

ARTÍCULO:

The phoretic genus *Neopodocinum* (Oudemans, 1902) in the Iberian Peninsula (Acari: Mesostigmata: Macrochelidae)

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ARTÍCULO:

THE PHORETIC GENUS *NEOPODOCINUM* (Oudemans, 1902) IN THE IBERIAN PENINSULA (ACARI: MESOSTIGMATA: MACROCHELIDAE)

M. L. Moraza

Abstract:

Neopodocinum caputmedusae (Berlese, 1908) and *N. meridionalis* (Sellnick, 1931) are recorded from the Iberian fauna for the first time, and described. *N. caputmedusae* was found on *Copris hispanicus* (L.), and *N. meridionalis* on two new hosts, *Trypocopris pyrenaëus* Carpentier, 1825 and *Jekelius (Jekelius) albarracinus* (Wagner, 1928). The idiosomal chaetotaxy, poroidotaxy and adenotaxy of these two species are illustrated.

Key words: Acari, Mesostigmata, Macrochelidae, *Neopodocinum*, Scarabaeidae, phoresy, systematics, Iberian Peninsula.

El género forético *Neopodocinum* (Oudemans, 1902) en la Península Ibérica (Acari: Mesostigmata: Macrochelidae)

Resumen:

Se citan por primera vez para la fauna ibérica y se describen *Neopodocinum caputmedusae* (Berlese, 1908), encontrado sobre *Copris hispanicus* (L.), y *Neopodocinum meridionalis* (Sellnick, 1931), sobre *Trypocopris pyrenaëus* Carpentier, 1825 y *Jekelius (Jekelius) albarracinus* (Wagner, 1928). Se ilustra la chaetotaxia, poroidotaxia y adenotaxia idiosomal.

Palabras clave: Acari, Mesostigmata, Macrochelidae, *Neopodocinum*, Scarabaeidae, forésia, taxonomía, Península Ibérica.

Introduction

The genus *Neopodocinum* (Oudemans, 1902) lives in tropical, subtropical and temperate regions of Asia, Africa and Europe. Protonymph, deutonymph and adult instars are phoretic on coprophagous beetles of the family Scarabaeidae, although they can leave the host and feed on small arthropods and nematodes living in dung or they may behave as true paraphagous mites (Krantz, 1965). Several species are associated with small mammals (rodents and insectivores), and may live in forest litter, under stones and in straw.

Actually there is a numerous group of described species of this genus from the Palearctic region (Sellnick, 1931, 1968; Götz & Hirschmann, 1957; Krantz, 1965; Koroleva, 1977; Davydova, 1979; Haitlinger, 1979; Ambros, 1983, 1984, 1986; Haitlinger, 1987; Arutunian, 1993), from the Etiopic region (Krantz, 1965) and from Oriental region: China (Berlese, 1910, Li & Chang, 1979; Gu & Ma, 1987), Nepal (Krantz, 1965; Samsinak & Hatini, 2001), Central Asia, Java, Tibet and North Vietnam (Bregotova, 1958; Micherdzinski, 1964; Krantz, 1965; Roy, 1994; Hartini & Takaku, 2003). This is the first time the genus *Neopodocinum* is reported from Spain.

Material and methods

The studied specimens were obtained using "pit-fall" traps or manually removed from scarabaeid dried beetles of the collection of the Departments of Zoology and Ecology (University of Navarra, Spain). The specimens from dried beetles were located on the venter, behind the foreleg coxa, and around the oral region. These mites were previously hydrated and afterwards cleared with Nesbitt liquid. The treated mites were finally mounted on permanent slides using Hoyer medium.

Idiosomal setal notation follows Lindquist & Evans (1965), with modifications for the caudal region as given by Lindquist (1994) and Lindquist & Moraza (1999); notation of idiosomal adenotaxy and poroidotaxy follows Johnston & Moraza (1991). Ontogenetic instars are abbreviated as follows: Lv larva, Pn protonymph, Dn deutonymph, Ad adult. All measurements are in micrometers rounded to the nearest whole micrometer (mean, range).

Neopodocinum caputmedusae (Berlese, 1908)

(Fig. 1)

Coprolaelaps caputmedusae Berlese (1908). *Redia* 5: 14; Berlese (1913); *Redia*, 9: 82; Costa (1963). *J. Linn Soc. (Zool.)* 45 (303): 35

Neopodocinum caputmedusae (Berlese). Krantz, 1965. *Acarologia* 7 (2): 167; Costa, 1963. *Israel Jour. Zool.*, 14: 63-86

This polymorphic species has been reported living associated with *Copris hispanicus* (L.) in Crimea, Central Asia, south part of Bulgaria, Italy, Israel and Algeria (Costa, 1965); associated with *Homalocopris tmolus* in Turkestan (Costa, 1963; Koroleva, 1977) and associated with *Scarabaeus sacer* L. in Turkey (Cobanoglu & Kirgiz, 2001).

