the paired convoluted tubes that house the secretory cell aggregates producing the scent fluid.’ AHMAD & KAMALUDDIN (1987) defined the *scent apparatus* in Pentatomidae in more detailed way as consisting of the ‘principal scent glands, ducts of the principal scent gland, the reservoir, the lateral ducts of the reservoir, the vestibules and the sclerotized ducts and the muscle fibres forming the valvular apparatus and the ostioles’. KHANNA (1963b) defined *thoracic stink glands* as ‘paired structures, each consisting of a gland proper, a reservoir, a transverse duct, a vestibule and an exit duct’. KMENT & VILÍMOVÁ (in press) accepted the term *metathoracic scent apparatus* and provided slightly modified definition: it ‘consists of internal parts (i.e., the principal scent glands, ducts of the principal scent glands, the reservoir, and the lateral ducts of the reservoir ending apically with valvular apparatus) [...], and the thoracic scent efferent system [...], always paired in Pentatomomorpha’. Despite *scent apparatus* is more frequently used than *metathoracic scent apparatus*, I prefer the latter, more exact term, to avoid confusion with e.g. the *scent system* (see above). Unfortunately, some authors used the term *metathoracic scent apparatus* also as a synonym of external scent efferent system (AHMAD & RANA 1992, 1994; HASAN & KITCHING 1993; SCHAEFER & AHMAD 2008). The list of synonyms of the *metathoracic scent apparatus* used throughout all Heteroptera is given in Appendix 2 (p. 152).

3.1.3. Thoracic scent efferent system

STADDON (1979) divided the ‘*metathoracic efferent system*’ into three parts: i) ‘the valve mechanism surrounding the gland external orifice’ [i.e., internal orifice herein], ii) ‘the scent canals formed by folding of from integument’ [i.e., vestibule of Pentatomoidea herein], and iii) ‘(in the land bug) the pleural or so-called scent “evaporation” surfaces’.

KMENT & VILÍMOVÁ (in press) similarly divided the *thoracic scent efferent system* into the **internal scent efferent system,** which is situated in the metathorax only and consists of the internal orifice and vestibule, and the **external scent efferent system** comprising the ostiole and the associated external structures.

3.1.4. Valvular apparatus

This is a complex structure regulating the passage of secretion from the lateral duct of the reservoir to the vestibule. Its structure and function was described for example by JOHANSSON (1957), REMOLD (1962, 1963), HEPBURN & YONKE (1971), AHMAD & KHAN (1973), AHMAD & AFZAL (1977) and STADDON (1979). The list of synonyms of the *valvular apparatus* used throughout the Pentatomomorpha is given in Appendix 2 (p. 154).

3.1.5. Internal orifice

The internal orifice is the inner opening of the vestibule, situated at the base of a metafurca, joining with the apex of the lateral duct of the reservoir and valvular apparatus including the valvular plate [Figs. 139, 143, 191–193] (e.g., MALOUF 1933, REMOLD 1962, CARAYON 1971, AHMAD & KAMALUDDIN 1987, KMENT & VILÍMOVÁ in press). After AFZAL & SAHIBZADA (1988), the internal orifice is surrounded by antero-lateral angle of the furcasternum together with the metafurca. The list of synonyms of the *internal orifice* used throughout the Pentatomomorpha is given in Appendix 2 (p. 155).

3.1.6. Vestibule

The vestibule is the cavernous tube situated inside metathorax, beginning with internal orifice, running externally towards the metapleural surface, and opening externally as an ostiole [Figs. 139, 191–192]. The *vestibule* developed by an invagination and enclosing of the original *scent groove* (MALOUF 1932, 1933; AFZAL & SAHIBZADA 1988; KAMALUDDIN & AHMAD 1988a; AHMAD et al. 1997c). The internal surface of the *vestibule* is covered by two distinct types of microsculpture – the mycoid and peritremal surface [Figs. 144–145, 194–199, 204] (see below). Besides the microsculpture, the internal surface could be also macroscopically furrowed along its longitudinal axis (the **vestibular furrows**) (MOODY 1930, LARSÉN 1945, GUPTA 1964, CHOUDHURI & DAS 1970, HEPBURNE

& YONKE 1971, KMENT & VILÍMOVÁ in press); HEPBURNE & YONKE (1971) used the synonym *vestibular duct grooves*.

NICHOLS & SCHUH (1989) did not note the term *vestibule*, but defined the *ostiolar canal* (with synonyms *orificial canal* and *ostiolar groove*) as 'external outflow pathway of metathoracic scent gland', which make these terms applicable to both the *vestibule* and *scent groove* (see below). In some cases, the *vestibule* should be externally visible as an elevation in anteromedian region of mesopleuron (e.g., Cydnidae – HASAN & KITCHING 1993).

In the Pentatomomorpha, the *vestibule* is completely closed (MOODY 1930; HENRICI 1940; LARSÉN 1945; REMOLD 1962, 1963; CARAYON 1971), despite the vestibular scar being visible in many taxa (see below). The *vestibule* is homologous to an incompletely closed *scent groove* (= *external groove, stink groove*, etc.) of Cimicomorpha (e.g., in Miridae, Nabidae, Tingidae – HENRICI 1940; DRAKE & DAVIS 1959; CARAYON 1962; REMOLD 1962, 1963; LIVINGSTONE 1969). It is also similar to the *stink groove* of Nepomorpha (e.g., LARSÉN 1945, PARSONS 1960). However, LARSÉN (1945) did not consider the *stink grooves* of the aquatic and terrestrial Heteroptera to be homologous. After BRINDLEY (1934), the location of the *scent groove* in Cimicidae corresponds to the area (or suture) between the precoxale (antepisternum plus preepisternum) and the antecoxale in 'lower insects'. According to MATSUDA (1970), in some Heteroptera the '*stink* (*scent*) *groove* appears to lie approximately on the area that corresponds to the paracoxal suture', which in his terminology corresponds to the location given by BRINDLEY (1934). AFZAL & SAHIBZADA (1988) describes the formation of *vestibule* as follows: 'In the forms with a scent apparatus the *scent groove* or *vestibular groove* appears to correspond to the paracoxal suture of such primitive forms as Orthoptera, Blattaria, Dermaptera and Neuroptera. The scent groove, therefore, divides the precoxal bridge into the anterior laterale (procoxale or anepisternum plus pre-episternum) and the posterior laterale or the antecoxale (katepisternum). […] The scent groove originates beneath this ring [i.e., internal orifice] and runs laterally in variably directions. A fold of the anterior laterale is reflexed above the scent groove and the gap left by this fold (so called scent-fold) is known as the ostiole. The scent fold may make a secondary connection with the antecoxale, thus forming a closed passage or the *scent vestibule* (or simply *vestibule*). The vestibule covers the scent groove area and reduces the ostiole to the outer end'. In Rhopalidae, the *vestibule* is secondarily missing and the scent glands communicate directly with the exterior at the metacoxal bases (HEPBURNE & YONKE 1971, AHMAD & AFZAL 1978b).

DHIMAN (e.g., 1984, 1985, 1988) used in his papers the term *atrium*. According to DHIMAN (1984), the secretion from the gland is carried ‘into the reservoir and from there into the *atrium* of scent gland ostiole [...]’ and ‘the *atrium* empties into the scent gland ostiole’, which corresponds to the definition of *vestibule*. However, DHIMAN (1985) wrote: ‘the scent gland orifice leads into a swollen chamber, the *atrium* or evaporatorium, which is connected through duct to common reservoir.’ Also in his subsequent paper (DHIMAN 1988) marked the internal surface of vestibule as ‘evaporatory surface’ and stated that the ‘evaporation’ take place here. It is apparent that DHIMAN (1985, 1988) incorrectly considered the presence of mycoid surface inside vestibule and it is very improbable that evaporation takes place here. DHIMAN (1983, 1984) also used the term *scent ridge* which is very hard to interpret from his drawings, but it is possibly meaning the elevated dorsal (= inner) wall of the *vestibule* in internal view (cf. PARSONS (1960, *Gelastocoris oculatus*): ‘across the precoxal bridge runs a deep stink groove which produces a high *stink ridge* internally’). The list of synonyms of the *vestibule* used throughout the Pentatomomorpha is given in Appendix 2 (p. 155).

3.1.7. Ostiolar plate

This scarcely used term refers to the elevated anteromedian part of metapleuron bearing the external scent efferent system, which is sometimes well delimited from depressed posteriori and lateral parts of metapleuron. SINCLAIR (2000) used this term in descriptions of Tessaratomidae: Oncomerinae, while MCDONALD & CASSIS (1984) used its variant *(raised) osteolar plate* in Scutelleridae.

3.1.8. External scent efferent system

The external scent efferent system corresponds to the part iii) of the ‘*metathoracic efferent system*’ by STADDON (1979), including the ostiole and associated structures – the peritreme and the evaporatorium. While the ostiole and peritreme are always situated on metapleuron, the evaporatorium regularly crosses to mesopleuron and in Plataspidae even on propleuron (GAPUD 1991, KMENT & VILÍMOVÁ in press). Several authors followed STADDON (1979) and used various modifications of his ‘*metathoracic efferent system*’ referring to pleural parts of metathoracic scent apparatus, e.g., CASSIS (1995), CASSIS & VANAGS (2006), SCHWARTZ (2008), SCHUH et al. (2007, 2009), and KMENT & VILÍMOVÁ (in press). HASAN & KITCHING (1993) used the term *external scent apparatus* as well as *metathoracic scent apparatus* as its synonym. Imtiaz Ahmad and his followers named the same structures many times by more vague terms, *metathoracic scent complex* and *metathoracic scent gland complex* (e.g., AHMAD et al. 1992; AHMAD & MOIZUDDIN 1990a, 1992; AHMAD & KAMALUDDIN 1989; MOIZUDDIN & AHMAD 1990). The list of synonyms of the *external scent efferent system* used throughout all the Heteroptera is given in Appendix 2 (p. 157).

3.1.9. Ostiole

NICHOLS & SCHUH (1989) defined *ostiole* as 'a small opening (Borror); in Heteroptera (Hemiptera), external opening of metathoracic scent gland'. *Ostiole* is a simple opening of various shape (round, oval, guttiform, slit-like) [Figs. 22, 37, 46, 58, 80, 100, 133, 188] located on metapleural surface in one plane, situated usually between meso- and metacoxae, and transporting the MTG secretion out on the external surface of the pleuron (KMENT & VILÍMOVÁ in press). There exist many synonyms of the *ostiole*. This term competes with several variants of terms *opening* and especially *orifice* (or *external orifice*), which were frequently used in the literature. However, NICHOLS & SCHUH (1989) defined *orificium* and *orifice* rather vaguely as 'the anal or genital opening' and 'opening of salivary duct on labial lonchus'. Therefore, I prefer herein the more specific term *ostiole*. The terminology is further complicated by confusing usage of the *ostiole* and its synonyms, inconsistently for both internal orifice and (external) *ostiole* (e.g., REMOLD 1962, 1963; COBBEN 1978; MOIZUDDIN & AHMAD 1980). To illustrate the general confusion in the terminology, two additional examples should be mentioned: DHIMAN (1988) used the term *scent gland ostiole* for peritreme in shape of auricle in Largidae, while AHMAD & KAMALUDDIN (1989) duplicated the terms in following statement '*metathoracic scent gland ostioles* with an oval aperture [...]'. The list of synonyms of the *ostiole* used throughout the Pentatomomorpha is given in Appendix 2 (p. 159).

The *ostiole* is secondarily elongated in Tessaratomidae (especially in Tessaratomidae *sensu stricto*) because the 'roof' of the vestibule is incised mesially and the *ostiole* is thus opened in two planes (both ventrally and laterally), this modification being called the

ostiolar groove (= *peritremal groove* of MOIZUDDIN et al. (1992)) (KMENT & VILÍMOVÁ in press).

3.1.10. Periostiolar depression

Periostiolar depression is the dish-like depression adjoining laterally, posterolaterally, or posteriorly the ostiole in several groups of the Pentatomoidea (e.g. in Dinidoridae, Tessaratomidae: Oncomerinae, Pentatomidae: Discocephalinae, Phyllocephalinae, Podopinae) [Figs. 84–85, 165, 189] (KMENT & VILÍMOVÁ in press).

3.1.11. Vestibular scar

Despite the vestibule of the Pentatomoidea is completely closed (LARSÉN 1945, CARAYON 1971), in several taxa the narrow line of a scar-like appearance remains externally visible in place of adhesion of the scent groove margins.' This scar starts at the anteromedian margin of metacoxal cavity and continues laterally towards the proximal margin of ostiole (KMENT & VILÍMOVÁ in press). The term scar is used as English equivalent of Latin *stria*, which is defined in entomology as 'fine longitudinal impressed line' (NICHOLS & SCHUH 1989), a definition fitting well for the *vestibular scar*. Many authors illustrated this structure in their figures of the external scent efferent system, but did not mention it in their descriptions. Only ŠTYS (1964b, 1967) used the term *ostiolar groove* for the situation in Malcidae and Thaumastellidae, where the vestibular scar merges the mesially elongated, guttiform ostiole. However, the term *ostiolar groove* was more often applied either to a groove-shaped peritreme (see Appendix 2), or to a special type of ostiole in Tessaratomidae (KMENT & VILÍMOVÁ in press). In Phloeidae, LESTON (1953) called this structure as *episternal furrow*, while MOODY (1930) used the term *third coxal cleft* in his legend to figures of *Anasa tristis* (De Geer, 1775) (Coreidae).

The *vestibular scars* occur regularly in the Coreoidea [Fig. 5] (e.g., MOODY 1930; BRINDLEY 1934; HENRICI 1940; REMOLD 1962, 1963; GUPTA 1964; PACKAUSKAS 1994), the Lygaeoidea [Fig. 1] (e.g., ŠTYS 1967, SLATER 1979), the Pyrrhocoroidea [Fig. 4] (e.g., BRINDLEY 1934, DHIMAN 1983), as well as in several families of the Pentatomoidea, i.e., Thaumastellidae [Fig. 78] (ŠTYS 1964, JACOBS 1989), Cydnidae [Fig. 57] (FROESCHNER 1960, HASAN & KITCHING 1993, LIS 1994), Thyreocoridae [Fig. 35] (BRINDLEY 1934, ŠTYS & DAVIDOVÁ 1979), Parastrachiidae [Fig. 43], Phloeidae [Fig. 28] (LESTON 1953), and Plataspidae [Figs. 19–21] (REMOLD 1962, 1963).

3.1.12. Peritreme

The *peritreme* is generally defined as a sclerotic plate enclosing any body opening (NICHOLS & SCHUH 1989), in this case the ostiole, therefore it is sometimes called *ostiolar peritreme* (e.g., AHMAD & MOIZUDDIN 1990a, BECKER 1977b, FERNANDES & VAN DOESBURG 2000b, GAPUD 1991, GRAZIA et al. 2000). AFZAL & SAHIBZADA (1988) defined *peritreme* as follows: 'the margins of the ostiole (*peritreme*) [are] either prolonged into a *spout* or several ear-like lobes or *auricles'*. In the Heteroptera, the term *peritreme* usually refers to a variously shaped area of macroscopically smooth cuticle with characteristic microsculpture [Figs. 89, 189–190, 208] (**peritremal surface**, see below) continuing from the vestibule through ostiole and further laterad, being different from the evaporatorium and surrounding unspecialized pleural surface (see below) (KMENT & VILÍMOVÁ in press). The *peritremal surface* is usually elevated above the surrounding pleuron, being supported by variously shaped **supporting projection** [Figs. 89, 165, 189, 208]**.** The *peritremal surface* is often concave (at least basally), forming a **median furrow** [Figs. 101–102, 229] (KMENT & VILÍMOVÁ in press).

Despite *peritreme* is not the best term for description of this structure, it is widely accepted (see Appendix 2) and could be used regardless of its exact shape. The other terms sometimes used as synonyms of the peritreme in general (i.e., *auricle*, *spout*, *peritremal disc*) more often refer to one of its particular shapes (see below). Other synonyms of the *peritreme* which does not reflect any particular shapes, i.e., the *raised area* (SCHAEFER 1972, SCHAEFER et al. 1988), defined as the 'modified structures surrounding the opening of the scent gland' (SCHAEFER 1972), or *scent accumulation surface* (STADDON 1979, STADDON et al. 1985, OLAGBEMIRO & STADDON 1983), did not come into general usage. The concept of the *peritreme* by AHMAD & AFZAL (1978a) in *Catacanthus incarnatus* (Drury, 1773) (Pentatomidae: Pentatominae) is also unusual. They they distinguished the '*ostiolar peritreme*' (= the base of peritreme bearing the median furrow), the '*ostiolar groove*' (= the median furrow) and the '*ostiolar spout*' (= the apical part of the ruga-shaped peritreme without median furrow).

Several misleading definitions of the *peritreme* occur as well in literature. For example, NICHOLS & SCHUH (1989) listed *ostiolar peritreme* as a synonym of evaporatorium. FARINE (1988) regarded the *peritreme* as a part of *evaporative area* but in remarkably confused way (‘central area of the ostiolar perimeter [*sic*!] which serves as an evaporative area’, ‘characteristic lips of the evaporative area’ [for *peritreme*]). Also JOHANSSON (1957) and JOHANSSON & BRÅTEN (1970) sometimes referred to the *peritreme* as *evaporative area*, while otherwise they distinguished both structures. DURAK & KALENDER (2007a,b,c) and DURAK (2008) counted *ostiolar groove* [meaning *peritreme*] as part of their broadly defined *evaporation area*. LESTON (1953) listed ‘*peritreme* (*evaporatorium*) [*sic*!]’ as synonyms in Phloeidae. The list of synonyms of the *peritreme* used throughout the Pentatomoidea is given in Appendix 2 (p. 165).

The following six basic shapes of *peritreme* (i.e., the ‘*peritrematic modifications*’ *sensu* HOFFMAN (1971)) can be distinguished. However, transitional states between them as well as some exceptional shapes exist. Evidence that at least some of these types evolved several times independently within Pentatomoidea exists (cf. GAPUD 1991).

i) **Auricle.** NICHOLS & SCHUH (1989) defined the *auricle* as ‘variously shaped structure on metapleuron of adult bugs assisting in spreading the products of scent glands from the ostiolar groove upon the evaporatorium of the metathoracic scent gland’, the definition being well *aplicable* to the peritreme in general. The *auricle* in its narrow sense is characterized as an ear-shaped *peritreme*, usually short, its peritremal surface is parallel with surrounding pleuron and only slightly elevated (KMENT & VILÍMOVÁ in press). This shape is common in the Lygaeoidea [Fig. 2] and Pyrrhocoroidea [Fig. 3] (e.g., SLATER 1979, HENRY 1997b). In the Pentatomoidea, the peritreme shape of the Thaumastellidae can be classified as an *auricle* [Figs. 78–80] (SCHAEFER & WILCOX 1971). On the other hand, the *auricles* of Coreoidea (usually two) [Fig. 6] refer to parts of more complex structure derived from simple plesiomorfic *auricle* (e.g., SCHAEFER (1972): Coreidae: ‘*spout* is reduced and the *raised area* [= *peritreme*] consists largely of several earlike lobes (*auricles*)’; SCHAEFER (1999): Alydidae: ‘lateral and anterior *auricles’*; SCHAEFER (1981): Stenocephalidae).

ii) **Spout**. this type of *peritreme* is formed by a well-developed supporting projection bearing the peritremal surface, which is perpendicular or oblique to pleural surface, rarely parallel, always distinctly elevated above surrounding pleuron, rather short (KMENT & VILÍMOVÁ in press). SCHAEFER (1972) defined the *spout* simply as ‘prolongation of opening’. The *spout* occurs in Berytidae (HENRY 1997b) and several families and subfamilies of the Pentatomoidea [Figs. 8, 22, 85, 89, 165, 189] (e.g., KUMAR 1974a,b;

GHAURI 1982, 1988; DURAI 1987; LIS 1990; KOCOREK 2000; SINCLAIR 2000b, KMENT & VILÍMOVÁ in press). However, nomenclature of this type of *peritreme* is rather confused. The SCHAEFER's (1964, 1972) use of the *spout* covers both the *auricle* and *spout*. KUMAR (1974a,b) or WOODWARD (1953) used *scent gland spout* as synonym of *peritreme* regardless of its actual shape; it is documented by the KUMAR's (1974a) definition of the *scent gland spout* as 'canal leading from the external opening of the metasternal scent gland'. Many other authors called this shape of *peritreme* the *auricle* (KOCOREK & LIS 2000, GHAURI 1982, KAMALUDDIN & AHMAD 1988a, KMENT 2008, LARIVIÈRE 1992, ROLSTON 1992, etc.).

iii) **Groove**. The *peritreme* is narrow and usually long, the peritremal surface is parallel with surrounding pleuron, the median furrow is well developed in most of its length, apex is usually rounded. This type occurs particularly in the Pentatomidae and Scutelleridae [Figs. 101, 107–109, 149–150] (e.g., MALOUF 1933, MCDONALD & CASSIS 1984, THOMAS 1992, DURAK & KALENDER 2007b, KMENT & VILÍMOVÁ in press). HASAN (1990a,b, 1991b) and HASAN & KITCHING (1993) used the term *peritremal groove* for a median furrow on the peritremal surface of a *spout*, *groove*, or *disc*.

iv) **Ruga.** The *peritreme* is narrow and usually long, the peritremal surface is parallel with surrounding pleuron, the median furrow is short and developed only basally, apical half or more of the *peritreme* length is ridge-shaped, apex is usually pointed. This type occurs particularly in Pentatomidae [Figs. 172, 179, –109, 218–220, 224] (e.g., RIDER 2008a, KMENT & VILÍMOVÁ in press). Some authors used the term *ruga* in broad sense, for example RIDER (1994) distinguished *ostiolar ruga acuminate* fitting well for the *ruga* in present usage, while *ostiolar ruga auriculate* corresponds to the *spout*.

v) **Disc.** The *peritreme* is enlarged into variously shaped *disc* widening laterad, the peritremal surface is parallel with and slightly elevated above surrounding pleuron, the median furrow is usually obsolete. This type occurs in several representatives of Cydnidae [Fig. 59], Parastrachiidae [Fig. 44], Acanthosomatidae [Figs. 128, 138], Scutelleridae [Figs. 116], and Pentatomidae [Fig. 151] (KMENT & VILÍMOVÁ in press). HASAN (1990a,b, 1991b) and HASAN & KITCHING (1993) used the term *peritremal disc* in broad sense, including the *spout*, *groove*, and *ruga*.

vi) **Peritremal lobes.** The *peritreme* is formed by swollen anterior and posterior margin (*lobes*) of large ostiolar groove. The *lobes* are distally covered with peritremal surface.

This type is specific for the Tessaratomidae *sensu stricto* (Moizuddin et al. 1992, Kment & Vilímová in press).

The traditional conception of the *peritreme* in Cydnidae differs from the above description. Froeschner (1960) gave the following definition: ‘The osteole occurs in a cuticular modification referred to here as the peritreme. The peritreme consists of a pair of close-set transverse ridges which may or may not be in contact along their summits; the anterior ridge is usually more strongly developed and frequently modified beyond the osteolar opening. When present, this apical modification furnishes good characters for definition of genera. The osteolar opening may be situated ventrally on the peritreme, or posteriorly where it is concealed by a projecting ledge’. Lis (1994) accepted the Froeschner’s (1960) conception in verbatim, as well as other authors writing about the burrower bugs (e.g., Linnavuori 1993, Mayroga Martinez 2002). The largest part of the *peritreme sensu* Froeschner (1960) is in fact the ventral (= outer) wall of the vestibule. This wall is medially bearing the vestibular scar dividing it into anterior and posterior part (the so-called transverse ridges *sensu* Froeschner (1960)). The vestibular scar ends at proximal margin of the ostiole. In Cephalocteinae and Cydninae: Geotomini the ventral wall of vestibule is often elevated, the posterior part of the vestibular elevation (= the posterior transverse ridge) ends at the ostiole, while the anterior part (= anterior transverse ridge) is projecting laterad beyond the ostiole and forming a lobe-shaped structure, the **terminal lobe** *sensu* Froeschner (1960) (= *apex of peritreme* – Lis 1993a,b, 1994, 2000a; *lóbulo terminal* – Mayroga Martinez 2002; etc.) [Figs. 63–75]. The peritremal surface (i.e., the *peritreme* in sense herein) starts at the ostiole and extends laterad as a smooth polished area which is distinct from the surrounding evaporatorium (= *polished part of peritreme* – Lis 1994, 1996a,b); the peritremal surface forms a groove or a disc, or it covers the posterior margin or the entire ventral surface of the *terminal lobe* (= *auricle sensu* Froeschner 1960; Lis 1990c, 1993a,b, 1994, 2000a), sometimes with attached claw-like projection. Only Dethier (1974) presented slightly different conception of the peritreme within Cydnidae; his term *gouttière odorifique principale* corresponds to anterior part of the vestibular elevation (= the anterior transverse ridge *sensu* Froeschner (1960)), *gouttière odorifique secondaire* to meso-metathoracic suture including the spiracle, *gouttière odorifique primaire* to a depressed groove posteriorly on mesopleuron, and *péritrème* stands for the polished peritremal surface. More synonyms of the particular structures are listed in Appendix 2.

3.1.13. Evaporatorium

Some authors used this term *evaporatorium* (pl. *evaporatoria*) incorrectly as *evaporatoria* in singular (‘*evaporatoria* is’ – e.g., AFZAL & SAHIBZADA 1988, AHMAD et al 1992, AHMAD & MOIZUDDIN 1990a, SIDDIQUI et al. 1992). NICHOLS & SCHUH (1989) defined *evaporatorium* as ‘the part of cuticle associated with the orifice (and/or ostiolar groove, auricle), modified for assistance in rapid evaporation of scent gland products, provided with a specialized microsculpture, and, in the case of adult metathoracic scent gland, occupying a varying portion of thoracic pleuron’. The *evaporatorium* usually appears as a dull area, being covered with the mycoid microsculpture (see below). *Evaporatorium* (if developed) is always present on metapleuron, surrounding the ostiole and peritremal surface, often reaching or surrounding the metathoracic spiracle, and extending onto mesopleuron, rarely even onto propleuron and/or sternal regions of thorax [Figs. 8, 19, 36, 56, 59, 79, 84–85, 97, 130, 132, 185–187, 228]. According to its position, some authors distinguish **mesopleural** and **metapleural evaporatorium** (e.g., BECKER 1977a,b, BECKER & GRAZIA 1986, LIS 2000, KMENT & VILÍMOVÁ in press), while the terms *supra-auricular* and *postauricular* [*sic*!] *evaporatorium* were used only by ŠTYS & DAVIDOVÁ (1979) in Thyreocoridae.

Most of the terms ever used for the *evaporatorium* are related to this term (e.g., *evaporatory area*, etc.), while few others refer either to its dull appearance (e.g., *opaque surface* – MCATEE & MALLOCH 1933; *plaques mates* – SIGNORET 1881; *pruinose area* – SAILER 1952) or its microsculpture (*flaked cuticle* – JOHANSSON & BRÅTEN 1970; ‘*Pilzchen*’*-Areal* – REMOLD 1962). The only exceptions are *ostiolar area* and *ostiolar surface* (MCATEE & MALLOCH 1933), *ostiolar peritreme* (NICHOLS & SCHUH 1989), and *pleural scent area* (STADDON 1979). Some authors as well included the peritreme as a part of the evaporatorium, or used the term(s) inconsistently in different ways (LESTON 1953, JOHANSSON 1957, JOHANSSON & BRÅTEN 1970, FARINE 1988) (see above paragraph about the peritreme). DURAK & KALENDER (2007a) defined the *evaporation area* as follows ‘ostiole, ostiolar groove and their surrounding are collectively called evaporation area’ (see also DURAK & KALENDER 2007b,c, DURAK 2008), but DURAK & KALENDER (2009) used the term in the common narrower sense. WEIRAUCH (2006) used the term *evaporatorium* also for probably non-homologous evaporative structure adjoining the metathoracic scent gland ostiole of Ectrichodiinae (Reduviidae) which lacks the mycoid microsculpture. Similarly, SCHUH (2006a) used the term ‘metathoracic scent-gland evaporatory area’ in

Plokiophilidae, despite its microsculpture does not consist of mushroom bodies. The list of synonyms of the *evaporatorium* used throughout the Pentatomoidea is given in Appendix 2 (p. 173).

3.1.14. Evaporatory channel

LARIVIÈRE & LAROCHELLE (2006) used the term *evaporatory channel* (also as *channel of evaporatory area* and *channel-like evaporatory area*) in the Aradidae to describe a depressed channel covered with mycoid surface conducting the secretion from the peritreme towards the lateral pleural margin. A similar structure in *Triplatyx* Horváth, 1904 (Pentatomidae: Pentatominae) was described by KMENT (2008) as an *outlet channel*.

3.1.15. Gyrification

The surface of evaporatorium can have a pattern of shallow to deep furrows and low to high wrinkles, resembling, if well-developed, the brain surface [Figs. 36, 39–40, 84–85, 101, 165]. This macrosculpture was described by several authors who usually referred to the shape without proper naming this pattern. The following characteristics should be mentioned as examples: ‘evaporatoria plissé [= pleated]’ (Cydnidae: DETHIER 1974); ‘evaporatorium rugose’ (Pentatomidae: FROESCHNER 1981); ‘evaporatorium […] obscurelly rugose’ (Pentatomidae: RUCKES 1959a); ‘evaporatorium vermiculately rugose’ (Pentatomidae: LINNAVUORI 1982); ‘evaporatorium coarsly and prominently transverselly rugose’ (Pentatomidae: RUCKES 1958b); ‘evaporatoria wrinkled’ (Plataspidae: AHMAD & MOIZUDDIN 1992); ‘wrinkled evaporative surface’ (Berytidae: HENRY 1997c); ‘evaporation area with a vermiculate pattern’ (Pentatomidae: GROSS 1978); ‘evaporative area ridged’ (Scutelleridae: MCDONALD & CASSIS 1984); ‘evaporative areas […] bearing […] longitudinal ridges’ (Cydnidae: LIS 2000b); ‘a series of irregular ridges’ (Alydidae, Coreidae: SCHAEFER 1965); ‘parallel ridges to increase the evaporative surface’ (Coreidae: SCHAEFER 1968); ‘evaporative area often thrown into hills and valleys’ (Trichophora: SCHAEFER 1972); ‘evaporatorium […] grooved / smooth’ (Thyreocoridae: ŠTYS & DAVIDOVÁ 1979); ‘a smooth region along posterior margin of peritreme followed by a region of parallel furrows, in turn followed by a larger region of irregular furrows forming most of metasternal evaporatoria, mesosternal part of evaporatoria uniformly rough-textured’ (Pentatomidae: *Catacanthus*: AHMAD & AFZAL 1978a). The only terms used for this macrosculpture are **gyrification** (Pentatomidae: KMENT 2008, KMENT & JINDRA 2009; Pentatomoidea: KMENT & VILÍMOVÁ in press) and *texture of evaporatoria* (Scutelleridae: AFZAL et al. 1982).

3.2. Microsculpture

The peritreme, evaporatorium, and vestibule are defined as well by their characteristic microsculptures, which differ from each other and the surroundung pleural surface. Two basic types, the **mycoid microsculpture** and the **peritremal microsculpture** are recognized (see below). The usually irregular, e.g. scale-like or vermiculate, microsculpture in patches where the mycoid surface merges peritremal surface or typical pleural surface is called the **transitional microsculpture** [Figs. 11, 49, 82, 167, 171, 199, 204, 231] (KMENT & VILÍMOVÁ in press). The hair-shaped or column-shaped projections in the opening of the metathoracic spiracle are called *filter processes* (CARVER 1990) or *tree-like structures* (KITAMURA et al. 1984) [e.g., Figs. 60, 88, 121, 168–169, 197].

3.2.1. Mycoid microsculpture

The area covered by *mycoid microsculpture* is refered to as the **mycoid surface** (CARVER 1990, CARVER et al. 1991, HENRY 1997b, KMENT & VILÍMOVÁ in press). This type of microsculpture occurs inside the vestibule as well as externally on evaporatorium. See Appendix 3 for the list of synonyms (p. 176).

The *mycoid microsculpture* consists of **mushroom bodies** (= *processus mycoïdes* [sg.], *processi mycoïdes* [pl.]), each composed of a flat, polygonal to rounded **cap** [Figs. 83, 203], and a slender **stem** bearing the *cap* [Fig. 203]; the *caps* are at the same level as surrounding pleural surface [Fig. 83, 204]. The angles of the polygonal *caps* are connected by **bridges** [Figs. 83, 203], 3–6 *caps* and their interconnecting *bridges* surround a depressed **alveole** [Fig. 83, 202–203]; the entire microsculpture forms a net of the connected *mushroom bodies* and *alveoles* [Figs. 62, 82, 90, 136–137, 142, 202]. The bottom of *alveoles* is usually covered by low ridges (**trabeculae** [pl.]) of somewhat mycelium-like appearance [Fig. 90, 136–137, 142, 202–203]. There are scattered sensoric setae among the *mushroom bodies* [Figs. 11, 27, 61–62, 90, 103–105, 142]. The terminology used above follows mostly CARAYON (1971), for synonymy see Appendix 3.

The morphogenesis of the *mycoid microsculpture* of the evaporatorium was described in detail by FILSHIE & WATERHOUSE (1969) in *Nezara viridula* (Linnaeus, 1758). For more information and SEM photographs see also REMOLD (1962, 1963), JOHANSSON & BRÅTEN (1970), CARAYON (1971), HEPBURN & YONKE (1971), DETHIER (1974), MCDONALD & EDWARDS (1978), STADDON (1979), KITAMURA et al. (1984), CARVER (1990), HASAN (1990), CARVER et al. (1991), MCDONALD (1992), HASAN & KITCHING (1993), NAGNAN et al. (1994), and KMENT & VILÍMOVÁ (in press).

3.2.2. Peritremal microsculpture

The area covered by the *peritremal microsculpture* is refered to as **peritremal surface** (KMENT & VILÍMOVÁ in press). The macroscopically lustrous *peritremal surface* is not covered by the mushroom bodies (CARAYON 1971, STADDON 1979). Inside the vestibule, the *peritremal surface* is quite smooth but it is gradually more rough where it continues onto the peritreme (STADDON 1979, KMENT & VILÍMOVÁ in press). The *peritremal microsculpture* outside the vestibule can be scale-like, thorn-like, hairy, wrinkled, or nearly smooth, depending on the families [Figs. 13, 24, 38, 47, 80, 102, 134, 141, 145, 166, 190, 194, 204, 228, 230] (see JOHANSSON & BRÅTEN 1970; CARAYON 1971, 1972; DETHIER 1974; STADDON 1979; WOOD & MCDONALD 1984; FARINE 1988; CARVER 1990; HASAN 1990; DAVIDOVÁ-VILÍMOVÁ 1993; LIS 2000b; XUE & BU 2007; KMENT & VILÍMOVÁ in press).

The *peritremal surface* was first described by MOODY (1930) as *smooth area*. It begins in front of the internal orifice, follows along the anterior wall of the vestibule, and is curved posteriorly so that it approaches the ostiole at an obtuse angle. The *peritremal surface* originates inside the metafurca (the metasternal apophyseal pit *sensu* STADDON (1979)) and continues through the ostiole towards the (usually ventral) surface of peritreme. STADDON (1979) referred to the *peritremal surface* inside the vestibule as *apophyseal surface* or *central stripe*.

4. Structure of the external scent efferent system and its diversity in the Pentatomoidea

4.1. Urostylididae Dallas, 1851

(Figs. 7–14)

Since Grazia et al. (2008) raised Saileriolinae to family rank, the family Urostylididae *sensu stricto* includes only one subfamily with about 170 species distributed almost exclusively in eastern Palaearctic and Oriental region. The subfamily Urostylidinae is divided in two tribes – Urolabidini (1 genus – *Urolabida* Westwood, 1837) and Urostylidini (7 genera) (Ahmad et al. 1992; Rider 2006b, 2009).

In the examined representatives of Urostylididae (*Urolabida*, *Urochela* Dallas, 1850 [Fig. 14], *Urostylis* Westwood, 1837 [Figs. 7–13]), the vestibule is short and more or less elevated distally at the base of ostiole; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, large, round to oval, opening postrolaterally; the periostiolar depression is missing; the peritreme in a form a distinctly elevated spout joins the distal margin of ostiole; the evaporatorium is large, covering anterior and anteromedian parts of metapleuron (not reaching the lateral margin), and ca. posterior half of mesopleuron, reaching its lateral margin; the gyrification of evaporatorium is developed, shallow. The microsculpure of the external scent efferent system of *Urostylis lateralis* Walker, 1867 is shown in Figs. 10–13.

Additional illustrations of the external scent efferent system of Urostylididae were published by Distant (1902), Ahmad et al. (1992) and Ren & Lin (2003).

4.2. Saileriolidae China & Slater, 1956

(Figs. 15–16)

The little known taxon was originally established as the subfamily of Urostylididae (Rider 2006b), recently elevated to the family rank by Grazia et al. (2008). Only three genera of small bugs (2.5–4.5 mm) – *Bannacoris* Hsiao, 1964 (1 species), *Ruckesona* Schaefer & Ashlock, 1970 (1 species) and *Saileriola* China & Slater, 1956 (2 species) – distributed in southern China, Vietnam, Thailand, and Kalimantan belong to the taxon (Schaefer & Ashlock 1970, Schuh & Slater 1995, Rider 2006b).

SCHAEFER & ASHLOCK (1970) characterized the external scent efferent system of Saileriolinae as follows: ‘Metathoracic scent gland opening at meso-metasternal border; opening long, slit-like, transverse; no peritreme (but edges of slit slightly flared) or evaporative area.’ However, HSIAO (1964) mentioned ‘ostiola and ostiolar canal absent’ in the description of *Bannacoris*.

I examined one specimen of each *Bannacoris arboreus* Hsiao, 1964 (Fig. 15) and *Ruckesona vitrella* Schaefer & Ashlock, 1970 (Fig. 16) but neither ostiole nor other parts of the external scent efferent system were found. At least, it is certain that neither peritreme nor evaporatorium are developed in the Saileriolidae. It is possible, that SCHAEFER & ASHLOCK (1970) mistook the metathoracic spiracle of *R. vitrella* for the ostiole (cf. Fig. 15). The detailed SEM study of the Saileriolidae is necessary.

4.3. Plataspidae Dallas, 1851

(Figs. 17–27)

Fifty nine genera, including about 530 species, belong to the family Plataspidae, distributed exclusively in the Eastern Hemisphere. The genera are classified in two subfamilies, Plataspinae and Coptosomatinae, however, the subfamiliar classification has not yet been proposed for most of the genera (DAVIDOVÁ-VILÍMOVÁ 2006, RIDER 2009).

The condition in *Caternaultiella* Spinola, 1850 (Fig. 17) and *Probaenops* White, 1842 (both unplaced) seems to be plesiomorphic. The ventral side of thorax is convex; the vestibule is slightly elevated distally at the base of ostiole; the vestibular scar is developed; the ostiole is shifted slightly laterad, situated ca. in one third of metapleuron width, opening posteriorly; the periostiolar depression is developed; the peritreme has a form of a short, slightly elevated spout, either distinctly separated (*Caternaultiella*), or anteriorly fused with the pleuron (*Probaenops*), the peritremal surface varies from perpendicular (*Caternaultiella*) to nearly parallel (*Probaenops*) with pleuron surface; the evaporatorium is very large, covering all mesopleuron and metapleuron and surpassing even on posterior margin of propleuron, however, evaporatorium does not extend on sternum.

In the Plataspidae with flat body venter, the ostiole is shifted more laterad, situated ca. in half-width (*Ceratocoris* White, 1841, *Heterocrates* Amyot & Serville, 1843) or in the lateral one third of metapleuron width (*Brachyplatys* Boisduval, 1835 [Fig. 18], *Coptosoma* Laporte, 1832 [Fig. 19–27], *Spathocrates* Montandon, 1893), either opening posteriorly and accompanied with periostiolar depression (*Brachyplatys*, *Coptosoma*, *Heterocrates*, *Spathocrates*) or opening ventrally, without periostiolar depression (*Ceratocoris*); spout short (*Brachyplatys*, *Coptosoma*, *Spathocrates*) to long (*Heterocrates*), anteriorly merging with metapleuron and only slightly elevated but well emarginated posteriorly, in *Ceratocoris* reduced to a flat smooth peritremal surface hardly elevated above surrounding metapleuron; lateral and posterolateral mesopleural margin of several representatives (*Brachyplatys*, *Coptosoma* [*partim*], *Spathocrates*) is smooth and lustrous, similar to peritreme to which apex it is continuous; the evaporatorium coveres nearly entire pleuron (*Heterocrates*) or extends to sterna and coveres nearly all ventral surface of thorax (*Brachyplatys*, *Coptosoma*). The microsculpure of the external scent efferent system of *Coptosoma scutellatum* (Geoffroy, 1785) is shown in Figs. 22–27. Tady bych popis rozdelila do vice vet. Takto s citacemi rady rodu je hodne neprehledne.

After AHMAD (1990) the peritreme is completely lost in the *Pseudoponsila* Montandon, 1895, considering this character state to be an apomorphy. Additional illustrations of the external scent efferent system of Plataspidae were given by DISTANT (1902), AHMAD (1990), AHMAD & MOIZUDDIN (1992), and CACHAN (1952b), SEM photographs of microsculpture by CARAYON (1971).

4.4. Phloeidae Amyot & Serville, 1843

(Figs. 28–30)

The family includes two subfamilies of the flattened corticicolous true bugs. The Neotropical Phloeinae includes two genera – *Phloea* Lepeletier & Serville, 1825 with 2 species and monotypic *Phloeophana* Kirkaldy, 1908 (LESTON 1953, GRAZIA et al. 2008).

In *Phloeophana longirostris* (Spinola, 1837) (Figs. 28–29), the vestibule is slightly elevated in distal half; the vestibular scar is well developed; the ostiole is strongly shifted laterad and situated near the lateral margin of metapleuron, small and opening ventrally; the peritreme is strongly reduced into short triangular projection at distal margin of the ostiole; the evaporatorium is rather large, covering anterior and anterolateral parts of metapleuron, and posterior and lateral parts of mesopleuron. The condition in the *Phloea* species is similar.

ROLSTON & MCDONALD (1979) used the position of ostiole as a character distinguishing Phloeinae from other New World families of Pentatomoidea.

The subfamily Serbaninae, including only *Serbana borneensis* Distant, 1906 from Kalimantan, was originally described in Phloeinae (DISTANT 1906). LESTON (1953) arised new subfamily Serbaninae, which he transferred to the Pentatomidae. Recently, GRAZIA et al. (2008) returned the taxon as the subfamily back to Phloeidae

The vestibule of *S. borneensis* is elevated distally (Fig. 30); the vestibular scar is not apparent; the ostiole is shifted laterad, slightly behind half-width of metapleuron, opening ventrally; the peritreme in a form an elongated spout; the evaporatorium is large, covering ca. anterior two thirds of metapleuron length, and posterior and lateral parts of mesopleuron.

4.5. Thyreocoridae Amyot & Serville, 1843

(Figs. 31, 34–41)

The family has been for a long time accepted as a subfamily within the Cydnidae (e.g., SCHUH & SLATER 1995). It includes nine genera (ca. 200 species) distributed in the Western Hemisphere, and three genera (eight species) from the Eastern Hemisphere (MCATEE & MALLOCH 1933, LIS 2006b). DOLLING (1981) classified the New World genera in the subfamily Corimelaeninae, while the Old World genera in the Thyreocorinae, both of them within his wide conception of the Cydnidae. PLUOT-SIGWALT & LIS (2008) and GRAZIA et al. (2008) supported the independent status of the family, however, GRAZIA et al. (2008) suggested to incorporate the Parastrachiinae as subfamily into the Thyreocoridae.

In *Thyreocoris scarabaeoides* (Linnaeus, 1758) (Figs. 34–41), the vestibule is elevated only distally at the base of ostiole; the vestibular scar is developed and well visible; the ostiole is only slightly shifted laterad from the position between meso- and metacetabulum, drop-shaped, elongated mesially, opening ventrally; the periostiolar depression is missing; the peritreme is narrow and elongated, parallel with anterior metapleural margin, distinctly elevated above surrounding metapleuron, forming a possible transition between the spout and groove; the peritreme apically touches a smooth, lustrous, groove-shaped ‘peritreme-like’ structure of mesopleuron which begins on the posterior mesopleural margin and then curves slightly anterolaterad and joins the lateral margin of mesopleuron; the evaporatorium is large, covering ca. anterior third of metapleuron length, while the mesopleural evaporatorium is divided by the smooth ‘peritreme-like groove’ into two parts – the small posterolateral part, forming a continuation of metapleural evaporatorium, and the large anteromedian part covering most of the posterior and median parts of mesopleuron, but not reaching the lateral margin of mesopleuron; gyrification developed. The microsculpure of the external scent efferent system of *T. scarabaeoides* Walker, 1867 is shown in Figs. 37–41.

The external scent efferent system in *Galgupha impressa* Horváth, 1919 (Fig. 31) is very similar to *T. scarabaeoides*, however, the peritreme is not elevated above surrounding pleuron, it is flat, without median furrow, except base itself, and the ‘peritreme-like’ structure of mesopleuron and entire evaporatorium.

The presence of ‘peritreme-like’ structure on mesopleuron dividing the evaporatorium into two parts seems to be common feature in all the examined representatives of *Allocoris* McAtee & Malloch, 1933, *Galgupha* Amyot & Serville, 1843, *Carrabas* Distant, 1908, and *Thyreocoris* Schrank, 1801. This character thus can be a diagnostic feature of the Thyreocoridae. The peritreme of species examined varies ca. between the two types mentioned above, sometimes can resemble the groove or ruga.

Additional illustrations of the external scent efferent system of Thyreocoridae were given by ŠTYS & VILÍMOVÁ (1979).

4.6. Parastrachiidae Oshanin, 1922

(Figs. 32–33, 42–49)

The East Asian genus *Parastrachia* Distant, 1883 (2 species) was originally placed in pentatomid subfamily Asopinae, subsequently in the tribe Strachiini in Pentatominae, in the cydnid subfamily Sehirinae, or as the independent subfamily Parastrachiinae within Cydnidae (DOLLING 1981, SCHAEFER et al. 1988, THOMAS 1994a, SCHUH & SLATER 1995, LIS 2006c). SWEET & SCHAEFER (2002) elevated Parastrachiinae to the family level. GRAZIA et al. (2008) included *Dismegistus* Amyot & Serville, 1843 (excluded formerly from Cydnidae by DOLLING (1981) and treated as *incertae sedis* by RIDER (2009)) as sister group of *Parastrachia* in the monophyletic Parastrachiinae, which they placed as a subfamily within Thyreocoridae. However, PLUOT-SIGWALT & LIS (2008) did not accept any closer relationship of Parastrachiidae and Thyreocoridae based on a structure of spermathecae. Meanwhile, I prefer to retain Parastrachiidae as the distinct family untill the complicated relationships within the Cydnidae *sensu lato* will be definitely resolved (see also KMENT & VILÍMOVÁ in press). The species of the family have aposematical pattern.

In *Parastrachia* species (*Parastrachia nagaensis* Distant, 1908 on Figs. 32, 42–49), the vestibule is not elevated; the vestibular scar is well developed; the ostiole is situated between meso- and metacetabulum, narrow and slit-like, opening ventrally; the periostiolar depression is missing; the peritreme has a form of a large disc elevated above surrounding pleuron; the evaporatorium is reduced, developed only on metapleuron, narrowly surrounding the vestibular scar, ostiole, and peritreme, flat, gyrification is not developed. The microsculpure of the external scent efferent system of *Parastrachia nagaensis* is in Figs. 45–49.

In *Dismegistus sanguineus* De Geer, 1778 (Fig. 33), the external scent efferent system is even more reduced; the narrowly spindle-shaped ostiole opens posteriorly; the peritremal surface is not macroscopically distinct; the only remnant of peritreme is probably represented by a narrow shallow groove surrounded by narrow stripe of evaporatorium, which follows the anterior metapleural margin and reaches slightly beyond the metathoracic spiracle.

4.7. Cydnidae Billberg, 1820

(Figs. 50–76)

The concept of Cydnidae is the most controversial of all the pentatomoid family-group taxa. DOLLING (1981) included Thaumastellinae, Thyreocorinae, and Corimelaeninae, and SCHAEFER et al. (1988) also Parastrachiinae into Cydnidae *sensu lato*, however, these taxa are currently excluded from the family (e.g., SWEET & SCHAEFER 2002; LIS 2006b,c,d,e; GRAZIA et al. 2008, PLUOT-SIGWALT & LIS 2008). The more limited concept of the Cydnidae includes the subfamilies Amnestinae, Garsaurinae, Cephalocteinae, Cydninae, and Scaptocorinae (e.g., FROESCHNER 1960; LIS 1994, 2000d), however, the monophyly of this group is still questionable (GRAZIA et al. 2008; PLUOT-SIGWALT & LIS 2008). Recently, PLUOT-SIGWALT & LIS (2008) raised the Amaurocorinae to subfamily rank (previously a tribe within Sehirinae) and suggested closer relationship of the taxa in Cydnidae *sensu stricto* (i.e., Cephalocteinae + Cydninae + Sehirinae: Sehirini). The Cydnidae includes 89 genera and about 680 species distributed worldwide, however, their majority is known from warm and tropical parts of the Old World (LIS 2006d). The external scent efferent system of Cydnidae is commonly used to distinguish genera and species, and many line drawings and few SEM photographs are available in literature (e.g., FROESCHNER 1960; DETHIER 1974; LINNAVUORI 1993; HASAN & KITCHING 1993; LIS 1994, 2000b). Conditions of selected species are described below:

In *Amnestus spinifrons* (Say, 1825) (Fig. 50), the vestibule is short, not elevated; the vestibular scar is prominent; the ostiole is situated between meso- and metacetabulum, very large, V-shaped, widely opening ventrally; the periostiolar depression and terminal lobe are not developed; the peritreme has a form of a long and narrow groove, the peritremal surface begins inside the ostiole, is parallel with surrounding pleuron, the median furrow is quite deep in proximal half, while shallow in apical part; the evaporatorium is very large, covering anterior half of metapleuron and most of mesopleuron, reaching the lateral margin of both pleura; the metapleural evaporatorium is nearly flat, the mesopleural evaporatorium is shallowly and irregularly gyrificated.

In *Peltoxys typicus* (Distant, 1901) (Fig. 51), the vestibule is not elevated; the vestibular scar is prominent; the ostiole is situated between meso- and metacetabulum, rather large, V-shaped, opening ventrolaterally; the periostiolar depression and terminal lobe are not developed; the peritreme has a shape of a long groove, slightly widening and raising towards the apex, the peritremal surface has a distinct median furrow reaching nearly the apex; the evaporatorium is large, covering anterior part of metapleuron and posterior part of mesopleuron where reaching the lateral margin; the gyrification in a form furrows and wrinkles is not developed, but the evaporatorium is roughly punctured in the same way as the surrounding pleuron.

In *Tritomegas sexmaculatus* (Rambur, 1842) (Fig. 52), the vestibule is not elevated; the vestibular scar is prominent; the ostiole is situated between meso- and metacetabulum, small, V-shaped, opening ventrally; the periostiolar depression and terminal lobe are not developed; the peritreme has a shape of an elongated disc, anteriorly merging the pleuron, posteriorly and laterally well emarginated, the peritremal surface is nearly parallel with surrounding pleuron, only slightly sloping anteriad, nearly flat; the evaporatorium covers anterior part of metapleuron, posterior part of mesopleuron, and a narrow stripe along lateral mesopleural margin; the gyrification is shallow.

In *Legnotus limbosus* (Geoffroy, 1785) (Fig. 53), the structure of the external scent efferent system is very similar to *T. sexmaculatus*, only the ostiole is situated slightly more laterally, ca. between the lateral margins of meso- and metacetabulum; the peritremal surface is slightly convex, sloping anteriad; the evaporatorium is larger.

In *Chilocoris* (*Statanus*) *assmuthi* Breddin, 1904 (Fig. 54), the vestibule is short and not elevated; the vestibular scar is prominent; the ostiole is situated between meso- and metacetabulum, large, drop-shaped, opening posterolaterally; the periostiolar depression and terminal lobe are not developed; the peritreme has a shape of a very long and narrow groove, apically widening and curving posteriad, the peritremal surface is anteriorly merging the pleuron, posteriorly and laterally emarginated, and has a shallow median furrow except the flat apex; the evaporatorium is very large, covering anterior half of the metapleuron and most of the mesopleuron, reaching the lateral margins of both pleura; the evaporatorium is flat, not gyrificated.

In *Cydnus aterrimus* (Forster, 1771) (Figs. 56–62), the vestibule is short and elevated; the vestibular scar is developed but hardly visible in its distal half; the ostiole is situated between meso- and metacetabulum, large, drop-shaped, opening ventrally; the periostiolar depression and terminal lobe are not developed; the peritreme has a shape of an oval disc, its peritremal surface is parallel with surrounding metapleuron and convex except the base, anteriorly merging the pleuron, and emarginated both posteriorly and laterally; the evaporatorium is large, of rhombic outline, covering anterior and median parts of metapleuron, and posterior and median parts of mesopleuron between the mesopleural suture and the metathoracic spiracle, both parts of evaporatorium reach laterally to the distal margin of the metathoracic spiracle; the evaporatorium is irregularly gyrificated. The microsculpure of the external scent efferent system of *C. aterrimus* is shown in Figs. 58–62.

