

First records of Endeostigmata and Sphaerolichina mites (Acari: Sarcoptiformes and Trombidiformes) from the Iberian Peninsula and the Canary Islands

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ABSTRACT

Endeostigmata and Sphaerolichina mites from the Iberian Peninsula and the Canary Islands are reported for the first time. A total of seven families, 14 genera and 16 species have been collected from oak and pine forests of Navarra (northern Spain) and other habitats of the Canary Islands. A key to families and genera identified in this study is presented.

Key words: Acari, Endeostigmata, Sphaerolichina, Iberian Peninsula, Canary Islands.

RESUMEN

Primeras citas de ácaros Endeostigmata y Sphaerolichina (Acari: Sarcoptiformes and Trombidiformes) de la Península Ibérica e Islas Canarias.

Este artículo es el primero que se dedica al estudio de los ácaros Endeostigmata y Sphaerolichina de la Península Ibérica y las Islas Canarias. Un total de siete familias, 14 géneros y 16 especies han sido recolectados en robledales y pinares de Navarra (Norte de España) y otros biotopos de las Islas Canarias. Se adjunta una clave para la identificación de las familias y géneros de estudio.

Palabras clave: Acari, Endeostigmata, Sphaerolichina, Península Ibérica, Islas Canarias.

INTRODUCTION

The mites of Suborder Endeostigmata Grandjean, 1937, are early derivative lineages of desclerotized, anamorphic, sarcoptiform mites, often of reduced body size. They exhibit various important characteristics, among

them constrictions reflecting opisthosomal segmentation. (GRANDJEAN, 1937, 1939, 1942; WALTER, 2001).

Actually, these saprophages, microbivores, and predators of other small soil invertebrates are established in 9 families: three were proposed by GRANDJEAN (1937, 1939) –Alicorhagiidae, Nanorchestidae and Ternacaridae; three clearly belong in the endeostigmatid families –Nematallycidae (Strenzke, 1954), Micropsammidae (Coineau & Theron, 1983) and Proteonematallycidae (Kethley, 1989); two were proposed by KETHLEY (1977) –Grandjeanicidae and Oehserchestidae, and finally Alycidae Canestrini & Fanzago (1877) (=Pachygnathidae Kramer, 1877 and Bimichaeliidae Womersley, 1944) and the most recent family Proterorhagiidae Lindquist & Palacios-Vargas, 1991.

Two more families, Lordalychidae Grandjean 1939 and Sphaerolichidae Grandjean 1937, used to be considered Endeostigmata mites, but are presently considered the sister group to the Prostigmata and placed in the Sphaerolichida (Order Trombidiformes) (O'Connor, 1984).

Endeostigmatid mites from the Iberian Peninsula and the Macaronesian Region are completely unknown. Here, we present the first data on these taxa to make names available for current ecological studies and contribute to the knowledge of their diversity and geographical distribution. A key to the identification of the families of these mites, modified from KETHLEY (1990) and WALTER (2001), is provided.

MATERIAL AND METHODS

Mites were collected mainly from pine forests (*Pinus halepensis* Mill) and oak forests (*Quercus robur* L. and *Quercus ilex* L., subsp. *ballota* (Desf.)) from different localities of Navarra (northern Spain) (Table 1), and from different habitats of the Canary Islands (Tenerife and La Gomera). The mites were extracted from soil, humus and litter using a Berlese-Tullgren funnel. The specimens were cleared in Nesbitt's solution before mounting in Hoyer's medium and sealed with Glyptal insulating varnish. Morphological observations and identifications were made using a compound microscope equipped with a phase-contrast optical system. Setal designation follows KETHLEY (1990) and LINDQUIST AND PALACIOS-VARGAS (1991). Specimens are deposited in the Museum of Zoology of the University of Navarra (MZUNAV).

Table 1. Data about studied localities from Navarra (Spain).**Tabla 1.** Datos sobre las localidades estudiadas (España).

