

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

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MITES, ORIBATIDA,
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ABSTRACT: *Gehypochthonius mariano* 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.

ACAROS, ORIBATIDA,
PARHYPOSOMATA,
GEHYPOCHTHONIUS,
DUNAS COSTERAS,
ARGENTINA.

RESUMEN: Se describe *Gehypochthonius mariano* n. sp. (Acari: Oribatida), a partir de inmaduros y adultos obtenidos en dunas de arena de la costa de Buenos Aires, Argentina. Se compara a la nueva especie con los adultos e inmaduros de *G. rhadamanthus* y *G. xarifae* respectivamente. Se incluye a *G. mariano* en el "complejo *rhadamanthus*" (LEE, 1982) y se discute la caracterización del mismo.

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 Brachypylina). 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 stage, 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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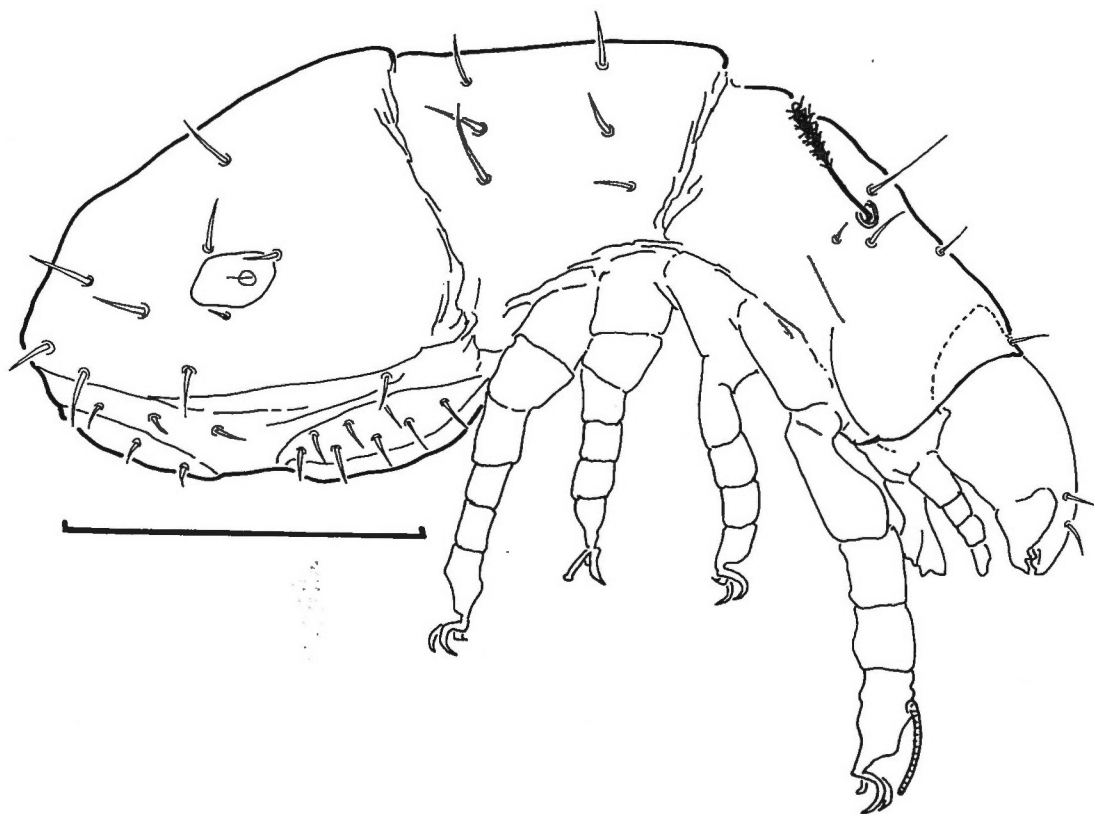


FIG. 1. — *Gehypochthonius marianoï*, adult, lateral view. Scale bar= 100 μ m.

vince, 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 μ m, 125 μ m and 42 μ m 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. rhadamanthus* from the South Australian Natural History Museum Collection (N19794-19795, Cordeaux, N.S.W., Australia).

