

DESCRIPTION OF THE FEMALE OF THE MYRMECOPHILOUS MITE *ANTENNOPHORUS GOESSWALDI* WIŚNIEWSKI ET HIRSCHMANN, 1992 (ACARI: MESOSTIGMATA: ANTENNOPHORIDAE)

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ABSTRACT: The first description of the female of *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992 (Acari: Mesostigmata: Antennophoridae) associated with the ant *Lasius flavus* Fabricius, 1781 (Hymenoptera: Formicidae) from Crimea is provided. The family Antennophoridae is recorded in Crimea for the first time.

KEY WORDS: Parasitiformes; Trigynaspida; Antennophorina; ants; Formicidae; *Lasius flavus*; morphology.

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INTRODUCTION

The suborder Trigynaspida comprises about 350 mite species from 27 families that are mostly associated with arthropods in subtropical and tropical habitats (Lindquist *et al.* 2009; Beaulieu *et al.* 2011). Four families of Trigynaspida have been recorded from Crimea: Celaenopsidae, Cercomegistidae, Diplogyniidae and Parantennulidae (Khaustov 1997, 1999; Trach 2013; Trach and Khaustov 2017; unpublished data).

The monotypic family Antennophoridae is characterized by a Holarctic distribution and includes ten described species: *Antennophorus boveni* Wiśniewski et Hirschmann, 1992; *A. donisthorpei* Wheeler, 1910; *A. foreli* Wasmann, 1902; *A. goesswaldi* Wiśniewski et Hirschmann, 1992; *A. grandis* Berlese, 1904; *A. krantzi* Wiśniewski et Hirschmann, 1992; *A. pavani* Wiśniewski et Hirschmann, 1992; *A. pubescens* Wasmann, 1899; *A. uhlmanni* Haller, 1877; and *A. wassmanni* Wheeler, 1910 (Haller 1877; Wasmann 1899, 1902; Berlese 1904; Wheeler 1910; Krantz 1970; Wiśniewski and Hirschmann 1992).

Mites of the genus *Antennophorus* Haller, 1877 are closely associated with ants of the genus *Lasius* Fabricius, 1804 (Hymenoptera: Formicidae). In Europe, their hosts are *Lasius alienus* (Förster); *L. flavus* Fabricius; *L. fuliginosus* (Latreille); *L. mixtus* (Nylander); *L. niger* (Linnaeus); *L. umbratus* (Nylander) (Janet 1897; Wasmann 1902; Berlese 1904; Karawaiew 1905a, 1905b; Wiśniewski and Hirschmann 1992).

The mites position themselves under the ant's head and induce themselves to regurgitate a drop of fluid by stroking the ant's mouthparts with their

hypertrophied pair of front legs (Franks *et al.* 1991; Lindquist *et al.* 2009).

During the study of mites associated with insects, Alexander A. Khaustov found specimens of the genus *Antennophorus* on *Lasius flavus* in Crimea. Later, these mites were identified as *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992 by the senior author. This species was described on the base of one male specimen from the ant *Lasius flavus*; it is known only from the type locality—Poland (Wiśniewski and Hirschmann 1992). The family Antennophoridae is reported from Crimea for the first time.

The purpose of this paper is to describe a female of *Antennophorus goesswaldi*.

MATERIAL AND METHODS

The ants were sampled with the help of an aspirator and placed into vials containing 96% ethanol. Mites from the alcohol sediments were extracted and mounted in Hoyer's medium for the purposes of light-microscopy. The morphology of mites was studied with the aid of an Axioskop 40 microscope (Carl Zeiss) as well as a compound microscope, a Mikmed-1 (Lomo), equipped with a binocular head AU-12, an ocular micrometer AM9-2 and a digital camera DCM900. SEM micrographs were taken with the aid of a JSM-6510LV SEM microscope (JEOL). The morphological terminology generally follows Evans and Till (1979). Palpal and leg chaetotaxy follows Evans (1963a, 1963b, 1965). The length of the second cheliceral segment was measured from its base to the apex of the fixed digit. Leg length was taken

