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Two new species of *Holoparasitus* Oudemans, 1936 from Italy – Tuscany and Trentino (Acari: Gamasida: Parasitidae)

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Abstract. Two new mite species, *Holoparasitus amiatus* n. sp. and *H. fovealis* n. sp. (Parasitidae) from Tuscany and Trentino (Italy), respectively, are described. The former species is morphologically close to the *Holoparasitus calcaratus* species-group, whereas *H. fovealis* is most similar to *H. dallaii* Witaliński, 1994 and *H. globosus* Witaliński, 1994.

Key words: acarology, taxonomy, Parasitidae, *Holoparasitus*, new species, Italy

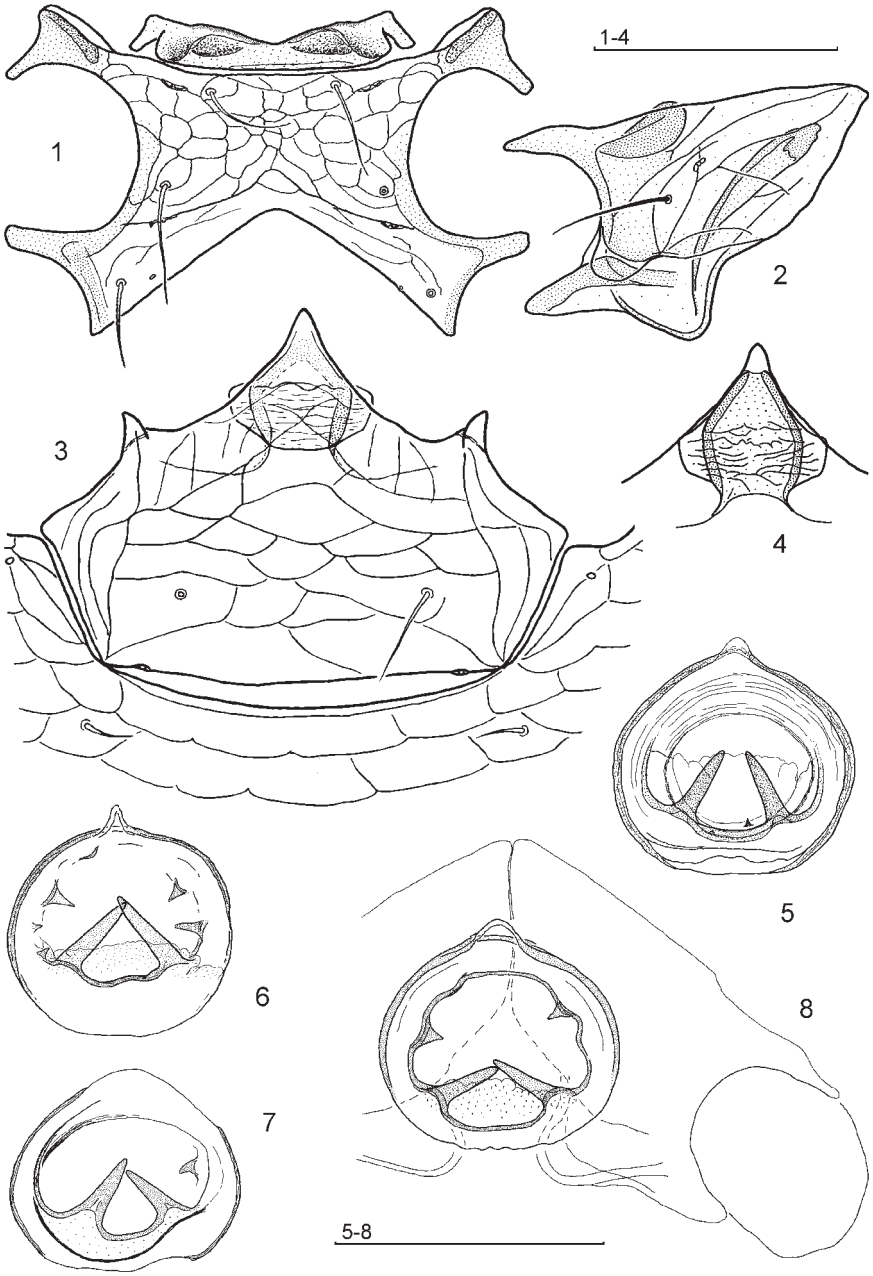
The genus *Holoparasitus* Oudemans, 1936 contains 36 described species, more than half of which are arranged in five species groups: *annulus* (2 species), *caesus* (4), *mallorcae* (6), *peraltus* (2), and *calcaratus* (7) (Juvara-Bals 1975; Hyatt 1987; Witaliński & Skorupski 2002, 2003; Juvara-Bals & Witaliński 2006). In this paper we describe two new *Holoparasitus* species from chestnut forest at Monte Amiata (Tuscany) and from beech forest in Tiarno (Trentino).

