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GEHYPOCHTHONIUS MARIANOI N. SP. (ACARI: ORIBATIDA), FROM SAND DUNES IN COASTAL ARGENTINA.

by Pablo Antonio MARTÍNEZ * and Verónica BERNAVA LABORDE **

(Accepted February 2000)

MITES, ORIBATIDA, PARHYPOSOMATA, GEHYPOCHTHONIUS, COASTAL SAND DUNES, ARGENTINA.

ABSTRACT: Gehypochthonius marianoi n. sp. (Acari: Oribatida), is described from adults and immatures collected in coastal sand dunes in Buenos Aires, Argentina. The species is compared with adults and immatures of G. rhadamanthus and G. xarifae respectively, and included in “rhadamanthus complex” (Lee, 1982). Diagnosis of this complex is discussed.

INTRODUCTION

Parhyposomata represent a group of Oribatid mites which possess a post-pedal articulation, like other taxa considered more primitive (some Enarthronota), that divides the hysterosoma into two regions, and a pair of opisthosomatic glands, like more advanced groups (Mixonomata, Desmonomata and Brachyphyllina). They comprise only three families, one of which, Gehypochthoniidae, was proposed by STRENZKE (1963). The genus Gehypochthonius, with G. rhadamanthus as type species, was previously proposed by JACOT (1936), who incorporated Parhy­pochthonius urticinus Berlese (Berlese, 1910) in it. STRENZKE (1963) proposed G. xarifae, describing both adult and immatures. AOKI (1975) proposed G. frondifer, describing only the adult stase, and com­paring it with that of rhadamanthus and xarifae. LEE (1982) proposed a fifth species, G. strenzkei, and redescribed the genus. Of the mentioned species, G. rhadamanthus appears to be the most widely distributed, having been found in USA (JACOT, 1936), Japan (AOKI, 1975), France (GRANDJEAN, 1948) and Australia (Lee, 1982).

Recently, from a sampling in sand dunes in the Southeast coast of Buenos Aires Province, Argentina, we obtained adults and immatures of a new species of Gehypochthonius. In this work we describe this species and compare adults with those of previously named species, specially with those of rhadamanthus, the most similar taxon, and also we describe immature stases and compare them with those of G. xarifae, the only species whose life cycle is described.

MATERIAL AND METHODS

Specimens were collected on 19 Dec. 1996, near the mouth of a brackish coastal lagoon called Mar Chiquita (37°44'42"S, 57°25'20"W), Buenos Aires Pro-

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province, Argentina. The sampling site is a chain of coastal sand dunes with a vegetation of *Spartina ciliata, Cakile maritima, Hydrocotyle* sp. and other plants.

We sampled the sandy soil under *S. ciliata*, at a depth of 10-15 cm. Samples were washed through sieves with different mesh sizes. Fractions retained in 250 µm, 125 µm and 42 µm meshes were put in alcohol for later viewing under stereomicroscope. For detailed observations the specimens were mounted in temporary (open slides) and permanent preparations (in Hoyer’s medium).

As a complement to this study we have examined four adults (females) of *G. rhadamantus* from the South Australian Natural History Museum Collection (N19794-19795, Cordeaux, N.S.W., Australia).

**Gehypochthonius marianoi n. sp.**

**ADULT**

All adults were females. Characters of the adults are very similar to those of *Gehypochthonius rhadamantus* (See Aoki, 1975, Figs. 1-3, p. 56 and Lee, 1982, Fig. 2, p. 332). Only a lateral view is included here (Fig. 1).

**Material examined:** 6 females (1 holotype and 4 paratypes deposited in Laboratorio de Artrópodos, Univ. Nac. de Mar del Plata, and 1 paratype deposited in Museo de La Plata, Argentina).

**Size:** From 275 to 300 µm, mean = 285 µm.

**Colour:** All specimens are near-white, poorly sclerotized.
Prodorsum: Rostral, lamellar, and interlamellar setae are progressively larger (13 μm:20 μm:33 μm); anterior exobothridial setae as long as lamellar setae; posterior exobothridial setae very small (3 μm). Sessillus with apical portion dilated, directed laterad.

Gnathosoma: Chelicera similar to that of G. xarifaiae. Palps show a total of 10 fanerae (Fig. 2E), lacking e and su (eupathidia) with respect to G. xarifaiae (STRENZKE, 1963, Fig. 10). Setae e could be undergone a severe regression, just remaining its alveolus-ventral to pair ul.