<i>Locality Navarra</i>	<i>Habitat</i>	<i>UTM</i>
El Yugo	Pine forest <i>P. halepensis</i>	30TXN156731
Funes	Pine forest <i>P. halepensis</i>	30TWM978850
La Gerinda	Pine forest <i>P. halepensis</i>	30TXN159099
Tafalla	Pine forest <i>P. halepensis</i>	30TXN111123
Leitza	Oak forest <i>Q. rubor</i>	30TWN8870
Biurrun	Oak forest <i>Q. ilex</i>	30TXN084277
Caparroso	cornfield	30TXM1190

RESULTS

Key to families of Sphaerolichida and Endeostigmata mites based on adults

1. Prodorsal trichobothria present; genital papillae present in nymphs and adults; body shape never worm-like; eyes present or absent. 2
— Prodorsal trichobothria absent; genital papillae absent in nymphs and adults; body often worm-like; eyes absent..... 8
2. One pair of prodorsal trichobothria present; rutella present..... 3
— Two pairs of prodorsal trichobothria present; rutella present or absent..... 6
3. Long trichobothrium present on tarsus I which lacks claws; adults with 3 pairs of genital papillae **Grandjeanicidae**
— Trichobothrium absent on tarsus I; tarsus I claws present or absent; adults with 2-3 pairs of genital papillae..... 4
4. Pretarsi II-IV lack claws, only empodium present; prodorsum with 6 pairs of structures (including trichobothria); chelicerae with 1 seta; sclerotized esophagus present extending into the prodorsum region.
..... **Alicorhagiidae**
— Pretarsi II-IV usually with paired claws and empodium; prodorsum with 4 or more pairs of setae (including trichobothria); sclerotized esophagus when present, not extending to the level of the prodorsum..... 5
5. Legs I tridactilous (claws and empodium); 6 pairs of prodorsal structures..... **Terpnacaridae**

- Legs I monodactilous (claws absent); 5 pairs of prodorsal structures.....**Oehserchestidae**
- 6. Adults with segment C with no more than 2 pairs of setae; prodorsum with 2 pairs of filamentous trichobothria..... **Sphaerolichida**
 - Adult with segment C usually hypertrichous, with 4 or more pairs of setae, one pair of prodorsal trichobothria often clavate or capitate..... 7
- 7. Pretarsi I-IV tridactilous, each with 2 claws and empodium; labrum unsclerotized**Lycidae**
 - Pretarsi I-IV monodactilous, only empodial claw present; labrum sclerotized..... **Nanorchestidae**
- 8. Peritremes present between cheliceral bases; rutellum tridentate; hysteronotal series 4-2-2-2-3 pairs of setae; coxal fields III and IV longitudinally separate; trochanters I-IV of adults nude
 - **Proteonematalycidae**
 - Peritremes absent..... 9
- 9. Six pairs of prodorsal setae present; rutellum massive, tridentate; adults with at least 1 seta on trochanters III and IV; genu IV and tibia III and IV with 3 setae; femur IV with 2 setae.....
 - **Micropsammidae**
 - At most 7 prodorsal setae present (3 pairs plus 1 seta); rutellum minute, unsclerotized; adults trochanters III and IV nude; genu IV and tibia III and IV with no more than 2 setae; femur IV with no more than 1 seta **Nematalycidae**

Family Alicorhagiidae Grandjean, 1939

Diagnosis: Prodorsum with one pair of filamentous prodorsal trichobothria and 5 pairs of setae; naso well developed bearing 1 pair of setae; lateral eyes absent. Subcapitulum with 6 pairs of setae; rutella slender and dentate; chelicera chelate-dentate, each with 1 seta. Dorsal chaetotaxy: 4-2-2-3-3-3-4-4. Adults with 2-3 pairs of genital papillae. Genital flaps with 7-10 pairs of setae in two rows. Pretarsi I-IV with a claw-like empodium. Five species in three genera (see HALLAN, 2000).

Key to genera:

- 1. Rutella slender, with distal teeth; adults with 2 pairs of genital papillae; 10 pairs of genital setae in two rows.....**Alicorhagia**
 - Rutella bilobed; adults with 3 pairs of genital papillae; 7 pairs of genital setae.....**Stigmalycus**

Alicorhagia* Berlese, 1910: 243**Alicorhagia usitata* Theron *et al.*, 1970: 669**

Material examined: Spain (Navarra). It is a very abundant and frequent species in soil, humus and litter from several localities of Navarra. From soil of pine forest: Tafalla, 277 specimens, all instars, 22.XI.2001; La Gerinda, 372 specimens, all instars, 22.XI.2001; El Yugo, 59 specimens, all instars, 29.X.2001; Funes, 70 specimens, 16.XI.2001. From litter from oak forests, humus and soil: Leitza, 2 specimens, 18.III.1992; Biurrun, 7 specimens, 21.XII.1993.

