REVUE SUISSE DE ZOOLOGIE, 103 (1) : 119-150; mars 1996

A Revision of the Madeiran species of the genus *Geostiba* Thomson, 1858 (Coleoptera: Staphylinidae)

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A Revision of the Madeiran species of the genus *Geostiba* Thomson, 1858 (Coleoptera: Staphylinidae). - A revision of the types of all Madeiran taxa of *Geostiba* Thomson as well as of further material collected by the authors and from various collections yielded 15 species, all of them endemic to the Madeiran archipelago. 11 species are described for the first time: *G. arieiroensis* n. sp., *G. ruivomontis* n. sp., *G. bicacanaensis* n. sp., *G. brancomontis* n. sp., *G. graminicola* n. sp., *G. vaccinicola* n. sp., *G. lauricola* n. sp., *G. caligicola* n. sp., *G. occulta* n. sp., *G. endogea* n. sp. and *G. subterranea* n. sp. Both *G. israelsoni* (Palm) and *G. waldeni* (Palm) are considered junior synonyms of *G. filiformis* (Woll.), and *G. carli* Palm is recognized as a synonym of *G. lindrothi* Franz. *Sipalia leileri* Palm is transferred to *Atheta* Thoms. *Atheta juengeri* Benick is shown to be a junior synonym of *Sipalia leileri* Palm. The study includes detailed descriptions of each species, illustrations of diagnostic characters, faunistic and ecological data as well as a key allowing identification.

Key-words: Coleoptera - Staphylinidae - *Geostiba* - Madeira - Taxonomy.

INTRODUCTION

In his first account of Madeiran insects WOLLASTON (1854) described the genus *Xenomma* with three species. Only the first of these (*X. planifrons*) has remained in the genus, which today is placed in the Oxypodini. PALM (1981a) treated the other two species (*X. formicarum* and *X. filiformis*) as members of *Sipalia* Muls. & Rey – a name erroneously used and to be replaced with *Geostiba* Thomson (e.g. BLACKWELDER (1952)) – and described four further species from the Madeiran archipelago: *Sipalia leileri*, *S. lindrothi*, *S. israelsoni* and *S. waldeni*. In the same year FRANZ (1981) added *Geostiba lindrothi* and *G. portosantoi*, and *S. lindrothi* Palm was renamed *Geostiba carli* (PALM 1981b). Thus a total of 8 endemic species of *Geostiba* have so far been described from Madeira and Porto Santo.

* Names in alphabetical order.
Manuscript accepted 31.03.1995.

During a joint excursion to Madeira proper and Porto Santo in spring 1993 we collected mostly large series of various species of *Geostiba*. Their identification, however, based on the original descriptions and the key in PALM (1981a) failed in most cases. A subsequent examination of all the types revealed that not only did our material contain a number of yet undescribed species, but some of the previously described taxa had also been misinterpreted.

Material from the following museum collections was studied: The Natural History Museum London (BMNH), the Muséum d'histoire naturelle, Genève (MHNG), the Museum of Zoology and Entomology Lund (MZEL) and the Swedish Museum of Natural History Stockholm (SMNH).

THE MADEIRAN SPECIES OF *GEOSTIBA* THOMSON

Our study of 812 specimens of Madeiran *Geostiba* both from our own and from loaned material yielded 15 species, 11 of them are described as new. Three names are placed in synonymy, and one species is excluded from the genus. Some characters such as colour, punctation, microsculpture, body size and even body proportions may be subject to considerable variability. The presence or absence of functioning eyes, the shape of the genitalia and the sclerites of the abdominal segment VIII generally represent more reliable diagnostic criteria. As in Italian *Geostiba* (PACE 1977) and certain *Oxypoda* (ZERCHE, pers. comm.), the form of the apex of the parameres and the parameral sensilla were found to be of high taxonomic value. For a proper evaluation of these characters, particularly in the small subterraneous species, the genitalia and the genital segments were mounted on slides.

In the descriptions, measurements of head width (HW), pronotal width (PW) and length (PL), length of elytra at suture (EL) and the length from labrum to elytral apex (SL) are indicated in µm, the total length from labrum to hind margin of tergite VIII (TL) is given in mm. Measurements of body length, of course, strongly depend on the mode of preparation. Whenever series of specimens were available, the range of the measurements, the arithmetic mean and standard deviation are also presented.

Paratypes of most of the new taxa described here as well as part of the material of the remaining species collected by us are deposited in the Muséum d'histoire naturelle, Genève (MHNG).

Geostiba formicarum (Wollaston, 1854) (Figs 1a–k)

Xenomma formicarum WOLLASTON, 1854: 545; 1857: 172; 1865: 457.
Geostiba formicarum (Wollaston), FAUVEL 1897: 338.
Sipalia formicarum (Wollaston), JANSSON 1940: 16.
nec *Sipalia formicarum* (Wollaston), PALM, 1981a: 294.

TYPES: Lectotype: ♂, here designated and labelled accordingly, in coll. Wollaston (BMNH). Paralectotypes: 1 ♂, 1 ♀, in coll. Wollaston (BMNH).

The specimen here chosen as lectotype carries a round label 'type' and a hand-written label '*Xenomma formicarum* Woll., type'. Since the former is a "curator label' (HAMMOND,

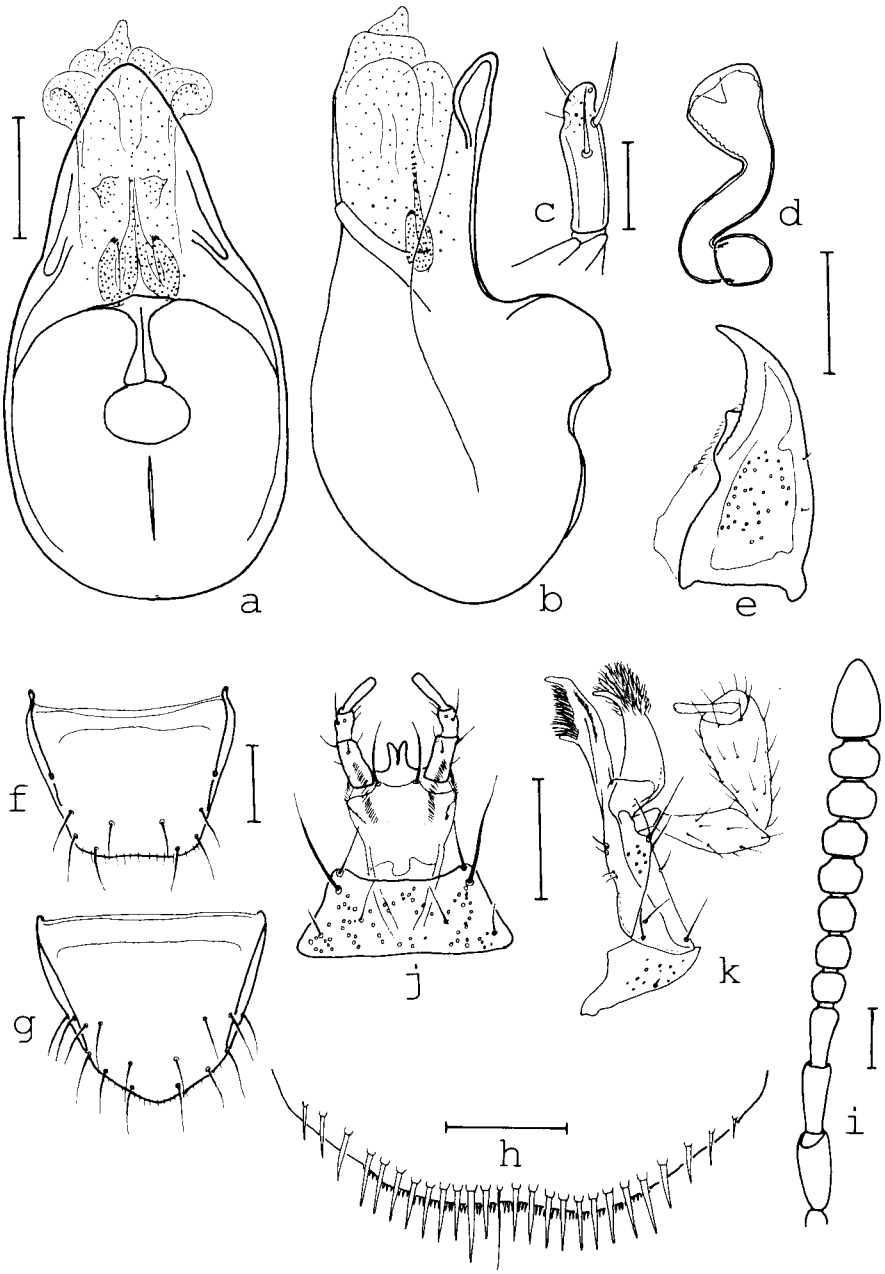

FIG. 1a–k

Geostiba formicarum (Woll.) median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); right mandible (e); ♂ tergite (f) and sternite (g) VIII; ♀ hind margin of sternite VIII (h); antenna (i); labium (j); maxilla (k); pubescence partly omitted in f–i. Scales: a–b, d–e, h–k: 0.1 mm; c: 0.05 mm; f–g: 0.25 mm.

pers. comm.) and therefore of no taxonomic significance and as Wollaston based his original description on several specimens without fixing a type, the three specimens in the Wollaston collection must be regarded as syntypes.

Further material studied: 18 ♂♂, 15 ♀♀: Madeira, Rabacal, 1050 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♂: Rabacal, 7.VIII.1975, leg. Vit (coll. Assing).

Description

Measurements: HW: 380–460, 408±22; PW: 450–590, 527±31; PL: 450–520, 485±20, EL: 250–320, 296±22; SL: 1100–1330, 241±72; TL: 3.0–3.6, 3.37±0.18.

Colour of body including the appendages reddish yellow to yellowish brown; tergites III–VI increasingly darkened, tergites III and IV mostly with slightly darker antero-central area, most of the surface of tergites V and especially VI, except for the hind margins, generally brown to blackish brown; tergite VII clearly lighter than tergite VI, often brownish in anterior half, tergite VIII reddish yellow; colour of the abdomen, on the whole, very variable.

Head clearly (0.76–0.80x) narrower than pronotum, with reticulate microsculpture and therefore subdued shine, punctation mostly shallow and indistinct; eyes present and functioning, their diameter equal to or slightly exceeding maximal width of first antennal segment; antennae longer than head (measured from anterior margin of labrum) and pronotum together (Fig. 1i); mouthparts as in Figs 1e, j, k.

Pronotum usually slightly wider (0.97–1.15) than long, with distinct reticulate microsculpture and often almost effaced punctation, caudadly directed pubescence short and rather inconspicuous.

Elytra much shorter (0.55–0.67x) and slightly wider than pronotum, with distinct granulose punctation, surface more shining than that of pronotum; alae reduced.

Abdomen increasing in width from segment III to V or VI, its maximal width slightly exceeding that of elytra; surface somewhat shining, but with clear reticulate microsculpture, and with rather sparse fine punctation.

