

STUDY OF SOME MITES (ACARI) INFESTING *MICROTUS NIVALIS*, MARTINS IN SPAIN

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RADFORDIA,
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RESUMEN : Se describe una nueva subespecie de Glycyphagidae, *Dermacarus hypudaei* ssp. *nivalis*, parásita de *Microtus nivalis*, al ser comparada con las subespecies más próximas, parásitas de *Microtus* spp. Además, se redescribe la especie : *Radfordia* (*Microtimyobia*) *lemnina lemnina*, y se mencionan a : *Tyrophagus putrescentiae* y *Myocoptes japonensis japonensis*, encontradas sobre *Microtus nivalis*.

ABSTRACT : A new Glycyphagidae subspecies, *Dermacarus hypudaei* ssp. *nivalis*, infesting *Microtus nivalis*, is described after comparing it with other related subspecies found on *Microtus* spp. In addition, *Radfordia* (*Microtimyobia*) *lemnina lemnina* is redescribed, *Tyrophagus putrescentiae* and *Myocoptes japonensis japonensis*, found also on *Microtus nivalis*, are mentioned.

RÉSUMÉ : Une sous-espèce nouvelle de Glycyphagidae, *Dermacarus hypudaei nivalis* n. subsp., parasite de *Microtus nivalis*, est décrite et comparée aux espèces les plus proches, parasites des *Microtus* spp. En outre, l'espèce *Radfordia* (*Microtimyobia*) *lemnina lemnina* est redécrise, et sont mentionnées sur *Microtus nivalis* en Espagne, les espèces *Tyrophagus putrescentiae* et *Myocoptes japonensis japonensis*.

INTRODUCTION

ROBERTSON carried out a revision of genus *Tyrophagus* Oudemans in 1959 in which he did not only discuss about its taxonomic status, but also he described exhaustively the species belonging to this genus, like *Tyrophagus putrescentiae* (Schrank, 1781). In 1959, GIL COLLADO & JIMÉNEZ MILLÁN cited this species as *T. castellani* Hirst, 1912 on *Sus scrofa domesticus*.

The hypopial forms of mites belonging to family Glycyphagidae associated with micromammals were extensively studied by FAIN. *Dermacarus hypudaei* (Koch, 1841) was also studied by this author, who established 4 new subspecies on the basis of

morphological and biometrical differences observed in the population infesting different micromammal species (FAIN, 1969 a).

A large study of Myocoptidae family was carried out by FAIN *et al.*, 1969 b ; FAIN, 1970 a ; FAIN, 1970 b ; FAIN *et al.*, 1970 c and FAIN *et al.*, 1970 d, based on material collected on micromammals from several countries. In his study on myocoptids found on rodents from Holland and Belgium, FAIN redescribed *Myocoptes japonensis japonensis* Radford, 1955 on *Microtus agrestis*, *M. arvalis* and *M. pennsylvanicus pennsylvanicus*. FAIN *et al.* described in 1984 two species belonging to family Myocoptidae found on North American rodents.

In 1973, FAIN began a series of works on

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Myobiidae mites. In the same year he proposed a new nomenclature for the idiosomal chaetotaxy, in order to simplify the preexisting one.

FAIN (1974) also studied and described the genera belonging to this family. Among these genera, genus *Radfordia* Ewing, 1938 is included. FAIN and LUKOSCHUS (1976) described subgenus *Microtimyobia*, separating it from subgenus *Graphiurobia* Fain, 1972 according to the shape of the anterior pair of setae of the ventral side of gnathosoma : plane in *Graphiurobia* and foliaceous in *Microtimyobia*. These authors, in 1977, gave the description of genus *Microtimyobia*, including the species infesting microtids and a key for the identification of the species. They distinguish several subspecies belonging to *Radfordia* (*Microtimyobia*) *lemnina* (Koch, 1841) in terms of the host-specificity.

Genus *Tyrophagus* Oudemans, 1924 has been analyzed by HUGHES (1976) in a monographic work on mites from stored food and house.

In Barcelona (Spain), PORTUS & GÁLLEGO, amongst other authors, have researched on mites infesting micromammals. They found *Radfordia* (*M.*) *l. lemnina* (Koch, 1841) on *Pitymys duodecimcostatus* as well as *Myocoptes j. japonensis* Radford, 1955 on *Clethrionomys glareolus*, *P. duodecimcostatus* and *Microtus agrestis* (PORTUS & ROURA, 1978). Moreover, they described two new myocoptids belonging to genus *Trichoecius* Canestrini, 1899, parasites of avicolid hosts (PORTUS & GÁLLEGO, 1986). In 1987 Myobiidae species of micromammals in Cataluña (Spain) were studied. Geographic distribution of *Radfordia* (*M.*) *l. lemnina* infesting arvicolid hosts is subordinate to those of host.