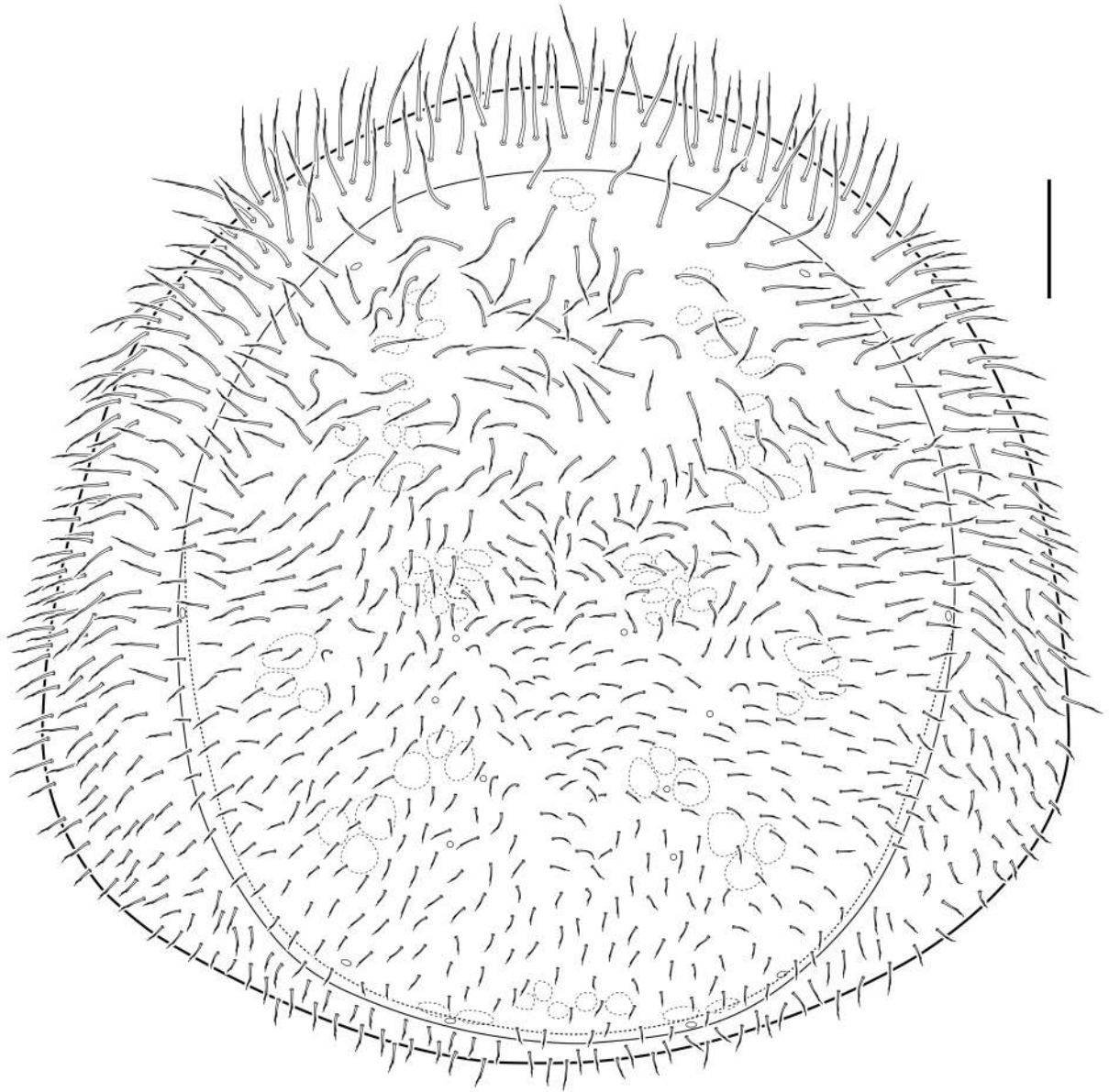


Fig. 1. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, female: idiosoma, dorsal view. Scale bar=100 μ m.

from the base of the coxa to the apex of the tarsus, excluding the ambulacrum. Measurements are given in micrometres (μ m). The studied materials are deposited in the collection of the Department of Zoology of Odessa I.I. Mechnikov National University (Ukraine).