♂: hind margin of tergite VIII slightly concave, that of sternite VIII convex to bluntly angled (Figs. 1f–g); median lobe and apex of paramere as in Figs. 1a–c.

♀: posterior margin of sternite VIII weakly concave with a conspicuous row of numerous bristles (Fig. 1h); spermatheca as in Fig. 1d.

Distribution and bionomics

Wollaston (1854) reports *G. formicarum*, an endemic of Madeira proper, from the southern slope of Pico Arieiro and from the Lombo das Vacas in the north of the island (1 and 2 specimens, respectively). We sieved numerous specimens from soil and leaf litter in *Laurus* stands near Rabacal (1050m), where it has also been collected by Lundblad (Jansson 1940) and Vit. It has been recorded at the end of March, in June and during the period from the end of July to the first half of August. The presumed affinity to ants (name!), which Wollaston (1854) concludes from the fact that he took his specimens "from beneath stones in the neighbourhood of ants' nests", appears very doubtful, particularly since *G. formicarum* does not possess any

of the external characters typical of other myrmecophilous Aleocharinae. Our own observations do not confirm any such relationship either.

COMMENTS

PALM's (1981a) description and illustrations do not refer to this species, but to the endemic *Atheta (Mocyta) sanguinolenta* (Wollaston, 1854), a light-coloured brachypterous species which PALM apparently mistook for a *Geostiba* and whose types the first author had the opportunity to study in the BMNH. Specimens of *A. sanguinolenta* in Palm's collection, which does not contain any true *G. formicarum*, are labelled '*Sipalia formicarum*'.

Geostiba filiformis (Wollaston, 1854) (Figs 2a–i)

Xenomma filiforme WOLLASTON, 1954: 545; 1857: 172; 1865: 457.
Geostiba filiformis (Wollaston) FAUVEL, 1897: 338.
nec(?) *Sipalia filiformis* (Wollaston), JANSSON 1940: 16.
Sipalia waldeni PALM, 1981: 298; syn. nov.
Sipalia israelsoni PALM, 1981: 298; syn. nov.
nec *Sipalia filiformis* (Wollaston), PALM, 1981: 297.

TYPES: Lectotype: ♀, '*Xenomma filiforme* Woll., type', here designated and labelled accordingly, in coll. Wollaston (BMNH).

Paralectotype: 1 ♀, in coll. Wollaston (BMNH).

There were three syntypes (see remarks below *G. formicarum*) in Wollaston's collection, one of them heavily damaged. According to the original description two of the specimens were collected on Porto Santo and one on Madeira proper.

Further material studied: 4 ♂♂, 6 ♀♀: Porto Santo, Pico do Castelo, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle; 28 ♂♂, 31 ♀♀: Porto Santo, Pico Juliana, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♂, 1 ♀: Porto Santo, Pico Branco, H. Franz leg.; 1 ♀: Porto Santo, Pico Juliana, 3.II.1978, Waldén leg., Allotypus '*Sipalia israelsoni*' det. Thure Palm, coll. Palm (MZEL); 1 ♀: Madeiro, Faja da Pedro, 11.II.1978, Waldén leg., Holotypus '*Sipalia waldeni*' det. Thure Palm, coll. Palm (MZEL); 7 Ex.: Porto Santo, Pico Branco, 10.IV.1970, leg. & coll. Franz.

DESCRIPTION

Measurements: HW: 345–365, 355±7; PW: 435–500, 474±16; PL: 405–470, 434±19; EL: 280–350, 308±16; SL: 1100–1230, 1164±44; TL: 3.0–3.5, 3.29±0.11.

Colour of body including the appendages yellow to reddish yellow; abdomen dorsally darkened to various extents ranging from only slightly darker hue on central area of tergites III to V and on anterior half of tergites VI and VII to almost completely blackish or darkbrown colour of tergites III to VII leaving only the hind margins reddish yellow, anterior half of tergite VIII sometimes darkened, too.

Head with sides less rounded than in *G. formicarum*, clearly (0.72–0.79x) narrower than pronotum, with reticulate microsculpture (similar to *G. formicarum*), punctation usually distinct but often shallow; eyes present and functioning (ca. 6–8 ommatidia), their diameter (ca. 70 µm) exceeding maximal width of first antennal segment; antennae somewhat shorter than head and pronotum together (Fig. 2i).

Pronotum a little wider (1.07–1.14) than long, with distinct reticulate microsculpture; punctation variable, with transitions from deep and distinct to shallow and fine; pubescence even shorter and less conspicuous than in *G. formicarum*.

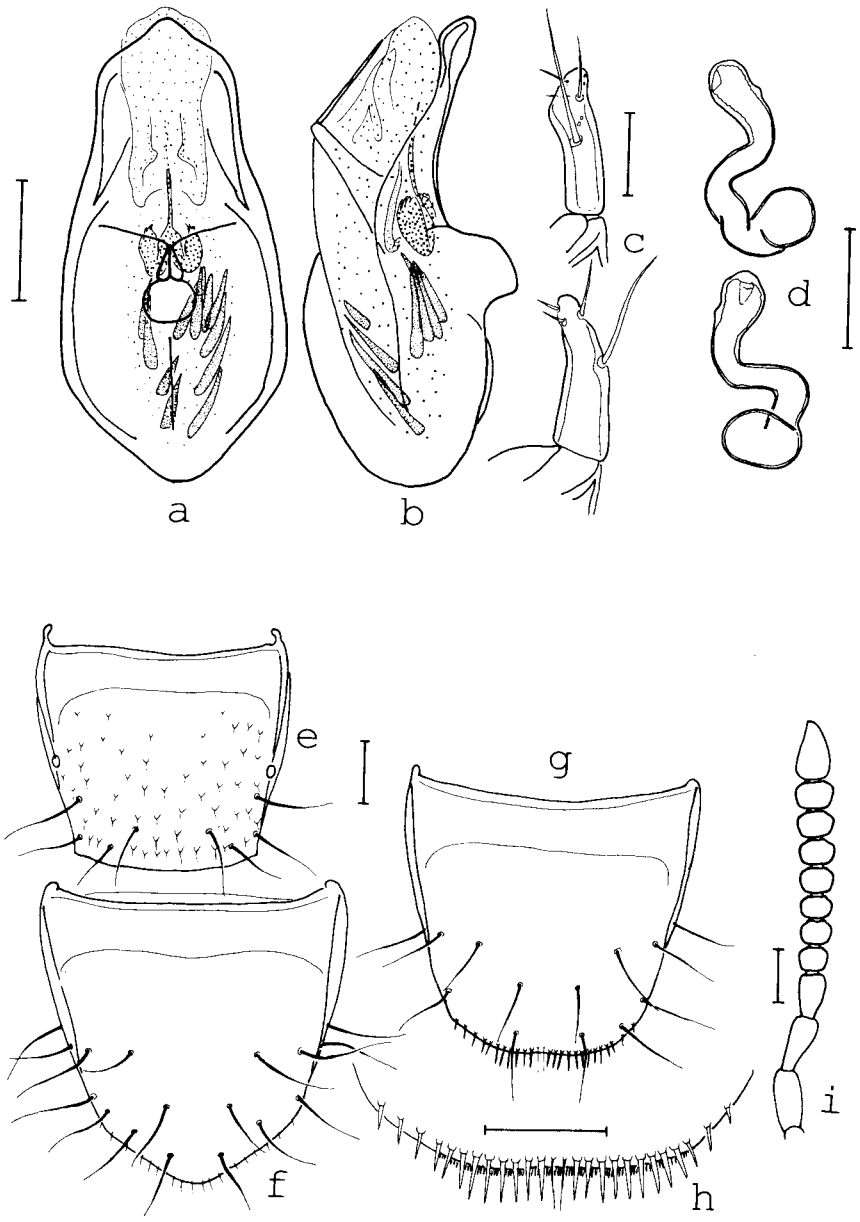

FIG. 2a–i
Geostiba filiformis (Woll.) median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; ♀ sternite VIII (g–h); antenna (i); pubescence partly omitted in f–i. Scales: a–b, d–i: 0.1 mm; c: 0.05 mm.

Elytra much shorter (0.68–0.75x) than pronotum, but relatively longer than in *G. formicarum*; maximal width only indistinctly exceeding that of pronotum; with usually distinct granulose punctation and with reticulate microsculpture; ♂♂ with a characteristic longitudinal elevation on anterior half of both elytra near suture; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; surface with sparse fine punctation and somewhat shining, but with clear isodiametric to transverse microreticulation.

♂: tergites VII and VIII with pronounced granulose punctures; hind margin of tergite VIII slightly convex, that of sternite VIII bluntly angled (Figs. 2e–f); aedeagus with conspicuous spines in internal sac, median lobe and apex of paramere as in Figs. 2a–c.

♀: posterior margin of sternite VIII ± convex, slightly concave or straight in the middle, with a row of numerous bristles (Figs 2g–h); spermatheca as in Fig. 2d.

Distribution and bionomics

G. filiformis appears to be the only Madeiran *Geostiba* occurring on both Madeira proper, where it is apparently very rare, and Porto Santo. Wollaston (1854) collected his Madeiran specimen above Funchal and the specimens from Porto Santo "beneath stones ... on ... grassy mountain slopes" in April and "early spring". The records indicated by Jansson (1940) obviously refer to a different species, since what he considers to be *G. filiformis* is only 1.9–2.4 mm long. We sieved our specimens, some of them still immature, together with larvae that apparently belong to the species, on April 1 from deep and moist leaf litter and under logs of dead wood on the northern slopes of Pico Juliana and Pico do Castelo (Porto Santo).

Comments

In his account of Madeiran *Geostiba* Palm (1981a) clearly misiterprets *G. filiformis*, although he states that he has seen the type. His description, illustrations and records of *G. filiformis* as well as the corresponding material in his collection refer to an as yet undescribed species dealt with below. In addition, he describes *G. israelsoni* n. sp. from Porto Santo without commenting on the fact that Wollaston (1854) reports *G. filiformis* from the same island in his original description. Moreover, Palm (1981a) describes another new species, *G. waldeni* n. sp., on the basis of one ♀ without antennae stating that *G. waldeni* is very similar to *G. israelsoni*, but "ein wenig grösser, das [!] Hinterleib in grösserem Umfang verdunkelt und besonders durch die Form der Spermatheca distinkt abweichend" (p. 298). Our examination of the types revealed that *G. israelsoni* (Palm) is, without doubt, conspecific with *G. filiformis* (Woll.). Similarly, with regard to all the characters available the (damaged) type of *G. waldeni* is well within the range of variability of *G. filiformis*, and Palm's differential diagnosis is based on two of the most variable characters as well as on inadequate drawings of the spermathecae. Therefore, we regard both *G. israelsoni* (Palm) and *G. waldeni* (Palm) as junior synonyms of *G. filiformis* (Woll.).

Geostiba arieiroensis spec. nov. (Figs. 3a–i)

Sipalia filiformis (Woll.), PALM, 1981: 297f.

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing.