***Holoparasitus amiatus* n. sp.**

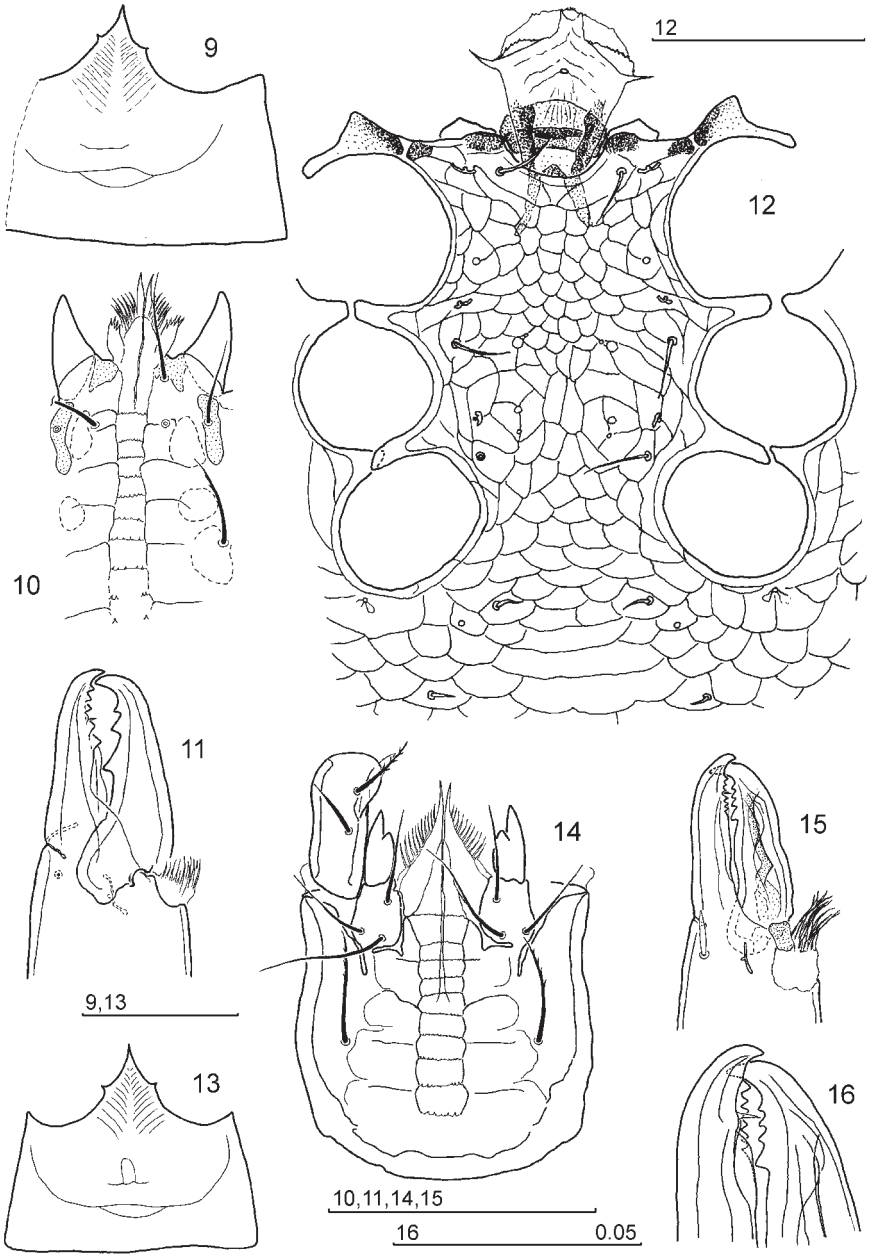
(Figs 1-19)

Etymology

The specific name refers to its *locus typicus*, the Monte Amiata, a prominent (1738 m a.s.l.) volcanic mountain lying in southernmost Tuscany.



1-8. *Holoparasitus amiatus* n. sp. Female: 1 – presternal plate and sternal shield; 2 – paragynium; 3 – epigynium; 4 – central prong of epigynium with subapical structure; 5 – endogynium, holotype; 6, 7 – different aspects of the endogynium (in fig. 7 endogynial lamella not shown); 8 – endogynium, with outlines of paragynia and opening for coxa IV. (1-3,5: holotype, slides 909-B1, -B2, -B3; 4,7: slide 909-C2; 6,8: slide 1852). Scale bar 0.1 mm



9-16. *Holoparasitus amiatus* n. sp. Female: 9 – gnathotectum; 10 – hypognathal groove and corniculi; 11 – chelicera. (9,11: slide 909-C1; 10: holotype, slide 909-B3). Male: 12 – genital lamina and sternogenital region; 13 – gnathotectum; 14 – gnathosoma and palptrochanter; 15,16 – chelicera. (12,13,15,16: slides 909-D2, -D3, -D4; 14: slide 1851). Scale bar 0.1 mm (9-15) and 0.05 (16)

Diagnosis

In both sexes the gnathotectum is trispinate with a prominent central prong and low lateral ones; gland pores *gv1* present; gland pores *gv2* in normal cuticle.

In the female the presternal plate is wide and narrowed medially, with frontal margin smooth and lateral platelets accreted anteriorly; sternal shield complete; central prong of epigynium with a blunt, less pigmented apex; subapical epigynial structure composed of two lateral narrow thickenings, each divided into anterior and posterior parts joined at an open angle; hyaline lateral protrusions three-sided, slightly extending beyond the margin of the epigynium; the posterior half of the subapical structure shows a characteristic wavy reticulation; endogynium relatively large, cup-shaped, its margin and margin of the sac visible as two distinct concentric circles; both endogynial posterior main thorns settled at sac margin, straight and directed centripetally; two to four additional denticles are distributed bilaterally at the entrance of the sac, but sometimes only one or two small denticles are present, located randomly and much deeper in the sac.

In the male the excipulum on the sternal shield is absent; genital lamina prominent, trapezial, located in a deep concavity of the sternum, with anterior edge forming left and right convexities and two large, acute lateral projections; the corniculi each bear a prominent protrusion adaxially; the fixed digit of the chelicera is straight, with 5-6 small teeth of similar size in its distal third part, followed by a low lamina in proximal part of the edge; movable digit with 4 teeth, the proximal one larger; the brush-like process of the arthrodial membrane well pronounced; seta *v1* on palptrochanter simple, *v2* pilose in its terminal part; hypostomatic setae on a separate fragment of cuticle; spur on genu II small, ending in a small, rounded apex; axillary process small, but its apical part is larger than that of the main spur; spur on genu small and roundish; spur on tibia low, extending throughout the distal half of the tibia, but ending behind the distal margin of the segment.

