

ORIBATID MITES FROM THE AZORES ISLANDS (ACARI, ORIBATIDA)

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With 14 figures

ABSTRACT: The authors present a list of oribatid mites derived from samples taken by Drs. P. OROMÍ and N.P. ASHMOLE, mainly in caves, but also from lava and volcanic craters, on several islands of the archipelago of the Azores. Ten of these species are probably new to science, 22 are new records to Macaronesia, and 30 are new to the Azores.

RESUMO: ÁCAROS DOS AÇORES (ACARI, ORIBATIDA). Os autores apresentam a lista de ácaros provenientes de amostras colhidas, principalmente em cavernas, mas também em lava e crateras vulcânicas, pelos doutores P. OROMÍ e N.P. ASHMOLE, em várias ilhas do Arquipélago dos Açores. Dez destas espécies são provavelmente novas para a ciência, 22 são novos assinalamentos para a Macaronésia e 30 são novas para os Açores.

INTRODUCTION

The first references of oribatid mites from the Azores were made by HAMMER (1969) who identified four species, and eight more only at genus level. Later WEIGMANN (1976) published a paper on the oribatid mites of the Azores where, with some reservation, 42 species were identified, 6 of which he considered new to science. C. PEREZ-ÍÑIGO (1987) published a study on the oribatid mites from the islands of Santa Maria and São Jorge, where this author refers to 31 species, 8 of which new to science, and two subspecies as typical of these islands. The number of oribatid species known from the Azores up to the present amount to 72. In this paper reference to 51 species is made, 30 of which have not been collected in the Azores before, containing 10 probably new to science. Two of the new species, *Phthiracarus* (*Archiphthiracarus*) *falciformis* and *Heminothrus* (*Heminothrus*) *oromii*, are described in this paper. As is usual for oribatid mites, all the species collected are from soil and none of them can be considered strictly from caves.

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As C. PEREZ-IÑIGO (1987) indicates the Azores are placed in the North Atlantic, between 36° 55' and 39° 43' N latitude and 24° 41' and 31° 17' W longitude. The archipelago is composed of nine larger islands and some small ones. The island closest to Europe is Santa Maria, at 1,500 Km. from Cabo da Roca in Portugal, and the most distant island, Flores, at 2,100 Km. from Europe and at 3,600 Km. from the U.S.A.

The total surface of all the islands amounts to 2,314 Km², and they form three groups; the western one being composed of Flores and Corvo, the middle one Terceira, Graciosa, São Jorge, Pico and Faial, and the eastern one Santa Maria and São Miguel.

The Azores are of volcanic origin, of great recent volcanic activity. There is a large number of volcanic cones, some of which rise to a great height, such as the one of Pico reaching a height of 2,352 m.

The climate is temperate, with a maximum temperature of 29°C and a minimum one of 4° C, varying according to heights in the interior of the island. Moist environment allows an exuberant vegetation with abundant growth of bracken, mosses, and lichens. Four fifth of the island flora are constituted of European species, the rest are African or Macaronesian, consisting of 40 species exclusive of these islands. The volcanic slopes present a large fertility that allows the growth of subtropical cultures, forest areas, and pasture land.

MATERIAL

A total number of 932 specimens of mites derived from 49 soil samples have been studied. Soil samples were collected by Dr. P. OROMÍ, from La Laguna University (Canary Islands), and Dr. N. P. ASHMOLE, from the Edinburgh University, during the two expeditions to the Azores, under the auspices of The National Geographic Society. The first expedition was carried out from July 26th to August 21st 1987, and the second one from July 18th to August 23rd 1989. The greater part of the soil samples are from caves, but a small number of samples were taken from lava or from some volcanic craters. In these cases the indication "lava", or "crater" has been added after the sample reference. "Mouth" indicates mouth of cave still with visibility. The list of localities is the following:

FIRST EXPEDITION

FAIAL

Vulcão dos Capelinhos

Crater: Recent volcanic eruption (1957-58) at the western tip of the island. It was mainly composed of pyroclastic materials, and the crater considered here is located at the western part of the complex (nearly eroded) at an altitude of 130

m. Vegetation is here very scarce but not absent, and inside the crater itself only lichens exist.

Lava: It is perhaps the only lava flow preserved in this volcano, since others are already eroded or covered with ashes. It is an "aa" flow, rather short and steep and located on the NE slope of the crater mentioned above, at 65 m. a.s.l.

Samples: 7 Lava, 9, and 21 crater.

Dates: August 16th-20th, 1987.

Cabeço do Fogo. The site is located in a parasitic cone of the main one of Cabeço do Fogo; both formed during the eruption of 1672. It is located on the western slope of this cone-shaped island, at 500 m. a.s.l. This parasitic cone has a rocky ground with very deep cracks filled with bushes and even small trees, as well as abundant lichens and mosses on the exposed surfaces.

Samples: 3, and 22.

Dates: August 17th-21st, 1987.

Costa da Nau. This is an old lava field now covered with a shallow layer of ash coming from the neighbouring Capelinhos Volcano. The site is placed at 105 m. a.s.l., near the edge of an old cliff on the northern shore. Ash on the ground is very fine, and the most common plants are tall grasses sparsely spread.

Sample: 23.

Dates: August 17th-21st, 1987.

PICO

Mistério da Silveira. Lava tube in a historic flow (1720), with the main entrance at 30 m. a.s.l., in the southern part of the island, with some parts near the sea (from 15 up to 30 m. a.s.l.) of "aa" lava covered with lichens.

Samples: 5, and 8.

Dates: August 6th-10th, 1987.

Furna dos Montanheiros. A very large, 250 m. long lava tube in the central plateau of the island, at 830 m. a.s.l. It is in a non historic flow, covered with grasslands and some spots of natural shrub vegetation. It is very wet inside the cave.

Sample: 15.

Dates: August 6th-10th, 1987.

Furna da Agostina. Lava tube in a pahoehoe non-historic flow on the northwest part of the island. The entrance is about 60 m. a.s.l., in the middle of a dense forest growing on abandoned fields. The northern part of the cave is quite long (350 m.),

dark, and wet.

Samples: 11, 12, and 14.

Dates: August 8th-12nd, 1987.

Baía Cachorro. The same pahoehoe flow mentioned above, which has the ending near the sea with hardly any vegetation. The site was at 10 m. a.s.l. This pahoehoe lava has very deep cracks.

Sample: 17.

Dates: August 8th-12nd, 1987.

Porto Cachorro. A historic lava flow (1718) on the NW part of the island, with a coastal part (about 15 m. a.s.l.) consisting of "aa" lava and covered with lichens.

Samples: 13, and 18.

Dates: August 8th-12nd, 1987.

Ponta do Pico (Piquinho). The highest peak of the island (2350 m. a.s.l.) and all the other Azores. It is a very steep cone situated on the north eastern part of the Caldeira, and is composed of pahoehoe lava covered with scarce vegetation of bushes, grass, and mosses.

Samples: 6, and 16.

Dates: August 11th-15th, 1987.

TERCEIRA

Colada Cantera. Lava flow of the eruption of 1761, placed in the centre of the island and descending to the north. The site is situated at 500 m. a.s.l., and its "aa" lava is densely covered with lichens as well with several sparse bushes.

Sample: 2.

Dates: July 26th-30th, 1987.

Mistério Negro. Group of volcanic domes built on a dark, rough, deeply cracked lava and very well separated from surrounding, older land. Central plateau, at 580 m. a.s.l. Scarce vegetation on the top of the domes, and more abundant on the slopes, mainly near the base. Much more vegetation on some parts of the slopes (called kipuka by us), probably due to the presence of older rocks and some soil. Mistério Negro was formed in 1761.