Paratypes: 42 ♂♂, 32 ♀♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 81 ♂♂, 88 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 10 Ex.: Pico Arieiro, 1600 m, 7.II.1978, leg. & coll. Palm (MZEL); 4 Ex.: Pico Arieiro, 23.IV.1978, leg. & coll. Palm (MZEL); 1 ♂: Pico Arieiro, Rib. das Calas, 4.IV.1967, leg. & coll. Franz.

DESCRIPTION

Measurements: HW: 325–370, 354±12; PW: 390–425, 411±9; PL: 345–370, 362±8; EL: 225–245, 233±7; SL: 980–1090, 1024±47; TL: 2.5–2.8, 2.66±0.08.

Colour of body including the appendages yellowish with most of tergites V and especially VI usually clearly darker, light brown to blackish, sometimes also central area of tergites III and IV and anterior half of tergite VII slightly darkened.

Head narrower than pronotum (0.82–0.90x), but relatively wider than in the two preceding species, with pronounced reticulate microsculpture and subdued shine (similar to *G. formicarum*), punctation usually distinct, but often shallow; eyes present and functioning (mostly 4 ommatidia), but small, their diameter (40–50 µm) shorter than maximal width of first antennal segment; antennae subequal in length to or slightly shorter than head and pronotum together (Fig. 3e).

Pronotum a little wider (1.12–1.17) than long, its maximal width a short distance behind the anterior angles; with reticulate microsculpture similar to that of head; punctation usually very fine and indistinct; pubescence short and inconspicuous; ♂♂ often with wide and shallow longitudinal impression on disk.

Elytra considerably shorter (0.60–0.67x) than pronotum; maximal width subequal to that of pronotum; microsculpture much weaker than on head and pronotum, therefore surface of shiny appearance; with distinct granulose punctation; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; microreticulation and punctation as in *G. filiformis*.

♂: hind margin of tergite VIII with pronounced concavity, posterior margin of corresponding sternite rounded to obtusely pointed (Figs. 3f–g); median lobe with conspicuous ventral process; median lobe and apex of paramere as in Figs. 3a–c.

♀: hind margin of tergite VIII slightly concave, straight or weakly rounded; sternite VIII posteriorly with shallow concavity and an interrupted row of long bristles (Figs 3h–i); spermatheca as in Fig. 3d.

DISTRIBUTION AND BIONOMICS

So far this new species has only been recorded from the type locality (name!) in early spring (February through April). We extracted our specimens from deep litter layers and soil in stands of *Erica* sp. (*arborea* or *scoparia*) and *Vaccinium padifolium* in both northern and southern expositions. On April 3, the ovaries of several ♀♀ contained a mature egg.

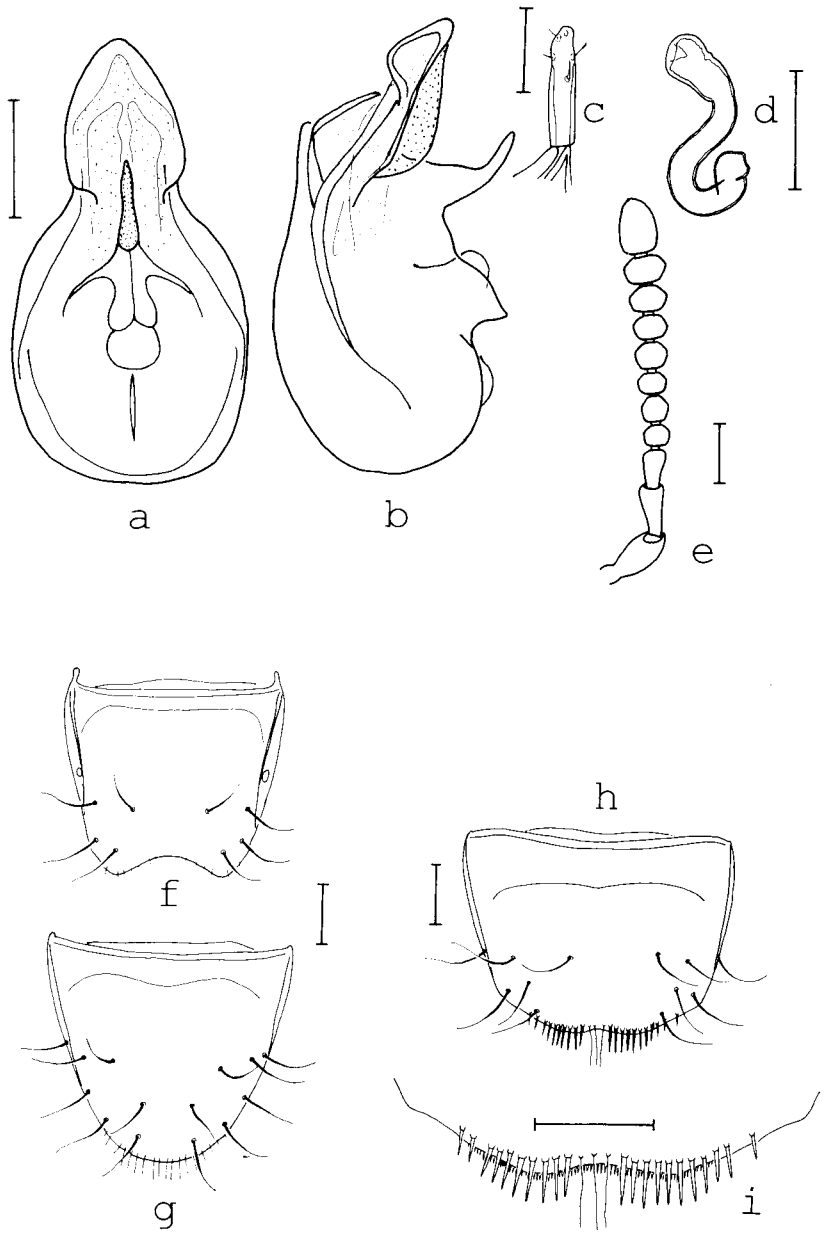

FIG. 3a–i.

Geostiba arieiroensis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d–i: 0.1 mm; c: 0.05 mm.

Geostiba ruivomontis spec. nov. (Figs. 4a–f)

TYPES: Holotype: ♂, Madeira, Ach. do Teixeira, 1350 m, 6.IV.1993, leg. & coll. Assing.

Paratypes: 18♂♂, 8 ♀♀: Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Assing & Wunderle; 76♂♂, 52 ♀♀: Madeira, Ach. do Teixeira, 1350 m, 6.IV.1993, leg. & coll. Assing & Wunderle; MHNG.

DESCRIPTION

Measurements: HW: 320–365, 348±10; PW: 370–420, 400±13; PL: 320–365, 349±12; EL: 210–230, 225±8; SL: 920–1050, 986±32; TL: 2.2–2.8, 2.53±0.15.

In external characters highly similar to the preceding species. It differs from *G. arieiroensis* in its on average slightly smaller body size, in that tergite VII is usually also darkened and of about the same colour as tergite V, in that the microreticulation of head and pronotum is often less distinct and in that the ♂♂ lack the longitudinal impression on the disk of the pronotum. The most reliable differences are, however, found in the shape of the sclerites of the abdominal segment VIII and the genitalia.

♂: hind margin of tergite VIII ± straight or slightly concave (Fig. 4e), that of sternite VIII strongly convex (Fig. 4f); median lobe with characteristic ventral process (Figs. 4a–b), apex of paramere as in Fig. 4c.

♀: posterior margin with shallow concavity, similar to *G. arieiroensis*; spermatheca as in Fig. 4d.

DISTRIBUTION AND BIONOMICS

At present, *G. ruivomontis* is only known from the northeastern slope of the Pico Ruivo (name!) near the Achada do Teixeira. We collected it from debris and moss in the shade of big rocks at 1600 m and from litter in a stand of old *Erica* sp. in northern exposition at 1350 m.

Geostiba bicacanaensis spec. nov. (Figs. 5a–f)

TYPES: Holotype: ♂, Madeira, Bica da Cana, 1550 m, 29.III.1993, leg. & coll. Assing.

Paratypes: 62 ♂♂, 37 ♀♀: Madeira, Bica da Cana, 1550 m, 29.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 315–350, 336±9; PW: 370–400, 385±9; PL: 320–370, 344±11; EL: 210–245, 223±10; SL: 860–1020, 954±47; TL: 2.1–2.6, 2.34±0.13.

In external characters also highly similar to the two preceding species. *G. bicacanaensis* is, on average, slightly smaller, its pronotum generally a little narrower; length of eyes ca. 45–55 µm, with 4–5 ommatidia; colour of tergites as in *G. ruivomontis*; microsculpture of head and pronotum as in *G. arieiroensis*; ♂♂ without longitudinal impression on disk of pronotum. For a safe identification of this species an examination of the genitalia, particularly of the males, is essential.

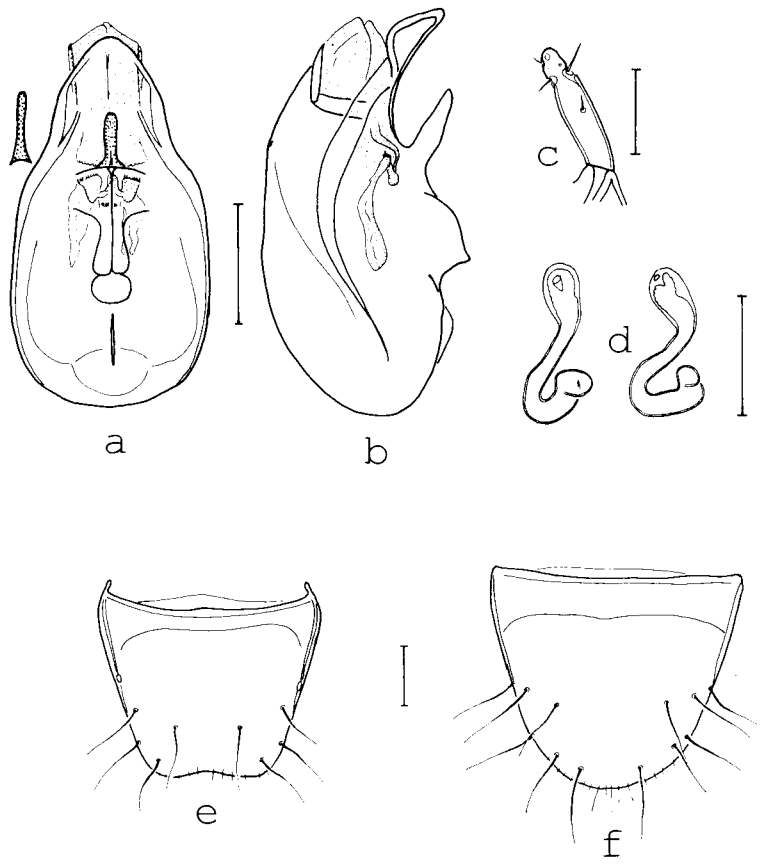

FIG. 4a–f

Geostiba ruivomontis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in e–f. Scales: a–b, d–f: 0.1 mm; c: 0.05 mm.