In *Microporus nigritus* (Fabricius, 1794) (Fig. 55), the vestibule is not elevated; the vestibular scar is prominent; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, large, oval, opening ventrally; neither the periostiolar depression nor the terminal lobe are developed; the peritreme has a form of a round elevated and emarginated disc, its peritremal surface being flat and parallel with surrounding metapleuron; the evaporatorium is large, covering anterior part of the metapleuron, and median part of the mesopleuron, not reaching the lateral pleural margin; the gyrification is hardly developed.

In *Scoparipes* (*Euscoparipes*) *affinis* Lis, 1990 (Fig. 63), the vestibule is elevated; the vestibular scar is developed but very fine; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, smal, oval, opening posteriorly; the periostiolar depression is shallow; the terminal lobe is developed, lobe-shaped, strongly flattened, sharply emarginated laterally, posteriorly merging the sabre-shaped peritremal surface; the peritremal surface is widening towards apex, flat, and nearly parallel with surrounding metapleuron, sharply emarginated posteriorly and laterally; the evaporatorium is very large, covering anterior and median parts of the metapleuron, and posterior and median parts of the mesopleuron, reaching the lateral mesopleural margin in its posterolateral angle; the evaporatorium is shallowly to deeply gyrificated in its different parts.

The following representatives of the Geotomini has the same general structure of the external scent efferent system as *S. affinis*. The following differences should be noted: In *Pseudoscoparipes* (*Pseudoscoparipes*) *nilgiricus* Lis, 1990 (Figs. 64–65), the vestibular scar is prominent; the ostiole is drop-shaped; the terminal lobe is lobe-shaped and flattened; the peritremal surface is narrow, curved and raising towards apex, with shallow median furrow. In *Dalasiellus* (*Dalasiellus*) *solitarius* (Horváth, 1919) (Figs. 66–67), the vestibular scar is fine; the terminal lobe is developed, lobe-shaped; the peritreme has a shape of a short spout (twice as long as the ostiole diameter), the peritremal surface is raising towards apex, well separated from the terminal lobe, with distinct median furrow. In *Prolobodes giganteus* (Burmeister, 1835) (Figs. 68–69), the vestibular scar is fine; the ostiole is opening posterolarally; the terminal lobe is short, lobe-shaped, posteriorly bearing short and oval peritremal surface; the peritremal surface is nearly parallel with surrounding metapleuron, shallowly concave, posteriorly and laterally emarginated; the evaporatorium is shallowly but densely gyrificated.

In *Macroscytus brunneus* (Fabricius, 1803) (Fig. 70), the vestibule is elevated distally; the vestibular scar is prominent; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, small, round, opening posteriorly; the periostiolar depression is developed; the terminal lobe is developed, anteriorly merging with anterior metapleural margin; the peritremal surface is very small, situated on posterior margin of terminal lobe, flat and nearly parallel with surrounding metapleuron; the evaporatorium is very large, covering anterior and median parts of the metapleuron (not reaching the lateral margin), and most of the mesopleuron except a wide lustrous stripe extending from the anterior margin of the metathoracic spiracle towards the anterolateral angle of mesopleuron, thus isolating the patch of evaporatorium in posterolateral angle, which forms a continuation of the metapleural part; the gyrification is hardly developed.

In *Stibaropus* (*Stibaropus*) cf. *molginus* (Schiødte, 1847) (Figs. 71–73), the metapleuron is convex, sloping from the centre towards the sides; the vestibule is well elevated; the vestibular scar is developed, very fine; the ostiole is shifted laterad, situated in half-width of metapleuron, small, oval, opening posteriorly; the periostiolar depression is missing; the terminal lobe is developed, lobe-shaped, bearing ventrally a reniform peritremal surface, parallel with surrounding metapleuron, and apically a slender hook-shaped projection; the evaporatorium is very large, covering anterior and median parts of the metapleuron, and posterior part of the mesopleuron, reaching posterolaterally the lateral mesopleural margin; the evaporatorium is flat except the shallowly gyrificated area posteromesially of the elevated vestibule.

In *Scaptocoris castaneus* Perty, 1833 (Figs. 74–75), the metapleuron is convex, sloping from the centre towards the sides; the vestibule is well elevated; the vestibular scar is visible but very fine basally and obsolete distally; the ostiole is shifted laterad, situated in half-width of metapleuron, small, oval, opening posterolaterally; the periostiolar depression is missing; the terminal lobe is developed, lobe-shaped, bearing posteriorly a rudimentary peritremal surface, only slightly larger than the ostiole; the evaporatorium is very large, covering anterior and median parts of the metapleuron, and forming stripes along posterior and lateral mesopleural margins; the evaporatorium is flat, without gyrification.

In *Linospa orbicularis* (Jakovlev, 1885) (Fig. 75), the vestibule is well elevated distally; the vestibular scar is developed but fine; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, small, drop-shaped, opening ventrally; the periostiolar depression is missing; the terminal lobe is not developed; the peritreme is rudimentary, limited to the distal margin of ostiole; the evaporatorium is small, covering anterior margin of the metapleuron and narrow stripe on posterior margin of the mesopleuron anteriorly of the metathoracic spiracle; the evaporatorium without gyrification.

4.8. Thaumastellidae Seidenstücker, 1960

(Figs. 77–83)

This small family includes single genus and three species – *Thaumastella aradoides* Horváth, 1896 (Near East and North Africa), *T. namaquensis* Schaefer & Wilcox, 1971, and *T. elizabethae* Jacobs, 1989 (both from South Africa) (LIS 2006e). SEIDENSTÜCKER (1960) established Thaumastellinae within Lygaeidae *sensu lato*. Later, the taxon was raised to a family rank and transferred to Pentatomoidea by ŠTYS (1964b). DOLLING (1981) included Thaumastellinae within his wide concept of Cydnidae, but this classification was not generally accepted (e.g., SCHUH & SLATER 1995, LIS 2006e, PLUOT-SIGWALT & LIS 2008, GRAZIA et al. 2008).

In *T. aradoides* (Figs. 77–83), the vestibule is not elevated; the vestibular scar is well visible (especially distally); the ostiole is strongly shifted laterad, situated ca. in 0.75 of metapleuron width, slit-like, opening posterolaterally; the periostiolar depression is missing; the peritreme joins the distal margin of ostiole and has a form of an auricle elevated above surrounding pleuron; the evaporatorium is large, covering anterior part of metapleuron (not reaching the lateral margin), and posterior margin of mesopleuron where it reaches the lateral margin; the gyrification is not developed. The microsculpure of the external scent efferent system of *T. aradoides* is shown in Figs. 80–83.

JACOBS (1989) published SEM photographs of external scent efferent system of *T. elizabethae* (similar to *T. aradoides*) and *T. namaquensis* (ostiole less shifted laterad, metapleural evaporatorium reaching less laterad, mesopleural evaporatorium narrow and hardly reaching the lateral mesopleural margin). The external scent efferent system of *T. aradoides* was alsou figured by ŠTYS (1964b).

4.9. Dinidoridae Stål, 1867

(Figs. 84–91)

This family includes 16 genera and about 100 species distributed particularly in the Old World tropics, only the type genus *Dinidor* Latreille, 1829 is known from Neotropical region. The family is divided into two subfamilies, Dinidorinae and Megymeninae (KOCOREK & LIS 2000, LIS 2006f).

In the examined representatives of Dinidorididae (*Amberiana* Distant, 1911, *Colpoprocus* Stål, 1870, *Coridius* Illiger, 1807 [Figs. 84–90], *Cyclopelta* Amyot & Serville, 1843, *Dinidor*, *Eumenotes* Westwood, 1847, *Megymenum* Guérin-Méneville, 1831 [Fig. 91], *Sagriva* Spinola, 1850, *Urusa* Walker, 1868), the vestibule is short and distinctly elevated distally at the base of ostiole; the vestibular scar is not macroscopically distinct, however, it is visible on SEM photographs of thorax of *Coridius viduatus* (Fabricius, 1794); the ostiole is situated between meso- and metacetabulum, large, oval, opening laterally; the periostiolar depression is well developed; the peritreme has a form of a robust and distinctly elevated spout, short (e.g. *Dinidor*) to rather long (e.g., *Sagriva*), the peritremal surface is perpendicular to metapleuron surface in its entire length or it turns ventrally so it is nearly parallel with surrounding pleuron apically (*Colpoproctus*, *Eumenotes*); the metapleural evaporatorium is large, covering its anterior and median parts (not reaching the lateral margin), the mesopleural evaporatorium is rather small, limited only to posterior part of mesopleuron or triangularly produced anteriad, sometimes reaching the posterolateral margin of mesopleuron (*Sagriva*); the gyrification of evaporatorium is usually well developed, sometimes very deep (e.g., *Dinidor*, *Urusa*). In *Eumenotes*, the mesopleural evaporatorium is limited to the very posterior margin, metapleural evaporatorium is rather small, entirely depressed under surface of the surrounding pleuron, and produced laterad in a form a depressed evaporatory channel following the mesometathoracic suture and opening at the lateral pleural margin (also KOCOREK & LIS 2000). The microsculpure of the external scent efferent system of *Coridius viduatus* (Fabricius, 1794) is shown in Figs. 86–90.

In *Byrsodepsus* Stål, 1872, the peritreme and metasternal evaporatorium are not developed, this character being considered an autapomorphy (KOCOREK & LIS 2000). In *Patanocnema* Karsch, 1892, the ostiole is shifted more laterad (see DURAI 1987). Additional illustrations of the external scent efferent system of Dinidoridae were given by DISTANT (1902), CACHAN (1952b), DURAI (1987), and AHMAD et al. (1997).

4.10. Tessaratomidae Stål, 1865

This family, including the largest species of the Pentatomoidea, is divided into three subfamilies (Natalicolinae, Oncomerinae, and Tessaratominae), with 55 genera and ca. 240 species (RIDER 2006c). The subfamily Oncomerinae is distributed mostly in Australian region and Malesia east of Wallace Line, with one genus in Oriental region and one genus shared by Afrotropical and Neotropical regions, the subfamily Natalicolinae is particularly Afrotropical with one genus in India, and Tessaratominae occurs in Afrotropical and Oriental regions, surpassing to southern China (ROLSTON et al. 1993, RIDER 2006c).

The structure of the external scent efferent system of Tessaratomidae was described in detail (including SEM photographs) by KMENT & VILÍMOVÁ (in press). Based on the structure of the external scent efferent system, the Tessaratomidae *sensu lato* can be divided into Oncomerinae and Tessaratomidae *sensu stricto* (Tessaratominae + Natalicolinae). The results are shortly summarized as follows:

Two basic types of the external scent efferent system are recognized within Tessaratomidae *sensu lato*. In Oncomerinae, the ostiole is slightly removed laterally from the position between coxal acetabula, oval, ostiolar groove is not developed or very short, and peritreme in a form a spout is attached anterolaterally to the ostiole. In Tessaratomidae *sensu stricto*, the ostiole is situated between acetabula, strongly incised mesad, thus the vestibule is distally opened in two planes (ventrally and laterally) as an ostiolar groove, peritreme has the form of anterior and posterior peritremal lobe surrounding the ostiolar groove. An extreme modification of the ‘tessaratomine’ type is developed in *Platytatus ambiguus* Bergroth, 1892 (Tessaratominae: Sepinini: Platytatina), where the ostiole is shifted close to lateral metapleural margin, the ostiolar groove is reduced and situated between two flat, reniform processes (median and lateral) homologous to anterior and posterior peritremal lobes.

The evaporatorium is usually present on both meso- and metapleuron, the absence of mesopleural evaporatorium being apparently a secondary loss (e.g., Platytatina). In Oncomerinae, the mesopleural evaporatorium is usually triangular, spread between mesopleural suture and posterior mesopleural margin, while in Tessaratominae the mesopleural evaporatorium forms usually an anterolaterally oriented stripe separated from metapleural evaporatorium by lustrous elevated median area situated close to posterior margin of mesopleuron. For SEM photographs of the microsculpture see KMENT & VILÍMOVÁ (in press).

4.11. Canopidae Amyot & Serville, 1843

(Fig. 92)

This is an exclusively Neotropical taxon, containing a single genus, *Canopus* Fabricius, 1803, with eight species (McAtee & Malloch 1928, Grazia et al. 2008). It was first established as subfamily of Pentatomidae (McAtee & Malloch 1928), raised to family status by McDonald (1979).

In *Canopus caesus* (Germar, 1839) (Fig. 92), the vestibule is not elevated externally, the vestibular scar is not apparent; the ostiole is shifted slightly laterad from meso- and metacetabulum, opening ventrally, surrounded by narrow ring or raised cuticle; the peritremal surface is not visible externally; the evaporatorium is large, covering anteromedian part of metapleuron, and posterior and lateral parts of mesopleuron.

McAtee & Malloch (1928) used the structure of the external scent efferent system to distinguish the Canopidae from Megarididae: ‘metapleural ostiole prominent, with more or less extensive opaque area adjacent.’ They further used the structure of the external scent efferent system to divide the *Canopus* into two species groups in their key: i) ostiole with a broad lip, evaporatorium little extending upon mesopleuron, attenuating laterally and ending upon suture between meso- and metapleuron, not reaching the lateral margin; and ii) ostiole with a narrow lip, evaporatorium occupying nearly half of mesopleuron, reaching the lateral margin where it has the form of a narrow stripe accross the entire lateral margin (this group includes the examined *C. caesus*).

4.12. Megarididae McAtee & Malloch, 1928

(Fig. 93).

The family Megarididae includes a single Neotropical genus, *Megaris* Stål, 1862, with 16 species of small body size (McAtee & Malloch 1928, McDonald 1979, Grazia et al. 2008). The taxon was established as a subfamily of Pentatomidae by McAtee & Malloch (1928), raised to a family status by McDonald (1979).

I was not able to see any ostiole even under magnification 125× in the only specimen of *Megaris peruviana* Horváth, 1919 (Fig. 93) available for my study. However, it is certain that neither peritreme nor evaporatorium are developed in the Megarididae. The examination of Megarididae using SEM is strongly needed.

McAtee & Malloch (1928) described the external scent efferent system of Megarididae as follows, using it for distinguishing the family from the Canopidae: 'metapleural ostiole like a puncture, and difficult to see, with no opaque area adjacent.' The McDonald's (1979) description of *Megaris rotunda* McDonald, 1979 is similar: 'Metathoracic stink gland orifice minute, represented by an oval raised area; no evaporative area developed.' (See also figures by McAtee & Malloch (1928) and McDonald (1979)).

4.13. Scutelleridae Leach, 1815

(Figs. 94–126)

The family includes seven subfamilies (Elvisurinae, Eurygastrinae, Odontoscelinae, Odontotarsinae, Pachycorinae, Scutellerinae, and Tectocorinae), about 80 genera and presently at least 450 species. They occur in almost all zoogeographical regions, however, most common are in tropical and subtropical areas. The subfamily Scutellerinae almost exclusively occurs in the Eastern Hemisphere, Eurygastrinae is particularly Old World element, Odontotarsinae is particularly Holarctic element, with representatives in most of the other regions. Pachycorinae is almost exclusively New World subfamily (27 genera and 125 species), with only two genera in the Old World, and monotypic Tectocorinae occurs in Australian and Oriental regions (Göllner-Scheiding 2006a, Cassis & Vanags 2006).

Besides the Pentatomidae, Scutelleridae shows the largest variability in the structure of the external scent efferent system. There are present not only all basic shapes of the peritreme common in Pentatomoidea (spout, groove, ruga, disc), but also several cases of reduction of both peritreme and evaporatorium are known. Herein I present several examples of this variability.

In *Steganocerus multipunctatus* (Thunberg, 1783) (Fig. 94), the vestibule is elevated distally at the base of ostiole; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, rather large, round, opening posteriorly; the periostiolar depression is developed; the peritreme has a form of a short spout, directed laterad, the peritremal surface is concave and oblique with metapleural surface; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior and median parts of mesopleuron, not reaching the lateral pleural margin; the gyrification is shallow.

In *Chelycoris haglundi* (Montandon, 1895) (Fig. 95), the vestibule is elevated in distal half; the vestibular scar is missing; the ostiole is shifted laterad, situated ca. in half-width of metapleuron, rather small, round, opening laterally; the periostiolar depression is missing; the peritreme has a form of a short spout, directed posterolaterad, the peritremal surface is very narrow, nearly parallel with surrounding metapleural surface, only slightly raising towards apex; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior part of mesopleuron, not reaching the lateral pleural margin; the gyrification is shallow.

In *Polytes lineolatus* (Dallas, 1851) (Fig. 96), the vestibule is elevated in distal half; the vestibular scar is missing; the ostiole is shifted laterad, situated nearly in half-width of metapleuron, small, round, opening laterally; the periostiolar depression is developed, shallow; the peritreme is strongly reduced, in a form a very short U-shaped projection on dorsal margin of ostiole, the peritremal surface is shorter than ostiole diameter; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, reaching here the margin of mesopleuron; the gyrification consists of sparse and fine furrows.

In *Psacasta* (*Psacasta*) *exanthematica cerinthe* (Fabricius, 1787) (Fig. 106), the vestibule is short, elevated only distally; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, very small, round, opening laterally at the top of small conic tubercle; the periostiolar depression is developed; the peritreme is missing; the evaporatorium is reduced, the metapleural part is covering the area surrounding the ostiole and anterior margin of metapleuron (not reaching the lateral margin), while the mesopleural part is limited only to the median region of the posterior mesopleural margin; the gyrification is irregular.

In *Eurygaster maura* (Linnaeus, 1758) (Figs. 97–105, 107), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, narrowly oval, opening ventrally; the periostiolar depression is missing; the peritreme has a form of a long and narrow groove, well emarginated, directed slightly posterolaterad, the peritremal surface has a deep median furrow reaching nearly the apex of the groove; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, reaching here the lateral margin of mesopleuron (forming a ‘laying L’); the gyrification is well developed, irregular. The microsculpure of the external scent efferent system of *E. maura* is shown in Figs. 100, 102–105 (also described by DURAK & KALENDER 2007b).

In *Poecilocoris pulcher* Dallas, 1848 (Fig. 108), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, small, oval, opening laterally; the periostiolar depression is missing; the peritreme has a form of a very long and narrow groove, directed slightly posterolaterad and apically curved anteriorly and slightly widening, the peritremal surface has a deep median furrow reaching nearly the apex of the groove; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron but without the sole lateral mesopleural margin.

In *Procilia morgani* (White, 1839) (Fig. 109), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, small, round, opening posterolaterally; the periostiolar depression is missing; the peritreme has a form of a sabre-shaped, long groove, the peritremal surface has a deep median furrow reaching nearly the apex of the groove; the metapleural evaporatorium is rather large, covering anterior and median parts of metapleuron, including a very narrow stripe bordering the posterior margin of peritreme, the mesopleural part is reduced into a small patch on the lateral side of mesopleural suture; the gyrification is poorly developed, evaporatorium being mostly flat.

In *Agonosoma trilineatum* (Fabricius, 1782) (Fig. 110), the vestibule is only slightly elevated; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, very large, round, opening ventrolaterally; the periostiolar depression is missing; the peritreme has a form of a sabre-shaped groove, slightly widening apically, anteriorly merging pleural surface, well emarginated posteriorly and laterally, the peritremal surface is concave basally and apically flat; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, reaching here the lateral margin of mesopleuron (forming a ‘laying L’); the gyrification is shallow. For SEM photograph of the external scent efferent system see CASSIS & VANAGS (2006).

In *Lobothyreus lobatus* (Westwood, 1837) (Fig. 111), the vestibule is slightly elevated distally; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, large, drop-shaped, opening ventrally; the periostiolar depression is missing; the peritreme has a form of a slightly elevated ruga apically reaching the anterior metapleural margin, the peritremal surface has a shallow and wide median furrow basally, it is convex distally; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, reaching here the lateral margin of mesopleuron (forming a 'laying L'); the gyrification is shallow.

In *Cryptacrus comes* (Fabricius, 1803) (Figs. 112–114), the vestibule is not elevated; the trace of the vestibular scar is possibly visible proximally, obsolete distally; the ostiole is situated between meso- and metacetabulum, small, oval, opening laterally; the periostiolar depression is missing; the peritreme has a form of a ruga with variable shape, directed slightly posterolaterad and sometimes apically curved anteriorly, the peritremal surface has a very short median furrow at its base; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior part of mesopleuron, not reaching the lateral mesopleural margin; the evaporatorium is shallowly to deeply gyrificated. *Cryptacrus comes* is one of the very few species with known intraspecific variability in the structure of the external scent efferent system in Heteroptera.

In *Sphyrocoris obliquus* (Germar, 1839) (Fig. 115), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, very small, round, opening laterally; the periostiolar depression is missing; the proximal part of the peritreme has a form of a narrow and very shallow groove, which distally widens into large reniform, well emarginated disc, the surface of the disc is flat and punctured; the evaporatorium is large, covering anterior and median parts of metapleuron, very bordering narrowly the lateral margin of the peritreme, and posterior and lateral parts of mesopleuron, reaching here the lateral mesopleural margin; the gyrification in a form furrows and wrinkles is not developed, but the evaporatorium is roughly punctured in the same way as the surrounding pleuron.

In *Calliphara nobilis* (Linnaeus, 1763) (Fig. 116), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, very small, oval, opening posterolaterally; the periostiolar depression is missing; the peritreme has a form of a very large and well emarginated disc, the peritremal surface has a median furrow near its posterior margin, deep and distinct proximally, shallow and fading distally;

the evaporatorium is developed only on metapleuron, rather small, V-shaped, divided into two stripes by the peritremal disc; the gyrification is shallow.

In *Calliscyta stalii* (Vollenhoven, 1863) (Fig. 117), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, very small, oval, opening laterally; the periostiolar depression is missing; the peritreme is not delimited, the peritremal surface merges surrounding pleuron distally, forming a triangular structure, only basally with a short and narrow median furrow; the evaporatorium is developed only on metapleuron, reduced, V-shaped, divided into two stripes; the gyrification is shallow. For SEM photograph of the external scent efferent system see CASSIS & VANAGS (2006).

In *Tectocoris diophthalmus* (Thunberg, 1783) (Fig. 117), the vestibule is not elevated; the vestibular scar is missing; the ostiole is situated deep between meso- and metacetabulum, very small, opening ventrally; the periostiolar depression is missing; the peritreme has a form of a very narrow groove, distally narrowing into scar-like line; the evaporatorium is developed only on metapleuron, reduced to a narrow stripe bordering the rudimentary peritreme, flat, without any gyrification. For SEM photograph of the external scent efferent system see CASSIS & VANAGS (2006).

In *Elvisura irrorata* Spinola 1837 (Fig. 126), the vestibule is short, not elevated; the vestibular scar is missing; the ostiole is situated deep between meso- and metacetabulum, very large, round, funnel-shaped, opening ventrally; the periostiolar depression, peritreme, and evaporatorium are missing; the all nebo whole ventral body surface is covered with hairs.

In *Odontotarsus robustus* Jakovlev, 1884 (Figs. 118–124), as well as in species of some other genera (*Irochrotus* Amyot & Serville, 1843, *Melanodema* Jakovlev, 1880, *Odontoscelis* Laporte, 1833 and *Phimodera* Germar, 1839), there is no external scent efferent system and the all metathoracic scent apparatus is not developed. Only the SEM photographs of *O. robustus* revealed the possible rudiments of ostiole (Figs. 119–120) and internal orifice (Figs. 121, 123–124).

Additional illustrations and SEM photographs of the external scent efferent system of Scutelleridae were given e.g. by DISTANT (1902), SCHOUTEDEN (1904), MCDONALD & CASSIS (1984), AHMAD & MUSHTAQ (1977), EGER (1987), CASSIS & VANAGS (2006), and DURAK & KALENDER (2007b).

4.14. Lestoniidae China, 1955

(Fig. 127)

This family is endemic for Australia, including only a single genus, *Lestonia* China, 1955, with two species (CHINA 1955, MCDONALD 1969). The taxon was originally established as a subfamily of the Plataspidae (CHINA 1955), later raised to family level by CHINA & MILLER (1959).

The ventral surface of Lestoniidae is flattened, the mesothorax and metathorax being laterally covered by explanate lateral margins of pronotum and costal area of hemelytron (CHINA 1955, MCDONALD 1969). In *Lestonia grossi* McDonald, 1969 (Fig. 127), the vestibule is not elevated; the vestibular scar is not developed; the ostiole is situated between meso- and metacetabulum, narrow, slit-like, ca. comma-shaped, opening ventrally; the periostiolar depression is missing; the peritreme has a form of a long and narrow ruga with median furrow reaching ca. half-length of the peritreme, which is slightly elevated above surrounding pleuron and reaching ca. two thirds of its width; the metapleural evaporatorium is small, surrounding the ostiole and peritreme, sligthly triangularly producing posteriorly, mesopleural evaporatorium reduced to a stripe on posterior mesopleural margin in front of metathoracic spiracle (also MCDONALD 1969).

In. *L. haustorifera* China, 1955 the external scent efferent system differs conspicuously. The ostiole is situated slightly more deeply between meso- and metacetabulum, oval, opening laterad; neither peritreme nor evaporatorium are developed (also CHINA 1955).

MCDONALD (1969) mentioned the differences of the external scent efferent systems as the key characters of both species.

4.15. Acanthosomatidae Signoret, 1864

(Figs. 128–145)

The family Acanthosomatidae is divided into three subfamilies with 54 genera and about 180 species (KUMAR 1974a, KMENT 2005, GÖLLNER-SCHEIDING 2006b). However, subfamily classification of the genera *Uhlunga* Distant, 1892 and *Ibocoris* Roche, 1947 was recently questioned by KMENT (2005) and FISCHER (2006). While Blaudusinae and

Ditomotarsinae occur only in Southern Hemisphere, Acanthosomatinae has cosmopolitan distribution (KUMAR 1974a, GÖLLNER-SCHEIDING 2006b).

In *Ditomotarsus punctiventris* Spinola, 1852 (Figs. 130–137), the vestibule is elevated in distal half; the vestibular scar is missing; the ostiole is shifted ca. at lateral margins of meso- and metacetabulum, small and drop-shaped, opening posterolaterally; the periostiolar depression is missing; the peritreme joins the distal margin of ostiole and has a form of a short and slightly elevated spout, the peritremal surface is drop-shaped, nearly parallel with surounding metapleuron; the evaporatorium is large, covering anterior and anteriomedian parts of metapleuron (not reaching the lateral margin), and posterior and lateral portions of mesopleuron (forming a 'lying L'), the SEM photographs revealed that evaporative surface extends also on meso- and metasternum between meso- and metacoxae; the gyrification of evaporatorium is developed but shallow. The microsculpure of the external scent efferent system of *D. punctiventris* is shown in Figs. 133–137.

Acanthosoma haemorrhoidale (Linnaeus, 1758) (Figs. 138–145) differs from *Ditomotarsus* in having the vestibule short and hardly elevated; the ostiole is situated between meso- and metacetabulum, large and oval, opening ventrally; the peritreme has a form of a long and narrow disc with peritremal surface parallel with surrounding metapleuron, short and wide median furrow basally, rest of the surface being slightly covex; the evaporatorium is basicaly of the same pattern as in *Ditomotasus*, only the metapleural part is smaller, and it does not extend on meso- and metasternum. The microsculpure of the external scent efferent system of *A. haemorrhoidale* is shown in Figs. 140–145.

The spout with peritremal surface oblique or perpendicular to metapleuron is rather rare within Acanthosomatidae, however, represented in all three subfamilies (e.g., *Acrophyma* Bergroth, 1916, *Aesepus* Stål, 1876, *Catadipson* Breddin, 1903, *Proctophantasta* Breddin, 1903, *Sangarius* Stål, 1865, *Tolono* Rolston & Kumar 1974 – after KUMAR 1974a, ROLSTON & KUMAR 1974, KMENT 2005). In *Cylindrocnema plana* Mayr, 1864, the spout is very small, ca. twice as long as the width of the small ostiole. In other representatives, the spout is short and its peritremal surface is turned so it is only slightly oblique to nearly parallel with surrounding pleuron (e.g., *Planois* Signoret, 1863, *Ditomotarsus* Spinola, 1850, *Sinopla* Signoret, 1863 – Kment pers. observ.). This type is probably basic one for further transformation of the spout which changes into a groove (e.g., *Phorbanta variabilis* (Signoret, 1863) – KUMAR 1974a, Kment pers. observ.;

Noualhieridia rufa Cachan, 1952 – KMENT 2005), or a disc which is common especially among Holarctic Acanthosomatinae (*Mahea* Distant, 1909, *Rhopalimorpha* Dallas, 1851, *Acanthosoma* Curtis, 1824, *Cyphostethus* Fieber, 1860 [Fig. 128], *Elasmucha* Stål, 1864 [Fig. 129] – WOODWARD 1953, AHMAD & MOIZUDDIN 1990, KMENT 2005), or are transitional between both (KUMAR 1974a). The rather large evaporatorium with metapleural part in a form of a 'lying L' is also common and distributed throughout all the three subfamilies (e.g., *Acanthosoma*, *Acrophyma*, *Cylindrocnema* Mayr, 1864, *Cyphostethus*, *Ditomotarsus*, *Elasmucha*, *Elasmostethus* Fieber, 1860, *Microdeuterus* Dallas, 1851, *Planois*, *Proctophantasta*, *Xosa* Kirkaldy, 1904 – Kment pers. observ.). However, there are also genera with reduced size of the evaporatorium, which is not reaching the lateral margin of mesopleuron (e.g., *Catadipson*, *Noualhieridia* Breddin, 1898) or is limited only to the metapleuron (*Ibocoris* Roche, 1947, *Mahea*) (KMENT 2005).

4.16. Pentatomidae Leach, 1815

(Figs. 146–245)

The family Pentatomidae is the largest Pentatomoidea taxon, presently containing over 4700 species in nearly 900 genera. Pentatomids occur worldwide, and are especially diverse in both the Old World and New World tropics (RIDER 2006d, 2009). The higher classification is very unsettled, and has changed considerably through the years. Currently, there are nine subfamilies recognized and accepted within the Pentatomidae, while the Serbaninae has been recently transferred to the Phloeidae (GRAZIA et al. 2008).

4.16.1. Aphylinae Bergroth, 1906

(Figs. 146–148)

This endemic Australian subfamily of controversial status includes only two genera and three species (ŠTYS & DAVIDOVÁ-VILÍMOVÁ 2001, RIDER 2009). This taxon is characterized by several apomorphies in the structure of both thorax and abdomen, which lateral margins are explanate, forming so-called exponium, and covering the body venter (ŠTYS & DAVIDOVÁ-VILÍMOVÁ 2001).

In *A. bergrothi* Schouteden, 1906 (Figs. 146–148), the vestibule is only slightly elevated distally; the vestibular scar is missing; the ostiole is slightly shifted laterad, situated ca. at lateral margins of meso- and metacetabulum, small, drop-shaped, opening ventrally; the periostiolar depression is missing; the peritreme has a shape of a narrow and well emarginated groove, directed straight laterad, slightly widening distally, ending at the inner side of the expanded lateral exponial sclerite (= LES), the peritremal surface has a deep median furrow; the metapleuron is highest at the peritreme, sloping both anteriorly and posteriorly; the mesopleuron is depressed in comparison with metapleuron, sloping laterad, where it is squeezed between the explanate pronotal margin and metapleuron; the metapleural evaporatorium is very large, covering most of metapleuron except of the metacetabulum, peritreme, and lateral margin; the mesopleural evaporatorium is limited to mesepimeron and reaching its lateral margin; in lateral view of the body (Fig. 148), there is an ‘external opening’ between pronotum, LES, and the anterior mesal exponial sclerite (= AMES); the AMES has an Y-shaped depression continuous with the ‘external opening’ and then directed dorsally, the surface of AMES is mostly matt and appears to be covered with mycoid microsculpture (observed under 125× magnification).

ŠTYS & DAVIDOVÁ-VILÍMOVÁ (2001) also described and figured the metapleural part of the external scent efferent system and lateral area of mesopleuron of *Neoaphylum grossi* Štys & Davidová-Vilímová, 2001 and *Aphylum syntheticum* Bergroth, 1906. After them, the evaporatorium of *A. syntheticum* extends all over the mesepimeron and metepisternum; the AMES has ‘anterior and posterior areas often vaguely delimited by a lateral indentation or a superficial groove, matt, without puncturation characteristic of the lateral and triangular sclerites’ (ŠTYS & DAVIDOVÁ-VILÍMOVÁ 2001). It seems that the ‘external opening’ and AMES covered by evaporatorium represent an outlet of the external scent efferent system which is otherwise closed by the explanate thoracic and abdominal margins. In *Neoaphyllum grossi* the pronotum does not closely attach the LES and the ‘external opening’ is not developed (ŠTYS & DAVIDOVÁ-VILÍMOVÁ 2001).

4.16.2. Asopinae Amyot & Serville, 1843

(Figs. 149–157)

This subfamily includes 66 genera and 299 species distributed worldwide, all of them being secondary predators, which is only one exception within the Pentatomoidea (RIDER 2009).

The Asopinae genera examined (Figs. 149–157) are uniform in having the vestibule not elevated; loss of the vestibular scar; the ostiole being situated between meso- and metacetabulum, small and drop-shaped to elongated mesially, narrow and slit like, opening ventrolaterally (less often ventrally or posteroventrally); the missing periostiolar depression.

However, there is a considerable variability in the shape of the peritreme and evaporatorium among the genera (cf. THOMAS 1994a). None of the examined genera has a spout-shaped peritreme, the peritremal surface is always parallel with surrounding metapleural surface. The basic shape of the peritreme within Asopinae represents probably a groove with median furrow well developed throughout most of its length (e.g., *Arma custos* (Fabricius, 1794) [Fig. 149]; *Troilus luridus* (Fabricius, 1775) [Fig. 150]; *Podisus* spp.). Other distinct type is a disc, which is wider than the groove and the median furrow is developed only basally (e.g., *Picromerus bidens* (Linnaeus, 1758) [Fig. 151]), however, there are also intermediate shapes between the groove and disc (e.g., *Pinthaeus sanguineus* (Fabricius, 1787) [Fig. 152]). A common tendency to a reduction of the peritreme also exists, when the peritremal surface is not emarginated, at least apically, and merges surrounding pleuron, with only the median furrow remaining more or less distinct (e.g., *Jalla dumosa* (Linnaeus, 1758) [Fig. 153], *Marmessulus nigricornis* (Stål, 1865) [Fig. 154], *Oechalia schellenbergi* (Guérin-Méneville, 1831) [Fig. 155], *Rhacognathus punctatus* (Linnaeus, 1758) [Fig. 156], *Zicrona caerulea* (Linnaeus, 1758) [Fig. 157]).

Also the evaporatorium shows a tendency to a reduction. The mesopleural evaporatorium is rather variable in shape, in largest size found in *Eocanthecona* spp., it is covering posterior part, as a wide stripe, and lateral part of mesopleuron, except of small lustrous spot medially close to the lateral margin. However, it is usually smaller (e.g., *A. custos*, *T. luridus*), either reduced to a very narrow stripe on the extreme posterior (e.g., *R. punctatus, Z. caerulea*), and sometimes also lateral, mesopleural margin (e.g., *P. bidens, P. sanguineus*), or it is completely missing (e.g., *J. dumosa*, *M. nigricornis*). The metapleural evaporatorium in its largest extent surrounds the ostiole and peritreme, forming a rather wide stripe laterally of the peritreme apex, and extending laterally along the anterior metapleural margin up to the distal end of the metathoracic spiracle (e.g., *A. custos*), however, more often the evaporatorium borders the apical margin of peritreme only as a very narrow stripe (e.g., *P. bidens*, *T. luridus*). In the genera with the peritremal surface merging the surrounding pleuron, the evaporatorium is laterally either discontinued and V-shaped (e.g., *J. dumosa*, *Z. caerulea*), or reduced to merely a small V-shaped area bordering proximally the ostiole (*M. nigricornis*).

THOMAS (1994a) illustrated the external scent efferent systems of 36 Old World genera of this subfamily, for additional SEM photographs see HASAN & KITCHING (1993).

4.16.3. Cyrtocorinae Distant, 1880

(Fig. 158)

This subfamily includes bugs of controversial status, classified in four genera and 11 species distributed exclusively in Neotropical region (PACKAUSKAS & SCHAEFER 1988, RIDER 2009).

PACKAUSKAS & SCHAEFER (1988) characterized the external scent efferent system in the diagnosis of Cyrtocorinae as follows: ‘Metathoracic scent gland opening with a single auricle, teardrop-shaped, laterally directed, black or brown, free of pubescence’

Results of the observation of *Ceratozygum horridum* (Germar, 1839) and *Cyrtocoris* White, 1842 agree with this characteristic. In *Ceratozygum horridum* (Fig. 158), the vestibule is not elevated; the vestibular scar is missing; the ostiole is slightly shifted laterad, situated ca. at lateral margins of meso- and metacetabulum, small, drop-shaped, opening ventrally; the periostiolar depression is missing; the peritreme has a shape of a short groove with a drop-shaped outline, directed posterolaterad, the peritremal surface is slightly elevated above and parallel with surrounding metapleuron, with distinct median furrow; the evaporatorium is developed only on metapleuron, surrounding the ostiole and peritreme, rest of the body venter is covered with thick, whitish to brownish scale-like hairs. The situation in *Cyrtocoris egeris* Packauskas & Schaefer, 1988 is similar, the evaporatorium is even smaller, forming only a narrow ring around the ostiole and peritreme.

4.16.4. Discocephalinae Fieber, 1861

(Figs. 159–177)

This subfamily includes 80 genera and 303 species distributed in Neotropical region and southern parts of Nearctic region (RIDER 2009).

In *Miopygium cyclopeltoides* Breddin, 1904 (Figs. 164–171), the vestibule is elevated distally; the vestibular scar is missing; the ostiole is situated ca. at lateral margins of meso- and metacetabulum, drop-shaped, opening posteroventrally; the periostiolar depression is well developed; the peritreme has a form of a short spout, the peritremal surface is basally perpendiculate with metapleuron surface while apically it turns ventrally; the evaporatorium is large, covering anteromedian part of metapleuron, extending laterad along its anterior margin towards the distal end of metathoracic spiracle, near its lateral margin; the metathoracic evaporatorium is ridge-like elevated; the mesopleural evaporatorium is smaller and worse delimited, confined to an area laterad of the mesopleural suture and to posterolateral angle of mesopleuron; the gyrification is well developed. The microsculpture of the external scent efferent system of *M. cyclopeltoides* is shown in Figs. 166–171.

In *Macropygium* Spinola, 1837 (Fig. 159), *Alathetus* Dallas, 1851, *Alitocoris* Sailer, 1950, *Lincus* Stål, 1867, *Moncus* Stål, 1867, *Ochlerus* Spinola, 1837, and *Schaefferella* Spinola, 1850 (all Ochlerini), the structure of the external scent efferent system is very similar.

The species of Discocephalini generally resemble those of the Ochlerini, mostly except the shape of peritreme, which is transitional between a spout and ruga, and extent of the evaporatorium. In *Discocephala marmorea* Laporte, 1832 (Fig. 160), the ostiole is situated ca. at lateral margins of meso- and metacetabulum, large, oval, opening laterally; the periostiolar depression is well developed, dish-shaped, posteriorly and laterally delimited by elevated ridges; the peritreme has a form of a long and robust spout, distinctly elevated above surrounding pleuron, ridge-shaped, with rounded and elevated apex, the peritremal surface forms a distinct groove posteriorly, running from the ostiole towards the apex; the evaporatorium is very large, covering anterior and median parts of metapleuron (not reaching the lateral margin), and posterior and lateral areas of mesopleuron, except an oval lustrous spot medially on the mesopleural margin; the gyrification is well developed both on meso- and metapleuron, formed by deep irregular grooves and ridges.

In *Dinocoris variolosus* (Linnaeus, 1767) (Fig. 161), the spout is short and slender, distinctly elevated above surrounding pleuron. In *Eurystethus nigropunctatus* Mayr, 1864 (Fig. 162), the spout is long, distinctly elevated above surrounding pleuron, the peritremal surface has a distinct groove proximally, vanishing distally, the apex is almost flat. In *Psorus cassidiformis* Bergroth, 1914 (Fig. 163), the peritreme is very long and conspicuous, forming a narrow ridge directed laterad, with a grooved peritremal surface on its posterior side; the evaporatorium is very large, without the smooth lustrous median spot on lateral mesopleural margin, and almost lacking gyrification. In *Dryptocephala brullei* Laporte, 1832 (Fig. 172), the peritreme is very long and conspicuous, forming a high and narrow ruga continually decreasing towards the anterior metapleural margin, proximally with a distinct shallow groove on its posterior side, vanishing towards apex; the evaporatorium is of similar pattern like in *Discocephala* Laporte, 1833. In *Coriplatus depressus* White, 1842 (Fig. 173), the ostiole is shifted more laterad, being situated ca. in half-width of metapleuron, large, oval, opening almost posteriorly; the peritreme is rather long, distinctly elevated above surrounding pleuron, forming a disc with very shallow median furrow on upper surface; the metapleural evaporatorium is very large, but the mesopleural part is hardly apparent, limited to the most posterior mesopleural margin.

In *Antiteuchus mixtus* (Fabricius, 1787) (Figs. 174–175), the peritreme is long, with two distinct parts: upper part has a form of a high ridge, ending by yellowish, rounded and elevated apex, while lower part has a form of a long, narrow, and shallow groove, proximally hidden under the elevated upper part, distally visible as shallow, and only slightly elevated groove leading towards anterior metapleural margin. The situation in other examined species of *Antiteuchus* Dallas, 1851 and *Mecistorhinus* Dallas, 1851 is similar, while in *Cataulax eximius* (Stål, 1860) (Fig. 176), the upper part of peritreme is elevated, but its apex is indistinct and continually merges the distal groove.

In *Ablaptus varicornis* (Walker, 1867) (Fig. 177), the ostiole is incised mesially, forming an ostiolar groove directed posterolaterad, superficially similar to that of Tessaratomindae *sensu stricto*; the peritreme consists of two peritremal lobes, the anterior lobe is prolonged into long, laterally directed ridge, the posterior lobe is much shorter and without any projection.

4.16.5. Edessinae Amyot & Serville, 1843

(Figs. 178–179)

This subfamily includes 12 genera and 306 species distributed in Neotropical region and southern parts of Nearctic region (RIDER 2009).

In *Bothrocoris* Mayr, 1866 (currently subgenus of *Lopadusa* Stål, 1860) (Fig. 178), the vestibule is short and distally elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, large, oval, opening posterolaterally; the periostiolar depression is developed; the peritreme has a form of short and well elevated spout directed anterolaterad, the peritremal surface is oblique to surrounding metapleuron, continually raising towards apex, and without distinct median furrow; the evaporatorium is large, covering anterior and median parts of metapleuron (not reaching the lateral margin), and posterior area of mesopleuron, reaching its lateral margin only as a very narrow stripe along posterior mesopleural margin; the gyrification is well developed, deep.

In *Edessa rufomarginata* (De Geer, 1773) (Fig. 179), the vestibule is short and distally elevated; the vestibular scar is missing; the ostiole is situated between meso- and metacetabulum, very large, oval, opening posterolaterally; the periostiolar depression is developed, shallow; the peritreme has a form of a ruga, basally widest, narrowing towards apex, and directed slightly anterolaterad, the peritremal surface is basally developed on posterior side of ruga, having a short and shallow, triangular median furrow, than it turns over to anterior side of the ruga; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior, median, posterolateral, and anterolateral regions of mesopleuron, mesopleuron has laterally an oval spot of smooth lustrous cuticle.

This basic pattern occurs also in other examined species of *Edessa* Fabricius, 1803, *Brachystethus* Laporte, 1833, *Olbia* Stål, 1862, and *Periomatus* Amyot & Serville, 1843, however, some scale of variotin exists, e.g. in the position of ostiole, shape and length of the ruga, and shape and position of the smooth lustrous spot close to lateral mesopleural margin.

4.16.6. Pentatominae Leach, 1815

(Figs. 180–236)

This subfamily is the largest taxon within Pentatomoidea, including 621 genera and 3336 species worldwide, classified in 42 tribes (39 genera remain unplaced). The ascertained variability in the structure of the external scent efferent system corresponds to the vaste number of the taxa included; herein I present several examples of this variability:

Despite the variability in remaining structures, none of the examined species of the Pentatominae has developed the vestibular scar. However, examining the holotype and single known specimen of *Mustha longispinis* Reuter, 1890 (Fig. 180), I found that vestibules on both sides are not externally closed and remain open as a wide scent grooves beginning at anterior margin of metacoxal cavities and reaching the bases of peritremes, the ostioles are not developed. This condition seems to be a case of teratology, as the specimen is also aberrant in other aspects of its morphology from all other examined specimens of *Mustha* Amyot & Serville, 1843 (e.g., the structure of hemelytra).

In *Pentatoma rufipes* (Linnaeus, 1758) (Figs. 183–204), the vestibule is elevated distally; the ostiole is situated between meso- and metacetabulum, large, oval, opening posterolaterally; the periostiolar depression is very shallow; the peritreme is rather short, in a form a spout, the peritremal surface is oblique with surrounding pleuron, slightly raising towards apex, having a fine median furrow; the evaporatorium is very large, covering anterior and median parts of the metapleuron, and posterior and lateral parts of the mesopleuron, except the smooth median spot on mesopleural margin; the gyrification is shallow. The microsculpure of the external scent efferent system of *P. rufipes* is shown in Figs. 188–190, 195–204. *Rhaphigaster nebulosa* (Poda, 1761) (Fig. 181) differs only in details of peritreme structure.

In *Eysarcoris venustissimus* (Schrank, 1776) (Fig. 182), the vestibule is elevated; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, small, round, opening laterally; the periostiolar depression is developed; the peritreme has a form of a short spout, the narrow peritremal surface is oblique with surrounding pleuron, raising towards apex; the evaporatorium is rather small, covering anterior and median parts of metapleuron, and posterior part of mesopleuron, not reaching its lateral margin; the gyrification is shallow. *Sciocoris* (*Aposciocoris*) *homalonotus* Fieber, 1851 (Fig. 205) differs from *E. venustissimus* only in details of the structure of the spout and the extent of the evaporatorium.

In *Mustha spinosula* (Lefebvre, 1831) (Fig. 206–208), the vestibule is elevated distally; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, very large, oval, opening posterolaterally; the periostiolar depression is very shallow; the peritreme has a form of a long spout, its peritremal surface is oblique with surrounding pleuron, raising towards apex, having a fine median furrow in its basal half, while slightly turning ventrally in its distal half; the evaporatorium is limited to the metapleuron, covering its anterior and median parts, its lateral margin is partly ridge-like elevated; the gyrification is rather shallow but distinct. In *M. spinosula* and an additional undescribed species of *Mustha* Amyot & Serville, 1843 from Iran, I found a slight intraspecific variability in the shape of the spout and the lateral elevated ridge of evaporatorium, even in specimens from the same locality (Figs. 209–210).

In *Myrochea inermis* Distant, 1912 (Fig. 211), the vestibule is hardly elevated; the ostiole is situated between meso- and metacetabulum, small, drop-shaped, opening ventrolaterally; the periostiolar depression is not developed; the peritreme is short, groove-shaped, the peritremal surface is nearly parallel with surrounding metapleuron, concave; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron; the gyrification is hardly developed, the metapleural part is laterally completely flat.

In *Trichopepla semivittata* (Say, 1831) (Fig. 212), the vestibule is not elevated; the ostiole is situated between meso- and metacetabulum, small, V-shaped, opening ventrally; the periostiolar depression is not developed; the peritreme is short, groove-shaped, the peritremal surface is parallel with surrounding metapleuron, having a distinct median furrow basally; the evaporatorium is small, on metapleuron surrounding the ostiole and peritreme, extending laterad along the anterior metapleural margin towards the distal end of metathoracic spiracle, on mesopleuron forming only a narrow stripe bordering anteriorly the metathoracic spiracle.

In *Neottiglossa* (*Neottiglossa*) *pusilla* (Gmelin, 1789) (Fig. 213), the vestibule is slightly elevated distally; the ostiole is situated ca. between lateral margins of meso- and metacetabulum, small, oval, opening ventrolaterally; the periostiolar depression is not developed; the peritreme has a shape of a short spout, its peritremal surface is nearly parallel with surrounding metapleuron, only slightly raised towards apex; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, except a smooth shallow groove posterolaterally, reaching the lateral mesopleural margin, and isolating the patch of mycoid surface in posterolateral angle of mesopleuron, this patch being a continuation of metapleural evaporatorium; the gyrification is shallow. In *Neottiglossa* (*Neottiglossa*) *leporina* (Herrich-Schäffer, 1830) (Fig. 214), the structure of the external scent efferent system is very similar except the peritreme, which has a shape of long and narrow groove, directed anterolaterally and reaching the anterior metapleural margin, where it touches an additional short and well delimited groove reaching the lateral mesopleural margin.

In *Nezara viridula* (Linnaeus, 1758) (Fig. 215–216), the vestibule is elevated distally; the ostiole is situated between meso- and metacetabulum, large, drop-shaped, opening ventrolaterally; the periostiolar depression is not developed; the peritreme is rather short, in a form a groove, the peritremal surface is parallel with surrounding pleuron, having a shallow median furrow; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, except the smooth median spot on lateral mesopleural margin; the gyrification is shallow.

In *Palomena prasina* (Linnaeus, 1761) and *Acrosternum millieri* (Mulsant & Rey, 1866), the external scent efferent system is principally of the same structure as in *N. viridula*, except the shape of peritreme. In *P. parasina* (Fig. 217), the peritreme is rather long and narrowing towards apex, in a form a groove but with pointed keel-shaped apex, with a distinct triangular median furrow, while in *A. millieri* (Fig. 218), the peritreme is longer, continually narrowing towards apex, in a form of a ruga, with the median furrow in its proximal half.

In *Carpocoris purpureipennis* (De Geer, 1773) (Fig. 219–220), the vestibule is not elevated; the ostiole is situated between meso- and metacetabulum, rather large, rhombic, opening ventrally; the periostiolar depression is not developed; the peritreme is rather short, continually narrowing towards apex, in a form of a ruga, with a shallow median furrow in its proximal half, the peritremal surface is parallel with surrounding pleuron; the evaporatorium is very large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, except the smooth median spot on lateral mesopleural margin; the gyrification is distinctly developed.

In *Anaxarchus pardalinus* Stål, 1876 (Fig. 221), the vestibule is hardly elevated; the ostiole is situated between meso- and metacetabulum, large, oval, opening posterolaterally; the periostiolar depression is developed; the peritreme is long and narrow, in a form a ruga, slightly curved anteriorly, the peritremal surface bears a median furrow in its proximal half, while it is keel-shaped distally; the evaporatorium is large, covering anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, except the smooth median spot at lateral mesopleural margin; the gyrification is shallow.

In *Rhynchocoris humeralis* (Thunberg, 1783) (Fig. 222), the vestibule is slightly elevated distally; the ostiole is situated between meso- and metacetabulum, very large, oval, opening laterally; the periostiolar depression is not developed; the peritreme is very long and narrowing towards apex, reaching the anterior metapleural margin, its form being between a groove and ruga, basally with a wide median furrow vanishing towards apex; the evaporatorium is very large, covering anterior and median parts of metapleuron and posterior and lateral parts of mesopleuron, except the smooth median spot posterolaterally on lateral mesopleural margin which isolates a small patch of mycoid surface on the posterolateral angle of mesopleuron; the gyrification is very shallow.

The *Evoplitus laciniatus* (Spinola, 1837) (Fig. 223) has a similar basic pattern of the external scent efferent system like the *R. humeralis*, only the ostiole is large, drop-shaped, opening posterolaterally; the ruga is very long and narrow with a deep median furrow in its basal two thirds, the distal third being keel-shaped; the patch of mycoid surface in posterolateral angle of mesopleuron is connected with the main part.

In *Amasenus corticalis* Stål, 1863 (Fig. 224), the vestibule is elevated distally; the ostiole is situated between meso- and metacetabulum, large, drop-shaped, opening ventrolaterally; the periostiolar depression is developed; the peritreme is very long and narrow, in a form a ruga, with deep median furrow developed in its proximal half; the evaporatorium is large but limited mostly to the metapleuron, where it is deeply gyrificated and laterally ridge-like elevated, on mesopleuron the mycoid surface forms only an indistinct spot posteromedially.

In *Placocoris viridis* Mayr, 1864 (Fig. 225), the whole body is strongly dorsoventrally flattened, the fact also affecting the thoracic morphology. The vestibule is only slightly elevated distally; the ostiole is shifted laterad, situated ca. in half-width of the metapleuron, small, round, opening posterolaterally; the periostiolar depression is not developed; the peritreme is short, nearly groove-shaped, anteriorly merging the pleuron, distally and posteriorly well emarginated, the peritremal surface is nearly parallel with surrounding metapleuron, only slightly raising towards apex; the evaporatorium covers anterior and median parts of metapleuron, and posterior and lateral parts of mesopleuron, except the smooth spot posteriorly on mesopleural margin, which isolates a small triangular patch of mycoid surface in the posterolateral angle of mesopleuron, this being connected with the metapleural evaporatorium; the gyrification is hardly developed, large parts of the evaporatorium surface are flat.

In *Agaeus elegantulus* Jensen-Haarup, 1931 (Fig. 233), the vestibule is very short and not elevated; the ostiole is situated deeply mesially, between mesacetabulum and metacetabulum, very small, oval, opening laterally; the periostiolar depression is not developed; the peritremal surface is distally not emarginated and merging surrounding metapleuron, only the median furrow is distinct basally; the evaporatorium is small, on metapleuron surrounding the ostiole and peritremal surface, V-shaped, anteriorly extending laterad along the anterior metapleural margin towards the distal end of metathoracic spiracle, the mesopleural evaporatorium forms only an inconspicuous narrow stripe bordering anteriorly the metathoracic spiracle.