SYSTEMATICS

Family Antennophoridae

Diagnosis (based on Kethley 1977; Kim 2004; Lindquist *et al.* 2009; Gwiazdowicz 2010). Body strongly convex dorsally; holodorsal shield and soft cuticle hypertrichous, all setae of similar shape. Tritosternal laciniae free and pilose. Jugular shield entire. In female, sternal shield entire or divided

longitudinally; latigynial shields free, overlapping mesogynal region; vaginal sclerites present; mesogynal shield reduced; ventrianal shield with anterior projection. In male, sternal shield paired, entire or fused with ventrianal shield. Metapodal-peritrematal shields large, peritremes wide and relatively short. Hypostomal seta *hpl* sharply modified, swollen and denticulate. Corniculi membranous, with irregularly margins and rounded apex. Epistome triangular, with median keel. Palp-genu with 7 setae, palptibia and palptarsus ventrally clearly distinguished, palptarsal apotele 2-tined. In female, chelicera chelate-dentate with minute denticles; fixit digit without excrescence or membranous process; movable digit ventrally with

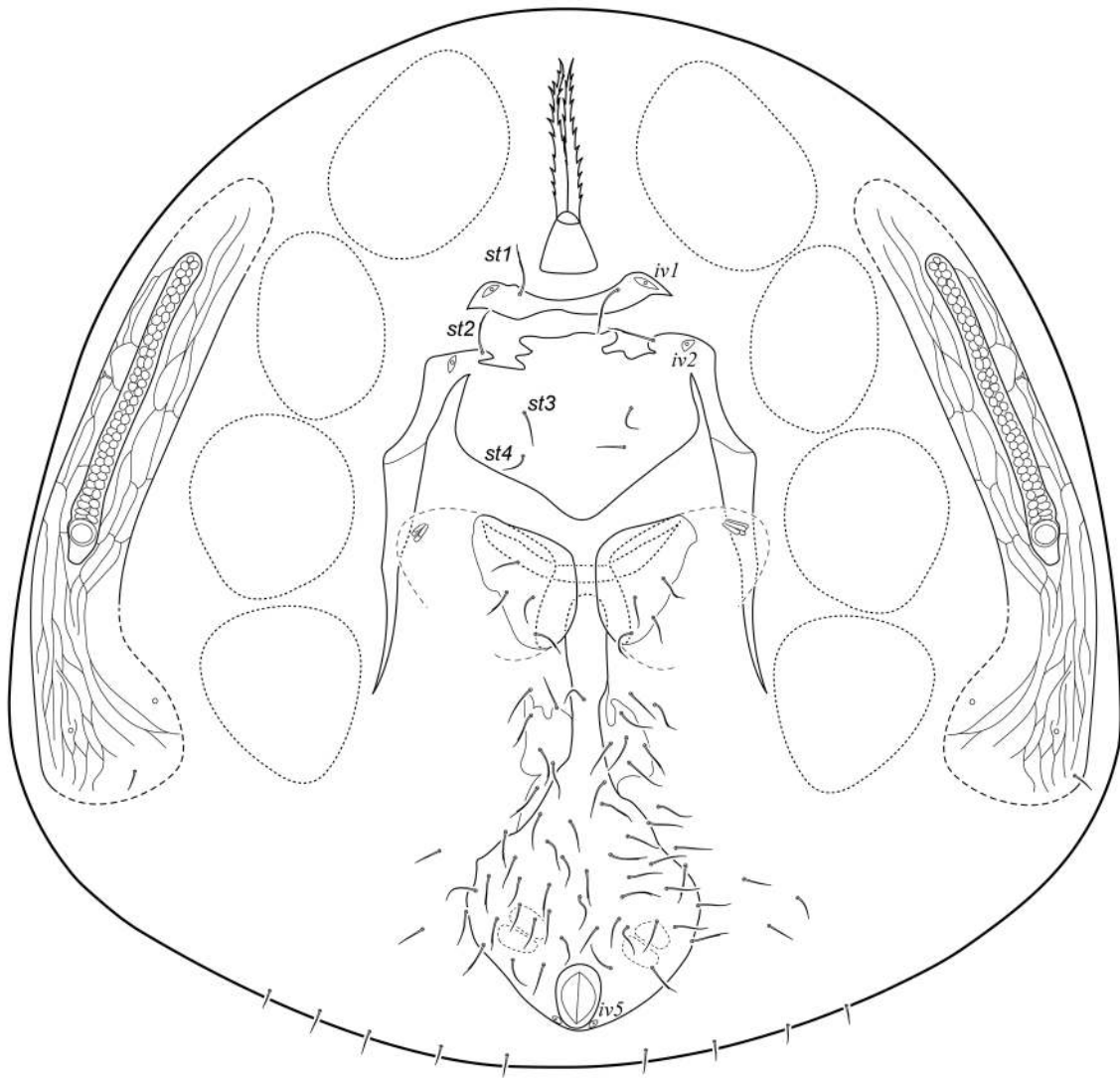


Fig. 2. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, female: idiosoma, ventral view. Scale bar=100 µm.