Description

Female. Idiosoma well sclerotised, brownish, 465-495 x 650-700 μm (N=10). Dorsal setae very short, 7-13 μm.

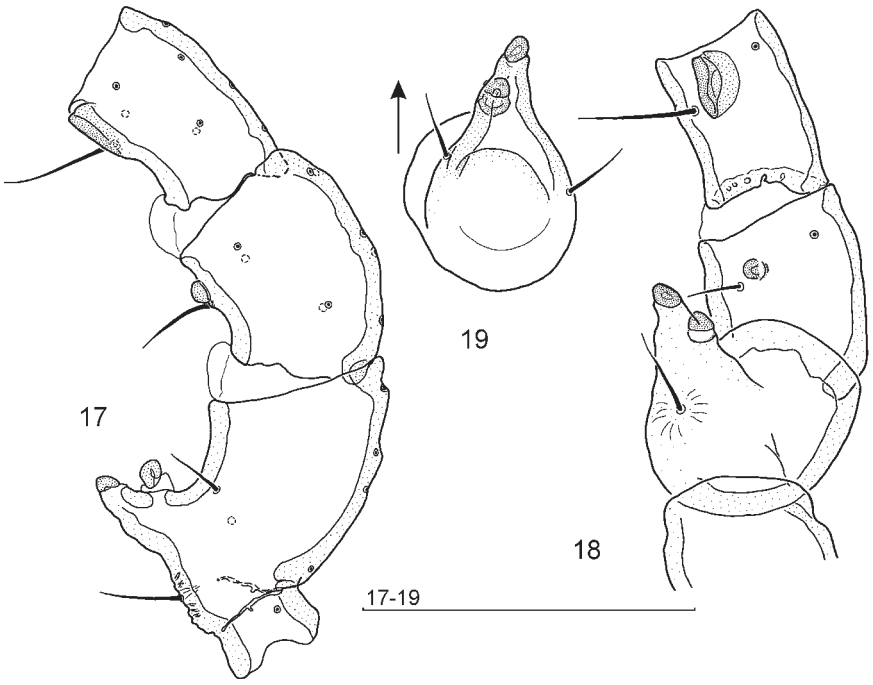
Ventral side. Presternal plate wide, medially more narrow, partially fused to lateral platelets (fig. 1). Anterior margin of sternal plate without larger concavities or indentations, sternum reticulation well pronounced, demarcated in the posterior portion by a line running through the second pair of pores (*iv2*). Gland pores *gv1* present adaxially to bases of setae *st3,* but their location can vary. Setae of sternogenital region from 39 μm (*st1*) to 56 μm (*st3*) in length.

Genital region. Paragynial shield (fig. 2) with somewhat more sclerotised adaxial border; metagynial sclerite arcuate and narrow; posterolateral protrusion "locking" epigynial plate elliptical; underside of anterior paragynial edge facing coxa III, with a distinct, roundish thickening. Epigynial shield (figs 3, 4) roughly heptagonal, central apex less sclerotised and rather blunt, lateral prongs curved abaxially. Subapical structure with two lateral narrow thickenings, each divided into two parts joined at an open angle (fig. 4). Each hyaline lateral protrusion wing-like, rounded or three-sided,

slightly extending beyond the epigynial margin. The posterior half of the subapical structure including the hyaline lateral protrusions shows a characteristic wavy pattern of reticulation. Endogynium (figs 5-8) relatively large, cup-shaped and circular in ventral perspective. Its margin and margin of the sac distinctly visible, usually as two concentric circles. Two posterior main thorns are settled on sac margin, straight and directed centripetally, accompanied by two to five additional denticles located bilaterally at sac entrance, i.e. at a level similar to that of the main thorns. Sometimes, however, only one or two small denticles are present, located randomly and deeper in the sac (figs 5, 7). Endogynium opening is covered posteriorly by a hyaline endogynial lamella, which has a frontal margin showing undulations and incisions (figs 5, 6, 8). Gland pores *gv2* in normally sclerotised cuticle. Opisthogaster with 8 pairs of setae ca. 25-31 µm long.

Gnathosoma (figs 9, 10). Gnathotectum trispinate with a prominent central prong and low lateral ones (fig. 9). Corniculi conical. Hypognathal groove with 9-11 weakly visible rows of denticles, but proximal two rows are represented only by one-two lateral denticles (fig. 10). Palpcoxal setae finely barbed, hypostomatics simple.

Chelicerae (fig. 11). Distal half of the fixed digit with three teeth in front and two behind *pilus dentilis*, followed by lamellar edge. Movable digit with three teeth.



17-19. *Holoparasitus amiatus* n. sp. Male: 17 – femur, genu and tibia of leg II (most setae not shown); 18 – *ibid*., from ventral perspective; 19 – spurs on Fe II, ventrally (arrow at anterolateral side). (17: slide 909-D1; 18: slide 1850; 19: slide 1851). Scale bar 0.1 mm

Pedipalps. Trochanter with seta *v1* finely barbed and seta *v2* richly barbed terminally, anterolateral seta of femur spatulate and finely pectinate on one edge, anterolateral setae of genu spatulate.

Legs. Leg structure and setation unremarkable.