Eurydema oleracea (Linnaeus, 1758) (Figs. 226–232, 234) has the same pattern of the peritreme as *A. elegantulus*, but the mesopleural evaporatorium is completely missing and the metapleural evaporatorium is smaller, not reaching the metathoracic spiracle. The microsculpure of the external scent efferent system of *E. oleracea* is shown in Figs. 228–232.

In *Atelocera serrata* (Fabricius, 1803) (Fig. 235), the vestibule is slightly elevated distally; the ostiole is situated between meso- and metacetabulum, small, oval, opening laterally; the periostiolar depression is not developed; the peritreme is rudimentary, the peritremal surface is shorter than ostiole diameter; the evaporatorium is limited to the metapleuron, very small, reaching only half-length of the metathoracic spiracle, flat, without gyrification.

In *Aeptus singularis* Dallas, 1851 (Fig. 236), the vestibule is not elevated; the ostiole is situated deeply between meso- and metacetabulum, very small, oval, opening ventrally; the periostiolar depression is not developed; the peritreme is rudimentary, the peritremal surface is ca. as long as the ostiole diameter; the evaporatorium seems to be completely missing (observed under 125× magnification).

I did find neither the ostiole nor any other trace of the external scent efferent system in *Trochiscocoris rotundatus* Horváth, 1895.

Additional illustrations and SEM photographs of the external scent efferent system of Pentatominae were given in many papers, e.g., AHMAD & AFZAL (1989), AHMAD & KAMALUDDIN (1989), DISTANT (1902), CACHAN (1952b), CARVER (1990), CARVER et al. (1991), FILSHIE & WATERHOUSE (1969), HASAN (1990), JOHANSSON & BRÅTEN (1970), HASAN & KITCHING (1993), KITAMURA et al. (1984), KMENT (2008), KMENT & JINDRA (2009), LINNAVUORI (1982), MCDONALD (1992), MCDONALD & EDWARDS (1978), MCPHERSON (1982), NAGNAN et al. (1994), ROLSTON et al. (1980). ROLSTON &

McDonald (1981, 1984), Rider (1994), Wood & McDonald (1984), Woodward (1953), and many others.

4.16.7. Phyllocephalinae Amyot & Serville, 1843

(Figs. 237–238)

This subfamily includes 45 genera and 213 species distributed in tropics and subtropics of the Old World (Rider 2009).

In *Phyllocephala negus* Distant, 1910 (Fig. 237), the vestibule is elevated distally; the vestibular scar is missing; the ostiole is shifted laterad, situated ca. in half-width of metapleuron, small, merging median furrow of the spout, opening posterolaterally; the periostiolar depression is not developed; the peritreme has a form of a spout, being directed anterolaterad, elevated, the peritremal surface is ca. perpendicular with the metapleuron surface in its basal two thirds and has a deep median furrow, in the apical third it turns ventrally and it is apically flat; the evaporatorium is large, covering anterior and median parts of both meso- and metapleuron, not reaching the lateral pleural margin, metapleural evaporatorium laterally ridge-shaped emarginated; the gyrification is well developed, deep.

Macrina juvenca (Burmeister, 1835) (Fig. 238) differs in having the ostiole being situated between meso- and metacetabulum, large, and narrowly oval, the spout being slightly reduced, its peritremal surface being nearly parallel with metapleuron, only slightly raising towards apex, without a median furrow, and the smaller mesopleural evaporatorium.

The other genera of Phyllocephalinae (*Chalcopis* Kirkaldy, 1909, *Dalsira* Amyot & Serville, 1843, *Diplorhinus* Amyot & Serville, 1843, *Gonopsis* Amyot & Serville, 1843, *Lamtoplax* Linnavuori, 1982, *Megarrhamphus* Bergroth, 1891, *Salvianus* Distant, 1902, *Schyzops* Spinola, 1837, *Tantia* Distant, 1910) fit this variation. For additional illustrations of the external scent efferent system of Phyllocephalinae see e.g., Ahmad & Kamaluddin (1988, 1990), Kamaluddin & Ahmad (1988a,b, 1997), and Linnavuori (1982); Hasan & Kitching (1993) included SEM photographs of mycoid microsculpture.

4.16.8. Podopinae Amyot & Serville, 1843

(Figs. 239–245)

This subfamily includes 64 genera and 249 species distributed worldwide (RIDER 2009).

The structure of the external scent efferent system of the Podopinae can be summarized as follows: The vestibule is usually elevated distally (in species with ostiole opening laterally). The vestibular scar is always missing. The ostiole is usually shifted laterad, located ca. at lateral margins of meso- and metacetabulum (e.g., *Ancyrosoma* Amyot & Serville, 1843 [Fig. 239], *Crypsinus* Dohrn, 1860, *Derula* Mulsant & Rey, 1856 [Fig. 240], *Graphosoma* Laporte, 1833 [Fig. 241], *Podops* Laporte, 1833 [Fig. 242], *Scotinophara* Stål, 1868; *Ventocoris* Hahn, 1834) or in half-width of metapleuron (*Sternodontus* Mulsant & Rey, 1856, *Tholagmus* Bärensprung, 1860 [Fig. 243], *Vilpianus* Stål, 1860 [Fig. 244]); the genus *Cyptocoris* Burmeister, 1845 with ostiole placed between meso- and metacetabulum is rather an exception (Fig. 245). The ostiole is usually small or very exceptionally small and round (*Ancyrosoma*, *Crypsinus*, *Derula*, *Graphosoma*, *Podops*, *Scotinophara*, *Sternodontus*, *Vilpianus*), less frequently oval (*Cyptocoris*, *Ventocoris*), opening laterally (*Ancyrosoma*, *Crypsinus*, *Derula*, *Graphosoma*, *Scotinophara*, *Sternodontus*, *Ventocoris*, *Vilpianus*), ventrolaterally (*Cyptocoris*), or posterolaterally (*Podops*). The periostiolar depression is usually developed (except of *Tholagmus*), shallow (e.g., *Cyptocoris*) to deep, small (e.g., *Vilpianus*) to large (e.g., *Graphosoma*).

The peritreme has a shape of a spout with peritremal surface oblique to metapleuron surface. The spout is usually small and short (ca. 2–3× as long as the ostiole diameter) (e.g., *Ancyrosoma*, *Crollius* Distant, 1901, *Graphosoma*, *Ventocoris*) to very short and minute, hardly longer than the ostiole diameter (*Crypsinus*, *Podops*, *Sternodontus*, *Vilpianus*); in *Derula* the ostiole is situated on a small tubercle and lacks any visible peritremal surface. In *Tholagmus*, the peritreme forms an oval, mushroom-shaped structure elevated above surrounding pleuron, proximally bearing a very small and oval ostiole, opening ventrally, the peritremal surface is parallel with surrounding pleuron. Similar structure was described in *Kundelungua* Schouteden, 1951, where the perireme forms a knob-like, round protuberance bearing a very small, slit-like ostiole on its proximal margin (DAVIDOVÁ-VILÍMOVÁ 1993b).

There is also considerable variability in the extent of the evaporatorium. In *Graphosoma* and *Derula*, the evaporatorium is very large, covering posterior and lateral areas of mesopleuron, and anterior, median, and centre of posterior part of metapleuron. In *Ancyrosoma* and *Podops*, the evaporatorium is also very large, but it does not reach either lateral margin of mesopleuron or posterior margin of metapleuron. The evaporatoria of Podopinae (except the most reduced ones) are usually distictly gyrificated; the best developed gyrification is developed in *Podops*, where the evaporatorium surface is divided into many small, oval, and well elevated tubercles (Fig. 242). On the opposite, in *Cyptocoris*, *Sternodontus* and *Tholagmus*, the evaporatorium is considerably reduced, surrounding only the ostiole, peritreme, and sometimes the metathoracic spiracle (*Sternodontus*, *Tholagmus*), however, still it is developed on both meso- and metapleuron. In *Kundelungua*, the evaporatorium is limited only to a narrow ring around the peritreme and does not cross on mesopleuron (DAVIDOVÁ-VILÍMOVÁ 1993b).

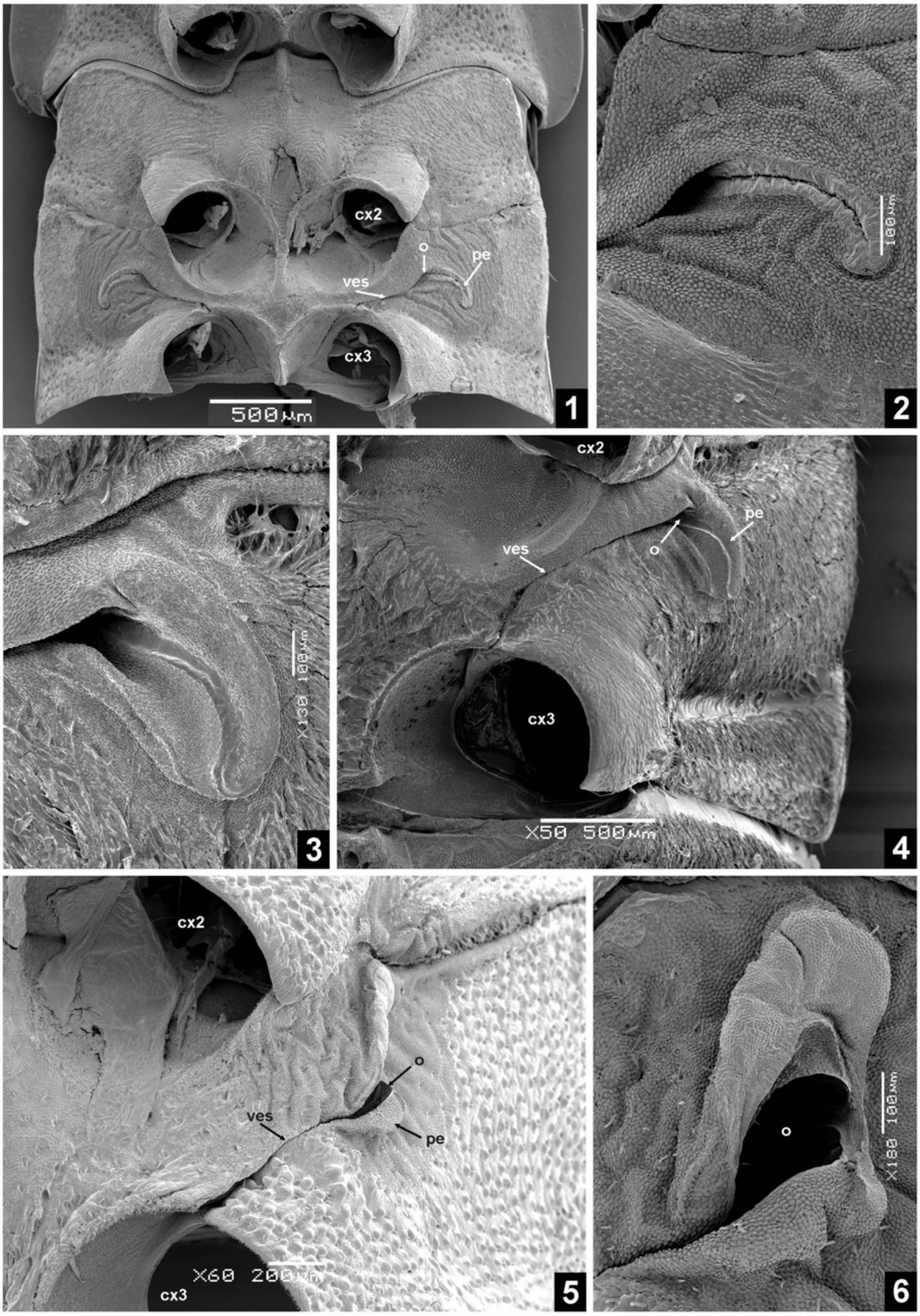
In the *Tarisa* Amyot & Serville, 1843 (Tarisini) and *Tornosia* Bolívar, 1879 (Podopini), the ostioles and remaining parts of the external scent efferent system are not developed at all (HASAN & KITCHING 1993, DAVIDOVÁ-VILÍMOVÁ 1999).

For additional illustrations and SEM photographs of the external scent efferent systems of Podopinae see e.g., DISTANT (1902), DURAK & KALENDER (2007c, 2009) and LINNAVUORI (1982).

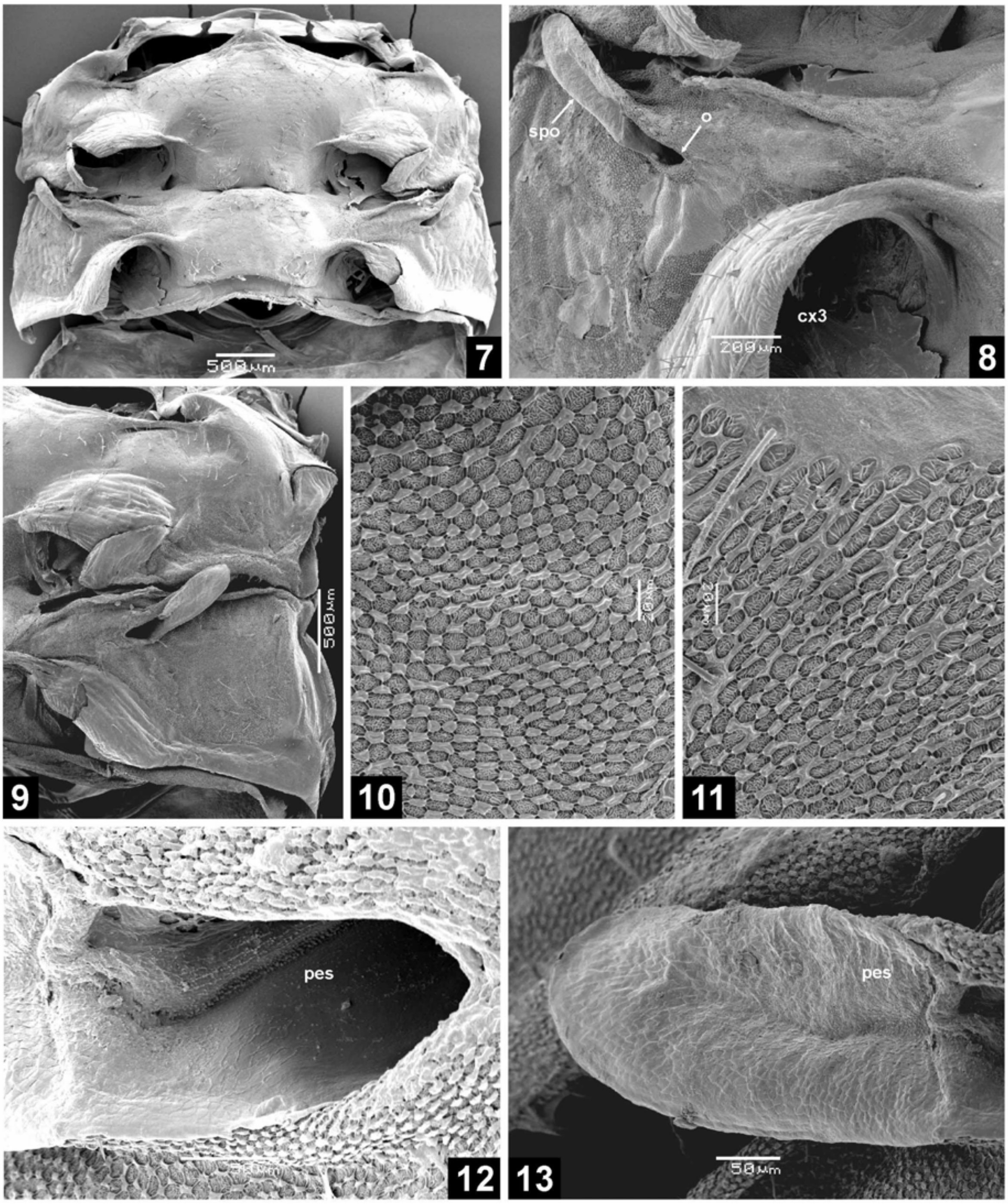
4.16.9. Stirotarsinae Rider, 2000

A monotypic subfamily including only the aberrant species *Stirotarsus abnormis* Bergroth, 1911 from tropical South America.

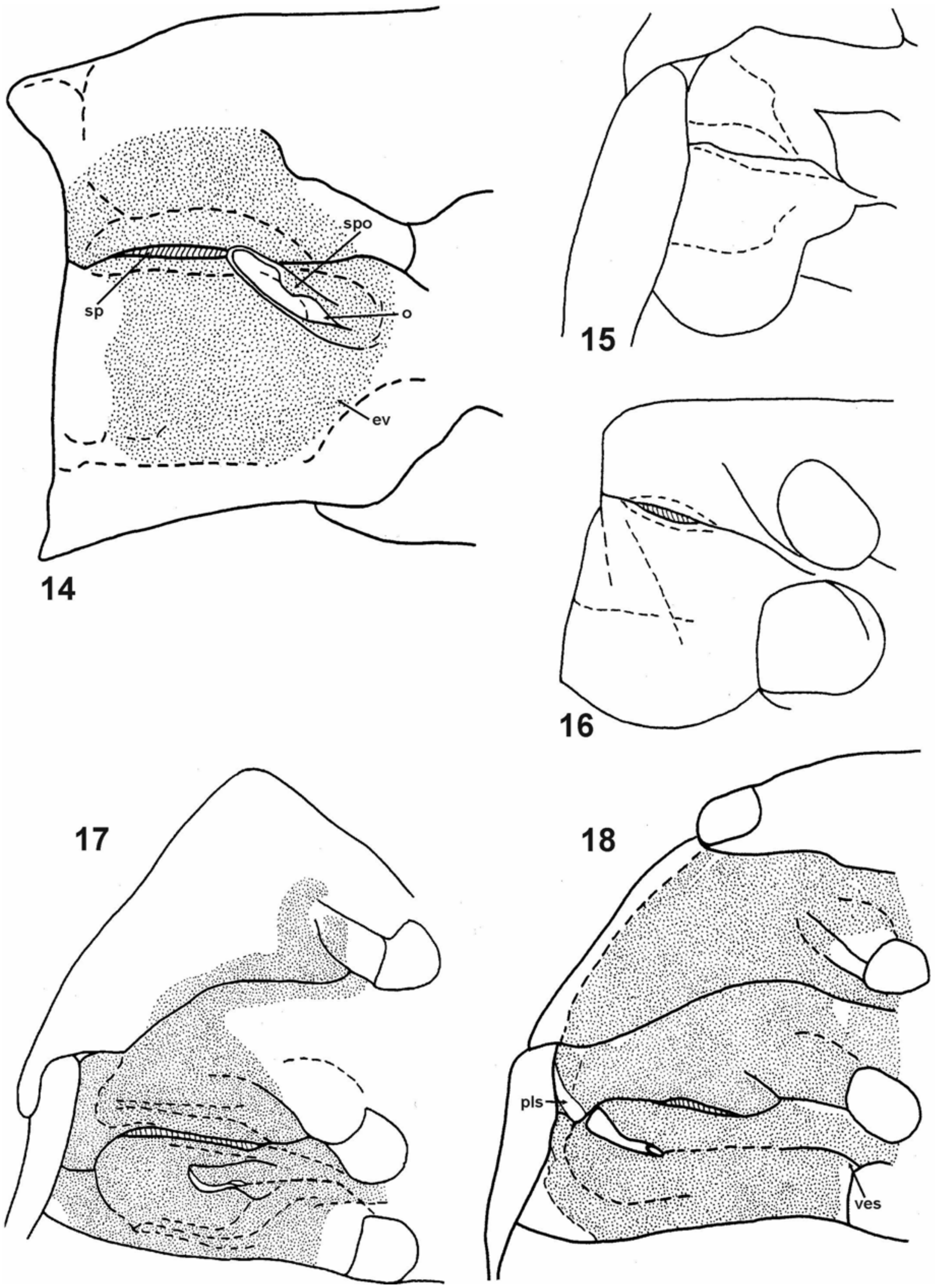
BERGROTH (1911) described the external scent efferent system of *S. abnormis* as ‘orificia haud distinguenda; area evaporativa nulla [= ostioles hardly distinguishable, no evaporative area]’. Similarly, RIDER (2000) published the following short description: ‘Ostiole obsolete, evaporatoria very small.’ Neither BERGROTH (1911) nor RIDER (2000) illustrated the external scent efferent system of *S. abnormis*. Unfortunatelly, no specimen of this species was available for the study.



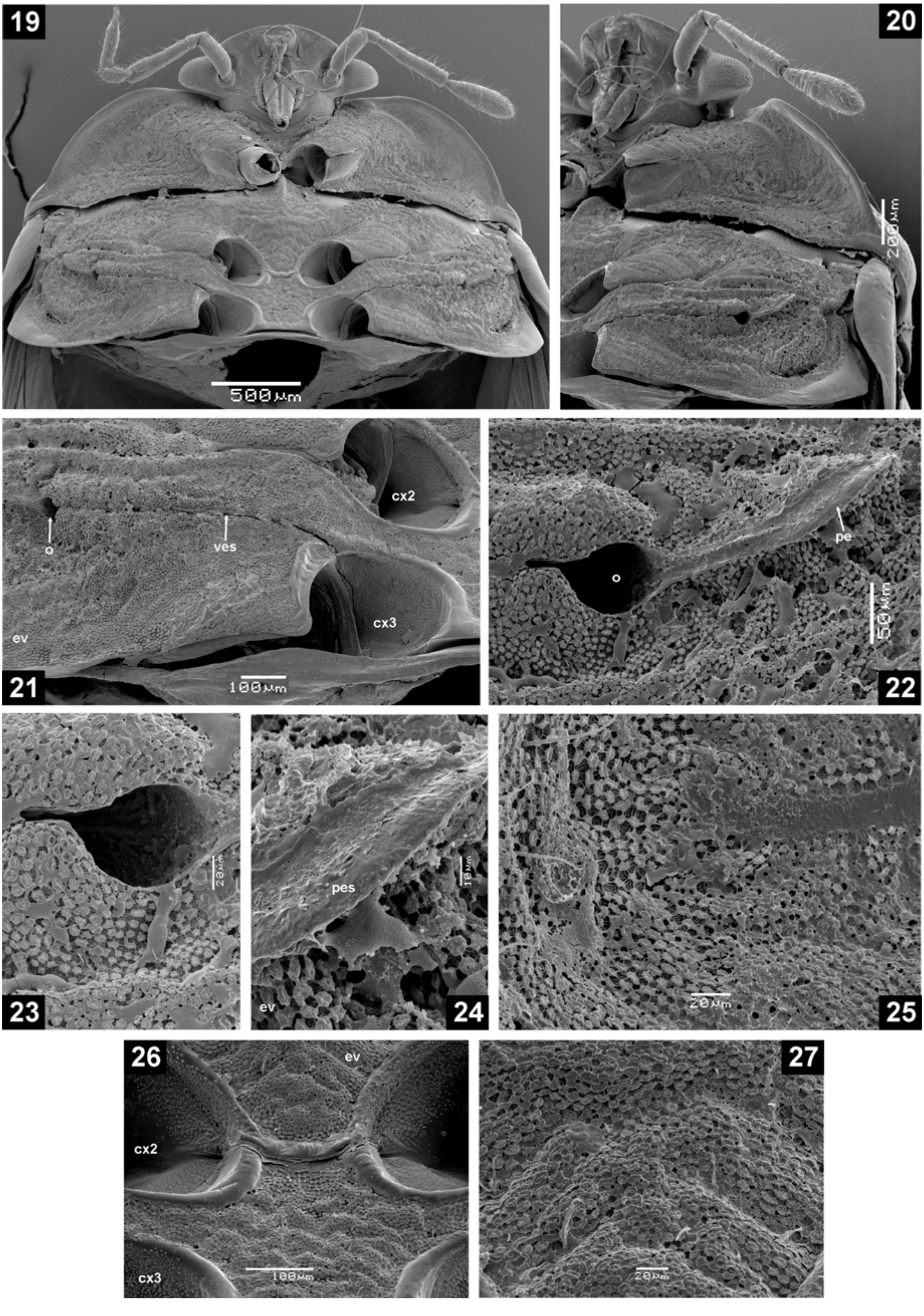
Figs. 1–6. 1–2 – *Emblethis verbasci* (Fabricius, 1803): 1 – thorax in ventral view (magnification 40×), 2 – ostiole and auricle (180×). 3–4 – *Physopelta gutta gutta* (Burmeister, 1834): 3 – ostiole and auricle (130×), 4 – detail of vestibular scar (50×). 5–6 – *Coreus marginatus* (Linnaeus, 1758): 5 – detail of vestibular scar (60×), 6 – ostiole and auricle (180×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, o – ostiole, pe – peritreme, ves – vestibular suture.



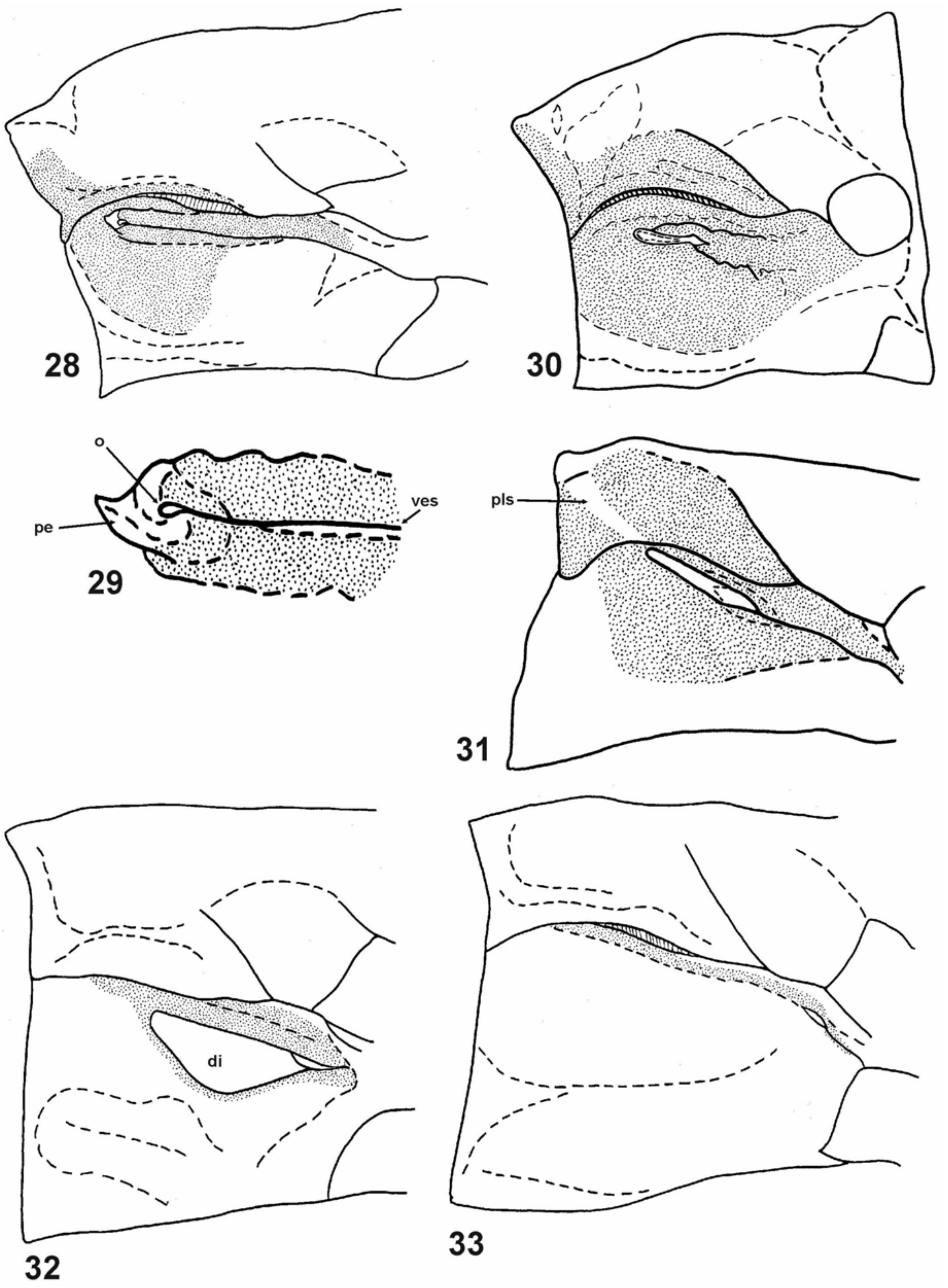
Figs. 7–13. *Urostylis lateralis* Walker, 1867: 7 – thorax in ventral view (magnification 27×), 8 – detail of area between metacoxa and ostiole (90×), 9 – meso- and metapleuron (45×), 10 – mycoid surface in centre of metapleural evaporatorium (600×), 11 – mycoid surface and transitional microsculpture anterior on margin of mesopleural evaporatorium (600×), 12 – ostiole (posterolateral view, 500×), 13 – detail of peritremal surface (posterolateral view, 330×). Abbreviations: cx3 – metacoxal cavity, o – ostiole, pes – peritremal surface, spo – spout.



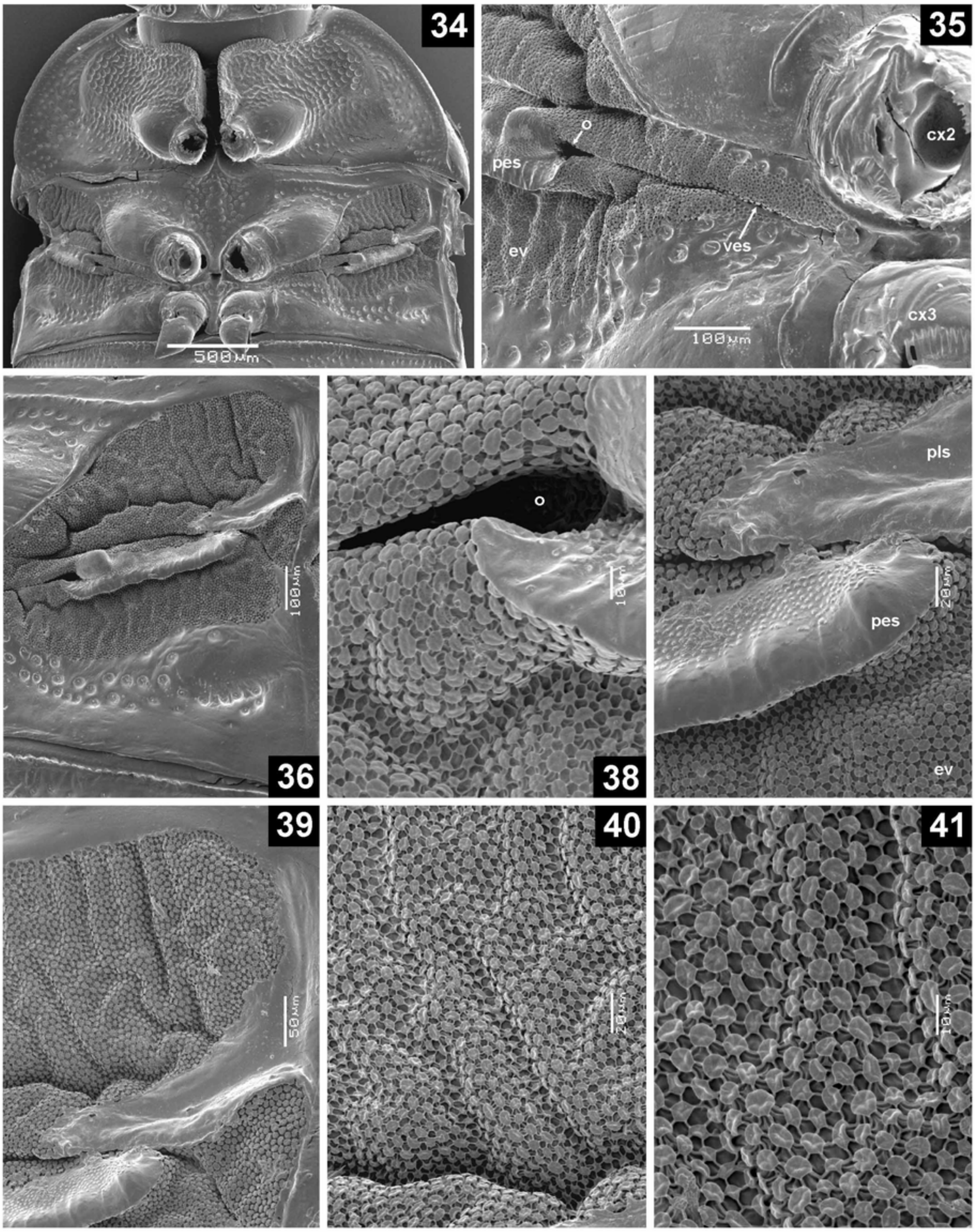
Figs. 14–18. Meso- and metapleuron, most exposed view: 14 – *Urochela* (*Urochela*) *luteovaria* Distant, 1881 (magnification 40×), 15 – *Bannacoris arboreus* Hsiao, 1964 (50×), 16 – *Ruckesona vitrella* Schaefer & Ashlock, 1970 (50×), 17 – *Caternaultiella ferruginea* Montandon, 1899 (32×), 18 – *Brachyplatys hemisphaericus* Westwood, 1837 (32×). Abbreviations: ev – evaporatorium (dotted), o – ostiole, pls – peritreme-like structure of mesopleuron, sp – metathoracic spiracle, spo – spout, ves – vestibular suture.



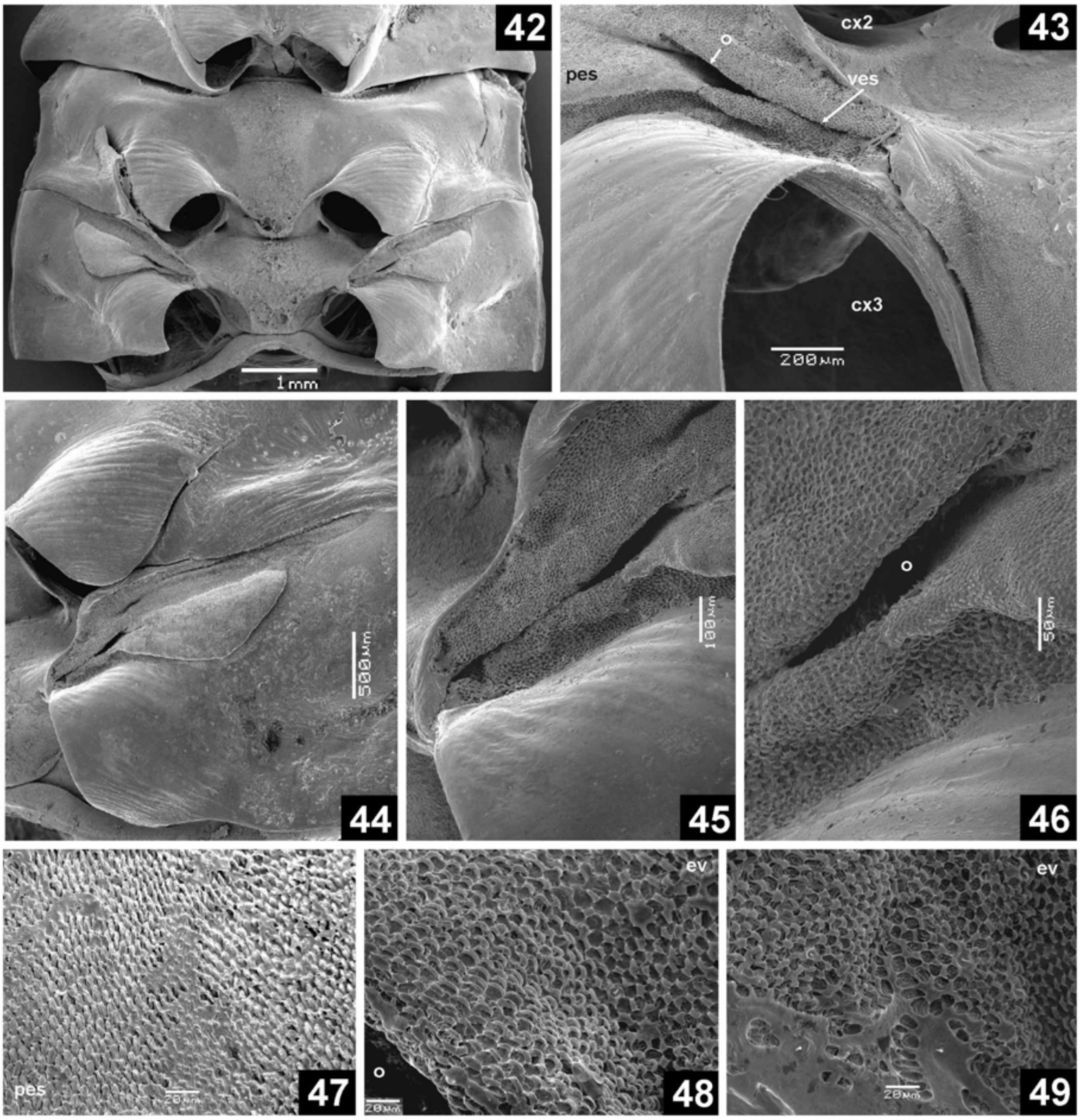
Figs. 19–27. *Coptosoma scutellatum* (Geoffroy, 1785): 19 – thorax in ventral view (magnification 40×), 20 – pleuron (60×), 21 – detail of vestibular scar (120×), 22 – detail of ostiole and peritreme (270×), 23 – detail of ostiole (700×), 24 – detail of peritreme (1200×), 25 – mycoid surface of propleural evaporatorium (600×), 26 – mycoid surface of meso- and metasternum (250×), 27 – detail of mycoid surface of metasternum (600×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, o – ostiole, pe – peritreme, pes – peritremal surface, ves – vestibular suture.



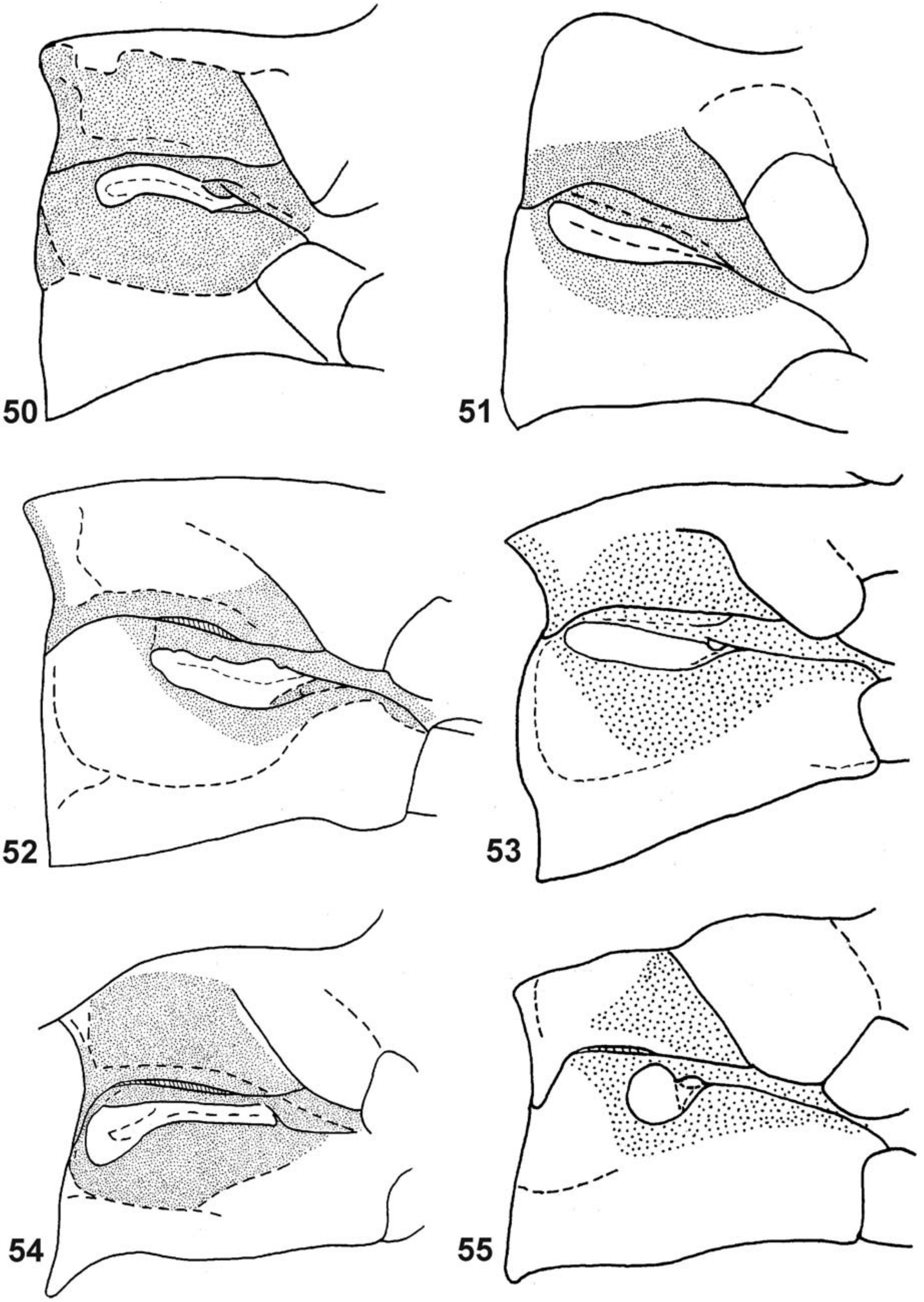
Figs. 28–33. Meso- and metapleuron, most exposed view: 28–29 – *Phloeophana longirostris* (Spinola, 1837) (28 – magnification 25×; 29 – detail of ostiole and peritreme, 20×), 30 – *Serbana borneensis* Distant, 1906 (32×), 31 – *Galgupha* (*Gyrocnemis*) *impressa* Horváth, 1919 (50×), 32 – *Parastrachia nagaensis* Distant, 1908 (25×), 33 – *Dismegistus sanguineus* De Geer, 1778 (25×). Abbreviations: di – disc-shaped peritreme, o – ostiole, pe – peritreme, pls – peritreme-like structure of mesopleuron, ves – vestibular suture; evaporatorium is dotted.



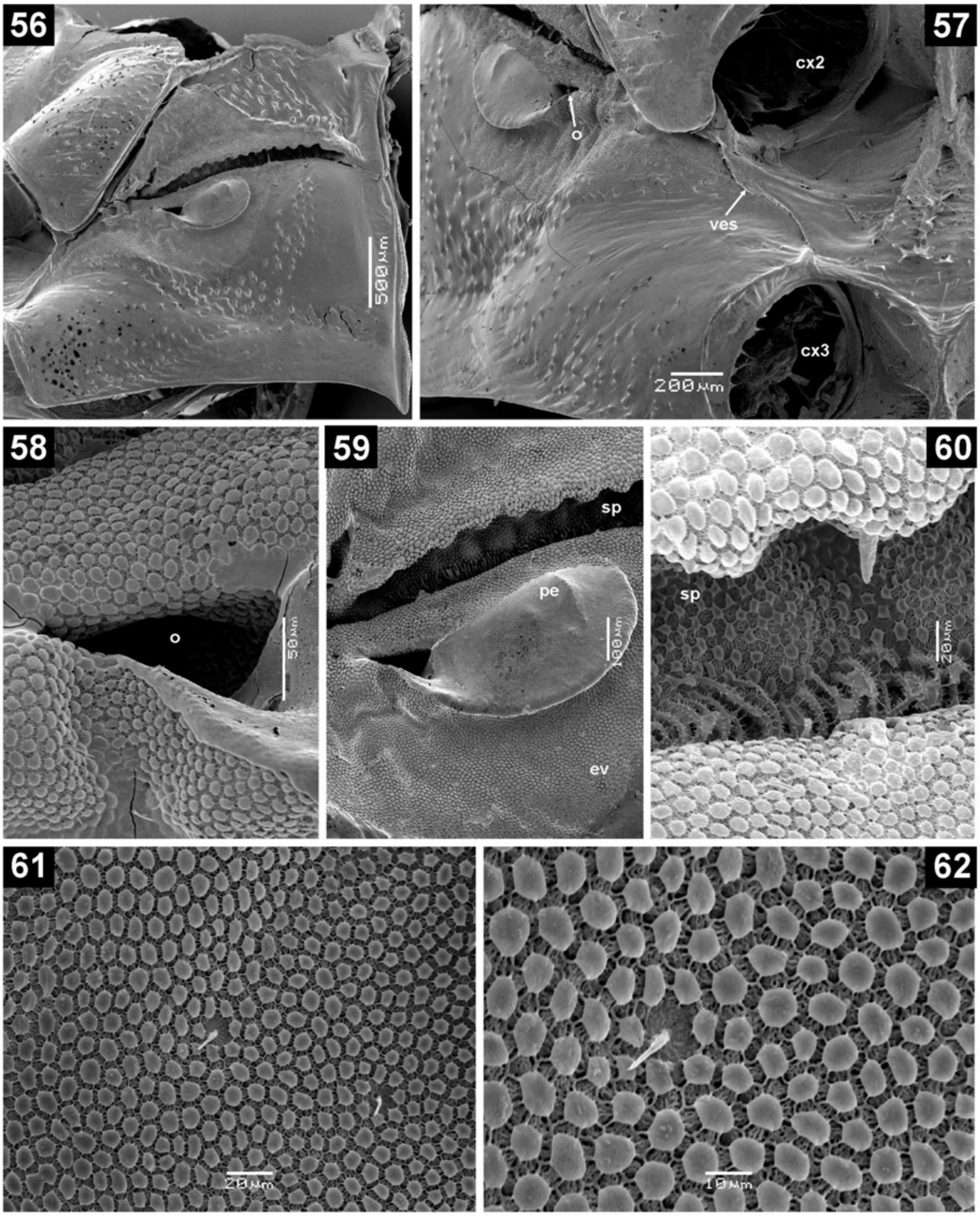
Figs. 34–41. *Thyreocoris scarabaeoides* (Linnaeus, 1758): 34 – thorax in ventral view (magnification 45×), 35 – detail of vestibular scar (200×), 36 – meso- and metapleuron (130×), 37 – detail of ostiole (1000×), 38 – detail of peritremal apex and peritreme-like structure of mesopleuron (600×), 39 – detail of lateral part of the mesopleural evaporatorium and peritreme-like structure of mesopleuron (300×), 40–41 – mycoid surface of mesopleural evaporatorium (40 – 600×, 41 – 1200×). Abbreviations: cx2 – mesocoxa, cx3 – metacoxa, ev – evaporatorium, o – ostiole, pes – peritremal surface, pls – peritreme-like structure of mesopleuron, ves – vestibular suture.



Figs. 42–49. *Parastrachia nagaensis* Distant, 1908: 42 – thorax in ventral view (magnification 16×), 43 – detail of vestibular scar (95×), 44 – external scent efferent system (33×), 45 – detail of vestibular scar and ostiole (130×), 46 – detail of ostiole (300×), 47 – detail of peritremal surface on base of peritremal disc (600×), 48–49 – details of mycoid surface of metapleural evaporatorium (48 – area anteriorly of ostiole, 600×; 41 – posterior margin of lateral part of evaporatorium, 600×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, o – ostiole, pes – peritremal surface, ves – vestibular suture.



Figs. 50–55. Meso- and metapleuron, most exposed view: 50 – *Amnestus spinifrons* (Say, 1825) (magnification 50×), 51 – *Peltoxys typicus* (Distant, 1901) (50×), 52 – *Tritomegas sexmaculatus* (Rambur, 1842) (50×), 53 – *Legnotus limbosus* (Geoffroy, 1785) (40×), 54 – *Chilocoris* (*Statanus*) *assmuthi* Breddin, 1904 (50×), 55 – *Microporus nigritus* (Fabricius, 1794) (40×). Evaporatorium is dotted.



Figs. 56–62. *Cydnus aterrimus* (Forster, 1771): 56 – meso- and metapleuron (magnification 33×), 57 – detail of vestibular scar (60×), 58 – detail of ostiole (500×), 59 – detail of peritreme (130×), 60 – detail of metathoracic spiracle (median part, 600×), 61–62 – detail of mycoid microsculpture in centre of metapleural evaporatorium (61 – 600×, 62 – 1200×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, o – ostiole, pe – peritreme, sp – metathoracic spiracle, ves – vestibular suture.