The polymorphism of this species was pointed out by Costa (1965), describing for the first time the presence of heteromorphic males in the family Macrochaelidae. The same author described two types of deutonymph (normal and globular) and provided important biological data about this mite.

The larval description given by Costa (1965), indicates that this instar bears only four pairs of setae on the opisthonotal shield – *J5*, *Z4*, *Z5*, *S5*– (setae *Z3*, *S3*, *S4*, *S5* sensu Costa). Larval setae *J3*, *J4* and *S3* are absent in all instars.

DESCRIPTION.

Measurements. The only female found has a size of 1115 µm long (holotype measures 1050 µm in length and approximately 625 µm at the level of coxa II sensu Krantz (1965); Koroleva (1977) indicates a length of 970-1250 µm); normal male 1113 µm long.

Idiosoma. This species is easily identified because most setae of anterior region and marginal area of dorsal shield are long, thick, bent and pilose in their distal half, whereas central setae are short, some vestigial. A strong neotrichy of the anterior and marginal podonotal setae in the dorsal shield is present, as in all marginal setae on the soft cuticle (off the shield) *r6*, *R1-R6* and *UR*. On the podonotal shield, with exception of *j1*, *s2*, *s4*, *z4*, *z5* and central reduced setae, plicate setae are thinner and at least two times shorter than the thick, bent and pilose setae of the immature instars. Opisthonotal region of dorsal shield with nine pairs of setae; one seta *Jx* (between setae *Z2*) may be present. Dorsomarginal podonotal neotrichy in the studied specimen is stronger than in the specimen illustrated by Krantz (1965).

Dorsal adenotaxy and poroidotaxy such as in fig. 1, with six pair of glands (*gdz2*, *gdj4*, *gds4*, *gdz6*, *gdZ3* y *gdS4*) and 17 pairs of lyrifissures (*idj1*, *idj4*, *idj6*, *idz2*, *idz6*, *ids4*, *ids6*, *idJ1*, *idJ2*, *idJ4*, *idZ1*, *idZ3*, *idS1*, *idS2*, *idS4*, *idS5*). Peritrematal shield fused with dorsal shield at the level of setae *r2*; peritreme reaches the insertion of setae *z1*. Sternal shield with strong concave anterior margin. Ventral setae with a strong neotrichy.

Legs. Tarsus II with two apical spine-like setae with a blunt apex.

Studied material. One female and one male found over one specimen of *Copris hispanus* from Madrid ç.VI.1981.

Neopodocinum meridionalis (Sellnick, 1931)

(Figs. 2-13)

Coprolaelaps meridionalis Sellnick (1931). *Sitzung mathem. naturw. Kl.*, abt. 1, 9.u. 10, Hft. 140: 767; Götz & Hirschmann (1957). *Mikrokosmos* 46: 115.

Neopodocinum meridionalis Krantz, 1965. *Acarologia*, 7:187.

This species has been reported living associated with *Geotrupes silvaticum* in Greece (Götz & Hirschmann, 1957) and with *Geotrupes stercorosus* and *Geotrupes vernalis* in Poland (Haitlinger, 1987). In West Germany and Czechoslovakia the mite has been found on unidentified *Geotrupes* (Koroleva, 1977).

In Spain, this species has been found on two different new hosts, *Trypocopris pyrenaicus* Carpentier, 1825 (beetle reported from Belgium, Great Britain, France, Italy and southern part of the Pyrenees (Spain) and *Jekelius (Jekelius) albarracinus* (Wagner, 1928) (reported from the eastern Pyrenees (France) and eastern and northern parts of Spain.

DESCRIPTION.

PROTONYMPH. Measurements. Idiosoma length 743-823 µm, width 351-364 µm.