♂: hind margin of tergite VIII straight or very shallowly concave (Fig. 5e), the corresponding sternite rounded posteriorly (Fig. 5f); median lobe without ventral process (Figs. 5a–b), apex of paramere as in Fig. 5c.

♀: posterior margin of sternite VIII slightly concave to almost straight, similar to *arieiroensis*; spermatheca as in Fig. 5d.

DISTRIBUTION AND BIONOMICS

G. bicacanaensis has hitherto only been recorded from the type locality. It was collected on the northern slope of Bica da Cana (name!) from deep litter in stands of *Erica* sp. and *Vaccinium padifolium*. The gonads of several ♀♀ contained a mature egg.

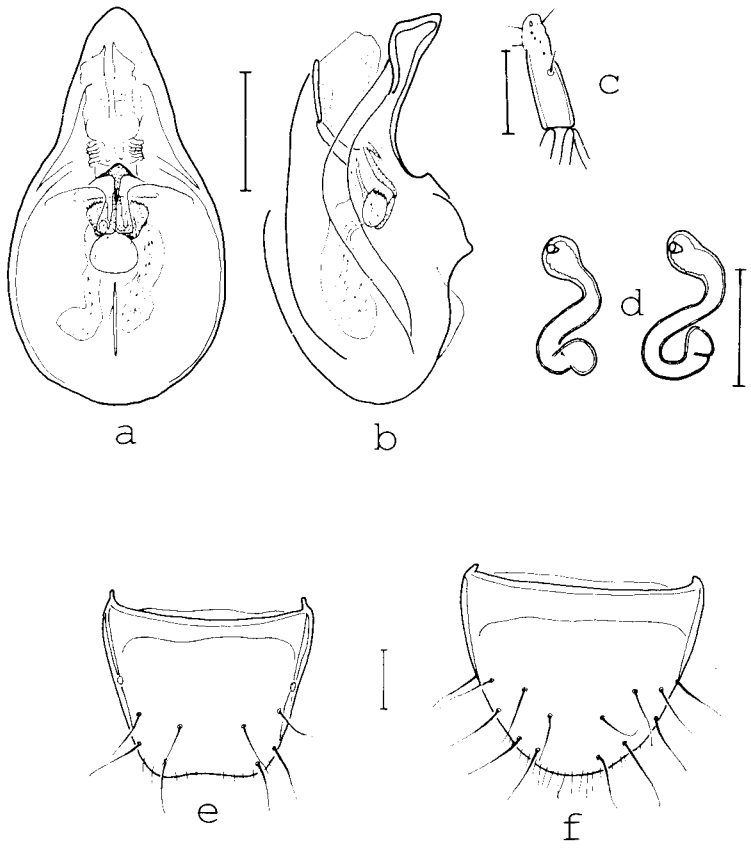

FIG. 5a–f

Geostiba bicanaensis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in e–f. Scales: a–b, d–f: 0.1 mm; c: 0.05 mm.

Geostiba portosantoi Franz, 1981 (Figs 6a–h, 8a)

Geostiba portosantoi FRANZ, 1981: 329ff.

TYPES: Holotype: ♂, Porto Santo, Pico Juliana, leg. & coll. Franz.
Paratype: 1 ♀, same data as holotype, leg. & coll. Franz.
FURTHER MATERIAL STUDIED: 22 ♂♂, 15 ♀♀: Porto Santo, Pico Juliana, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 250–275, 262±5; PW: 310–350, 334±10; PL: 300–350, 327±10; EL: 210–245, 231±8; SL: 770–940, 863±46; TL: 2.0–2.5, 2.39±0.12.

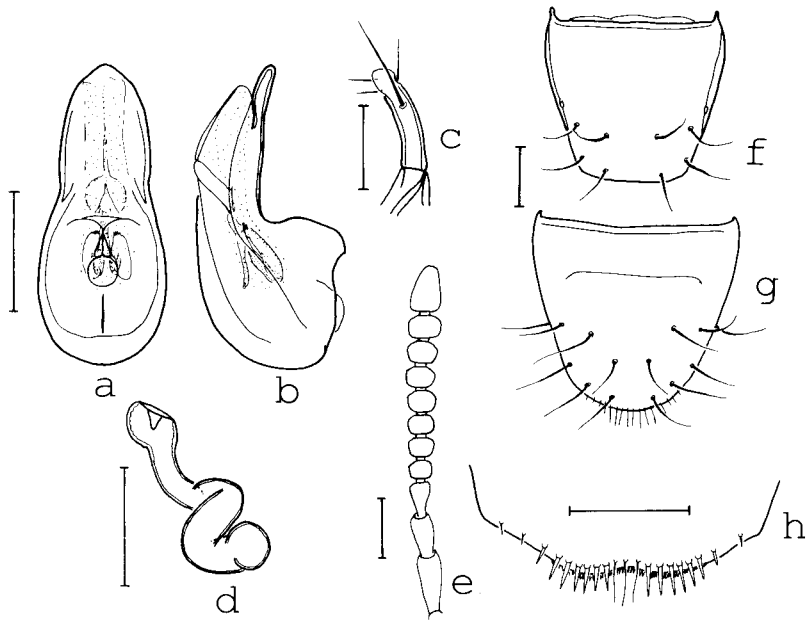

FIG. 6a–h.

Geostiba portosantoi Franz: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Colour of body including appendages and tergites more or less uniformly yellowish to reddish yellow.

Head slender, suboval (Fig. 8a), clearly narrower than pronotum (0.74–0.81x) and than in *G. arieiroensis* and allied species; with variable, but usually weaker microreticulation and therefore more shine than in *G. arieiroensis*; punctation shallow and sparse; length of antennae slightly exceeding that of head and pronotum together (Fig. 6e); small eyes (maximal diameter ca. 40 µm) present and functioning, with usually 4 ommatidia. (Note that FRANZ (1981) states that this species is blind.)

Pronotum with lateral margins almost subparallel in the middle, about as wide as long (1.0–1.05x), smaller than in the preceding species and somewhat narrower than elytra; microsculpture and punctation similar to those of head; pubescence short, sparse and inconspicuous.

Elytra considerably shorter (0.68–0.74x) than pronotum, microsculpture similar to, sometimes even more distinct than, that of head and pronotum; with granulose punctation, which is, however, spaced more sparsely than in *G. arieiroensis*; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; dorsal surface with isodiametric microreticulation similar to that of elytra and with fine and sparse punctation.

♂: hind margin of tergite VIII ± straight, that of the corresponding sternite rounded (Figs. 6f–g); median lobe and apex of paramere as in Figs. 6a–c.

♀: hind margin of tergite VIII weakly rounded, sternite VIII weakly concave (Fig. 6h); spermatheca as in Fig. 6d.

DISTRIBUTION AND BIONOMICS

G. portosantoi is endemic to Porto Santo, where it has only been recorded from the northern slope of Pico Juliana. FRANZ (1981) sieved the type material under stones and dead trunks of *Pinus* sp. We collected our specimens from more or less isolated spots with deep and still rather moist litter and soil. Since the distribution of *G. portosantoi* is apparently restricted to a (forest) area of only a few hectares, where — according to our observations — suitable conditions are scarce, this species must be considered highly endangered. Small scale deforestation or even a fire might result in its extinction.

Geostiba brancomontis spec. nov. (Figs. 7a–c, 8b)

TYPES: Holotype: ♂, Porto Santo, Pico Branco, Gipfelbereich, 13.IV.1968, leg. and coll. H. Franz.

Paratypes: 1 ♂, 2 ♀♀: same data as holotype, coll. Assing & Wunderle.

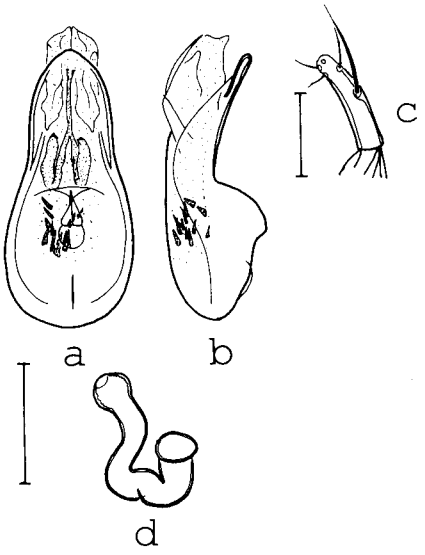

FIG. 7a–d

Geostiba brancomontis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d). Scales: a–b, d: 0.1 mm; c: 0.05 mm.

DESCRIPTION

Measurements: HW: 260–275; PW: 310–335; PL 290–305; EL: 200–215; SL: 750–770.

Body entirely yellowish; in size and general appearance highly similar to the following 4 species (see below), from which it is, however, externally distinguished by the presence of functioning eyes (maximal diameter ca. 40 µm) with 4 ommatidia. *G. brancomontis* differs from *G. portosantoi* especially in the distinctly shorter head (measured from anterior margin of clypeus to posterior margin of head), which is about as wide as long in the former and clearly longer than wide (ca. 1.15x) in the latter (Fig. 8b). Compared with *G. portosantoi* this species is also on the whole even smaller, and the pronotum is on average narrower and shorter with its maximal width a short distance behind the anterior angles and its sides more clearly converging posteriorly.

♂: hind margin of tergite VIII obtusely pointed, that of the corresponding sternite convex, similar to *portosantoi*; internal sac with sclerotized spines (Fig. 7a–b), apex of paramere as in Fig. 7c.

♀: hind margin of tergite VIII convex or very weakly obtuse, posterior margin of sternite VIII with weak concavity centrally; spermatheca smaller than in *portosantoi* and of different shape (Fig. 7d).

DISTRIBUTION AND BIONOMICS

G. brancomontis is endemic to Porto Santo and apparently exclusively inhabits the Pico Branco (name!). We have not seen the type locality during our visit to the island. It would be interesting to examine if suitable biotopes and this species still exist.

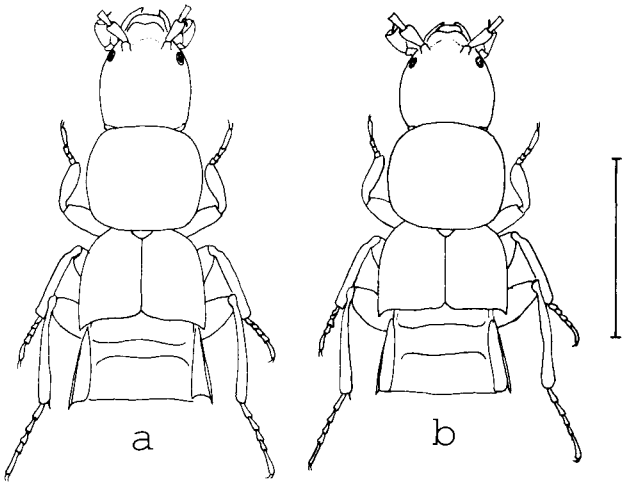

FIG. 8a–b
Habitus (forebody) of *Geostiba portosantoi* Franz (a) and *G. brancomontis* spec. nov. (b). Scale: 0.5 mm.