Samples: 10, and 20.

Dates: July 28th-August 1st, 1987.

Domo. Older domes very close to Mistério Negro. 560 m. a.s.l. Covered with

very dense, low bushland (mainly heather) and small *Cryptomeria* trees.

Sample: 1.

Dates: July 28th-August 1st, 1987.

Gruta das Agulhas. Lava tube in a pahoehoe lava flow, in the entrance opening on the coastal cliff at 5 m. a.s.l. The entrance area is influenced by the sea spray and even sea water. Deep part of the cave without this marine influence. Surface covered with cultivated fields.

Samples: 4, and 19.

Dates: July 29th-August 2nd, 1987.

SECOND EXPEDITION:

FAIAL

Ruim. Furna Ruim. A large volcanic tip situated in the west of the island, at 325 m. a.s.l., in a volcano covered by a dense forest of *Pittosporum* and *Hedychium*. It is more than 60 m. deep, very humid but never completely dark.

Samples: 30 Mouth, 35, and 46 Mouth.

Dates: August 9th-13rd, 1989.

Capel. Vulcão dos Capelinhos. A historic volcano (1957-58) appeared in the sea but became later attached to the island at the westernmost point. The complex is mainly built of pyroclasts, being quickly destroyed by the waves and wind erosion.

Sample: 36.

Dates: August 9th-13rd, 1989.

SÃO JORGE

Fogo. Furna das Bocas do Fogo. A complex volcanic tip at the bottom of a large crater, at 500 m. a.s.l., covered with a mixed forest of *Pittosporum*, *Erica*, etc. It has a vast cavity communicating with the outside through three different, aligned entrances. Inside the cave it is cool, moist, but never completely dark.

Samples: 39, 40 Mouth, 43, 45 Mouth, 48 Mouth, and 49.

Dates: August 7th-11th, 1989.

PICO

Maciel. Gruta do Henrique Maciel. A long lava tube on the northern slope of the island, at 125 m. a.s.l. in a mixed forest of *Picconia*, *Pittosporum*, and *Erica*. Most

of the cave is dark, humid and with abundant roots hanging from the roof.

Samples: 38 Mouth, and 42 Mouth.

Dates: August 9th-13th, 1989.

GRACIOSA

Enx. Furna do Enxofre. Huge volcanic pit in the centre of the southeastern caldeira. 150 m. a.s.l. The deeper part is occupied by a lagoon. There are some fumaroles and cauldrons inside the cave, sometimes rending breathing difficult.

Samples: 28, and 29.

Dates: August 17th-18th, 1989.

SANTA MARIA

Anj. Gruta dos Anjos. This cave is on the NW coast of the island, at 45 m. a.s.l., probably not being a lava tube. Because of its large entrance and inner dimensions, the light reaches almost everywhere except the most remote corners.

Sample: 44.

Date: July 31st, 1989.

SÃO MIGUEL

Pau. Gruta de Água de Pau. Lava tube 5 m. a.s.l. at the base of a cliff 75 m. high.

Sample: 32 Mouth.

Dates: July 21st-25th, 1989.

Cruz. Gruta do Pico da Cruz. Lava tube in the central, more recent part of the island. 275 m. a.s.l. Under artificial pastures.

Samples: 31 Mouth, 33, and 47.

Dates: July 22nd-26th, 1989.

Esq. Gruta do Esqueleto. Large lava tube on the northern slope of Lagoa de Fogo massif, a recent and even now very active area. 250 m. a.s.l., under a recently destroyed *Pittosporum* and *Acacia* forest.

Sample: 34.

Date: July 23rd, 1989.

Enf. Gruta do Enforcado. A short lava tube (65 m. long) in the midwest, recent part of the island, at 250 m. a.s.l., under artificial pastures.

Sample: 37.

Date: July 30th, 1989.

Que. Furna do Pico Queimado. A volcanic pit some 25 m. deep, with only a few parts completely dark, but very humid and with constant temperature. In a historic volcano now covered with a mixed, not natural forest.

Samples: 24, 25 Mouth, 26, and 41 Mouth.

Dates: August 4th-20th, 1989.

Peixe. Mistério de Rabo de Peixe. A recent lava flow (but more than 500 years old) at the northern coast, covered by shrub and forest except close to the sea shore (100-120 m.), where lichens predominate.

Sample: 27.

Dates: July 24th-28th, 1989.

All the collected material is stored in the Cátedra de Entomología de la Facultad de Biología de la Universidad Complutense de Madrid (C.E.F.B.U.C.M.), and the different species studied, systematically ordered, are the following:

PHTHIRACARIDAE

Phthiracarus (Phthiracarus) piger (SCOPOLI, 1763)

Samples: 8(6 specns.), 25(1 specn.), and 30(1 specn.).

Dimensions: prodorsum 349-491 μ m. and notogaster 599-935 μ m.

Dimensions of the specimen proceeding from sample 25 are smaller than the smallest ones assigned by RUIZ and SUBIAS, 1984 (355-510 x 705-1120 μ m.) for spanish specimens.

Distribution: Holartic, RUIZ and SUBIAS, 1984.

Phthiracarus (Archiphthiracarus) anonymus GRANDJEAN, 1934

Sample: 2 (1 specn.).

Dimensions: prodorsum 217 μ m. and notogaster 404 μ m.

The specimen studied coincides with all the characters described by GRANDJEAN 1934, except in the rostral striation in front of the rostral setae, which is absent in the Azores specimen. The absence of this character was mentioned by E. PEREZ-ÍÑIGO (1979) for the mites of the Iberian Peninsula.

Distribution: We consider this species a meridional palaearctic one; F. BERNINI, *et al.* 1988 assigned it to a central south-European and Caucasian species; it has

however also been recorded from the south of Asiatic Russia (KARPPINEN *et al.* 1986). This is the first time this species is cited from Macaronesia.

Phthiracarus (Archiphthiracarus) falciformis n sp.
(Fig. 1 a-e)

TYPE MATERIAL

One female specimen, the holotype, originates from Terceira island, sample 4, and is stored in 70% lactic acid, and deposited in C.E.F.B.U.C. Madrid.

DESCRIPTION

Dimensions and tegument:

The studied specimen's dimensions are 304 μ m. prodorsum length, and 566 μ m. notogaster length.

The tegument is very slightly amber coloured, fine and densely dotted on the prodorsum and on the notogaster surfaces.

Prodorsum: (Fig. 1b)

The rostral margin is rounded in dorsal view as well as in lateral view. The lateral carena starts on the superior area of the bothridium, and reaches the anterior rostral edge. There is a central crista on the posterior region of the prodorsum, distinctly seen in dorsal view. The rostral setae are thin, smooth, and curved inwards. Lamellar and interlamellar setae are similar to the above mentioned rostral ones, being slightly longer than the interlamellar ones, which are equally distant from the rostral setae. Exobothridial setae are located behind their respective bothridia, and are of the same length as the lamellar ones. The bothrium has a protective flake over it. The sensilli (Fig. 1e) are fusiform, slightly widened on their central part, and sharp-ended. There is a hyaline capsule from the widened area covering the rest of the surface of the sensillus. This capsule ends in a rounded tip.