Dorsum (Figs. 2, 3). Dorsum with two shields, podonotal shield with 11 pairs of setae (*j1-j6*, *z2*, *z4-z5*, *s4-s5*) and opisthonotal with eight pairs (*J4*, *J5*, *Z1*, *Z2*, *Z4*, *Z5*, *S2*, *S4* and *S5*); six pairs of dorsal setae on the soft cuticle (*r2*, *r3*, *r5*, *s6*, *S2* y *R1*). Setae *j1* and *j2* slightly pilose (*j1=j2=* 54µm); setae *j3*, *z2*, *z4*, *s4*, *s5* and *S5* thick, long, sinuous and slightly pilose (*j3=z4=* 200 µm, *z2=*114 µm, *s4=* 154 µm, *s5=* 257 µm, *S5=* 207 µm); other dorsal setae are short, thin and smooth (*j4=j6=* *r2=r3=r5=r6=J3=Z3=R1=* 11 µm, *j5=J4=J5=Z5=* 7 µm and *z5=Z1=S2=S4=* 18 µm). Dorsal adenotaxy and poroidotaxy such as in figure 1, with six pairs of glands and 14 pairs of lyrifissures. Peritreme short; *ip2* and *gp2* present.

Venter (Fig. 3). Sternal shield wide with three pairs of setae and two pairs of lyrifissures. Three pairs of small endopodal shields. Genital setae short and may be substituted by lyrifissures. Anal shield with *gv3* at level of post-anal seta; Para-anal setae are the longest ventral setae; euanal setae are vestigial. Four pairs of thin and smooth ventral setae (*Jv1*, *Jv2*, *Jv5* and *Zv2*); setae *Jv1* are the longest (18 µm) and *Zv2* is half the length of *Jv1*.

DEUTONYMPH. Measurements. Idiosoma length 702 µm, width 378-473 µm.

Dorsum (Fig. 4). Holodorsal shield with 29 pairs of thin and smooth setae (deutonymphal setae *z6*, *r4*, *r6*, *J2*(Lv)* in addition to larval and protonymphal setae) and 16 pairs on the soft cuticle (*S1*, *R1-R6*, *UR1-UR7* in addition to the protonymphal dotation). These setae are slightly heterogeneous in length: *j1* and *S5* are the longest (47 µ); *j2=* 38 µm, *j3=S4=* 31 µm, *z2=z4=S2=* 28 µm, *j4-j6=z5-z6=J2-J5=Jx=Z5=* 13 µm, *S4* twice *Z4*; other dorsal setae 16 µm. In one specimen an extra seta *jx* between *j6* setae is present. Peritrematal shield free and long peritreme. Dorsal poroidotaxy and adenotaxy such as in the figure 3.