Male. Idiosoma brownish, well sclerotised, 365-405 x 575-630 µm (N=10). Dorsal setae very short, 7-12 µm.

Ventral side (fig. 12). Presternal plates trapezoid. Genital lamina prominent, trapezial, located in a deep concavity in the anterior sternal margin, flanked by tubercular protrusions; its anterior hyaline edge forms left and right convexities separated medially by a deep concavity, as well as two large, acute lateral projections. Microsclerite under genital lamina dumbbell-shaped and moderately sclerotised. Sternogenital shield regularly reticulated, excipulum absent. Gland pores *gv1* at *st3* level, with channels directed laterally and dilated terminally. Two pairs of weakly discernible pore-like points of differently sclerotised cuticle (corresponding to button-like thickenings in some species) at level of *iv3* pores and *st4* setae. Gland pores *gv2* in unmodified cuticle. Sternal setae length from 38 µm (*st1*) to 34 µm (*st4*), opisthogastric setae 24-30 µm.

Gnathosoma (figs 13, 14). Gnathotectum (fig. 13) trispinate, like in female. Hypognathal groove with 11 rows of well-visible denticles (fig. 14); palpcoxal setae finely barbed, hypostomatics simple. Incisions in cuticle behind hypostomatic setae present. Corniculi with prominent protuberance on adaxial border.

Chelicera (figs 15, 16). Fixed digit slender, with a distal row of 6 uniform denticles followed proximally by lamellar edge. *Pilus dentilis* located in the middle of the denticle row. Movable digit with 4 teeth in distal part. Arthrodial membrane with a well-pronounced brush-like process; synarthrodial membrane triangular.

Pedipalps. Trochanter (fig. 14) with seta *v1* simple, *v2* distally barbed; anterolateral seta on femur spatulate and finely pectinate on one edge, anterolateral setae on genu spatulate.

Legs. Leg I, III, and IV unremarkable. Leg II spurred as follows (figs 17-19): the main spur on femur short, conical, ending in a very small rounded apical segment. Axillary process with apical part rounded and larger than the apical segment of the main spur. Both structures end at a similar level. Genu with minute, medially located spur similar in size and shape to apical part of axillary process. Spur on tibia low and long, ending distally behind the margin of the tibia.

Type material

Holotype female (slides no. 909-B1, -B2, -B3), 17.09.1990, Monte Amiata, Tuscany (Italy), loc. E, alt. ca. 1000 m a.s.l., chestnut forest litter (*leg.* WW). Paratypes:

1♀, 1♂ (slides no. 909-C, 909-D), *ibid.*; paratypes: 30♀♀, 38♂♂ (slides no. 1848, 1850-1852, 1855, 1915, 1916, 1918, 1920), 17.09.2004, Monte Amiata, loc. N, alt. ca. 950 m a.s.l., chestnut forest litter (*leg.* WW & MS); paratypes: 5♀♀, 2♂♂ (slides no. 1857, 1859), *ibid.*, moss on rocks and trees (*leg.* Bożena Sikora, A. Mickiewicz University, Poznań, Poland). Types are deposited in the Zoological Museum of the Jagiellonian University, Cracow, Poland.

***Holoparasitus fovealis* n. sp.**

(Figs 20-36)

Etymology

The specific name refers to the location of *gv2* pores in the heavy sclerotised cuticular foveolae.

Diagnosis

In both sexes the gnathotectum is trispinate, lateral prongs in the male less acute; gland pores *gv1* present; gland pores *gv2* in cuticular foveolae.

In the female the presternal plate is wide but narrowed medially, with frontal margin smooth and lateral platelets accreted anteriorly or free; sternal shield complete; thickenings of epigynial subapical structure form two anterior and two lateral sides of a pentagon; hyaline lateral protrusions three-sided with rounded corners, slightly extending beyond the epigynium margin; endogynium cup-shaped, armed with two long, frequently curved posterior main thorns, and numerous, relatively long dents distributed at endogynial sac entrance and directed centripetally.

In the male the excipulum on the sternal shield is absent; genital lamina located in a deep concavity of the sternum, with anterior hyaline edge forming left and right dentate convexities and two large, acute lateral projections; corniculus bears a more or less prominent protrusion adaxially; fixed digit of chelicera slightly curved and narrowing distally, with a row of ca. 11 uniform, fine denticles (4-5 in front and the rest behind the *pilus dentilis*), and a convex lamella located abaxially, beginning at the level of the *pilus dentilis*; movable digit with concave internal (dorsal) edge armed with 4 denticles followed by larger tooth; arthrodial membrane fringed; seta *v1* on palptrochanter simple, *v2* larger and barbed distally; cuticle bearing hypostomatic setae separated by incisions; spur on femur II relatively small, conical, ending in a small, rounded apex; axillary process small, rounded and slightly asymmetric; spur on genu II with straight ventral side, roundish distal end reaching the segment margin; spur on tibia II larger than that on the genu, with ventral side concave, ending behind the distal margin of the tibia.