Stigmalychus* Theron, Meyer & Ryke, 1970: 672**Stigmalychus veretrum* Theron, Meyer & Ryke, 1970: 672**

Material examined: Spain (Navarra). From litter, humus and soil of oak forests: Leitza: 1 specimen, 18.III.1992; 29 specimens, 09.IV.1993; 13 specimens, 16.XII.1993; Biurrun, 1 specimen, 14.V.1991.

Family Alycidae Canestrini & Fanzago 1877

(= Pachygnathidae Kramer 1877, Bimichaeliidae Womersley 1944)

Diagnosis: Prodorsum with 2 pairs of prodorsal trichobothria, posterior pair may be clavate or capitate, and 4 or more pairs of barbed to stellate setae; naso reduced or absent; median eye may be present on the naso; lateral eyes present or absent. Subcapitulum with 4 pairs of setae; rutella present or absent; chelicera chelate or stylet-like, each with 0 to 2 setae. Adults with 3 pairs of genital papillae. Dorsal chaetotaxy usually hypertrichous. At least 23 species in 11 genera (HALLAN, 2000).

Key to genera:

1. Prodorsum with posterior pair of trichobothria (*sci*) capitate and 4 or more pairs of setae; naso with median eye; lateral eyes absent; chelicerae styliform and nude, opisthosoma usually hypertrichous..... ***Bimichaelia***
 — Prodorsum with 2 pairs of trichobothria filiform (*si*, *ve*) and 3-4 pairs of setae..... 2
2. Chelicera with swollen bases, nude, attenuate-edentate..... ***Pachygnathus***
 — Chelicerae chelate-dentate, with 1 or 2 setae each..... 3
3. Prodorsum with 3 pairs of setae, naso and median eye absent; 1 pair of lateral eyes; chelicerae each with 1 seta; opisthosoma hypertrichous..... ***Orthacarus***

- Prodorsum with 4 pairs of setae (*vi, se, in, exp*) and 2 pairs of filiform trichobothria; 2 pairs, lateral eyes present 4
4. Naso reduce, median eye absent; chelicera each with 2 setae.....
..... *Alycus*
- Naso absent, medial eye present; chelicera each with 1 seta
..... *Amphialycus*

***Alychus* Canestrini & Fanzago, 1841**

***Alychus roseus* (Koch, 1841)**

Material examined: Spain (Navarra). From oak litter and humus: Leitza, 1 specimen, 18.III.1992 and 2 specimens, 16.XII.1993; Biurrun, 2 specimens, 21.V.1991 and 17 specimens, 21.XII.1993.

***Amphialycus* Zakhvatkin, 1949**

***Amphialycus pentophthalmus* Zakhvatkin, 1949: 296**

Material examined: Spain (Tenerife, Canary Islands). One specimen from soil and humus of *Ficus carica* and *Retama raetam*, Tamaimo (UTM: 28RCS 221 2931), altitude 750 m, 2 specimens, 9.12.1995 (T-20).

***Bimichaelia* Thor, 1902**

***Bimichaelia sarekensis* (Trägårdh 1910)**

Bimichaelia setigera var. *sarekensis* Trägårdh, 1910: 468; Thor & Willmann, 1941: 143

Material examined: Spain (Navarra). From litter and humus of pine forests (*P. halepensis*): La Guerinda, 14 specimens, 21.XI.2001; El Yugo, 14 specimens, 29.X.2001, 18 specimens, 14.XI.2001 and 14 specimens, 16.XI.2001.

***Pachygnathus* Duges, 1834**

***Pachygnathus leucogaster* Grandjean, 1937d: 262**

Material examined: Spain (Navarra). Biurrun, from soil and oak forest litter: 1 specimen, 14.V.1991.

Orthacarus Zakhvatkin, 1949***Orthacarus tremli* Zakhvatkin, 1949: 291**

Material examined: (Spain, La Gomera). One specimen from La Gomera (Canary Islands), s. Apartacaminos (UTM: 28RBS748158), from rotten wood from floor of a green forest (faya-heath & laurisilva), altitude 1,080 m, 30.V.2002 (G-48).