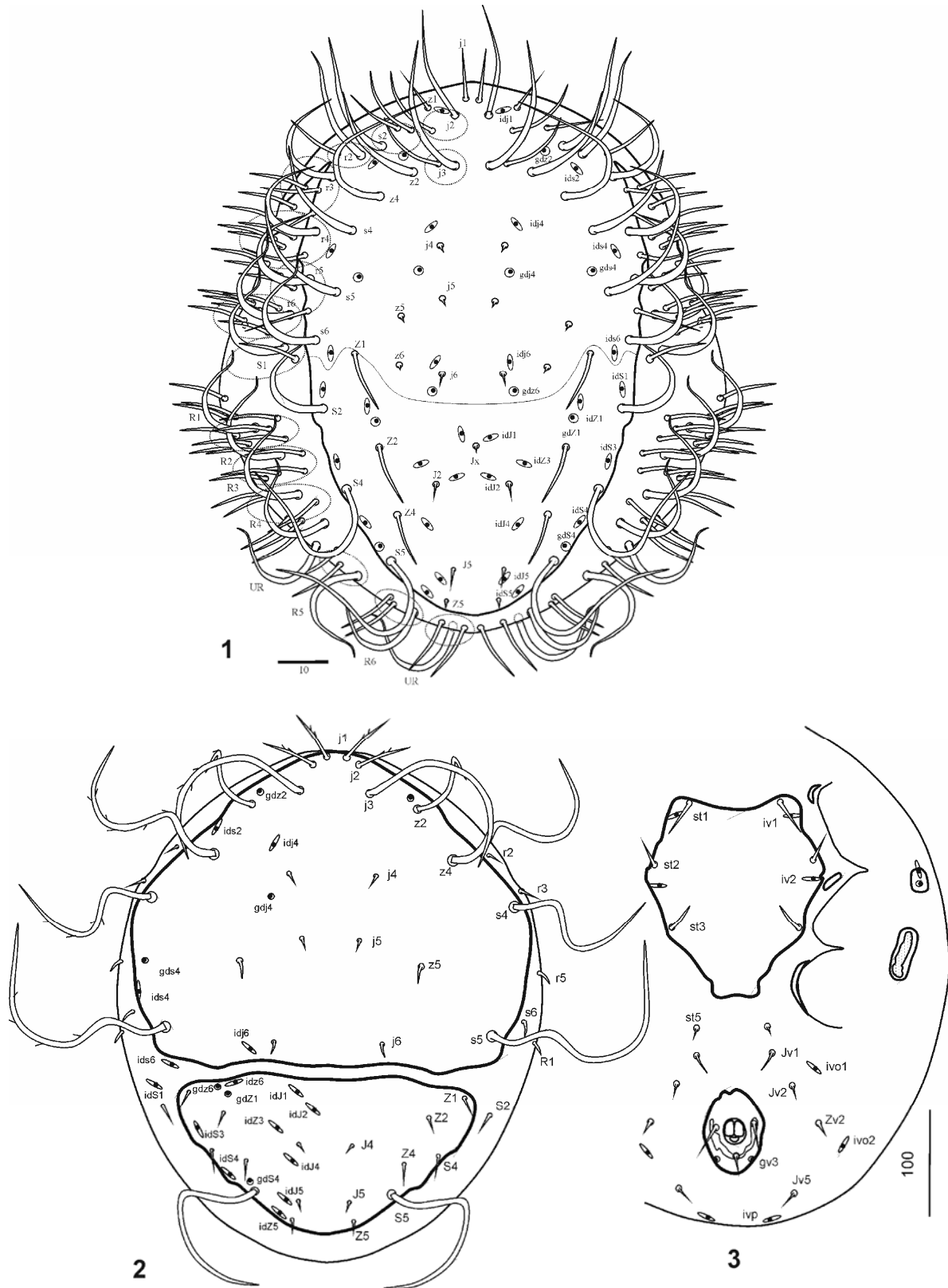


Fig. 1. *Neopodocinum caputmedusae*, female, idiosoma dorsal.
Figs. 2-3. *Neopodocinum meridionalis*, protonymph: **2.** Idiosoma dorsal; **3.** Idiosoma ventral.

Venter (Fig. 5). Subpentagonal sternal shield, with truncated posterior margin, four pairs of sternal setae and three pairs of lyrifissures. Endopodal shields present. Nine pairs of ventral setae thin and smooth (*Jv1-Jv5*, *Zv2-Zv5*) (16 µm long).

FEMALE. Measurements. Idiosoma: 743-824 µm long, 567-594 µm wide.

Gnathosoma. chelicera, palps, subcapitulum and tectum standard for the genus. Palp claw with two well-developed tines and third very reduced.

Idiosoma dorsal (Fig. 6). Dorsal shield bears 29 pairs of setae and three or four deutonymphal setae Jx between setae $J1$ and $J4$. Setae $r6$, $S1$, R and UR on the soft cuticle. Setae $j1$ (47, 44–50 μm), are 0.5 times shorter than $S5$, (114, 85–143 μm); setae $j2$ (28, 22–33 μm) similar to setae s ; setae $S2$ (46, 44–47 μm) similar to $j1$; $S4$ (64, 59–73 μm) is slightly longer than setae $j1$ and 0.6 times shorter than $S5$ ($j1 = S2 < S4 < S5$). Dorsal central setae are very short, thin and smooth; lateral setae more developed and marginal opisthonotal seta thicker, longer (except $J5$) and pilose in the their distal half. Adenotaxy and poroidotaxy such as in figures 6. Peritrematal shield (Figs. 8) narrow with two pairs of lyrifissures ($ilp1$ and $ilp2$) and two pairs of glands ($glp1$ and $glp2$). Peritreme long, slightly bent in its distal region and with four pairs of lyrifissures ($ip1$ – $ip4$).

Venter (Figs. 8, 9). Sternal shield six to eight times wider than long (at the medial level), concave in its anterior and posterior margin. The cuticle has a thin punctuated or strongly granulated ornamentation. The shield bears three pairs of thin and smooth sternal setae and two pairs of lyrifissures ($iv1$, $iv2$). Reduced metasternal setae insert on or off small metasternal shields. Genital shield with posterior convex margin, a pair of genital setae longer than metasternal setae. A pair of lyrifissures $iv5$ on the soft cuticle. Glands $gv2$ simple on the podal shields. Anal shield rounded, longer than wide, with punctuated cuticle and $gv3$. Anal valves with vestigial euanal setae. Nine pairs of ventral setae on the soft cuticle ($Jv1$ – $Jv5$, $Zv2$ – $Zv5$). Ventral setae similar in length to setae UR .

Legs. Tarsus I with ambulacrum and standard chaetotaxy. Tarsus II without spine-like apical setae.