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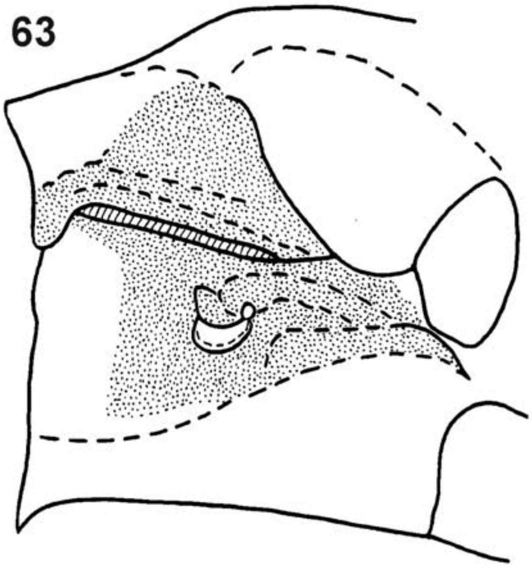

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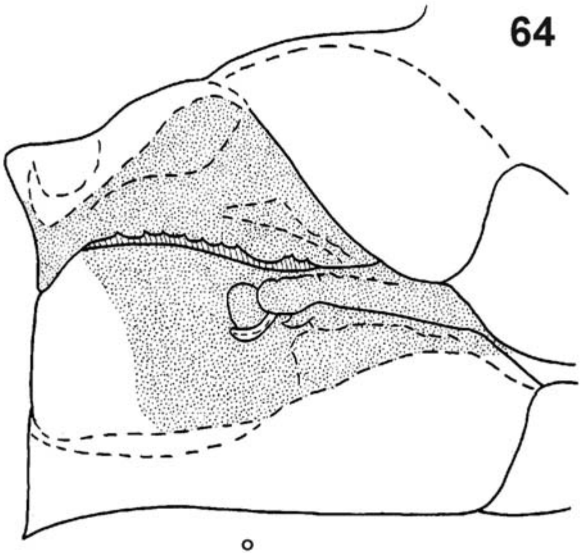

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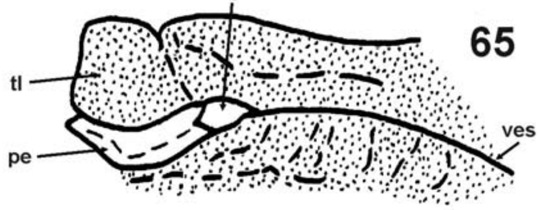

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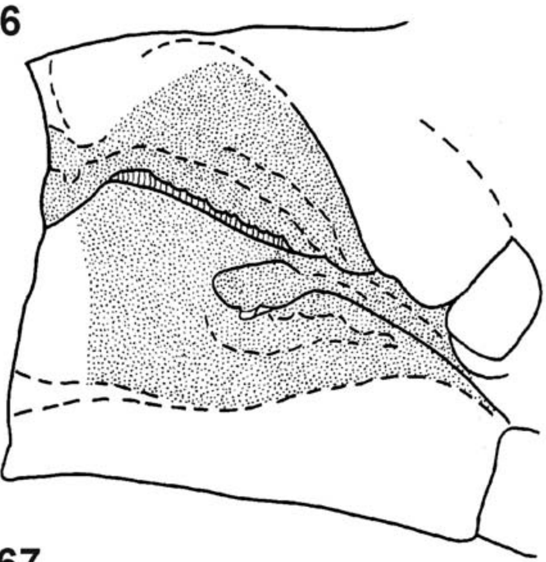

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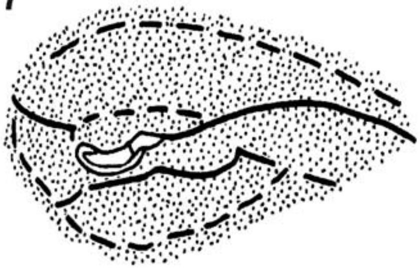

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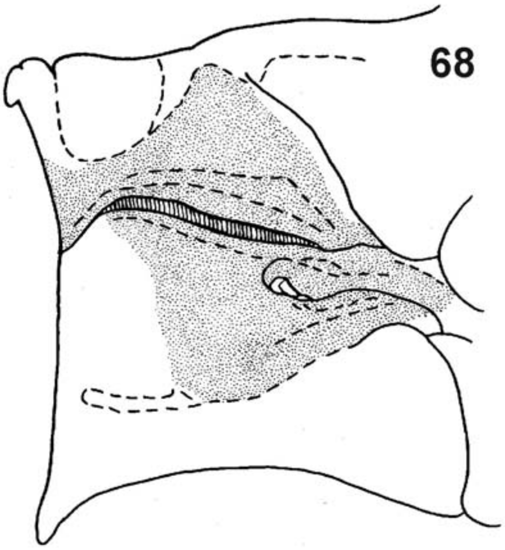

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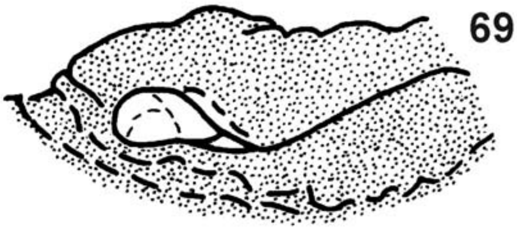
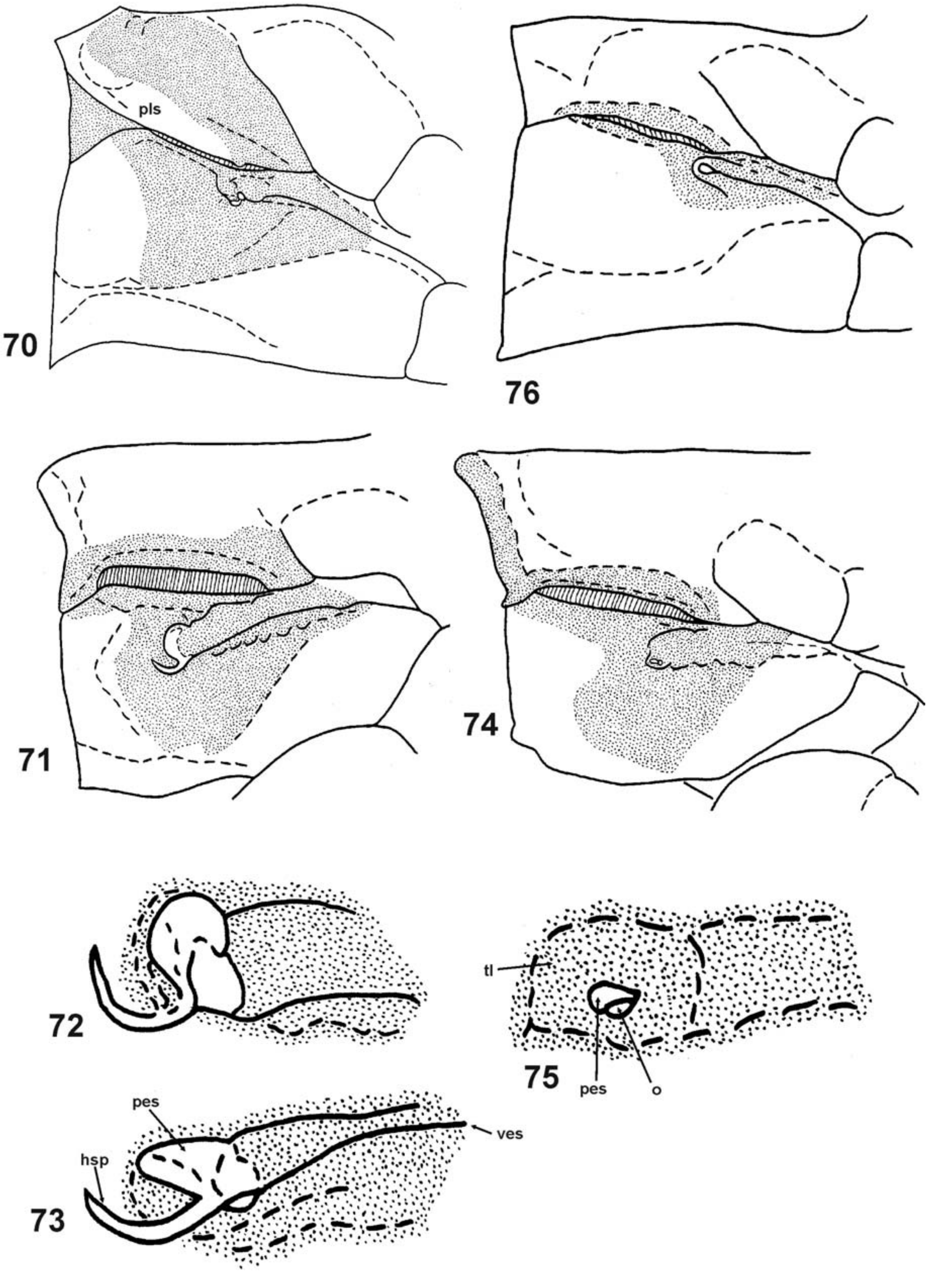
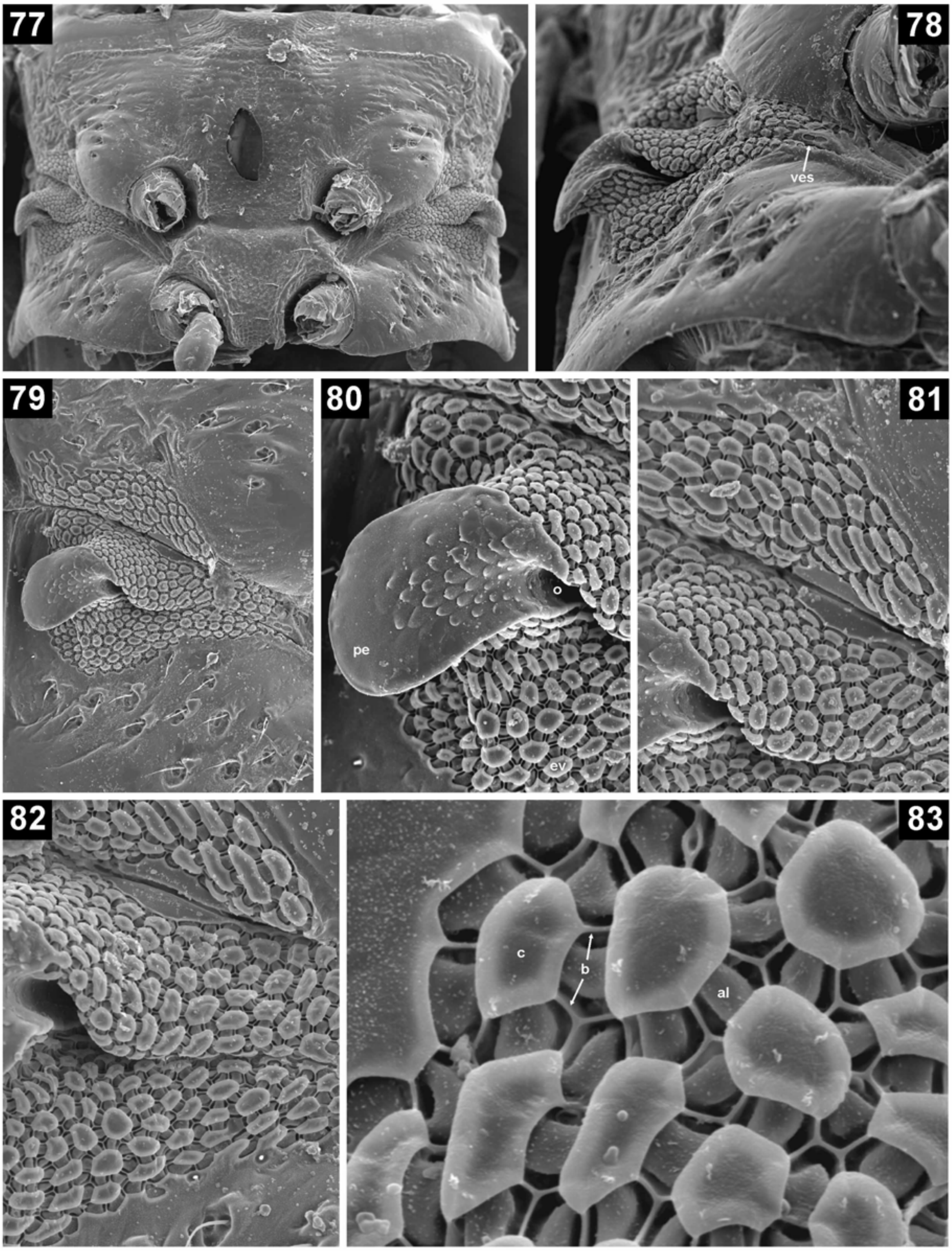


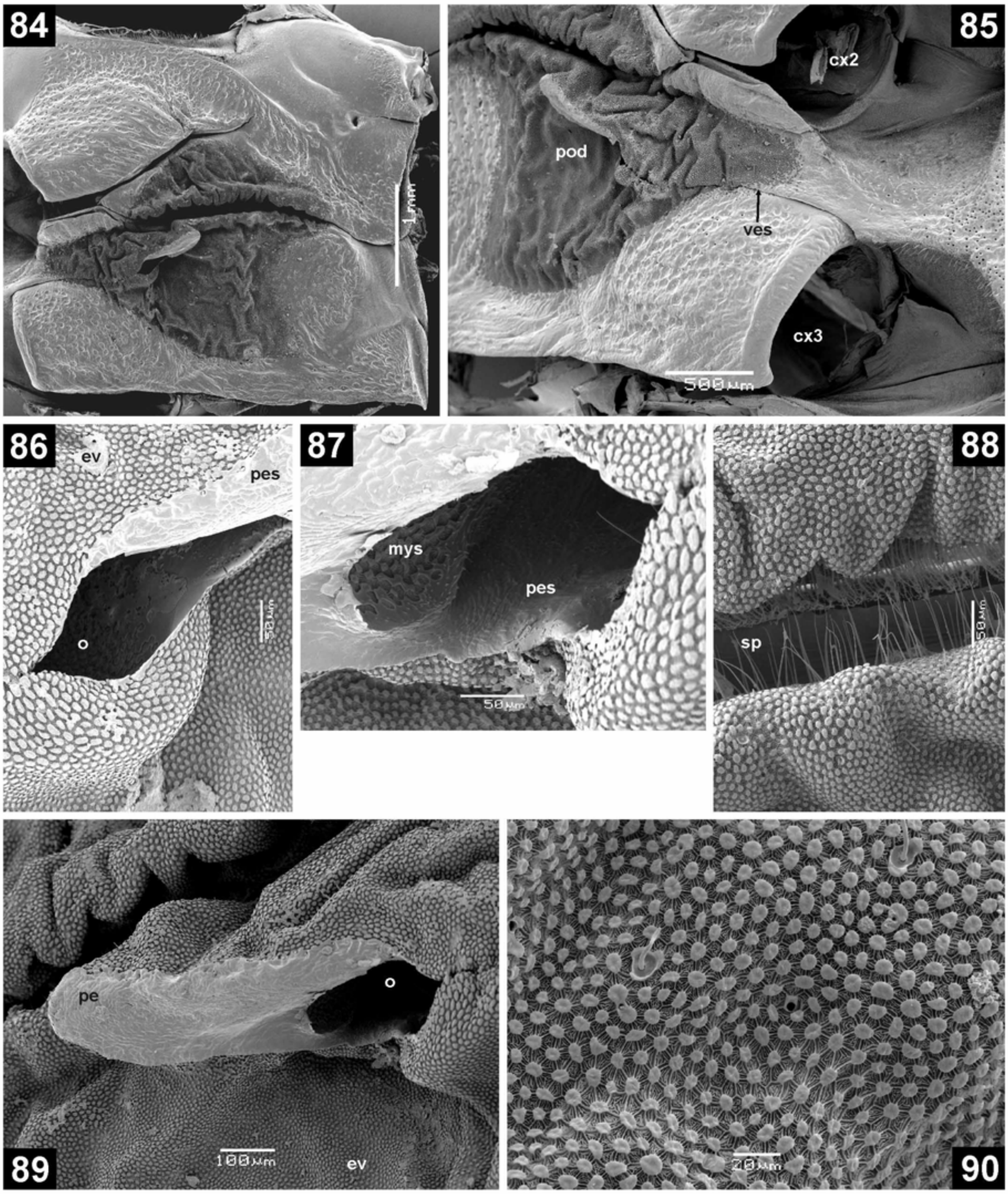
Figs. 63–69. 63–64, 66, 68 – meso- and metapleuron, most exposed view; 65, 67, 69 – detail of ostiole, terminal lobe and peritreme: 63 – *Scoparis* (*Euscoparipes*) *affinis* Lis, 1990 (magnification 32×), 64–65 – *Pseudoscoparipes* (*Pseudoscoparipes*) *nilgiricus* Lis, 1990 (64 – 32×, 65 – 50×), 66–67 – *Dalasiellus* (*Dalasiellus*) *solitarius* (Horváth, 1919) (66 – 32×, 67 – 50×), 68–69 – *Prolobodes giganteus* (Burmeister, 1835) (68 – 25×, 69 – 50×). Abbreviations: o – ostiole, pe – peritreme, tl – terminal lobe, ves – vestibular suture; evaporatorium is dotted.



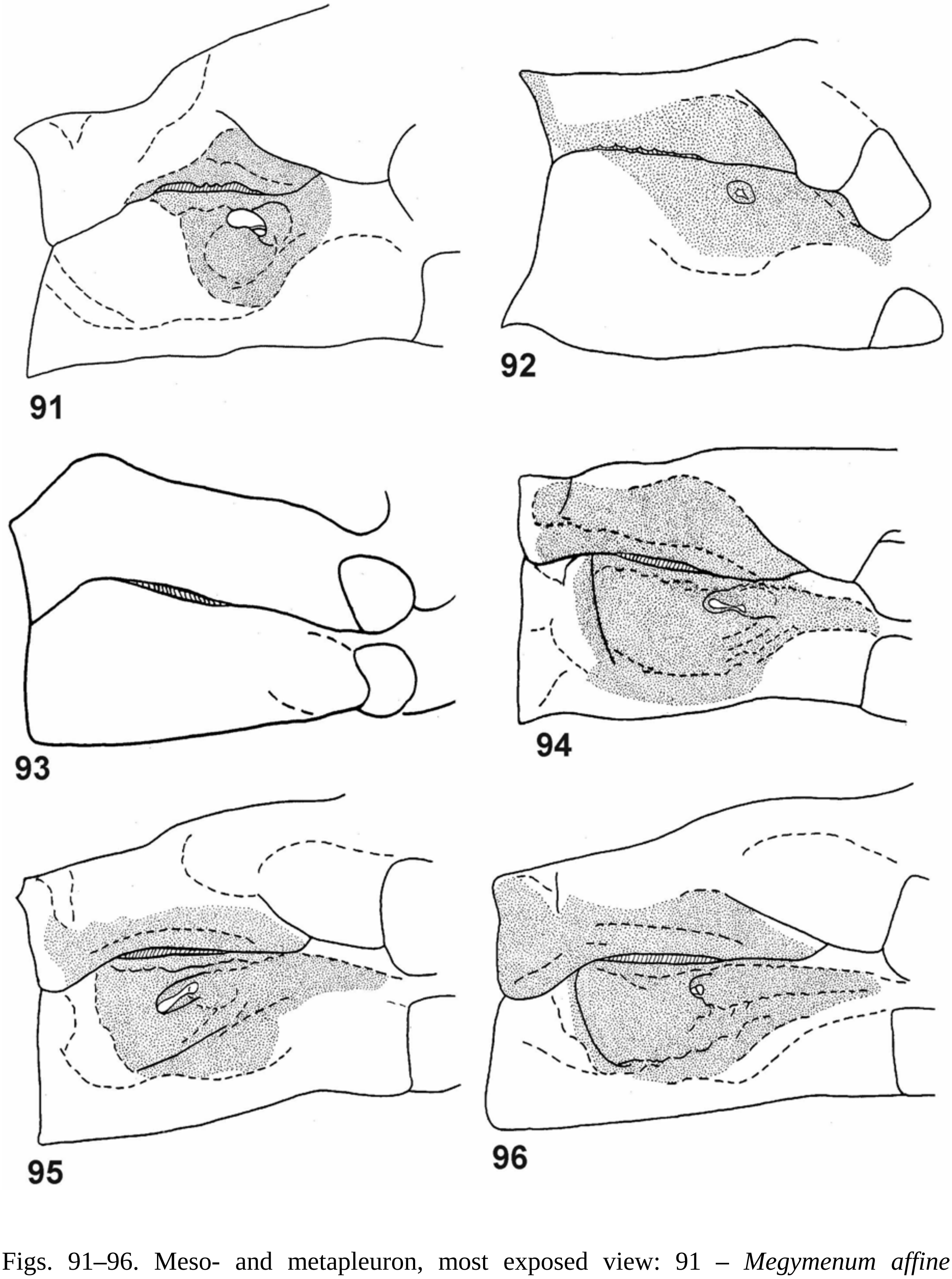
Figs. 70–76. 70–71, 74, 76 – meso- and metapleuron, most exposed view; 72–73, 75 – detail of ostiole, terminal lobe and peritreme: 70 – *Macroscytus brunneus* (Fabricius, 1803) (magnification 50×), 71–73 – *Stibaropus* (*Stibaropus*) cf. *molginus* (Schiødte, 1847) (71 – 32×, 72–73 – 50×), 74–75 – *Scaptocoris castaneus* Perty, 1833 (74 – 32×, 75 – 50×), 76 – *Linospa orbicularis* (Jakovlev, 1885) (32×). Abbreviations: hsp – hook-shaped projection, o – ostiole, pes – peritremal surface, pls – peritreme-like structure of mesopleuron, tl – terminal lobe, ves – vestibular suture; evaporatorium is dotted.



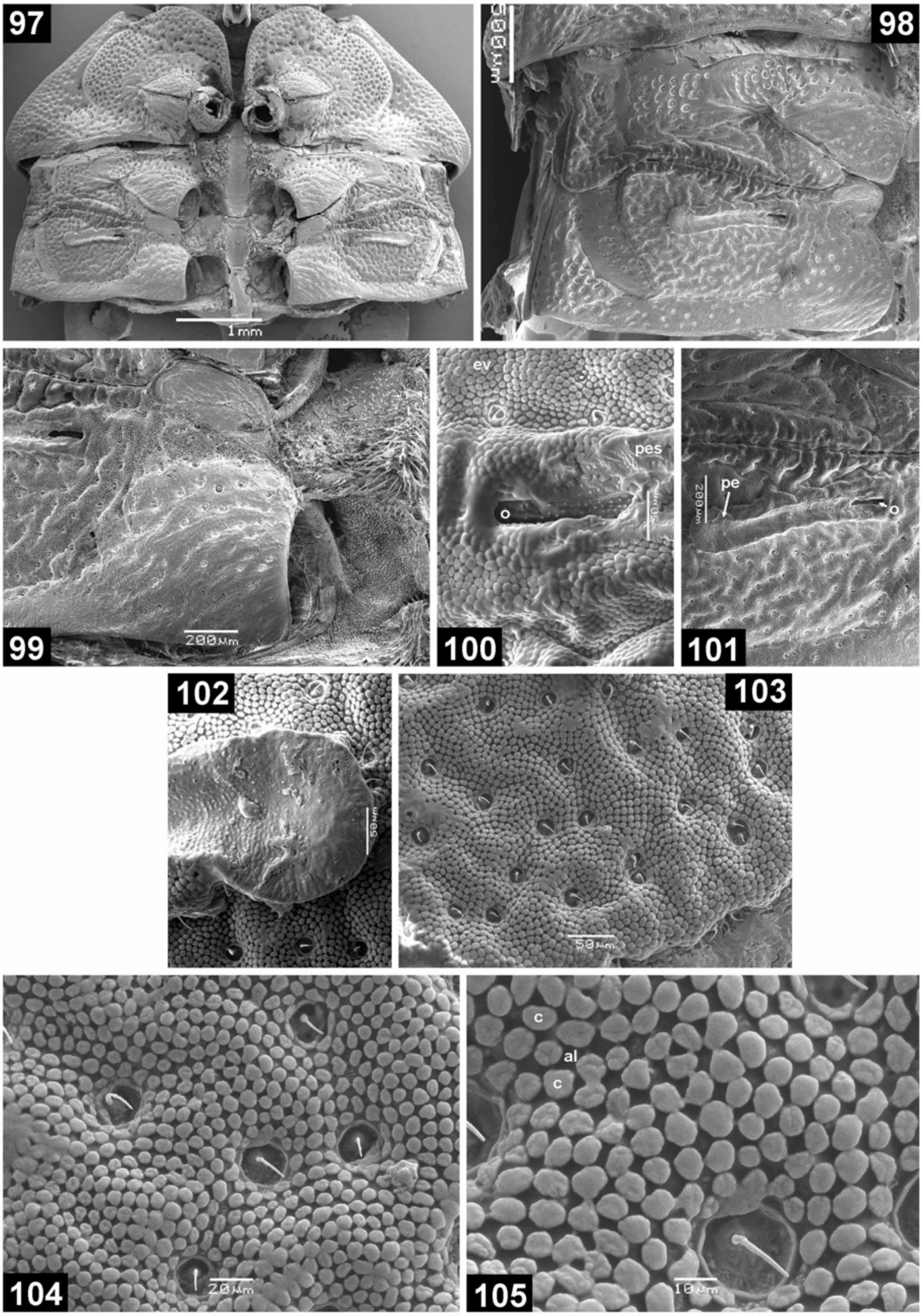
Figs. 77–83. *Thaumastella aradoides* Horváth, 1896: 77 – thorax in ventral view (magnification 140×), 78 – detail of vestibular scar (posterior view , 400×), 79 – external scent efferent system (400×), 80 – detail of ostiole and peritreme (1000×), 81–82 – details of ostiole and evaporatorium (both 1000×), 83 – detail of mushroom bodies (3500×). Abbreviations: al – alveole, b – bridges interconnecting mushroom bodies, c – cap of mushroom body, ev – evaporatorium, o – ostiole, pes – peritremal surface, ves – vestibular suture.



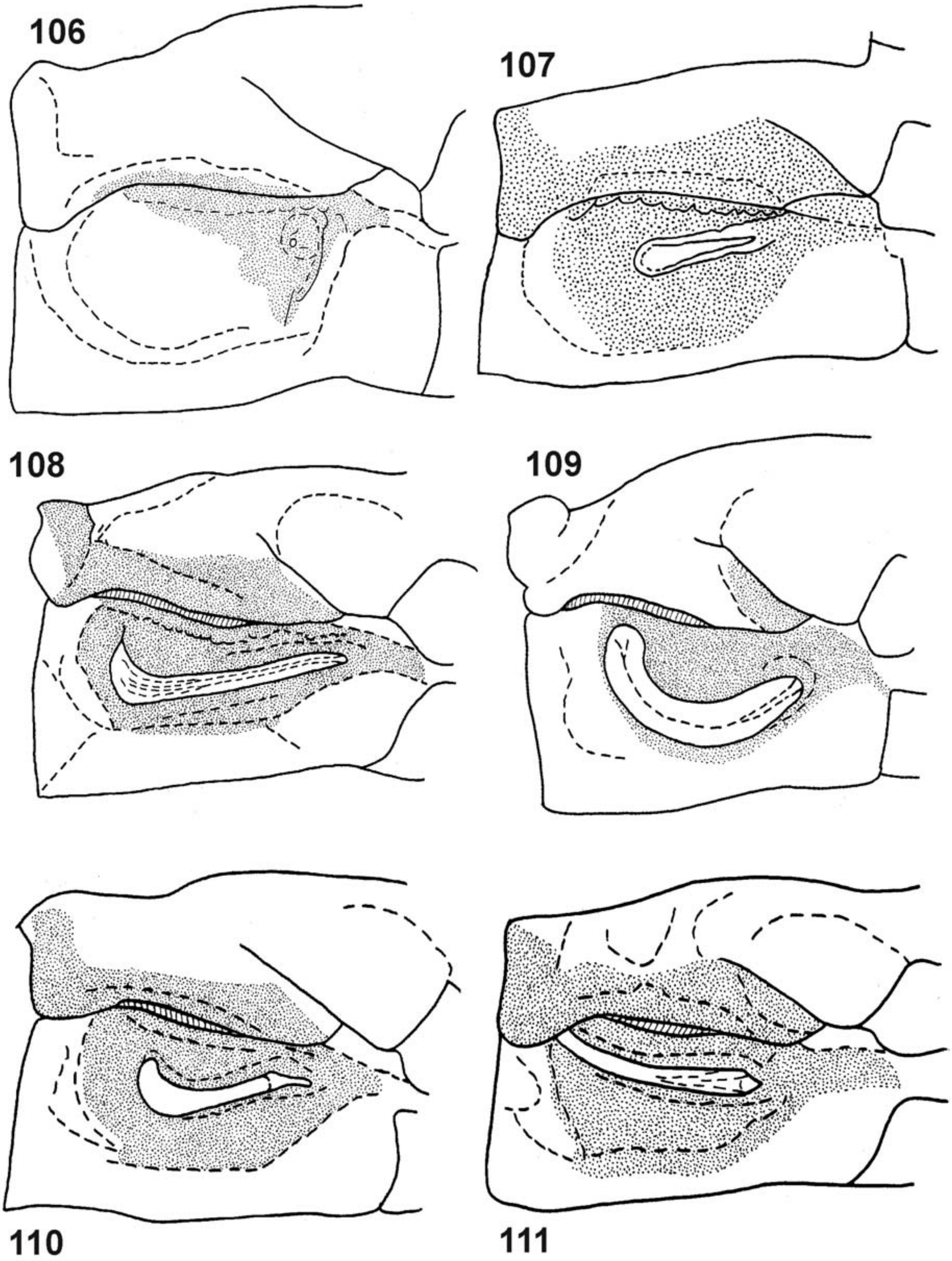
Figs. 84–90. *Coridius viduatus* (Fabricius, 1794): 84 – meso- and metapleuron (magnification 22×), 85 – detail of vestibular scar (40×), 86–87 – details of ostiole (86 – ventral view, 270×; 87 – posterior view, 400×), 88 – detail of metathoracic spiracle (median part, 300×), 89 – detail of ostiole and peritreme (posteroventral view, 50×), 90 – detail of mycoid surface of mesopleural evaporatorium (600×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, mys – mycoid surface, o – ostiole, pes – peritremal surface, pod – periostiolar depression, sp – metathoracic spiracle, ves – vestibular suture.



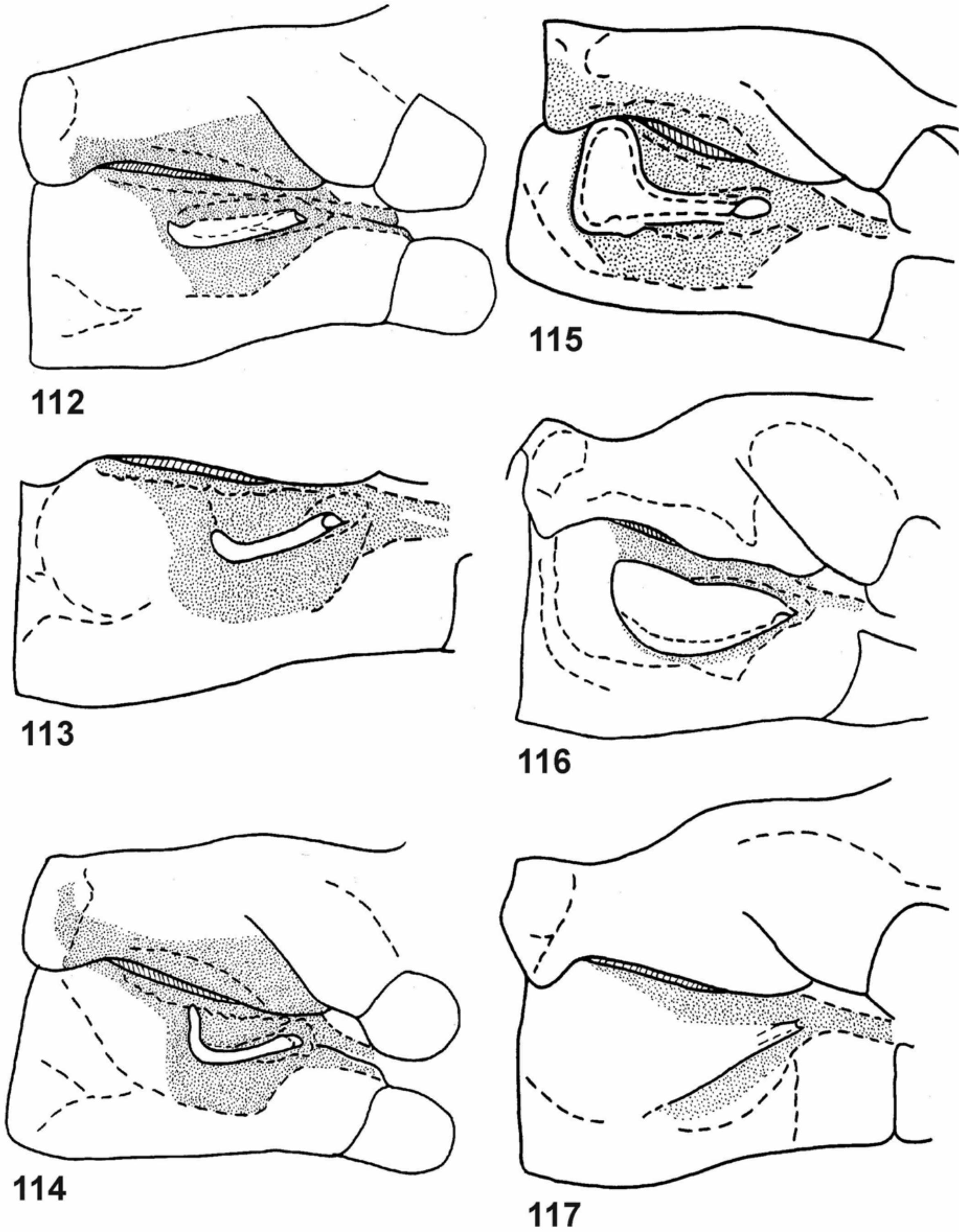
Figs. 91–96. Meso- and metapleuron, most exposed view: 91 – *Megymenum affine* Boisduval, 1835 (magnification 32×), 92 – *Canopus caesus* (Germar, 1839) (50×), 93 – *Megaris peruviana* Horváth, 1919 (50×), 94 – *Steganocerus multipunctatus* (Thunberg, 1783) (32×), 95 – *Chelycoris haglundi* (Montandon, 1895) (32×), 96 – *Polytes lineolatus* (Dallas, 1851) (32×). Evaporatorium is dotted.



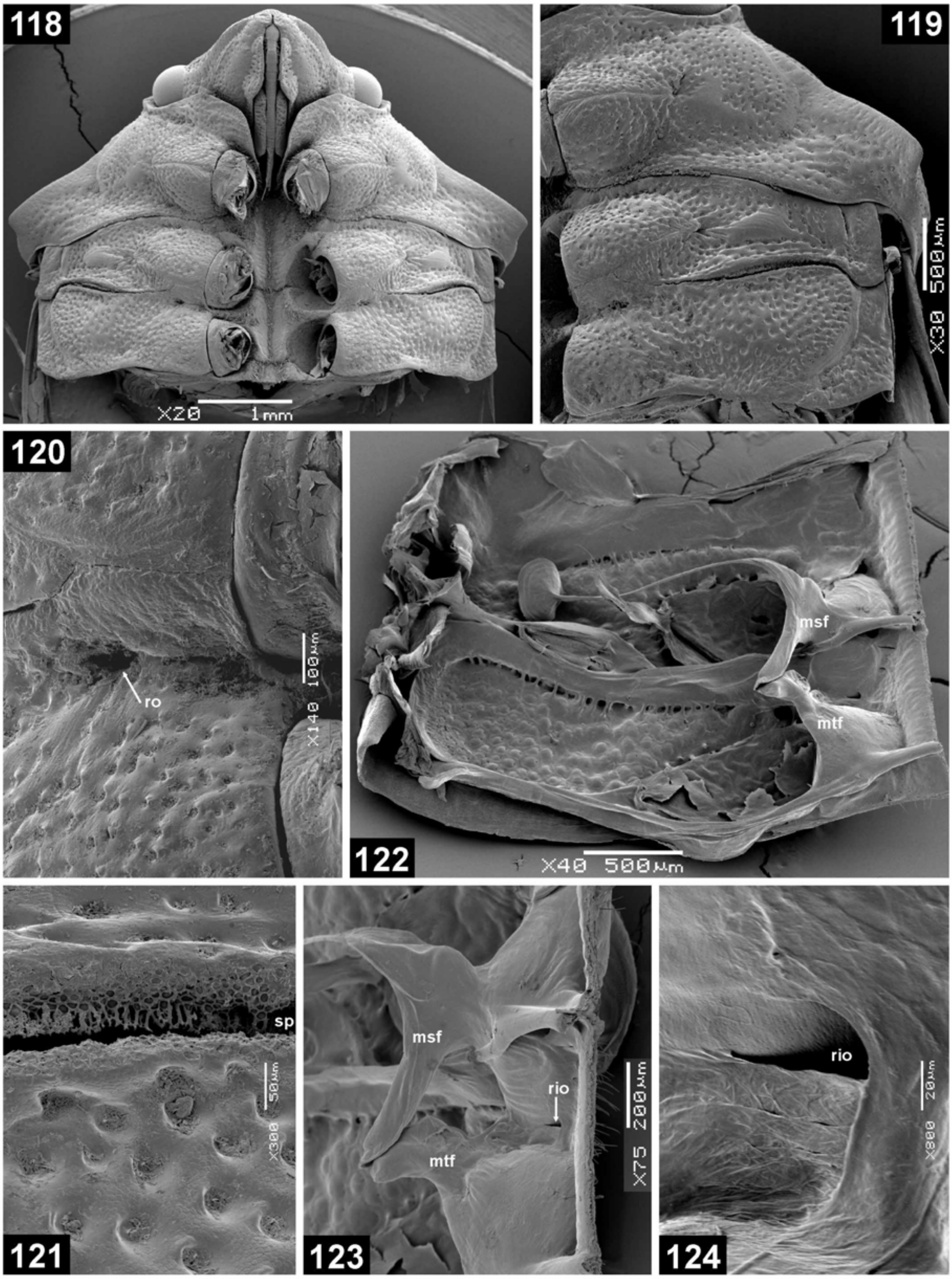
Figs. 97–105. *Eurygaster maura* (Linnaeus, 1758): 97 – thorax in ventral view (magnification 22×), 98 – meso- and metapleuron (30×), 99 – detail of area between metacoxa and ostiole (80×), 100 – detail of ostiole (400×), 101–102 – details of peritreme (101 – 95×; 102 – apex, 400×), 103–105 – details of mycoid surface of metapleural evaporatorium (103 – 300×, 104 – 600×, 105 – 1200×). Abbreviations: al – alveole, c – cap of mushroom body, cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, o – ostiole, pe – peritreme, pes – peritremal surface.



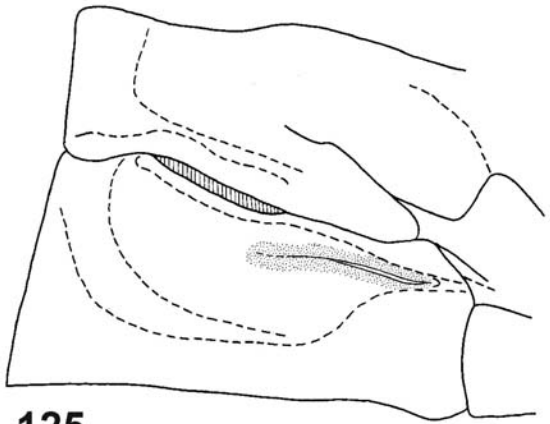
Figs. 106–111. Meso- and metapleuron, most exposed view: 106 – *Psacasta* (*Psacasta*) *exanthematica cerinthe* (Fabricius, 1787) (magnification 40×), 107 – *Eurygaster maura* (Linnaeus, 1758) (25×), 108 – *Poecilocoris pulcher* Dallas, 1848 (32×), 109 – *Procilia morgani* (White, 1839) (20×), 110 – *Agonosoma trilineatum* (Fabricius, 1782) (32×), 111 – *Lobothyreus lobatus* (Westwood, 1837) (32×). Evaporatorium is dotted.



Figs. 112–117. Meso- and metapleuron, most exposed view: 112–114 – *Cryptacrus comes* (Fabricius, 1803) (112 – Democratic Republic of the Congo, var. *princeps*; 113 – no locality, var. *rufopicta*; 114 – Somalia, var. *rufopicta*) (magnifications 16×), 115 – *Sphyrocoris obliquus* (Germar, 1839) (32×), 116 – *Calliphara nobilis* (Linnaeus, 1763) (20×), 117 – *Calliscyta stalii* (Vollenhoven, 1863) (20×). Evaporatorium is dotted.



Figs. 118–124. *Odontotarsus robustus* Jakovlev, 1884: 118 – thorax in ventral view (magnification 20×), 119 – meso- and metapleuron (30×), 120 – detail of possible rudiment of ostiole (140×), 121 – detail of metathoracic spiracle (300×), 122 – meso- and metathorax in internal view (40×), 123–124 – details of possible rudiment of internal orifice (103 – 75×, 104 – 800×). Abbreviations: msf – mesofurca, mtf – metafurca, rio – possible rudiment of internal orifice, ro – possible rudiment of ostiole, sp – metathoracic spiracle.



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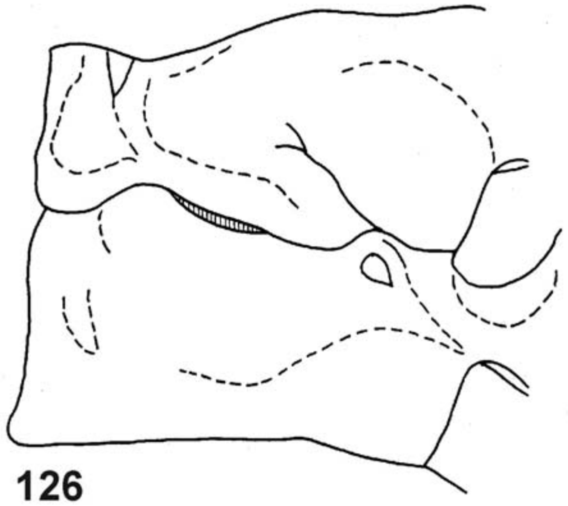

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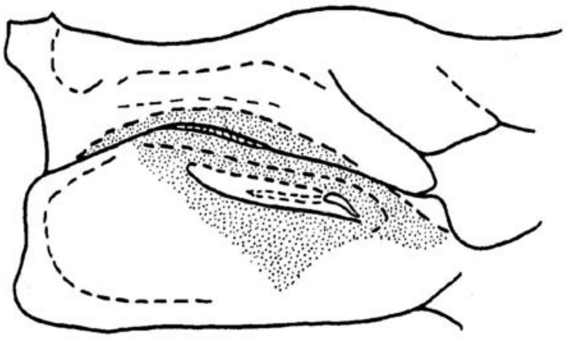

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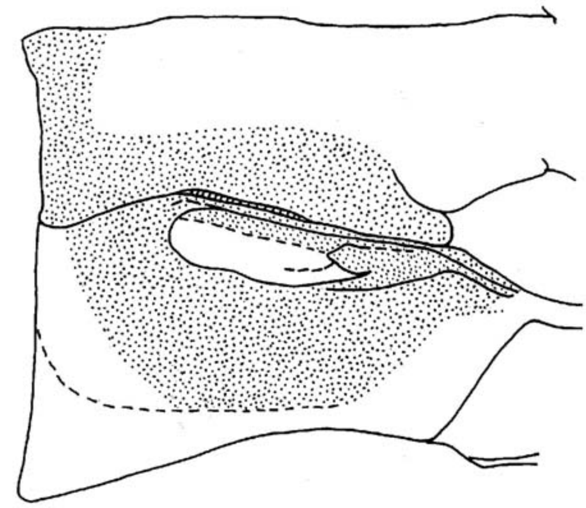

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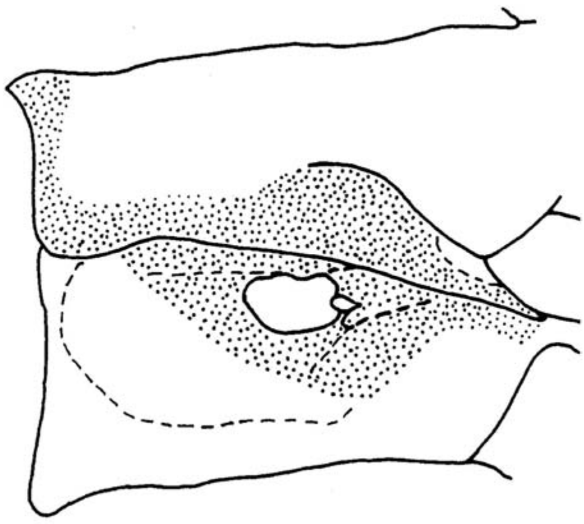

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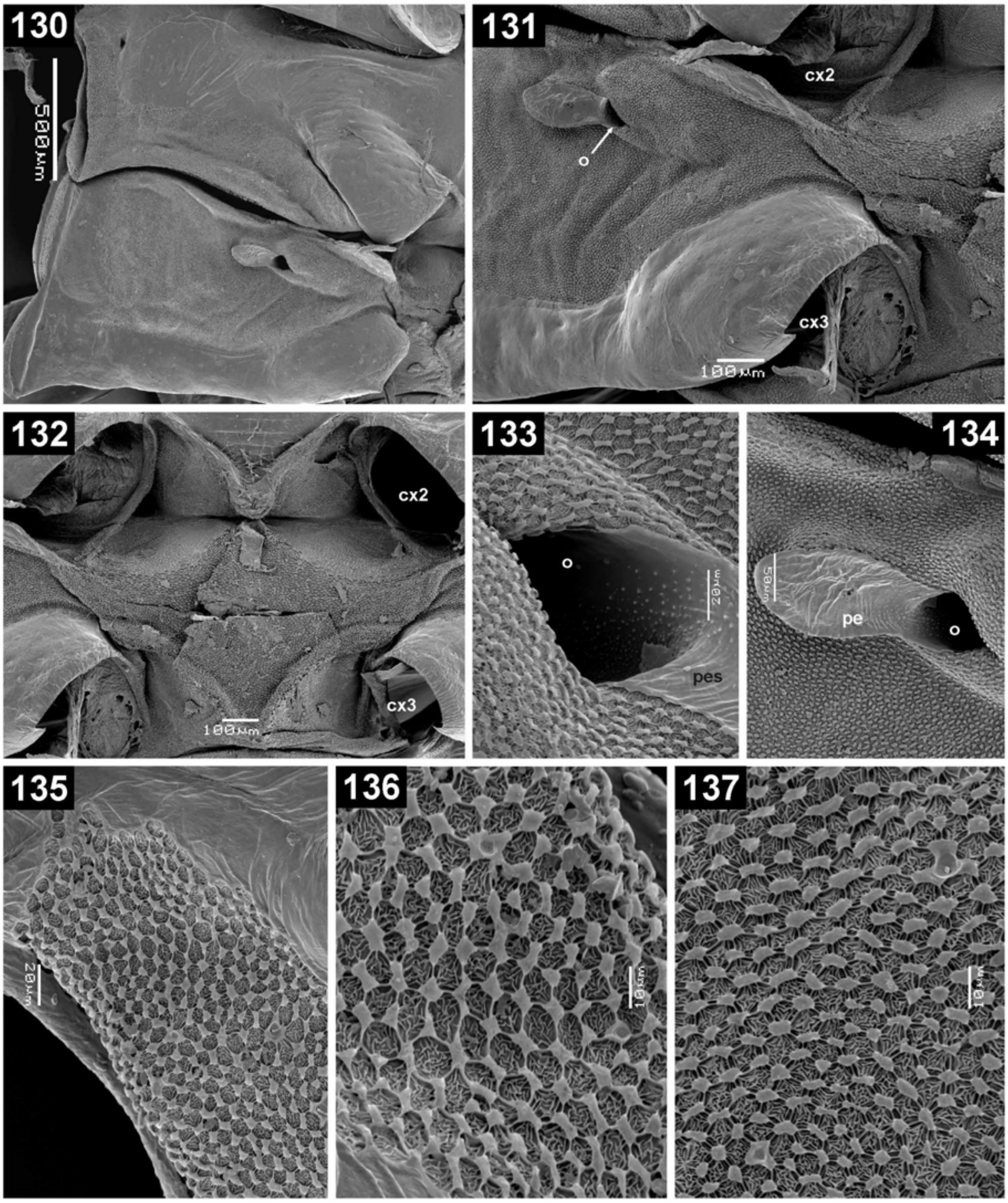
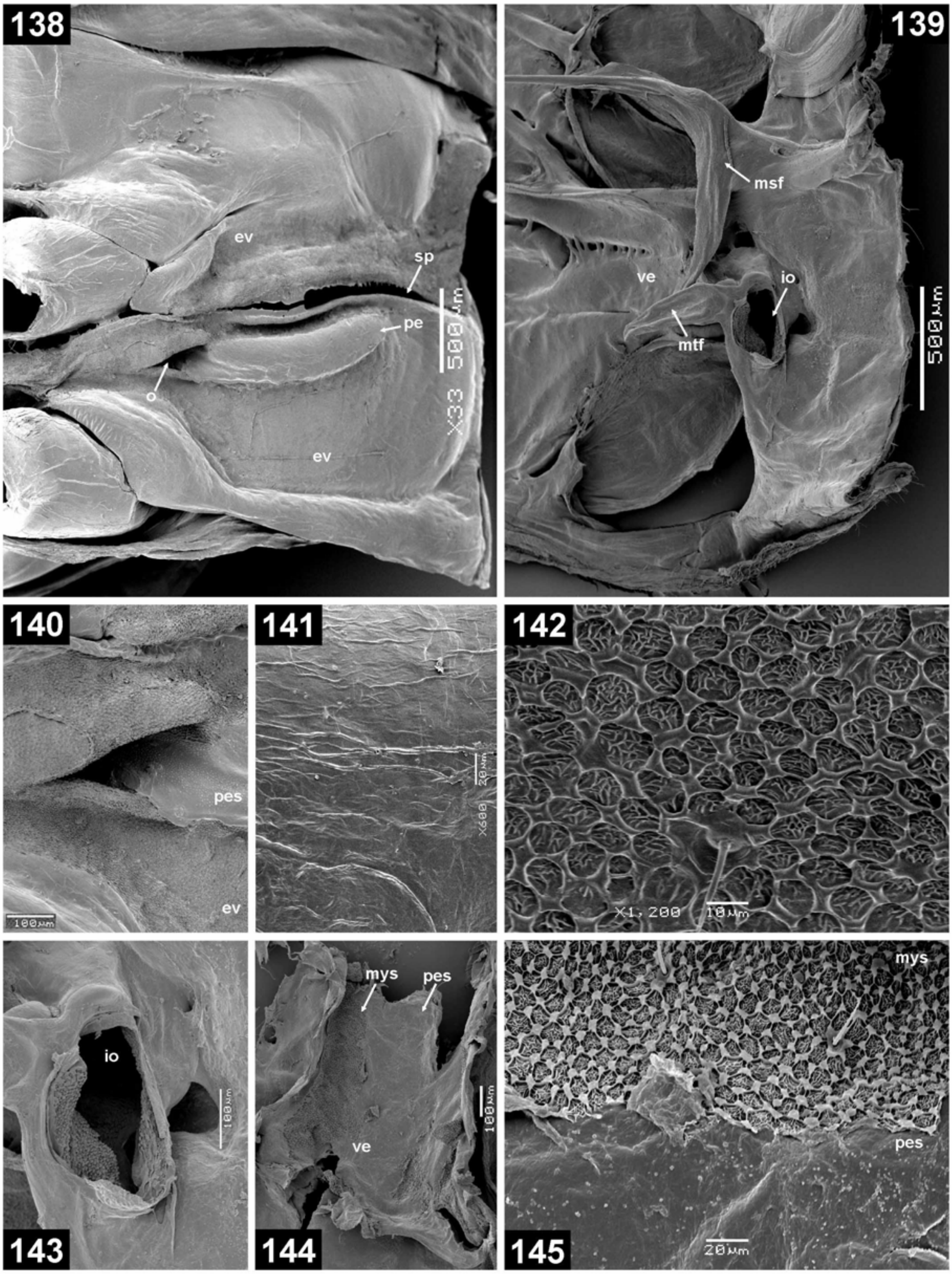
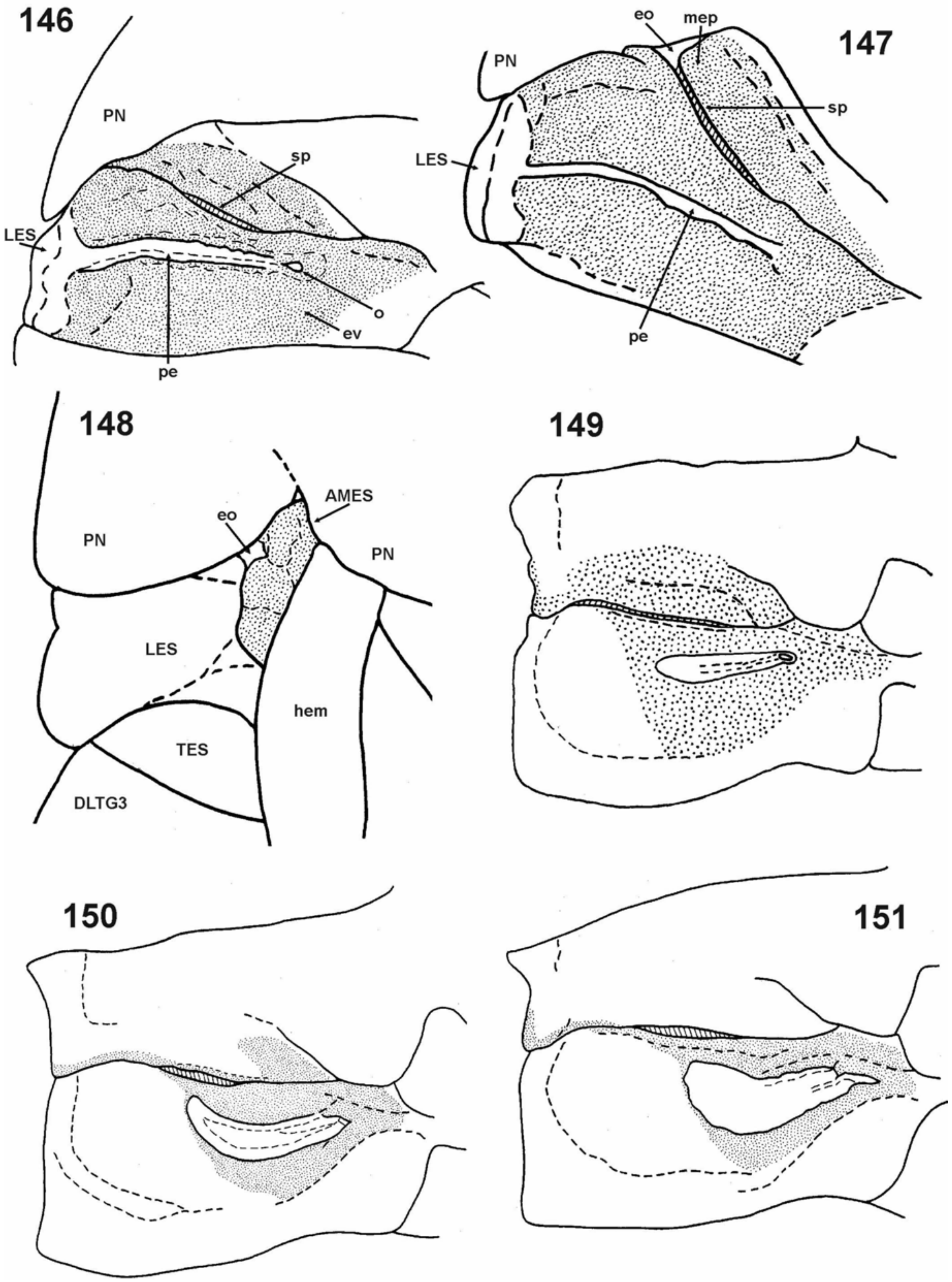
Figs. 125–129. Meso- and metapleuron, most exposed view: 125 – *Tectocoris diophthalmus* (Thunberg, 1783) (magnifications 25×), 126 – *Elvisura irrorata* Spinola, 1850 (25×), 127 – *Lestonia grossi* McDonald, 1969 (50×), 128 – *Cyphostethus tristriatus* (Fabricius, 1787) (40×), 129 – *Elasmucha ferrugata* (Fabricius, 1787) (32×). Evaporatorium is dotted.