Family Nanorchestidae Grandjean 1937

Diagnosis. Body elongate or globular. Prodorsum with 2 pairs of trichobothria (*bo*, *ro*), posterior pair may be clavate or capitate, and 4 pairs of setae (*le*, *exa*, *in*, *exp*); naso nude; 1-2 pairs of lateral eyes, median eye usually present. Labrum tubular, elongate and well sclerotized; chelicerae weakly dentate, each with 2 setae; rutella simple or highly modified; subcapitulum with 5-6 pairs of setae (2-3 pairs of adoral and 3 pairs of hypostomal setae); palps with 4-5 free segments. Dorsal chaetotaxy hypertrichous, setae typically dendritic, orcuneate; 2-3 pairs of genital papillae. Empodial claw smooth with a swollen, setulose basal region. At least 33 species in seven genera (HALLAN, 2000).

Key to genera:

1. Body globular; prodorsal seta *ro* with latch-like seta *le* ; 1 pair of lateral eyes and median eye usually present; opisthosomal setae typically dendritic ***Nanorchestes***
 — Body elongate; prodorsum without latch-like seta; 1–2 pairs of lateral eyes and median eye usually present; opisthosomal setae often cuneate ***Speleorchestes***

Nanorchestes Topsent & Trouessart, 1890***Nanorchestes pulvinar* Grandjean, 1942: 264**

Material examined: Spain (Navarra). From litter, humus and soil from oak forests: Leitza, 66 specimens, all instars, 09.IV.1991; Biurrun, 2 specimens, 21.V.1991. From soil of pine forest in Funes, 3 specimens, 18.XI.94.

***Nanorchestes siculus* (Berlese, 1910): 200**

Material examined: Spain (Tenerife). Nine specimens, from Tenerife (Canary Islands), from lichens and moss on vertical shady wall (north exposure), altitude 2080 m, UTM: 28RCS 345 221, Parque Nacional del Teide. Cañada de Chavao, 5.VIII.1997 (T-110).

***Speleorchestes* Trägårdh, 1090**

Speleorchestes pratensis Willmann, 1936: 286; Thor & Willmann, 1941: 161

Material examined: Spain (Navarra). From oak forest litter, humus and soil, Leitza, 8 specimens, 09.IV.1991. From soil of pine forests (*P. halepensis*): Biurrun, 3 specimens, 21.XII.1993; Tafalla, 21 specimens, all instars, 22.XI.2001; La Guerinda, 45 specimens, 21.XI.2001; Yugo, 20 specimens, 29.XI.2001; Funes, 2 specimens, 14.XI.2001.

***Speleorchestes* sp.**

Material examined: Spain (Tenerife). Four specimens from dry soil and humus at the base of *S. supranubius*, altitude 2,225 m, Parque Nacional del Teide. Cañada Blanca, 5.VIII.1997 (T-99); two specimens from soil and humus of *Echium auberianum*, altitude 2100 m, Parque Nacional del Teide. Siete Cañadas (Arenas Negras), 6.VIII.1997 (T-114).

Family Terpnacaridae Grandjean 1939

Diagnosis: Prodorsum with 1 pair of filiform trichobothria (*bo*) and 5 pairs of setae; naso well developed and bearing 1 pair of setae and median eye; lateral eyes present or absent. Subcapitulum with 5-6 pairs of setae; rutella slender; chelicerae chelate-dentate, each with 2 setae. Adult females with 28-35 pairs of dorsal setae; 10-16 pairs of genital setae in 2 rows: 3 pairs of genital papillae. Pretarsi with a pair of simple claws and a claw-like empodium with a rayed base. Three species in two genera (HALLAN, 2000).