Gehypochthonius marianoï n. sp.

ADULT

All adults were females. Characters of the adults are very similar to those of *Gehypochthonius rhadamanthus* (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 μ m, mean= 285 μ m.

Colour: All specimens are near-white, poorly sclerotized.

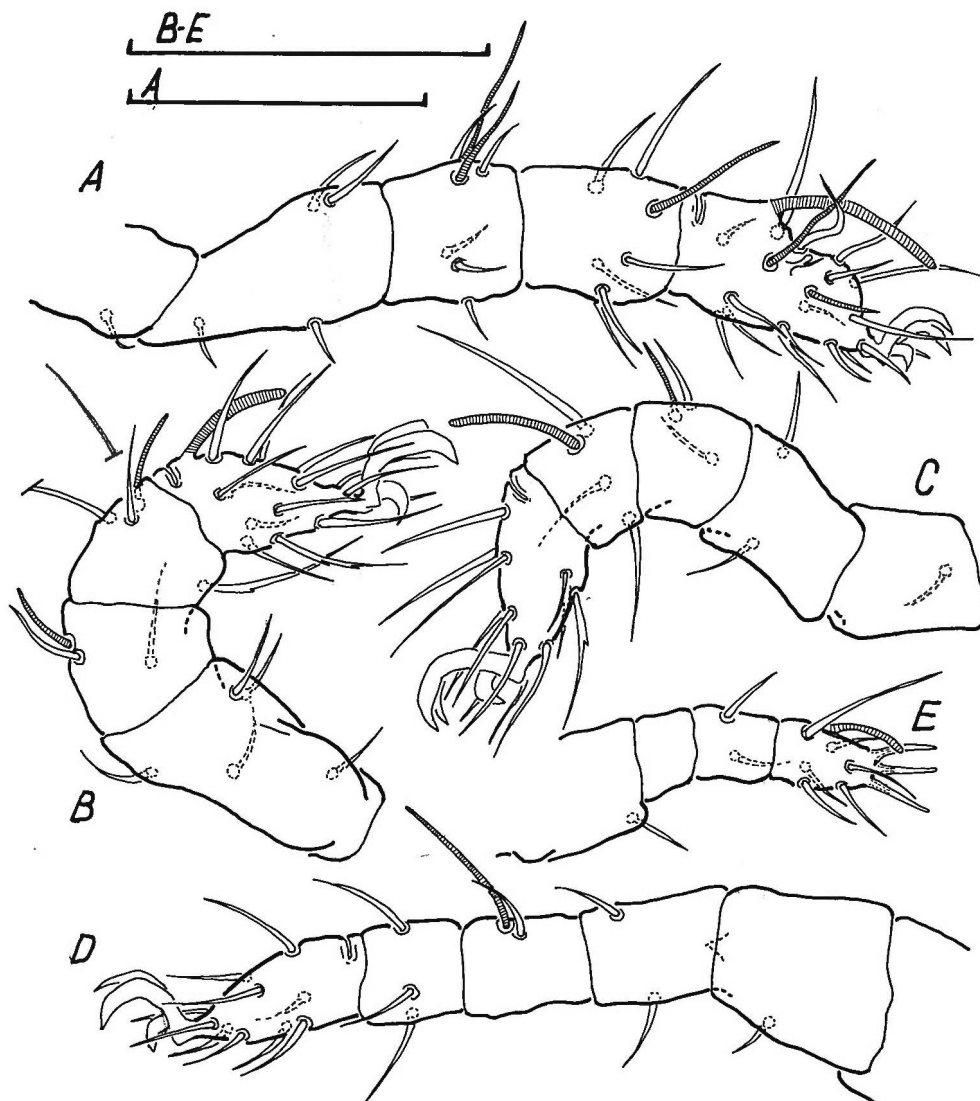


FIG. 2.—: *Gehypochthonius marianoi*, adult. A.— Leg I, right, antiaxial. B.— Leg II, left, paraxial (trochanter omitted). C.— Leg III, left, paraxial. D.— Leg IV, right, antiaxial. E.— Palp, left, paraxial. Scale bars= 50 μ m.