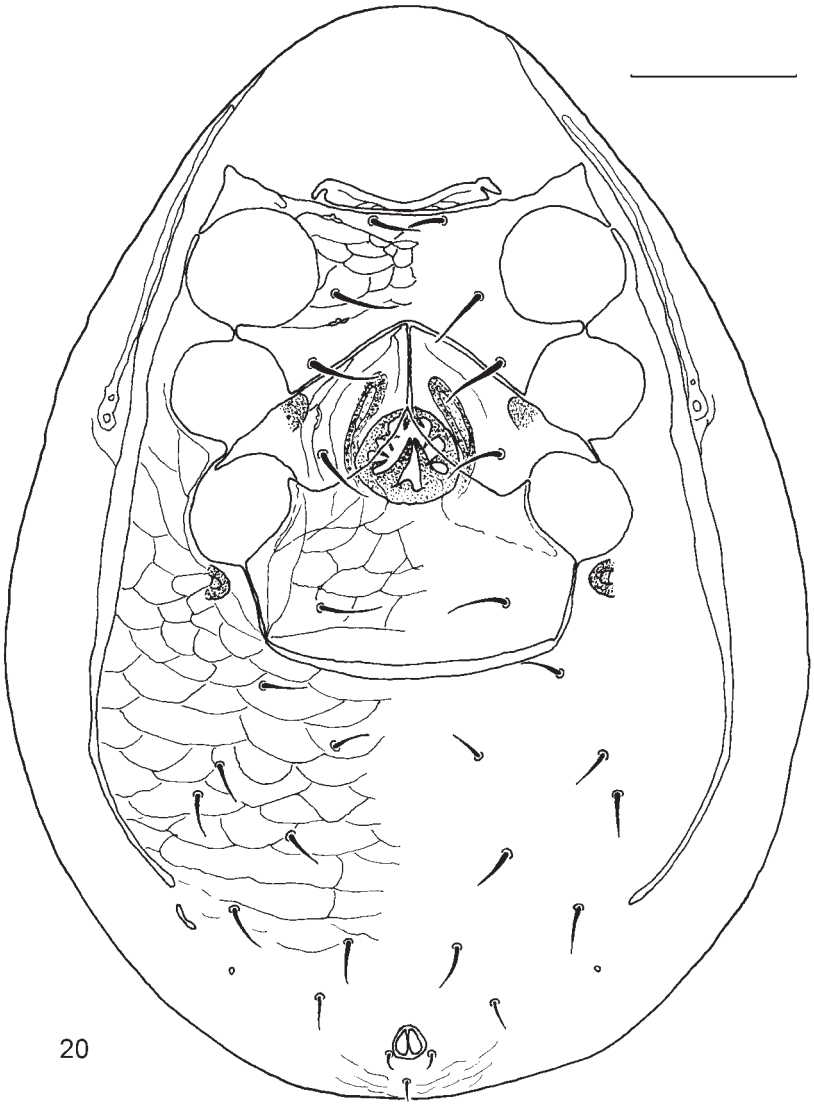
Description

Female. Idiosoma brownish or yellow-brownish, 440-455 x 610-655 μm (N=8). Dorsal setae very short, 8-16 μm.

Ventral side (figs 20, 21). Presternal plate wide, medially narrowed, its anterior margin smooth; lateral platelets either partially fused to presternal plate or free. Anterior margin of sternal plate with paired indentations adaxially to setae *st1*, sternum reticulation well pronounced, except for the posterior portion demarcated by a line running through the second pair of pores (*iv2*). Gland pores *gv1* present on sternal shield, adaxially to setae *st3*. Setae of sternogenital region from 40 μm (*st1*) to 50 μm (*st3*) in length.

Genital region (figs 20-27). Paragynial shield (fig. 21) with somewhat more sclerotised adaxial border; metagynial sclerite regularly arcuate, parallel to paragynium reticulation; posterolateral protrusion “locking” epigynial plate circular or elliptical;

underside of anterior paragynial edge facing coxa III with moderately sclerotised elliptical thickening. Epigynial shield (figs 22, 23) heptagonal. Central apex pointed, its edge forms a right angle; lateral prongs large, curved abaxially. Subapical structure with thickening forming two anterior and two lateral sides of a pentagon, the anterior ones somewhat undulate. Hyaline lateral protrusions three-sided with rounded corners, slightly extending beyond the epigynium margin. Endogynium (figs 24-27) cup-shaped, armed with two long, frequently curved posterior main thorns, and numerous (6-9),

