TWO NEW SPECIES OF *MACROCHELES* FROM FRANCE (MESOSTIGMATA: MACROCHELIDAE)

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(Accepted October 2006)

MACROCHELES
FRANCE
PHORETIC MITE
NEW SPECIES
DESCRIPTION
NICROPHORUS
APHODIUS

SUMMARY: *Macrocheles lisae* and *Macrocheles paucipectinatus* are described from France. *Macrocheles lisae* was found phoretic on *Nicrophorus vespilloides*, and is recognizible by the smooth dorsal setae and the ornamentation of sternal shield. *Macrocheles paucipectinatus* with only four dorsal pilose setae (*j1*, *S5*, *Z5* and *J5*) is hosted by *Aphodius scybalarius*. *Aphodius* and *Nicrophorus* are both unusual hosts. The association of *M. lisae* with *Nicrophorus* illustrates the relationships of some species of macrochelids with carriers living in favourable habitats where mite predates on eggs or larvae of Diptera living on carrion.

RÉSUMÉ : *Macrocheles lisae* et *Macrocheles paucipectinatus* sont décrits de France. Le premier est phorétique de *Nicrophorus vespilloides*, et se distingue par les soies dorsales lisses et le bouclier sternal. *Macrocheles paucipectinatus* est capturé sur *Aphodius scybalarius* et ne compte que 4 soies dorsales plumeuses (*j1*, *S5*, *Z5* and *J5*). Les deux hôtes sont inhabituels et l'association de *M. lisae* avec *Nicrophorus* illustre les associations de macrochélides avec d'autres transporteurs exploitant des habitats favorables où les acariens se nourrissent sue les œufs et les larves de Diptères.

INTRODUCTION

In Western Europe, literature on the macrochelids living in pastures is abundant (EVANS & BROWNING 1956 and EVANS & HYATT 1963, CICOLANI 1979; CICOLANI 1983; CICOLANI & SABATINO 1991; GLIDA & BERTRAND 2002; NIOGRET et al. 2006) and fourteen coprophilous species were recorded from France (NIOGRET *et al.*, 2007): *M. glaber* (Müller, 1860), *M. perglaber* Filipponi & Pegazzano, 1962, *M. scutatus* (Berlese, 1904), *M. vernalis* (Berlese, 1887), *M. falsiglaber* Glida & Bertrand, 2002, *M. craspedochetes* Glida & Bertrand, 2002, *M. robustulus* (Berlese, 1904), *M. merdarius* (Berlese, 1889), *M. muscaedomesticae* (Scopoli, 1772), *M. pisentii* (Berlese, 1882), *M. saceri* Costa, 1967, *M. subbadius* (Berlese, 1904), *M. penicilliger* (Berlese, 1904) and *M. seraphim* Niogret & Nicot, 2007. The most common species play a key-role in grazed areas by feeding on fly eggs and larvae, nematodes, mites in the coprophilous community. Phoresy allows dispersal, the colonization of habitats with abundant resources (dung pats, carrions...) and ensures the trophic continuity in exploitation of such vanishing habitats. Some of the species, often the opportunists, are cosmopolitan (*glaber*, *robustulus*...). The rarer species are limited by

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host distribution (*saceri*, ..) or are rarely collected (*craspedochetes*). Two new species collected on carrion feeder (*Nicrophorus vespilloides* Herbst, 1783) and on the dung beetle *Aphodius scybalarius* Fabricius, 1781 are described here.

Materials and methods

The mites were found phoretic on *Aphodius scybalarius* Fabricius, 1781, collected by pitfall traps baited with cattle dung (CSR model, according to Lobo et al. 1988 and Veiga *et al.* 1989) in grazed area: Le Caylar, 03°10′ E, 43°51′ N, 800 m a. s. l., December 2005. Other macrochelids were collected attached to *Nicrophorus vespilloides* Herbst, 1783: St-Just-en-Chevalet, 03°50′ E, 45°54′ N, 630m a. s. l., July 2001 in Barber traps during a survey of biodiversity in grazed areas (collected by Lisa Bertrand).

Females were collected with a fine brush and stored in 95% ethanol, cleared in hot lactic acid and dissected under an Olympus® SZH stereoscopic microscope. Specimens were mounted either on temporary or permanent slides using lactic acid or Hoyer's medium. Observations were made with a Leitz Dialux® 20 EB. A 480 Motic® digital camera driven by Motic® Image Plus software 2. 0 was used for measurements (mean ± SD μm).