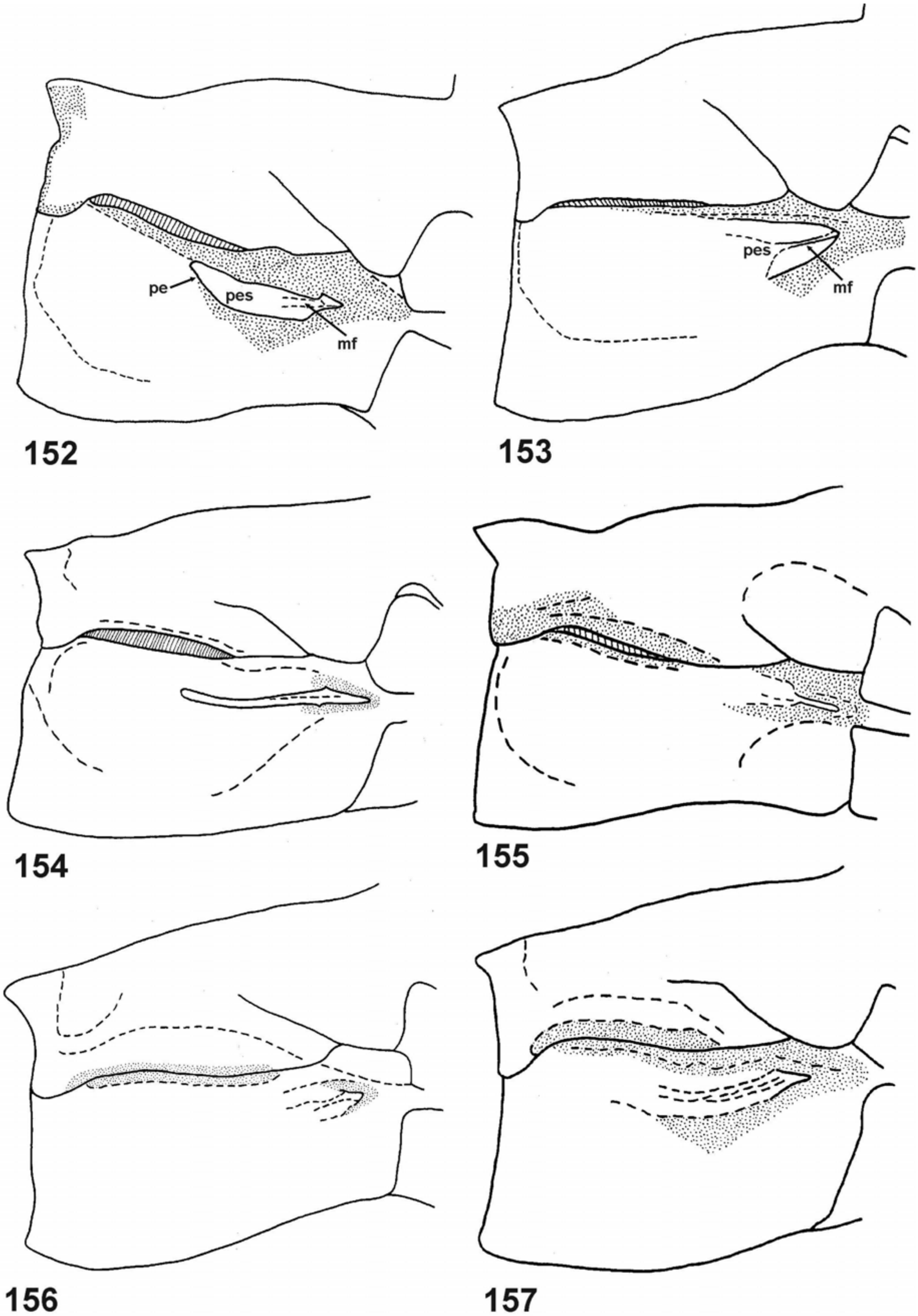
Figs. 130–137. *Ditomotarsus punctiventris* Spinola, 1852: 130 – meso- and metapleuron (magnification 50×), 131 – detail of area between metacoxa and ostiole (110×), 132 – sternum with mycoid surface (100×), 133 – detail of ostiole (900×), 134 – detail of ostiole and peritreme (350×), 135–136 – details of mycoid surface in anerolateral angle of mesopleural evaporatorium (135 – 600×, 136 – 1200×), 137 – detail of mycoid surface in centre of metapleural evaporatorium (1200×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, o – ostiole, pe – peritreme.



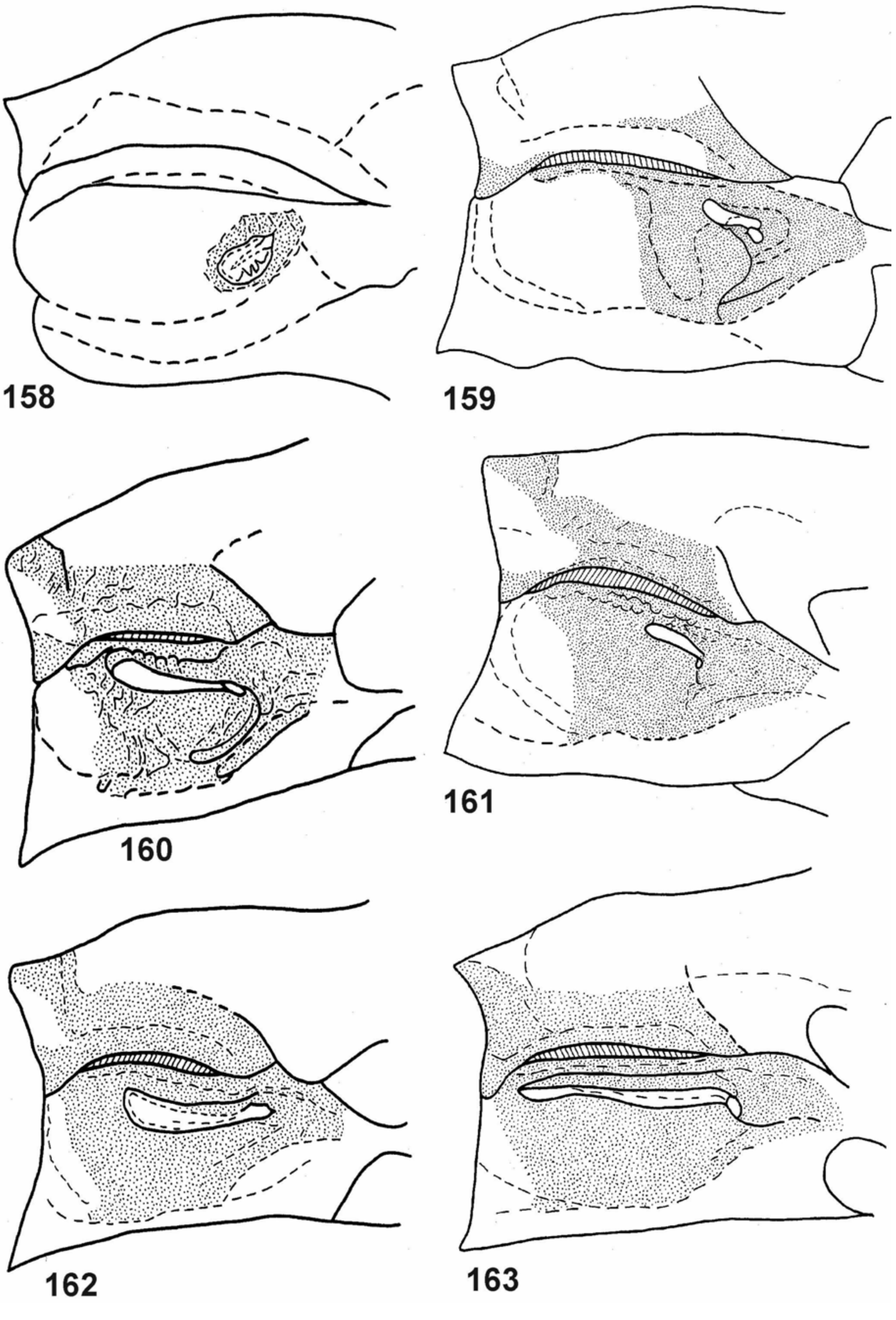
Figs. 138–145. *Acanthosoma haemorrhoidale* (Linnaeus, 1758): 138 – meso- and metapleuron (magnification 33×), 139 – meso- and metathorax in internal view (50×), 140 – detail of ostiole (180×), 141 – detail of peritremal surface (600×), 142 – detail of mycoid surface in centre of metapleural evaporatorium (1200×), 143 – detail of internal orifice (230×), 144–145 – vestibiule, internal surface in longitudinal section (144 – 100×; 145 – detail of microsculpture, 600×). Abbreviations: ev – evaporatorium, io – internal orifice, msf – mesofurca, mtf – metafurca, mys – mycoid surface, o – ostiole, pe – peritreme, pes – peritremal surface, sp – metathoracic spiracle, ve – vestibule.



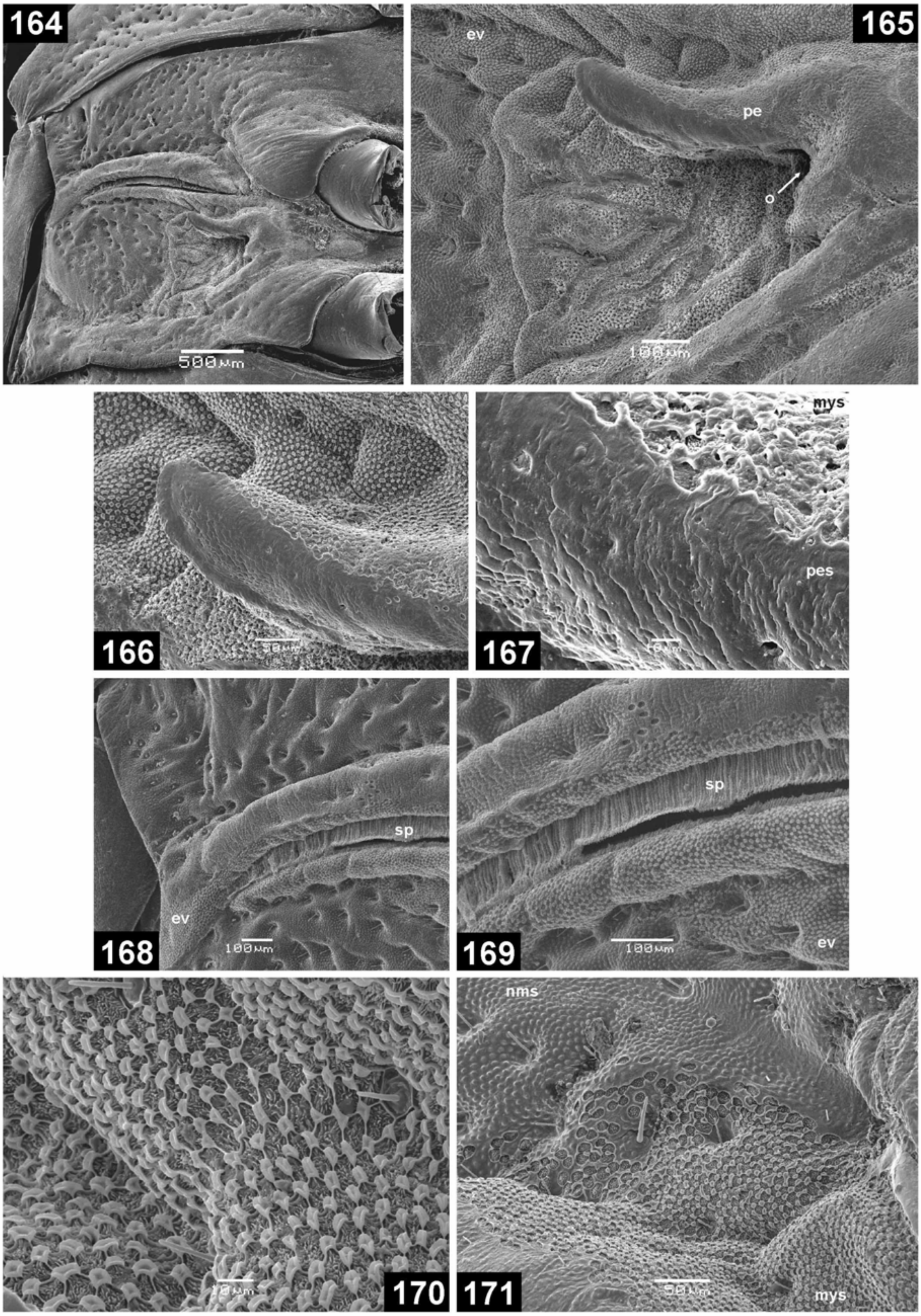
Figs. 146–151. 146–148 – *Aphylum bergrothi* Schouteden, 1906: 146 – pleuron in ventral view (50×), 147 – pleuron in anteromedian view (50×), 148 – lateral part of thorax and abdominal base in dorsal view (50×). 149–151 – meso- and metapleuron, most exposed view: 149 – *Arma custos* (Fabricius, 1794) (25×), 150 – *Troilus luridus* (Fabricius, 1775) (40×), 151 – *Picromerus bidens* (Linnaeus, 1758) (40×). Abbreviations: AMES – anterior mesal exponial sclerite, DLTG3 – dorsal abdominal laterotergite 3, eo – external opening, ev – evaporatorium (dotted), hem – hemelytron, LES – lateral exponial sclerite, mep – mesepimeron, o – ostiole, pe – peritreme, PN – pronotum, sp – metathoracic spiracle, TES – triangular exponial sclerite. The abbreviations AMES, DLTG3, LES, PN and TES follows ŠTYS & DAVIDOVÁ-VILÍMOVÁ (2001).



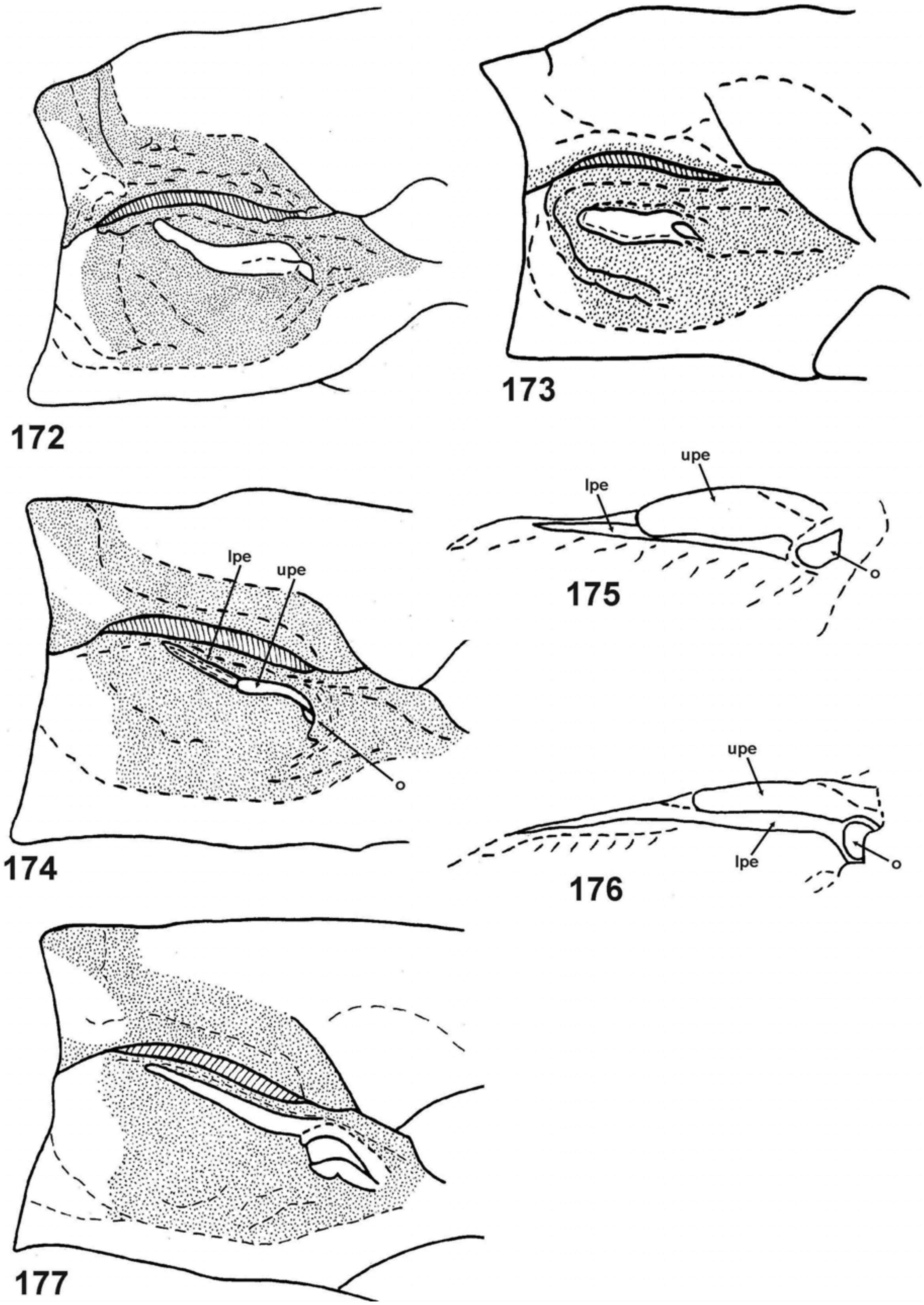
Figs. 152–157. Meso- and metapleuron, most exposed view: 152 – *Pinthaeus sanguineus* (Fabricius, 1787) (magnification 25×), 153 – *Jalla dumosa* (Linnaeus, 1758) (32×), 154 – *Marmessulus nigricornis* (Stål, 1865) (25×), 155 – *Oechalia schellenbergi* (Guérin-Méneville, 1831) (32×), 156 – *Rhacognathus punctatus* (Linnaeus, 1758) (50×), 157 – *Zicrona caerulea* (Linnaeus, 1758) (50×). Abbreviations: mf – median furrow of peritreme, pe – peritreme, pes – peritremal surface; evaporatorium is dotted.



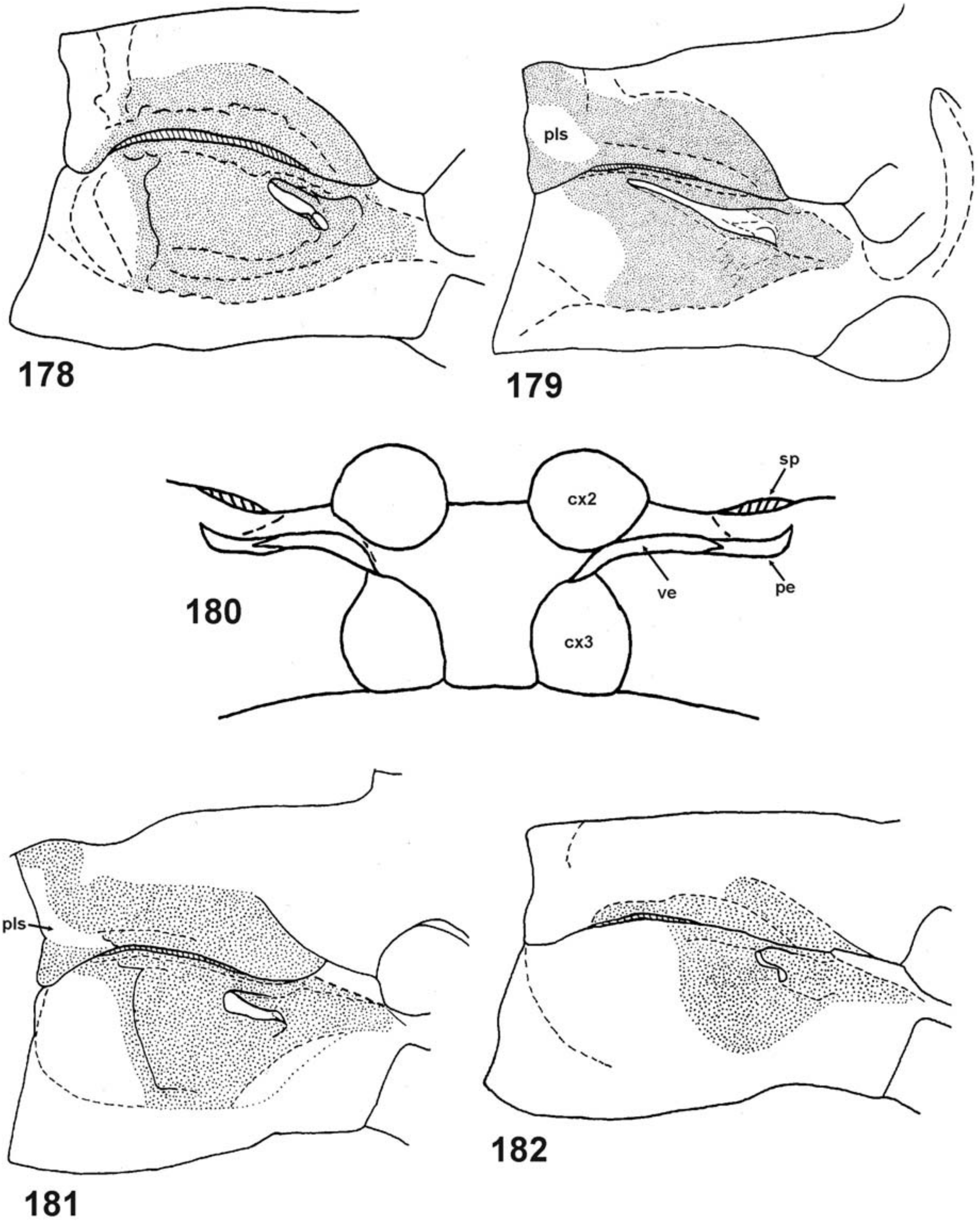
Figs. 158–163. Meso- and metapleuron, most exposed view: 158 – *Ceratozygum horridum* (Germar, 1839) (magnification 32×), 159 – *Macropygium* cf. *reticulare* (Fabricius, 1803) (40×), 160 – *Discocephala marmorea* Laporte, 1832 (32×), 161 – *Dinocoris variolosus* (Linnaeus, 1767) (32×), 162 – *Eurystethus* (*Eurystethus*) *nigropunctatus* Mayr, 1864 (32×), 163 – *Psorus cassidiformis* Bergroth, 1914 (32×). Evaporatorium is dotted.



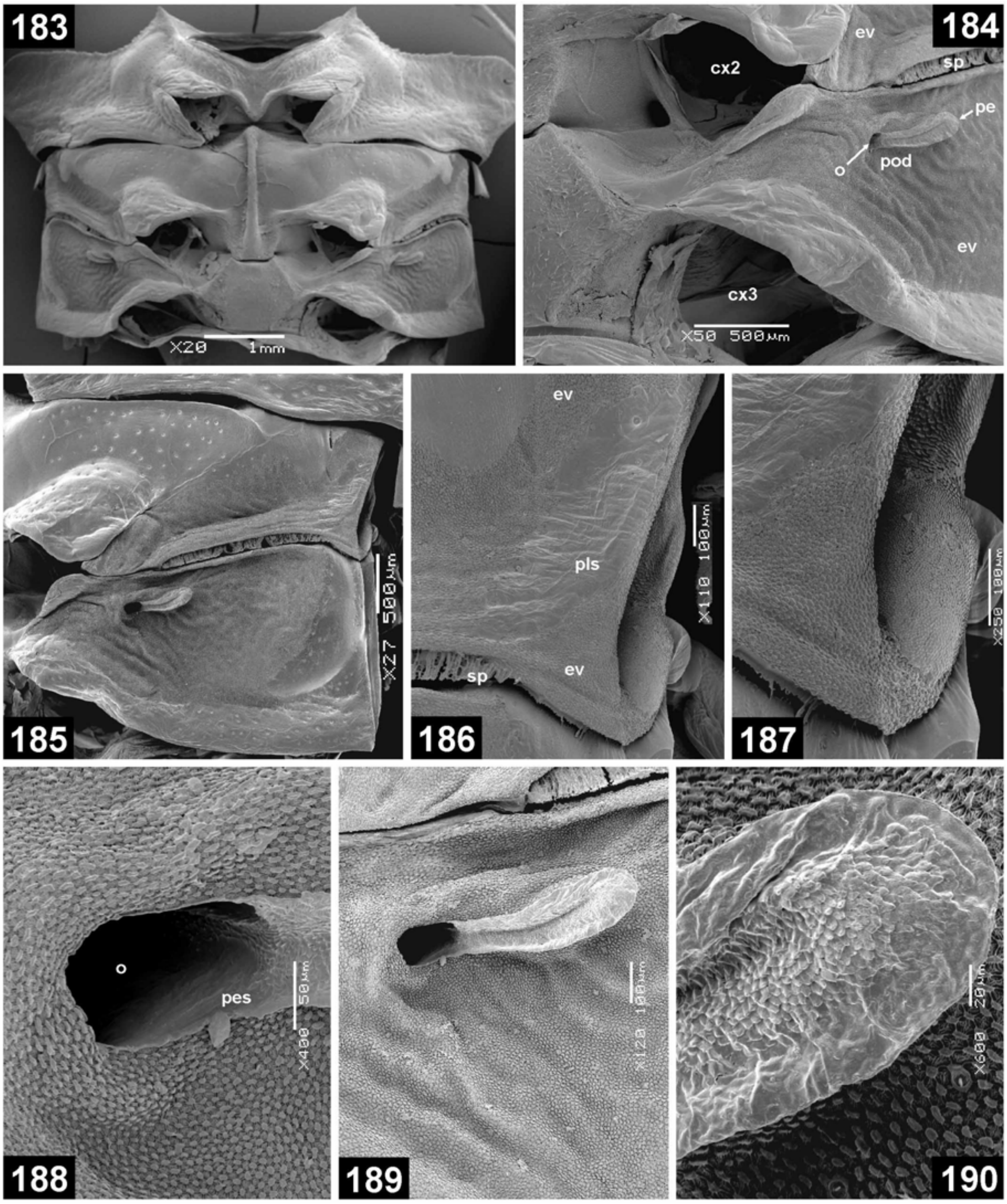
Figs. 164–171. *Miopygium cyclopeltoides* Breddin, 1904: 164 – meso- and metapleuron (magnification 30×), 165 – detail of ostiole, peritreme and metapleural evaporatorium (120×), 166–167 – details of peritreme and peritremal surface (166 – 300×, 167 – 1000×), 168–169 – details metathoracic spiracle (168 – distal part, 100×, 169 – median part, 200×), 170 – detail of mycoid surface of metapleural evaporatorium (1000×), 171 – detail of transition between mycoid and non-mycoid surface of metapleuron (300×). Abbreviations: ev – evaporatorium, mys – mycoid surface, nms – non-mycoid surface, o – ostiole, pe – peritreme, pes – peritremal surface, sp – metathoracic spiracle.



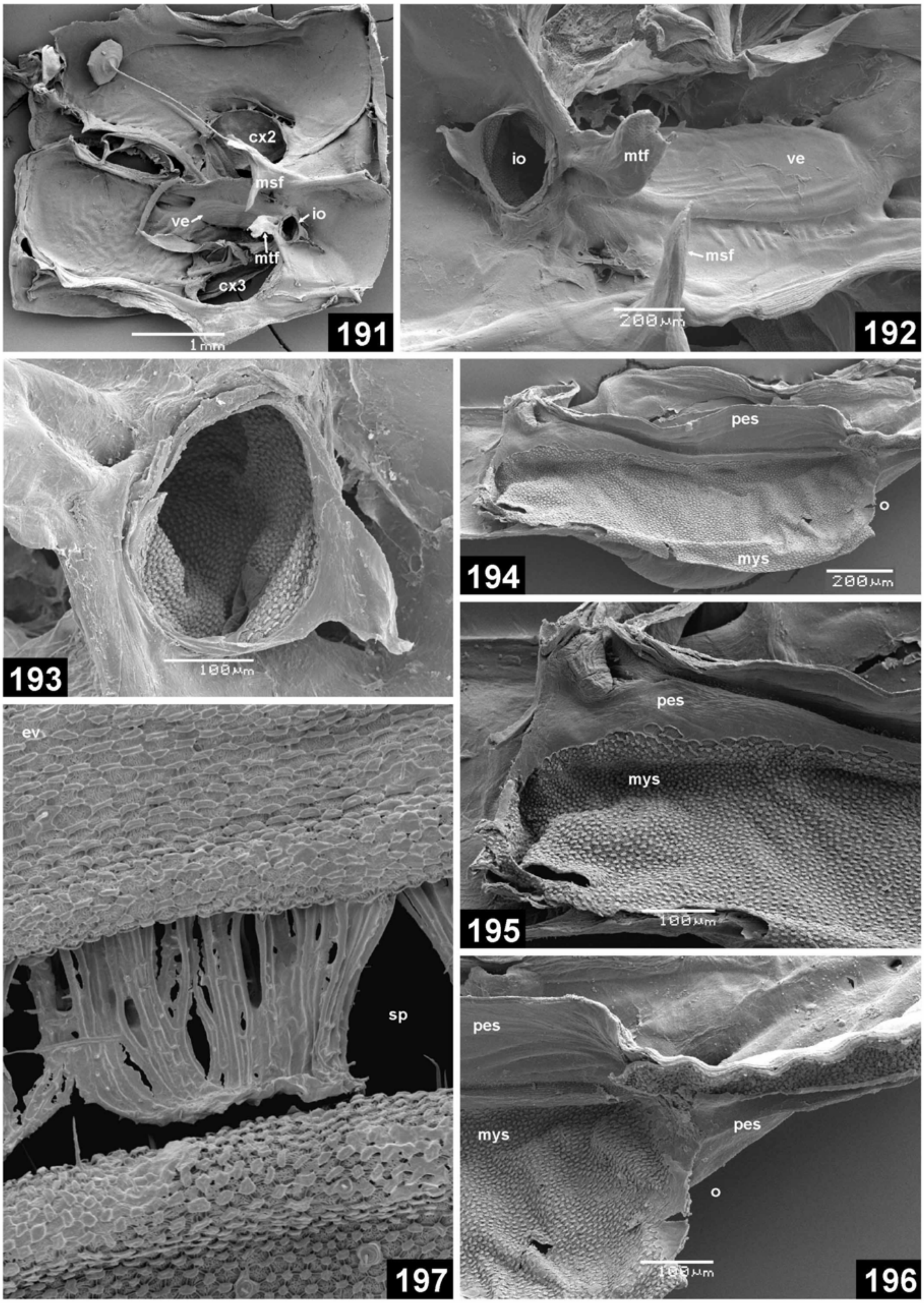
Figs. 172–177. 172–174, 177 – meso- and metapleuron, most exposed view; 175–176 – detail of ostiole and peritreme. 172 – *Dryptocephala brullei* Laporte, 1832 (magnification 32×), 173 – *Coriplatus depressus* White, 1842 (32×), 174–175 – *Antiteuchus mixtus* (Fabricius, 1787) (174 – 32×, 175 – 80×), 176 – *Cataulax eximius* (Stål, 1860) (80×), 177 – *Ablaptus varicornis* (Walker, 1867) (32×). Abbreviations: lpe – lower part of peritreme, o – ostiole, upe – upper part of peritreme; evaporatorium is dotted.



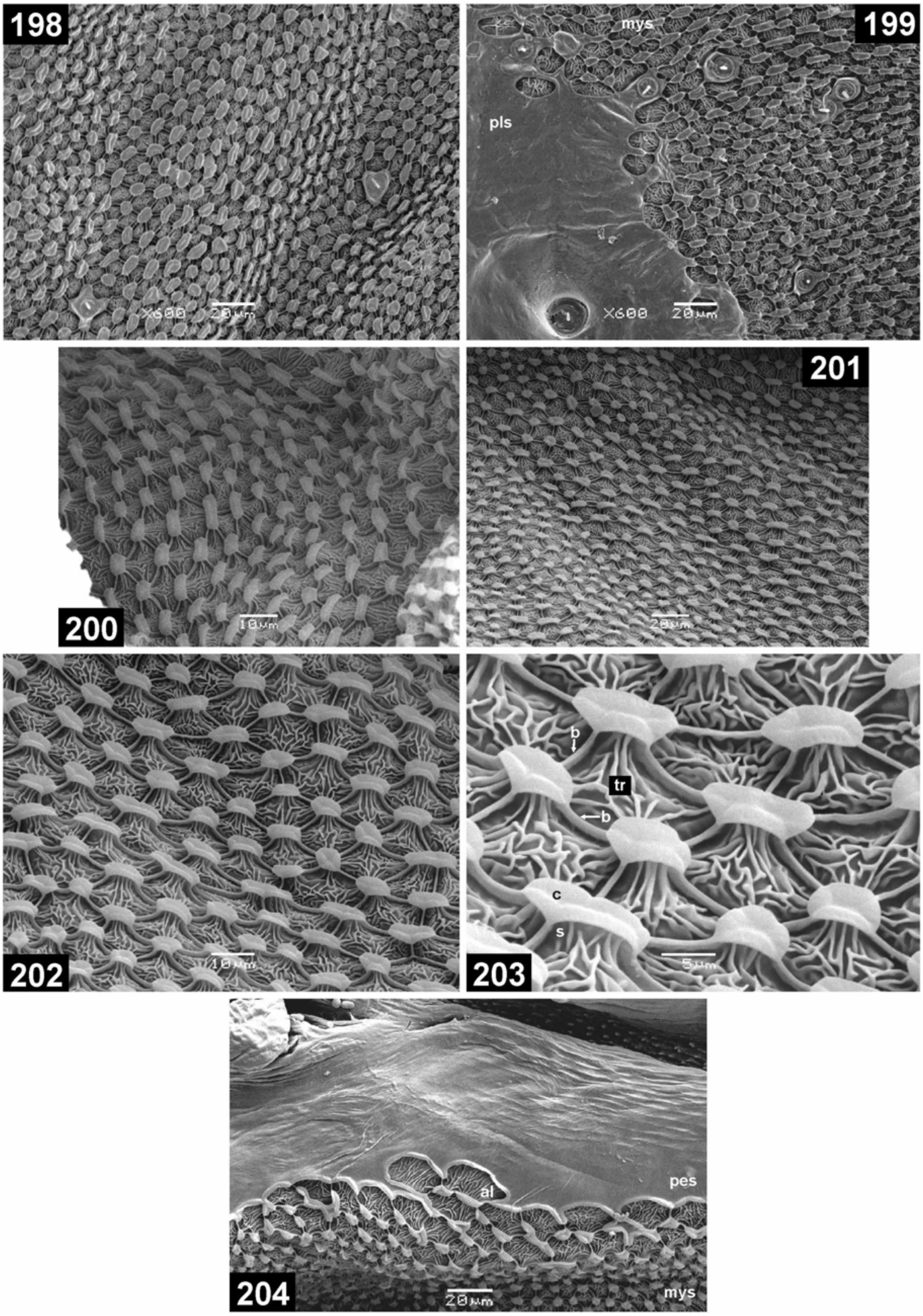
Figs. 178–182. 178–179 – meso- and metapleuron, most exposed view: 178 – *Lopadusa* (*Bothrocoris*) sp. (magnification 32×), 179 – *Edessa rufomarginata* (De Geer, 1773) (25×). 180 – *Mustha longispinis* Reuter, 1890, sternum (15×). 181–182 – meso- and metapleuron, most exposed view: 181 – *Rhaphigaster nebulosa* (Poda, 1761) (25×), 182 – *Eysarcoris venustissimus* (Schrank, 1776) (40×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, pe – peritreme, pls – peritreme-like surface, sp – metathoracic spiracle, ve –vestibular groove (vestibule not closed); evaporatorium is dotted.



Figs. 183–190. *Pentatoma rufipes* (Linnaeus, 1758): 183 – thorax in ventral view (magnification 20×), 184 – detail of area between metacoxa and ostiole (50×), 185 – meso- and metapleuron (27×), 186–187 – lateral margin of mesopleuron (186 – 110×, 187 – 250×), 188 – detail of ostiole (400×), 189 – detail of ostiole, peritreme and metapleural evaporatorium (120×), 190 – apex of peritreme with detail of peritremal surface (600×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, o – ostiole, pe – peritreme, pes – peritremal surface, pls – peritreme-like surface, sp – metathoracic spiracle.



Figs. 191–197. *Pentatoma rufipes* (Linnaeus, 1758): 191 – meso- and metathorax in internal view (23×), 192 – detail of internal orifice and vestibule (75×), 193 – detail of internal orifice (250×), 194–196 – internal surface of vestibiule (194 – 85×; 195 – base of vestibule, 200×; 196 – apex of vestibule, 200×), 197 – metathoracic spiracle (median part, 450×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, io – internal orifice, msf – mesofurca, mtf – metafurca, mys – mycoid surface, o – ostiole, pes – peritremal surface, sp – metathoracic spiracle, ve – vestibule.



Figs. 198–204. *Pentatoma rufipes* (Linnaeus, 1758), details of mycoid surface: 198 – metapleural evaporatorium posterolaterally from ostiole (600×), 199 – anterolateral part of mesopleural evaporatorium with peritreme-like surface (600×), 200 – mycoid surface inside vestibule seen through internal orifice (1200×), 201–204 – internal surface of vestibiule (201 – 600×; 202 – 1200×; 203 – 3000×; 204 – transition of mycoid and peritremal surface, 600×). Abbreviations: al – alveole, b – bridges interconnecting mushroom bodies, c – cap of mushroom body, mys – mycoid surface, pes – peritremal surface, pls – peritreme-like surface, s – stem of mushroom body, tr – trabeculae on bottom of alveole.

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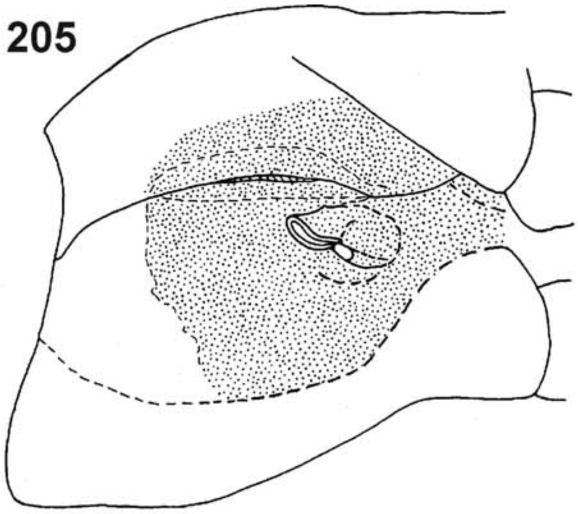

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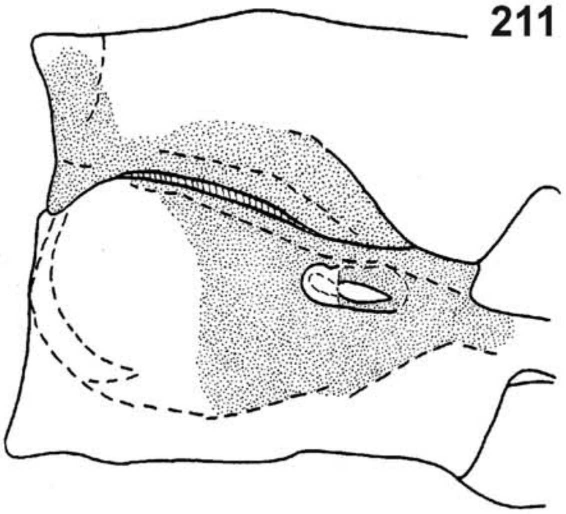

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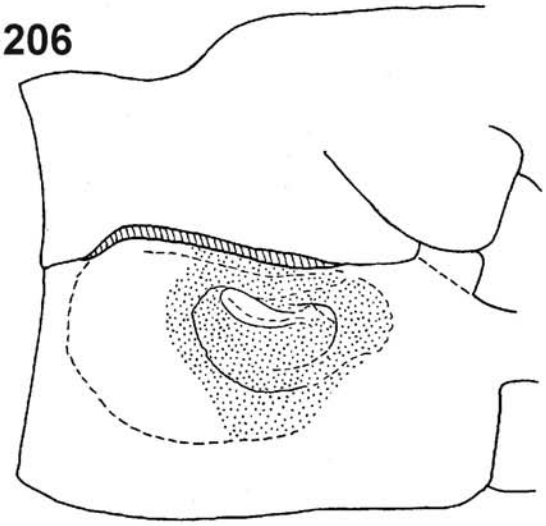

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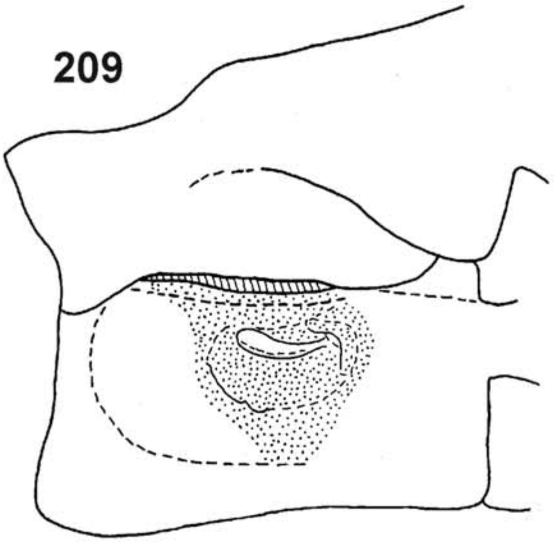

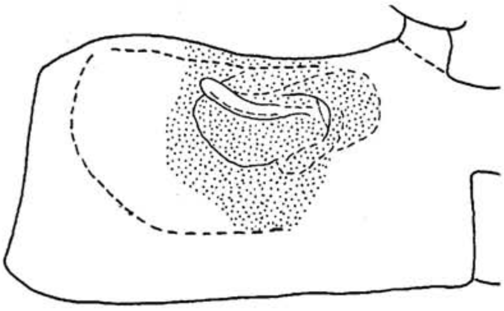

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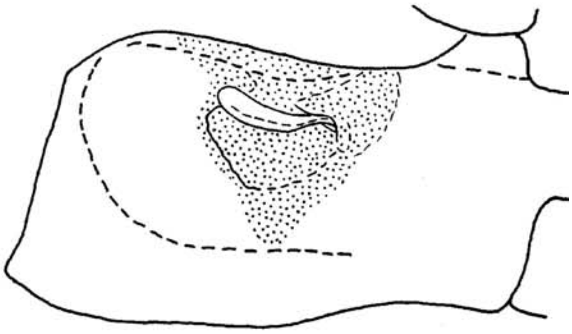

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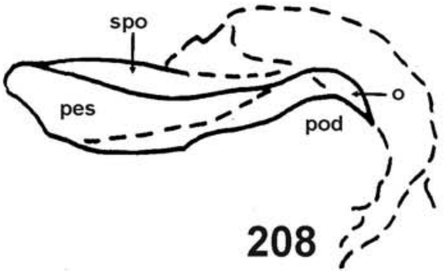

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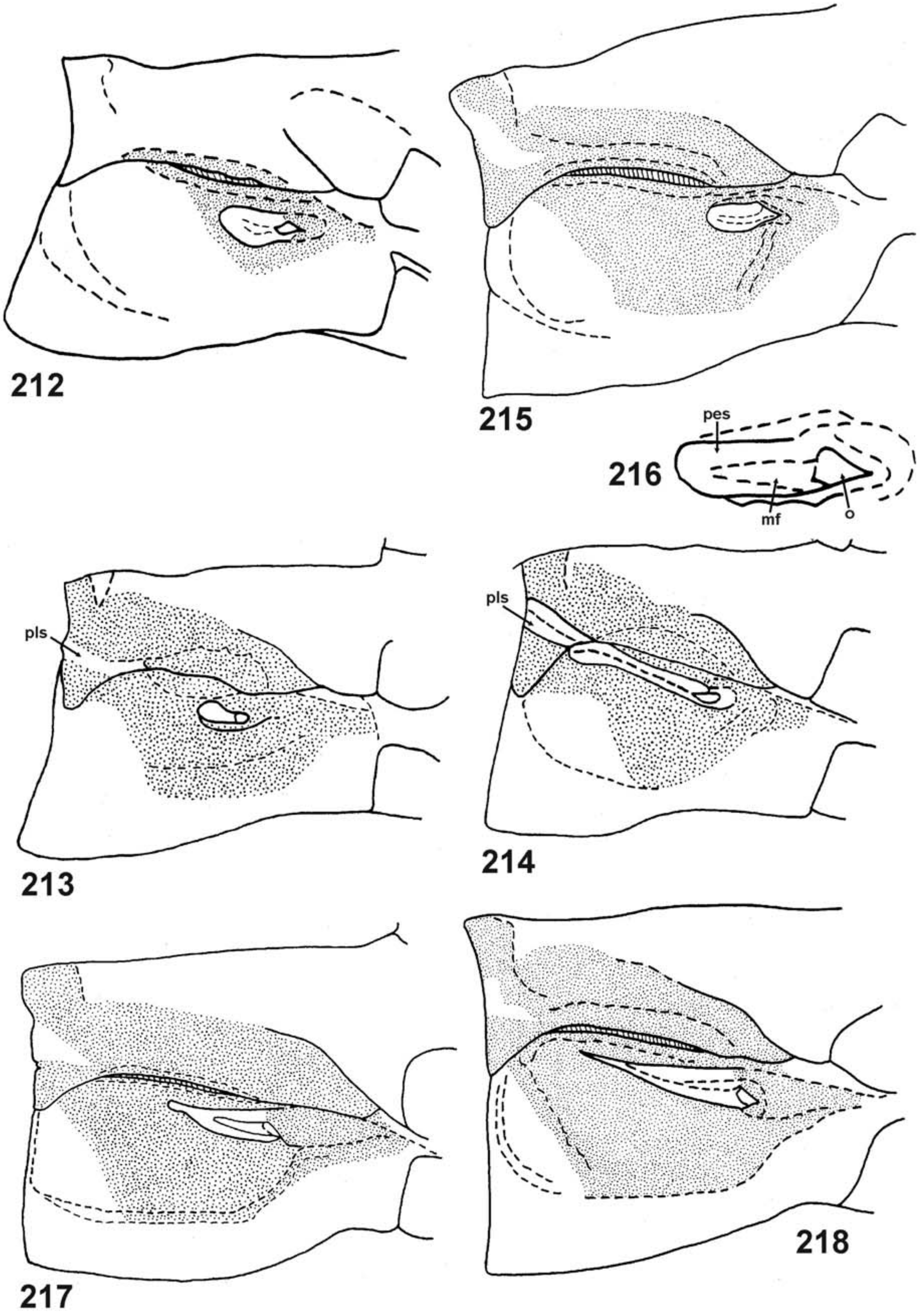
Figs. 205–211. Meso- and metapleuron, most exposed view: 205 – *Sciocoris* (*Aposciocoris*) *homalonotus* Fieber, 1851 (magnification 56×), 206–208 – *Mustha spinosula* (Lefebvre, 1831) (206 – specimen from Slanchev Bryag, 15×; 206 – specimen from Sakarılıca, 15×; 206 – detail of peritreme, specimen from Dojran lake, 50×), 209–210 – *Mustha* sp. nov. (two specimens from Horramabad: 209 – 15×, 210 – 15×), 211 – *Myrochea inermis* Distant, 1912 (32×). Abbreviations: o – ostiole, pes – peritremal surface, pod – periostiolar depression, spo – spout; evaporatorium is dotted.



Figs. 212–218. Meso- and metapleuron, most exposed view: 212 – *Trichopepla semivittata* (Say, 1831) (magnifications 32×), 213 – *Neottiglossa* (*Neottiglossa*) *pusilla* (Gmelin, 1789) (40×), 214 – *Neottiglossa* (*Neottiglossa*) *leporina* (Herrich-Schäffer, 1830) (40×), 215–216 – *Nezara viridula* (Linnaeus, 1758) (215 – 50×; 216 – detail of peritreme, 50×), 217 – *Palomena prasina* (Linnaus, 1761) (25×); 218 – *Acrosternum millieri* (Mulsant & Rey, 1866) (40×). Abbreviations: mf – median furrow of peritreme, o – ostiole, pes – peritremal surface, pls – peritreme-like structure; evaporatorium is dotted.