Notogaster: (Fig. 1a)

There are 15 pairs of notogastral sickle-shaped setae, directed forward, this configuration being observed better on the marginal setae in lateral view (Fig. 1d). For this reason we have chosen the specific name of *falciformis*. All the notogastral setae are sharp pointed, and slightly rough, but there are no thorns. The c series setae are inserted outside the notogastral flange. Setae c3 are more distant from this flange, thinner, and slightly shorter than the rest of the notogastral setae.

Ventral region:

Genito-adgenital plates (Fig. 1c) provided with 9 pairs of thin and smooth setae, g1-g5 setae close to the paraxial margin, and the rest, g6-g9 more distant from the margin, and longer than the previous ones. Anal and adanal setae well developed. The three adanal setae are inserted well separated from the paraxial margin of the valve, they are thin, tip curved forward, and seta ad1 slightly longer. The two anal setae are inserted near the edge of the valve, with similar aspect as the previous ones, but shorter than the adanals.

Legs are monodactyle, the nail being very thick.

AFFINITIES

Among all the species of the genus *Phthiracarus* PERTY, 1839 that present setae ad1 and ad2 developed (subgenus *Archiphthiracarus* BALOGH and MAHUNKA, 1979), the one most similar to the new one is *Phthiracarus parobotrichus*, described by FEIDER and SUCIU (1957) from Romania. Both species are similar mainly in the aspect of the sensilli, length of prodorsal setae, and the disposition of the setae of the anterior margin of the notogaster and the anogenital setae. But both species can be easily distinguished from one another by several characters; the new species presents smaller dimensions than the smallest ones indicated for *P. parobotrichus*, 368-423 μm . prodorsum and 754-920 μm . notogaster, notogastral setae sickle-shaped and longer, notogaster less convex, and sensillus slightly longer with a different disposition of the hyaline capsule.

Recently NIEDBALA (1986) has considered *Phthiracarus parobotrichus* a synonym of *Phthiracarus laevigatus* (C.L. KOCH, 1841). However HAMMEN (1963) redescribed *P. laevigatus* indicating the presence of very short notogastral setae, seta c3 being very close to the notogastral flange, and setae ad1 and ad2 being vestigial. PARRY, 1979 indicated that the characters of the especimens of *P. laevigatus* he has studied agree with HAMMEN's, 1963 redescription. Thus, a character such as the presence of setae ad1 and ad2 vestigial or well developed (character used by BALOGH and MAHUNKA, 1979 to separate *Phthiracarus* from *Archiphthiracarus*) as well as the length, shape, and disposition of the notogastral setae being different, and as a result of which it does not seem reasonable that NIEDBALA, 1986 considered both species synonymous. The dimensions indicated by HAMENN, 1963 for *P. laevigatus* (females 345-415 μm . prodorsum, and 625-760 μm . notogaster, and males 390-540 μm . and 750-1050 μm .) are greater than the ones of the new species.

In 1987, C. PEREZ-IÑIGO described the species *Archiphthiracarus atlanticus* from the Azores, which differs from the new one by the larger size of *A. atlanticus*, 336-420 μm ., prodorsum and 708-804 μm . notogaster, length of the lamellar setae superior to the length of the interlamellar ones (the opposite of the new species), sensillus

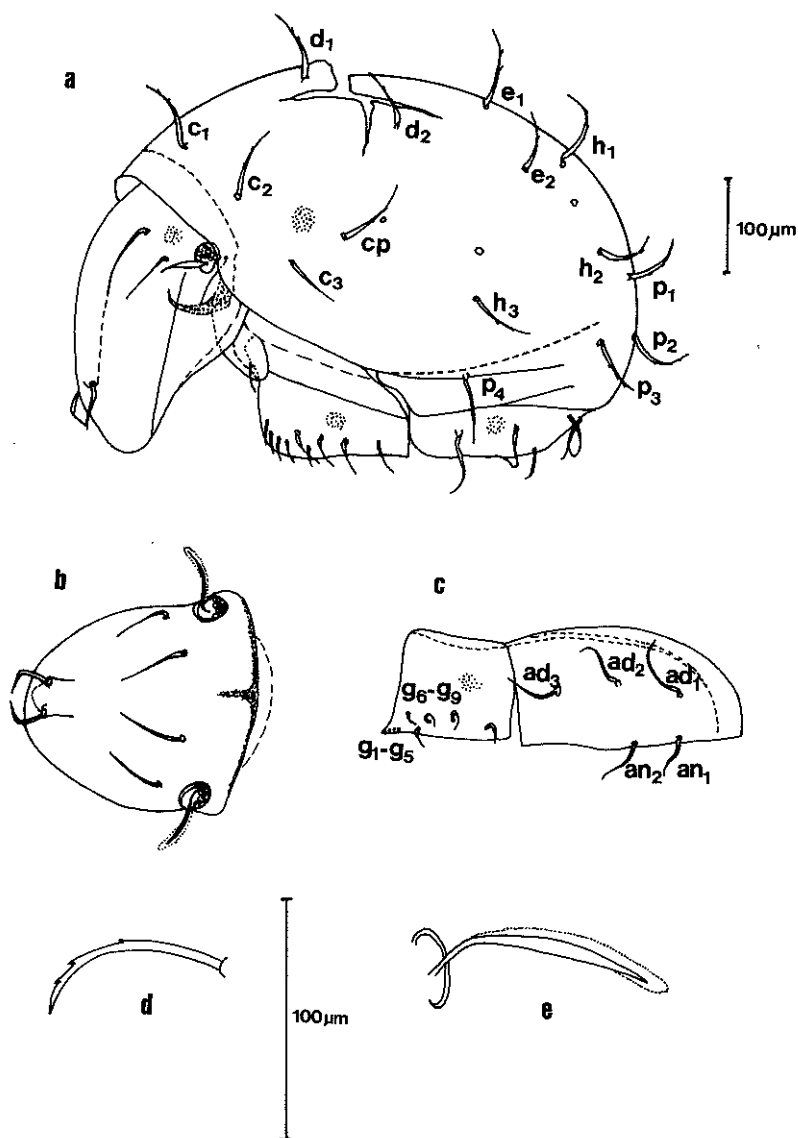


Fig. 1 a-e -- *Phthiracarus* (*Archiphthiracarus*) *falciformis* n. sp. a - Lateral view, b - Dorsal view of prodorsum, c - Anogenital plates, d - Notogastral seta C_1 , e - Sensillus.

without hyaline capsule, very convex notogaster, notogastral setae long but flexible, setae c3 much shorter than the rest and closer to the notogastral flange than in the new species, and anal setae with similar length to the adanal ones.

STEGANACARIDAE

Steganacarus (Steganacarus) hirsutus C. PEREZ-IÑIGO, 1974

Sample: 25 (1 specn.).

Dimensions: Prodorsum 429 μm , and notogaster 757 μm .

C. PEREZ-IÑIGO, 1987 remarks that the notogastral setae of the Azorean mites are slightly thicker, sharp-ended, and with less cillia than the Iberian Peninsula mites, as we have also observed on the sample studied.

Distribution: Occidental Mediterranean, F. BERNINI *et al.*, 1988.

ORIBOTRITHIDAE

Oribotritia berlesei (MICHAEL, 1898)

Samples: 8 (2 specns.), and 34 (1 specn.).

Dimensions: Prodorsum 603-620 μm ., and notogaster 1065-1155 μm ..

Size of the Azorean mites studied by C. PEREZ-IÑIGO (1987) 510-570 μm . and 900-1140 μm . are smaller than the dimensions indicated for European mites, MARKEL (1964) 640-760 μm . and 1240-1390 μm . The dimensions of the samples we have studied are more similar to the European ones.