Measures. — Dorsal shield: maximal length; width of the dorsal shield at the *r3* level.— Sternal shield: length from anterior to posterior end of the shield along the median axis; — width: minimal width length at the level of coxae II. Epigynial shield: length from anterior to posterior end along the sagittal axis.

Description

Family ***Macrochelidae*** Vitzthum 1930
Genus ***Macrocheles*** Latreille 1829
Macrocheles lisae Niogret & Nicot

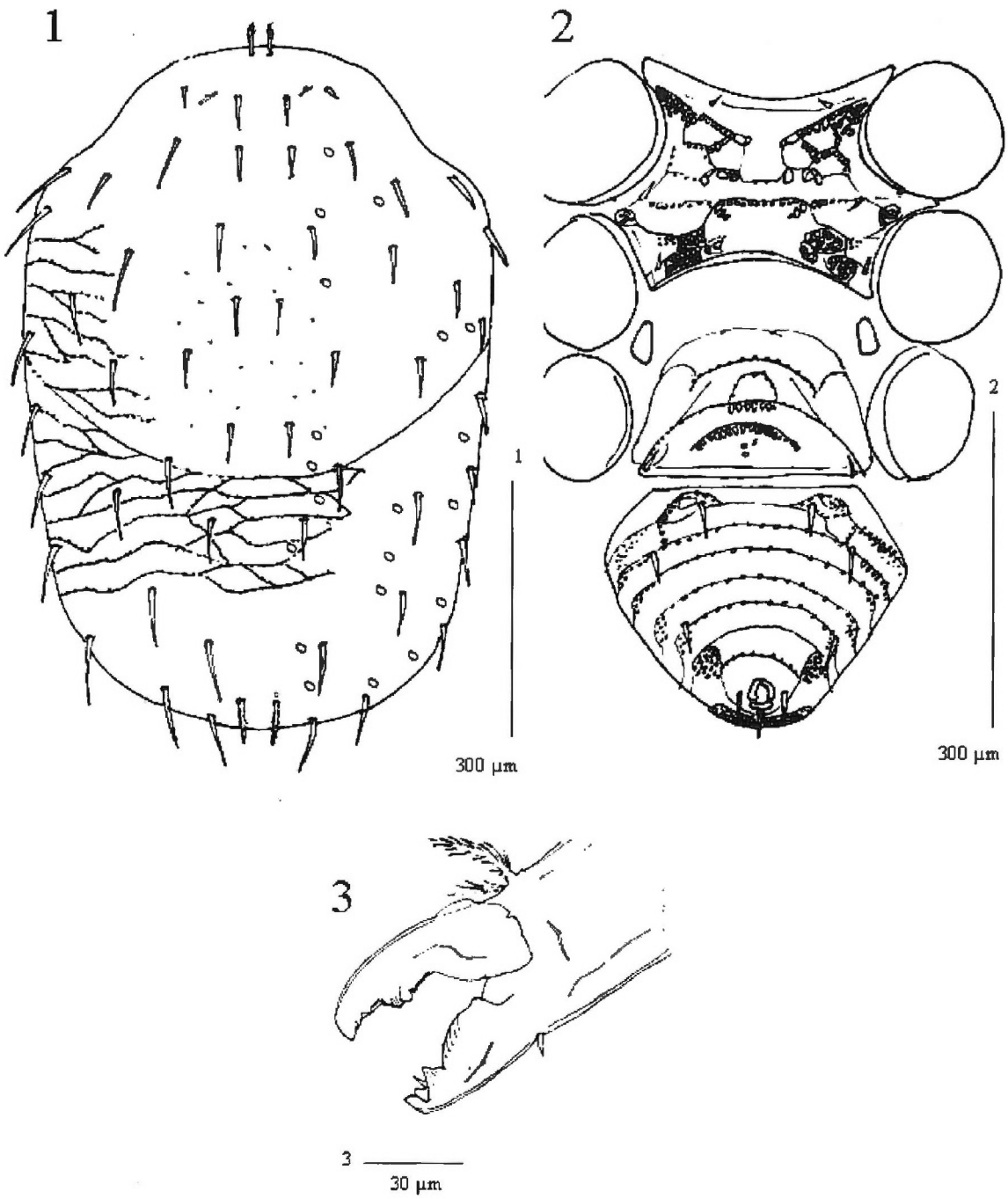
Description. Female. Yellowish-brown in colour. Dorsal shield (Fig. 1): Similar in shape to *Macrocheles glaber*, with distinct ornamentation lines, 782 μm long, 519 μm wide. Procurved line present; dorsal shield with ornamental pattern underlined by punctures. Dispersed reticulations on median part and forward procurved line. Twenty two pairs of pores, the pairs between *j2* and *z1* elongated. Twenty-eight dorsal setae, *j1* pilose and directed forward, *z1* simple and short. *J5* pilose on the distal half, simple setae are *j2, j3, j4, j5, j6, z2, z4, z5, z6, s2, s4, s5, s6, r2, r3, r4, J2, Z1, Z2, Z4, Z5, S1, S2, S4, S5.*