Prodorsum: Rostral, lamellar, and interlamellar setae are progressively larger (13 μ m:20 μ m:33 μ m); anterior exobothridial setae as long as lamellar setae; posterior exobothridial setae very small (3 μ m). Sensillus with apical portion dilated, directed laterad.

Gnathosoma: Chelicera similar to that of *G. xarifae*. Palps show a total of 10 fanerae (Fig. 2E), lacking *e* and *su* (eupathidia) with respect to *G. xarifae* (STRENTZKE, 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: *c1*= 19 μ m, *c2*= 14 μ m, *c3*= 17 μ m, *d1*= 22 μ m, *d2*= 19 μ m and *cp*= 31 μ m, Region posterior to post-pedal articulation with 9 pairs of setae: *e1*= 19 μ m, *e2*= 14 μ m, *f1*= 21 μ m, *h1*= 31 μ m, *h2*= 30 μ m, *h3*= 10 μ m, *ps1*= 31 μ m, *ps2*= 30 μ m, *ps3*= 16 μ m.

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 adanal setae.

TABLE 1. — Setal addition on legs during ontogenetic development in *G. marianoi*. Tr: trochanter, Fe: femur, Ge: genu, Ti: tibia, Ta: tarsus.

	Leg I					Leg II				
	Tr	Fe	Ge	Ti	Ta	Tr	Fe	Ge	Ti	Ta
Larva		d,v	d,(l)	d,(l), (v)	(p),(u),s, (a), (tc), (ft),(pv), (pl)		d,v	d,(l)	d,(l), v''	(p),(u), s, (a), (tc), (ft),(pl)
Protonymph	v		v'		(it)		(l)			
Deutonymph			v''	c''		v	v			
Tritonymph		(l)								(it)

	Leg III					Leg IV				
	Tr	Fe	Ge	Ti	Ta	Tr	Fe	Ge	Ti	Ta
Larva		d,v	d,l'	d,(v)	(p),(u),s, (tc), ft', (pv)					
Protonymph	v		v'							(p),(u), ft'',(pv)
Deutonymph	l''		v''	c''		v	d,v	d	d,v	a,(tc)
Tritonymph					(it)				l'	

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)

IMMATURES

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 ontogenetic 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, 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.

Legs: Setation development on legs is shown in Table 1, while setal formulae are in Table 4.

Solenidial formulae are:

Larva: I (2-1-1), II (1-1-1); III (1-1-0)

Protonymph: I (2-1-2), II (1-1-1), III (1-1-0), IV (0-0-0)

Deutonymph: I (2-1-2), II (1-1-1), III (1-1-0), IV (1-0-0)

Tritonymph: I (2-1-3), II (1-1-1), III (1-1-0), IV (1-0-0)

ETYMOLOGY: This species is dedicated to the memory of Prof. Mariano Manuel MARTÍNEZ, a young ornithologist who worked toward the conservation of natural areas in Argentina, particularly the Mar Chiquita coastal lagoon ecosystem.

DISCUSSION

Comparison between adults of *G. rhadamanthus* and *G. marianoi*: LEE (1982) considered that *G. rhadamanthus* may be a composite species, based on a comparison of setal characters of adults from USA, Japan and Australia. In a first analysis we considered that our specimens could be included in *rhadamanthus*, but considering a sum of dissimilarities in setation we proposed our species as a new. We compare *marianoi* with specimens of *rhadamanthus* from