The following mite species were collected on seven specimens of *Microtus nivalis* Martins (Mammalia : Microtinae) captured in Southern Spain between October 1985 and October 1987 : *Radfordia* (*Microtimyobia*) *lemnina lemnina* (a male and a female); *Dermacarus hypudaei* ssp. *nivalis* n. spp. (eight hypopial forms); *Myocoptes japonensis japonensis* (fifteen females and ten males).

This material was treated according to the techniques described by KRANTZ (1978) and SOLER CRUZ *et al.* (1979).

Radfordia (*Microtimyobia*) *lemnina lemnina* (Koch, 1841)

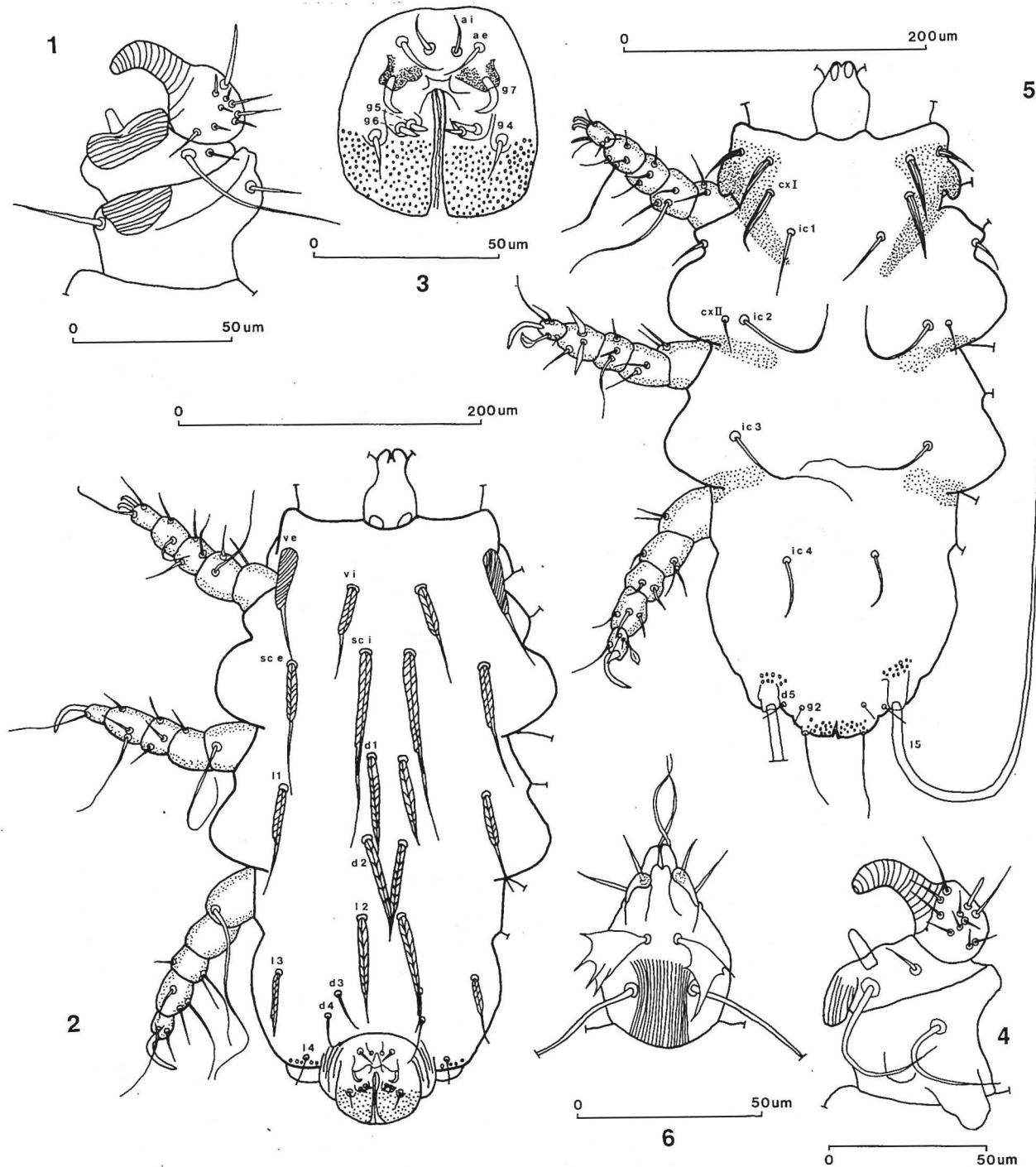
Type-host : *Microtus agrestis hirtus* Bellami.