Ventral shields (Fig. 2): sternal shield large, 164 μm long, 155μm wide. Three pairs of setae and two pairs of pores. Median transverse line underlined by puncture, reaching the oblique anterior lines. Arched and angular lines delimiting a zone with three pentagonal patterns drawn by punctures. Posterior part of the sternal shield with *areae punctatae*. Sternal shield overtakes the coxae III level. Reticulate area at the level of the posterior pore. Metasternal plates close to the sternal shield. Epigynial shield broader than long (151 μm long, 194 μm maximal width), one pair of setae, ornamentation drawing two principal median arched patterns, both underlined by punctures. Two tinier lateral and arched lines complete ornamentation. Ventrianal shield wider than long (252 μm long; 300 μm maximal width), with seven main transverse lines underlined by punctures. Two anterior zones on the first line with a central rounded zone, reticular pattern on each side. Three pairs of preanal setae, 3 paranal setae. Metapodal sclerites elongated. The postcoxal pore is visible, included in the posterior part of the sclerotized ring.

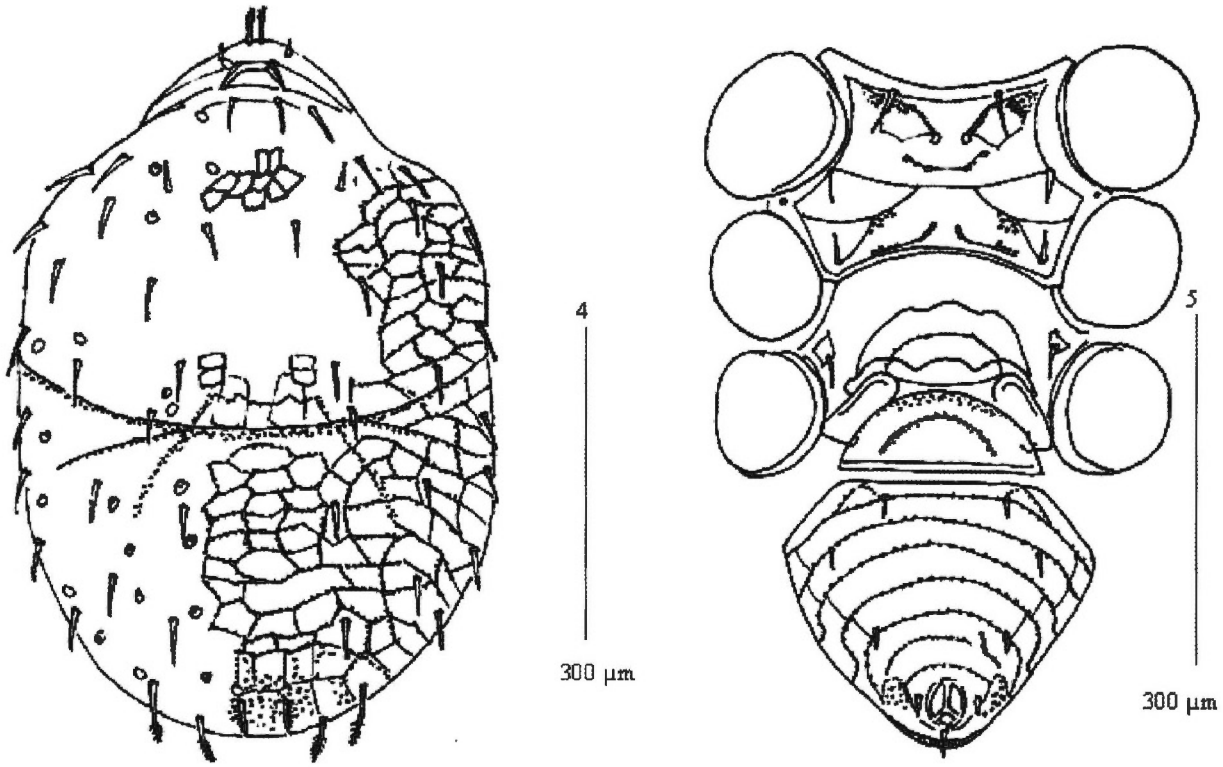
Gnathosoma: Chelicerae (Fig. 3): fixed digit with ridged blade, *pilus dentilis*, with three teeth, principal and pyramidal tooth, and a strongly ridged tooth. Movable digit with three teeth, distal small tooth, the median and proximal teeth fused and ridged, and terminal hook. Arthrodial brush highly pilose, shorter than mobile digit (1/3). Hypostomal groove with five transverse rows of denticles.