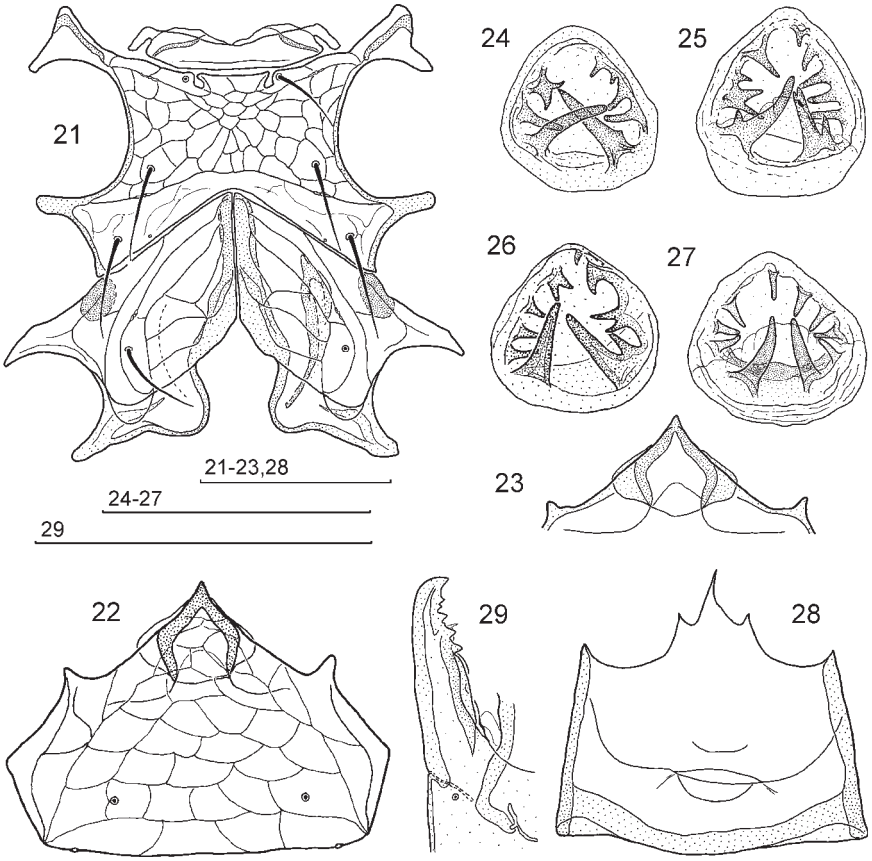


20. *Holoparasitus fovealis* n. sp. Female: ventral side of idiosoma. (slide 1008-A). Scale bar 0.1 mm

relatively long and sometimes forked dents distributed at endogynial sac entrance and directed centripetally. The endogynium opening is covered ventrally by a fan-like, hyaline endogynial lamella (figs 25, 27). Gland pores *gv2* in heavy sclerotised cuticular foveolae. Opisthogaster with 8 pairs of setae ca. 20-35 µm long.

Gnathosoma. Gnathotectum trispinate (fig. 28), corniculi conical. Hypognathal groove with a total number of 10-11 rows of denticles of which 6-9 distal rows are usually visible, whereas the posteriormost are present only occasionally. Palpcoxal setae finely barbed, hypostomatics simple.

Chelicerae. Fixed digit (fig. 29) with three teeth in front of *pilus dentilis* of which the second tooth is tiny. Two teeth are present behind the *pilus dentilis*, followed by two parallel lamellar edges: the adaxial edge is medially concaved, whereas the abaxial edge is convex. Movable digit with three teeth.



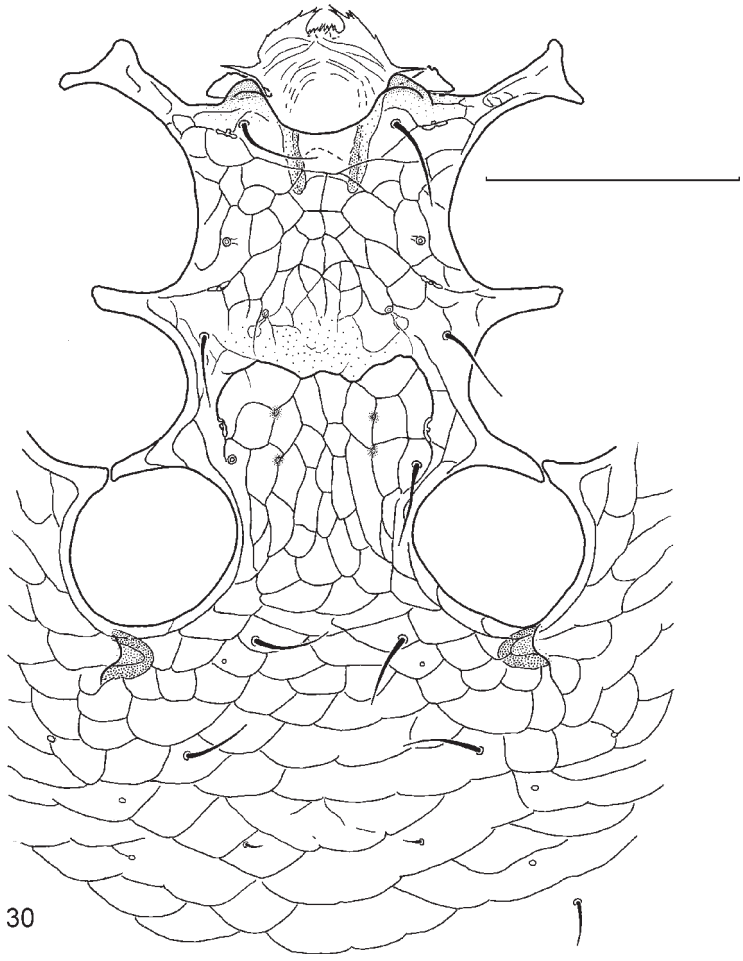
21-29. *Holoparasitus fovealis* n. sp. Female: 21 – presternal plate, sternal shield and paragynia; 22 – epigynium; 23 – anterior part of epigynium with subepigynial structure; 24-27 – endogynium, different specimens (in figs 24 and 26 endogynial lamella not shown); 28 – gnathotectum; 29 – fixed digit of chelicera, abaxial side. (21,22,26: slides 1003-E1, -E2; 24,25: slide 1008-A; 23,27-29: holotype, slides 1003-F1, -F2, -F3). Scale bar 0.1 mm

Pedipalps. Trochanter with seta *v1* simple and *v2* barbed distally, anterolateral seta of femur spatulate and finely pectinate on one edge, anterolateral setae of genu spatulate.