Notogaster: All setae glabrous. Region anterior to post-pedal articulation with 6 pairs of setae: e1=19 μm, e2=14 μm, c3=17 μm, d1=22 μm, d2=19 μm and cp=31 μm, Region posterior to post-pedal articulation with 9 pairs of setae: e1=19 μm, e2=14 μm, e3=21 μm, h1=31 μm, h2=30 μm, h3=10 μm, ps1=31 μm, ps2=30 μm, ps3=16 μm.

Ventral region: Epimeric setation: 3-2-2-3. Ventral setation: 8 pairs of genital setae, in two rows, 1 pair of aggenital, 2 pairs of anal and 3 pairs of anal setae.
Table 1.—Setal addition on legs during ontogenic development in G. marianoi. Tr: trochanter, Fe: femur, Ge: genu, Ti: tibia, Ta: tarsus.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Tr</th>
<th>Fe</th>
<th>Ge</th>
<th>Ti</th>
<th>Ta</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>d,v</td>
<td>d,(i)</td>
<td>d,(i)</td>
<td>(v)</td>
<td>(p),(o),(a), (te), (f),(p),(p)</td>
</tr>
<tr>
<td>II</td>
<td>d,v</td>
<td>d,(i)</td>
<td>d,(i)</td>
<td></td>
<td>(p),(o), s, (a), (te), (f), (p)</td>
</tr>
</tbody>
</table>

Legs (Figs. 2A-D): Setation (trochanter to pretarsus): I (1-4-5-6-18*-3), II (1-5-3-4-15-3), III (2-2-2-3-12-3), IV (1-2-1-3-10-3).

Solenidial formulae (genu to tarsus): I (2-1-3), II (1-1-1), III (1-1-0), IV (1-0-0).

Material examined: 3 larvae, 1 protonymph, 4 deutonymphs and 4 tritonymphs (All considered syntypes, deposited in Laboratorio de Artrópodos, Univ. Nac. de Mar del Plata).

Size (mean): larvae: 181 μm; protonymph: 197 μm; deutonymph: 237 μm; tritonymph: 250 μm.

Prodorsum: number and disposition of dorsal setae similar to those of adult.

Notogaster: Setae added and or displaced during ontogenic development (h, ps) take a lateral or ventral position, but none clearly dorsal.

Ventral region (Figs. 3A-D):

Epimeric setation: larva (3**,1-2), protonymph (3-1-2-1), deutonymph (3-2-2-2), tritonymph (3-2-2-3).

Genital development (larva to protonymph): 1-4-6-8; aggenital 0-1-1-1.

Anal development: seta ps (larva to adult): 4-3-3-3-3-3, seta ad (protonymph to adult): 3-3-3-3 and seta an (deutonymph to adult): 2-2-2.

* include famulus
* Seta lc developed in a scale, covering Claparède's organ.

ETYMOLOGY: This species is dedicated to the memory of Prof. Mariano Manuel MARTINEZ, a young ornithologist who worked toward the conservation of natural areas in Argentina, particularly the Mar Chiquita coastal lagoon ecosystem.
Table 2 – Comparison between some morphologic characters and habitats of adults of *G. rhadamthus* and *Geypochthonius marianoi*. (Data except Mar Chiquita from Lee (1982))

<table>
<thead>
<tr>
<th></th>
<th><em>G. rhadamthus</em></th>
<th><em>G. marianoi</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locality</strong></td>
<td>Carolina, N.S.W., USA</td>
<td>Japan, Argentina</td>
</tr>
<tr>
<td><strong>Total length (µm)</strong></td>
<td>255</td>
<td>262-275</td>
</tr>
<tr>
<td><strong>Epimeral setation</strong></td>
<td>3-2-3-3</td>
<td>3-2-3-4</td>
</tr>
<tr>
<td><strong>Setae cp</strong></td>
<td>= d₁, d₂</td>
<td>&gt;&gt; d₂</td>
</tr>
<tr>
<td><strong>Setae h₁</strong></td>
<td>slim</td>
<td>stout</td>
</tr>
<tr>
<td><strong>Setae g</strong></td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td><strong>Setae ag</strong></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>forest: litter and mineral soil</td>
<td>Coastal dunes: sand</td>
</tr>
</tbody>
</table>

Different localities, and the later between them, in order to contribute to an analysis of the possible composite character of these species. Some differences between adults of *marianoi* and those of the *rhadamanthus* are summarised in Table 2.