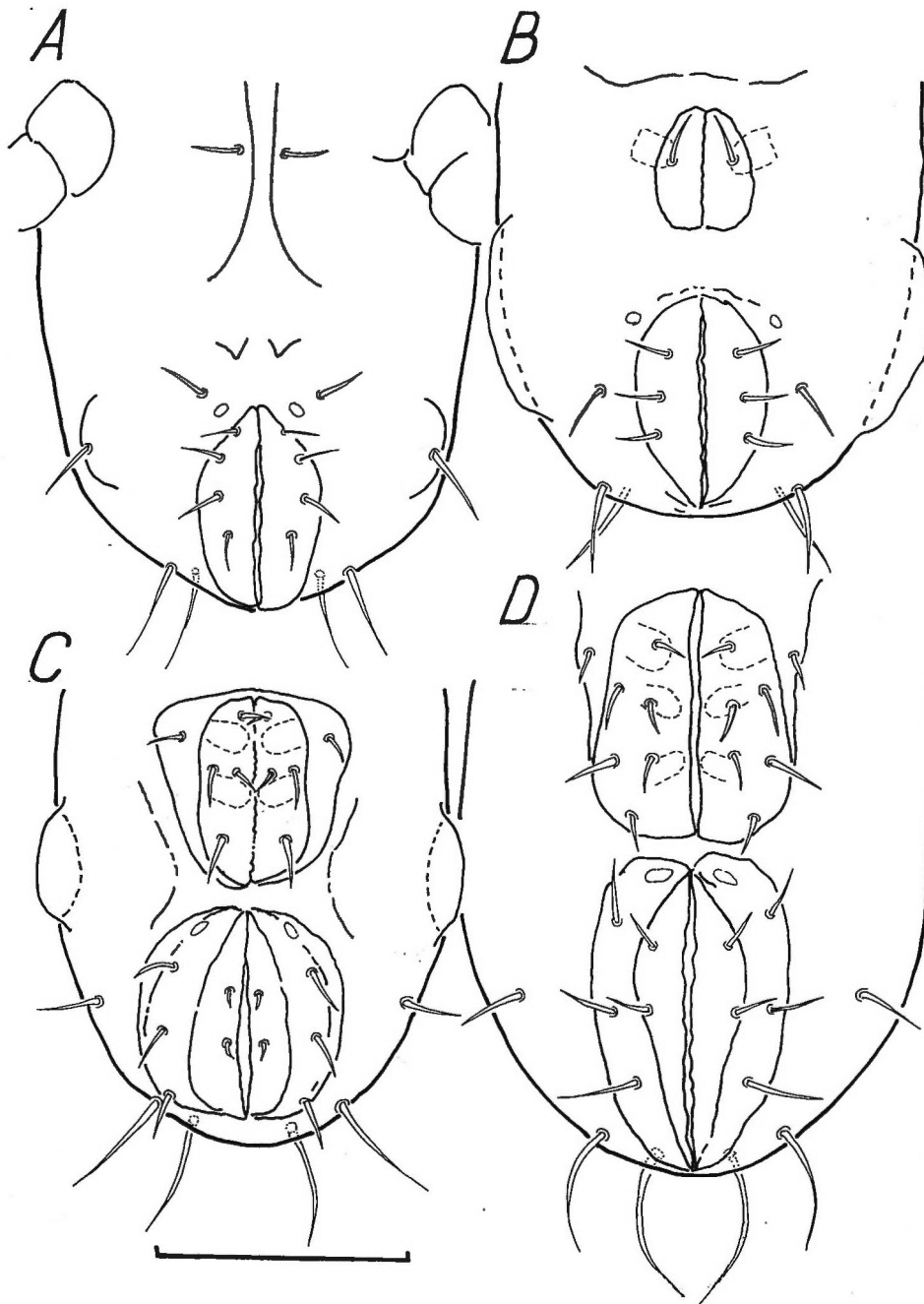


FIG. 3.— *Gehypochthonius marianoï*, immatures, anal and genital region. A.— Larva. B.— Protonymph. C.— Deutonymph. D.— Tritonymph. Scale bar= 50 μ m.

TABLE 2 — Comparison between some morphologic characters and habitats of adults of *G. rhadamanthus* and *Gehypochthonius marianoi*. (Data except Mar Chiquita from Lee (1982))

	<i>G. rhadamanthus</i>			<i>G. marianoi</i>
Locality	Carolina, USA	N.S.W., Australia	Japan	Mar Chiquita, Argentina
Total length (μm)	255	250	262-275	285
Epimeral setation	3-2-3-3	3-2-3-4	?	3-2-2-3
Setae <i>cp</i>	= <i>d1</i> , <i>d2</i>	>> <i>d2</i>	< <i>d2</i>	> <i>d1</i> , <i>d2</i>
Setae <i>h1</i>	slim	stout	lanceolate	slender
Setae <i>g</i>	9	8	9	8
Setae <i>ag</i>	2			1
Habitat	forest: litter and mineral soil			Coastal dunes: sand