FEMALE (Figs. 1-6) (Table I) :

Gnathosoma. Anteroventral setae are membranous, wide and with terminal points unequal.

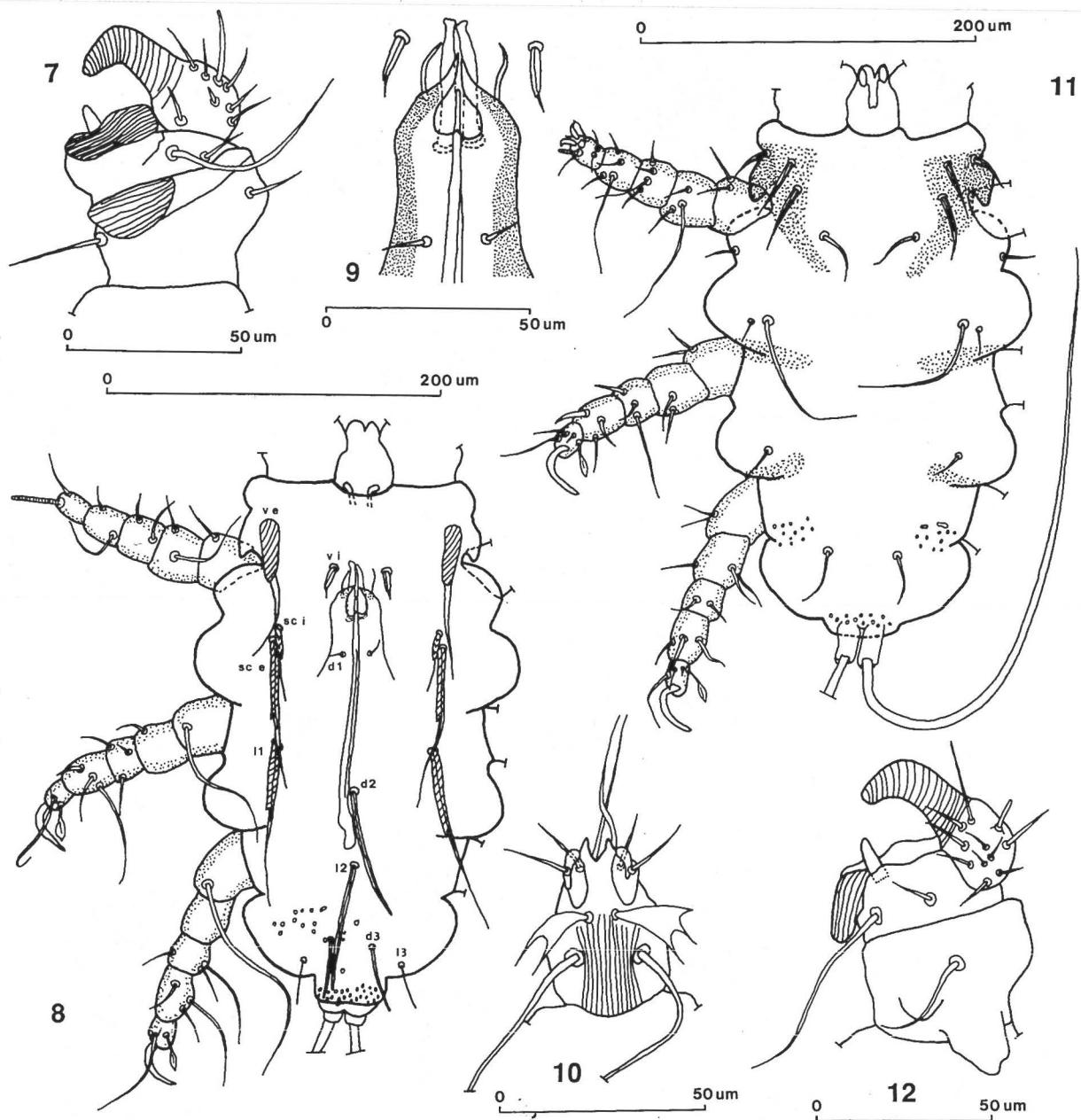
TABLE 1 : Measurements, in micrometers, of *Radfordia* (*Microtimyobia*) *lemnina lemnina* (Koch, 1841) and *Myocoptes japonensis japonensis* Radford, 1955.