Legs: Chaetotaxy normal, setae simple or poorly pilose at the distal end except in PII, six setae on genu IV.

Type material: Holotype and paratype: collection of Muséum National d'Histoire Naturelle de Paris (France); other specimens in the laboratory collection, Montpellier (France) collected on *N. vespilloides*.



Figs. 1-3. *Macrocheles lisae* n. sp. 1. — female, dorsal shield; 2. — female, ventral view; 3. — female, distal end of chelicera.



FIGS. 4 & 5. *Macrocheles paucipectinatus* n. sp. 4. — female, dorsal shield; 5. — female, ventral view.

Macrocheles paucipectinatus Niogret & Nicot

DESCRIPTION. FEMALE. Yellowish-brown in colour, medium size. Dorsal shield (FIG. 4): *glaber*-like in shape, longer than wide (716 µm long, 450 µm wide) with distinct ornamentations, procurved line visible and underlined by two punctured lines distally oriented towards posterior part of the shield. Reticular pattern underlined by punctures draws irregular pentagonal or hexagonal tiles. Twenty two pairs of pores. Twenty-eight dorsal setae with *j1* directed forward and pilose, *z1* reduced in length and simple. Setae *j5* and *z5* are slightly shorter and simple. *J5* irregular all along, *Z5* and *S5* are pilose at the half of the setae. Setae *z2, z4, z6, j2, j3, j4, j6, s2, s4, s5, s6, r2, r3, r4, Z1, Z2, Z4, J2, S1, S2, S4* long and simple.

Ventral shields (FIG. 5): Sternal shield (149 µm long, 107 µm wide), with three pairs of setae and two pairs of pores. Median transverse line is clearly visible; the oblique anterior lines toned down forward. Arched line is short, central part of sternal shield with reticular pattern. Angular line divided in 2 branches posteriorly. Oblique posterior lines *glaber*-like. Posterior part of sternal shield with punctured *posterior areae*, more or less reduced in size and two horizontal symmetric punctured lines.

Metasternal plates closed to the sternal shield, not extending behind the posterior edge of coxae III. Epigynial shield (116 µm long, 183 µm maximal wide) with 1 pair of longer than wide setae. Sclerotization deeply attenuated forward, sclerotized lines drawing arched pattern, underlined by punctures. Ventrianal shield rounded, wider than long (249 µm long; 285 µm maximal wide) with 7 main transverse lines, longitudinal ornamentation is masked, punctures draw two polygons. 3 pairs of preanal setae, 3 paranal setae.

Gnathosoma: glaber-like. Hypostomal groove with five transverse rows of denticles. Other features of gnathosoma normal for genus. Palp: similar to *glaber*.

Legs: Chaetotaxy normal for the genus, six setae on genu IV.

TYPE MATERIAL, holotype and paratype: collection of Muséum National d'Histoire Naturelle de Paris (France); other specimens in the laboratory collection, Montpellier (France).

DISCUSSION

By several characters, *Macrocheles paucipectinatus* n. sp. is closed to the *glaber* group: the well defined procurved line, the pattern on sternal shield, the simple and pilose dorsal setae (*S5*, *Z5* pilose and serrated *J5*). However simple *z4* and *r4* get *M. paucipectinatus* n. sp. different from the standard definition (WALTER & KRANTZ 1992). *Macrocheles caelatus* Berlese, 1918, could be confused but it differs by 1) pilose setae *z4* and *j4*, 2) *linea angulata* lacking in the median part, 3) the weak ornamentation, 4) *linea arcuata* lacking on sternal shield.

Macrocheles paucipectinatus n. sp. was found on *Aphodius scybalarius* (800m a. s. l.). the genus *Aphodius* is not greatly involved in dispersion if compared with larger beetles (NIOGRET *et al.*, 2006). However, species active all along the year could contribute to disperse macrochelids during less favourable seasons for the thermophilous dung beetles (*Bubas*, *Geotrupes*, *Scarabaeus* genera) (GLIDA et al. 2003).