MALE. Measurements. Males show a high variability of size, idiosoma 675 – 1000 μm long and 523 – 769 μm wide.

Gnathosoma. Chelicera (Fig. 13) with smooth dorsal seta posterior to dorsal lyrifissure. Fixed digits with two well-developed teeth and movable digits with a tooth coarsely strigulated. Spermatodactyl is short, dorsally directed, with truncated and bent apex and not exceeding the cheliceral digit apex.

Dorsum (Figs. 10, 11). Several dorsal setae exhibit differences in relationship to body size. The smallest males (743–783 μm long, 567–607 μm wide) (Fig. 11), show a podonotal dorsal chaetotaxy with 16 pairs of short and thin setae insert in the shield, except setae $j1$ (53 μm) and $s6$ (123 μm) which are longer, thicker, bent and pilose. Marginal opisthonotal setae S are the longest dorsal setae, curly and barbed in their distal half: $S3$

(197 μm) $> S4$ (167 μm) $< S5$ (233 μm); setae $Z4$ (57 μm) pilose, four times shorter than setae $S5$; $Z2/S2 = 0.14$. Pair $J1$ and two central setae Jx present. Adenotaxy and poroidotaxy similar to female.

The biggest males (878–932 μm long, 675 μm wide) (Fig. 10), show a higher degree of sclerotization, setae $r3 < j1 < s5 < r4 = r5 = Z4 < s6 < S2 < S4 = S5$, setae $j1$ (65 μm) is 0.2 times $S5$ (322 μm); $j2$ reduced, similar to other j setae or longer, almost half $j1$; $S5$ is 2.5 times longer than $Z4$; $s4 = Z2$ (39 μm), 0.6 times shorter than $j1$; setae $j1$, $s5$, $r4$, $r5$, $s6$, $S2$, $S4$, $S5$ and $Z4$ are thick and pilose; other dorsal setae are short, thin and smooth ($j5$, $z5$, $j6$ and J are very reduced, almost vestigial); $Z2/S2 = 0.13$. Seta $J2$ may be substituted by lyrifissures. In the soft cuticle 12 pairs of setae, $r6$ smooth $R1$ – $R6$ and $UR1$ – $UR5$ thicker and pilose pilose in their distal half.

Venter. Sternogenital shield with five pairs of thin and smooth setae and three pairs of lyrifissures. These shield marrows at level of coxa IV. Lyrifissures $iv5$ off the shield. Exopodal IV well developed and may bear a simple $gv2$. Anal shield similar to female. Ventral differences between studied males are noticeable: some males (Fig. 12) show the cuticle around the anal shield more sclerotized and pigmented but not giving rise to a true ventrianal shield. This ventral area bears several ventral setae; setae $Jv1$ is reduced in some large males; $Jv5$ and $Zv5$ are the longest ventral setae.

Legs. Legs II without spine-like setae in the tarsal apex and with ventral spurs in the femur, tibia and tarsus. Trochanters IV have one ventral spur.

STUDIED MATERIAL: Specimens collected from *T. pyrinaeus*: four females and three males collected on *T. pyrinaeus*, Arricibita leg., 18.V.1986; two females and two males, in beech forest, Preseta, Macizo de Quinto Real (Navarra), Moraza M.L. leg, 25.V.1989; one male, Sierra de Aralar, Moraza M.L. leg, 25.V.1989; three females and one male from one beetle specimen, Echauri (Navarra), 15.V.1985; one protonymph, one deutonymph and two females, Macizo de Quinto Real (Navarra), Moraza M.L. leg, 4.IX.1990. Specimens collected from *Jekelius (Jekelius) albarracinus*: two females, one male, two deutonymphs and two protonymphs from a pitfall tramp located in macchia, Sierra de Peña (Navarra), 7.V.1984; one female, one protonymph and one deutonymph from one beetle from Echauri (Navarra), col. J.M. Lantero, 14.V.1978, one male, Pamplona (Navarra), ¿?.5.1990. Material deposited in the Museum of Zoology, University of Navarra, Pamplona, Spain (MZUN).



Figs. 4–5. *Neopodocinum meridionalis*, deutonymph: **4.** Idiosoma dorsal; **5.** Idiosoma ventral. **Figs 6–7.** *Neopodocinum meridionalis*, female, idiosoma dorsal: **6.** Ex *Trypocopris pyrinaeus*; **7.** Ex *Jekelius (Jekelius) albarracinus*.

Table I. Relative length of several dorsal setae of *Neopodocimum meridionalis* (ex *T. pyrenaicus* and ex *J. (J.) albarracinus*) in adult female, male and deutonymphal instar.