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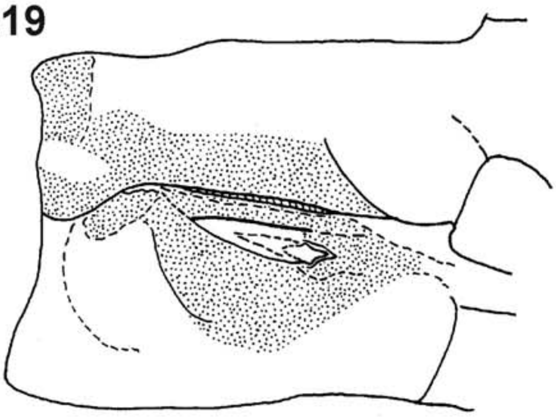

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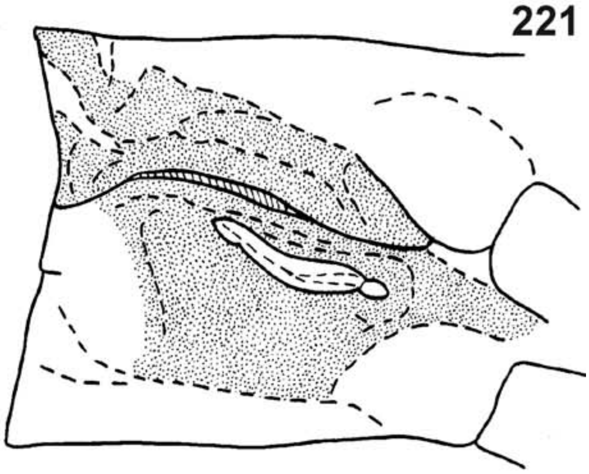

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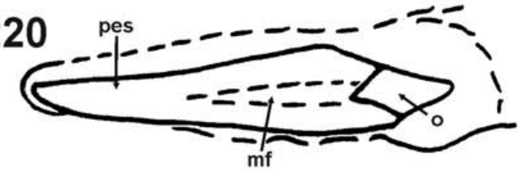

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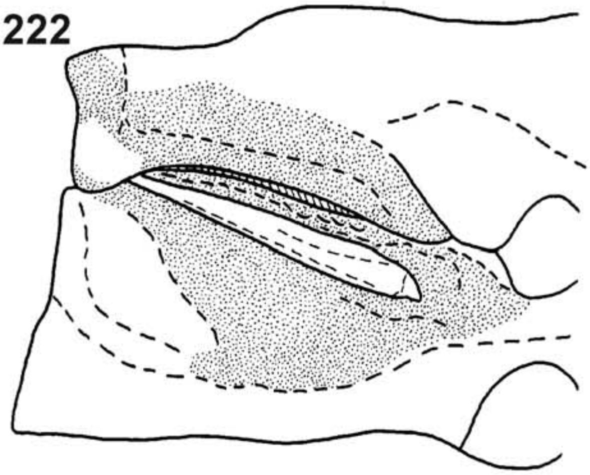

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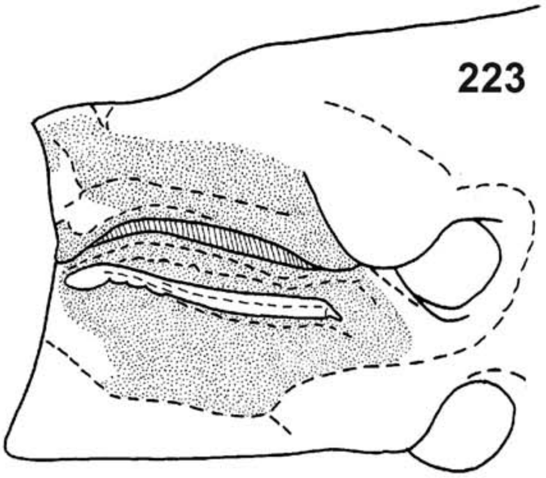

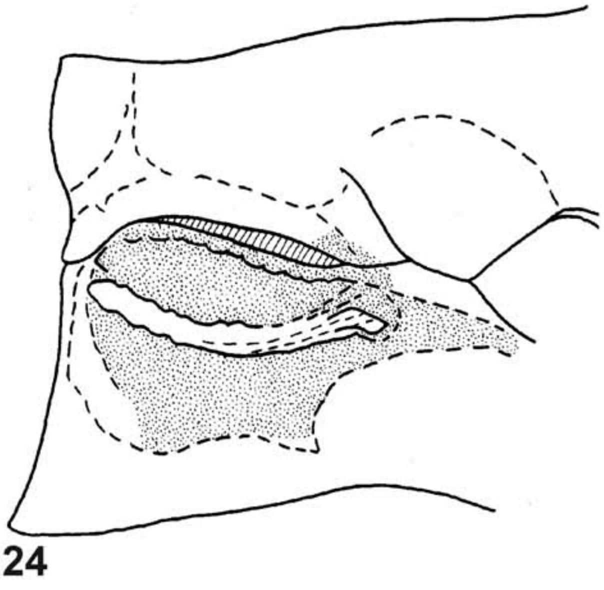

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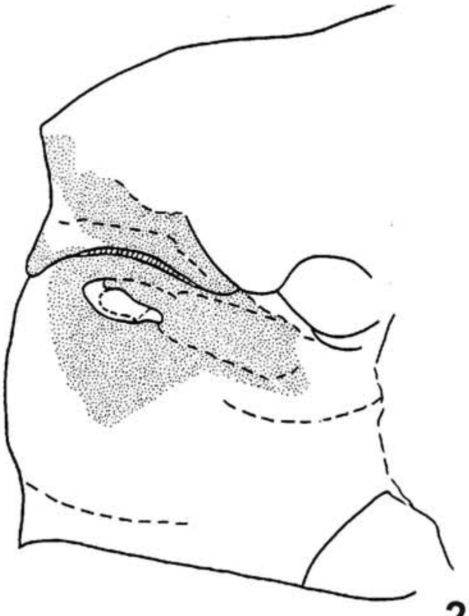

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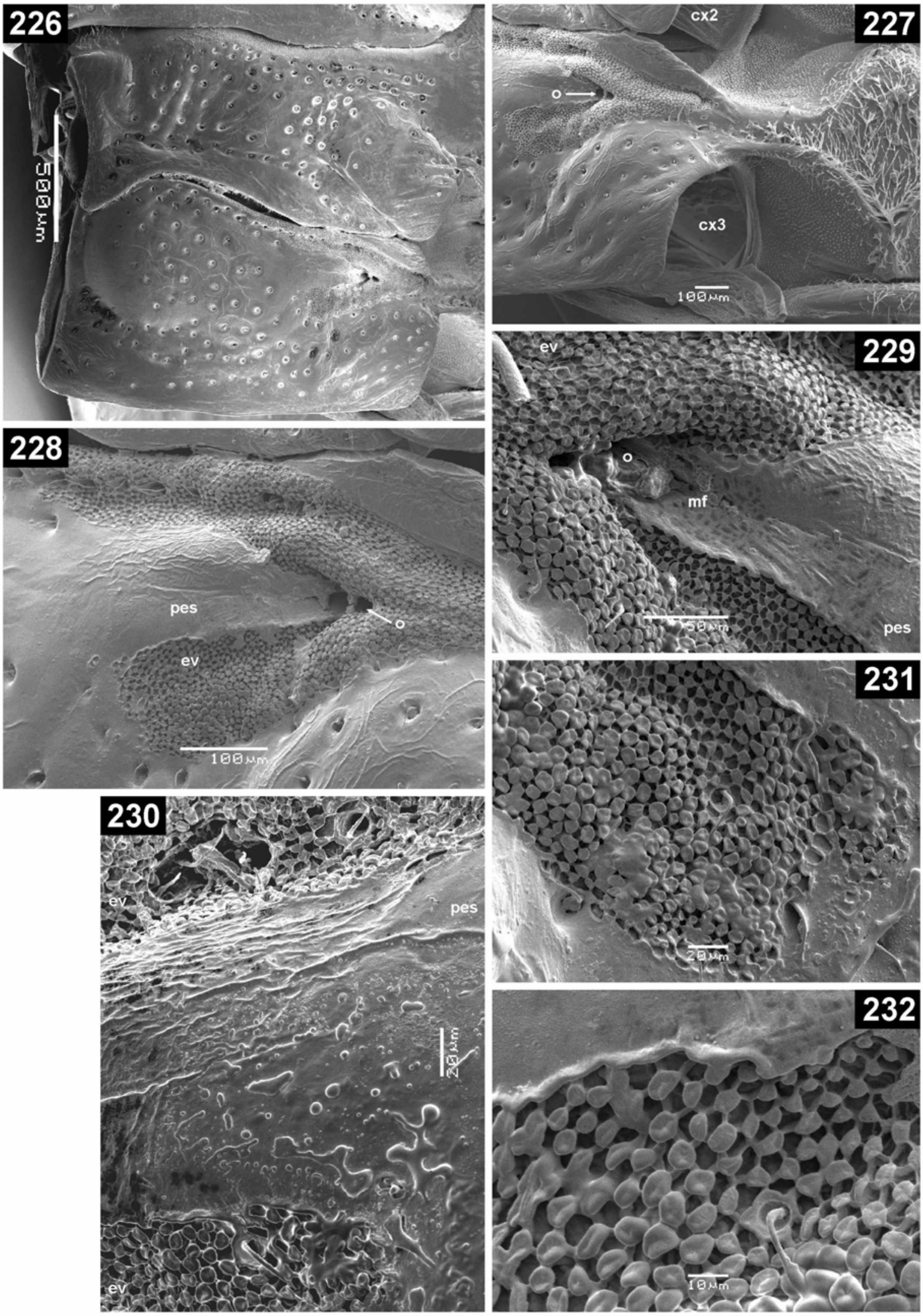
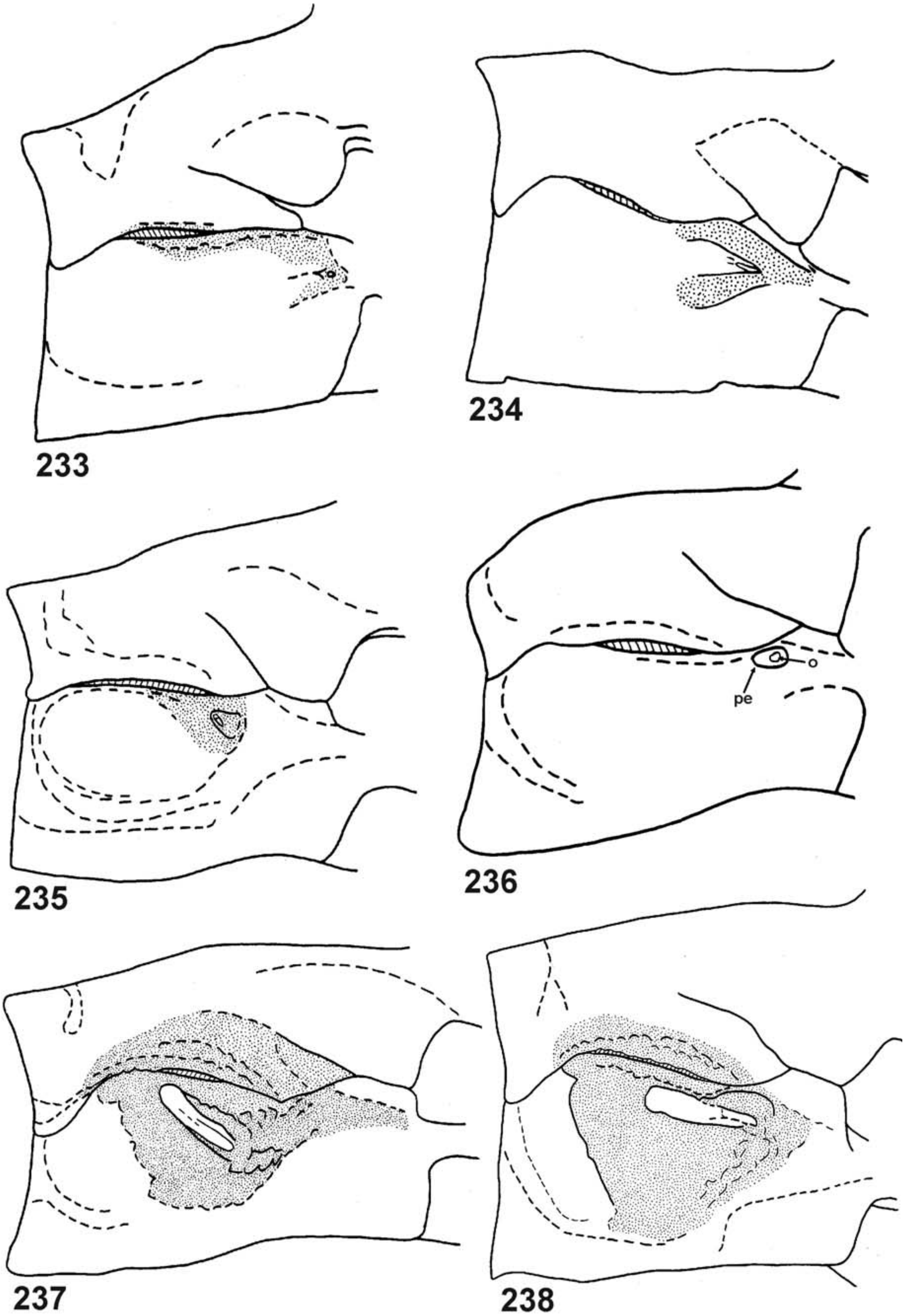
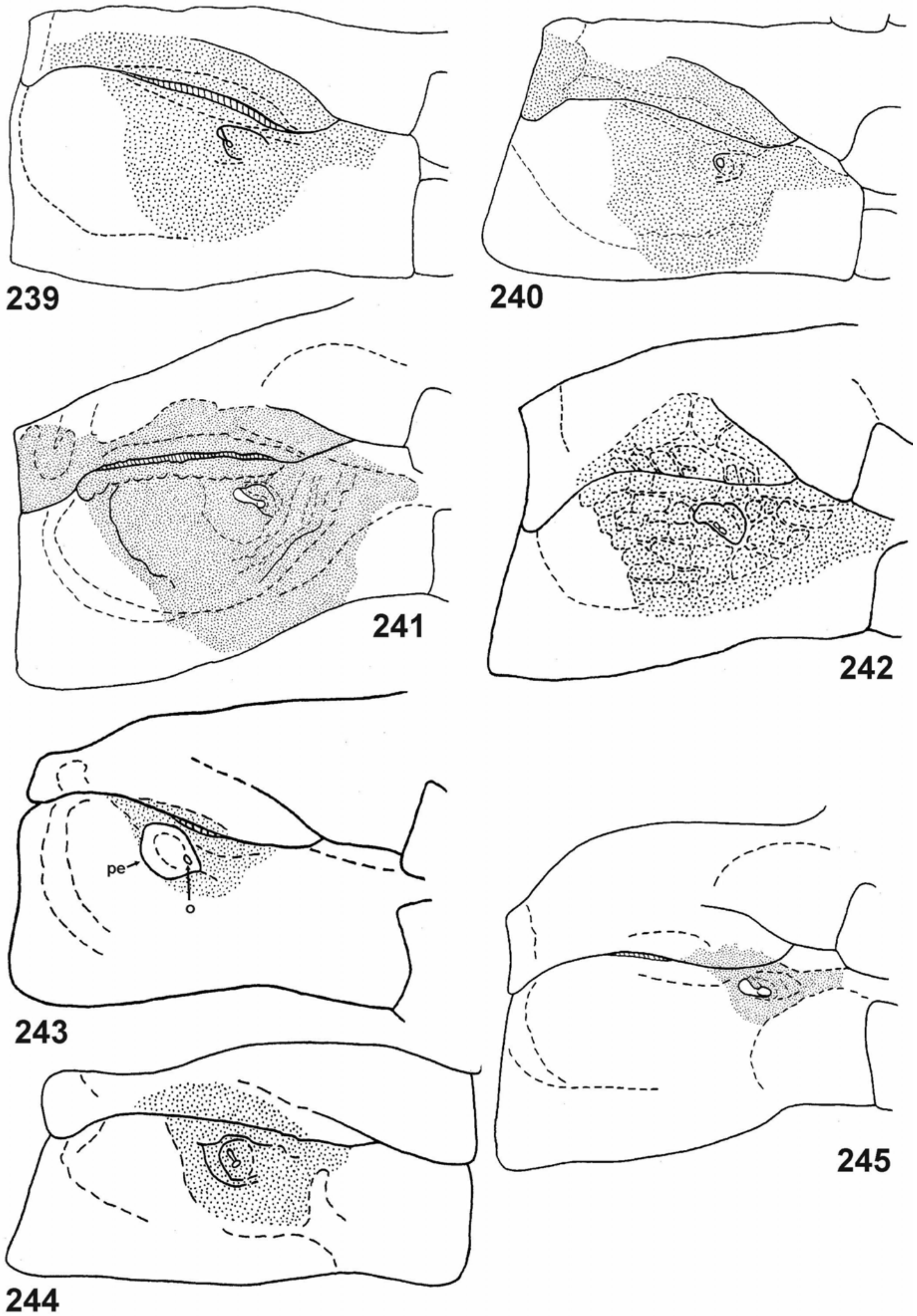
Figs. 219–225. Meso- and metapleuron, most exposed view: 219–220 – *Carpocoris purpureipennis* (De Geer, 1773) (219 – magnification, 32×; 220 – detail of peritreme, 50×), 221 – *Anaxarchus pardalinus* Stål, 1876 (20×), 222 – *Rhynchocoris humeralis* (Thunberg, 1783) (16×), 223 – *Evoplitus laciniatus* (Spinola, 1837) (20×), 224 – *Amasenus corticalis* Stål, 1863 (16×), 225 – *Placocoris viridis* Mayr, 1864 (32×). Abbreviations: mf – median furrow of peritreme, o – ostiole, pes – peritremal surface; evaporatorium is dotted.



Figs. 226–232. *Eurydema oleracea* (Linnaeus, 1758): 226 – meso- and metapleuron (magnification 50×), 227 – detail of area between metacoxa and ostiole (100×), 228–229 – details of ostiole, peritremal surface and metapleural evaporatorium (228 – 230×, 229 – 500×), 230 – detail of peritremal surface (600×), 231–232 – details of evaporatorium (apex of posterior branch, 400×). Abbreviations: cx2 – mesocoxal cavity, cx3 – metacoxal cavity, ev – evaporatorium, mf – median furrow of peritreme, o – ostiole, pes – peritremal surface.



Figs. 233–238. Meso- and metapleuron, most exposed view: 233 – *Agaeus elegantulus* Jensen-Haarup, 1931 (25×), 234 – *Eurydema oleracea* (Linnaeus, 1758) (40×), 235 – *Atelocera serrata* (Fabricius, 1803) (20×), 236 – *Aeptus singularis* Dallas, 1851 (50×), 237 – *Phyllocephala negus* Distant, 1910 (20×), 238 – *Macrina juvenca* (Burmeister, 1835) (32×). Abbreviations: o – ostiole, pe – peritreme; evaporatorium is dotted.



Figs. 239–245. Meso- and metapleuron, most exposed view: 239 – *Ancyrosoma leucogrammes* (Gmelin, 1789) (40×), 240 – *Derula flavoguttata* Mulsant & Rey, 1856 (56×), 241 – *Graphosoma* (*Graphosoma*) *lineatum* (Linnaeus, 1758) (50×), 242 – *Podops* (*Podops*) *inuncta* (Fabricius, 1775) (40×), 243 – *Tholagmus flavolineatus* (Fabricius, 1798) (50×), 244 – *Vilpianus galii* (Wolff, 1802) (50×), 245 – *Cyptocoris lundi* (Fabricius, 1803) (32×). Abbreviations: o – ostiole, pe – peritreme; evaporatorium is dotted.

6. Discussion

6.1. Anagenesis and polarization of the external scent efferent system characters in the Pentatomoidea

The comparison of results obtained with published phylogenetic analyses of Pentatomoidea (GAPUD 1991, GRAZIA et al. 2008) allows the polarization of important characters of the external scent efferent system. For recognition of the plesiomorphic states I use predominantly the situation developed in Urostylididae, the most plesiomorphic pentatomoidean family (GAPUD 1991, GRAZIA et al. 2008), as well as the comparison with the conditions in the Lygaeoidea, Coreoidea, and Pyrrhocoroidea. The polarizations were partly tested by the cladistic analysis which is included in KMENT & VILÍMOVÁ (in press).

Vestibular scar. Vestibular scar occurs regularly in the Coreoidea (e.g., MOODY 1930; BRINDLEY 1934; HENRICI 1940; REMOLD 1962, 1963; GUPTA 1964; PACKAUSKAS 1994), the Lygaeoidea (e.g., ŠTYS 1967, SLATER 1979) and the Pyrrhocoroidea (e.g., BRINDLEY 1934, DHIMAN 1983). In the Pentatomoidea, I confirm its presence in Thaumastellidae (see also ŠTYS 1964, JACOBS 1989), Cydnidae (FROESCHNER 1960, HASAN & KITCHING 1993, LIS 1994), Thyreocoridae (BRINDLEY 1934, ŠTYS & DAVIDOVÁ 1979), Phloeidae: Phloeinae (LESTON 1953), Plataspidae (REMOLD 1962, 1963), as well as Parastrachiidae. The SEM photographs reveal presence of a fine vestibular scar also in *Coridius viduatus* (Dinidoridae), and possibly there is a trace of vestibular scar in *Cryptacrus comes* (Scutelleridae). I consider the presence of vestibular scar in Pentatomoidea as the plesiomorphy, which was secondarily lost (probably several times independently) in Urostylididae, Phloeidae: Serbaninae, Tessaratomidae, Acanthosomatidae, Lestoniidae, Canopidae, Pentatomidae, and most of the Dinidoridae and Scutelleridae. This suggestion is also supported by the teratological case represented by holotype of *Mustha longispinis* (Pentatomidae. Pentatominae), where both vestibules are not closed and has a form of scent grooves in the same place where the vestibular scar regularly occurs.

Position of the ostiole. The basal position of ostiole ca. between mesoacetabulum and metacetabulum is considered as plesiomorphic, as it is the situation in Urostylididae, as well as in Lygeoidea, Coreoidea, and Pyrrhocoroidea, while lateral shift of the ostiole is an advanced state, although occurring independently in different taxa of Pentatomoidea (Phloeidae, Thaumastellidae, Cydnidae, Plataspidae, etc.) and thus homoplasious. GAPUD

(1991) and HASAN & KITCHING (1993) polarized this character similarly, regarding the basal position of ostiole plesiomorphic within the Pentatomoidea (GAPUD 1991).

Shape and size of the ostiole. The rather large, oval, mesially not incised ostiole of the Urostylididae is considered as plesiomorphic within the Pentatomoidea. This state developed in different groups of the Pentatomoidea in the apomorphies, for example the small and rounded ostiole is common in groups with rather reduced peritreme (e.g., Cydnidae: Scutelleridae: *Psacasta exanthematica*, several genera of Pentatomidae: Podopinae). Development of the ostiolar groove is an apomorphy of the Tessaratomidae (see KMENT & VILÍMOVÁ in press), however, it occurs independently also in *Ablaptus varicornis* (Pentatomidae: Discocephalinae). HASAN & KITCHING (1993) supposed the large and clearly visible ostiole as plesiomorphic, while small and indistinct ostiole as apomorphic within Pentatomoidea.

Opening of the ostiole. The ostiole opening laterally (condition in the Urostylididae) is considered plesiomorphic, while ostioles opening posterolaterally, posteriorly, ventrolaterally, or ventrally represent the advanced states. Such change usually corresponded to the shape of the peritreme, for example, the groove-shaped or disc-shaped peritreme is usually connected with ventrally oriented ostiole (KMENT & VILÍMOVÁ in press).

Presence of the periostiolar depression. Absence of the periostiolar depression (e.g., in Urostylididae, also in Lygaeoidea, Coreoidea, and Pyrrhocoroidea) is probably plesiomorphic. The depression evidently developed several times independently in different groups (e.g., Tessaratomidae: Oncomerinae, Dinidoridae, Plataspidae, Pentatomidae: Discocephalinae, Phyllocephalinae, Podopinae, etc.) (KMENT & VILÍMOVÁ in press). The periostiolar depression is usually associated with the ostiole opening laterally, posterolaterally or posteriorly and with the peritreme in a shape of a spout. It is usually missing in species with the ostiole opening ventrally and peritreme developed as a groove, ruga, disc, or peritremal lobes. Since it is probable that presence of the periostiolar depression optimizes the function of particular type of the external scent efferent system, this structure is secondarily reduced in those species where it lost its function.

Shape of the peritreme. Auricle is a common type of the peritreme in the Lygaeoidea, Pyrrhocoridea, and partly in Coreoidea (e.g., SLATER 1979, DHIMAN 1983, HEPBURN & YONKE 1971). Its occurrence in the Thaumastellidae (e.g., ŠTYS 1964, JACOBS 1989) is isolated within the Pentatomoidea and, in my opinion, it is a reversal condition developed by reduction of a spout-shaped peritreme.

The spout is, in slight minor variants, widely distributed within Pentatomoidea, i.e., in Urostylididae (AHMAD et al. 1992, REN & LIN 2003), Phloeidae: Serbaninae, Dinidoridae (CACHAN 1952b, DURAI 1987, AHMAD et al. 1997b, KOCOREK & Lis 2000), Tessaratomidae: Oncomerinae (e.g., SINCLAIR 2000, KMENT & VILÍMOVÁ in press), Acanthosomatidae (KUMAR 1974b, ROLSTON & KUMAR 1975, KMENT 2005), Scutelleridae (e.g., DISTANT 1902, CACHAN 1952b), Plataspidae (*Caternaultiella*, *Probaenops*), and several subfamilies of Pentatomidae: Discocephalinae (e.g., ROLSTON 1992, NAGNAN et al. 1994, CAMPOS & GRAZIA 2006), Edessinae (*Bothrocoris*), Phyllocephalinae (e.g., DISTANT 1902, LINNAVUORI 1982, KAMALUDDIN & AHMAD 1988b), Podopinae (e.g., DISTANT 1902, LINNAVUORI 1982, DURAK & KALENDER 2007c, 2009), and many tribes of Pentatominae (e.g., Aeliini, Agonoscelidini, Carpocorini, Caystrini, Coquereliini, Diploxyini, Eysarcorini, Halyini, Myrocheini, Nealeriini, Nezarini, Pentatomini, Procleticini, Sciocorini, Triplatygini – DISTANT 1902; CACHAN 1952b; ROLSTON et al. 1980; ROLSTON & MCDONALD 1981, 1984; LINNAVUORI 1982; GHAURI 1982, 1988; WOOD & MCDONALD 1984; KAMALUDDIN & AHMAD 1988; GAPUD 1991; KMENT 2008). The occurrence of this type in the Urostylididae is especially remarkable, as this family is accepted to be the most plesiomorphic group of Pentatomoidea (e.g., CHINA & MILLER 1959, SCHAEFER & ASHLOCK 1970, KUMAR 1971, COBBEN 1978, GAPUD 1991, GRAZIA et al. 2008). Based on this evidence, I regard the spout-shaped peritreme as plesiomorphic within the Pentatomoidea (see also KMENT & VILÍMOVÁ in press). The term spout was used also in other groups of Pentatomomorpha (e.g., in Berytidae – HENRY 1997b), however, these structures are most probably parallelisms evolved independently from the ancestral auriculate consition.

Reduction of the spout (or the entire peritreme), as well as development of a groove, ruga, disc, or peritremal lobes, are considered advanced states which occur independently in different groups (KMENT & VILÍMOVÁ, unpubl.). GAPUD (1991) polarized shape of peritreme in Pentatomidae, regarding short peritreme (7.0; not reaching middle of metapleuron, the figure corresponding to a spout) plesiomorphic in all the Pentatomoidea, while peritreme reaching or extending slightly beyond middle of metapleuron (7.1) or occupying at least two thirds of metapleuron width (7.2) (his figures correspond to a groove and a ruga) was considered apomorphic. Based on the resulting cladogram, GAPUD (1991) stated that character state 7.1 evolved at least seven times and 7.2 four times independently within Pentatomoidea, while reversal to 7.0 happened at least three times independently. HASAN & KITCHING (1993) considered the presence of well developed peritreme (called 'posterior peritremal disc') in Pentatomoidea plesiomorphic, while its absence (compared to Cydnidae: *Macroscytus subaeneus* (Dallas, 1851)) as apomorphic. Using my preferred terms, the polarization of peritreme shapes in Character 25 by HASAN & KITCHING (1993) is as follows: groove (25.0: median furrow deep, running for most of the peritreme length; plesiomorphy), ruga (25.1: median furrow short and shallow; apomorphy), and disc (25.2: median furrow missing; apomorphy). KOCOREK & LIS (2000) scored the scent gland opening unmodified as plesiomorphic in the Dinidoridae, while modified into a lobe-like auricle (= spout in the present sense) as apomorphic, howeverer, their analysis showed the unmodified scent gland opening of *Byrsodepsus* as a reversal.

The spout consists of a cuticular supporting projection of the metapleuron, bearing the peritremal surface, which is originally perpendicular or oblique with the surface of metapleuron. However, this basic condition was modified into more apomorphies in different groups of the Pentatomoidea. The originally perpendicular peritremal surface often curves so its apex is turned ventrally, this state being often combined with prolongation of the spout laterally (e.g., Dinidoridae, Pentatomidae: Discocephalinae: *Miopygium cyclopeltoides*, Pentatominae: *Mustha* spp.). Another common situation in the spout is, that the peritremal surface is oriented posteriorly, its ventral margin is merging the supporting projection, while its distal and dorsal margins are well (sometimes sharply) emarginated. Next step is reduction of the supporting process, thus the peritremal surface is only slightly elevated above surrounding pleuron and usually became more or less parallel with it (e.g., Pentatomidae: Cyrtocorinae). These modifications of spout further differentiated into groove-shaped or ruga-shaped peritreme. It is interesting, that in many cases of groove, ruga, or disc, the peritremal surface is anteriorly merging metapleural surface (corresponding to the ventral margin of spout), while its distal and posterior margins are well emarginated, which supports the idea of reduction of the supporting projection during evolution.

The groove is rather narrow, short to long, and usually characterized by well developed median furrow reaching almost the apex of the peritreme (e.g., Pentatomidae: Pentatominae: *Nezara viridula*; Scutelleridae: Scutellerinae: *Poecilia morgani*, *Poecilocoris pulcher*). In the case of ruga, the median furrow is developed only proximally and apical part of peritreme is raised and keel-shaped (e.g., Pentatomidae: Pentatominae: *Carpocoris purpureolineatus*, *Acrosternum millieri*). The ruga could developed either directly from a spout with the peritremal surface twisted ventrally and reduced the supporting projection, or from a groove with apically reduced median furrow, both conditions being non-homologous. The peritremal disc was most probably derived from the groove, which is further enlarged and the median furrow is developed only basally or completely obsolete (e.g., Parastrachiidae: *Parastrachia* spp.; Pentatomidae: Asopinae: *Picromerus bidens*; Scutelleridae: Scutellerinae). However, the diversity of particular shapes of peritreme within Pentatomoidea (especially the most species-rich families – Acanthosomatidae, Cydnidae, Scutelleridae, Pentatomidae) is rather high and some of the cases are transitional between the basic shapes of peritreme (e.g., Pentatomidae: Cyrtocorinae) or cannot be attributed to any of the basic shapes, their homology needing further study (e.g., Pentatomidae: Podopinae: *Kundelungua*, *Tholagmus*).

The anagenesis of the peritremal lobes in the Tessaratomidae sensu stricto was hypothesized by KMENT & VILÍMOVÁ (in press) as follows: The ancestral condition (developed in the Oncomerinae) is represented by the ostiole not forming ostiolar groove, with a dorsal margin not produced into a projection bearing peritremal surface. In the next step in the evolution, the ostiole was enlarged mesially, apically truncated, forming a short ostiolar groove, and the dorsal margin of the ostiole is projected into distinct process bearing anteriorly the peritremal surface. This projection can be homologized with a posterior peritremal lobe of the Tessaratomidae *sensu stricto*. In the Tessaratomidae *sensu stricto*, the ostiolar groove expanded further mesially, followed by a prolongation and further development of adjacent anterior and posterior peritremal lobes. In this stage, the spout is reduced, probably merging the anterior peritremal lobe. Because no transitional state documenting the reduction of the spout have been found, this stage is hypothetical. However, an area of peritremal surface at the apex of anterior peritremal lobe can be a remnant of the peritremal surface of the spout. The apex of the posterior peritremal lobe is distally lustrous and bearing the peritremal surface continuing from the dorsal surface of a vestibule. The most advanced condition within the Tessaratomidae is represented by *Platytatus*. The vestibule opening obliquely to the metapleuron, the ostiolar groove being reduced, forming a funnel leading towards lateral peritremal lobe, homologous to posterior peritremal lobe (or probably only its distal part covered with peritremal surface). The median peritremal lobe is homologous to the anterior peritremal lobe of the other Tessaratomidae *sensu stricto*. KMENT & VILÍMOVÁ (in press) polarized the absence of the posterior peritremal lobe as plesiomorphy and its development as an autapomorphy of the Tessaratomidae.

The terminal lobe is a structure exclusive to the Cydnidae: Cephalocteinae: Scaptocorini and Cydninae: Geotomini (cf. LIS 1994). This structure should be either homologous to the supporting projection of the spout, or it is a new structure in the evolution (?dilatation of a vestibule). The SEM studies of the cross-sections can help to resolve this question. It is interesting, that PLUOT-SIGWALT & LIS (2008) found that the Cephalocteinae and part of the Geotomini share the same type of female spermatheca ('geotoman facies'), the fact which can suggest the closer relationship of these groups and then the terminal lobe could be another synapomorpy. However, in *Microporus nigritus* and also *Cephalocteus melolonthoides* Schiødte, 1843 (see drawing by LIS (1994)), the terminal lobe is not developed, the peritreme forming a disc similar to other cydnid taxa (?plesiomorphy).

Extent of the evaporatorium. The plesiomorphic condition of the evaporatorium size within the Pentatomoidea is less clear than in the case of peritreme. In the Urostylididae, the evaporatorium is developed on both mesopleuron and metapleuron and rather large, reaching the lateral pleural margin. While the presence of evaporatorium on both mesopleuron and metapleuron seems to be really plesiomorphic in Pentatomoidea, its rather large extent and the mesopleural part reaching the lateral mesopleural margin could be, as well, parallelisms with situation in other groups of the Pentatomoidea. The extension of evaporatorium towards anterolateral angle of mesopleuron (e.g., many Pentatomidae), onto propleuron (Plataspidae) or sterna (Plataspidae, Acanthosomatidae: *Ditomotarsus*) on one hand, as well as various reductions of evaporatorium on the other hand represent advanced states (KMENT & VILÍMOVÁ in press).

GAPUD (1991) polarized the extent of evaporatorium in the Pentatomoidea as follows: (4.0) small area around ostiole (plesiomorphic), (4.1) evaporatorium moderatelly expanded laterally towards middle of metapleuron and posterior margin of mesopleuron (apomorphic), and (4.2) evaporatorium occupying whole pleural region (apomorphic). However, in description of his cladogram, GAPUD (1991) listed character state 4.1 as synapomorphy of Pentatomoidea, the state 4.0 in Lestoniidae was considered as reversal, and 4.2 was given as synapomorphy of Plataspidae. KOCOREK & LIS (2000) polarized the evaporatorium condition in Dinidoridae as follows: evaporatorium on metapleuron: large, conspicuously developed (plesiomorphic), very small (apomorphic), absent (apomorphic); evaporatorium on mesopleuron: present (plesiomorphic), absent (apomorphic). HASAN & KITCHING (1993) scored large evaporatorium, covering most of the metasternum, as plesiomorphic within Pentatomoidea, while small evaporatorium surrounding just the ostiole and peritreme as apomorphic. In Cephalocteinae (Cydnidae), LIS (1999a) regarded the mesopleural evaporatorium large and well developed as plesiomorphic, while narrow and hardly visible as apomorphic.

Gyrification developed in a form of low wrinkles and furrows is present in Urostylididae and occurs widely in the Pentatomoidea. Thus I consider this state as a plesiomorphy, while well developed and coarse gyrification (e.g., Dinidoridae, Pentatomidae: Phyllocephalinae, several Podopinae), as well as its total absence (often corresponding with reduction of the evaporatorium size) are considered advanced states (KMENT & VILÍMOVÁ in press). In Coreoidea, SCHAEFER (1965, 1968, 1972) suggested that 'deep ridges, parallel or anastomosing, occur in the evaporative area in the more advanced groups'.

Development of possible functional prolongation of peritreme on mesopleuron. On the mesopleuron of several pentatomoidean taxa, smooth and lustrous patch of pleural surface which is not covered by mycoid microsculpture is possible to observe. This structure is usually situated between the distal end of the metathoracic spiracle and median area of mesopleural margin. In most primitive form, this structure is merely a lustrous spot lacking the dull appearance of surrounding evaporatorium, this state is developed in many Pentatomidae (Discocephalinae: Discocephalini, Edessinae, Pentatominae). In *Neottiglossa pusilla* (Pentatomidae: Pentatominae), this spot has a form of a smooth shallow groove reaching the lateral mesopleural margin, similar to other Pentatominae, while in the *N. leporina*, the groove is deep and forms a direct continuation of the groove-shaped peritreme. Similar condition seems to be a common character in the Thyreocoridae and it also occurs in *Macroscytus brunneus* (Cydnidae: Cydninae).

In several species of the Plataspidae, the lateral and posterolateral margin of mesopleuron is smooth and lustrous and joins the apex of peritreme as well. In several of the Pentatomidae with lustrous patch on mesopleuron the peritreme is rather short (e.g., Pentatominae: *Neottiglossa pusilla*, *Pentatoma rufipes*) and it is a question if the patch has any function in scent spreading. However, such condition could be a preadaptation for futher development (cf. *Neottiglossa pusilla* and *N. leporina*). In Thyreocoridae, *Macroscytus brunneus*, *Neottiglossa leporina* and some other taxa there is a close association of these mesopleural structures with the apex of peritreme and they can be hypothesized as a functional prolongation of the peritreme. These structures are clearly advanced states developed several times independently in different groups of the Pentatomoidea.

6.2. Convergent trends in evolution of the external scent efferent system

Reduction of the metathoracic scent apparatus. The complete reduction of the metathoracic scent apparatus happened several times independently in different taxa of Nepomorpha (Belostomatidae: Belostomatinae, Nepidae, Aphelocheiridae, Notonectidae: Anisopinae, Gelastocoridae: Nerthrinae), Gerromorpha (Hydrometridae: Hydrometrinae, Gerridae: several genera of Rhagadotarsinae and Trepobatinae), Cimicomorpha (Reduviidae: Emesinae, Harpactorinae, Holoptilinae, Saicinae, Visayanocorinae) (e.g., COBBEN 1978, STADDON & THORNE 1979, ANDERSEN 1982, WEIRAUCH 2006a), and Pentatomomorpha (see below).

Within Pentatomoidea, I was not able to trace ostiole and the other parts of the external scent efferent system in Saileriolidae, Megarididae, and several representatives of Scutelleridae (Odontoscelinae, Odontotarsinae) and Pentatomidae (Podopinae, Pentatominae). Concerning Saileriolidae, my observations agree with HSIAO's (1964) results, however, they are contradictory with those by SCHAEFER & ASHLOCK (1970), who mentioned the presence of ostiole 'at meso-metasternal border', which, however, could be the misinterpreted metathoracic spiracle, well visible in *Ruckesona vitrella*. Also in Megarididae my results do not agree with those by MCATEE & MALLOCH (1928) and MCDONALD (1979). In any case, I am sure that neither peritreme nor evaporatorium are developed in these two families. The SEM investigation of the rare representatives of Saileriolidae and Megarididae are necessary to bring more light into this matter.

In *Odontotarsus robustus* (Scutelleridae: Odontotarsinae), I did not found macroscopic traces of the external scent efferent system, as well as the dissections did not reveal the presence of metathoracic scent gland(s) and reservoir(s). The subsequent SEM investigation showed possible rudiments of non-functional ostiole and internal orifice. My macroscopic observation, as well as published evidence confirm the absence of the external scent efferent system in other genera of Scutelleridae (*Irochrotus*, *Melanodema*, *Odontoscelis*, *Phimodera*). Within Pentatomidae, the complete absence of the external scent efferent system was observed in podopine genera *Tarisa* (see SEM photograph by HASAN & KITCHING (1993)), *Tornosia* (DAVIDOVÁ-VILÍMOVÁ 1999), and pentatomine genus *Trochiscocoris*.

Reduction of the external scent efferent system. The reduction affects usually either peritreme, or evaporatorium, but most often both of these structures together.

The reduction of peritreme happened in two different ways:

i) reduction of spout, which peritremal surface is small (ca. twice as long as ostiole diameter) to extremely small (as long as ostiole diameter, or shorter) (e.g., Acanthosomatidae: *Cylindrocnema plana*; Cydnidae: *Linospa orbicularis*, *Scaptocoris castaneus*; Scutelleridae: *Polytes lineolatus*; Pentatomidae: Pentatominae: *Aeptus singularis*, *Atelocera serrata*; Podopinae: *Derula*), or completely missing (e.g., Canopidae: *Canopus caesus*, Scutelleridae: *Psacasta exanthematica*).

ii) the peritremal surface (of disc-shaped peritreme) is not emarginated distally and merges surrounding metapleuron. This character state developed independently in several taxa of Pentatomidae (Pentatominae: Agaeini, Strachiini; Asopinae) and Scutelleridae (Scutellerinae: *Calliscyta stalii*). GAPUD (1991) considered this peritremal modification as an apomorphy, which, however, developed at least two times independently within the Pentatomidae. The absence of peritreme in *Lestonia haustorifera* in comparison with well developed peritreme of *L. grossi* (Lestoniidae) should be also explained by fusion of the peritremal surface with surrounding pleuron.

A reduction of the evaporatorium happened many times independently in different groups. The mesopleural evaporatorium is usually more affected by reductions than the metapleural part. For example, the mesopleural evaporatorium is limited to a small spot (e.g., Pentatomidae: Pentatominae: *Amasenus corticalis*; Podopinae: *Cyptocoris lundi*), narrow stripe on posterior mesopleural margin (e.g., Cydnidae: *Linospa orbicularis*; Lestoniidae: *Lestonia grossi*; Pentatomidae: Pentatominae: *Trichopepla semivittata*) or present only along the anterior margin of metathoracic spiracle (e.g., Pentatomidae: Pentatominae: *Agaeus elegantulus*). The mesopleural evaporatorium was completely lost in several taxa (e.g., Parastrachiidae; Pentatomidae: Asopinae: *Jalla dumosa*, *Marmesullus nigricornis*; Pentatomidae: Pentatominae: *Atelocera serrata*, *Mustha* spp.; Tessaratomidae: *Platytatus ambiguus* – KMENT & VILÍMOVÁ in press), The metapleural evaporatorium is often reduced to a patch surrounding the ostiole and peritreme (e.g., Pentatomidae: Plataspidae: *Cyptocoris lundi*; Tessaratomidae: *Platytatus ambiguus* – KMENT & VILÍMOVÁ in press) or it forms a V-shaped area surrounding anteriorly and posteriorly either the peritremal disc, or the peritremal surface distally merging pleural surface (Pentatomidae: Pentatominae: Agaeini, Strachiini; Asopinae; Scutelleridae: Scutellerinae:

Calliphara nobilis, *Calliscyta stalii*). In several cases, the evaporatorium is completely reduced (see below).

The combination of the reduced peritreme and the large evaporatorium is relatively rare, however, it occurs in several Canopidae and Pentatomidae: Podopinae (*Derula*). The most common situations are either combination of reduced peritreme with small evaporatorium (e.g., Pentatomidae: Cyrtocorinae, Stirotarsinae – cf. PACKAUSKAS & SCHAEFER 1988, RIDER 2000), or reduced peritreme and the evaporatorium completely missing (e.g., Pentatomidae: Pentatominae: *Aeptus singularis*), or both peritreme and evaporatorium missing and only the ostiole being developed (Lestoniidae: *Lestonia haustorifera*, Scutelleridae: *Elvisura irrorata*; Dinidoridae: *Byrsodepsus* – KOCOREK & LIS 2000). On the other hand, I do not know any species with well developed peritreme combined with missing evaporatorium.

Correlations between the reduction of the external scent efferent system and aposematism. According to SCHAEFER (1972), the external scent efferent system is poorly developed in aposematic bugs. However, this hypothesis is problematical, as it is valid in several taxa of the aposematic bugs (e.g., Lygaeidae *sensu stricto*, Pyrrhocoridae, Rhopalidae: Serinethinae, Pentatomidae: Pentatominae: Strachiini), but it is not true in other taxa, where aposematic species retain the well developed external scent efferent system (e.g., Pentatomidae: Podopinae: *Grpahosoma* spp.; Scutelleridae: Scutellerinae). There are, sometimes, remarkable differences between closely related taxa (e.g., Parastrachiidae: peritreme well developed in *Parastrachia* spp., reduced in *Dismegistus* spp.). It is possible, that reduction of the external scent efferent system is primarily connected with sequestration of plant toxins, and subsequent reduction of the metathoracic scent glands and change of deffensive strategies in several taxa of the true bugs (Lygaeidae *sensu stricto*, Serinethinae, Strachiini, Scutelleridae: *Pachycoris klugii* (Burmeister, 1835)), rather than with aposematism itself (e.g., ALDRICH 1988; ALDRICH et al. 1990a,b, 1996; ALIABADI et al. 2002; DUFFEY 1980; SCUDDER & DUFFEY 1972; SCUDDER & MEREDITH 1982; WINK et al. 2000; RAŠKA 2009).

Lateral shift of the external scent efferent system. Within Pentatomidae, there is an evolutionary trend towards biconvex body (both dorsally and ventrally) (e.g., Cydnidae, Scutelleridae, Pentatomidae) or the body is dorsally strongly convex while the body venter is flat (Plataspidae, Megarididae, Canopidae, Lestonidae, Pentatomidae: Aphylinae). Moreover, the whole body is dorsoventrally flattened in several pentatomoideans, due to the subcorticolous or corticolous way of life (Phloeidae, Tessaratomidae: *Platytatus*, Pentatomidae: *Platycoris*, some Discocephalinae: Discocephalini). Taking into account the plesiomorphic basal position of the ostiole and short spout-shaped peritreme, the flattened body venter, sometimes even emarginated by explanate thoracic and abdominal margins, could prevent an effective spreading of the defensive scent secretion towards potential predator. This situation led either to reduction of the external scent efferent system or evolution of various modifications removing this handicap, often convergent in different taxa of the Pentatomoidea and Pentatomomorpha.

The reduction of the external scent efferent system in true bugs with flattened venter is represented e.g. by Megarididae (see above), in several species of Canopidae (MCATEE & MALLOCH 1928), and also in several subfamilies of the Aradidae (Aradinae, Aneurinae, Calisiinae, Carventinae) (USINGER & MATSUDA 1959, LARIVIÈRE & LAROCHELLE 2006).

The following trends helping in more effective spreading of the scent secretion in the Pentatomoidea with flattened body venter are mentioned:

i) *Ostiole shifted laterad* is present in many taxa of the Pentatomoidea, but usually the shift is small and ostiole is situated only ca. between lateral margins of mesoacetabulum and metacetabulum (common in several families and subfamilies). However, in several taxa the ostiole is located in half-width of metapleuron (e.g., Cydnidae: Cephalocteinae, Cydninae: Geotomini; Thaumastellidae; Scutelleridae: *Chelycoris haglundi*; Pentatomidae: Discocephalinae: *Coriplatus depressus*; Pentatominae: *Placocoris viridis*; Podopinae:. *Sternodontus*, *Tholagmus*), or even more laterad (e.g., Phloeidae: Phloeinae, Tessaratomidae: *Platytatus ambiguus*).

ii) *Peritreme prolonged* towards the lateral margin of metapleuron (e.g., Pentatomidae: Aphylinae; Discocephalinae: *Psorus cassideus*; Pentatominae: *Amasenus corticalis*, *Evoplitus laciniatus*; Scutelleridae: *Poecilocoris pulcher*).

iii) *Development of the structures functioning as prolongation of the peritreme on mesopleuron*. These structures were discussed in detail above, at least in several taxa (e.g., Pentatomidae: Pentatominae: *Neottiglossa leporina*, Thyreocoridae: *Thyreocoris* spp.) there is little doubt about their function.

iv) *The evaporatorium is widely reaching lateral margin* on both mesopleuron and metapleuron (e.g., Cydnidae: Amnestinae, Cydninae: *Chilocoris assmuthi*; Phloeidae: Serbaninae; Plataspidae).

v) *Development of evaporatory channel*, a depressed groove covered with mycoid surface, leading from apex of the peritreme or lateral margin of evaporatorium towards lateral margin of the pleuron (often following the meso-metapleural suture) (e.g., in Pentatomidae: Pentatominae: *Triplatyx* (KMENT 2008) or in Dinidoridae: *Eumenotes*). The evaporatory channel is also developed in several subfamilies of dorsoventrally flattened Aradidae (i.e., Mezirinae, Isoderminae, Prosympiestinae, Chinamyersinae) (USINGER & MATSUDA 1959, LARIVIÈRE & LAROCHELLE 2006).

vi) *Complex changes following the novel thoracic structure* in Pentatomidae: Aphylinae (see Results and below).

These trends usually combine together, for example we can see in several species of the Plataspidae the ostiole shifted laterad to half-width of the metapleuron, prolonged peritreme, a smooth and lustrous lateral margin of mesopleuron, and the evaporatorium widely reaching the pleural margin on both mesopleuron and metapleuron and extending even on prothorax. The most complex situation seems to exist in Pentatomidae: Aphylinae, where ostiole is shifted slightly laterad, peritreme is elongated towards lateral metapleural margin, the mesopleuron is depressed in comparison with metapleuron, sloping laterad, and squeezed between the explanate pronotal margin and metapleuron; metapleural evaporatorium is large, mesopleural evaporatorium reaching the lateral mesopleural margin, and especially, there is an 'external opening' towards the lateral side of the body, accompanied with a newly developed 'anterior mesal exponial sclerite' covered externally with mycoid microsculpture.

Correlations between the evolution of the external scent efferent system and habitat. SCHAEFER (1972) analysed development of the external scent efferent system in several dozens of Trichophora species and compared it with their habitat requirements. He suggested several convergent trends correlating the external scent efferent system development with the habitat of the bugs. For example, that the external scent efferent system is well developed in ground living bugs, while less developed in those living on plants. He also noted that the large and well developed evaporatorium is often combined with small spout (ground-living bugs), while well developed spout is combined with small evaporatorium (plant-living bugs). Unfortunatelly, these hypotheses are rather vaguelly formulated and they were never rigorously tested by statistic methods. It is clear that there are either species or other taxa fitting well to this scheme, but also many exceptions; e.g., in the ground living Cephalocteinae (Cydnidae) or *Podops* (Pentatomidae: Podopinae) the large evaporatorium is combined with small peritreme, but the *Graphosoma* species with similar ratio of peritreme and evaporatorium lives on herbs, while several undoubtedly ground living genera have reduced the external scent efferent system (Scutelleridae: *Psacasta*) or even the metathoracic scent glands (Scutelleridae: *Odontoscelis*, *Phimodera*; Pentatomidae: *Trochiscocoris*).

6.3. External scent efferent system and use of its features in the phylogeny reconstruction

Neither HENRY (1997a) nor GRAZIA et al. (2008) included characters based on the structure of the external scent efferent system in their cladistic analyses of the Pentatomomorpha and Pentatomoidea, respectivelly. GAPUD (1991) included four characters (i.e., extent of the evaporatorium, position of the ostiole, length and development of the peritreme) in his analysis, however, the only unambigous apomorphy he recognized was the evaporatorium covering whole pleural region in Plataspidae, in other features the advanced states showed to be homoplasious, either reversals or parallelisms. Namely in a case of the peritreme length, GAPUD (1991) wrote: ‘this variable is prone to numerous parallelisms and reversals and cannot be used for cladistic analysis by itself’ (see also chapter Polarization above). HASAN & KITCHING (1993) scored eleven characters of the thoracic scent efferent system, but them neither succeeded in a recognition of some non-homoplasious apomorhy within their sample of the Pentatomidae.

KMENT & VILÍMOVÁ (in press) polarized eleven characters based on the structure of the external scent efferent system and the metathoracic spiracle for 22 pentatomoidean taxa, and analyzed them combined with 57 characters data set used by GRAZIA et al. (2008). The distribution of particular character states of these eleven characters in a cladogram revealed that most of these characters are homoplasious and of limited value for a reconstruction of the interfamily relationships within the Pentatomoidea. However, few of the characters were revealed as apomorphies, thus helpful in a definition of particular family-group taxa, namely Plataspidae (evaporatorium on propleura, mesopleura, and metapleura, large), Tessaratomidae *sensu stricto* (ostiole in form of long ostiolar groove, posterior peritremal lobe long and ridge-shaped), Tessaratomini (metathoracic spiracle short, oval, shifted laterad, opening posteroventrally), and Platytatina (posterior peritremal lobe reduced into ear-lobe-shaped structure). In addition to these results, some other apomorphies may be pointed out: the extreme lateral shift of the ostiole towards lateral metapleural margin in Phloeinae, the novel morphology of the thorax in Aphylinae (cf. ŠTYS & DAVIDOVÁ-VILÍMOVÁ 2001), possibly the presence of a peritreme-like groove on mesopleuron of the Thyreocoridae, or the terminal lobe in Cydnidae: Cephalocteinae + Cydninae: Geotomini.

The character states homoplasious on the interfamily level can be certainly valuable for the phylogenetic reconstruction of a relationships on tribal or genus-group and species-group level.

6.4. Variability of the external scent efferent system and its use in taxa definition

The structure of the external scent efferent system is often used for a recognition of genus- or species-group taxa within Pentatomoidea (especially in Cydnidae) for more than a century (e.g., STÅL 1870, 1873; UHLER 1877; SIGNORET 1881; HORVÁTH 1900; FROESCHNER 1960; ROLSTON & KUMAR 1975; ROLSTON et al. 1980; ROLSTON & MCDONALD 1981, 1984; SCHAEFER 1981; THOMAS 1994a; LIS 1994). In the taxonomic revisions included in this thesis, the structures of the external scent efferent system prooved to be useful characters for recognition of Madagascar genera of Acanthosomatidae (KMENT 2005), as well as for distinguishing genera of Triplatygini and species of the genus *Triplatyx* (Pentatomidae: Pentatominae) (KMENT 2008). In contrast, I found no differences among the external scent efferent systems of the genera *Tripanda* Berg, 1899 and *Tenerva* Cachan, 1952 (Pentatomidae: Pentatominae). This superficial observation started a detailed revision of both the taxa and revealed their synonymy on a generic level (KMENT & JINDRA 2009).

So far, the structures of the external scent efferent system were supposed to be constant in particular species. According to my observations, this is true for most of the species in which I was able to examine sufficient number of specimens. However, some exceptions were recognized as well. A substantial variation in the shape of peritreme was observed in three examined specimens of *Cryptacrus comes* (Scutelleridae: Scutellerinae). In this case, a taxonomic revision seems to be appropriate for exclusion the possibility that this taxon is in fact a complex of two or more cryptic species. A slight variability in the shape of spout and evaporatorium (especially the raised ridge near its lateral margin) was found in specimens of *Mustha spinosula* and *Mustha* sp. nov. (both Pentatomidae: Pentatominae: Halyini), in the second species even in two specimens from the same locality. In this case, I was able to confirm the identity of both species based on examination of male genitalia and thus the intraspecific variability of the external scent efferent system. These findings suggest that characters in the structure of peritreme and evaporatorium shoud be treated with caution, especially when only single specimen is available in a study.

6.5. Microsculpture of the external scent efferent system

The mushroom bodies of the evaporatorium were first described by REMOLD (1962, 1963). The morphogenesis of the mycoid microsculpture was later described in detail by FILSHIE & WATERHOUSE (1969). In the following four decades, different authors examined the microsculpture and published SEM photographs of the external scent efferent system of few dozens of Heteroptera species including Pentatomoidea (e.g., JOHANSSON & BRÅTEN 1970, CARAYON 1971, DETHIER 1974, MCDONALD & EDWARDS 1978, STADDON 1979, KITAMURA et al. 1984, WOOD & MCDONALD 1984, CARVER 1990, HASAN 1990, CARVER et al. 1991, MCDONALD 1992, DAVIDOVÁ-VILÍMOVÁ 1993, HASAN & KITCHING 1993, NAGNAN et al. 1994, LIS 2000b, and KMENT & VILÍMOVÁ in press).

CARAYON (1971) provided SEM photographs of the mycoid as well as peritremal microsculpture of several representatives of Dipsocoromorpha, Cimicomorpha, and Pentatomomorpha. He concluded that the general pattern of the mycoid microsculpture of the evaporatorium is rather constant, but certain distinguishing characters exist in the microsculpture on the species-, genus-, and family levels (illustrated by several examples in the Cimicidae), however, he also admit the differences between perifery and centre of the evaporatorium. HASAN & KITCHING (1993) included four characters based on mycoid microsculpture in their analysis (shape and size of mushroom bodies, presence of bridges, presence and shape of trabeculae), however, the particular characters states were found to be homoplasious (e.g., a reduced number of trabeculae in Cydnidae, Asopinae, Podopinae, and Pentatominae: Strachiini, their complet lost in part of Strachiini and part of Podopinae).

I was able to examine the mycoid microsculpture in several taxa of the Pentatomoidea using the scanning electron microscope. There are indeed differences between species, however, this sample is too small to make some generalization. Even at the first look, the mycoid microsculpture of *Eurydema oleraceum* (Pentatomidae: Pentatominae) is more similar to *Eurygaster maura* (Scutelleridae: Eurygastrinae), then to *Pentatoma rufipes* (Pentatomidae: Pentatominae), so the parallelisms undoubtedly exist also in the evolution of the microsculpture of the external scent efferent system. Moreover, there are two objective complications which decrease the suitability of these characters for practical use in either identification or phylogeny reconstruction:

i) The mycoid microsculpture is more or less variable within the external scent efferent system (e.g., in the surroundings of the ostiole and peritreme, in the centre and near the margins of the evaporatorium). In Tessaratomidae (KMENT & VILÍMOVÁ in press; also in *Coreus marginatus* from Coreidae – HEPBURNE & YONKE 1971, Kment, unpubl.), there is striking difference between the shape of mushroom bodies in vestibule and on evaporatorium, but in *Acanthosoma haemorrhoidale* or *Pentatoma rufipes* the shape is only slightly different.

ii) The well developed gyrification distorts the shape of mushroom bodies which are viewed in different angles. This artefact much complicates the comparison between different taxa.

6.6. Function of the metathoracic scent apparatus

The biology of the scent glands is very complex and its study needs integration of several scientific approaches, from morphology to regulation of gene expression and from biochemistry to ethology. Unfortunately, the amount of information already known in this puzzle is very unbalanced. There is a large number of papers dealing with the gross morphology and anatomy of the metathoracic scent apparatus, as well as numerous literature dealing with the chemical composition of the scent secretion (see references mentioned in the Introduction). However, other topics, such as genetic background of the processes or biophysical parameters of the scent secretion remain unknown. Unfortunately, one of the most serious gaps in our knowledge is the information about how exactly the bugs use the scent secretion during the defensive reaction or in infraspecific comunication and which role play the particular structures of the external scent efferent system in this process.

There is only a little doubt that primary function of the metathoracic scent gland was defensive and that these glands can provide a strongly efficient defence against small arthropods, as well as large vertebrates (e.g., FALKENSTEIN 1931; REMOLD 1962, 1963; JANAIAH et al. 1979a; STADDON 1979; CANT et al. 1996; KRALL et al. 1997, 1999). There are three different types of the defence behaviour in terestrial bugs (REMOLD 1962; STADDON 1979):

i) Emission of scent onto the cuticle surrounding the ostiole.

ii) Transference of the emitted scent from the ostiole via the tarsus to the body surface of the attacker.

iii) Ejection of scent in a jet, unilaterally or bilaterally, and often accurately towards the attacker.

The transfer of the scent secretion by tarsi was observed in *Tritomegas* species (Cydnidae: Sehirinae) (REMOLD 1962). In *Cosmopepla bimaculata* (Thomas, 1865), both the types i) and ii) were observed (KRALL et al. 1999), while REMOLD (1962) mentioned a combination of mechanisms ii) and iii) in *Troilus luridus* (Pentatomidae: Asopinae). The ejection of the scent in a jet is known in *Tessaratoma papillosa* (Drury, 1770) (Tessaratomidae) (FALKENSTEIN 1931), *Coptosoma scutellatum* (Plataspidae) (REMOLD 1962, 1963), *Eurygaster testudinaria* (Geoffroy, 1785) (Scutelleridae: Eurygastrinae) (REMOLD 1962), and several representatives of Pentatomidae (Asopinae, Pentatominae, Podopinae) (REMOLD 1962, 1963). As these taxa differ substantially in the structure of the peritreme and the whole external scent efferent system, no conclusion about their function can be done without detailed study of the defensive reactions of the bugs.