	<i>Radfordia</i> (<i>M.</i>) <i>l. lemnina</i>	<i>Myocoptes j. japonensis</i>	
	Female (n = 1)	Male (n = 1)	Female (n = 2)
Idiosoma length	446	354	356 332 344
Idiosoma width	228	192	184 157 170
ratio	1.97	1.84	2.11 1.93 2.02
v i	67	17	41 40 40
sc i	130	48	25 22 23
sc e	89	95	89 85 87
d1	63	—	52 45 48
d2	68	80	55 53 54
d3	28	41	67 67 67
d4	33	—	13 12 12
l1	73	100	31 30 30
l2	73	78	67 61 64
l3	48	29	56 53 54
cx I	48	—	54 51 52
v i (diameter)	7	2	
sc i (diameter)	8	4	
sc e (diameter)	6	5	
ic 1	46	—	
ic 2	74	85	
ic 3	96	21	
ic 4	41	37	
g2	13	—	
g7	9	—	
cx II	27	19	
Long penis	—	152	
d5		16 12 14	
l4		22 16 19	
l5		225 216 220	
cx III		45 44 44	
g a		45 45 45	
g m		65 65 65	
g p		22 19 20	
a i		41 40 40	
a e		69 69 69	
a i-a e		41 37 39	
a3		34 31 32	
Nr. scales on :			
Coxa I		0 0 0	
Coxa II		5 5 5	
Coxa III		4 4 4	
Coxa IV		1 1 1	
Prevulvars		2 2 2	



Figs. 1-6 : *Radfordia (Microtimyobia) lemnina lemnina* (Koch, 1841). Female.

1. — Leg I : dorsal view. 2. — Dorsal view of idiosoma and legs II, III and IV. 3. — Genital region. 4. — Leg I : ventral view. 5. — Ventral view of idiosoma and legs II, III and IV. 6. — Gnathosoma : ventral view ; anteroventral seta.



FIGS. 7-12 : *Radfordia (Microtimyobia) lemnina lemnina* (Koch, 1841). Male.

7. — Leg I : dorsal view. 8. — Dorsal view of idiosoma and legs II, III and IV. 9. — Genital region. 10. — Gnathosoma : ventral view ; anteroventral setae. 11. — Ventral view of idiosoma and legs II, III and IV. 12. — Leg I : ventral view.

Idiosoma. VENTRAL-SIDE : the two pairs of inner setae of coxae I are thicker and more striated than *ic 1* ones. The cuticle at the base of setae *l 5* is slightly warty.

DORSAL-SIDE : shape and chaetotaxy as can be observed in the corresponding figures.

GENITALIA : the warts on the vulvar region spread over beyond setae *g 4*. The spines *g 7* are curved inwards.

MALE (Figs. 7-12) (Table I) :

Gnathosoma. The anteroventral setae are wide and membranous, their terminal points equal or unequal.

Idiosoma. VENTRAL-SIDE : the pairs of inner setae in coxae I (*ic 1* setae) are similar to those of the female. The cuticle at the base of setae *l 5* is slightly warty.

DORSAL-SIDE : shape and chaetotaxy as shown in the figures.

GENITALIA : the peneal length and the shape of

sexual scutum as can be observed in tables and figures.

Dermacarus hypudaei ssp. nivalis n. spp.