Geostiba lindrothi Franz, 1981 (Figs. 9a–h)

Geostiba lindrothi FRANZ, 1981: 329.
Sipalia lindrothi PALM, 1981a: 297.
Geostiba carli nom. nov. for *Sipalia lindrothi* PALM, 1981b: 447; syn. nov.

TYPES: Holotype: ♀, Madeira, Queimadas, 3.IV.1967, leg. & coll. Franz.
Paratype: 1 ♀: same data as holotype, leg. & coll. Franz.
Types of *G. carli* Palm: Holotype ♂, Madeira, Ribeira do Inferno (1150 m), 10.VIII.1935, leg. & coll. Lundblad (SMNH). Paratypes: 11 Ex., same data as holotype; 1 Ex., Caramujo (1250 m), 6. — 14.VIII.1935, leg. & coll. Lundblad (SMNH); 1 ♀: Madeira, Funchal, 500-1200 m, Terr. Luta, Febr. 1966, Palm (MZEL)

FURTHER MATERIAL STUDIED:
13 ♂♂, 6 ♀♀: Madeira, Caramujo, 1300 m, 4.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

COMMENTS

An examination of the type material of *Geostiba lindrothi* Franz and of *G. carli* Palm revealed that both taxa are conspecific. (It should be noted that the types of *G. carli* deposited in the SMNH carry the handwritten label 'Sipalia lundbladi Palm', apparently an *in litteris* name; the specimens are without doubt identical with those mentioned in the original description of *G. carli* or *Sipalia lindrothi*, respectively.) Both *Geostiba lindrothi* Franz and *Sipalia lindrothi* Palm were described in 1981 in the same journal. Since PALM (1981b), as the first revising author, suggested the new

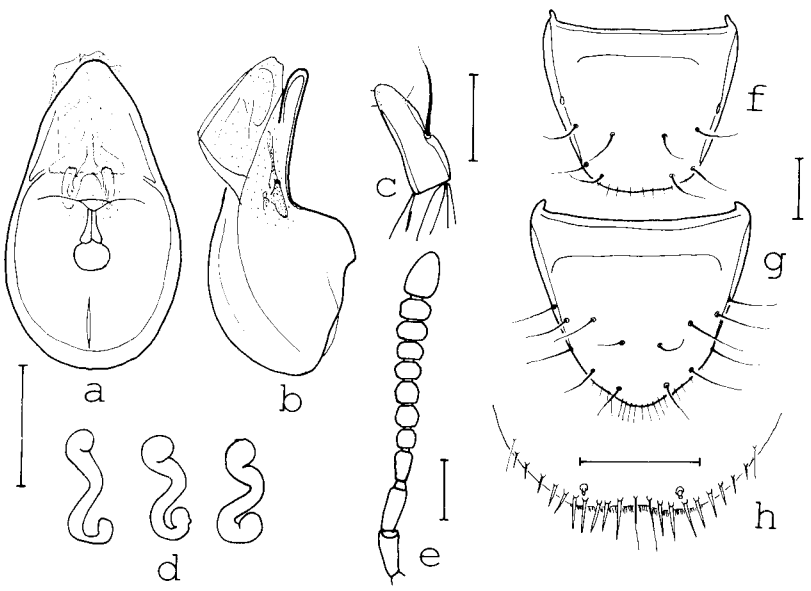

FIG. 9a–h.
Geostiba lindrothi Franz: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales a–b, d–h: 0.1 mm; c: 0.05 mm.

name *Geostiba carli* for his *Sipalia lindrothi* shortly afterwards and thus implicitly recognized the priority of *G. lindrothi* Franz, his *G. carli* must be considered a synonym of the former.

DESCRIPTION

Since this and the following four species of blind small subterraneous *Geostiba* can only be distinguished on the basis of the sclerites of abdominal segment VIII and the genitalia, only the first will be fully described. The descriptions of the remainder will focus on differential characters.

Measurements: HW: 250–275, 259±6; PW: 285–310, 301±7; PL: 275–305, 327±10; EL: 180–215, 194±7; SL: 710–830, 777±29; TL: 1.9–2.4, 2.18±0.16.

Colour of body including appendages entirely yellowish with only the antero-central area of tergites III-VI occasionally with a slightly darker hue.

Body even smaller and, on the whole, slenderer than in *G. portosantoi*.

Head narrower than pronotum (0.83–0.88x), but relatively wider than in the *G. portosantoi*. Surface somewhat shiny, but with distinct, yet variable microreticulation and mostly rather fine, sparse punctation; eyes rudimentary and without ommatidia, their maximal diameter ca. 27–30 µm; antennae about as long as head and pronotum together (Fig. 9e).

Pronotum small, as wide as or slightly wider than long (1.0–1.1x) with maximal width in anterior half; microreticulation similar to that of head, punctation very fine and sometimes indistinct; pubescence short and inconspicuous.

Elytra much shorter (0.63–0.70x) than and about as wide as pronotum; microsculpture variable, reticulate, often superficial; punctation granulose and sparse; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; dorsal surface with isodiametric microreticulation similar to that of elytra and with fine and sparse punctation.

♂: hind margin of tergite VIII straight to weakly rounded (Fig. 9f), that of sternite VIII obtusely pointed (Fig. 9g); median lobe as in Figs. 9a–b; apex of paramere with one long and three short setae (Fig. 9c).

♀: hind margin of tergite VIII weakly convex, sternite VIII posteriorly with weak concavity (Fig. 9h); spermatheca as in Fig. 9d.

DISTRIBUTION AND BIONOMICS

So far *G. lindrothi* is only known from the localities indicated above. FRANZ (1981) sieved the types from *Laurus* trunks. We extracted our specimens from soil in a stand of old *Erica* sp. in northern exposition. Two of the females had mature eggs in their abdomen.

Geostiba graminicola spec. nov. (Figs. 10a–h)

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1750 m, 26.III.1993, leg. & coll. Wunderle.
Paratypes: 24 ♂♂, 22 ♀♀: Madeira, Pico Arieiro, 1750 m, 26.III.1993, leg. & coll. Assing & Wunderle, MHNG.

Description

Measurements: HW: 270–290, 276±5; PW: 300–350, 320±8; PL: 285–320, 302±8; EL: 190–210, 197±6; SL: 740–910, 809±45; TL: 2.0–2.6, 2.25±0.15.

In colour and external morphology highly similar to *G. lindrothi*; the antennae are less slender with segments 4–6 clearly more transverse than in the preceding species (Fig. 10e); rudiments of eyes variable in size, often even smaller than in the preceding species (maximal diameter 20–27 µm).

♂: hind margin of tergite and sternite VIII similar to *G. lindrothi* (Figs. 10f–g); median lobe as in Figs. 10a–b; apex of paramere with two long and two short setae (Fig. 10c)

♀: hind margin of tergite VIII ± straight, that of sternite with pronounced concavity (Fig. 10h); spermatheca as in Fig. 10d.

Distribution and bionomics

G. graminicola has only been recorded from the type locality, where it was collected in the shade of a big rock. A few specimens were found under stones, the majority, however, was sieved from soil and the roots of the grass vegetation (name!). The abdomen of one of the ♀♀ contained a mature egg.

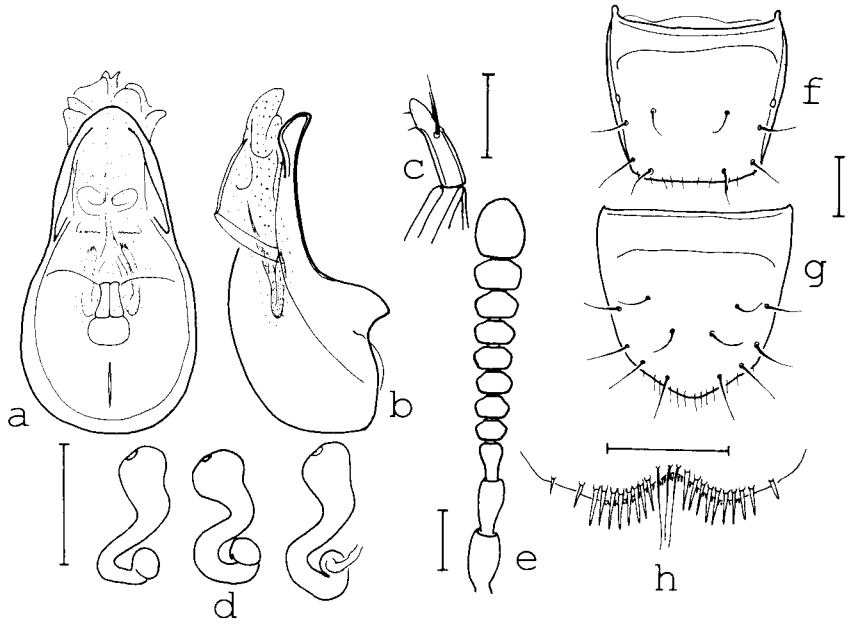

Fig. 10a–h.
Geostiba graminicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Geostiba vaccinicola spec. nov. (Figs. 11a–h)

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Wunderle. Paratypes: 5 ♂♂, 6 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 2 ♂♂, 1 ♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 2 ♂♂: Madeira, Pico Arieiro, Fonte Vermelha, 16.IV.1970, leg. & coll. Franz.

DESCRIPTION

Measurements: HW: 265–290; PW: 300–335; PL: 285–330; EL: 190–210; SL: 770–880; TL: 2.1–2.5.

Colour and external morphology as in *G. lindrothi*.

♂: hind margin of tergite and sternite VIII similar to *G. lindrothi* (Figs. 11f–g); median lobe slenderer in ventral view and larger (Figs. 11a–b); apex of paramere with one long and three short setae (Fig. 11c).

♀: hind margin of sternite VIII similar to *G. lindrothi* (Fig. 11h); spermatheca stouter and larger than in *G. lindrothi* (Fig. 11d).

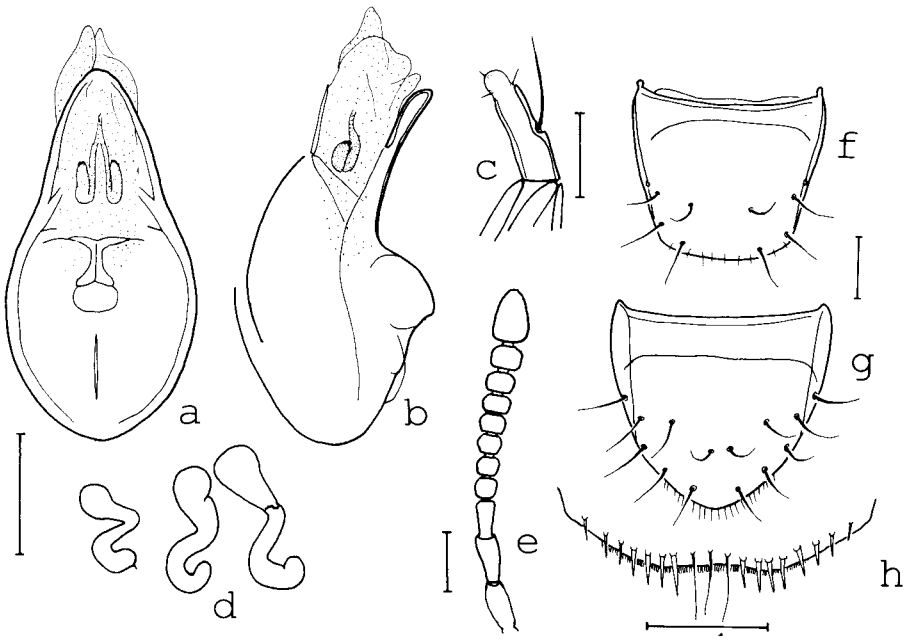

FIG. 11a–h.
Geostiba vaccinicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales a–b, d–h: 0.1 mm; c: 0.05 mm.