series of short setae and bunch of whip-like apically blunt projections. In male, chelicera edentate; fixit digit with several protrusions and sharp protuberance at the base of movable digit; movable digit smooth, ventrally with series of short setae and bunch of long blunt projections. Leg I hypertrophied, without ambulacrum, legs II–IV with ambulacra lacking in distinct claws.

Genus *Antennophorus* Haller, 1877

Type species: *Antennophorus uhlmanni* Haller, 1877, by monotypy

Diagnosis. As for family (monobasic).

***ANTENNOPHORUS GOESSWALDI*
WIŚNIEWSKI ET HIRSCHMANN, 1992**

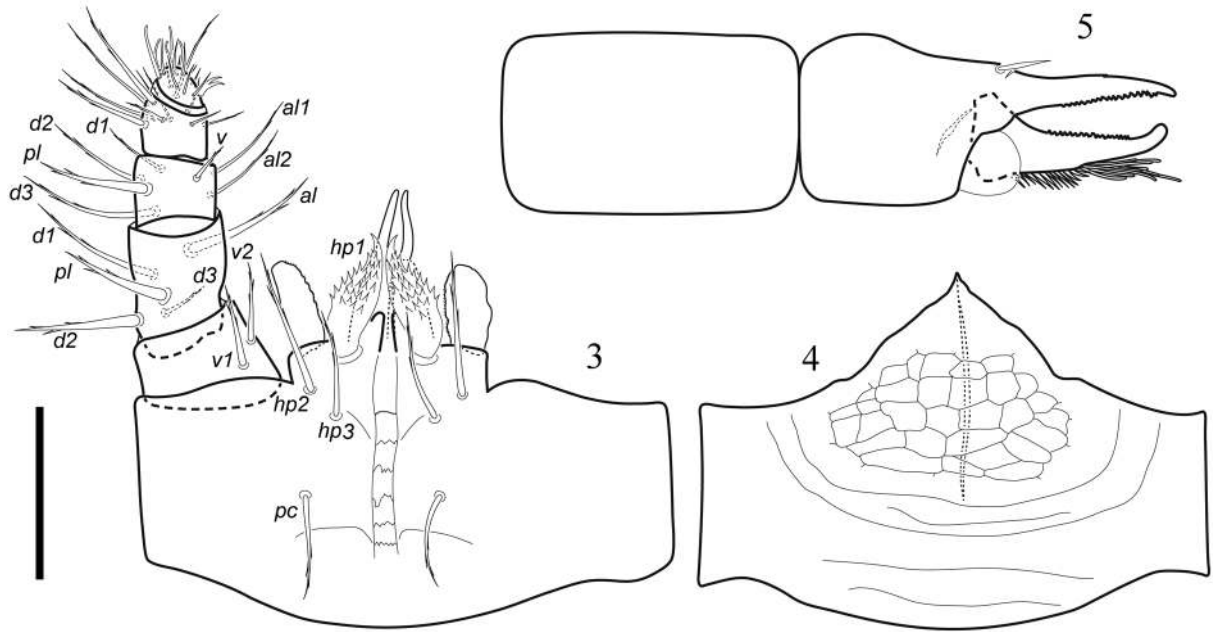
Figs. 1–21

Antennophorus goesswaldi Wiśniewski et Hirschmann, 1992, p. 242, Figs. 26–30.

Diagnosis. Dorsal shield hypertrichous, with more than 600 setae. Sternal shield not divided, smooth; in female, with 3 pairs of setae, *st2–st4* (rarely additional seta present asymmetrically); in male, with 4–5 pairs of setae. Ventrianal shield with numerous setae; in female, flask-like narrowing anteriad, its posterior edge rounded; in male, posterior edge weakly protruding, not widely rounded. In female, fixed cheliceral digit with about 20 small teeth, movable digit with 20–25 small teeth.