	Female <i>T. pyrenaicus</i>	Female <i>J.(J.) albarracinus</i>	Male <i>T. pyrenaicus</i>	Male <i>J.(J.) albarracinus</i>	Deutonymph
<i>j1 / j2</i>	1,5 - 2	1,5 - 2	2 - 3	1,5	1,45
<i>j1 / S5</i>	0,5	0,3	0,1	0,1	0,1
<i>s4 / r3</i>	1	2	0,7 - 1	1	2
<i>s5 / r5</i>	1	2	≤ 1	1	0,5
<i>Z2 / s6</i>	0,5 - 1	0,8	0,1 - 0,6	0,4 - 0,4	0,7
<i>Z1 / Z4</i>	1	1	0,3 - 0,7	0,5 - 0,8	1
<i>Z4 / S5</i>	0,2 - 0,3	0,2	0,3 - 0,4	0,3	0,5
<i>S4 / S5</i>	0,7 - 0,8	0,5 - 0,6	0,7 - 1	1	0,5

Discussion

Differences between adults phoretic mites from both hosts are noted and illustrated (see Tables I with relative length of setae *r3*, *r5*, *s4*, *s5*, *Z4* and *S5* in the females and *j1* and *j2* in the males). However, immature instars (Pn and Dn) do not exhibit differences between them regarding the host source. Differences between adults are not sufficiently important to consider the specimens from different hosts as members of different taxa. Other adult specimens from *Geotrupes vernalis* from Poland have been studied and are similar to the Spanish specimens.

Sellnick (1931) described the female of *N. meridionalis* and, although he does not illustrate the dorsum, he notes that it is similar to the male, that is, with dorsal setae very heterogeneous in length, setae *S* (between others) pectinated and considerably longer than the *j* and *J* setae. Sellnick appears to be describing a dorsal chaetotaxy for the female of *N. meridionalis* very similar to the males now described, that is, a dorsal chaetotaxy which does not resemble the chaetotaxy of the female of this paper.

Protonymph and deutonymph specimens are similar to the corresponding instars described by Krantz (1965) and Götz *et al.* (1957) for *N. meridionalis*. However, certain differences are found. Krantz illustrated a protonymph with bent and shorter podonotal setae (*j3* two times longer than *j2*, *z2* similar to *z4* and *s4* and setae *J4* antiaxial to *S5*). According to Götz *et al.* (1957), the deutonymph of *N. meridionalis* has an extra

pair of setae between setae *j4* and *j5*, an additional pair between setae *z4* and *z5* and all opisthonotal setae are of the same length. None extra setae are found in these areas in the Spanish specimens and opisthonotal setae *S* are longer than other dorsal setae.

Sellnick (1931) and Gotz *et al.* (1957), do not described polymorphism for *N. meridionalis*. The single male allotype is 770 µm long and 638 µm wide and has a dorsum similar to the one which is now described, except with regard to the relative length of *S4* and *S5* (Table I). Males from Spain do not show significant differences in relation to size, sclerotization degree, dorsal chaetotaxy and ventral region configuration, however be may assume a low degree of polymorphism.

Although it was possible to assume that the Spanish specimens belong to a new species (a closely related or even a sibling species of *N. meridionalis*), based on differences in immature and adult instars, these specimens are assigned to the assemblage of demes of *N. meridionalis* highly selected by local conditions and host source. The characteristic demes of most phoretic species may lead to genetic isolation and the existence of polymorphic males as a strategy to preserve genetic variability (Athias-Binche, 1991).