DISTRIBUTION AND BIONOMICS

The type specimens of this subterraneous blind species were sieved from deep litter and extracted from soil in stands of *Vaccinium padifolium* (name!) and *Erica* sp. in northern exposition below the Pico Arieiro.

Geostiba lauricola spec. nov. (Figs. 12a–d)

TYPES: Holotype: ♂, Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Wunderle.
Paratypes: 5 ♂♂, 2 ♀♀: Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 260–280; PW: 300–325; PL: 285–310; EL: 200–215; SL: 770–850; TL: 2.0–2.3.

Colour and external morphology as in *G. lindrothi*.

♂: hind margin of tergite and sternite VIII as in *G. lindrothi*; median lobe slenderer (Figs 12a–b); apex of paramere long and slender, with three short and one long setae, the latter situated nearer to base than in *G. lindrothi* (Fig. 12c).

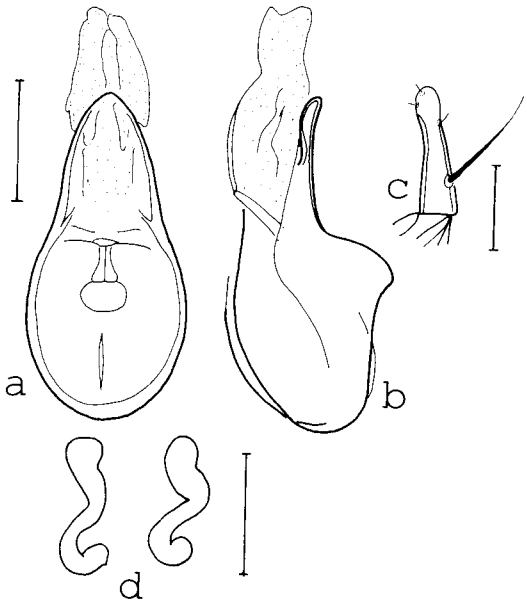

FIG. 12a–d.
Geostiba lauricola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d): Scales: a–b, d: 0.1 mm; c: 0.05 mm.

♀: hind margin of sternite VIII as in *G. lindrothi*; spermatheca slightly larger and stouter than in *G. lindrothi* (Fig. 12d).

DISTRIBUTION AND BIONOMICS

The type specimens were extracted from soil and deep litter layers in a *Laurus* stand (name!) on the ascent from Ribeira da Janela to Fanal in the northwest of Madeira.

Geostiba caligicola spec. nov. (Figs 13a–h)

TYPES: Holotype: ♂, Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Wunderle.

Paratypes: 3 ♂♂, 4 ♀♀: Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 255–265; PW: 285–295; PL: 270–290; EL: 170–185; SL: 720–775.

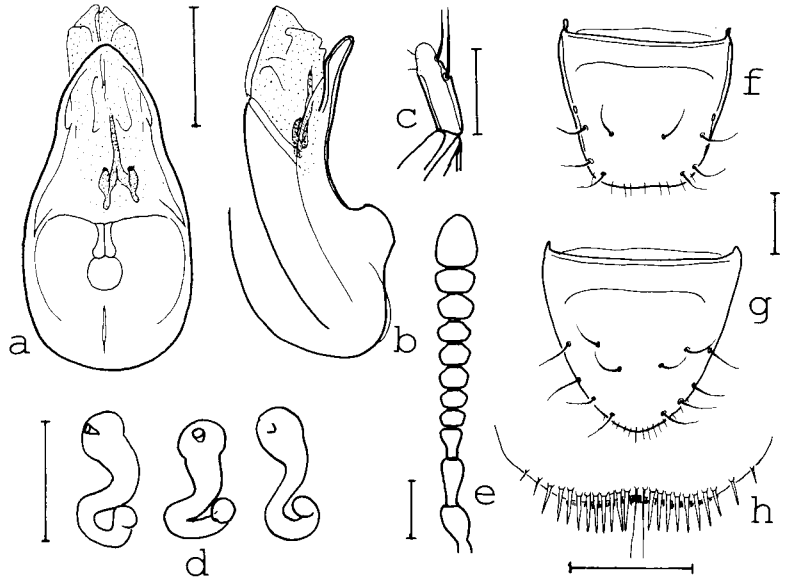

FIG. 13a–h.
Geostiba caligicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Colour and general external morphology as in *G. lindrothi*; antennae similar to *G. graminicola*, but shorter with the first three antennomeres less elongate (Fig. 13e).

♂: hind margin of tergite and sternite VIII as in *G. lindrothi* (Figs 13f–g); median lobe in lateral view apically slightly slenderer than in *G. graminicola* (Figs 13a–b); apex of paramere with setal pattern similar to *G. graminicola*, but the apical long seta usually longer than in that species (Fig. 13c).

♀: hind margin of sternite VIII as in *G. lindrothi* (Fig. 13h); spermatheca as in Fig. 13d.

DISTRIBUTION AND BIONOMICS

The type series was sieved below the Pico Ruivo near Achada do Teixeira from moss and litter in the shadow (name!) of rocks.

Geostiba occulta spec. nov. (Figs. 14a–i)

TYPES: Holotype: ♂, Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing.
Paratypes: 2 ♂♂, 8 ♀♀: Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW 405–430; PW 480–530; PL: 480–530; EL: 350–380; SL: 1330–1404; TL: 3.4–3.9.

G. occulta is the largest of all blind species of Madeiran *Geostiba*.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

Head narrower than pronotum (0.81–0.84x); surface with distinct microreticulation and mostly rather fine, sparse punctation; eyes reduced to minute rudiments, without ommatidia; antennae slender, longer than head and pronotum together (Fig. 14e).

Pronotum as wide as long (0.99–1.03x) with maximal width in anterior half, microreticulation similar to that of head, punctation even finer than on head; pubescence short and inconspicuous.

Elytra much shorter (0.69–0.75x) and a little wider than pronotum; microsculpture reticulate, weaker than on head and pronotum, surface therefore more shiny; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct isodiametric microreticulation and sparse and fine punctation.

♂: hind margin of tergite VIII deeply concave; sternite VIII rounded posteriorly (Figs. 14f–g); median lobe and paramere as in Figs. 14a–c.

♀: hind margins of tergite and sternite VIII shallowly concave centrally (Figs. 14h–i); spermatheca as in Fig. 14d.

DISTRIBUTION AND BIONOMICS

The type specimens were found under the same conditions and in the same locality as *G. lauricola*.

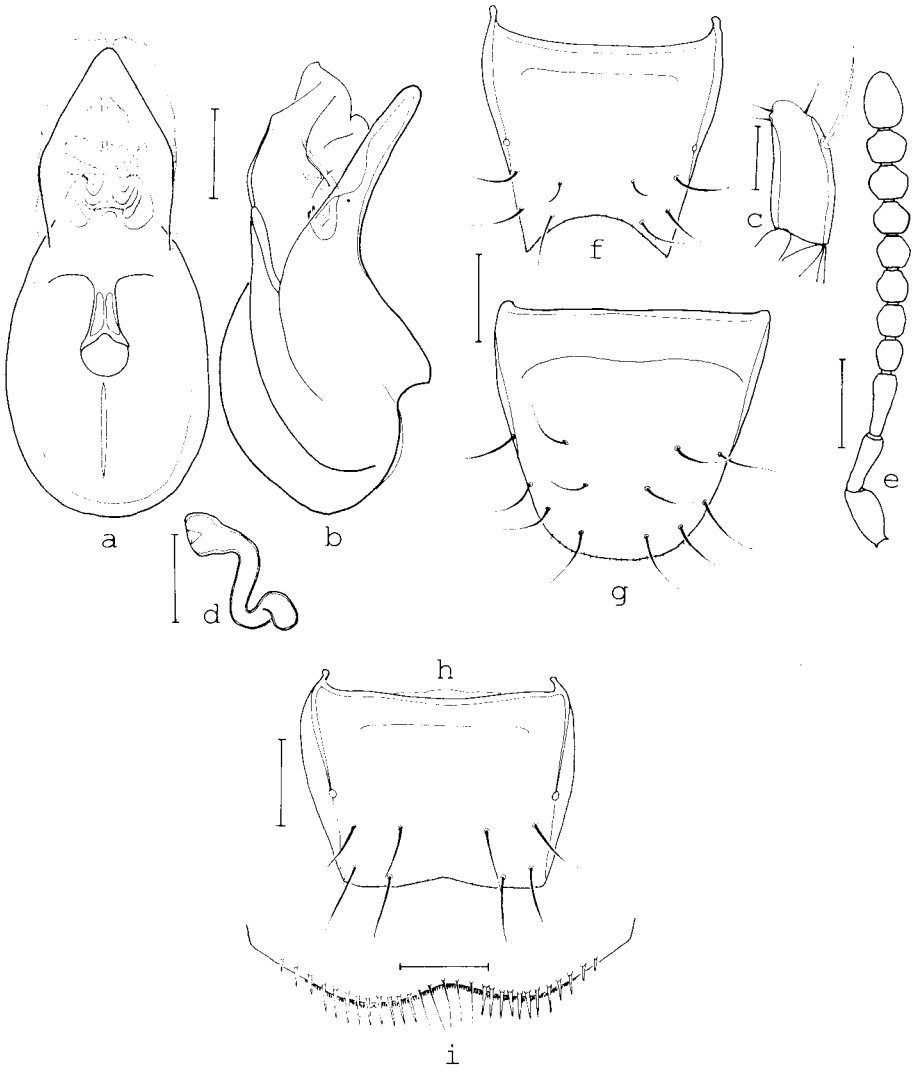

FIG. 14a–i
Geostiba occulta spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀ tergite and sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d, i: 0.1 mm; e–h: 0.2 mm; c: 0.05 mm.

Geostiba endogea spec. nov. (Figs. 15a–i)

TYPES: Holotype: ♂, Madeira, Caramujo, 1220 m, 29.III.1993, leg. & coll. Wunderle.
Paratypes: 3 ♂♂, 4 ♀♀: Madeira, Caramujo, 1220 m, 29.III.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♀: Madeira, Rosario, 800 m, 5.IV.1993, leg. & coll. Assing & Wunderle.

DESCRIPTION

Measurements: HW: 345–365, 353±7; PW: 405–455, 429±13; PL: 375–425, 404±13; EL: 290–325, 310±10; SL: 1090–1220, 1159±44; TL: 3.0–3.3.