Distribution: Palaearctic, C. PEREZ-IÑIGO, 1988.

NOTHRIDAE

Nothrus palustris (C.L. KOCH, 1839)

Sample: 44 (1 specn.).

Dimensions: 995 x 650 μm .

The length of the sample now studied is slightly less than the length indicated by C. PEREZ-IÑIGO (1968) which is 1060-1070 μm . for the Iberian mites.

C. PEREZ-IÑIGO (1987) describes the subspecies *Nothrus palustris azorensis*, which can be distinguished from the nominate species because of its shorter sensilli, the

distance between the lamellar apophysis being almost twice the length of the lamellar setae, the coxisternal formulae being 4-3-4-5 or 4-3-5-5 (nominate species being 4-3-4-4 or 4-3-3-4), the p1 setae being inserted on a well developed apophysis, and the h2 setae being double the length of h1 and by being inserted on the p1 setae apophysis.

Distribution: Holarctic, C. PEREZ-ÍÑIGO, 1988.

This is the first time this species is being cited from the Azores, although it had been mentioned from Madeira, WILLMANN, 1939.

Nothrus silvestris NICOLET, 1855

Sample: 42 (1 specn.).

Dimensions: 755 x 403 µm..

The sample studied is very similar in all characters of *N. anauniensis*: SELLNICK and FORSSLUND (1955), which GRANDJEAN (1985) supposed to be a synonym of *N. silvestris*. Both species were distinguished from one another by the number of claws, but GRANDJEAN (1961) remarked that in the same population of *N. silvestris* he had found mites with one claw, and with two claws, and even some specimens with three claws.

The only specimen we have studied presents monodactyle tarsi, and lamellar setae spatulated as the interlamellar ones, but no leaden as ITURRONDOBEITIA (1985) indicates in his redescription of this species.

Distribution: Cosmopolitan, SCHATZ, 1983.

CAMISIIDAE

Camisia horrida (HERMANN, 1804)

Samples: 6(1 specn.), 16(1 specn.), and 18(1 specn.).

Dimensions: 849-960 x 442-495 µm..

Distribution: Holarctic, RUIZ *et al.*, 1986.

This is the first time that this species is cited from Macaronesia.

Heminothrus (Heminothrus) oromii n. sp.
(Fig. 2 a-f)

TYPE MATERIAL

One female specimen, holotype, and two female specimens, paratypes, all of them from Terceira, sample number 20. The holotype is preserved in a semipermanent

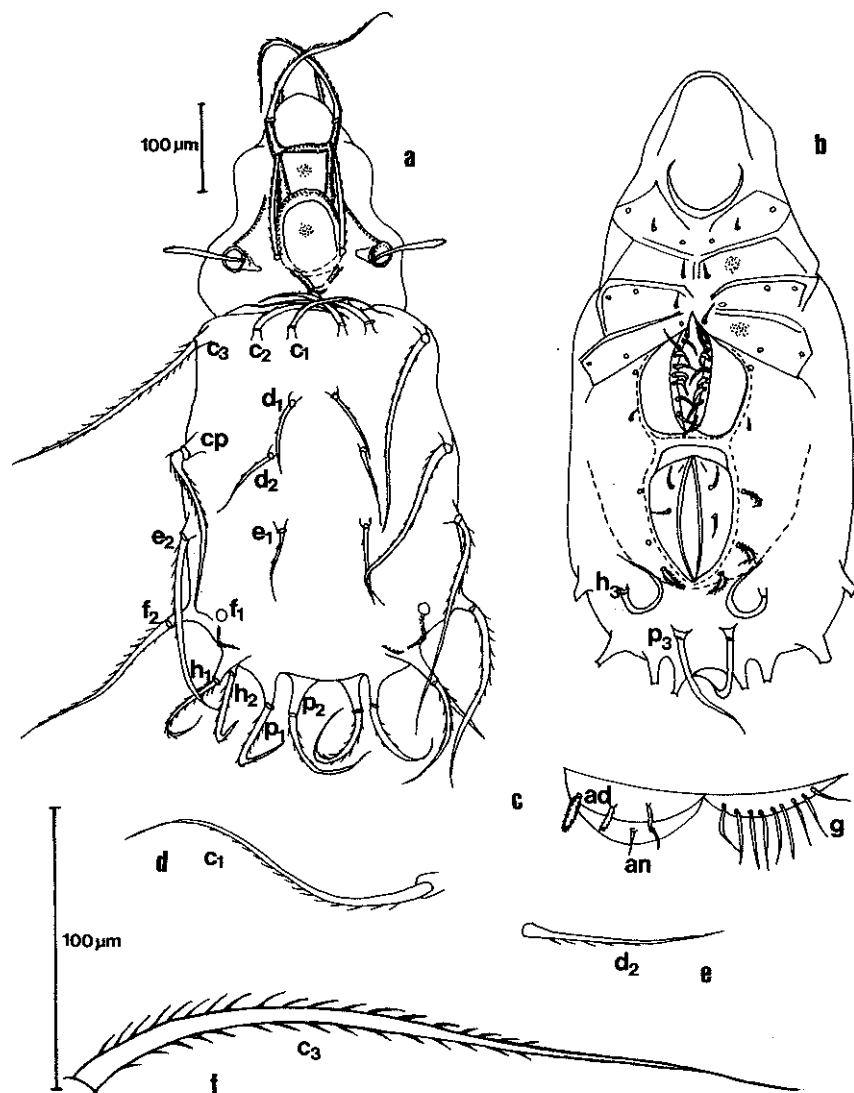


Fig. 2 a-f -- *Heminothrus (Heminothrus) oromii* n. sp. a - Dorsal view, b - Lateral view, c - Anal and genital plates, d - Notogastral seta c_1 , e - Notogastral seta d_2 , f - Notogastral seta c_3 .

"Hoyer" slide, and the paratypes are in 70% lactic acid. All the material is stored in the C.E.F.B.U.C. Madrid.

DESCRIPTION

Dimensions and tegument:

Dimensions of the three specimens are very similar: 666 μm length, not including the posterior setae apophysis, and 317 μm width.

Tegument dark yellow coloured, with a large amount of particles and residues attached to all over the surface. Only fine dots can be distinguished on the central region of the prodorsum, and on the epimeral surface.

Prodorsum: (Fig. 2a)

Rostrum rounded. Rostral setae thinner than the rest of the prodorsal setae, straight, and without cilia. Lamellar setae thick, ciliated, and with undulating tip. Interlamellar setae slightly thinner than the lamellar ones, ciliated, and with broken tips, which makes it impossible to know their length. The sensillus is a thick ribbon only slightly widened and rugose on its distal third. The prodorsum presents a very characteristic structure, constituted of several chitinous ribbons: The lamellar setae apophyses are transversely joined by a translamella, and they are projected posteriorly to get in touch with a circular ribbon which is placed on the mid-posterior region of the prodorsum. Between the circular band and the posterior margin of the prodorsum there is a "V"-shaped crest, which is interrupted in some specimens.

Notogaster: (Fig. 2a)

Notogaster square shaped. All the notogastral setae are inserted on varyingly sized apophyse, the posterior ones thicker and longer, the lateral ones slightly shorter, and the dorsal and anterior ones even shorter. Notogastral setae ciliated, the cilia being longer and more abundant on those thicker and longer setae as c3 (Fig. 2f), cp, e2, and f2, with undulating tips. Setae h1, h2, h3, p1, p2, and p3 are shorter than the anterior ones and with very incurved tips. Setae c1 (Fig. 2d) and c2 are similar in length to the anterior ones, strongly curved inwards over the anterior margin of the notogaster, and with flagelliform tips which are easily broken. Setae d1, d2 (Fig. 2e), and e1 are the thinnest and shortest ones, their tips scarcely passing the insertion points of the next setae.