Description of female (six specimens measured; Figs. 1–20)

Idiosomal dorsum (Figs. 1, 10, 15, 16). Body subcircular in plan, strongly convex dorsally; color from yellow to brown; length of idiosoma

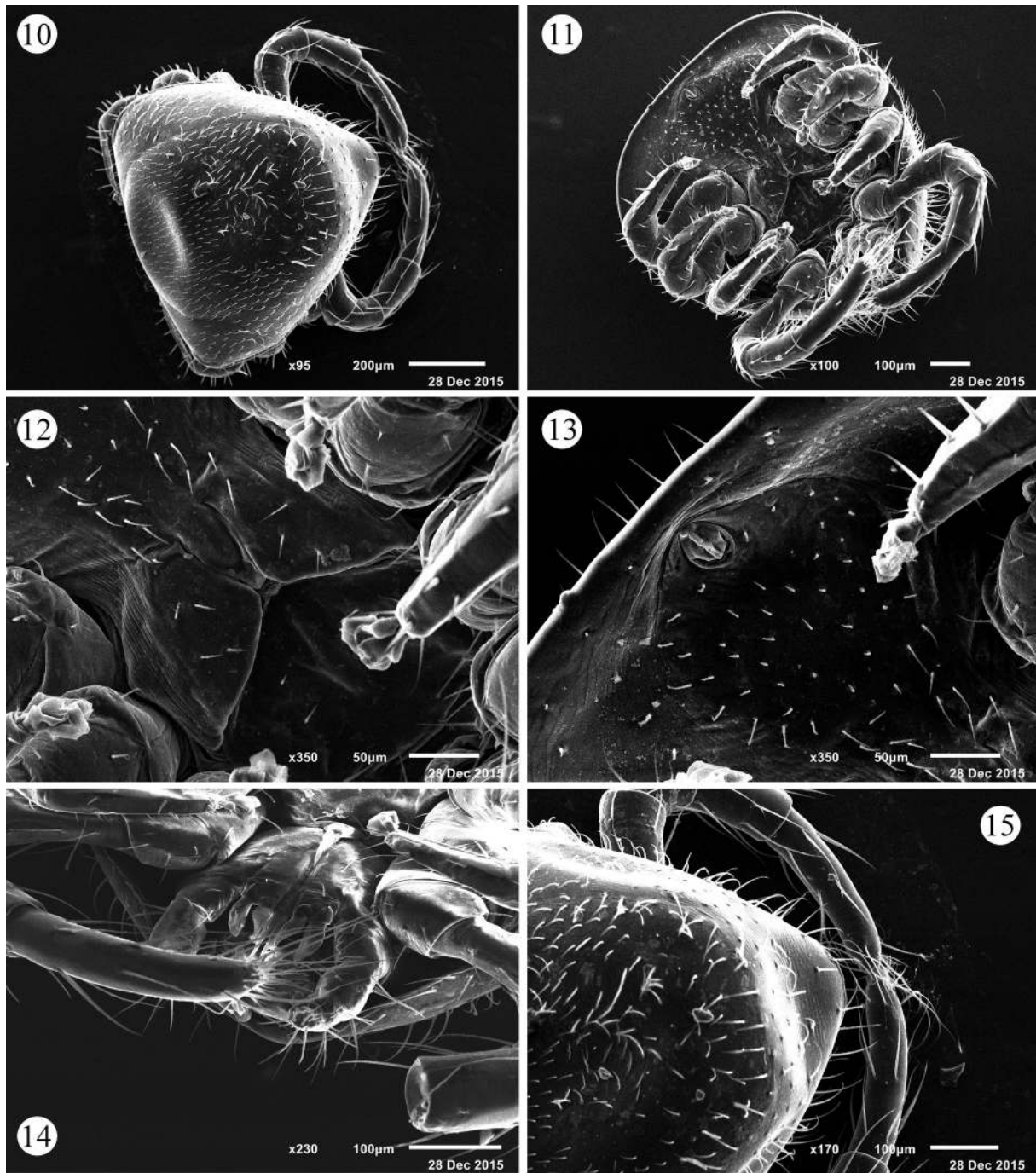


Figs. 3–5. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, female: 3—subcapitulum and palp, ventral view; 4—epistome; 5—chelicera, lateral view. Scale bar=100 μ m.