In general appearance *G. endogea* resembles *G. occulta*, but it is considerably smaller than the latter; on the other hand it clearly exceeds the species of the *G. lindrothi* group in body size.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

Head narrower than pronotum (0.80–0.85x); surface somewhat shiny, with apparent, yet superficial microreticulation and very fine, sparse punctation; eyes reduced to minute rudiments; antennae less slender than in *G. occulta*, a little shorter than head and pronotum together (Fig. 15e).

Pronotum slightly wider than long (1.05–1.10x) with maximal width near the middle; microreticulation and punctation similar to that of head; pubescence short and inconspicuous.

Elytra clearly shorter (0.74–0.81x) and a little wider than pronotum; microreticulation rather superficial, with larger meshes than on head and pronotum; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct isodiametric microreticulation similar to that of elytra and sparse and fine punctation.

♂: hind margin of tergite VIII ± straight to slightly convex, that of sternite VIII convex (Figs. 15f–g); median lobe and paramere as in Figs. 15a–c.

♀: hind margin of tergite VIII slightly convex, that of sternite VIII with distinct concavity, centrally with rather many (7–9) long hairs clearly exceeding the row of bristles in length (Figs. 15h–i); spermatheca as in Fig. 15d.

DISTRIBUTION AND BIONOMICS

At the localities indicated above the type material was sieved and extracted from soil and deep litter layers, under moss and tree trunks in stands of deciduous trees with northern exposition.

Geostiba subterranea spec. nov. (Figs. 16a–f)

TYPES: Holotype: ♂, Madeira, Ribeiro Bonito, leg. & coll. H. Franz.
Paratype: 1 ♂: Madeira, Ribeiro Bonito, leg. H. Franz, coll. Wunderle.

DESCRIPTION

Measurements of the two specimens: HW: 362, 378; PW: 453, 498; PL: 438; EL: 317; SL: 1163, 1223.

In general appearance rather similar to *G. endogea*.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

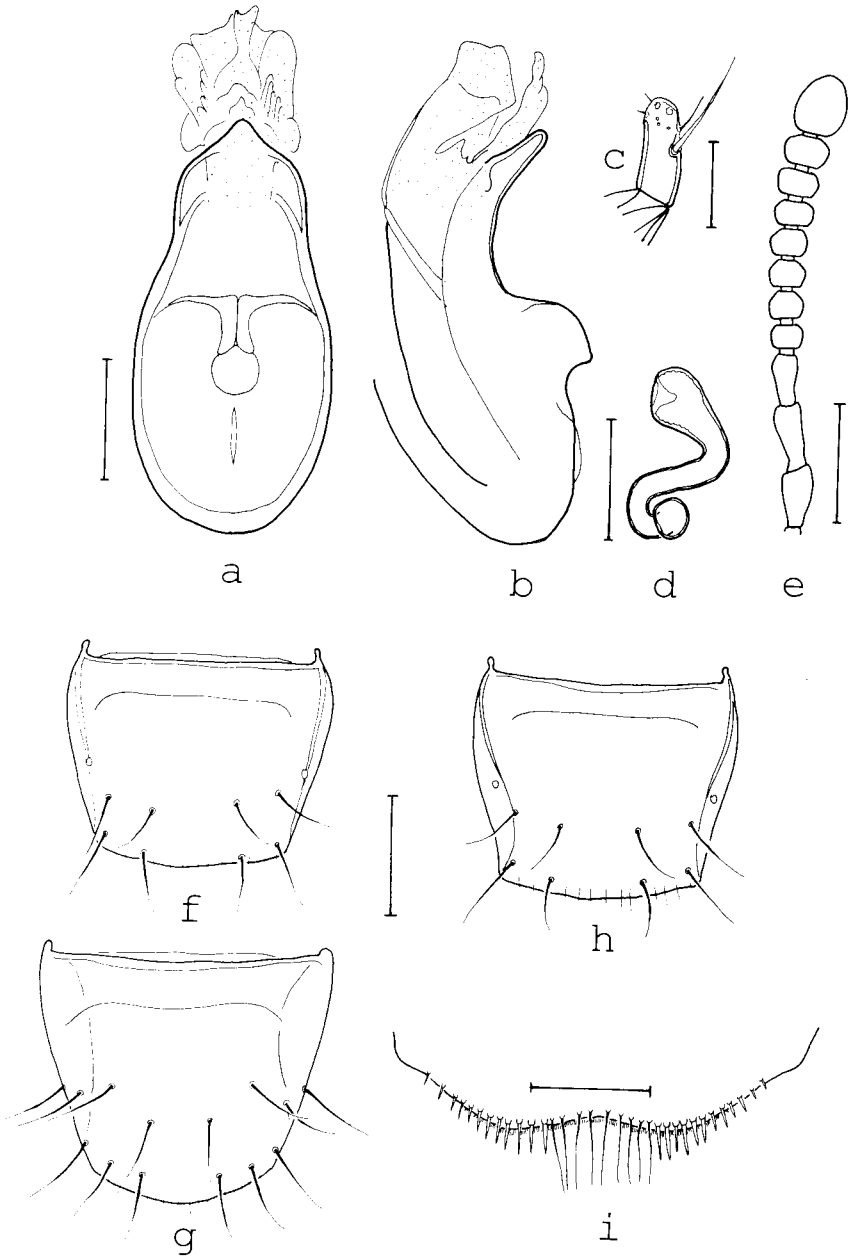

FIG. 15a–i
Geostiba endogea spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀ tergite and sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d, i: 0.1 mm; e–h: 0.2 mm; c: 0.05 mm.

Head narrower than pronotum (0.75–0.80x), with distinct microreticulation, punctation sparse and fine; eyes reduced to minute rudiments; antennae slenderer than in *G. endogea* with segments 5–10 weakly transverse, longer than head and pronotum together (Fig. 16d).

Pronotum a little wider than long (1.05–1.15x) with maximal width in anterior half; microreticulation similar to that of head, punctation fine and sparse; pubescence short and inconspicuous.

Elytra much shorter (0.7x) and a little wider than pronotum; microsculpture less distinct than on head and pronotum; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct microreticulation and fine and sparse punctation.

♂: hind margin of tergite VIII weakly convex, sternite VIII rounded posteriorly (Figs. 16e–f); median lobe and paramere as in Figs. 16a–c.

♀: unknown.

Distribution and bionomics

At present this species is only known from the type locality. Unfortunately, the labels lacked any information as regards the ecological circumstances.

Species excluded

Atheta leileri (Palm, 1981) comb. nov.

Sipalia leileri Palm, 1981a: 294ff.
Atheta (Parameotica) juengeri Benick 1984: 166ff. syn. nov.

Types: Holotype; ♂, Madeira, Pico Arieiro, 23.IV.1975, Holotypus, *Sipalia leileri* Palm, det. Thure Palm (MZEL).

Paratypes: 2 ♀♀: same data as holotype (MZEL).

Further material studied: 21 ♂♂, 18 ♀♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 8 ♂♂, 13 ♀♀: Bica da Cana, 1550–1600 m, 29.III.1993, leg. & coll. Assing & Wunderle; 8 ♂♂, 4 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle.

Palm (1981a) erroneously believed this species to be a *Sipalia* or *Geostiba*, respectively, apparently because of the general appearance, the small eyes and the rather short elytra. However, it does not possess any of the further typical characters of *Geostiba*. The construction of the genitalia is completely different. Furthermore, the pubescence of the pronotum is not directed caudad, but ± laterally on the sides; along midline it is directed cephalad in the anterior half and caudad in the posterior half (type III *in* Benick & Lohse (1974)). Having examined various characters including the mouthparts and the genitalia we conclude that *S. leileri* Palm has to be transferred to *Atheta* Thoms. For a detailed diagnosis and illustrations of the genitalia (including the internal sac of the aedeagus) see Benick (1984), who described the same species again as *Atheta juengeri*, now a junior synonym of *S. leileri* Palm. J. Vogel, Görlitz, who studied the types of *A. juengeri* Benick, kindly confirmed that they were indeed conspecific with our material of *leileri* (pers. comm.).

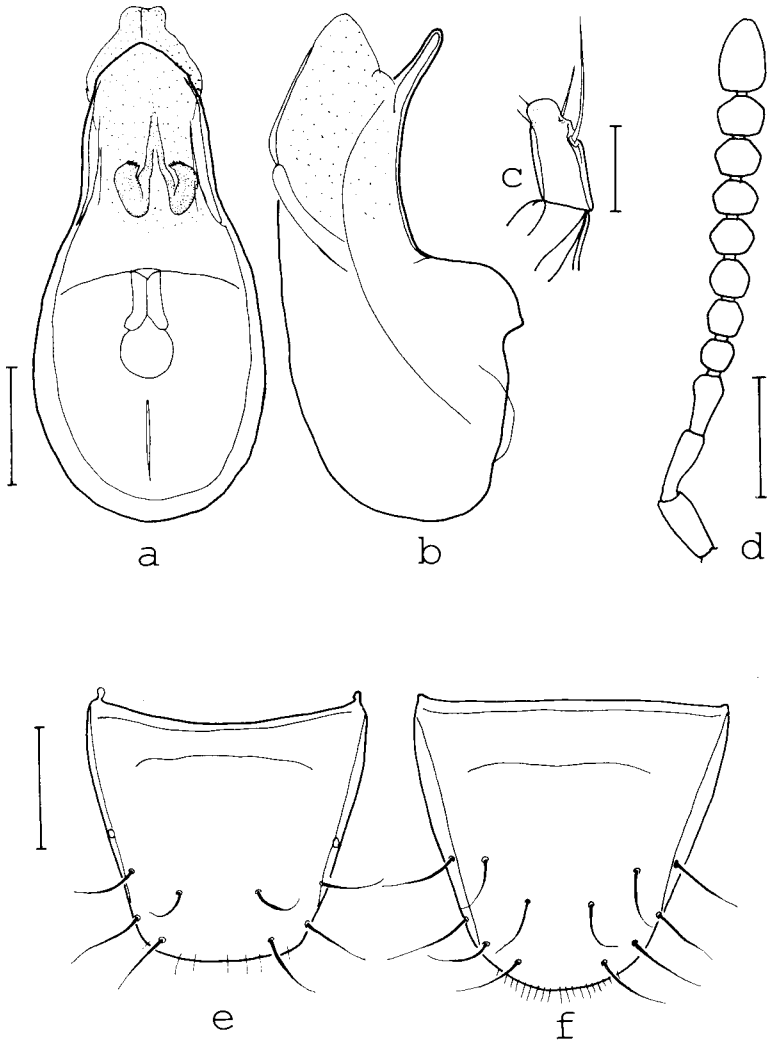

FIG. 16a–f
Geostiba subterranea spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); antenna (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in d–f. Scales: a–b: 0.1 mm; c: 0.05 mm; d–f: 0.2 mm.