Ventral region: (Fig. 2b)

Coxisternal formulae 3-1-3-3. Most of the epimeral setae are absent, when present they are thin, without cilia, and placed perpendicularly to the epimeral surface. Genital plates (Fig. 2c) are provided with nine pairs of setae, thick, smooth,

and strongly curved inwards. Two pairs of adgenital setae are also placed perpendicularly to the ventral surface. Preanal plate rectangular in shape. The two pairs of anal setae are thin and smooth. Adanal setae thicker than the previous ones, and provided with abundant cilia, mainly setae ad1.

Legs monodactyle.

DISCUSSION

KUNST (1971) includes new genera, not before described, in his key of genera for this family. Those new genera included are *Paulonothrus*, *Capillonothrus*, and *Ovonothrus*. He does not indicate type species for each genus, but provides one figure for each one, which will therefore be considered the type species. The characters used by KUNST to separate those new genera as well as the previously known ones, *Heminothrus* BERLESE, 1913, *Neonothrus* FORSSLUND, 1955 and *Platynothrus* BERLESE, 1913, are: the presence or absence of well developed apophysis where the posterior notogastral setae are inserted, the presence or absence of well distinguished longitudinal central cristae on notogaster, the disposition of the central notogastral setae inside or outside the central cristae, and the number of genital setae.

BALOGH and MAHUNKA, 1983, separate three subgenera from the genus *Heminothrus*, using the above mentioned characters, and also the shape of the notogaster and of the central notogastral setae. These subgenera are *Heminothrus*, *Neonothrus*, and *Platynothrus*, which, as we have seen above, were considered genera. KUNST's 1971 keys would be valid only for palaearctic species known until now, but most of the rest of the known species present mixed characters among the considered genera. KUNST (1971), and BALOGH and MAHUNKA (1983) keys were elaborated from known palaearctic species. When all the before described species in the world are considered, most of them have intermediate characters.

For example the number of genital setae is of great variability, even on the species level. *Platynothrus peltifer* (C.L. KOCH, 1939) presents a genital setae variation from 7 to 17 pairs (TRAWE and OLSZANOSKY, 1988).

Because of all the above explained, we consider the most convenient for the time being, to use the characters of the following key we provide. There are three subgenera of the genus *Heminothrus* in this key, and the following synonymies are presented: *Neonothrus* FORSSLUND (1955) (type species *Neonothrus humicola*, FORSSLUND, 1955) synonymy of *Platynothrus* BERLESE (1913) (type species *Nothrus peltifer* C.L. KOCH, 1939), *Ovonothrus* KUNST (1971) (type species *Angelia capillata* BERLESE, 1914) synonymy of *Capillonothrus* KUNST (1971) (type species *Angelia thori* BERLESE, 1904), *Paulonothrus* KUNST (1971) (type species *Heminothrus paolianus longisetosus* WILLMANN, 1925) synonymy of *Heminothrus* BERLESE (1913) (type species

Nothrus targionii BERLESE, 1885).

- (1) With well developed apophyses in the posterior region of notogaster where the posterior notogastral setae are inserted *Heminothrus* s. str.
- (2) Without the above mentioned apophyses (3)
- (3) With well distinguished longitudinal cristae on the central region of notogaster.
..... *H. (Platynothrus)*
- (4) Without the above mentioned cristae. *H. (Capillonothis)*

The new species would be included in *Heminothrus* s. str. This new species is similar in the dimensions of the specimens, and the length of the notogastral setae, to two of the known species of this genus; *Heminothrus apophysiger* HAMMER, 1979, from Java, and *Heminothrus longisetosus* WILLMANN, 1925, a palaearctic species.

H. apophysiger HAMMER, 1979, is well distinguished from the new one by the presence of foveolae on the central region of the prodorsum, shorter sensillus, different structure of the chitinous prodorsal ribbons with the absence of the circular band, posterior margin of notogaster rounded, e1 setae longer than c1, c2 and d2 setae shorter than d1, shorter lateral notogastral setae, 15-16 pairs of genital setae, ciliated anal setae, and adanal setae inserted in apophyses.

H. longisetosus WILLMANN, 1925, is also distinguished from the new one by the different structure of the chitinous ribbons of prodorsum, presence of foveolae on the prodorsal surface and dotted notogastral surface, setiform and long sensillus, smooth interlamellar setae, setae d 2 does not reach e1 insertion, and posterior notogastral setae with undulating tip, but not strongly curved.

This species has been dedicated to Dr. D. PEDRO OROMÍ, who provided us with the samples studied for this paper.

Heminothrus (Platynothrus) peltifer (C.L. KOCH, 1839)

Samples: 1(2 specns.), and 25 (1 specn.).

Dimensions: 690-792 x 367-445 µm..

We have studied specimens smaller than C. PEREZ-IÑIGO's (1987) ; 780-810 x 450-480 µm. also from the Azores.

C. PEREZ-IÑIGO (*op. cit.*) draws attention to the presence of 9 pairs of genital setae, and exceptionally 10, for the different mites of the Iberian peninsula studied by several authors, and to the specimens studied by himself from the island of Santa Maria, Azores. This variation was also indicated by GRANDJEAN (1971). AOKI (1965)

indicates 13-15 pairs of genital setae for specimens from Japan, which will correspond to *Platynothrus grandjeani* SITNIKOVA, 1975. But later TRAVE and OLSZANOSKY (1988) demonstrated the variability of 7 to 17 pairs of genital setae for this species, as well as the synonymy of *P. grandjeani* with *P. peltifer*. The three specimens we have studied present 9 pairs of genital setae.

Distribution: Cosmopolitan, SCHATZ, 1983.

HERMANNIIDAE

Hermannia nodosa MICHAEL, 1888

Sample: 1(1 spec.).

Dimensions: 786 x 427 μm ..

Size of the studied specimen is slightly smaller than the dimensions indicated by WOAS (1978) for this species, 850-970 x 500-570 μm ..

WOAS (*op. cit.*) includes in *H. nodosa* several of the *H. scabra* citations of different authors. ITURRONDOBEITIA (1985) cites *H. scabra*, but for some of the characters he indicates, it can also be *H. nodosa*.

Distribution: Euroatlantic, WOAS (1981) indicates that this species has been found in Great Britain, Portugal, Norway, Northern Germany, and central Europe.

This is the first time this species is recorded from Macaronesia.

NANHERMANNIIDAE

Nanhermannia nana (NICOLET, 1855)

Samples: 42 (1 specn.), and 49 (1 specn.).

Dimensions: 576-613 x 265-281 μm ..

These specimens present very similar dimensions to Tenerife (Canary Islands) mites of C. PEREZ-IÑIGO (1972) 576-600 μm . length, while Gomera (Canary Islands) mites are longer, C. PEREZ-IÑIGO (1986) 615-660 μm ..

Distribution: Cosmopolitan, TRAVE, 1984.

HERMANNIELLIDAE

Hermanniella incondita C. PEREZ-IÑIGO, 1987

Samples: 3 (1 specn.), and 8 (1 specn.).

Dimensions: 734-823 x 504-536 μm ..