791–837, maximum width 725–772. Dorsal shield circular in form; covering about half of dorsal surface; 716–753 long and 521–577 maximum wide; its surface slightly reticulated; with numerous (more than 600) weakly barbed setae and 8 pairs of distinguishable pore-like structures; dorsal shield setae decreasing in length from 63–84 (anterior setae) to 15–21 (posterior setae). Soft cuticle weakly striated (Fig. 16), hypertrichous; all setae weakly barbed.

Idiosomal venter (Figs. 2, 11–14, 17, 20). Tri-tosternum with trapezoidal base, 46–55 long, 42–53 wide at base; laciniae free, pilose, 120–126 long. Jugular shield transversal; minimal length 8–19 (at midline), maximal width 179–200; smooth; with one pair of fine barbed setae (*st1*; 46–50 long) and one pair of lyrifissures (*iv1*). Sternal shield pentagonal, with irregular anterior margin and convex, obtuse angled posterior margin; 141–155 long; smooth; sternal shield partly fused with endopodal strip combining platelets of coxae I/II, coxae II/III and coxae III/IV; shield bearing three pairs of weakly barbed setae (*st2*, *st3*, *st4*; rarely one additional seta present) and lyrifissures *iv2*; setae *st2* located at anterolateral margins of shield, 36–40 long; setae *st3* and *st4* located in center of shield, *st3* 29–34 long, *st4* 25–29 long. Latigynial shields triangular (Figs. 2, 12), with rounded edges; smooth; their lateral margins indistinguishable;

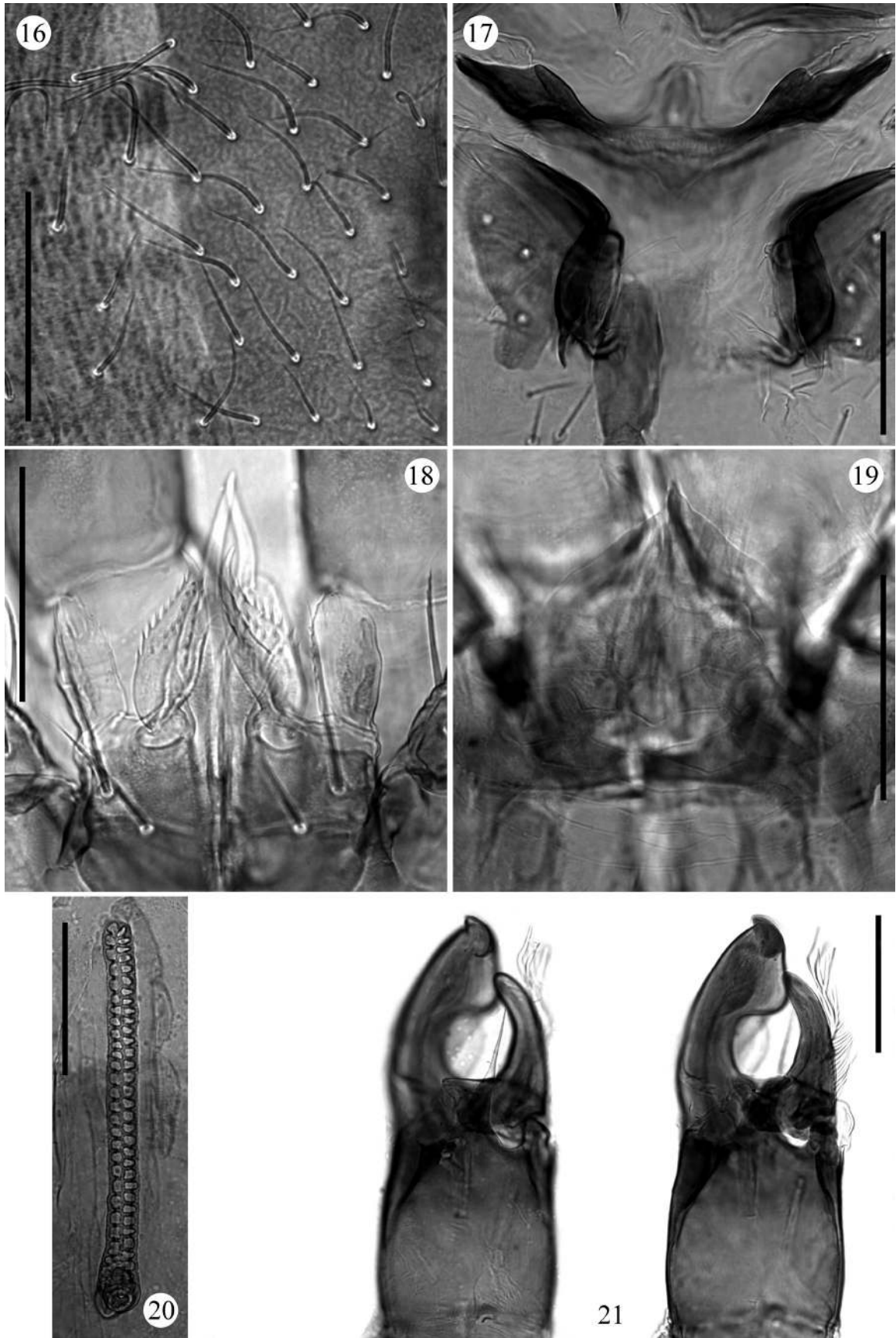
each bearing 3–6 (usually 4) weakly barbed and smooth setae (23–32 long) and group of pore-like structures. Vaginal sclerites well-developed (Fig. 17). Mesogynal shield reduced or imperceptibly merged with ventral shield. Ventrianal shield elongated, flask-like, smooth, with narrow anterior part reaching middle of latigynial shield and expanded posterior part, its posterior margin rounded, almost reaching posterior idiosomal edge (Figs. 12, 13); length 307–328, minimum width of anterior part 21–29, maximum width of posterior part 170–181; shield bearing about 40 unpaired smooth and weakly barbed setae (23–34 long); anus and lyrifissures *iv5* located near posterior shield margin; sigillae well-developed; pair of weakly sclerotized irregular platelets adjoining to middle part of ventrianal shield each with 5–9 setae. Soft cuticle behind these platelets with 1–7 pairs of smooth or weakly barbed setae (23–32 long); besides 3–5 pairs of smooth setae (17–21 long), located caudally. Metapodal-peritrematal shields large and curved, reticulated; with anterior margin weakly sclerotized and poorly visible; every shield bearing 0–2 setae (posteriorly) and 3 pairs of distinguishable pores. Peritremes wide (15–17 in middle) and relatively short (231–273), extending between posterior level of coxae III and anterior level of coxae II; with two rows of cells (about 30 in each; Fig. 20).