Respect to epimeral setation, there are differences between *rhadamanthus* specimens from Carolina (mentioned, and partially drawn, in Jacot’s paper) and Australia (revised here), and between those and *G. marianoi*, having 3-2-3-3, 3-2-3-4 and 3-2-2-3 setae respectively. Setae lacking in the later are 3b and 4d.

The range of hysteronotal setae anterior to post pedal articulation (cp, dl and d₂) in *G. rhadamthus* has been object of detailed analysis by Lee (1982) and Aoki (1975). Carolina specimens shows a setae d₂ longer than a half of cp length; in Australian specimens d₂ is shorter than half of cp length (Fig. 4A); and in those from Japan seta d₂ is lightly longer than cp and dl. On *marianoi*, in contrast, cp is longer than dl and d₂ (Fig. 4C).

The number of two aggenital setae is a constant character in *rhadamanthus*, but only one pair is present in *marianoi*. Conversely, the number of genital setae is not constant in the former, showing 9 pairs the specimens from Japan and Carolina (USA), and 8 pairs (as *marianoi*) those of Australia.

Other differences are about the setal shape, concluding from literature and observational data that hysteronotal seta h₂ is slim, stout or lanceolate, depending of specimens provenience. In Australian *rhadamanthus*, for example those are lightly stout (Fig. 4 B), whilst in *marianoi* are slender (Fig. 4 D).

A complete comparison of leg setation is possible only with Australian specimens. From these analysis, no differences are observed between them. Nevertheless, a modification is necessary in Lee's *rhadamanthus* setal formulae, to make comparable with *marianoi*, considering that these author used a proper terminology (e.g.: he counted together solenidia and setae in some podomeres as tarsus I and II, but not in other). Modified formulae for Australian *rhadamanthus* are:

- Setae: I (1-4-5-6-18*), II (1-5-3-4-15), III (2-2-3-3-12), IV (1-2-1-3-10)
- Solenidia: I (2-1-3), II (1-1-1), III (1-1-0), IV (0-1-0)

Grandjean (1948) compared setation of *G. rhadamthus* (from Périgueux, France) with those of *Atopochthonius*, remarking that the former have 18 pairs of setae in tarsus I, not including famulus. Additional seta, respect our observations on *marianoi* and *G. rhadamthus* from Australia, is ventral and proximal. Beside ventral setae u', u'' and s, Grandjean noted three setae, which, comparing with *Atopochthonius*, he considered as a pair v₂ and a v₁'. In our case we note only one pair, which noted as pv.

In Lee’s paper, the number of tarsal phanerae is augmented in one in all four legs. This probably occur because he included in his count of tarsi the central claw of the apotele. Coherently, the author considered only two phanerae in the apotele.

The number of tarsal claws is a confusing theme. Grandjean (1939, 1948) remarked that *Geypochthonius* is the genus most perfectly bidactyle, referring to a complete absence of a central claw.
However, Jacot (1936), in the original description of *G. rhadamanthus*, wrote: “(tarsal hooks)...with a minute point between their proximal ends”, which is the condition found in *G. marianoi*, *G. rhadamanthus* (Australia) and in *G. xarifae*. Unfortunately, this character is not mentioned by Aoki (1975). *Gehypochthonius marianoi* has the same condition as in *xarifae*. There is a reduced central claw, clearly visible. About the lateral claws, these are similar to those of *xarifae*, in having not a perfectly curved contour (Strenzke, 1963, Fig. 23, 24).

Lee (1982) did not reported detailed formulae of solenidia at specific level, but remarked that “*rhadamanthus*-complex” have one solenidion on genu I (see below). In contrast, *G. marianoi* presents two solenidia on genu I in all stases (as *G. xarifae*).

Finally, palpal setation differs between *marianoi* and Australian *rhadamanthus*, showing later I 1 phanere, against 10 in *marianoi* (Fig. 2 E).

**Comparisons between marianoi and xarifae immatures:**

There are no differences in prodorsal and notogastral setation, except for the morphology of setae, which are more or less barbed and wide in *xarifae*, but glabrous and setiform in *marianoi*. Differences begin with the protonymph, having *G. xarifae* more epimeral setae (Table 3). This continues to the adult stase, which have, unlike *marianoi*, setae 3b and 4d.

Leg setation follows the same tendency, having differences in all podomeres, except trochanter and apotele (Table 4).

Notwithstanding differences in setal number, tarsal chaetoma presents a coincident development, showing the same timing of setal addition except for tarsus I, which remains without changes from the protonymph in *marianoi* (Table 5).