The studied specimens fit very well into the description by C. PEREZ-IÑIGO

(1987) except for the prodorsal surface. C. PEREZ-ÍÑIGO indicates the presence of rounded irregular granules on the posterior region of the prodorsal surface, and large foveolae on the anterior region. In our mites all the prodorsal surface presents foveolae.

Distribution: Macaronesian, only known from the Azores Island, from where it was described.

Hermanniella sp. 1

Sample: 32 (1 specn.).

Dimensions: 670 x 467 μm .

Probably a new species due to characters differing from those of the remaining known species. As we are preparing a future paper giving a revision of the Hermanniellidae, we shall provide the description of the different new species in it.

Hermanniella sp. 2

Sample: 42 (1 specn.).

Dimensions: 670 x 416 μm .

As with the previous species also this one is probably new, and will be described in detail in our next paper.

DAMAEIDAE

Damaeus (Eudamaeus) pomboi C. PEREZ-ÍÑIGO, 1987

Sample: 45 (1 specn.).

Dimensions: 1.131 x 763 μm .

Distribution: Macaronesian, described by C. PEREZ-ÍÑIGO (1988) from these islands.

Damaeus (Adamaeus) onustus C.L. KOCH, 1844

Sample: 31 (2 specns.).

Dimensions: 1.367-1.500 x 980-1.028 μm .

Distribution: Euroatlantic. F. BERNINI *et al.* (1988) assigned this species European distribution.

This is the first time this species is cited from Macaronesia.

CEPHEIDAE

Conoppia palmicincta (MICHAEL, 1884)

Sample: 30 (2 specns.).

Dimensions: 776-914 x 604-709 μm .

Dimensions of the studied specimens are inferior to those indicated by C. PEREZ-ÍÑIGO (1972) for Tenerife (Canary Islands) mites, 900-1040 x 780-884 μm ., and for Azores mites (1987) 1.170-1.200 x 950-960 μm ..

C. PEREZ-ÍÑIGO (1987) also indicates a variation on the form of the sensillus, with a fusiform head, narrow, and projected on seta similar to the genus *Liacarus*, for the Azores mites. And a sensillus with a wider head, and without terminal seta for the mites of Tenerife.

Distribution: Palaearctic. F. BERNINI *et al.* (1988) assigned it previously a European distribution, and it has also been cited from Asiatic Russia by GOLOSOVA *et al.* (1983).

Tritegeus bisulcatus GRANDJEAN, 1953

Sample: 40 (1 specn.).

Dimensions: 847 x 699 μm .

Distribution: Occidental Palaearctic. F. BERNINI *et al.* (1988), assigned it Euro-magrebin distribution.

This is the first time this species is cited from Macaronesia.

Tritegeus? sp.

Sample: 22 (1 specn.).

Dimensions: 749 x 556 μm .

This specimen probably represents a new genus and species, which will be studied in detail and its description is intended to appear in a future paper in which a revision of the Cepheidae will be given.

Tritegeus sp.

Sample: 41 (1 specn.).

Dimensions: 857 x 651 μm .

Probably a new species because of its different characters compared with the rest of the known species. Its description will appear in a future paper.

LIACARIDAE

Li acarus (Dorycranosus) alatus BERLESE, 1904

Samples: 25 (3 specns.), and 40 (2 specns.).

Dimensions: 613-800 x 384-505 μm .

It has been considered that *Dorycranosus punctulatus* MIHELICIC, 1956 and *Dorycranosus alatus* (BERLESE, 1904) are the same species, based on BERNINI's (1973) redescription of *Dorycranosus alatus*, thus the correct name is *L. (D.) alatus*. Among the specimens from the Iberian Peninsula that have been studied showed a number of variations, such as; length of the lamellar setae, width of lamellae, different development of internal lamellar tooth, presence or absence of a small external lamellar tooth, and the extent of the interlamellar space. BERNINI (1973) indicates that *D. alatus* is a species very close to *D. punctulatus*, but the two can be distinguished from one another by the narrower lamellae, and shorter lamellar setae presented by *D. punctulatus*. Based on the great variability mentioned above, and also observed by BERNINI (1973) for *D. alatus*, we consider they are the same species.

This species has been cited under the name of *D. punctulatus* from the Azores, C. PEREZ-ÍÑIGO (1987)

Distribution: Mediterranean, C. PEREZ-ÍÑIGO, 1988.

Li acarus (Dorycranossus) angustatus (WEIGMANN, 1976)

Sample: 15 (1 specn.).

Dimensions: 1.194 x 762 μm .

C. PEREZ-ÍÑIGO (1987) indicates the presence of two incisions with rounded bottom, and a more or less bilobular central region, on the rostral margin, for the mites of Santa Maria. Mites studied by WEIGMANN (1976) from Faial present the central lobe more or less quadrangular. We consider this a normal variability. The specimen we have studied, from Pico, has the central lobe quadrangular and bilobed at the same time, and also one of the lateral teeth is bilobed.

Distribution: Macaronesian, only known from the Azores.

Li acarus (Li acarus) madeirensis WILLMANN, 1939

Sample: 26 (1 specn.).

Dimensions: 1.076 x 687 μm .

Distribution: Macaronesian. It has been cited from Madeira, WILLMANN, 1939, and from the Azores, C. PEREZ-ÍÑIGO, 1987.

Li acarus (Li acarus) mucronatus WILLMANN, 1939

(Fig. 3 a-c)

Samples: 8 (1 specn.), 38 (2 specns.), and 40 (1 specn.).**Dimensions:** 945-1.086 x 646-707 μm .

Dimensions of the studied specimens are more similar to the dimensions indicated by WILLMANN (1939) for the Madeira mites, 930-1.180 x 550-720 μm ., and by C. PEREZ-IÑIGO (1987) for the Azorean mites, 900-1.095 x 570-660 μm . All of them are larger than the dimensions indicated by C. PEREZ-IÑIGO (1976) for the Tenerife (Canary Islands) mites, 715-871 x 416-520 μm ..

C. PEREZ-IÑIGO (1987) adds new characters, such as the presence of a trilobed rostrum with a longer middle tooth (Fig. 3b), and the great length of the interlamellar setae, which are easily broken. We have observed these characters, and also a ventral surface finely dotted (Fig. 3a), and great length of the ventral setae, mainly the genital (Fig. 3c) and the adgenital ones, which are placed perpendicularly to the surface of the plates turning it difficult to ascertain their total length.

Distribution: It is considered an Ibero-Macaronesian species because besides the above mentioned cites of Madeira, the Azores, and the Canary Islands, it has been cited also from Navarra (North Spain), MORAZA *et al.*, 1980.

XENILLIDAE

Xenillus discrepans azorensis C. PEREZ-IÑIGO, 1987

Samples: 1(1 specn.), 8 (2 specns.), 12 (1 specn.), 30 (1 specn.), 37 (1 specn.), and 42 (1 specn.).

Dimensions: 931-1.238 x 593-840 μm .

This subspecies presents great variability in dimensions, as also the nominate species do.

Distribution: Macaronesian, only being known from the Azores.

SCUTOVERTICIDAE

Hypovortex sp.

Sample: 13 (1 specn.).

Dimensions: 632 x 360 μm .