As the scent secretion is known to be toxic for the bugs themselves (FALKENSTEIN 1931; REMOLD 1962, 1963), the close association of the metathoracic spiracle with external scent efferent system brings the so far unresponsed questions how it is protected against its penetration inside the tracheal system. CARVER (1990) expressed the speculation that '[...] metathoracic spiracles participate in the defensive process by promoting dispersion of the secretion by means of an exhalation-ventilation process'. Considering this suggestion, the metathoracic spiracle in most of the Tessaratomini with short opening shifted laterad, opening close to the lateral margin of metapleural evaporatorium can be ideally an adaptation helping to spray the secretion. However, without observations of living bugs this hypothesis cannot be tested (KMENT & VILÍMOVÁ in press).

7. References

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APPENDIX 1. List of specimens used for line drawings [LD] and scanning electron microphotographs [SEM]. The material originates from the following collections:

AMSA	Australian Museum, Sydney, Australia;
CUPC	Faculty of Science, Charles University, Prague, Czech Republic (coll. J. Vilímová);
MMBC	Moravian Museum, Brno, Czech Republic;
MNHN	Museum Nationale d'Histoire Naturelle, Paris, France;
MZHF	Zoological Museum, University of Helsinki, Helsinki, Finland;
NHMW	Naturhistorisches Museum, Vienna, Austria;
NMPC	National Museum, Prague, Czech Republic;
ZJPC	Zdeněk Jindra Collection, Prague, Czech Republic.

List of material

ACANTHOSOMATIDAE: Acanthosomatinae: *Acanthosoma haemorrhoidale* (Linnaeus, 1758): Slovakia centr., Muráň env. (7286), Hrdzavá dolina valley, 500 m a.s.l., 22.v.2002, J. Skuhrovec lgt., P. Kment det. (NMPC) [SEM]. *Cyphostethus tristriatus* (Fabricius, 1787): Czech Republic, Moravia mer., Brno – Veveří (6765), Faculty of Science campus, 6.xii.2001, P. Kment lgt. & det. (NMPC) [LD]. *Elasmucha ferrugata* (Fabricius, 1787): Czech Republic, Bohemia bor., Blíževedly – Hvězda (5352), Vlhošť NR, Malý Vlhošť hill, 26.iv.2002, P. Kment lgt. & det. (NMPC) [LD]. **Ditomotarsinae: Ditomotarsini:** *Ditomotarsus punctiventris* Spinola, 1852: Chile, Isla de Chiloe, SW of Castro (S42°59′, W73°45′), 200 m a.s.l., 7.ii.2005, M. Halada lgt., P. Kment det. (NMPC) [SEM].

CANOPIDAE: *Canopus caesus* (Germar, 1839): Suriname, Paramaribo, Michaelis lgt. (NHMW) [LD].

COREIDAE: Coreinae: *Coreus marginatus* (Linnaeus, 1758): Czech Republic, Moravia mer. or., Malá Vrbka (7170; N48°52′03″, E17°26′36″), restored meadow, 2.v.2001, P. Kment lgt. & det. (NMPC) [SEM].

CYDNIDAE: Amaurocorinae: *Linospa orbicularis* (Jakovlev, 1885): Tunisia, Al Blidet, south of Kebili, 25.iv.2000, J. Batelka lgt., P. Kment 2004 det. (NMPC) [LD]. **Amnestinae:** *Amnestus spinifrons* (Say, 1825): USA, Tennessee, Hamilton Co., 3.xi.1939, W. F. Turner lgt., R. C. Froeschner 1964 det. (NHMW) [LD]. **Cepahlocteinae: Scaptocorini:** *Scaptocoris castaneus* Perty, 1833: Venezuela, Caracas, coll. & det. Signoret (NHMW) [LD]; *Stibaropus* (*Stibaropus*) cf. *molginus* (Schiødte, 1847): Laos, Vientiane prov., Lao Pako env., 55 km NE of Vientiane, 200 m a.s.l., 1.–4.v.2004, J. Bezděk lgt., P. Kment 2004 det. (NMPC) [LD]. **Cydninae: Cydnini:** *Chilocoris* (*Statanus*) *assmuthi* Breddin, 1904: Sri Lanka, Henaratgoda, 16.ii.[19]02, Uzel lgt., R. C. Froeschner det. (NHMW) [LD]; *Cydnus aterrimus* (Forster, 1771): Croatia, Pag Island, vii.1996, M. Fikáček lgt., P. Kment det. (NMPC) [SEM]. **Geotomini:** *Dalasiellus* (*Dalasiellus*) *solitarius* (Horváth, 1919): Peru, Dep. Cuzco, Santa Isabel, valley of Cosnipata River, 1.i.1952, F. Woytkowski lgt., R. C. Froeschner 1964 det. (NHMW) [LD]; *Macroscytus brunneus* (Fabricius, 1803): Italy, Toscana, Grosseto province, Principina a Mare (N42°42′ E11°20′), sand dune on beach, 7.iv.2003, P. Kment & M. Horsák lgt., P. Kment 2003 det. (NMPC) [LD]; *Microporus nigritus* (Fabricius, 1794): Slovakia or., Plešany env. near Královský Chlmec, 9.vii.1988, J. Vilímová lgt., P. Kment 2002 det. (NMPC) [LD]; *Prolobodes giganteus* (Burmeister, 1835): Brazil, Natterer lgt. (NHMW) [LD]; *Pseudoscoparipes* (*Pseudoscoparipes*) *nilgiricus* Lis, 1990: Indie, Madras, J. A. Lis det.

(NHMW) [LD]; *Scoparis* (*Euscoparipes*) *affinis* Lis, 1990: Indonesia, Java, J. A. Lis det. (NHMW) [LD]. **Garsaurinae:** *Peltoxys typicus* (Distant, 1901): India occ. centr., Maharashtra, 120 km NE of Mumbai, Igatpuri env. (N19°42.17′, E73°33.06′), 600 m a.s.l., 1.–12.viii.2002, P. Šípek & M. Fikáček lgt., P. Kment 2003 det. (NMPC) [LD]. **Sehirinae:** *Legnotus limbosus* (Geoffroy, 1785): Czech Republic, Moravia mer., Lednice env. (71–7266), 19.iv.1987, J. Vilímová lgt., P. Kment 2002 det. (NMPC) [LD]; *Tritomegas sexmaculatus* (Rambur, 1842): Czech Republic, Moravia mer., Mikulov (7165), Svatý kopeček NR (N48°48′25″, E16°38′50″), 13.v.2000, P. Kment & M. Horsák lgt., P. Kment 2001 det. (NMPC) [LD].

DINIDORIDAE: Dinidorinae: *Coridius viduatus* (Fabricius, 1794): Egypt, Cairo, coll. Baum, P. Kment det. (NMPC) [SEM]. **Megymeninae:** *Megymenum affine* Boisduval, 1835: Australia, Queensland, Thursday Island, Finsch lgt., A. Kocorek det. (NMPC) [LD].

LARGIDAE: Physopeltinae: *Physopelta gutta* (Burmeister, 1834): Taiwan, L. Dembický lgt., J. L. Stehlík 2009 det. (NMPC) [SEM].

LESTONIIDAE: *Lestonia grossi* McDonald, 1969: Australia, N Queensland, The Crater, near Herberton, 4.i.1967, McAlpine & Holloway coll., McDonald det. (paratype) (AMSA) [LD].

MEGARIDIDAE: *Megaris peruviana* Horváth, 1919: [?], San Esteban, iii.[18]88, E. Simon lgt., McAtee & Malloch det. (MZHF) [LD].

PARASTRACHIIDAE: *Dismegistus sanguineus* De Geer, 1778: Kenya, Nairobi, B.E.A., G. Babault lgt., P. Kment det. 2009 (MNHN) [LD]; *Parastrachia nagaensis* Distant, 1908: Laos bor. or., Houa Phan prov., Ban Saluei → Phou Pane Mt. (N20°12–13.5′, E103°59.5′–104°01′), 1340–1870 m a.s.l., V. Kubáň lgt., P. Kment det. (NMPC) [SEM].

PHLOEIDAE: Phloeinae: *Phloeophana longirostris* (Spinola, 1837): Brazil, Rio de Janeiro, L. H. Rolston 1982 det. (NMPC). **Serbaninae:** *Serbana borneensis* Distant, 1906: Malaysia, Sarawak, Mulu NP, Fluss bei [= river near] Deer Cave, 3.–5.iii.1993, M. Jäch lgt., P. Kment 2007 det. (NHMW) [LD].

PENTATOMIDAE: Aphylinae: *Aphylum bergrothi* Schouteden, 1906: Australia, Queensland, Clermont, viii.[19]28, Dr. K. K. Spence lgt., A. Musgrave det. (AMSA) [LD].

– Asopinae: *Arma custos* (Fabricius, 1794): Czech Republic, Bohemia bor., Jílové – Sněžník (5250), 'Vlčák', 22.ix.2000, E. Kula lgt., P. Kment 2001 det. (NMPC) [LD]; *Jalla dumosa* (Linnaeus, 1758): Czech Republic, Bohemia centr., Tišice env. near Mělník (5753), 19.v.1986, J. Vilímová lgt., P. Kment 2001 det. (NMPC) [LD]; *Marmessulus nigricornis* (Stål, 1865): Natal [*sic*!, error], coll. Signoret, Stål det. (NHMW) [LD]; *Oechalia schellenbergi* (Guérin-Méneville, 1831): Australia, Post. I., 1878, Fischer lgt. (NHMW) [LD]; *Picromerus bidens* (Linnaeus, 1758): Czech Republic, Bohemia bor., Panská Ves (5453), Mokřady horní Liběchovky NR, 21.viii.2000, L. Beran lgt., P. Kment 2002 det. (NMPC) [LD]; *Pinthaeus sanguineus* (Fabricius, 1787): North Corea, spring 1988, Z. Mráček lgt., P. Kment 2002 det. (CUPC) [LD]; *Rhacognathus punctatus* (Linnaeus, 1758): Czech Republic, Bohemia bor., Blíževedly – Hvězda (5352), Vlhošť NR, Malý Vlhošť, 1.vi.2000, L. Beran lgt., P. Kment 2002 det. (NMPC) [LD]; *Troilus luridus* (Fabricius, 1775): Czech Republic, Bohemia bor., Jílové – Sněžník, 'Vlčák', 7.iv.2000, E. Kula lgt., P. Kment 2001 det. (NMPC) [LD]; *Zicrona caerulea* (Linnaeus, 1758): Czech Republic, Moravia mer. or., Javorník, Petruchův Mlýn (7171; N48°51′54″, E17°33′25″), 23.ix.2001, I. Malenovský lgt., P. Kment 2002 det. (NMPC) [LD].

– **Cyrtocorinae:** *Ceratozygum horridum* (Germar, 1839): Brazil, Pará, Taperinha near Santarem, G. Hagmann lgt., H. Zettel det. (NHMW) [LD].

– **Discocephalinae: Discocephalini:** *Ablaptus varicornis* (Walker, 1867): Brazil, Pará, Taperinha near Santarem, 1.–10.vii.1927, Zerny lgt., H. Ruckes det. (NHMW) [LD]; *Antiteuchus mixtus* (Fabricius, 1787): 'Holl. Gujana' [= Suriname], Steindachner lgt. (NHMW) [LD]; *Cataulax eximius* (Stål, 1860): Brazil, Schott lgt. (NHMW) [LD]; *Coriplatus depressus* White, 1842: 'Südamer.' [= South America], coll. Signoret (NHMW) [LD]; *Dinocoris variolosus* (Linnaeus, 1767): Brazil, Schott lgt. (NHMW) [LD]; *Discocephala marmorea* Laporte, 1832: Brazil (NHMW) [LD]; *Dryptocephala brullei* Laporte, 1832: Brazil, Schott lgt. (NHMW) [LD]; *Eurystethus* (*Eurystethus*) *nigropunctatus* Mayr, 1864: Brazil, Schott lgt. (NHMW) [LD]; *Psorus cassidiformis* Bergroth, 1914: Brazil, Rio de Janeiro, coll. Signoret, H. Ruckes det. (NHMW) [LD]. **Ochlerini:** *Macropygium reticulare* (Fabricius, 1803) complex: Brazil, São Paulo, Mráz lgt., L. H. Rolston 1982 det. (NMPC) [LD]; *Miopygium cyclopeltoides* Breddin, 1904: Brazil, São Paulo, Mráz lgt., L. H. Rolston 1982 det. (NMPC) [SEM].

– **Edessinae:** *Edessa rufomarginata* (De Geer, 1773): Brazil, São Paulo, Mráz lgt., P. Kment 2009 det. (NMPC) [LD]; *Lopadusa* (*Bothrocoris*) sp.: Brazil, L. H. Ruckes 1982 det. (NMPC) [LD].

– **Pentatominae: Aeliini:** *Neottiglossa* (*Neottiglossa*) *leporina* (Herrich-Schäffer, 1830): Turkey centr., Tokat province, Pazar env., valley above Ballıca Mağarasi cave (N40°16′, E36°17′), 30.vi.2002, P. Kment lgt. & det. (NMPC) [LD]; *Neottiglossa* (*Neottiglossa*) *pusilla* (Gmelin, 1789): Czech Republic, Moravia mer. or., Javorník, Petruchův Mlýn (7171; N48°51′54″, E17°33′25″), 29.vi.2001, P. Kment lgt. & det. (NMPC) [LD]. **Aeptini:** *Aeptus singularis* Dallas, 1851: Guinea, Nimba, vii.–xii. 1951, Lamotte & Rey lgt., P. Kment 2009 det. (MNHN) [LD]. **Agaeini:** *Agaeus elegantulus* Jensen-Haarup, 1931: Tanzania, Mikindani, 1897, Reimer lgt., Arnold 1989 det. (NHMW) [LD]. **Carpocorini:** *Anaxarchus pardalinus* Stål, 1876: Indonesia, Irian Jaya, Mansinam Island, 1875, coll. Bruijn, Signoret det. (NHMW) [LD]; *Carpocoris purpureipennis* (De Geer, 1773): Czech Republic, Moravia mer. or., Malá Vrbka (7170; N48°52′03″, E17°26′36″), restored meadow, 2.v.2001, P. Kment lgt. & det. (NMPC) [LD]; *Trichopepla semivittata* (Say, 1831): 'Nordamer.' [= North America], coll. & det. Signoret (NHMW) [LD]. **Eysarcorini:** *Eysarcoris venustissimus* (Schrank, 1776): Czech Republic, Moravia or., Strání (7172), Záhumenice NM (N48°53′37″, E17°40′49″), 23.v.2002, P. Kment lgt. & det. (NMPC) [LD]. **Halyini:** *Atelocera serrata* (Fabricius, 1803): Democratic Republic of the Congo, 10 km E of Kisangani, 30.iv.1991, P. Kment 2007 det. (NHMW) [LD]; *Mustha longispinis* Reuter, 1890 (holotype): Turkey, Amasya, O. M. Reuter det. (MZHF) [LD]; *Mustha spinosula* (Lefebvre, 1831): Bulgaria, Slanchev Bryag, 22.vi.1971, Z. Černý lgt., Z. Jindra det. (ZJPC); Macedonia, Dojran Lake env., v.1985, J. Vitner lgt., P. Kment det. (NMPC) [LD]; Turkey, Eskişehir, Sakarılıca env., near Gümele [= Mihalgazi], 6.–9.vii.1997, P. Průdek & M. Říha lgt., Z. Jindra det. (ZJPC) [LD]; *Mustha* sp. nov.: Iran, Lorestān province, Dorúd, 80 km E Horramábád (N33°25′, E49°06′), 10.–11.vi.1999, P. Kabátek lgt., P. Kment det. (ZJPC) [LD]. **Myrocheini:** *Myrochea inermis* Distant, 1912: Burundi, Usumbura [= Bujumbura], Albert-Edward-See [= Tanganyika Lake], 1910, Grauer lgt. (NHMW) [LD]. **Nezarini:** *Acrosternum millieri* (Mulsant & Rey, 1866): Croatia bor. occ., Jadranovo (15 km SE of Rijeka), 22.–25.vii.2000, M. Mantič lgt., P. Kment 2002 det. (NMPC) [LD]; *Nezara viridula* (Linnaeus, 1758): USA, Florida, Okaloosa Co., Blackwater River near Holt, 18.x.1978, T. Soldán lgt., P. Kment 2002 det. (NMPC) [LD]; *Palomena prasina* (Linnaus, 1761): Czech Republic, Bohemia bor., Mšeno env. (5553), Kokořínský důl NR, Nebuželský důl valley, 1999, L. Beran lgt., P. Kment 2001 det. (NMPC) [LD].

Pentatomini: *Evoplitus laciniatus* (Spinola, 1837): Brazil, coll. & det. Signoret (NHMW) [LD]; *Pentatoma rufipes* (Linnaeus, 1758): Czech Republic, Moravia mer., Brno – Bystrc (6765), Kuršova street, 30.ix.2001, P. Kment lgt. & det. (NMPC) [SEM]; *Placocoris viridis* Mayr, 1864 (syntype): Brazil, Schott lgt. (NHMW) [LD]; *Rhaphigaster nebulosa* (Poda, 1761): Czech Republic, Bohemia centr., Praha – Nové Město (5952), Viniční street, 9.x.2001, P. Kment lgt. & det. (NMPC) [LD]. **Rhynchocorini:** *Rhynchocoris humeralis* (Thunberg, 1783): Pakistan, Sind, 1874, Plason lgt. (NHMW) [LD]. **Rolstoniellini:** *Amasenus corticalis* Stål, 1863: Malaysia, Malacca [= Melaka], coll. & det. Signoret (NHMW) [LD]. **Sciocorini:** *Sciocoris* (*Aposciocoris*) *homalonotus* Fieber, 1851: Czech Republic, Moravia mer., Hlohovec (7266), environs of 'Hraniční zámek' chateau, 25.vii.2000, P. Kment lgt. & det. (NMPC) [LD]. **Strachiini:** *Eurydema oleracea* (Linnaeus, 1758): Czech Republic, Moravia mer. or., Malá Vrbka (7170; N48°52′03″, E17°26′36″), restored meadow, 2.v.2001, P. Kment lgt. & det. (NMPC) [SEM]. **Trochiscocorini:** *Trochiscocoris rotundatus* Horváth, 1895: Bulgaria mer. or., Slanchev Bryag, 0–2 m a.s.l., 4.ix.1976, Pospíšilová lgt., J. L. Stehlík 1979 det. (MMBC).

– Phyllocephalinae: Phyllocephalini: *Macrina juvenca* (Burmeister, 1835): Gabon, coll. Dohrn, P. Kment 2003 det. (NMPC) [LD]; *Phyllocephala negus* Distant, 1910: Israel, Ejn Seddi, 19.iii.1944, Bytinski-Salz lgt., P. Kment 2003 det. (NMPC) [LD].

– Podopinae: Graphosomatini: *Ancyrosoma leucogrammes* (Gmelin, 1789): Slovakia mer., Štúrovo env., Hegyfarok hills, 12.ix.1995, J. Vilímová lgt., P. Kment 2001 det. (NMPC) [LD]; *Derula flavoguttata* Mulsant & Rey, 1856: Turkey or., Erzincan province, Çağlayan, valley above waterfall (N39°36′, E39°42′), 24.vi.2002, P. Kment lgt. & det. (NMPC) [LD]. *Graphosoma* (*Graphosoma*) *lineatum* (Linnaeus, 1758): Czech Republic, Moravia mer. or., Javorník, Petruchův Mlýn (7171; N48°51′54″, E17°33′25″), 29.vi.2001, P. Kment lgt. & det. (NMPC) [LD]; *Tholagmus flavolineatus* (Fabricius, 1798): Croatia, Brač Island, Rasotica env. (N 43°18′, E 16°53′), olive orchards along the road to Selca, 80 m a.s.l., 8.ix.2004, P. Kment lgt. & det. (NMPC) [LD]; *Vilpianus galii* (Wolff, 1802): Czech Republic, Moravia mer., Mikulov (7165), Svatý kopeček NR (N48°48′25″, E16°38′50″), 13.v.2000, P. Kment & M. Horsák lgt., P. Kment 2001 det. (NMPC) [LD]. **Podopini:** *Podops* (*Podops*) *inuncta* (Fabricius, 1775): Czech Republic, Moravia mer. or., Malá Vrbka (7170; N48°52′03″, E17°26′36″), restored meadow, 8.iv.–5.v.2000, P. Bezděčka lgt., P. Kment 2000 det. (NMPC) [LD]. **Unplaced:** *Cyptocoris lundi* (Fabricius, 1803): Central African Republic, Lamaboké (Mbaïki env.), 18.xii.1965, R. Pujol lgt., P. Kment 2009 det. (MNHN) [LD].

PLATASPIDAE: Coptosomatinae: *Coptosoma scutellatum* (Geoffroy, 1785): Czech Republic, Moravia mer. or., Kněždub (7170), Čertoryje National Nature Reserve (N48°51′20″, E17°25′11″), 28.vii.2001, P. Kment lgt. & det. (NMPC) [LD, SEM]. **Plataspinae:** *Brachyplatys hemisphaericus* Westwood, 1837: Madagascar, Sikora lgt. (NHMW) [LD]. **Unplaced:** *Caternaultiella ferruginea* Montandon, 1899: Democratic Republic of the Congo, Ukaika – Mawambi, 1911, Grauer lgt., Izzard 1952 det. (NHMW) [LD].

RHYPAROCHROMIDAE: Gonianotini: *Emblethis verbasci* (Fabricius, 1803): Czech Republic, Moravia mer., Budkovice (6964), steppe slope above Rokytná river, pitfall trap, 12.viii.2001, A. Konečný lgt., P. Kment det. (NMPC) [SEM].

SAILERIOLIDAE: *Bannacoris arboreus* Hsiao, 1964: China, Yunnan, Gaoligong Mts. (N 24°57′ E 98°45′), ca. 2400 m a.s.l., 8.-16.v.1995, V. Kubáň lgt., Z. Jindra 1997 det., P. Kment 2009 revid. (ZJPC) [LD]; *Ruckesona vitrella* Schaefer & Ashlock, 1970: N

Thailand, Chiang Mai Dist., Dol Pui env. (N18°49′, E98°54′), 16.v.1988, M. Knížek lgt., Z. Jindra det., P. Kment 2009 revid. (ZJPC) [LD].

SCUTELLERIDAE: Elvisurinae: *Elvisura irrorata* Spinola 1837: Somalia, 'Somaliland', Hardegger lgt., Schouteden det. (NHMW) [LD]. **Eurygastrinae: Eurygastrini:** *Eurygaster maura* (Linnaeus, 1758): Czech Republic, Moravia mer. or., Horní Němčí (7071), Drahy Nature Reserve, pasture, 21.ix.2001, P. Kment lgt. & det. (NMPC) [SEM]. **Psacastini:** *Psacasta* (*Psacasta*) *exanthematica cerinthe* (Fabricius, 1787): Portugal, Algarve prov., 12 km S of Monchique, Serra da Monchique (N37°14′05″, W08°32′39″), 43 m a.s.l., 14.-16.iv.2004, J. Skuhrovec lgt., A. Carapezza 2005 det. (NMPC) [LD]. **Odontotarsinae: Odontotarsini:** *Odontotarsus robustus* Jakovlev, 1884: Croatia, Brač Island, Rasotica env. (N43°18′, E16°53′), olive orchards along the road to Selca, 80 m a.s.l., 8.ix.2004, P. Kment lgt. & det. (NMPC) [SEM]. **Pachycorinae**: *Agonosoma trilineatum* (Fabricius, 1782): Panama, Aguadulce (NHMW) [LD]; *Chelycoris haglundi* (Montandon, 1895): Paraguay, San Luis, Reimoser lgt. (NHMW) [LD]; *Lobothyreus lobatus* (Westwood, 1837): Brazil, Natterer lgt. (NHMW) [LD]; *Polytes lineolatus* (Dallas, 1851): Bolivia, Yungas de Coroico, Fassel lgt. (NHMW) [LD]; *Sphyrocoris obliquus* (Germar, 1839): Costa Rica, Bebedero, near Las Cañas, 12.vi.–4.vii.[19]30, Reimoser lgt., R. J. Izzard 1954 det. (NHMW) [LD]. **Scutellerinae: Scutellerini:** *Calliphara nobilis* (Linnaeus, 1763): China, Sichuan, Yalung Tai between Huili and Yen-Yilen, 1200 m a.s.l., x.1914, H. Mazzetti lgt. (NHMW) [LD]; *Calliscyta stalii* (Vollenhoven, 1863): Australia, Signoret det. & coll. (NHMW) [LD]; *Cryptacrus comes* (Fabricius, 1803): Democratic Republic of the Congo, 'Urw. Moera' [= Mwera], 1910, Grauer lgt. (var. *princeps*) (NHMW) [LD]; Somalia, 'Somaliland', Hardegger lgt., Schouteden det. (var. *rufopicta*) (NHMW) [LD]; no locality (var. *rufopicta*) (NHMW) [LD]; *Procilia morgani* (White, 1839): Democratic Republic of the Congo, Yangambi, ix.–x.1952, Dr. Schedl lgt. (NHMW) [LD]; *Poecilocoris pulcher* Dallas, 1848: Borneo, 1886, F. Baczes lgt., D. Lattin 1965 det. (NHMW) [LD]. **Sphaerocorini:** *Steganocerus multipunctatus* (Thunberg, 1783): Burundi, Usumbura [= Bujumbura], Albert-Edward-See [= Tanganyika Lake], 1910, Grauer lgt. (NHMW) [LD]. **Tectocorinae:** *Tectocoris diophthalmus* (Thunberg, 1783): Australia, N Queensland, Edge Hills – Cairns, 12.viii.1979, Cermak lgt., P. Kment 2002 det. (MMBC) [LD].

UROSTYLIDIDAE: Urolabidini: *Urochela* (*Urochela*) *luteovaria* Distant, 1881: China, Hubei, Xianfeng county, in forest, 8.vi.1960, L.-Y. Zheng 1979 det. (NMPC) [LD]; *Urostylis lateralis* Walker, 1867: North Korea, Tesong-son near Phjongjang, 5.viii.1977, M. Josifov lgt. & det. (NMPC) [SEM].

THAUMASTELLIDAE: *Thaumastella aradoides* Horváth, 1896: S Iran, Minab (Loc. No. 203), 19.–20.v.1973, Exp. Nat. Mus. Praha lgt., L. Hoberlandt det. 1980 (NMPC) [SEM].

THYREOCORIDAE: *Galgupha* (*Gyrocnemis*) *impressa* Horváth, 1919: Bolivia, Yungas de Coroica, Fassel lgt. (NHMW) [LD]; *Thyreocoris scarabaeoides* (Linnaeus, 1758): Slovakia or., Beša env. (7497), 100 m a.s.l., 20.v.2002, J. Skuhrovec lgt., P. Kment det. (NMPC) [SEM].

APPENDIX 2. List of synonyms for the terms *metathoracic scent apparatus*, *valvular apparatus*, *internal orifice*, *vestibule*, *external scent efferent system*, *ostiole*, *peritreme*, and *evaporatorium*. The excerpted literature covers all Heteroptera (*metathoracic scent apparatus*, *external scent efferent system*), Pentatomomorpha (*valvular apparatus*, *internal orifice*, *vestibule*, *ostiole*), and Pentatomoidea (*peritreme*, *evaporatorium*). The following abbreviations are used: Eng. – English, Fr. – French, Ger. – German, Lat. – Latin, Port. – Portuguese, Sp. – Spain.

METATHORACIC SCENT APPARATUS	
adult scent-apparatus	Omaniidae – COBBEN (1970)
aparato [*sic*!] senescente (Sp.) [= scent apparatus]	Alydidae – BRAILOVSKY & ZURBIA FLORES (1979)
apparato odorifero metatoracico (Sp.)	Pentatomoidea – BAGGINI et al. (1966)
appareil odorant métathoracique (Fr.) [= metathoracic scent apparatus]	Heteroptera – CARAYON (1971); Nabidae, Reduviidae – CARAYON (1950); Tingidae, Piesmatidae – CARAYON (1962)
appareil odorifère métasternal (Fr.)	Pentatomoidea – DERJANSCHI & PÉRICART (2006)
appareil odorifique (Fr.)	Tingidae, Piesmatidae – CARAYON (1962)
appareil métathoracique (Fr.)	Tingidae, Piesmatidae – CARAYON (1962)
complex métathoracique (Fr.)	Heteroptera – PAVIS (1987)
Drüsenapparat (Ger.) [= glandular apparatus]	Corixidae – WALKER (1972)
Drüsenkomplex (Ger.) [= glandular complex]	Heteroptera – REMOLD (1962)
Duftdrüsensystem (Ger.) [= scent gland system]	Heteroptera – REMOLD (1962)
glandular apparatus	Gerromorpha – COBBEN (1978); Gerridae – RAMAMURTY & KRISHNANANDAM (1969)
imaginale Drüsenkomplex (Ger.)	Pyrrhocoridae – SCHUMACHER (1971), SCHUMACHER & STEIN (1971)
metathoracic gland apparatus	Heteroptera – COBBEN (1968)
metathoracic gland system	Heteroptera – COBBEN (1978)
metathoracic glandular apparatus	Heteroptera – DAZZINI VALCURONE & PAVAN (1978),
metathoracic glandular complex	Heteroptera – DAZZINI VALCURONE & PAVAN (1978)
metathoracic odoriferous apparatus	Coreidae – DHIMAN (1985)
metathoracic scent apparatus	Heteroptera – DAZZINI VALCURONE & PAVAN (1978), FORERO (2008); Gerromorpha – ANDERSEN (1982); Nepomorpha – STADDON & THORNE (1979); Gerromorpha – DAMGAARD (2008); Aradidae – USINGER & MATSUDA (1959); Cimicidae – CARAYON (1966); Coreoidea – HEPBURN & YONKE (1971); Largidae – DHIMAN (1988); Tessaratomidae – KMENT & VILÍMOVÁ (in press); Tingidae – LIVINGSTONE (1969)
metathoracic scent-apparatus	Pentatomidae – LUCCHI (1996)
metathoracic scent complex	Coreoidea – HEPBURN & YONKE (1971)

metathoracic scent gland	Coreoidea – HEPBURN & YONKE (1971)
metathoracic scent gland apparatus	Largidae – DHIMAN (1986, 1988); Pentatomidae – AHMAD & KAMALUDDIN (1987), NAGNAN et al. (1994); Scutelleridae – LEELA KUMARI et al. (1984); Tessaratomidae – LEELA KUMARI & JANAIAH (1985)
metathoracic scent-gland apparatus	Hyocephalidae, Stenocephalidae – SCHAEFER (1981)
metathoracic scent gland complex	Coreoidea – HEPBURN & YONKE (1971); Pentatomidae – SURENDER & JANAIAH (1990)
metathoracic scent gland system	Heteroptera – STADDON (1979), WHEELER et al. (1993); Nepomorpha – STADDON & THORNE (1979); Naucoridae – STADDON & THORNE (1973); Notonectidae – STADDON & THORNE (1974); Pentatomidae – NAGNAN et al. (1994); Reduvioidea – WEIRAUCH (2006a)
metathoracic scent system	Nepomorpha – STADDON & THORNE (1979); Pentatomidae – NAGNAN et al. (1994)
metathoracic stink apparatus	Tingidae – LIVINGSTONE (1969)
organe odorifique (Fr.)	Heteroptera – DUFOUR (1833)
organs odorants métathoracique (Fr.)	Piesmatidae, Tingidae – CARAYON (1962)
scent apparatus	Heteroptera – BRINDLEY (1930), GUPTA (1961), DAZZINI VALCURONE & PAVAN (1978); Gerromorpha – ANDERSEN (1982); Acanthosomatidae – AHMAD & MOIZUDDIN (1985, 1990b); Alydidae – GUPTA (1964); Berytidae – DHIMAN (1984); Coreidae – DHIMAN (1985); Cydnidae – AHMAD & MOIZUDDIN (1977); Dinidoridae – AHMAD et al. (1971); Gerridae – HASAN et al. (1985); Largidae – DHIMAN (1983, 1986, 1988); Pentatomoidea – AFZAL & SAHIBZADA (1988); Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1977, 1979), AHMAD & KHAN (1973), AHMAD & KHANUM (1968), AHMAD & KAMALUDDIN (1987), AHMAD & MOHAMMAD (1980, 1992), SURENDER & JANAIAH (1990); Plataspidae – AHMAD & MOIZUDDIN (1975, 1979), MOIZUDDIN & AHMAD (1979); Rhopalidae – AHMAD & AFZAL (1978b); Scutelleridae – MOIZUDDIN & AHMAD (1980, 1981); Stenocephalidae – AHMAD & AFZAL (1976)
scent gland apparatus	Heteroptera – NICHOLS & SCHUH (1989); Coreidae – DHIMAN (1985); Largidae – DHIMAN (1986, 1988); Nepomorpha – HASAN et al. (1985); Pentatomidae – SURENDER & JANAIAH (1990); Tingidae – DRAKE & DAVIS (1959)
scent-gland apparatus	Largidae – DHIMAN (1986); Hyocephalidae, Stenocephalidae – SCHAEFER (1981)
scent gland complex	Heteroptera – REMOLD (1963), PAVIS (1987); Coreidae, Hyocephalidae – WATERHOUSE & GILBY (1964); Pentatomidae – FILSHIE & WATERHOUSE (1968); Pyrrhocoridae – CALAM & SCOTT (1969)

stink apparatus	Heteroptera – MATSUDA (1970)
stink-apparatus	Cimicidae – PURI (1924); Pentatomidae – CHAUDHURI & DAS (1970)
stink gland apparatus	Scutelleridae – CHOUDHURI et al. (1965)
thoracic stink glands	Pyrrhocoridae – KHANNA (1963b)

VALVULAR APPARATUS

closing apparatus	Heteroptera – COBBEN (1978)
closing mechanism	Coreidae, Hyocephalidae – WATERHOUSE & GILBY (1964); Pentatomidae – FILSHIE & WATERHOUSE (1968)
closing system	Heteroptera – COBBEN (1978)
efferent apparatus	Lygaeidae – JOHANSSON (1957) [defined including associated muscles]
locking device	Heteroptera – REMOLD (1963)
mecanismo de la válvula (Sp.)	Alydidae – BRAILOVSKY & ZURBIA FLORES (1979)
metathoracic valve mechanism	Heteroptera – STADDON (1979)
occluding mechanism	Pentatomidae – GILBY & WATERHOUSE (1967)
orifice valve	Pentatomidae – LUCCHI (1996)
reservoir-closing mechanism	Coreidae, Hyocephalidae – WATERHOUSE & GILBY (1964)
valve	Pyrrhocoridae – KHANNA (1963b)
valve housing	Coreoidea – HEPBURN & YONKE (1971)
valve housing complex	Coreoidea – HEPBURN & YONKE (1971)
valve mechanism	Heteroptera – STADDON (1979); Coreoidea – HEPBURN & YONKE (1971)
valvular apparatus	Acanthosomatidae – AHMAD & MOIZUDDIN (1985, 1990b); Alydidae – GUPTA (1964); Coreoidea – HEPBURN & YONKE (1971); Coreidae – MOODY (1930); Cydnidae – AHMAD & MOIZUDDIN (1977); Dinidoridae – AHMAD & AFZAL (1977), AHMAD et al. (1971); Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1977, 1979), AHMAD & KAMALUDDIN (1987), AHMAD & KHAN (1973), AHMAD & KHNAUM (1968), AHMAD & MOHAMMAD (1992); Plataspidae – AHMAD & MOIZUDDIN (1975, 1979), MOIZUDDIN & AHMAD (1979); Scutelleridae – AHMAD & MOIZUDDIN (1980), MOIZUDDIN & AHMAD (1981); Stenocephalidae – AHMAD & AFZAL (1976); Tessaratomidae – KMENT & VILÍMOVÁ (in press)
valvular mechanism	Pentatomidae – CHAUDHURI & DAS (1970)
valvular structure	Pentatomidae – AHMAD & KHNAUM (1968)
Verschlußvorrichtung (Ger.) [= closing apparatus]	Heteroptera – REMOLD (1962)

INTERNAL ORIFICE

aperture from duct to ostiole	Coreidae – MOODY (1930)
gland external orifice	Heteroptera – STADDON (1979)
gland orifice	Heteroptera – STADDON (1979)
inner orifice	Pentatomidae – AHMAD et al. (1997), KAMALUDDIN & AHMAD (1988a), SIDDIQUI et al. (1992); Plataspidae – AHMAD & MOIZUDDIN (1979); Scutelleridae – AHMAD & MUSHTAQ (1977); Stenocephalidae – AHMAD & AFZAL (1976)
inner orifice of the vestibule	Pentatomidae – AHMAD & KAMALUDDIN (1987)
internal orifice	Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1977, 1979), AHMAD & KAMALUDDIN (1987), CHAUDHURI & DAS (1970), MALOUF (1932, 1933); Tessaratomidae – KMENT & VILÍMOVÁ (in press)
metathoracic external orifice	Heteroptera – STADDON (1979)
metathoracic gland external orifice	Heteroptera – STADDON (1979)
metathoracic orifice	Heteroptera – STADDON (1979)
Mündung der Stinkdrüsen (Ger.) [= mouth of the scent gland]	Heteroptera – LARSÉN (1945) [for both internal orifice and ostiole]
Oeffnung des Reservoirs in das Horn (Ger.) [= opening of reservoir into the horn]	Pyrrhocoridae – MAYER (1874)
Öffnung (Ger.) [= opening]	Pyrrhocoridae – SCHUMACHER & STEIN (1971)
opening	Dinidoridae – AHMAD et al. (1971)
oriffice [*sic*!] of the vestibule	Dinidoridae – AHMAD & AFZAL (1977)
orifice	Heteroptera – SCHUH & SLATER (1995)
orificium (pl. orificia) (Eng., Lat.)	Heteroptera – REMOLD (1963) [used inconsistently for both inner orifice and ostiole]; Pentatomidae – BERGROTH (1911)
orificium internum (Eng., Ger., Lat.)	Heteroptera – REMOLD (1962), DAZZINI VALCURONE & PAVAN (1978)
ostiole	Heteroptera – SCHUH & SLATER (1995); Acanthosomatidae – AHMAD & MOIZUDDIN (1985); Scutelleridae – MOIZUDDIN & AHMAD (1980, 1981) [for both internal orifice and ostiole]
Stinkdrüsenmündung (Ger.) [= scent gland mouth]	Heteroptera – LARSÉN (1945) [for both internal orifice and ostiole]
valved orifice	Heteroptera – CARVER et al. (1991)

VESTIBULE

atrial chamber	Largidae – DHIMAN (1986)
atrial chambre	Largidae – DHIMAN (1983)
atrium	Berytidae – DHIMAN (1984); Coreidae – DHIMAN (1985); Largidae – DHIMAN (1983, 1986, 1988); Piesmatidae – CARAYON (1962)
Ausführkanal (Ger.) [= outlet canal]	Coreidae, Lygaeidae, Pentatomidae – REMOLD (1962)
Ausflußrinne (Ger.) [= outflow	Coreidae – HENRICI (1940)

groove]	
Ausflußrohre (Ger.) [= outflow tube]	Pentatomidae – HENRICI (1940)
canal efférent (Fr.)	Heteroptera – PAVIS (1987)
channel	Pentatomidae – MALOUF (1933)
cuticular grove [*sic*!]	Pentatomidae – NAGNAN et al. (1994)
discharge canal	Heteroptera – PAVIS (1987); Coreidae, Hyocephalidae – WATERHOUSE & GILBY (1964); Pentatomidae – GILBY & WATERHOUSE (1967), LUCCHI (1996)
ducto vestibulare (Sp.)	Alydidae – BRAILOVSKY & ZURBIA FLORES (1979)
entothoracisches Horn [*partim*] [= entothoracic horn]	Pyrrhocoridae – MAYER (1874) [vestibule + metasternal apophysis (cf. Fig. 7 in STADDON 1979)]
evaporatorium	Coreidae – DHIMAN (1985)
excretory canal	Heteroptera – REMOLD (1963)
excretory duct	Heteroptera – REMOLD (1963), DAZZINI VALCURONE & PAVAN (1978)
Furcalumen (Ger.)	Pyrrhocoridae – SCHUMACHER (1971)
Röhre (Ger.) [= duct]	Coreidae, Pentatomidae – LARSÉN (1945)
scent canal	Heteroptera – STADDON (1979)
scent groove	Pentatomoidea – AFZAL & SAHIBZADA (1988)
scent vestibule	Pentatomoidea – AFZAL & SAHIBZADA (1988), AHMAD et al. (1997), KAMALUDDIN & AHMAD (1988a); Scutelleridae – AHMAD & MUSHTAQ (1977)
stink groove	Alydidae – AKBAR (1957)
tube	Heteroptera – DAZZINI VALCURONE & PAVAN (1978); Pentatomidae – MALOUF (1932)
tube basal (Fr.)	Heteroptera – CARAYON (1971)
vestibular duct	Coreoidea – HEPBURN & YONKE (1971)
vestibular groove	Pentatomoidea – AFZAL & SAHIBZADA (1988)
vestibule	Acanthosomatidae – AHMAD & MOIZUDDIN (1985, 1990b); Alydidae – GUPTA (1964); Coreoidea – HEPBURN & YONKE (1971); Coreidae – MOODY (1930), FAIN (1970); Cydnidae – ROTH (1961), AHMAD & MOIZUDDIN (1977); Dinidoridae – AHMAD & AFZAL (1977), AHMAD et al. (1971); Pentatomoidea – AFZAL & SAHIBZADA (1988), AHMAD et al. (1997c); Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1977, 1979, 1997), AHMAD & KAMALUDDIN (1987), AHMAD & KHAN (1973), AHMAD & KHNAUM (1968), AHMAD & MOHAMMAD (1992), CHAUDHURI & DAS (1970), HASAN & KITCHING (1993), KAMALUDDIN & AHMAD (1988a), RAI & TREHAN (1964), SIDDIQUI et al. (1992); Plataspidae – AHMAD & MOIZUDDIN (1975, 1979), MOIZUDDIN & AHMAD (1979); Pyrrhocoridae – KHANNA (1963b); Scutelleridae – AHMAD & MOIZUDDIN (1980), AHMAD & MUSHTAQ (1977), MOIZUDDIN & AHMAD (1981); Tessaratomidae – KMENT & VILÍMOVÁ (in press)

EXTERNAL SCENT EFFERENT SYSTEM

Ausleitungsapparat des Drüsenkomplexes (Ger.) [= outlet apparatus of the scent gland complex]	Pyrrhocoridae – Schumacher & Stein (1971)
efferent apparatus	Heteroptera – Cobben (1978); Naucoridae – Staddon & Thorne (1973)
efferent system	Nepomorpha – Staddon & Thorne (1979)
éléments externes de l'appareil odorant métathoracique (Fr.)	Heteroptera – Carayon (1971)
evaporative apparatus	Gerromorpha, terrestrial bugs – Andersen (1982);
evaporatory structures	Berytidae – Henry (1997b)
external apparatus	Idiostolidae – Schaefer (1966);
external apparatus of the scent gland system	Heteroptera – Carver et al. (1991) [used for both MTG and DAG]
external apparatus of the ventral thoracic scent gland system	Pentatomidae – Carver (1990)
external efferent system	Scutelleridae – Cassis & Vanags (2006)
external efferent system of (the) metathoracic glands	Miridae – Cassis et al. (2003), Cassis (2008); Scutelleridae – Cassis & Vanags (2006)
external metathoracic scent apparatus	Pentatomidae – Hasan (1990b)
external parts of the apparatus	Cimicidae – Carayon (1966)
external scent apparatus	Pentatomidae – Hasan & Kitching (1993)
external scent efferent system	Tessaratomidae – Kment & Vilímová (in press)
external scent-efferent system	Tingidae – Schuh et al. (2007)
external scent gland areas	Pentatomidae – Ahmad et al. (1977), Ahmad & Afzal (1978a); Stenocephalidae – Ahmad & Afzal (1976)
external scent glands system	Pentatomidae – Hasan (1990a)
external scent surface	Heteroptera – Staddon (1979) [for external parts only]
external structures of the scent apparatus	Coreoidea – Hepburn & Yonke (1971),
glandes métathoraciques (Fr.)	Pentatomidae – Ribes & Schmitz (1992)
integumental apparatus of the scent gland system	Pentatomidae – Carver (1990)
mesothoracic [*sic*!] scent gland opening	Cydnidae – Mayroga Martinez & Cervantes Peredo (2005)
metapleural scent gland apparatus	Pentatomidae – Thomas (1994a)
metasternal apparatus	Heteroptera – Cobben (1978)
metasternal ostiolar region	Stenocephalidae – Scudder (1957)
metasternal ostiole region	Stenocephalidae – Lansbury (1965)
metasternal stink-gland area	Tessaratomidae – Leston & Scudder (1957)
metathoracic efferent system	Heteroptera – Staddon (1979) [for internal as well as external parts]; Nepomorpha – Staddon & Thorne (1979)
metathoracic gland efferent system	Scutelleridae – Cassis & Vanags (2006)

metathoracic ostiolar area	Berytidae – HENRY (1997b)
metathoracic scent apparatus	Alydidae – SCHAEFER & AHMAD (2008); Pentatomidae – AHMAD & RANA (1992, 1994), HASAN & KITCHING (1993);
metathoracic scent complex	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a); Alydidae – AHMAD et al. (1997a); Cydnidae – MOIZUDDIN & AHMAD (1990), Pentatomidae – AHMAD et al. (1988), AHMAD & RANA (1989), AHMAD & ZAIDI (1989); Plataspidae – AHMAD & MOIZUDDIN (1992)
metathoracic scent efferent system	Heteroptera – STADDON (1979) [for internal as well as external scent efferent system]; Miridae – SCHWARTZ (1995), STONEDAHL & CASSIS (1991), STONEDAHL et al. (1997), STONEDAHL & KOVAC (1995)
metathoracic scent-efferent system	Cimicomorpha – SCHUH et al. (2009); Miridae – SCHUH (2006b)
metathoracic scent gland	Coreidae – SCHAEFER (1968); Pentatomidae – ROLSTON et al. (1980), ZAIDI (1994b, 1996), ZAIDI & AHMAD (1990)
metathoracic scent gland apparatus	Miridae – TATARNIC (2009); Trichophora – SCHAEFER (1964); Largidae – SCHAEFER (2000); Hyocephalidae, Stenocephalidae – SCHAEFER (1981: not including evaporative area); Parastrachiidae – SCHAEFER et al. (1988: including evaporative area); Pyrrhocoridae – SCHAEFER (1999b)
metathoracic scent-gland apparatus	Trichophora – SCHAEFER (1972)
metathoracic scent gland area	Cydnidae – AHMAD & MOIZUDDIN (1977)
metathoracic scent gland complex	Acanthosomatidae – KMENT (2005); Cydnidae – MOIZUDDIN & AHMAD (1990); Dinidoridae – AHMAD et al. (1997b); Pentatomoidea – AHMAD et al. (1997c); Pentatomidae – AHMAD & KAMALUDDIN (1989, 1999), AHMAD & MOHAMMAD (1992), AHMAD & RANA (1992), ZAIDI (1994b, 1996), ZAIDI & AHMED (1990); Plataspidae – AHMAD (1990), AHMAD & MOIZUDDIN (1992); Pyrrhocoridae – AHAMD & ABBAS (1989), Tessaratomidae – MOIZUDDIN et al. (1992); Urostylididae – AHMAD et al. (1992)
metathoracic scent-gland evaporatory area	Miridae – SCHUH (1984)
metathoracic scent gland external efferent system	Miridae – TATARNIC (2009)
metathoracic scent gland opening	Acanthosomatidae, Cydnidae – LARIVIÈRE (1995); Pentatomidae – PACKAUSKAS & SCHAEFER (1998), KAMALUDDIN & AHMAD (1988b: in figure)
metathoracic scent gland ostiolar complex	Pentatomidae – AHMAD & KAMALUDDIN (1989)
metathoracic scent ostioler [*sic*!]	Pentatomidae – ZAHID & AHMAD (2007)

complex	
metathoracic stink gland	Scutelleridae – McDonald & Cassis (1984)
metathoracic stink gland orifice	Pentatomidae – Rolston & McDonald (1981)
metepisternal scent efferent system	Miridae – Schwartz (2008)
MTG external efferent system	Miridae – Cassis (2008)
ostiolar area	Berytidae – Henry (1996); Miridae – Henry (1995, 2006)
pleural scent gland area	Rhyparochromidae – Ashlock (1985)
scent efferent system	Heteroptera – Staddon (1979); Miridae – Cassis (1995)
scent gland	Pentatomidae – Ahmad & Zaidi (1989), Freeman (1940), Ghauri (1962), Rider (2000), Zaidi (1994a), Zaidi & Ahmad (1990), Zaidi & Ahmed (1990)
scent gland apparatus	Pentatomidae – Hasan & Afzal (1990)
scent-gland apparatus	Trichophora – Schaefer (1972)

OSTIOLE

abertura (Sp.)	Cydnidae – Mayroga Martinez (2002)
abertura osteolar (Sp.)	Cydnidae – Mayroga Martinez (2002)
aperture	Pentatomidae – Ahmad & Afzal (1978a), Ahmad & Kamaluddin (1989)
Ausmündung (Ger.)	Heteroptera – Remold (1962)
débouché de la gouttière principale (Fr.)	Cydnidae – Dethier (1974)
excretory pore	Pentatomidae – Filshie & Waterhouse (1968, 1969)
external opening	Rhopalidae – Chopra (1967)
external opening of metathoracic scent apparatus	Oxycarenidae – Olagbemiro & Staddon (1983)
external opening of the metasternal scent gland	Acanthosomatidae – Kumar (1974a)
external orifice	Heteroptera – Cobben (1968), Dazzini Valcurone & Pavan (1978); Alydidae – Gupta (1964); Coreidae – Moody (1930); Lygaeidae – Johansson (1957), Johansson & Bråten (1970); Pentatomidae – Chaudhuri & Das (1970), Johansson & Bråten (1970), Malouf (1932, 1933); Rhopalidae – Chopra (1967); Pyrrhocoridae – Farine (1988), Johansson & Bråten (1970); Scutelleridae – Choudhuri et al. (1965); Tessaratomidae – Leston (1954)
external orifice of stink-gland	Pentatomidae – Hoberlandt (1984)
external scent-gland opening	Rhoplaidae – Schaefer & Chopra (1982)
external scent gland ostiole	Pentatomidae – Ahmad & Afzal (1989)
gland aperture	Pentatomidae – Gapon (2008)
gland external opening	Lygaeidae – Staddon et al. (1985)
gland opening	Phloeidae – Leston (1953)
gland orifice	Heteroptera – Dazzini Valcurone & Pavan (1978); Idiostolidae – Schaefer (1966); Pentatomidae –

	Krall et al. (1999)
glandular orifice	Heteroptera – Dazzini Valcurone & Pavan (1978)
glandular pore	Pentatomidae – Nagnan et al. (1994)
metapleural gland orifice	Hyocephalidae – Štys (1964a); Pentatomidae (Aphylinae) – Štys & Davidová-Vilímová (2001)
metapleural orifice	Lygaeidae – Štys (1972); Pentatomidae – Ruckes (1964)
metapleural ostiole	Canopidae, Megarididae – McAtee & Malloch (1928); Pentatomidae – Rolston (1981, 1982, 1984)
metapleural scent gland aperture	Pentatomidae – Thomas (1997)
metapleural scent gland orifice	Pentatomidae – Linnavuori (1975), Thomas (1997)
metapleural scent opening	Pentatomidae – Derjanschi & Péricart (2006)
metapleural stink gland opening	Pentatomidae – McDonald (1974)
metapleural stink-gland opening	Phloeidae – Leston (1953)
metasternal orifice	Pentatomidae – Ruckes (1946, 1958a)
metasternal ostiolar opening	Pentatomidae – Larivière (1992)
metasternal ostiole	Pentatomoidea – Ruckes (1963); Pentatomidae – Ruckes (1958b, 1959b, 1963)
metasternal scent gland opening	Pentatomidae – Hoberlandt (1984, 1997), McDonald (1982); Stenocephalidae – Scudder (1957), Lansbury (1965)
metasternal scent-gland opening	Pentatomidae – China (1962)
metasternal scent gland orifice	Pentatomidae – Thomas (1997)
metasternal scent gland ostiole	Pentatomidae – Hoberlandt & Safavi (1981)
metathoracic glandular orifice	Heteroptera – Dazzini Valcurone & Pavan (1978)
metathoracic ostiole	Heteroptera – Staddon (1979); Pentatomidae – Rolston (1974b, 1984), Rolston & McDonald (1984)
metathoracic gland opening	Cydnidae – Krall et al. (1997)
metathoracic scent gland opening	Alydidae – Schaefer & Ahmad (2008); Aradidae – Grozeva & Kerzhner (1992), Larivière & Larochelle (2006), Vásárhelyi (1987); Coreidae – O'Shea & Schaefer (1980), Packauskas (1994), Schaefer (1965); Idiostolidae – Schaefer (1966); Pentatomidae – Hamid & Abbasi (1972), Rolston & McDonald (1979), Thomas (1992b); Rhopalidae – Chopra (1967); Saileriolidae – Schaefer & Ashlock (1970)
metathoracic scent-gland opening	Rhoplaidae – Schaefer & Chopra (1982)
metathoracic scent gland orifice	Coreidae – Packauskas (1994); Dinidoridae – Ahmad et al. (1997b); Phloeidae – Rolston & McDonald (1979)
metathoracic scent-gland orifice	Pentatomoidea – Woodward (1953)
metathoracic scent gland osteole	Parastrachiidae – Sweet & Schaefer (2002)
metathoracic scent gland ostiole	Acanthosomatidae – Ahmad & Moizuddin (1990a); Cydnidae – Moizuddin & Ahmad (1990); Pentatomidae – Abbasi (1977), Ahmad & Afzal (1989), Ahmad & Kamaluddin (1981, 1988, 1989, 1990), Ahmad & Zaidi (1989), Hoberlandt &