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*, *d1* and *d2*) in *G. rhadamanthus* 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 *d1*. On *marianoi*, in contrast, *cp* is longer than *d1* 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 (2-2-2-3-12), 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. rhadamanthus* (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. rhadamanthus* 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 *vl'*. 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 *Gehypochthonius* is the genus most perfectly bidactyle, referring to a complete absence of a central claw.

*include famulus

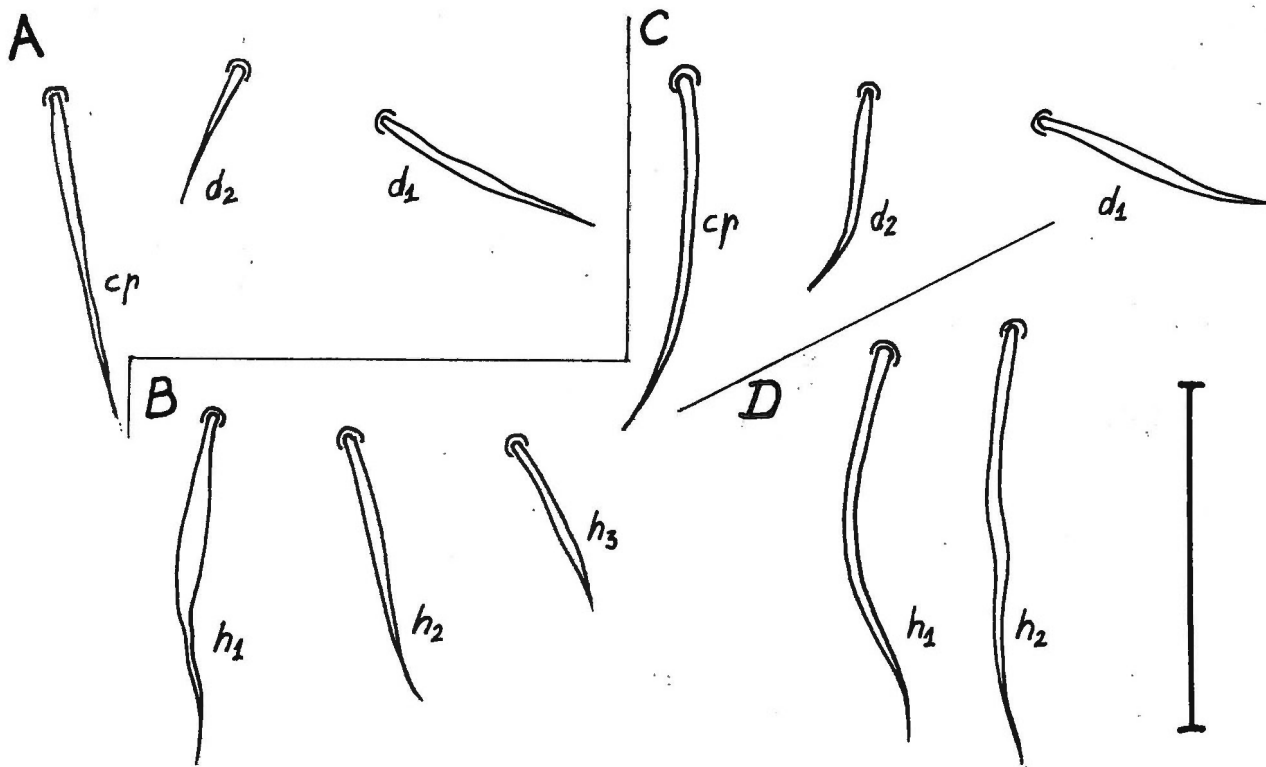


FIG. 4.— *Gehypochthonius rhadamanthus* (specimens from N.S.W., Australia), adults. A.— Notogastral setae *d1*, *d2* and *cp*. B.— Notogastral setae *h1*, *h2* and *h3*. *Gehypochthonius mariano*, adults. C.— Notogastral setae *d1*, *d2* and *cp*. D.— Notogastral setae *h1*, *h2* and *h3*. Distances between setae are at scale in A and C, but do not in B and D. Scale bar = 30 μ m.