Because of its characters differing to the rest of the known species we believe

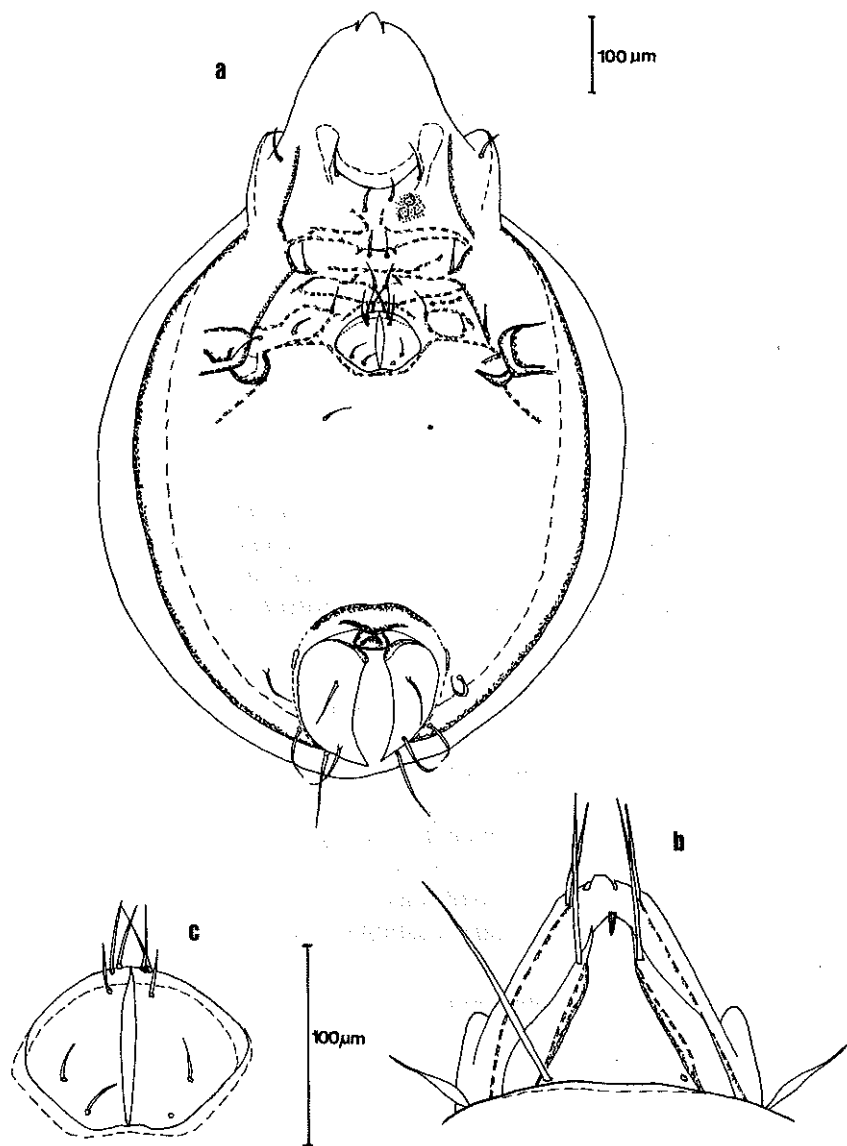


Fig. 3 a-c -- *Liacarus* (s. str.) *mucronatus* WILLMANN, 1939. a - Ventral view, b - Dorsal view of prodorsum, c - Genital plates.

it may be a new species. As we are preparing a paper dealing with the family it belongs to, it will be described in it.

Scutovertex sp.

Samples: 7 (16 specns.), and 9(107 specns.).

Dimensions: 468-555 x 265-320 μm .

As the previous species it may be new to the above genus and family, which will be the subject of a following paper.

PHENOPELOPIDAE

Eupelops occultus (C.L. KOCH, 1836)

Sample: 33 (1 specn.).

Dimensions: 468 x 345 μm .

Dimensions of the specimen studied are inferior to the ones indicated by C. PEREZ-ÍÑIGO (1972) for the mites of the Iberian Peninsula, 475-510 μm . length, and for the Gomera (Canary Islands) (1986) mites, 540-580 x 420-480 μm .

Distribution: Palaearctic, C. PEREZ-ÍÑIGO, 1988.

This is for the first time that this species is recorded from Azores.

ORIBATELLIDAE

Oribatella quadricornuta (MICHAEL, 1880)

Sample: 40 (1 specn.).

Dimensions: 512 x 358 μm .

The epimeral setae 4a and 4b are of greater length than the ones represented by BERNINI (1975). These setae are of a similar length to setae 3c, but slightly thinner.

Distribution: Occidental Palaearctic. (Centro-occidental European, according to BERNINI, *et al.*, 1988).

ACHIPTERIIDAE

Parachipteria petiti TRAVÉ, 1960

Sample: 42 (1 specn.).

Dimensions: 576-380 μm .

The specimens studied present a sensillus with a short head, more like the

sensillus of *P. weigmanni*. Setae r2 are placed more posteriorly to areae porosae A2 than in *P. weigmanni*, and they are placed anteriorly to those areas in *P. petiti*. In spite of all the before mentioned, this specimen has been assigned to *P. petiti* as a result of the remaining characters.

Distribution: Occidental Mediterranean. C. PEREZ-ÍÑIGO (1988) indicated for this species, cited from France (TRAVERE, 1960), Italy (BERNINI, 1970), and Spain (SUBIAS, 1977), a European distribution. It is considered more appropriate to assign this species an Occidental Mediterranean distribution, after the opinion of RUIZ *et al.* (1986).

Parachipteria willmanni v.d. HAMMEN, 1952

Sample: 31 (7 specns.).

Dimensions: 679-691 x 417-425 μm .

The notogastral setae, mainly c2 and c3, are longer than accepted until now.

Distribution: Holarctic, SCHATZ, 1983.

This is the first time this species is cited from the Azores.

CERATOZETIDAE

Ceratozetes simulator C. PEREZ-ÍÑIGO, 1970

Sample: 25 (1 specn.).

Dimensions: 519 x 328 μm .

Dimensions of the specimen studied are superior to those indicated by C. PEREZ-ÍÑIGO (1987), 492 x 260 μm ., also for Azorean mites, but more similar to the length indicated by the same author (1970) for the mites of the Iberian peninsula, 525 μm .

Distribution: Mediterranean, C. PEREZ-ÍÑIGO, 1988.

Humerobates rostromellatus gadarramicus C. PEREZ-ÍÑIGO, 1972

Sample: 8(1 specn.).

Dimensions: 860 x 595 μm .

The tibiae of both sides present small teeth of a different development, and in an irregular number, so they are not convex and without teeth as in the nominate species.

It is considered that the genus *Baloghobates* HAMMER, 1967, (which BALOGH (1972) indicates is distinct from *Humerobates* because the former has movable pteromorphae) is a synonym of *Humerobates*, for which also GRANDJEAN (1936)

indicates the presence of movable pteromorphae. The species *Baloghobates nudus* HAMMER, 1967 is similar to *H. r. guadarramicus*, and both of them have tutoria provided with teeth, but can be distinguished from one another because the sensillus of *B. nudus* is shorter, without stalk, and has a more rounded head.

Distribution: Up to the present date this subspecies has only been known from the Iberian Peninsula, so we can assigne it an Iberomacaronesian distribution.

This is the first time this subspecies is cited from Macaronesia.

Latilamellobates incisellus (KRAMER, 1897)

Sample: 36 (1 specn.).

Dimensions: 631 x 376 μm .

C. PEREZ-ÍÑIGO (1976) points out several differences between the Tenerife (Canary islands) mites, and the Iberian peninsula mites, such as the presence of slightly shorter lamellae, with the cuspidal tips not very developed, almost rounded, and thinner notogastral setae. The Azores specimen shows a lamellar cusp with a minute internal tooth, and the other cusp without tooth, and the notogastral setae are more like those of the peninsular mites.