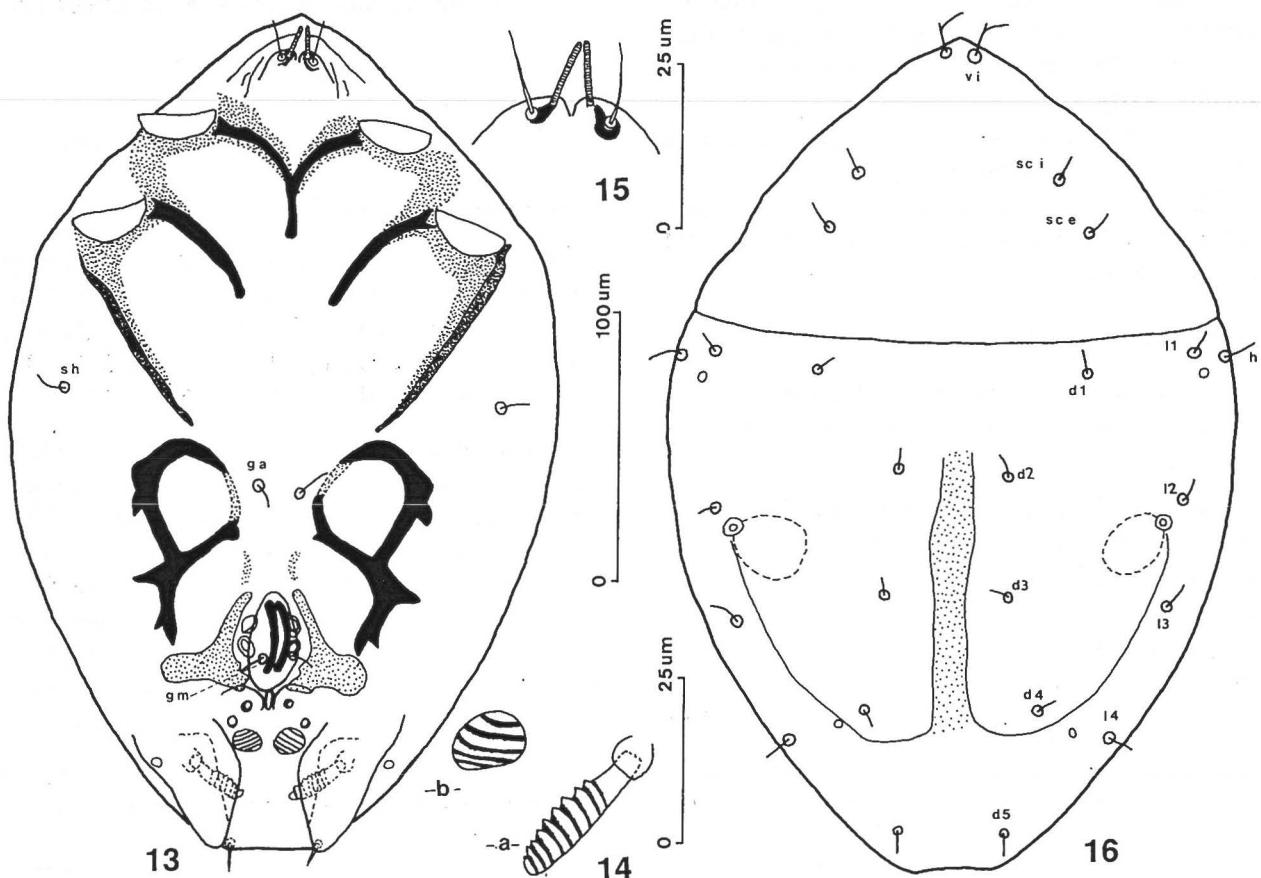
HYPOPUS (Figs. 13-20) (Table II) :

The mean size of the specimens studied is 285 by 186 micrometers. Holotype 297 μm long by 187 μm wide. In 7 paratypes, these measurements (in μm) are : 308 by 211, 320 by 211, 270 by 176, 269 by 177, 246 by 162, 284 by 184, 286 by 183.

VENTRAL-SIDE : Palposoma with a pair of solenidia (alpha) 10 (8-11) μm long, and a pair of simple setae (Fig. 15). The cuticle is not pointed. The epimeres I are soldered and being this structure « Y »-shaped ; epimeres II, III and IV are free. Epimerites I and IV absent. Between epimeres II and IV there is a slightly sclerotized zone. Genital slit encircled by a slightly sclerotized ring. Two pairs of genital suckers lateral to genital slit. The

TABLE II : Measurements, in micrometers, of *Dermacarus hypudaei nivalis* ssp. nov. Biometric comparative study with two nearest subspecies : *D. talpicola alpinus* Fain (1968) and *D. hypudaei hypudaei* (Koch, 1841).

Host	<i>D. Hypudaei nivalis</i> ssp. nov. (n = 8)			<i>D. talpicola alpinus</i> (FAIN, 1969a)	<i>D. Hypudaei hypudaei</i> (FAIN, 1969a)	
	Max.	Min.	\bar{x}	<i>M. nivalis</i>	<i>M. arvalis</i>	<i>M. agrestis</i>
Idiosomal length	320	246	285	285	340	309
Idiosomal width	211	162	186	180	210	210
Tarsus I	36	32	34	33	40	36
Tarsus II	36	29	31	30	40	40
Tarsus III	26	21	25	24	24	24
Tarsus IV	27	21	25	28	26	24
Claw I	11	10	10	10	8	8
Claw II	11	10	10	10	8	8
Claw III	11	10	11	10	10	10
Spur IV	14	8	12	4	2	2
Seta tibia III	17	15	16	—	18	18
Seta tibia IV	12	10	11	—	10	10
Sexual opening	31	24	28	—	—	—
omega 1	15	13	14	13	15	13
omega 3	18	13	15	8	16	15
Solenidia Alpha	11	8	10	4	13	10
Solenidia tibia I	43	34	37	32	38	39
Solenidia tibia II	29	23	25	17	25	23
Solenidia tibia III	10	8	9	—	11	11
Seta trochanter I	27	18	23	19	—	—
Seta trochanter II	30	17	23	19	—	—
Internal clubs (long)	11	9	10	6	10	10
Internal clubs (wide)	9	7	8	6	13	12
External clubs (long)	24	20	23	—	26	23



Figs. 13-16 : *Dermacarus hypudaei nivalis* ssp. nov. Hypopos.