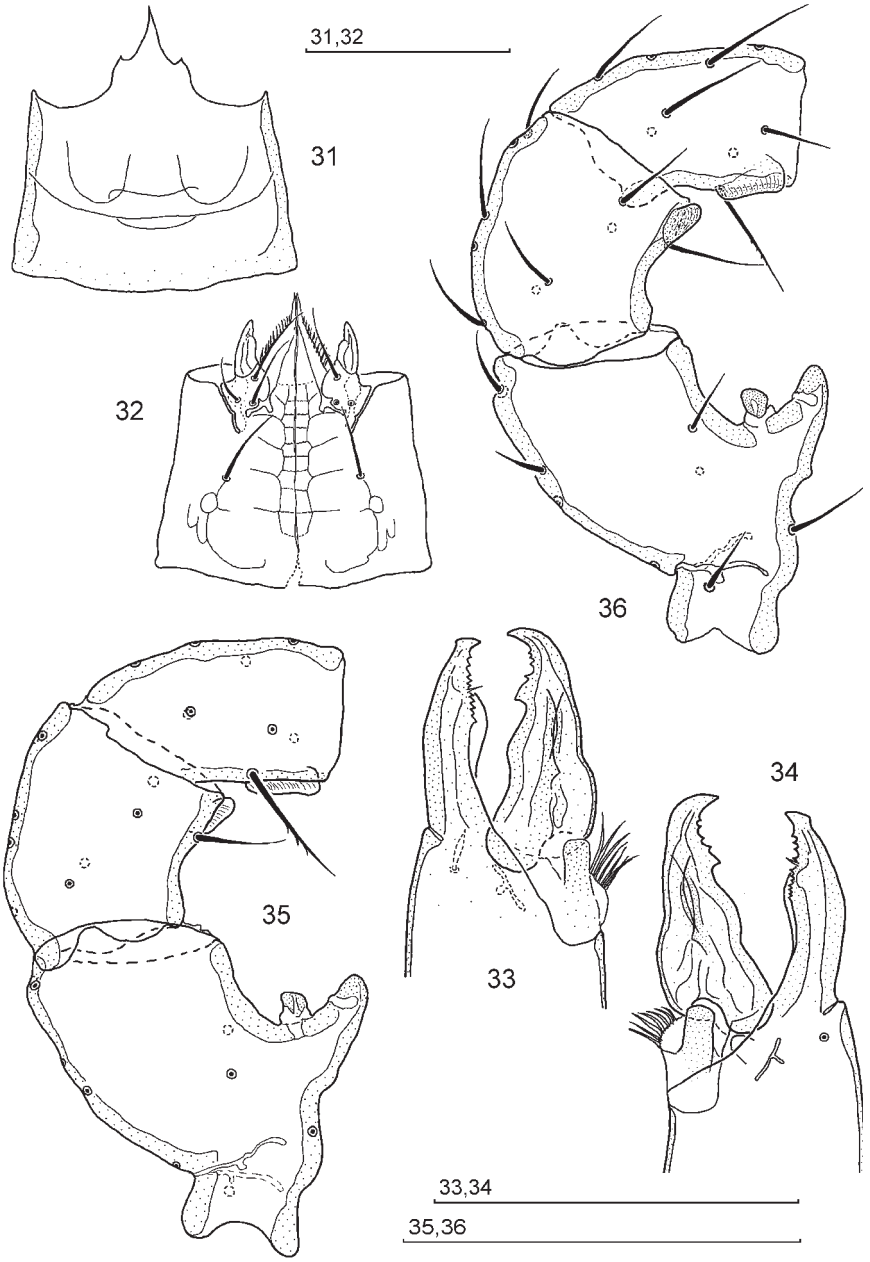
Legs. Leg structure and setation unremarkable.

Male. Idiosoma brownish, well sclerotised, 350-385 x 515-560 μm (N=6). Dorsal setae very short, 7-10 μm.

Ventral side (fig. 30). Presternal plates triangular. Genital lamina located in a deep concavity of anterior sternal margin, flanked by tubercular protrusions; its anterior hyaline edge forms two dentate lobes separated medially by a deep concavity; laterally, two large, acute projections are present. Microsclerite under genital lamina bar-shaped and



30. *Holoparasitus fovealis* n. sp. Male: genital lamina and sternogenital region. (slide 1003-H1). Scale bar 0.1 mm



31-36. *Holoparasitus fovealis* n. sp. Male: 31 – gnathotectum; 32 – gnathosoma; 33,34 – chelicera; 35,36 – femur, genu and tibia of leg II (only the position for most setae is marked). (slides 1003-H2, -H3, -H4). Scale bar 0.1 mm

well sclerotised. Excipulum absent, gland pores *gv1* located at *st3* level, with channels directed posterolaterally and dilated terminally. Reticulation of sternogenital shield well visible, except for an area at the level of setae *st3* and pores *gv1*, resulting in a posteriorly located distinct reticulation pattern demarcated by a convex line passing through pores *iv3* (Fig. 30). Two pairs of small cuticular sclerotisations, sometimes of gland pore appearance, are present at the level of *iv3* pores and *st4* setae. Gland pores *gv2* within heavily sclerotised cuticular foveolae. Approximate length of sternal setae: 29 µm (*st1*), 33 µm (*st2*), 26 µm (*st3*), 30 µm (*st4*), the length of opisthogastric setae is 18-29 µm.

Gnathosoma (figs 31, 32). Gnathotectum (fig. 31) trispinate, central prong like in female, whereas lateral ones less acute. Hypognathal groove with 10 rows of well-visible denticles (fig. 32); palpcoxal setae simple or finely barbed, hypostomatics simple. Incisions in cuticle behind hypostomatic setae present. Corniculus with more or less pronounced protuberance on adaxial border.

Chelicera (figs 33, 34). Fixed digit slightly curved and narrowed subterminally, with a row of ca. 11 uniform, fine denticles (4-5 in front and the rest behind the *pilus dentilis*); abaxially, a convex lamella runs posteriorly beginning at the *pilus dentilis*. Internal (dorsal) edge of movable digit in third distal portion with concavity armed with 4 denticles and larger tooth proximally, followed by toothless sigmoidal edge. Arthrodial membrane fringe-like, synarthrodial membrane rounded.