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. mariano*, *G. rhadamanthus* (Australia) and in *G. xarifae*. Unfortunately, this character is not mentioned by AOKI (1975). *Gehypochthonius mariano* 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 (STRENTZKE, 1963, Fig. 23, 24).

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

Finally, palpal setation differs between *mariano* and Australian *rhadamanthus*, showing later 11 phanere, against 10 in *mariano* (Fig. 2 E).

Comparisons between mariano 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 *mariano*. Differences begin with the protonymph, having *G. xarifae* more epimeral setae (Table 3). This continues to the adult stage, which have, unlike *mariano*, 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 *mariano* (Table 5).

We have not found the setae *v1* on femur II of the protonymph, which exists in *xarifae*. The possible

TABLE 3.— Development of epimeric setation in *Gehypochthonius xarifae* and *Gehypochthonius mariano*i (differences in bold).

	<i>G. xarifae</i>	<i>G. mariano</i> i
Larva	3-1-2	
Protonymph	3-2-2-1	3-1-2-1
Deutonymph	3-2-3-3	3-2-2-2
Tritonymph	3-2-3-4	3-2-2-3

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

		<i>G. xarifae</i>	<i>G. mariano</i> i
Stase	Leg		
Larva	I	(0-2-3-5-17-1)	(0-2-3-5-14-1)
	II	(0-3-3-5-15-1)	(0-2-3-4-13-1)
	III	(0-2-2-4-13-1)	(0-2-2-3-10-1)
Protonymph	I	(0-2-5-5-20-1)	(0-2-4-5-17-1)
	II	(0-4-3-5-15-1)	(0-4-3-4-13-1)
	III	(1-2-2-4-13-1)	(1-2-2-3-10-1)
	IV	(0-0-0-1-7-1)	(0-0-0-0-7-1)
Deutonymph	I	(1-2-5-6-20-1)	(1-2-5-6-17-1)
	II	(1-5-4-5-15-1)	(1-5-3-4-13-1)
	III	(2-2-3-4-13-1)	(2-2-2-3-10-1)
	IV	(1-2-1-3-13-1)	(1-2-1-2-10-1)
Tritonymph	I	(1-5-5-6-21-1)	(1-4-5-6-17-1)
	II	(1-5-5-5-17-1)	(1-5-3-4-15-1)
	III	(2-3-3-4-15-1)	(2-2-2-3-12-1)
	IV	(1-2-2-4-13-1)	(1-2-1-3-10-1)

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

	Protonymph		Deutonymph		Tritonymph		Adult	
Leg	<i>xarifae</i>	<i>mariano</i> i	<i>xarifae</i>	<i>mariano</i> i	<i>xarifae</i>	<i>mariano</i> i	<i>xarifae</i>	<i>mariano</i> i
I	3	2	0	0	1	0	1	0
II	0	0	0	0	2	2	0	0
III	0	0	0	0	2	1	0	0
IV	0	0	5	3	0	0	0	0

significance of this seta was discussed by STENZKE (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 *urticinus* 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 *mariano*i 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 *mariano*i and Australian *rhadamanthus* 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. rhadamanthus* 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 *rhadamanthus* 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 and 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 mariano*i is the first citation of a Parhyposomata from Argentina.

Adults of *G. mariano*i differ from those of *G. rhadamanthus*, 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. mariano*i presents differences in setation of legs and epimerae, in addition to the differences in setal morphology. The number of setae in *mariano*i is lower in general, specially on tarsi.

Our observations support both LEE's proposals (1982): that *Gehypochthonius rhadamanthus* 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 *rhadamanthus* complex "*G. rhadamanthus* and *G. mariano*i, being the former susceptible of future split-

ting off in two or more species. Further investigations and revisions are needed in order to establish a definitive status for the "*rhadamanthus*: "from diverse places around the world.

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