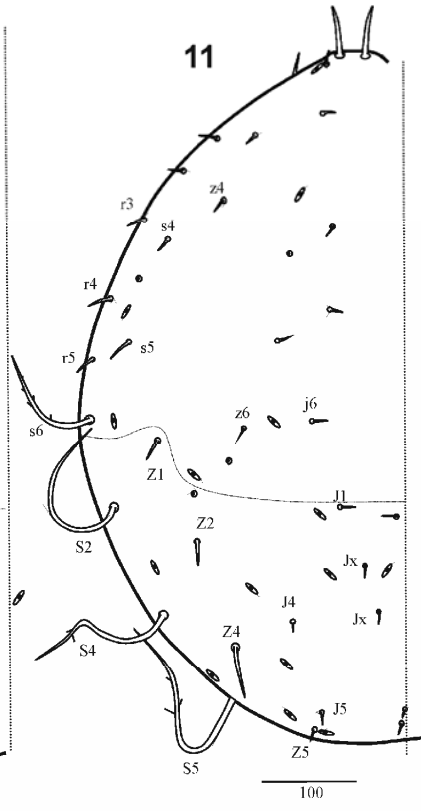
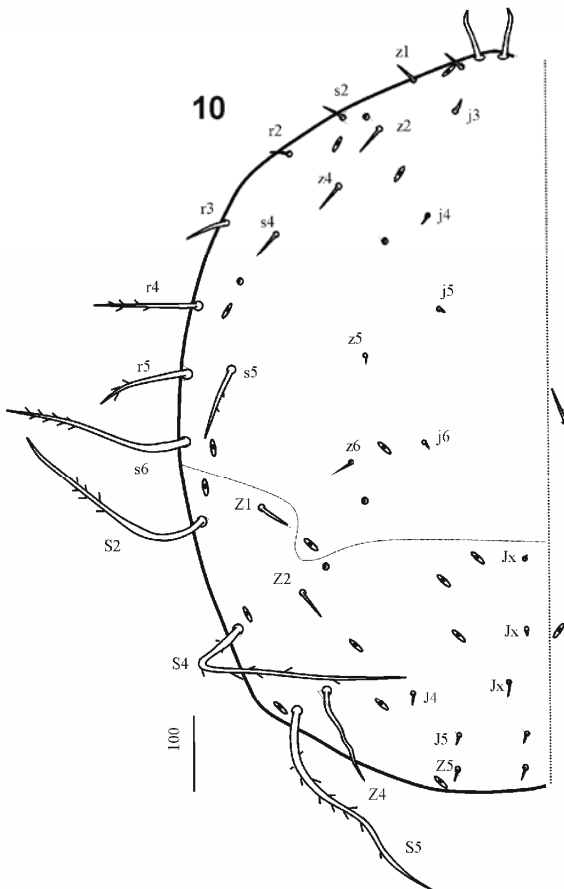
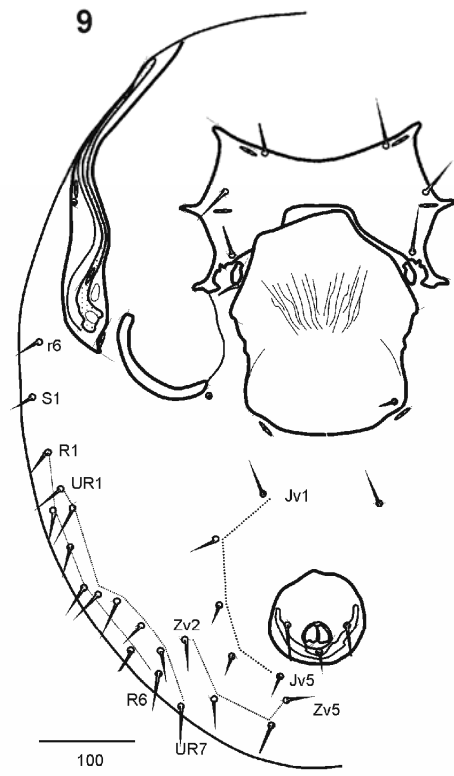
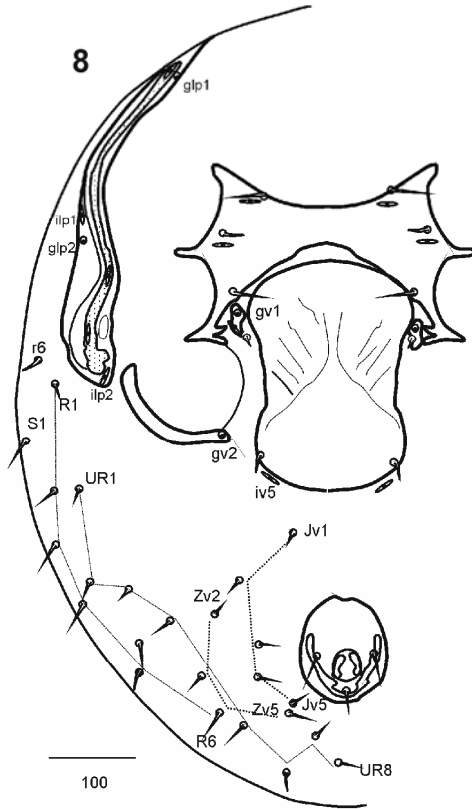
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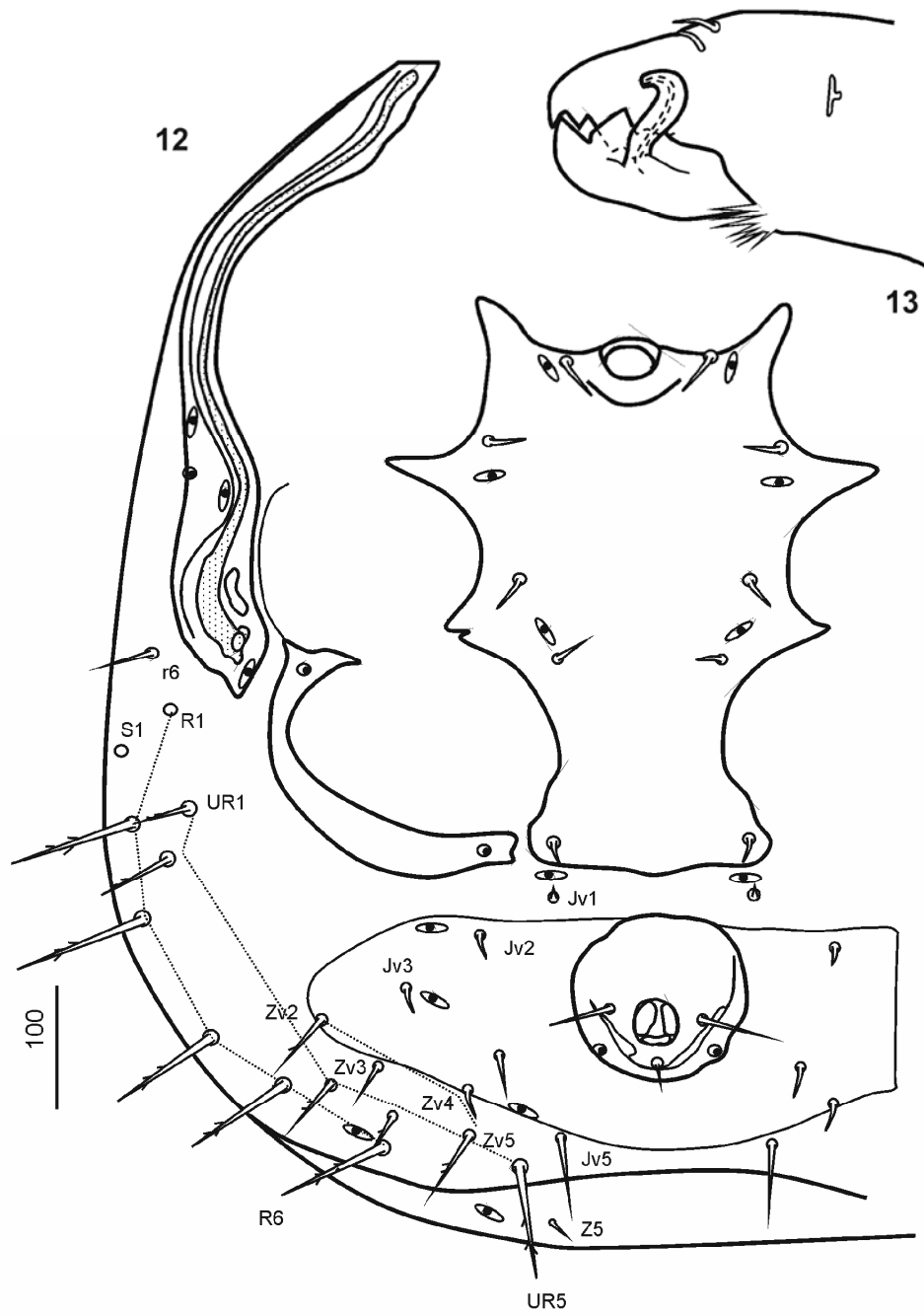
Special thanks to Dr. Ryszard Haitlinger, Department of Zoology and Ecology, University of Wrocław, for important material of *N. meridionalis* from Poland.



Figs. 8-9. *Neopodocimum meridionalis*, female, idiosoma ventral: **8.** Ex *Trypocopris pyrenaicus*; **9.** Ex *Jekelius (Jekelius) albarracinus*.

Figs. 10-11. *Neopodocimum meridionalis*, male, idiosoma dorsal: **10.** Ex *Trypocopris pyrenaicus*, large size male; **11.** Ex *Trypocopris pyrenaicus*, small size male.





Figs. 12-13. *Neopodocinum meridionalis*, male, idiosoma ventral: **12.** ex *Jekelius* (*Jekelius*) *albarracinus*; large size body; **13.** Chelicera, postero-lateral view.

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