Figs. 10–15. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, female, SEM micrographs: 10—general view, dorsally; 11—general view, ventrally; 12—sternal region; 13—anal region; 14—gnathosoma and tarsus I, anteroventral view; 15—anterior edge of the body and legs I, dorsally.

Gnathosoma (Figs. 3–5, 14, 18, 19). Subcapitulum 294–336 wide. Hypostome with 4 pairs of setae; *hp1* modified, club-shaped and S-shaped curved, with denticles; palpcoxal seta (*pc*) and setae *hp2*, *hp3* simple, weakly barbed; *pc* 55–63, *hp1* 69–76, *hp2* 63–76, *hp3* 53–63, (Figs. 3, 14, 18). Deutosternum with distinguishable 6 rows; row 1 with 10–15 small denticles, rows 2–6 each with about 5 irregular, often rounded, denticles.

Corniculi poorly sclerotized; with irregularly margins and rounded apex; their inner margins weakly serrated; 53–61 long, 23–27 wide. Internal malae elongated, narrowed distally, with rounded apex, longer than corniculi and setae *hp1*; smooth. Epistome triangular; with median keel; reticulated (Figs. 4, 19). Palp length from trochanter to tarsus tip 200–216; setal formula: 2–5–7–15–11; tarsus displaced to ventral surface of tibia; setae on tro-



Figs. 16–21. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, light microscopic micrographs. Female: 16—dorsal surface; 17—vaginal sclerites and latigynial elements; 18—gnathosoma, ventral view; 19— epistome; 20—peritreme. Male: 21—chelicera, with different depth of field. Scale bars=100 µm.

chanter, femur, genu and tibia finely barbed; palptarsal apotele 2-tined (Fig. 3). Chelicerae chelate-dentate; second cheliceral segment length 210–225, movable digit length 109–113 (Fig. 5). Fixed digit with about 20 small denticles; dorsal lyrifissure, antiaxial lyrifissure and dorsal seta distinct. Movable digit with 20–25 small denticles; ventrally with series of short setae and bunch of whip-like, apically blunt projections.