13. — Ventral view of idiosoma. 14. — Club-shaped hairs of the pilicolous organ : a) external clubs ; b) internal clubs. 15. — Palposoma : solenidia alpha. 16. — Dorsal view of idiosoma.

hair clasping (pilicolous) organ is slightly developed with small claspers or membranous flaps, and bears no apophysis nor hooles (Fig. 13). Anterior club-shaped hair (internal clubs) 10 (9-11) μm , 8 (7-9) μm wide, with 5 transverse crests ; posterior club-shaped hair (external clubs) 22 (20-24) μm long, with 9 crests (Fig. 14).

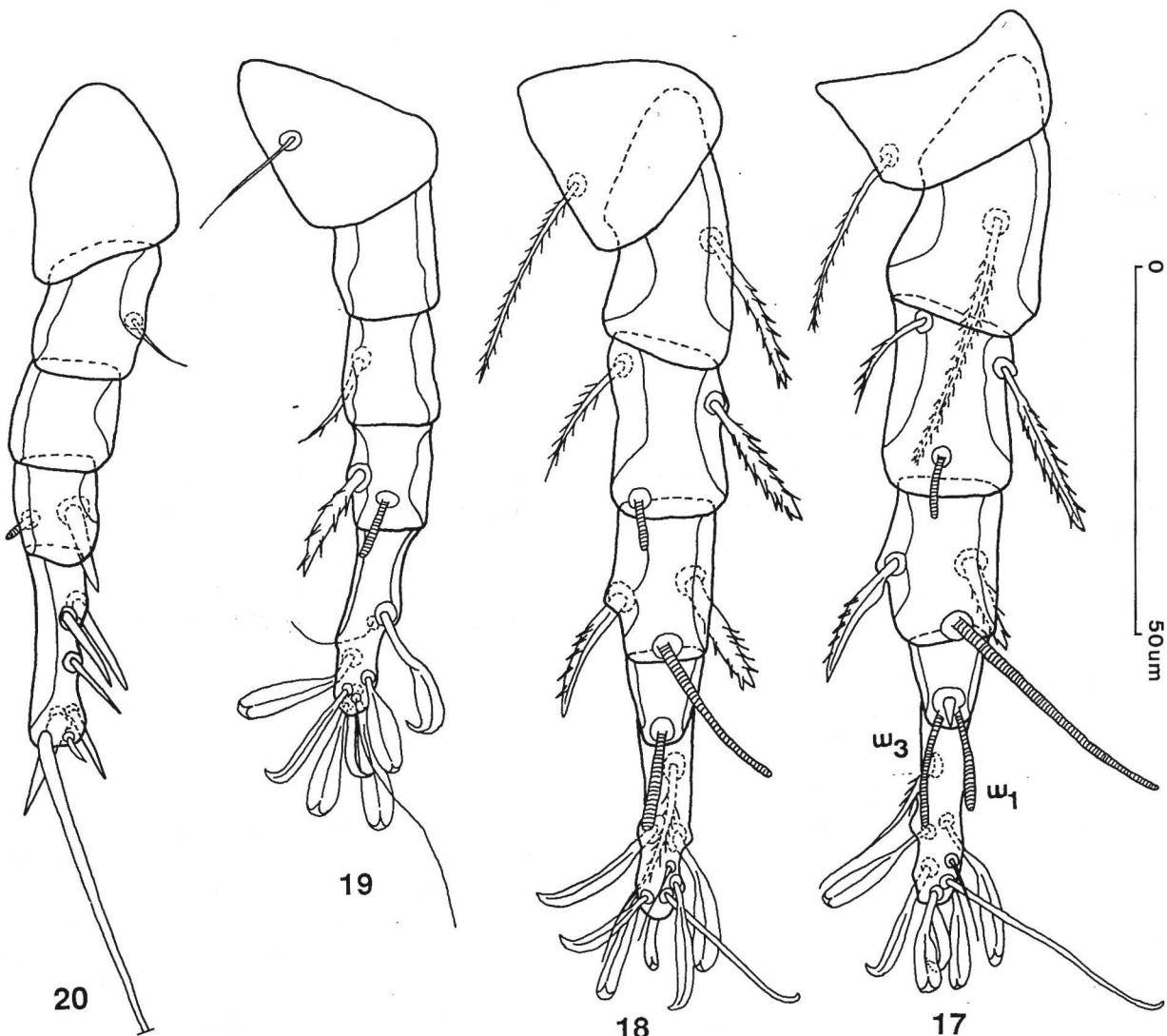
CHAETOTAXY : setae *sh*, *ga* and *gm* are present, and a pair of simple setae on the palposoma.

DORSAL-SIDE : the sejugal furrow is strongly marked (well developed). Anterior tip of the idiosoma is a sharp cone. Posterior border of body slightly concave. The cuticle is slightly punctate and sclerotized. Posterior one-thirds of hysterosoma not punctate and without a small network posteriorly.