	Safavi (1981), Kamaluddin & Ahmad (1988b, 1997), Memon & Shaikh (2004), Rishi & Abbasi (1973), Siddiqui et al. (1994), Zaidi (1994a, 1996), Zaidi & Ahmad (1990), Zaidi & Ahmed (1990); Plataspidae – Ahmad & Moizuddin (1992); Scutelleridae – Abbasi & Rishi (1973), Ahmad & Mushtaq (1977), Ahmad & Kamaluddin (1982); Tessaratomidae – Moizuddin et al. (1992), Sinclair (2000); Thyreocoridae – Ahmad & Moizuddin (1982)
metathoracic stink gland opening	Pentatomidae – McDonald (1992a,b), McDonald & Edwards (1978); Scutelleridae – McDonald & Cassis (1984)
metathoracic stink gland orifice	Megarididae – McDonald (1979); Pentatomidae – Rolston & McDonald (1981)
metathorax scent gland orifice	Pentatomidae – Linnavuori (1975)
MTG opening	Pentatomidae – Krall et al. (1999)
MTG orifice	Pentatomidae – Krall et al. (1999)
Mündung der Stinkdrüsen (Ger.) [= mouth of the scent gland]	Heteroptera – Larsén (1945) [for both internal orifice and ostiole]
odoriferous gland opening	Pentatomidae – McDonald (1974, 1976)
odoriferous orifice	Pentatomidae – Barber & Sailer (1953)
opening	Trichophora – Schaefer (1972); Berytidae – Henry (1996); Coreoidea – Schaefer (1964, 1965); Cydnidae – Lis (1990b,c, 1994); Hyocephalidae – Schaefer (1981); Parastrachiidae – Schaefer et al. (1988); Pentatomidae – Hoberlandt (1984), Hoffman (1971); Pyrrhocoridae – Ahamd & Abbas (1989), Schaefer (1999b); Rhopalidae – Schaefer & Chopra (1982); Stenocephalidae – Schaefer (1981); Tessaratomidae – Leela Kumari & Janaiah (1985)
opening of scent gland	Blissidae – Xue & Bu (2007); Dinidoridae – Kocorek (2003, 2004)
opening of the scent gland	Pentatomidae – Surender & Janaiah (1990)
opening of the scent-gland	Trichophora – Schaefer (1972)
opening of stink gland	Alydidae – Akbar (1957)
opening of the stink gland	Pyrrhocoridae – Khanna (1963a)
openning [*sic*!] of scent gland	Pentatomidae – Fernandes & Grazia (1998)
orifice (Eng., Fr.)	Heteroptera – Brindley (1930), Dazzini Valcurone & Pavan (1978), Dufour (1833), Pavis (1987); Berytidae – Dhiman (1984); Coreoidea – Schaefer (1964); Coreidae – Moody (1930), Fain (1970); Cydnidae *s. l.* – Dolling (1981); Cydnidae – Lis (1994); Dinidoridae – Schouteden (1913); Hyocephalidae – Štys (1964b); Largidae – Dhiman (1986); Pentatomoidea – Cachan (1952b), Distant (1902), Gross (1975); Rolston & McDonald (1979, 1981), Woodward (1953); Pentatomidae – Bonnemaison (1952), Davidová-Vilímová (1993a), Hamid & Abbasi

	(1972), Kitamura et al. (1984), Krall et al. (1999), Ribes & Schmitz (1992), Rolston (1974b, 1978b), Rolston & McDonald (1979, 1981), Ruckes (1958a, 1964), Schouteden (1905b), Thomas (1980, 1995); Pentatomidae (Aphylinae) – Schouteden (1906), Štys & Davidová-Vilímová (2001); Phloeidae – Leston (1953); Piesmatidae – Carayon (1962); Pyrrhocoridae – Cachan (1952a), Farine (1988); Scutelleridae – McDonald & Cassis (1984), Schouteden (1904); Thaumastellidae – Schaefer & Wilcox (1971); Thyreocoridae – Štys & Davidová (1979)
orifice de la glande odorifère (Fr.)	Pentatomidae – Bonnemaison (1952)
orifice externe (Fr.)	Piesmatidae – Carayon (1962)
orifice odorifère (Fr.)	Pentatomidae – Dufour (1833)
orifice odorifère métapleural (Fr.)	Pentatomoidea – Derjanschi & Péricart (2006)
orificio (Sp.)	Pentatomidae – Brailovsky & Rolston (1986), Prado (1991)
orificio odorífero (Sp.)	Pentatomidae – Brailovsky et al. (1988), Kormilev (1955)
orifício ostiolar (Port.)	Pentatomidae – Grazia (1968)
orificio senescente (Sp.) [= scent orifice]	Alydidae – Brailovsky & Zurbia Flores (1979)
orificium (Eng., Ger., Lat.)	Heteroptera – Remold (1962, 1963) [in Remold (1963) used inconsistently for internal orifice and ostiole], Dazzini Valcurone & Pavan (1978); Aradidae, Coreidae, Scutelleridae – Stål (1873); Pentatomidae, Tessaratomidae – Schouteden (1905a)
Orificium des Ausführkanals (Ger.) [= orifice of the outflow canal]	Heteroptera – Remold (1962)
orificium externum (Eng., Ger.)	Heteroptera – Remold (1962, 1963), Dazzini Valcurone & Pavan (1978); Pyrrhocoridae – Schumacher (1971), Schumacher & Stein (1971)
orificium odoriferum (Lat.)	Pentatomidae, Tessaratomidae – Horváth (1900)
orificium of the excretory canal	Heteroptera – Remold (1963)
osteolar aperture	Pentatomidae – Becker (1977a)
osteolar opening	Cydnidae – Froeschner (1960), Linnavuori (1993), Lis (1993b, 1994, 1996b); Pentatomoidea – Hoffman (1971)
osteolar pore	Cydnidae – Froeschner (1976)
osteole	Cydnidae – Uhler (1877), Froeschner (1960); Pentatomidae – McDonald (1984, 1992a); Scutelleridae – Eger (1990), McDonald & Cassis (1984)
osteolo (Sp.)	Cydnidae – Mayroga Martinez (2002)
osteolo metatoráxico (Sp.)	Pentatomidae – Brailovsky (1988)
osteolo de la glándula senescente metatóracica (Sp.)	Pentatomidae – Brailovsky (1988)

ostiola (pl. ostiolae) (Eng., Lat.)	Heteroptera – Nichols & Schuh (1989); Saileriolidae – Hsiao (1964)
ostiolar aperture	Pentatomidae – Grazia & Barcellos (2004)
ostiolar groove	Tessaratomidae – Kment & Vilímová (in press) [ostiole opened in two planes, ventrally and laterally]
ostiolar opening	Acanthosomatidae – Froeschner (1995); Berytidae – Henry (1997b); Pentatomidae – McDonald (1986), Rider (2006a)
ostiolar orifice	Cydnidae – Uhler (1877); Pentatomoidea – Eger (1978), Gapud (1991), Grazia et al. (2008)
ostiolar pore	Acanthosomatidae – Froeschner (1999); Cydnidae – Lis (2006a)
ostiole (pl. ostioles) (Eng., Fr.)	Heteroptera – Carver et al. (1991), Cobben (1968), Dazzini Valcurone & Pavan (1978), Künckel d'Herculais (1895), Nichols & Schuh (1989), Staddon (1979); Acanthosomatidae – Ahmad & Moizuddin (1990a,b), Kment (2005), Rolston & Kumar (1975); Alydidae – Gupta (1964); Berytidae – Henry (1997b); Canopidae – McAtee & Malloch (1928); Coreoidea – Hepburn & Yonke (1971); Coreidae – Moody (1930), Durak & Kalender (2007a); Cydnidae – Ahmad & Moizuddin (1977), Moizuddin & Ahmad (1990), Roth (1961), Signoret (1881), Uhler (1877); Dinidoridae – Ahmad & Afzal (1977), Ahmad et al. (1971, 1997b); Largidae – Dhiman (1986, 1988); Lygaeidae – Johansson (1957), Johansson & Bråten (1970); Malcidae – Štys (1967); Megarididae – McAtee & Malloch (1928); Pentatomoidea – Afzal & Sahibzada (1988), Ahmad et al. (1997c), Derjanschi & Péricart (2006), Gross (1975); Pentatomidae – Ahmad (1996), Ahmad & Afzal (1978a), Ahmad et al. (1977, 1979), Ahmad & Kamaluddin (1987, 1988, 1989), Ahmad & Khan (1973), Ahmad & Khnaum (1968), Ahmad & Mohammad (1992), Becker (1977b), Becker & Grazia (1986), Davidová-Vilímová (1999), Durak (2008), Durak & Kalender (2007c, 2009), Froeschner (1981), Grazia & Barcellos (2004), Hasan (1990a,b, 1991b), Hasan & Kitching (1993), Johansson & Bråten (1970), Kamaluddin & Ahmad (1988a), Kment (2008), Kment & Jindra (2009), Larivière (1992), Lucchi (1996), McPherson (1982), Rai & Trehan (1964), Rider (1986, 1987, 1991, 1994, 2000), Rider & Chapin (1991), Rolston (1971, 1973, 1974a, 1978a, 1983, 1986, 1987, 1988), Rolston et al. (1980), Rolston & McDonald (1981, 1984), Ruckes (1959b, 1963, 1966), Ruckes & Becker (1970), Siddiqui et al. (1992), Thomas

	(1992a), Zahid & Ahmad (2007), Zaidi & Ahmed (1990); Plataspidae – Ahmad & Moizuddin (1975, 1979, 1992), Moizuddin & Ahmad (1979); Pyrrhocoridae – Farine (1988), Johansson & Bråten (1970), Khanna (1963b); Rhopalidae – Ahmad & Afzal (1978b), Davidová-Vilímová et al. (2000); Scutelleridae – Afzal et al. (1982), Ahmad & Moizuddin (1980), Ahmad & Mushtaq (1977), Cassis & Vanags (2006); Durak & Kalender (2007b), Eger (1987), Eger & Baranowski (2002), Leela Kumari et al. (1984), Moizuddin & Ahmad (1980, 1981) [for both internal orifice and ostiole]; Stenocephalidae – Ahmad & Afzal (1976), Lansbury (1965), Scudder (1957); Urostylididae – Ahmad et al. (1992); Tessaratomidae – Kment & Vilímová (in press), Moizuddin et al. (1992), Sinclair (2000); Thyreocoridae – McAtee & Malloch (1933)
ostiole extérieur (Fr.)	Heteroptera – Dufour (1833)
ostiole odorifère (Fr.)	Pentatomidae – Dufour (1833)
ostiole odorifique (Fr.)	Heteroptera – Carayon (1971)
ostiolo (Sp.)	Alydidae – Brailovsky & Zurbia Flores (1979); Pentatomidae – Brailovsky (1986)
ostíolo (Sp.)	Acanthosomatidae – Prado (1991)
ostiolo de la glándula senescente metapleurale (Sp.)	Alydidae – Brailovsky & Zurbia Flores (1979)
ostiolo de la glándula senescente metatorácica (Sp.)	Pentatomidae – Brailovsky & Mayroga (1994)
ostíolo odorífero (Port.)	Pentatomidae – Becker & Grazia (1970), Grazia et al. (1993)
ostiolum	Pentatomidae – Grazia & Barcellos (2004), Grazia & Frey-da Silva (2003)
ostium odoriferum (Lat.)	Scutelleridae – Stål (1870)
ouverture odorifère (Fr.) [= odoriferous opening]	Pentatomidae – Derjanschi & Péricart (2006)
pit	Coreidae – Tower (1913); Pentatomidae – Ruckes (1937)
pore	Lygaeidae – Ramesh (1990); Pyrrhocoridae – Youdeowei & Calam (1969)
scent gland canal	Thaumastellidae – Jacobs (1989)
scent gland opening	Aradidae – Usinger & Matsuda (1959); Coreidae – Schaefer (1968); Cydnidae – Froeschner & Maldonado-Capriles (1992), Lis (2000b); Parastrachiidae – Schaefer et al. (1988); Pentatomidae – Gapon (2008), Larivière (1992), Thomas (1992a); Thaumastellidae – Jacobs (1989)
scent gland orifice	Alydidae – Ahmad et al. (1997a); Berytidae – Dhiman (1984); Coreidae – Dhiman (1985); Dinidoridae – Durai (1987), Lis (1990a); Idiostolidae – Woodward (1968); Largidae –

	DHIMAN (1983, 1986); Pentatomidae – DAVIDOVÁ-VILÍMOVÁ (1993b), LINNAVUORI (1975, 1982), RIDER (1991), THOMAS (1994a,c); Phloeidae – ROLSTON & MCDONALD (1979)
scent-gland orifice	Largidae – DHIMAN (1986); Pentatomidae – DOLLING (1995), ROCHE (1979), WOOD & MCDONALD (1984)
scent gland osteole	Parastrachiidae – SWEET & SCHAEFER (2002)
scent gland ostiole	Berytidae – DHIMAN (1984); Largidae – DHIMAN (1986, 1988); Pentatomidae – AHMAD & KAMALUDDIN (1990); Scutelleridae – EGER & BARANOWSKI (2002)
scent-gland ostiole	Idiostolidae – WOODWARD (1968); Largidae – DHIMAN (1986)
scent gland outlet	Heteroptera, Pentatomoidea – CARVER et al. (1991)
scent gland process	Largidae – DHIMAN (1988) [used for proximal margin of ostiole]
scent glands opening	Dinidoridae – KOCOREK & LIS (2000)
scent orifice	Alydidae – AHMAD et al. (1997a)
scent pore	Heteroptera – NICHOLS & SCHUH (1989)
Stinkdrüsenmündung (Ger.) [= scent gland mouth]	Heteroptera – LARSÉN (1945) [for both internal orifice and ostiole]
stink gland aperture	Lestoniidae – MCDONALD (1969)
stink-gland external orifice	Tessaratomidae – LESTON (1955)
stink gland opening	Lestoniidae – MCDONALD (1969); Pentatomidae – LESTON (1952a), MCDONALD (1974, 1992a); Scutelleridae – MCDONALD (1988), MCDONALD & CASSIS (1984); Tessaratomidae – LESTON (1955)
stink-gland opening	Pentatomidae – LESTON (1952a); Tessaratomidae – LESTON (1955)
stink-gland ostiole	Pentatomidae – HOBERLANDT (1959)
stink orifice	Heteroptera – BRINDLEY (1934)

PERITREME

Ablaufrinne der Stinkdrüsen (Ger.) [= outflow groove of the scent glands]	Cydnidae – WAGNER (1964)
Ablaufsrinne (Ger.) [= outflow groove]	Heteroptera – REMOLD (1962)
apex of peritreme	Cydnidae – LIS (1994, 1996a,b, 1999a, 2000a) [= corresponding to terminal lobe]
auricle	Heteroptera – NICHOLS & SCHUH (1989); Acanthosomatidae – LARIVIÈRE (1995), ROLSTON & KUMAR (1975); Cydnidae – FROESCHNER (1960, 1976), LARIVIÈRE (1995), LIS (1990c, 1993a, 1996b, 2000a), UHLER (1877); Dinidoridae – KOCOREK & LIS (2000); Pentatomoidea – AFZAL & SAHIBZADA (1988), RUCKES (1963); Pentatomidae – AHMAD et al. (1988), DAVIDOVÁ-VILÍMOVÁ (1993a,b), DOLLING (1995), HAMID & ABBASI (1972), GHAURI (1975, 1977, 1982), KAMALUDDIN & AHMAD (1988a),

	KMENT (2008), LARIVIÈRE (1992), MCPHERSON (1982), PACKAUSKAS & SCHAEFER (1998), ROLSTON (1974a, 1981, 1984, 1992), ROLSTON & MCDONALD (1979), RUCKES (1958a, 1959b), THOMAS (1992a, 1994a ,1995, 1997); Thaumastellidae – KMENT & VILÍMOVÁ (in press), SCHAEFER & WILCOX (1971)
auricle of ostiolar canal	Pentatomidae – RUCKES (1958b)
aurícula (Sp.)	Cydnidae – MAYROGA MARTINEZ (2002) [= corresponding to peritremal surface]
auriculate ostiole	Pentatomidae – ROLSTON (1974a)
auriculate process	Pentatomidae – WOOD & MCDONALD (1984); Tessaratomidae – LESTON (1955), LESTON & SCUDDER (1957)
auriculate sulcus	Pentatomidae – MCDONALD (1986)
auricule (Fr.)	Pentatomidae – SCHOUTEDEN (1905b)
auriculum	Thyreocoridae – ŠTYS & DAVIDOVÁ (1979)
canal (Eng.)	Pentatomoidea – HOBERLANDT (1984), HOFFMAN (1971), RUCKES (1963); Scutelleridae – MCDONALD & CASSIS (1984)
canal de escurrimiento (Sp.) [= run-off canal]	Pentatomidae – BRAILOVSKY et al. (1988)
canal déférent (pl. canaux déférents) (Fr.) [= outflow canal]	Heteroptera – KÜNCKEL D'HERCULAIS (1895)
canal del orificio ostiolar (Sp.)	Pentatomidae – PRADO (1991)
canal osteolar (Sp.)	Cydnidae – MAYROGA MARTINEZ (2002)
canal ostiolaire (Fr.)	Cydnidae – SIGNORET (1881)
canal of (the) metasternal orifice	Pentatomidae – RUCKES (1946, 1958b)
canal of (the) metasternal ostiole	Pentatomidae – RUCKES (1958b, 1959b, 1963)
cuticular excrescence	Pentatomidae – NAGNAN et al. (1994)
cuticular projection at the gland orifice	Pentatomidae – KRALL et al. (1999)
disc	Parastrachiidae – KMENT & VILÍMOVÁ (in press)
dispersal channel	Pentatomidae – CARVER et al. (1991)
Drüsenablaufrinne (Ger.) [= gland outflow groove]	Cydnidae – WAGNER (1964)
external groove	Pentatomidae – MALOUF (1933)
furrow	Pentatomidae – HOBERLANDT & SAFAVI (1981)
gouttière (Fr.) [= gutter, canal]	Pentatomoidea – DERJANSCHI & PÉRICART (2006) [in English key they use 'groove' as an equivalent]
gouttière apicale	Heteroptera – CARAYON (1971) [apical part of 'gouttière odorifique']
gouttière odorifère métapleurale (Fr.)	Dinidoridae – DERJANSCHI & PÉRICART (2006)
gouttière odorifique	Heteroptera – CARAYON (1971)
groove	Pentatomidae – DERJANSCHI & PÉRICART (2006), DOLLING (1995), HOFFMAN (1971), KMENT & VILÍMOVÁ (in press), THOMAS (1992a); Scutelleridae – KMENT & VILÍMOVÁ (in press)
gutter	Pentatomidae – BARBER & SAILER (1953)

languette (Fr.) [= tongue]	Dinidoridae – Schouteden (1913)
lateral canal	Pentatomidae – Ruckes (1963)
lip	Canopidae – McAtee & Malloch (1928)
[lobes]: anterior lobe and posterior lobe	Tessaratomidae – Moizuddin et al. (1992) [for peritremal lobes]
lóbulo apical (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
lóbulo apical terminal del peritremo osteolar (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
lóbulo terminal (del peritremo osteolar) (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
metasternal canal	Pentatomidae – Ruckes (1958a)
metasternal scent gland canal	Pentatomidae – Thomas (1980)
metathoracic ostiolar peritreme	Cydnidae – Lis (1999b); Pentatomidae – Ahmad & Rana (1994), Siddiqui et al. (1994)
metathoracic ostiole auriculate	Pentatomidae – Rolston (1974b, 1984)
metathoracic scent auricle	Dinidoridae – Ahmad et al. (1997b); Pentatomidae – Ahmad (1996), Ahmad & Afzal (1989), Zahid & Ahmad (2007), Memon & Shaikh (2004), Siddiqui et al. (1994)
metathoracic scent gland auricle	Pentatomidae – Ahmad & Afzal (1989), Schaefer et al. (1996)
metathoracic scent gland canal	Scutelleridae – Eger & Baranowski (2002)
metathoracic scent-gland opening	Heteroptera – Schuh & Slater (1995); Pentatomidae (Aphylinae), Plataspidae – China (1955)
metathoracic scent gland ostiolar peritreme	Cydnidae – Moizuddin & Ahmad (1990); Dinidoridae – Ahmad et al. (1997b); Pentatomidae – Ahmad (1996), Ahmad & Kamaluddin (1989), Ahmad & Rana (1989, 1992, 1994), Kamaluddin & Ahmad (1994), Memon & Shaikh (2004); Scutelleridae – Ahmad & Kamaluddin (1982); Urostylididae – Ahmad et al. (1992)
metathoracic scent gland ostiolar spout	Plataspidae – Ahmad & Moizuddin (1992)
metathoracic scent gland peritreme	Acanthosomatidae – Ahmad & Moizuddin (1990a); Pentatomidae – Ahmad (1996); Urostylididae – Ren & Lin (2003)
metathoracic scent gland spout	Pentatomidae – Fischer (1996)
metasternal sting [*sic*!] gland peritreme	Pentatomidae – Hoberlandt (1984)
metasternal stink gland peritreme	Pentatomidae – Hoberlandt (1984)
modificación apical (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
modificación terminal (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
odoriferous aperture	Pentatomoidea – Distant (1902),
odoriferous canal	Cydnidae – Uhler (1877); Pentatomidae – Bruner & Barber (1947)
odoriferous gland sulcus	Pentatomidae – McDonald (1976)

odoriferous groove	Pentatomidae – NAGNAN et al. (1994)
odoriferous plate	Cydnidae – UHLER (1877)
odoriferous spout	Pentatomidae – LESTON (1952b)
oreillette (Fr.) [= auricle]	Pentatomidae – RIBES & SCHMITZ (1992) [used as synonym of peritreme]
oreillette glandulaire (Fr.)	Pentatomidae – RIBES & SCHMITZ (1992)
orifice of scent gland auriculate	Pentatomidae – ROLSTON (1978b)
orificial canal	Heteroptera – NICHOLS & SCHUH (1989)
orificial peritreme	Cydnidae – THOMAS (1994b); Pentatomidae – GAPUD (1991), THOMAS (1994a)
orificial process	Pentatomidae – JOHANSSON & BRÅTEN (1970)
osteolar canal	Acanthosomatidae – HOFFMAN (1971); Cydnidae – FROESCHNER (1960); Pentatomidae – HOFFMAN (1971), MCPHERSON (1982), RUCKES (1937, 1958a), SAILER (1952), VAN DUZEE (1904); Scutelleridae – MCDONALD & CASSIS (1984), VAN DUZEE (1904)
osteolar groove	Scutelleridae – MCDONALD & CASSIS (1984)
osteolar peritreme	Cydnidae – FROESCHNER (1960), LINNAVUORI (1993); Pentatomidae – MCDONALD (1984)
osteolar peritreme canaliculate (canaliculate type) / auriculate (auriculate type)	Cydnidae, Pentatomidae – HOFFMAN (1971)
osteolar ruga	Scutelleridae – EGER (1990)
osteolar sulcus	Pentatomidae – ROSLTON & MCDONALD (1981), MCDONALD (1984)
ostiolar auricle	Pentatomidae – ROLSTON (1973), RUCKES (1958b)
ostiolar canal	Heteroptera – NICHOLS & SCHUH (1989); Acanthosomatidae – FROESCHNER (1995); Cydnidae – UHLER (1877); Pentatomidae – RIDER (1986, 1991), RIDER & CHAPIN (1991), ROLSTON (1978a), ROLSTON & MCDONALD (1981), RUCKES (1958b, 1963); Plataspidae – RUCKES (1963); Saileriolidae – HSIAO (1964)
ostiolar duct	Pentatomidae – DURAK (2008), DURAK & KALENDER (2007c); Scutelleridae – DURAK & KALENDER (2007b)
ostiolar groove	Heteroptera – NICHOLS & SCHUH (1989); Cydnidae – SCHUH & SLATER (1995); Pentatomidae – AHMAD & AFZAL (1978a), DURAK (2008), DURAK & KALENDER (2007c, 2009); Scutelleridae – DURAK & KALENDER (2007b), MCDONALD & CASSIS (1984)
ostiolar juga [*sic*!: error]	Pentatomidae – ROLSTON (1986)
ostiolar peritrema [*sic*!] (Eng.)	Pentatomidae – FERNANDES et al. (2008)
ostiolar peritreme	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a); Cydnidae – MOIZUDDIN & AHMAD (1990); Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1979), BECKER (1977b), DURAK (2008), FERNANDES & VAN DOESBURG (2000b), GAPUD (1991), GRAZIA et al. (2000), JOHANSSON & BRÅTEN

	(1970), RAI & TREHAN (1964), RUCKES (1965, 1966); Pentatomidae (Aphylinae) – CHINA (1955); Plataspidae – AHMAD (1990), AHMAD & MOIZUDDIN (1992), CHINA (1955); Urostylididae – AHMAD et al. (1992)
ostiolar perithreme [*sic*!]	Pentatomidae – HOBERLANDT (1959)
ostiolar ruga	Pentatomidae – EGER (1978), FERNANDES & VAN DOESBURG (2000a), FERNANDES & GRAZIA (1998), GRAZIA (1997), GRAZIA et al. (1999, 2006, 2008), GRAZIA & FREY-DA-SILVA (2003), RIDER (1986, 1987, 1989, 1994, 2006a, 2008), RIDER & CHAPIN (1991), ROLSTON (1983, 1988), ROLSTON et al. (1980), ROLSTON & MCDONALD (1981, 1984); Scutelleridae – EGER (1987)
ostiolar ruga acuminate/auriculate	Pentatomidae – RIDER (1989, 1994)
ostiolar scale	Cydnidae – UHLER (1877)
ostiolar spout	Pentatomidae – AHMAD & AFZAL (1978a), AHMAD et al. (1995); Tessaratomidae – SINCLAIR (2000); Thyreocoridae – AHMAD & MOIZUDDIN (1982)
ostiolar sulcus	Pentatomidae – FROESCHNER (1981), ROLSTON (1978a, 1987), ROLSTON et al. (1980), ROLSTON & MCDONALD (1981, 1984); THOMAS (1980, 1992a)
ostiole auriculate	Acanthosomatidae – ROLSTON & KUMAR (1975)
ostiole auriculé (Fr.)	Pentatomidae – SCHOUTEDEN (1905b), Scutelleridae – SCHOUTEDEN (1904)
perithreme	Cydnidae – ŠTUSÁK (1991)
peritrema ostiolar (Port., Sp.)	Acanthosomatidae – PRADO (1991); Pentatomidae – BECKER & GRAZIA (1985), FERNANDES & GRAZIA (1996), GRAZIA & BARCELLOS (1994), GRAZIA et al. (1993), SCHWERTNER & GRAZIA (2006)
peritremal disc	Pentatomidae – HASAN (1990a,b, 1991b), HASAN & KITCHING (1993); Pentatomoidea – AHMAD et al. (1997c)
peritremal groove	[used for median furrow on spout or disc]: Pentatomoidea – AHMAD et al. (1997c); Pentatomidae – HASAN (1990a,b), HASAN & KITCHING (1993)
peritremal lobes	Tessaratomidae – KMENT & VILÍMOVÁ (in press)
peritrematic modification	Pentatomoidea – HOFFMAN (1971)
peritrematic or supratrematic channel or groove	Pentatomoidea – HOFFMAN (1971)
peritrematic ridge	Pentatomidae – HOFFMAN (1971)
peritreme = Peritrema (Ger.) = peritrema (Port.) = péritrème (Fr.) = peritremo (Sp.)	Heteroptera – CARVER et al. (1991), SCHUH & SLATER (1995); Trichophora – SCHAEFER (1964); Acanthosomatidae – AHMAD & MOIZUDDIN (1990a), FROESCHNER (1999), KMENT (2005); Cydnidae – DETHIER (1974), FROESCHNER (1960, 1976), FROESCHNER & MALDONADO-CAPRILES (1992), LIS (1991, 1993a,b, 1994, 1996a,b, 1999a, 2000a,b, 2001, 2006a), MAYROGA MARTINEZ (2002),

	Mayroga Martinez & Cervantes Peredo (2005), Moizuddin & Ahmad (1990); Dinidoridae – Ahmad & Afzal (1977), Ahmad et al. (1997b); Lestoniidae – McDonald (1969); Lestoniidae – McDonald (1969, 1992); Pentatomoidea – Afzal & Sahibzada (1988), Derjanschi & Péricart (2006), Gross (1975), Kment & Vilímová (in press); Pentatomidae – Abbasi (1977), Abbasi & Rishi (1974), Ahmad & Afzal (1978a, 1989), Ahmad et al. (1979, 1988, 1997), Ahmad & Kamaluddin (1981, 1987, 1988, 1989, 1990, 1999), Ahmad & Mohammad (1992), Ahmad & Rana (1994), Ahmad & Zaidi (1989), Becker (1977a), Becker & Grazia (1970), Durak & Kalender (2009), Grazia & Barcellos (2004), Gross (1978), Hoffman (1971), Johansson & Bråten (1970), Kamaluddin & Ahmad (1988a,b, 1997), Kment & Jindra (2009), McDonald (1992a,b), McPherson (1982), Ribes & Schmitz (1992), Rishi & Abbasi (1973), Rolston (1983), Ruckes (1966), Ruckes & Becker (1970), Siddiqui et al. (1992, 1994), Zahid & Ahmad (2007), Zaidi (1994a, 1996), Zaidi & Ahmad (1990), Zaidi & Ahmed (1990); Pentatomidae (Aphylinae) – China (1955); Plataspidae – Ahmad (1990), Ahmad & Moizuddin (1992), Ren (2000); Scutelleridae – Abbasi & Rishi (1973), Afzal et al. (1982), Ahmad & Mushtaq (1977), Durak & Kalender (2007b), McDonald & Cassis (1984); Saileriolidae – Schaefer & Ashlock (1970); Scutelleridae – Cassis & Vanags (2006); Urostylididae – Ahmad et al. (1992); Tessaratomidae – Kment & Vilímová (in press); Thaumastellidae – Štys (1964b); Thyreocoridae – Ahmad & Moizuddin (1982)
peritreme (evaporatorium) [*sic*!]	Phloeidae – Leston (1953)
peritremo osteolar (Sp.)	Cydnidae – Mayroga Martinez (2002)
polished part of peritreme	Cydnidae – Lis (1994, 1996a,b) [= corresponding to peritremal surface]
posterior peritremal disc	Pentatomidae – Hasan & Kitching (1993)
proceso apical (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
proceso auricular (Sp.)	Pentatomidae – Brailovsky et al. (1988)
proceso terminal del peritremo (Sp.)	Cydnidae – Mayroga Martinez (2002) [= corresponding to terminal lobe]
process [apex of perithreme with (…) process]	Cydnidae – Štusák (1991) [= corresponding to peritremal surface]
processo apical do peritrema (Port.)	Pentatomidae – Becker & Grazia (1970)
processus auriculatus (Lat.)	Pentatomidae, Tessaratomidae – Horváth (1900), Schouteden (1905a)
processus externe (Fr.)	Pentatomoidea – Cachan (1952b)

processus externe de la glande métasternale (Fr.)	Pentatomoidea – CACHAN (1952b)
proyección osteolar (Sp.)	Pentatomidae – BRAILOVSKY (1986)
rainure centrale (Fr.) [= central groove]	Heteroptera – CARAYON (1971) [used for median furrow on peritreme]
raised area	Trichophora – SCHAEFER (1972), Parastrachiidae – SCHAEFER et al. (1988)
rigole centrale (Fr.) [= central trough]	Heteroptera – CARAYON (1971) [used for median furrow on peritreme]
rima of scent gland	Pentatomidae – GROSS (1978)
ruga (pl. rugae) [from Latin, = fold, crease, or wrinkle]	Pentatomidae – KMENT & VILÍMOVÁ (in press), RIDER (1986, 1991, 1994), ROLSTON (1971, 1978b, 1981, 1983), ROLSTON & MCDONALD (1979, 1984), THOMAS (1992a,b, 1997)
ruga ostiolar (Port.)	Pentatomidae – FERNANDES & GRAZIA (2006)
ruga of scent gland orifice	Pentatomidae – THOMAS (1994c)
scent accumulation surface	Heteroptera – STADDON (1979)
scent auricle	Pentatomidae – AHMAD & AFZAL (1989), AHMAD & KAMALUDDIN (1987, 1999)
scent gland auricle	Acanthosomatidae – THOMAS (1991); Cydnidae – LIS (1990b); Pentatomidae – THOMAS (1990, 1992a, 1994a), ZHENG (1980, 1983), ZHENG & LIU (1987)
scent-gland opening	Pentatomidae (Aphylinae) – CHINA (1955)
scent gland orifice	Pentatomidae – LINNAVUORI (1982) [used for both ostiole and peritreme: 'scent gland orifice very short to long']
scent gland peritreme	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a); Cydnidae – LIS (1990c)
scent gland ruga	Acanthosomatidae – THOMAS (1991); Pentatomidae – RIDER (2008), THOMAS (1992, 1994a)
scent gland spout	Acanthosomatidae – KUMAR (1974a), ROLSTON & KUMAR (1975); Dinidoridae – DURAI (1987), KOCOREK (2000), KOCOREK & LIS (2008), LIS (1990a,b); Pentatomidae – FREEMAN (1940), GHAURI (1988); Tessaratomidae – KUMAR (1974b)
scent trough	Cydnidae – LARIVIÈRE & FROESCHNER (1994)
sillon (Fr.) [= groove]	Dinidoridae – SCHOUTEDEN (1913); Pentatomidae – DERJANSCHI & PÉRICART (2006), SCHOUTEDEN (1905b); Scutelleridae – SCHOUTEDEN (1904)
sillon odorifère (Fr.)	Pentatomoidea – DERJANSCHI & PÉRICART (2006)
sillon orificial (Fr.)	Scutelleridae – SCHOUTEDEN (1904)
spine-like process	Pentatomidae – WOOD & MCDONALD (1984)
spout	Trichophora – SCHAEFER (1964, 1966, 1972); Dinidoridae – LIS (1990a); Pentatomoidea – AFZAL & SAHIBZADA (1988), KMENT & VILÍMOVÁ (in press), SCHAEFER (1965), WOODWARD (1953); Pentatomidae – FREEMAN (1940), LESTON (1952b), THOMAS (1997); Plataspidae – AHMAD & MOIZUDDIN (1992); Tessaratomidae – SINCLAIR (2000), KMENT &

	VILÍMOVÁ (in press)
spout of scent gland	Pentatomidae – GHAURI (1962)
spout of the orifice	Pentatomidae (Aphylinae) – ŠTYS & DAVIDOVÁ-VILÍMOVÁ (2001)
spur	Cydnidae – LINNAVUORI (1993) [= tooth- or claw-shaped projection of peritreme]
stink-gland peritreme	Pentatomidae – LINNAVUORI (1970); Tessaratomidae – LESTON & SCUDDER (1957)
stink groove	Heteroptera – BRINDLEY (1934); Dinidoridae – AHMAD & AFZAL (1977); Pentatomidae – CHAUDHURI & DAS (1970), TREHAN & RAI (1964)
sulco (Port.)	Pentatomidae – GRAZIA (1968)
sulcus (Eng., Lat., Sp.)	Pentatomidae – AHMAD & RANA (1992), BECKER (1977a), BRAILOVSKY & ROLSTON (1986), CHINA (1962), HOBERLANDT (1984), MCDONALD (1974, 1976, 1984), MCDONALD & EDWARDS (1978), ROLSTON (1978b, 1983), ROLSTON & MCDONALD (1984), RUCKES (1966), SCHOUTEDEN (1905a), THOMAS (1994a); Scutelleridae – MCDONALD & CASSIS (1984), STÅL (1870, 1873); Tessaratomidae – HORVÁTH (1900), SCHOUTEDEN (1905a)
sulcus del osteolo metatorácico (Sp.)	Pentatomidae – BRAILOVSKY (1988)
sulcus bordering a spatulate ridge	Pentatomidae – BECKER & GRAZIA (1986)
sulcus orificialis (Lat.)	Acanthosomatidae – BERGROTH (1912); Cydnidae – BERGROTH (1909); Pentatomidae, Tessaratomidae – HORVÁTH (1900), SCHOUTEDEN (1905a)
surco evaporatorio (Sp.) [= evaporatorial groove, wrinkle]	Pentatomidae – KORMILEV (1955)
terminal lobe	Cydnidae – FROESCHNER (1960)
terminal lobe of peritreme	Cydnidae – MCPHERSON (1982)
terminal modification auriculate	Cydnidae – FROESCHNER (1960) [= corresponding to terminal lobe]
terminal process of peritreme	Cydnidae – FROESCHNER (1960) [= corresponding to terminal lobe]
tooth	Cydnidae – LIS (1994, 1996a,b) [= tooth- or claw-shaped projection of peritreme]

EVAPORATORIUM

aire d'évaporation (Fr.)	Heteroptera – CARAYON (1971)
aire évaporatoire (Fr.)	Pentatomoidea – DERJANSCHI & PÉRICART (2006)
area evaporativa (Fr., Lat.)	Acanthosomatidae – BERGROTH (1912); Pentatomidae – BERGROTH (1911); Pentatomidae (Aphylinae) – SCHOUTEDEN (1906); Scutelleridae – SCHOUTEDEN (1904)
área evaporativa (Sp.)	Cydnidae – MAYROGA MARTINEZ (2002); Pentatomidae – BRAILOVSKY (1986), BRAILOVSKY & MAYROGA (1994), BRAILOVSKY & ROLSTON (1986)
área evaporatória (Port.)	Pentatomidae – BECKER & GRAZIA (1970, 1985),

	Campos & Grazia (2006), Fernandes & Grazia (1996, 2006), Grazia (1968), Grazia & Barcellos (1994), Grazia et al. (1993), Schwertner & Grazia (2006)
campo evaporatorio (Sp.) [= evaporative field]	Megarididae – Kormilev (1956)
elaborately microsculptured area	Heteroptera – Carver et al. (1991)
evaporating area	Heteroptera – Dazzini Valcurone & Pavan (1978); Cydnidae – Ruckes (1952); Pentatomidae – Ahmad & Kamaluddin (1981, 1987), Freeman (1940), Hamid & Abbasi (1972), Kamaluddin & Ahmad (1997), Leston (1952a), Lucchi (1996), Memon & Shaikh (2004), Rishi & Abbasi (1973), Roche (1979), Ruckes (1964), Siddiqui et al. (1992); Tessaratomidae – Moizuddin et al. (1992)
evaporating region	Thaumastellidae – Štys (1964b)
evaporating surface	Pentatomidae – Barber & Sailer (1953), Chaudhuri & Das (1970)
evaporation area	Pentatomidae – Durak (2008), Durak & Kalender (2007c, 2009), Gross (1978); Scutelleridae – Durak & Kalender (2007b)
evaporation field	Pentatomidae – Fischer (1996)
evaporation surface	Pentatomidae – Durak & Kalender (2007c)
evaporative area	Heteroptera – Cobben (1978), Nichols & Schuh (1989) [as synonym of evaporatorium], Schaefer (1966), Schuh & Slater (1995); Trichophora – Schaefer (1964, 1972); Acanthosomatidae – Froeschner (1995, 1999), Rolston & Kumar (1975); Cydnidae – Froeschner (1960), Froeschner & Maldonado-Capriles (1992), Lis (1993b, 1994, 1996b, 2000b, 2001, 2006a); Megarididae – McDonald (1979); Parastrachiidae – Schaefer et al. (1988); Pentatomoidea – Afzal & Sahibzada (1988), Ahmad et al. (1997c), Gapud (1991), Gross (1975); Pentatomidae – Becker (1977a,b), Davidová-Vilímová (1993a,b), Eger (1978), Fernandes & van Doesburg (2000a,b), Filshie & Waterhouse (1968, 1969), Grazia et al. (1999), Gross (1978), Hasan (1990a,b, 1991b), Hasan & Kitching (1993), Hoberlandt (1984, 1997), Hoberlandt & Safavi (1981), Johansson & Bråten (1970), Kitamura et al. (1984), Larivière (1992), McDonald (1974, 1976, 1982, 1984, 1986, 1992b), McDonald & Edwards (1978), McPherson (1982), Rider (1991, 1994, 2000, 2006a, 2008), Rolston (1971, 1973, 1974a, 1984, 1988), Rolston et al. (1980), Rolston & McDonald (1979, 1981), Ruckes & Becker (1970), Schaefer et al. (1996), Slater & Baranowski (1970), Thomas (1992a), Wood &

	McDonald (1984); Scutelleridae – Cassis & Vanags (2006), McDonald (1988), McDonald & Cassis (1984); Plataspidae – China (1955); Saileriolidae – Schaefer & Ashlock (1970); Thaumastellidae – Jacobs (1989)
evaporative region	Pentatomidae – Ahmad & Afzal (1978a)
evaporative surface	Cydnidae – Larivière & Froeschner (1994); Pentatomidae – Rider (1989), Thomas (1980)
evaporative surface area	Pentatomidae – Hasan & Kitching (1993)
evaporatorial region	Pentatomidae – Zheng & Liu (1987)
evaporatorio (Sp.)	Cydnidae – Mayroga Martinez (2002)
evaporatorium (pl. evaporatoria) (Eng., Fr.)	Heteroptera – Nichols & Schuh (1989), Schuh & Slater (1995); Acanthosomatidae – Ahmad & Moizuddin (1990a), Kment (2005), Kumar (1974a); Cydnidae *s. l.* – Dolling (1981); Cydnidae – Dethier (1974), Froeschner (1960), Hoffman (1971), Larivière & Froeschner (1976, 1994), Linnavuori (1993), Lis (1990b,c, 1991, 1993a, 1994, 1996a,b, 1999a,b, 2000a,b), Mayroga Martinez & Cervantes Peredo (2005), Moizuddin & Ahmad (1990), Štusák (1991), Thomas (1994b); Dinidoridae –Ahmad & Afzal (1977), Ahmad et al. (1997b), Kocorek (2000), Kocorek & Lis (2000); Pentatomoidea – Afzal & Sahibzada (1988); Pentatomidae – Abbasi (1977), Ahmad (1996), Ahmad & Afzal (1978a, 1989), Ahmad et al. (1979, 1992, 1995), Ahmad & Kamaluddin (1981, 1988, 1989, 1999), Ahmad & Rana (1994), Ahmad & Zaidi (1989), Becker (1977a,b), Becker & Grazia (1986), Davidová-Vilímová (1999), Dolling (1995), Durak & Kalender (2009), Fernandes et al. (2008), Froeschner (1981), Gapon (2008), Hoberlandt (1959, 1984), Kamaluddin & Ahmad (1988a), Kment (2008), Kment & Jindra (2009), Leston (1952b), Linnavuori (1975, 1982), McPherson (1982), Ribes & Schmitz (1992), Rider (2000), Rolston (1974b), Ruckes (1958a,b, 1959a,b, 1963, 1964, 1965, 1966), Ruckes & Becker (1970), Siddiqui et al. (1992, 1994), Thomas (1990, 1992a, 1994a, 1995, 1997), Zahid & Ahmad (2007), Zaidi (1994a,b, 1996), Zaidi & Ahmad (1990), Zaidi & Ahmed (1990); Plataspidae – Ahmad & Moizuddin (1992); Scutelleridae – Abbasi & Rishi (1973), Afzal et al. (1982), Ahmad & Mushtaq (1977); Tessaratomidae – Leston (1954, 1955), Leston & Scudder (1957), Kment & Vilímová (in press), Moizuddin et al. (1992); Thyreocoridae – Ahmad & Moizuddin (1982), Štys & Davidová (1979); Urostylididae – Ahmad et al. (1992)

evaporatorium area	Pentatomidae – FERNANDES et al. (2008)
evaporatorium of thoracic gland	Cydnidae – ŠTUSÁK (1991)
evaporatory area	Aradidae – LARIVIÈRE & LAROCHELLE (2006); Pentatomidae – DERJANSCHI & PÉRICART (2006), FERNANDES & GRAZIA (1998), GRAZIA & BARCELLOS (2004), GRAZIA & FREY-DA-SILVA (2003); Tessaratomidae – LEELA KUMARI & JANAIAH (1985)
flaked cuticle	Pentatomidae – JOHANSSON & BRÅTEN (1970)
matte Fläche (Ger.) [=matt surface]	Cydnidae – WAGNER (1964)
metathoracic evaporating area	Pentatomoidea – WOODWARD (1953)
metathoracic scent gland ostiolar evaporatoria	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a); Cydnidae – MOIZUDDIN & AHMAD (1990); Plataspidae – AHMAD & MOIZUDDIN (1992)
opaque area	Canopidae, Megarididae – MCATEE & MALLOCH (1928)
opaque ostiolar field	Canopidae – MCATEE & MALLOCH (1928)
opaque surface	Thyreocoridae – MCATEE & MALLOCH (1933)
ostiolar area	Thyreocoridae – MCATEE & MALLOCH (1933)
ostiolar evaporatoria	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a)
ostiolar peritreme	Heteroptera – NICHOLS & SCHUH (1989)
ostiolar surface	Thyreocoridae – MCATEE & MALLOCH (1933)
pleura covered with ‘mushroom’ structures	Heteroptera – REMOLD (1963)
peritreme (evaporatorium) [*sic*!]	Phloeidae – LESTON (1953)
‘Pilzchen’-Areal (Ger.) [= little mushrooms area]	Heteroptera – REMOLD (1962)
plaques mates (de la région odorifique) (Fr.) [= matt plates (of the scent region)]	Cydnidae – SIGNORET (1881)
pleural scent area	Heteroptera – STADDON (1979); Pentatomidae – KRALL et al. (1999), NAGNAN et al. (1994);
pruinose area	Pentatomidae – SAILER (1952)
scent evaporation surface	Heteroptera – STADDON (1979)
scent gland evaporatoria	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a)
scent gland ostiolar evaporatoria	Acanthosomatidae – AHMAD & MOIZUDDIN (1990a)
shagreened area of cuticle	Pentatomidae – THOMAS (1992a)
surface d’évaporation (Fr.)	Pentatomidae – BONNEMAISON (1952)

APPENDIX 3. List of synonyms for the terms *mycoid microsculpture*, *mushroom body*, *cap*, *stem*, *bridge*, *alveole*, and *trabeculae* used in association with evaporatorium within all the Heteroptera. The following abbreviations are used: Eng. – English, Fr. – French, Ger. – German, pl. – plural, sg. – singular; for the terms usually used in plural these are indicated.

MYCOID MICROSCULPTURE	
evaporative cuticle	Pentatomidae – Hasan (1990a)
evaporative integument	Coreoidea – Hepburn & Yonke (1971)
evaporative microsculpture	Heteroptera – Cobben (1978)
evaporatorial microsculpture	Pentatomidae (Aphylinae) – Štys & Davidová-Vilímová (2001)
evaporatorial sculpture	Thyreocoridae – Štys & Davidová (1979)
flaked cuticle	Lygaeidae, Pyrrhocoridae, Pentatomidae – Johansson & Bråten (1970)
microsculpture de l'evaporatorium (Fr.)	Cydnidae – Dethier (1974)
microsculptures of the evaporating areas	Pentatomidae – Nagnan et al. (1994)
microsculptures of the evaporation area	Heteroptera – Dazzini Valcurone & Pavan (1978)
mushroom-like microsculpture	Heteroptera – Schuh & Slater (1995); Pentatomidae – Carver (1990)
'mushroom' sculpture	Heteroptera – Cobben (1978)
mycoid microsculpture	Heteroptera – Carver et al. (1991), Kment & Vilímová (in press)
mycoid surface	Berytidae – Henry (1997b); Tessaratomidae – Kment & Vilímová (in press)

MUSHROOM BODY	
evaporative body(ies)	Miridae – Cassis et al. (2003), Cassis (2008), Schwartz (2008), Tatarnic (2009)
evaporative caps(s)	Miridae – Cassis (1995)
flake(s)	Lygaeidae, Pyrrhocoridae, Pentatomidae – Johansson & Bråten (1970)
hat	Anthocoridae – Carpintero & Dellapé (2006)
microflake(s)	Pentatomidae – Hasan (1990a), Hasan & Kitching (1993)
microflake(s) mushroom-shaped / amorphous	Pentatomidae – Hasan & Kitching (1993)
micro-flake(s)	Lygaeidae, Pyrrhocoridae, Pentatomidae – Johansson & Bråten (1970)
mushroom body(ies)	Coreoidea – Hepburn & Yonke (1971); Miridae – Schuh (2006b); Pentatomidae – Carver (1990); Kment & Vilímová (in press)
'mushroom-like' body(ies)	Scutelleridae – Cassis & Vanags (2006)
mushroom-like projection(s)	Heteroptera – Cobben (1978); Pentatomidae – Lucchi (1996)
mushroom-like structure(s)	Heteroptera – Remold (1963); Coreidae – Durak &

	Kalender (2007a); Pentatomidae – Durak (2008), Durak & Kalender (2007c, 2009), Kitamura et al. (1984); Scutelleridae – Durak & Kalender (2007b)
mushroom projection(s)	Pentatomidae – Filshie & Waterhouse (1969)
mushroom-shaped pillar(s)	Heteroptera – Staddon (1979); Nepomorpha – Staddon & Thorne (1979); Pentatomidae – Nagnan et al. (1994)
mushroom-shaped structure(s)	Pentatomidae – Filshie & Waterhouse (1969)
pillar(s)	Pentatomidae – Nagnan et al. (1994)
‘Pilzchen’-Strukture(n)	Heteroptera – Remold (1962)
processus mycoïdes (Eng., Fr., Lat.)	Heteroptera – Carayon (1971), Dazzini Valcurone & Pavan (1978); Cydnidae – Dethier (1974)

CAP

cap(s)	Pentatomidae – Carver (1990); Tessaratomidae – Kment & Vilímová (in press)
chapeau(x) (Fr.) [= hat]	Heteroptera – Carayon (1971); Cydnidae – Dethier (1974)
top	Heteroptera – Staddon (1979); Nepomorpha – Staddon & Thorne (1979); Pentatomidae – Filshie & Waterhouse (1969), Nagnan et al. (1994)

STEM

pied (Fr.) [= leg]	Heteroptera – Carayon (1971); Cydnidae – Dethier (1974)
stem	Tessaratomidae – Kment & Vilímová (in press)

BRIDGE

bridge(s)	Anthocoridae – Carpintero & Dellapé (2006); Tessaratomidae – Kment & Vilímová (in press)
connector(s)	Pentatomidae – Carver (1990)
pont(s) (Fr.) [= bridge]	Heteroptera – Carayon (1971); Cydnidae – Dethier (1974);
ridge(s)	Nepomorpha – Staddon & Thorne (1979); Coreidae – Durak & Kalender (2007a); Lygaeidae – Johansson & Bråten (1970); Pentatomidae – Durak (2008), Durak & Kalender (2007c, 2009), Filshie & Waterhouse (1969), Hasan (1990a), Hasan & Kitching (1993), Johansson & Bråten (1970), Nagnan et al. (1994); Pyrrhocoridae – Johansson & Bråten (1970); Scutelleridae – Durak & Kalender (2007b)

ALVEOLE

alveole	Tessaratomidae – Kment & Vilímová (in press)
alvéole(s) (Fr.) [= cell]	Heteroptera – Carayon (1971); Cydnidae – Dethier (1974)
alveolus (pl. alveoli) (Eng., Lat.)	Anthocoridae – Carpintero & Dellapé (2006)

depression(s)	Heteroptera – STADDON (1979)
hexagon(s)	Coreoidea – HEPBURN & YONKE (1971)
polygonal figure(s)	Pentatomidae – NAGNAN et al. (1994)
space(s) enclosed by cuticular ridges	Pentatomidae – HASAN (1990a)

TRABECULAE

folds	Pentatomidae – NAGNAN et al. (1994)
folds and pleats	Pentatomidae – FILSHIE & WATERHOUSE (1969)
microfurrows	Lygaeidae, Pyrrhocoridae, Pentatomidae – JOHANSSON & BRÅTEN (1970)
mycelia-like ridges	Pentatomidae – CARVER (1990)
pleat(es)	Pentatomidae – HASAN (1990a), HASAN & KITCHING (1993)
ridge(s)	Lygaeidae, Pyrrhocoridae, Pentatomidae – JOHANSSON & BRÅTEN (1970)
surfaces […] folded in an intricate manner	Heteroptera – STADDON (1979)
trabeculae (pl.) (Lat.; sg. trabecula) [= little beam]	Anthocoridae – CARPINTERO & DELLAPÉ (2006); Pentatomidae – CARVER (1990)
trabecule(s) (Eng.)	Coreidae – DURAK & KALENDER (2007a); Pentatomidae – DURAK (2008), DURAK & KALENDER (2007c, 2009); Scutelleridae – DURAK & KALENDER (2007b)
trabécule(s) (Fr.)	Heteroptera – CARAYON (1971); Cydnidae – DETHIER (1974)
vermiculate threads	Coreoidea – HEPBURN & YONKE (1971)