Key to genera:

1. Prodorsum with 5 pairs of setae, mostly expanded to foliose; lateral eyes absent; opisthosomal setae mostly expanded, foliose or subrectangular *Alycosmesis*
 — Prodorsum 5 pairs of setae unmodified; lateral eyes present or absent; opisthosomal setae unmodified *Terpnacarus*

***Alycosmesis* Grandjean 1939**

Alycosmesis palmata (Oudemans, 1904); Grandjean, 1939: 63

(=*Sebaia palmata* Oudemans, 1904: 171)

Material examined: Spain (Navarra). From litter, humus and soil of pine forests: La Boln. *Asoc. esp. Ent.*, 32 (3-4): 293-304, 2008

Guerinda, 116 specimens, 21.XI.2001; Tafalla, 4 specimens, 22.XI.2001; Yugo, 56 specimens, 29.X.2001; Funes, 66 specimens, 16.XI.2001.

***Terpnacarus* Grandjean, 1939**

***Terpnacarus bouvieri* Grandjean, 1939: 51**

Material examined: Spain (Navarra). One specimen, Caparroso, cornfield, ex *Capsella bursa-pastoris*, 04.III.1994.

Family Nematalycidae Strenke, 1954: 645

Diagnosis: Elongate, worm-like endeostigmatans without prodorsal trichobothria. Prodorsum with 6 setae, usually with a single, unpaired *vi* seta; rutellum massive, tridentate; chelicerae minute. Four species in four genera.

***Psammolycus* Schubart, 1973: 53**

Worm-like mites, prodorsum with unpaired *vi* setae; chelicerae with 1 seta each.

***Psammolycus delamarei* Schubart, 1973**

Material examined: Spain (Navarra). One specimen, Funes, from pine forest soil (*P. halepensis*), 16.XI.2001. *Ps. delamarei* was previously reported from deep sand in Brazil.

Cohort Sphaerolichina

Family Sphaerolichidae Grandjean, 1937

Diagnosis: Prodorsum with two pairs of filamentous prodorsal trichobothria present and 4 pairs of setae; naso well developed; lateral eyes present. Subcapitulum with 5 pairs of setae; rutella absent; chelicera with lobed teeth or with fixed digit truncate and movable digit serrulate; each with two dorsal setae. Dorsal chaetotaxy reduced, setal row *c* with no more than 2 pairs of setae. Adults with two pairs of genital papillae; genital flaps with 7 pairs of setae in one row. Pretarsi I bidactilous, pretarsi II, III and IV tridactilous (two claws and one claw-like empodium). Four species from one genus: *Sphaerolychnus* Berlese, 1904.

***Sphaerolychus barbarus* Grandjean, 1939: 84**

Material examined: Spain (Navarra). From oak litter, humus and soil: Leitza, 2 specimens, 18.III.1992; Biurrun, 7 specimens, 21.XII.1993.

Family Lordalychidae Grandjean, 1939

Diagnosis. Globular bodies and strongly ornamented cuticle. Prodorsum with two pairs of filamentous prodorsal trichobothria set in a communal depression; naso well developed; eyes absent. Subcapitulum with 4 pairs of setae; chelicera each with two dorsal setae; fixed cheliceral digit truncate distally. Adults with 2 pairs of genital papillae; genital flaps with 8 pairs of setae in 2 rows. Tarsi I-IV tridactilous. Seven species in 1 genus.

***Hybolicus peraltus* (Grandjean, 1942)**

Lordalycus peraltus Grandjean, 1942: 107

Material examined: Spain (Navarra). Biurrun, from oak forest soil and litter, 7 specimens, 14.V.1991; 2 specimens, 21.V.1991; 6 specimens, 26.II.1992; 6 specimens, 18.XI.1993. Funes, from soil with *Rosmarinus*, 2 specimens, 18.XI.1994.

REMARKS

Apart from the studies by Grandjean in France, these mites have hardly been studied in other European countries. The general lack of knowledge about this group of mites may be related to their small physical size and, hence, difficulty in observing them.

Two of the species reported in the present paper, *A. palmata* and *St. veretrum* (first described in South Africa), were found in Australia, probably introduced to this continent through ship ballast or in potted plants (WALTER, 2001). None of the insular species cited here have appeared on the Iberian Peninsula although *N. siculus* was previously cited in Italy, and *Or. tremli* and *A. pentophthalmus* in Ukraine (ZACHVATKIN, 1949).

In the Canary Islands, after investigating a wide diversity of habitats, only four species have been identified to date. This has not been the experience in Navarra where, if we consider that as of present there has been only limited examination of the habitats in which these mites could be found, it is possible that we have before us a group whose diversity and distribution may grow significantly as result of future studies.

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