Legs (Figs. 6–9, 14, 15). Lengths: I—921–1025, II—605–632, III—642–679, IV—679–744. Leg I without ambulacrum; legs II–IV with ambulacra, claws not distinct. Leg chaetotactic formulae: leg I: coxa 2 (0 0/1 0/1 0), trochanter 6 (1 0/1 1/2 1), femur 12 (2 2/1 2/3 2), genu 12 (2 3/1 3/1 2), tibia 14 (2 3/2 3/2 2); leg II: coxa 2 (0 0/1 0/1 0), trochanter 5 (1 0/1 0/2 1), femur 10 (2 2/1 2/2 1), genu 9 (1 3/0 2/1 2), tibia 10 (1 2/1 3/1 2), tarsus 19 (4 3/2 1/1 3/2 3); leg III: coxa 2 (0 0/1 0/1 0), trochanter 5 (1 1/1 0/2 0), femur 7 (1 2/1 2/1 0), genu 8 (2 2/1 2/0 1), tibia 10 (2 2/1 3/1 1), tarsus 19 (4 3/2 1/1 3/2 3); leg IV: coxa 2 (0 0/1 0/1 0), trochanter 5 (1 1/1 0/2 0), femur 8 (1 2/1 2/1 1), genu 8 (2 2/1 2/0 1), tibia 11 (2 2/1 3/1 2), tarsus 21 (4 3/3 1/1 3/3 3). All coxae and tarsi with pores. Setae *pv2* on trochanters II–IV flagellate and smooth, other setae on coxae, trochanters, femora, genua and tibiae weakly barbed; setae of *ad*- and *pd*-series on genua and tibiae II–IV thickened. Setae on tarsus I rather long, weakly barbed (located proximally) or smooth (located distally; Figs. 6, 14, 15). On tarsi II–IV, setae *ad1*, *pd1* and all ventral setae simple and smooth; setae *ad2*, *ad3*, *pd2*, *pd3* thickened, barbed; seta *md* thickened at base, smooth; setae *al1* and *pl1* flagellate, smooth; shape of setae *al2* and *pl2* variable (flagellate or weakly thickened); setae *al3* and *al4* weakly thickened, hardly barbed or smooth; setae *pl3* thickened, weakly barbed (Figs. 7–9).

Material examined. Ca. 100 females and males, Crimea, Yalta City Municipality, vicinity of Nikita, 44°33'40" N; 34°12'30" E, 12 July 2015, Nikitskaya Mt., mountain steppe, on workers of *Lasius flavus* Fabricius, 1781 (Hymenoptera: Formicidae) from the anthill, leg. A.A. Khaustov.

Remarks. Both sexes of *Antennophorus goesswaldi* are characterized by an undivided sternal shield. This trait they share with adults of *A. boveni*, female of *A. foreli* (male is not known), male of *A. pavani* (female is not known), and male of *A. pubescens* (female has a divided sternal shield). The female of *A. goesswaldi* differs from the female of *A. boveni* by the setae *st2* located on sternal shield

(on soft cuticle in *A. boveni*), the male of *A. goesswaldi* also differs from male of *A. boveni* by having a smooth sternal shield (reticulate-foveate in *A. boveni*). The female of *A. goesswaldi* differs from the female *A. foreli* by the number of setae on dorsal shield (>600 in *A. goesswaldi* vs ca. 100 in *A. foreli*) and ventrianal shield (ca. 40 setae in *A. goesswaldi* vs ca. 8 in *A. foreli*). The male of *A. goesswaldi* differs from the male of *A. pavani* by the number of setae on sternal shield (ca. 10 in *A. goesswaldi* vs ca. 20 in *A. pavani*) and by the shape of the posterior edge of ventrianal shield (weakly protruding in *A. goesswaldi*, rounded in *A. pavani*).

Kethley (1977) noted that the *Antennophorus* spp. are lacking seta *ad3* on genu II and seta *pl2* on tibia IV, but both setae are present in the studied specimens *A. goesswaldi*.

Only adults of *Antennophorus goesswaldi* were found on ants, and about half of females were gravid with 1–2 eggs inside.

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