Distribution: Palaearctic, F. BERNINI *et al.*, 1988.

This is the first time this species is cited from the Azores.

Melanozetes azoricus WEIGMANN, 1976

Sample: 20 (1 specn.).

Dimensions: 577 x 366 μm .

Distribution: Macaronesian, C. PEREZ-ÍÑIGO, 1988.

EUZETIDAE

Euzetes globulus (NICOLET, 1855)

Samples: 28 (22 specns.), 29 (9 specns.), 30 (261 specns.), 35 (14 specns.), 38 (109 specns.), 39 (81 specns.), 40 (136 specns.), 41 (47 specns.), 43 (16 specns.), 42 (11 specns.), 46 (4 specns.), and 48 (1 specn.).

Dimensions: 962-1.273 x 702-934 μm .

This is the most abundant and frequent species of all the soil samples studied.

Distribution: Palaearctic, BERNINI *et* ARCIDIACONO, 1985.

GALUMNIDAE

Acrogalumna longipluma (BERLESE, 1904)

Samples: 11 (1 specn.), 24 (1 specn.), 31 (2 specns.), and 39 (5 specns.).

Dimensions: 680-718 x 527-542 μm .

There is a great variability in the shape of the areae porosae. Aa closer to the pteromorphae charnela, as BERLESE (1915) and other authors formerly remarked.

Distribution: This species is assigned a probably cosmopolitan distribution as it has been cited from the Holarctic region and from the Australian region, MARSHALL *et al.*, 1987.

Galumna gibbula GRANDJEAN, 1956

Sample: 13 (1 specn.).

Dimensions: 543 x 308 μm .

Length of the studied specimen is slightly larger than that indicated by RUIZ *et al.* (1986), 411-489 μm .

Distribution: Occidental Mediterranean, RUIZ *et al.*, 1986.

This is the first time this species is cited from Macaronesia.

Galumna elimata (C.L. KOCH, 1841)

Samples: 31 (3 specns.), and 38 (1 specn.).

Dimensions: 794-804 x 581-612 μm .

Its size is more similar to the one indicated by C. PEREZ-ÍNIGO (1976) for the Tenerife (Canary Islands) mites 705-840 x 590-630 μm ., and for the Azores mites (1987) 750-840 x 630-690 μm ., than to the dimensions indicated by RUIZ *et al.* (1986) for the Iberian Peninsula mites cited as *G. obvia* 572-595 x 420-434 μm .. These mites cited as *G. obvia* have been studied, and they probably belong to different species.

Distribution: Cosmopolitan, TRAVE, 1984.

Galumna sp.

Samples: 8 (2 specns.), 29 (9 specns.), 30 (1 specn.), and 40 (1 specn.).

Dimensions: 845-924 x 613-684 μm .

These specimens probably belong to a new species which will be described in a future paper where the whole Galumnidae family from the Azores will be revised.

Galumna rasilis C. PEREZ-IÑIGO, 1987

Sample: 31 (6 specns.).

Dimensions: 701-707 x 527-555 μm .

Distribution: Macaronesia. It has been described by C. PEREZ-IÑIGO, 1987 from the Azores.

Pergalumna myrmophila (BERLESE, 1915)

Sample: 31 (11 specns.).

Dimensions: 623-679 x 462-493 μm .

Distribution: Probably Mediterranean. It was previously known from the south of Europe, but it was also cited from the Caucasus and Crimea, KARPPINEN *et al.*, 1987.

This is the first time this species is cited from Macaronesia.

Vaghia simplex TRAVÉ, 1957

Sample: 47 (1 specn.).

Dimensions: 886 x 660 μm .

Distribution: Occidental Mediterranean. It is also known from France (TRAVE, 1957), and Spain (C. PEREZ-IÑIGO, 1972 and several later authors).

This is the first time this genus and species is cited from Macaronesia.

Vaghia sp.

Sample: 31(7 specns.).

Dimensions: 842-906 x 604-688 μm .

This specimens probably belongs to a new species which will be described in a future paper on the Galumnidae, mentioned above.

ORIBATULIDAE

Oribatula (Zygoribatula) propinqua (OUDEMANS, 1902)

Samples: 23 (1 specn.), and 27 (1 specn.).

Dimensions: 425-441 x 249-263 μm .

Dimensions of the studied specimens are more similar to the Tenerife (Canary Islands) mites: 360-420 μm . length (C. PEREZ - IÑIGO, 1976), than to the Iberian

Peninsula ones, 315-385 x 170-230 μm .

Distribution: Meridional Palaearctic. SCHATZ, 1983 assigns, with some reserve, a palaearctic distribution to this species.

This is the first time this species is cited from the Azores.

Oribatula (Zygoribatula) undulata BERLESE, 1917

Samples: 10 (1 specn.), and 31 (1 specn.).

Dimensions: 500 x 318-322 μm .

Distribution: This species has been assigned a subtropical cosmopolitan distribution, due to the different citations from Middle, South, and Southeast Europe as well as Australia (SCHATZ, 1983), Egypt (BERNINI, 1979), the Tonga Islands (HAMMER, 1973 as *longiporosa*), and from the South of Asiatic Russia (KARPPINEN, *et al.*, 1986 also as *longiporosa*).

This is the first time this species is cited from Macaronesia.

PROTORIBATIDAE

Liebstadia gallardoi (MORELL, 1987)

Sample: 5 (1 specn.).

Dimensions: 387 x 190 μm .

After having studied the Iberian Peninsular specimens described as *Protoribates gallardoi*, it has been considered that this species must be in the genus *Liebstadia*, because of the immovable pteromorphae, with the charnela absent.

The dimensions of the studied specimen are slightly superior to those indicated by MORELL, 1987; 348-372 x 168-180 μm .

Distribution: This species has been described from the Iberian Peninsula (MORELL, 1987), and is now cited from the Azores, thus it is assigned an Iberomacaronesian distribution.

This is the first time this species is cited from the Azores.

SCHELORIBATIDAE

Scheloribates laevigatus (C.L. KOCH, 1936)

Samples: 17 (1 specn.), and 19 (1 specn.).

Dimensions: 410-495 x 280-308 μm .

Distribution: Cosmopolitan, F. BERNINI *et al.*, 1988.

This is the first time this species is cited from the Azores.

Scheloribates latipes (C.L. KOCH, 1844)

Sample: 1 (1 specn.).

Dimensions: 457.5 x 273 μ m.

Distribution: Holarctic, F. BERNINI *et al.*, 1988.

This is the first time this species is cited from the Azores.

Dometorina plantivaga (BERLESE, 1895)

Samples: 5 (6 specns.), 13 (10 specns.), and 14 (1 specn.).

Dimensions: 378-478 x 210-329 μ m.

Most of the specimens present five pairs of genital setae, there are however a small number of specimens with some variations; five pairs of genital setae on one plate and four on the other, or a specimen with five on one plate and three genital setae on the other. GRANDJEAN (1951) indicates the variability of the number of genital setae; among 20 specimens studied he found 17 with four pairs of genital setae, 2 with four on one plate and five on the other, and 1 with three on one plate and four on the other.

The lamellar setae insertions are closer to the interlamellar setae than to the rostral ones. GRANDJEAN (1951) represents the lamellar setae equally separated from the interlamellar and from the rostral setae.

Distribution: We consider this species has probably a cosmopolitan distribution, since MARSHALL *et al.* (1987) indicate it has been recorded from the U.S.A., Canada, Mexico, and Neotropical and Palearctic regions.

This is the first time this genus and species is cited from Macaronesia.

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