We have not found the setae *vl* on femur II of the protonymph, which exists in *xarifae*. The possible
TABLE 3.—Development of epimeric setation in Gehypochthonius xarifae and Gehypochthonius marianoi (differences in bold).

<table>
<thead>
<tr>
<th></th>
<th>G. xarifae</th>
<th>G. marianoi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larva</td>
<td>3-1-2</td>
<td></td>
</tr>
<tr>
<td>Protonymph</td>
<td>3-2-2-1</td>
<td>3-1-2-1</td>
</tr>
<tr>
<td>Deutonymph</td>
<td>3-2-3</td>
<td>3-2-2</td>
</tr>
<tr>
<td>Tritonymph</td>
<td>3-2-3-4</td>
<td>3-2-2-3</td>
</tr>
</tbody>
</table>

TABLE 4.—Development of leg setation in the ontogenetic development of Gehypochthonius xarifae and Gehypochthonius marianoi (differences in bold).

<table>
<thead>
<tr>
<th>Stase</th>
<th>G. xarifae</th>
<th>G. marianoi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larva</td>
<td>(0-3-5-17-1)</td>
<td>(0-2-3-5-14-1)</td>
</tr>
<tr>
<td>Protonymph</td>
<td>(0-2-3-15-1)</td>
<td>(0-2-3-13-1)</td>
</tr>
<tr>
<td>Deutonymph</td>
<td>(0-2-4-13-1)</td>
<td>(0-2-2-3-10-1)</td>
</tr>
<tr>
<td>Tritonymph</td>
<td>(0-2-4-15-1)</td>
<td>(0-4-3-4-13-1)</td>
</tr>
</tbody>
</table>

TABLE 5.—Number of setae added during ontogenic development of leg tarsi in Gehypochthonius xarifae and Gehypochthonius marianoi.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Protonymph</th>
<th>Deutonymph</th>
<th>Tritonymph</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>xarifae</td>
<td>marianoi</td>
<td>xarifae</td>
<td>marianoi</td>
</tr>
<tr>
<td>I</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

significance of this seta was discussed by Strenzke (1963).

Some considerations about "rhadamanthus complex" sensu Lee (1982):

With the purpose of clarify relations between Gehypochthonius species, Lee (1982) grouped them in two species complexes, named rhadamanthus and xarifae. Rhadamanthus complex contains only G. rhadamanthus and xarifae complex includes urticaeus Berlese, xarifae Strenzke, frondifer Aoki and strenzkei Lee. These groups differ, according to Lee, in body size, post-pedal articulation (transversal hysteronotal fissure sensu Lee), number and shape of several setae on body and legs, and number of solenidia on genu I.

Considering the similitude between marianoi and rhadamanthus in some of these characters we propose that the new species must be include in the rhadamanthus complex, and some modifications must be made in this taking account that:
a) Both marianoi and Australian rhadamantus revised here show 2 solenidia on genu I (as xarifae complex members), so, this character could not be considered for a separation of complexes.

b) Relative size of hysterosomal setae is not a valid element to discrimination. According to Lee, setae dl in G. rhadamantus are longer than half length of cp (Z2 and S2 from Lee, respectively), while in our observations of Lee’s material those are shorter than half of cp (Fig. 4A).

Other characters of the rhadamantus complex diagnosis remain valid, as appendage setation reduced, showing no seta on palp genu, and only 3 setae on both tibiae III and IV, against 1, 4 an 4 setae respectively in xarifae complex (tested only for G xarifae). If such complexes are maintained as valid groups, could be recommendable assign to these a category of subgenus, considering that this is the sole category recognised by the Zoological Code between genus and species (Jeffrey, 1989).

CONCLUSIONS

**Gehypochthonius marianoi** is the first citation of a Parhyposomata from Argentina.

Adults of *G. marianoi* differ from those of *G. rhadamantus*, the most similar species, with regard to epimeric and aggenital setal number. Other differences are related with size and shape of hysteronotal setae.

In relation to *G. xarifae*, ontogenetic development of *G. marianoi* presents differences in setation of legs and epimerae, in addition to the differences in setal morphology. The number of setae in *marianoi* is lower in general, specially on tarsi.

Our observations support both Lee’s proposals (1982): that *Gehypochthonius rhadamantus* may be a composite species and by other hand that is possible to array known *Gehypochthonius* species in two groups or complexes (subgenera?) including in the rhadamantus complex*G. rhadamantus* and *G. marianoi*, being the former susceptible of future splitting off in two or more species. Further investigations and revisions are needed in order to establish a definitive status for the "rhadamantus:" from diverse places around the world.

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