DISTRIBUTION AND BIONOMICS

A. leileri (Palm) has repeatedly been collected at or near the type locality (Pico Arieiro) at an altitude of ca. 1600 m (BENICK 1984; PALM 1981a; our own records, see above). We sieved numerous specimens from litter in stands of *Vaccinium* and *Erica* both in northern and southern exposition, also at Bica da Cana at 1600 m. One ♂ taken on 29.III.1993 was teneral

KEY TO THE MADEIRAN SPECIES OF *Geostiba* Thomson

1. Eyes functioning, with 4 or more ommatidia. 2
– Eyes reduced to minute rudiments, without ommatidia; inhabitants of Madeira proper. 8
2. Larger species, 3.0–3.6 mm, PW >430 µm, PL >400 µm; eyes with 6 or more ommatidia. ♂: apex of paramere with two or three long setae. 3
– Smaller species, 1.8–2.8 mm, PW >430 µm, PL >380 µm; eyes with 4–5 ommatidia. 4
3. Shape of head almost circular, HW >370 µm, abdomen distinctly widened posteriorly, pubescence of head and pronotum longer and more conspicuous, antennae slenderer with segments 6–10 only weakly transverse (Fig. 1i), elytra relatively shorter.
♂: without longitudinal elevation on elytra, pronotum without impression, punctation of tergites VII and VIII fine, median lobe and apex of paramere as in Figs. 1a–c.
♀: hind margin of sternite VIII concave (Fig. 1h), spermatheca as in Fig. 1d.
Madeira proper. . . . . *G. formicarum* (Woll.)
– Head slenderer, HW <370 µm, abdomen only slightly widened posteriorly, pubescence of head and pronotum short, less dense and inconspicous, antennae shorter with segments 5–10 distinctly transverse (Fig. 2i), elytra relatively longer.
♂: with longitudinal elevation on elytra near suture, pronotum with longitudinal impression on disk, tergites VII and VIII with pronounced granulose punctation, median lobe and apex of paramere as in Figs. 2a–c.
♀: hind margin of sternite VIII less concave (Fig. 2h), spermatheca as in Fig. 2d.
Madeira proper and Porto Santo. . . . . *G. filiformis* (Woll.)
4. Body colour ± uniformly yellowish to reddish yellow, head narrower with HW <290 µm; ♂: apex of paramere with one long and three shorter setae. Species of Porto Santo. 5
– Body ± bicoloured, yellowish with at least tergites V and VI somewhat darkened, head wider with HW >310 µm; ♂: apex of paramere with four short setae. For a safe identification of these species an examination of the aedeagus and the ♂ tergite VIII is essential. Species of Madeira proper. 6
5. Slightly smaller species; head shorter, about as long as wide (Fig. 8b), pronotum on the average shorter and narrower.
♂: median lobe smaller, with spines in internal sac (Figs. 7a–b); apex of paramere as in Fig. 7c.
♀: spermatheca smaller and of different shape (Fig 7d). Pico Branco (Porto Santo). . . . . *G. brancomontis* spec. nov.

– Somewhat larger species; head longer (ca. 1.15x) than wide (Fig. 8a), pronotum on the average longer and wider.
♂: median lobe larger, without spines in internal sac (Figs. 6a–b); apex of paramere as in Fig. 6c.
♀: spermatheca larger (Fig. 6d).
Pico Juliana (Porto Santo). . . . . *G. portosantoi* Franz

6. ♂: median lobe with pronounced ventral process. 7
– ♂: median lobe without ventral process (Fig. 5b); tergite VIII weakly concave posteriorly (Fig. 5e); pronotum without impression.
♀: spermatheca as in Fig. 5d. . . . . *G. bicacanaensis* spec. nov.

7. Abdomen mostly with only tergites V and VI darkened.
♂: pronotum often with longitudinal impression on disk; tergite VIII with pronounced concavity posteriorly (Fig. 3f); ventral process of median lobe bent (Fig. 3b), apex of paramere as in Fig. 3c.
♀: spermatheca as in Fig. 3d. . . . . *G. arieiroensis* spec. nov.
– Abdomen mostly with tergite VII as dark as tergites V and VI.
♂: pronotum without longitudinal impression on disk; tergite VIII weakly concave posteriorly (Fig. 4e); ventral process of median lobe ± straight (Fig. 4b), apex of paramere as in Fig. 4c.
♀: spermatheca as in Fig. 4d. . . . . *G. ruivomontis* spec. nov.

8. Larger species, 3.0–3.9 mm. 9
– Smaller species, 1.9–2.6 mm. 11

9. Body length 3.0–3.3 mm; HW <390 µm, PL <460 µm; body appendages shorter. 10
– Larger species, 3.4–3.9 mm; HW >400 µm, PL >490 µm; legs and antennae (Fig. 14e) long and slender.
♂: hind margin of tergite VIII deeply concave (Fig. 14f), median lobe and apex of paramere as in Figs. 14a–c.
♀: spermatheca as in Fig. 14d. . . . . *G. occulta* spec. nov.

10. Antennae shorter with segments 4–10 transverse (Fig. 15e).
♂: median lobe smaller (Figs. 15a–b); apex of paramere as in Fig. 15c.
♀: spermatheca as in Fig. 15d. . . . . *G. endogea* spec. nov.
– Antennae slenderer with segments 5–10 weakly transverse (Fig. 16d).
♂: median lobe larger and of different shape (Figs. 16a–b); apex of paramere as in Figs. 16c.
♀: unknown. . . . . *G. subterranea* spec. nov.

11. ♂: apex of paramere with one long and three very short setae (see e.g. Fig. 9c). 12
– ♀: apex of paramere with two long and two very short setae (e.g. Fig. 13c). 14

12. ♂: median lobe larger, ca. 0.3 mm long (Fig. 11a–b); apex of paramere as in Fig. 11c.
♀: spermatheca as in Fig. 11d. . . . . *G. vaccinicola* spec. nov.
– ♂: median lobe smaller, ca. 0.25 mm long. 13

13. ♂: median lobe slenderer (Fig. 12a); apex of paramere more elongate, long seta situated nearer to base (Fig. 12c).
♀: spermatheca slightly larger and stouter (Fig. 12d). . *G. lauricola* spec. nov.
– ♂: median lobe wider in ventral view (Fig. 9a); apex of paramere less elongate, long seta more distant from base (Fig. 9c).
♀: spermatheca slightly smaller (Fig. 9d). . . . . *G. lindrothi* Franz
14. Antennae longer with the first three antennomeres more elongate (Fig. 10e).
♂: median lobe in lateral view as in Fig. 10b; apical long seta usually shorter (Fig. 10c).
♀: posterior margin of sternite VIII with pronounced angular concavity (Fig. 10h); spermatheca as in Fig. 10d. . . . . *G. graminicola* spec. nov.
– Antennae shorter (Fig. 13e).
♂: median lobe in lateral view of different shape (Fig. 13b); apical long seta usually longer (Fig. 13c).
♀: posterior margin of sternite VIII only shallowly concave (Fig. 13h); spermatheca as in Fig. 13d. . . . . *G. caligicola* spec. nov.

DISCUSSION

At present, 15 endemic species of *Geostiba* are known to occur on the Madeiran islands. Thus speciation through adaptive radiation appears to have developed far more endemics in this than in any other staphylinid genus on the archipelago. Of the better known taxa only *Stenus* Latr., *Othius* Steph. (both 5 endemics) and *Mycetoporus* Mannh. (3 endemics) include an appreciable number of species whose distribution is restricted to Madeira (ASSING & WUNDERLE, 1994, 1995; PALM 1980). The genus *Atheta* Thoms., particularly the subgenus *Mocyta*, can be expected to comprise a considerable number of endemics, too, but in the absence of a recent revision precise figures are impossible.

Furthermore, the number of Madeiran species of *Geostiba* considerably exceeds that of other Atlantic Islands. Several species have been described from the Canary Islands (FRANZ 1981; PALM 1975, 1976; WOLLASTON 1864), but according to our own studies only two of them are true *Geostiba*: *G. muscicola* (Woll.) and *G. lanzarotensis* (Palm). One species is reported for the Azores, *G. melanocephala* (Crotch) (BERNHAUER 1940; CROTCH 1867), whose generic identity was confirmed through an examination of two syntypes in coll. Wollaston (BMNH).

It may seem surprising that in spite of a fairly long tradition of entomofaunistic activity on the Madeiran islands, so few species of *Geostiba* were described before; many studies list no or, at the most; two species of the genus (e.g. BERNHAUER 1940; ERBER 1990; ERBER & HINTERSEHER 1988, 1990; JANSSON 1940; LIKOVSKY 1963), probably because the methods used were inadequate for these more or less subterranean insects. Considering that during a two-week excursion it was possible to collect not only the *Geostiba* species known at that time, but in addition an even greater number of new taxa, most of them from one locality only, it seems certain that a number of species remain to be discovered in the future.

Regarding their morphological and ecological properties the Madeiran *Geostiba* can be subdivided into 5 species groups. Three of them possess functioning eyes: the *G. formicarum* group (*G. formicarum*, *G. filiformis*), the *G. arieiroensis* group (*G. arieiroensis*, *G. ruivomontis*, *G. bicacanaensis*) and the *G. portosantoi* group (*G. portosantoi*, *G. brancomontis*). The remaining two groups are blind and subterraneous: the *G. lindrothi* group (containing the minute species *G. lindrothi*, *G. graminicola*, *G. vaccinicola*, *G. lauricola*, *G. caligicola*) and the *G. occulta* group (with the larger *G. occulta*, *G. endogea*, *G. subterranea*). There are, at first glance, considerable differences between these groups regarding characters such as body size, development of eyes, etc., particularly when measured against the relative uniformity of continental *Geostiba*. However, having examined numerous external characters as well as the mouthparts and the genitalia (also in comparison with the type species *G. circellaris* (Grav.)), we are convinced that the species dealt with in this study are all true members of *Geostiba*. After all, morphological (and ecological) diversity within groups of closely related species is a well-known island phenomenon, exemplified not only in Darwin's finches, but also many other animal taxa.

On the other hand the species of the *G. lindrothi* group are of remarkable similarity. Nevertheless, we recognize them as different species for several reasons. Above all, constant differences in the genitalia and other sex-related characters suggest reproductive isolation. Moreover, most species of *Geostiba* in general cannot be safely identified on the basis of external characters alone (cf. PACE 1977). A low morphological diversity should particularly be expected in the species of the *G. lindrothi* group, all of them living subterraneously and representing similar life forms; selective pressure in such habitats will eventually result in similar morphological adaptations, especially various reductions (of pigmentation, eyes, size, etc.), which unfortunately also reduce the number of available diagnostic features for the taxonomist.

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Dr. Roy Danielsson (MZEL), Dr. Tord Nyholm and Dr. Per Lindskog (SMNH), and to Prof. Herbert Franz, Mödling, for loans of type material. We are furthermore indebted to Mr Peter M. Hammond and Ms Emma De Boise (BMNH), who arranged the loan of Wollaston's types and who made it possible for the first author to study Wollaston's collection of Madeiran Staphylinidae in the BMNH. Finally, we would like to thank Dr. Ivan Löbl (MHNG) for his valuable advice and critical comments on the manuscript.

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