Three cuticular or subcuticular sclerotized bands present on hysterosoma, 1 medial and 2 lateral — the latter converge posteriorly. Dorsum without small rounded flat scales. Lateral opisthosomal gland opening between lateral setae 2 and 3 (Fig. 16).

CHAETOTAXY : setae *vi*, *sc i*, *sc e*, *d1* to *d5*, *l1* to *l4* and *h* are present.

LEGS : they are well developed. Apophysis absent. In tarsus I, solenidia omega 1 (ω_1) is shorter or equal than omega 3 (ω_3). Tarsus I with 5 foliaceous setae, 1 simple dorsal seta, 1 ventral barbed seta, 1 cylindrical preapical seta with an abruptly recurved tip, and 1 famulus between omega 1 and 3. Tarsus II like I but without famulus and omega 3. Tarsus III with 6 foliaceous setae and



Figs. 17-20 : *Dermacarus hypudaei nivalis* ssp. nov. Hypopus.

17. — Leg I : dorsal view. 18. — Leg II : dorsal view. 19. — Leg III : dorsal view. 20. — Leg IV : dorsal view.

2 simple setae. Tarsus IV with a long apical seta, 1 preapical spur, 2 preapical spines, and 3 short setae (Figs. 17-20, Table II).

CHAETOTAXY : tarsi : 9-8-8-7 ; tibiae : 2-2-1-1 ; genua : 2-2-1-0 ; femora : 1-1-0-1 ; trochanters : 1-1-1-0.

SOLENIDOTAXY : tarsi : 2-1-0-0 ; tibiae : 1-1-1-1 ; genus : 1-1-0-0.

TYPE SPECIMENS :

Holotype hypopus and 7 paratype hypopi ex *Microtus nivalis* Martins (Mammalia : Microtinae), Spain : Granada Prov., El Veleta Mountain-Sierra Nevada (37°03'30" N, 3°21'30" E), 8-x-1987, collectors M. BURGOS and R. JIMÉNEZ. Host in the collection of the University of Granada, Department of Parasitology (UGDP) Nr. M-85. Additional paratypes from the same host species, same

locality and same collectors. Host (Nr. M-89, 7-x-1986 ; M-91, 8-x-1987) in the same collection.

Holotype deposited in the Collection of the University of Granada, Department of Parasitology. Paratypes deposited in the same Collection and in the authors' private collections. Two paratypes are deposited in the Collection of Muséum National d'Histoire Naturelle, Laboratoire de Zoologie (Arthropodes), Paris, registered with the Nr. 1.041 (slides : 62 F 6 and 62 F 7).

Tyrophagus putrescentiae (Schrank, 1781)

The mean size of male specimens studied is 327 by 183 micrometers. The mean size of female specimens studied is 370 by 200 micrometers. Biometric study of male and female as shown in Table III.

TABLE III : Measurements, in micrometers, of *Tyrophagus putrescentiae* (Schrank, 1781).

	Female (n = 15)			Male (n = 10)		
	Max.	Min.	X̄	Max.	Min.	X̄
Idiosomal length	420	296	370	402	274	327
Idiosomal width	233	162	200	244	121	183
sc i	222	145	192	202	137	167
sc e	147	82	114	122	67	91
ratio = sc i/sc e	2.01	1.42	1.69	2.15	1.57	1.84
s cx	39	33	36	35	24	31
d1	43	24	34	36	23	28
d2	125	74	107	94	67	78
d2/d1	3.76	2.42	3.18	3.17	2.61	2.82
d1-d2	61	41	51	60	40	45
I2	44	28	38	34	27	31
v i	111	81	94	94	55	75
v e	66	44	57	54	34	48
d5	389	279	329	473	385	423
a e	—	—	—	17	11	13
omega 1 (tarsus I)	17	12	15	15	10	13
omega 1 (tarsus II)	19	14	17	18	11	15
omega 2	6	5	5	6	3	5
sigma 2	28	17	22	28	16	21
sigma 1	48	31	40	43	31	36
Length						
Tarsus I	79	56	69	69	49	58
Tarsus II	75	52	66	67	49	56
Tarsus III	91	60	76	80	59	67
Tarsus IV	100	68	86	80	63	70
Chelicera	97	56	81	83	47	66
Ano	80	53	68	67	48	56
Sexual opening-anus	154	104	131	63	49	55
Anus-posterior margin	23	0	12	68	33	48
Penis sclerites width	—	—	—	49	40	45
a + b	—	—	—	53	37	44
c	—	—	—	28	16	23
ratio (a + b)/c	—	—	—	2.80	1.52	1.93
Anal suckers (Diam.)	—	—	—	23	16	20

The redescription used for the identification of *Tyrophagus putrescentiae* (Schrank, 1781) was that given by HUGHES, 1976.