Pedipalps. Trochanter with seta *v1* simple and smaller than *v2,* which is distally barbed. Femur with anterolateral seta spatulate and finely pectinate on one edge, and with broad elevation located ventrally at anterolateral seta level. Anterolateral setae on genu spatulate.

Legs. Legs I, III, and IV unremarkable. Leg II spurred as follows (figs 35, 36): the main spur on femur relatively small, conical, ending in a small, rounded apical part . Ventrally, a low tubercle is present at the base of the main spur. Axillary process small, rounded and slightly asymmetric. Spur on genu II with straight ventral side and roundish distal end reaching segment margin. Spur on tibia II larger than that on genu, with ventral side concave and distal end behind the margin of the tibia. If leg II is observed from a ventral perspective, the main femoral spur and axillary process are slightly bent posterolaterally.

Type material

Holotype female (slides no. 1003-F1, -F2, -F3), 24.09.1990, Tiarno di Sopra, Trentino (North Italy), alt. ca. 1100 m a.s.l., humus under beech and fir trees; 8♀♀, 5♂♂ paratypes (slides no. 1002-B, 1003-E1, -E2, -E3, -E4, 1003-H1, -H2, -H3), *ibid.*; 39♀♀, 10♂♂ paratypes (slides no. 1006-A, 1006-B, 1008-A, 1010-A), 24.09.1990, Tiarno di Sotto, Trentino (North Italy), alt. ca. 800 m a.s.l., humus under beech and fir trees.

Types were collected by staff of the Department of Evolutionary Biology, University of Siena, Italy, and are deposited in the Zoological Museum of the Jagiellonian University, Cracow, Poland.

Remarks on morphology and taxonomy

The two new *Holoparasitus* species described in this paper share many key characters, the most striking of which are as follows: the gnathotectum in both sexes is trispinate, in the female the presternal plate is anteriorly smooth (not serrated), the cup-shaped endogynium bears two main posterior thorns and additional teeth. In the male, the excipulum is absent and the corniculi have adaxial protrusions. Both species differ, however, in the structure of the cuticle around pores *gv2*: in *H. amiatus* the cuticle is normal, whereas in *H. fovealis* it forms thickened foveolar concavities with pores inside, similar to two other species possessing foveolae, *H. dallaii* Witaliński, 1994 and *H. globosus* Witaliński, 1994. In *H. dallaii*, the hyaline endogynial lamella has a thickened, sinuous anterior edge, as well as a relatively large subapical epigynial structure and central prong. Moreover, the endogynial sac is visible as a distinct structure smaller than the endogynium. In *H. globosus* and *H. fovealis*, the hyaline endogynial lamella has a very thin edge, the subapical epigynial structure and central prong are not conspicuously large, and the endogynial sac is of a similar diameter as the endogynium, thus is not visible separately. The best criterion distinguishing females of *H. globosus* and *H. fovealis* is body shape, strikingly roundish in the former species and elongate in the latter one. The males of these three species can be distinguished due to their sternum structure: in *H. dallaii* a large excipulum is present, whereas in *H. globosus* this structure is either rudimental or replaced by a circular, non-reticulated area on the sternum. In *H. fovealis,* neither the excipulum nor its rudiment on the sternal shield are present. Some other differences can be found in the relevant literature (Witaliński 1994a,b).

The females of *H. amiatus* resemble members of the *calcaratus* species-group (Witaliński & Skorupski 2002; Witaliński 2004) containing 7 species: *H. calcaratus* (Koch, 1839), *H. excipuliger* (Berl., 1906), *H. kerkirensis* Witaliński & Skorupski, 2002, *H. paradisiacus* Witaliński & Skorupski, 2003, *H. pollicipatus* (Berl., 1903), *H. pseudoperforatus* (Berl., 1906), and *H. rotulifer* (Willmann, 1940). The main difference is that the endogynium in *H. amiatus* has main posterior thorns, although the anterior main thorn is absent. In addition, the endogynium is relatively large and composed of two distinct concentric circles (external border of endogynium and sac margin). In contrary to all species belonging to the *calcaratus* species-group, the male of *H. amiatus* does not have an excipulum on its sternal shield.

Both newly described species require comment on morphology and distribution. *H. amiatus* is a species found in relatively large quantities but in a limited area and in a particular habitat, i.e. the leaf litter of old chestnut forest covering the foothills of Monte Amiata. Interestingly, this species has not been found in younger chestnut forest near the top of the mountain nor in beech forest at ca. 1600 m a.s.l. Therefore, it seems probable that the species is an element of an ancient mite fauna of chestnut forest that has survived in the surroundings of Monte Amiata and has recently been limited to this locality. The second species, *H. fovealis,* is distinct due to the presence of cuticular foveolae containing openings of glands (*gv2*). This structure was described for the first time in *H. dallaii* Witaliński, 1994 from Sardinia, and in the same year in *H. globosus* Witaliński, 1994 from Sicily (Witaliński 1994a,b). These species were

found in separate, distant places (islands) in moss on rocks and in leaf litter of oak forests. *H. fovealis* occurs in litter of beech and fir forest in North Italy. At the moment, neither the distribution, habitat, nor morphology suggest a close relationship between these three species. The cuticular foveolae surrounding the postcoxal openings of glands (*gv2*) occur also, although are much less pronounced, in some male and female specimens of *H. pseudoperforatus* (living in coniferous forests in North Italy). Thus, this character may be considered as an apomorphic modification which therefore would have appeared independently in several species. The interpretation of foveolae in terms of their function seems to be precocious.

ACKNOWLEDGEMENTS

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