This species was cited by GIL COLLADO & JIMENEZ MILLAN (1959) as *T. castellani* Hirst, 1912, on *Sus scrofa domesticus*.

Myocoptes japonensis japonensis Radford, 1955.

The biometry of the material collected from *Microtus nivalis* is included in Table I. The morphological variability present between both populations is as follows :

- Shape of the epimeres.
- Presence of 10 to 15 transversal lines bearing triangular scales in the dorsal part of the hysterosoma.
- Setae l3 are slightly thinner than setae d3.
- Shape and chaetotaxy of the ventral part of the hysterosoma.

DISCUSSION

The specimens belonging to genus *Radfordia*, parasites of microtids, were placed in a new subgenus, *Microtimyobia*, by FAIN & LUKOSCHUS (1976). In this subgenus *Radfordia (M.) lemnina* (Koch, 1841) was included, amongst other species, by these authors. Later, in 1977, this species was subdivided in several subspecies.

The specimens belonging to *Radfordia (M.) l. lemnina* captured in Granada were identified on the basis of the following morphological and biometrical criteria :

- Gnathosomal and anteroventral setae on the genital region of our specimens are proportional to those from specimens belonging to *Radfordia (M.) l. lemnina* found on *Microtus agrestis* by FAIN & LUKOSCHUS in 1977, although certain variability concerning to the setae was observed.
- On the other hand, our specimens were obviously different from specimens belonging to *Radfordia (M.) l. clethrionomys* Fain & Lukoschus, 1977

and *R. (M.) l. rutila* Fain & Lukoschus, 1977 collected on *Clethrionomys glareolus* and *C. rutilus* respectively.

— *Radfordia (M.) l. micromys* Fain & Lukoschus, 1977 found on *Micromys minutus* is only distinguished from the remaining subspecies at the level of shape and size of the gnathosomal setae.

After carrying out a comparative biometric study on the different subspecies we observed that the measurements given by FAIN & LUKOSCHUS, 1977 for *R. (M.) l. lemnina* are the most close to those shown by our specimens.

PORTUS & ROURA (1978) cited this subspecies on *Pitymys duodecimcostatus*, but it never was found on *Microtus nivalis*.

Dermacarus hypudaei hypudaei (Koch, 1841) was redescribed by FAIN, in 1969, on material collected from *Microtus arvalis*, *M. agrestis* and other micro-mammalian related genera.

The specific identification of the specimens collected in Granada was made on the basis of the following criteria :

- Idiosoma longer than 300 micrometers.
- Solenidia omega 1 is shorter or equal than omega 3.
- Palposomal solenidia (alpha) with length, at least 7 micrometers.
- Anterior club-shaped hair (internal clubs) in the hair clasping (pilicolous) organ with a length almost equal to their width. Posterior club-shaped hair (external clubs) not exceeding 27 micrometers in length.
- Tarsus IV not exceeding 28 micrometers.

Dermacarus talpicola alpinus Fain (1968) described from material collected on *Microtus nivalis* (FAIN, 1969a) is clearly different from the specimens collected in Granada at morphological as well as biometric levels.

On the other hand, the features shown by *Dermacarus h. hypudaei* not coincide with those shown by our specimens.

In a comparative study between *Dermacarus h. hypudaei*, *D. talpicola alpinus* (FAIN, 1969a) and our specimens we observed several morphological and biometric divergences at the following levels :

- Wide and feathered setae on tibiae I and III, and genu II.
- Width of setae on tibia IV.
- Posterior one-third of hysterosoma not punctate and without a small network posteriorly.
- Size of spur of tarsus IV.
- Width of the internal clubs in the pilicolous organ.
- Solenidia omega 1 shorter than omega 3.
- Palposomal solenidia (alpha) with length bigger than 7 micrometers.

According to the morphological and biometric differences observed we consider that our specimens can be included into a new subspecies which we name *Dermacarus hypudaei* ssp. *nivalis*.

The specimens belonging to *Myocoptes japonensis japonensis* show a high variability in terms of their host. These variations sometimes become strongly marked. According to PORTUS & ROURA (1979) this character proves the high specificity and evolution of this mite species.

The two females belonging to *Myocoptes j. japonensis* found on *Microtus nivalis* presented a morphological and biometric variability appreciable when they were compared with the specimens described on other hosts, such as *Microtus agrestis*, *M. arvalis* and *M. p. pennsylvanicus* (FAIN *et al.*, 1970d) and *M. cabrerae* (DIAZ-LOPEZ *et al.*, — in press —).

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