Macrocheles lisae n. sp. is a weakly ornamented species, considered by authors closed to the *subbadius* group. Weakened procurved line and the pilose setae *J5* help in identification (*J5* is smooth in the group). Moreover, *M. lisae* n. sp. presents special reticulated and punctured pattern of sternal shield. *Macrocheles lisae* n. sp. was found borne by the scavenger *Nicrophorus*: *M. glaber* can be collected from insects exploiting corpses (HYATT & EMBERSON 1988). Smallest predators find in this habitat homologous conditions of life condition in dung pads: the ephemeral resource, substratum changing with time, and providing abundant resource that decreases with time (resources: nematodes, and eggs and larvae of Diptera developing on animal carcass). SPRINGETT (1968) showed that *Nicrophorus* failed to breed on corpses infested with *Calliphora* fly eggs unless mites *Poecilochirus* sp. were present to predate them. *Macrocheles* mites predate on eggs and young fly larvae (AXTELL 1963; KRANTZ 1983): *Macrocheles paucipectinatus* borne by necrophagous host could participate in limiting fly competition with beneficit to the host. These type of interaction could be one of the first step leading to mutualism, mites paying back the insect by limiting competition.

REFERENCES

AXTELL R.C., 1963. — Manure-inhabiting Macrochelids (Acarina, Mesostigmata) predacious on the house fly. — Adv. Acarol., 1: 55-59.

CICOLANI B., 1979. — Osservazioni faunistiche ed ecologiche sugli Acari coprobionti (Nota I): il genera *Macrocheles* Latr. (Mesostigmata) in Abruzzo. — Niologia Contemporanea VI (3). XX convegno del ANLSB, 116-126.

CICOLANI B., 1983. — Action de différentes températures constantes sur la durée de développement, de l'œuf à l'adulte, des Macrochelides fimicoles *Macrocheles subbadius* et *Macrocheles vernalis* (Acarina: Mesostigmata).— Acarologia, 24 (2): 145-158.

CICOLANI B. & SABATINO, A., 1991. — Genetic differenciation between *Macrocheles penicilliger* and *Macrocheles minervae* (Acarina: Mesostigmata). — *In*: Dusbabek, F. & Bukva, V. (eds.) Modern Acarology Vol. 2. Prague, Academia and The Hague, SPB Academic Publishing bv. Pp. 437-442.

COSTA M., 1967. — Notes on macrochelids associated with manure and coprid beetles in Israel. II. Three new species of the *Macrocheles pisentii* complex, with notes on their biology. — Acarologia, 9: 411-428.

EVANS G.O. & BROWNING E., 1956. — British mites of the subfamily Macrochelinae Trägårdh (Gamasina – Macrochelidae).— Bull. Brit. Mus. (Nat. Hist.), Zool., 4: 1–55.

EVANS G.O. & HYATT K.H., 1963. — Mites of the genus *Macrocheles* Latr. (Mesostigmata) associated with coprid beetles in the collections of the British Museum (Natural History). — Bull. Brit. Mus. (Nat. Hist.), Zool. 9, 327–401.

FILIPPONI A. & PEGAZZANO F., 1962. — Specie italiana del gruppo-*glaber* (Acarina, Mesostigmata, Macrochelidae, *Macrocheles*).— Redia, 47: 211-238.

FILIPPONI A. & PEGAZZANO F., 1963. — Specie Italiane del gruppo-*subbadius* (Acarina, Mesostigmata, Macrochelidae).— Redia, 48: 69-91.

GLIDA H. & BERTRAND M., 2002. — The occurrence of *Macrocheles* mites (Acari: Macrochelidae) in relation to the activity of dung beetles. A field study in Southern France, pp. 235-242, *In* BERNINI F. NANNELLI R. NUZZACCI G. DE LILLO E. (eds). *Acarid Phylogeny and Evolution. Adaptations in mites and Ticks.* — Kluwer Academic Publ. Dordrecht.

GLIDA H., BERTRAND M. & PEYRUSSE V., 2003. — A limiting factor in the abundance of predatory phoretic mites (Acari: Macrochelidae): the seasonal abundance of their phorionts (dung beetles) in southern France. — Can. J. Zool., 81: 2066-2072.

HALLIDAY R.B., 1990. — Mites of the *Macrocheles muscaedomesticae* group in Australia (Acarina: Macrochelidae). — Invertebr. Taxon. 3: 407-430.

HYATT K.H. & EMBERSON R.M., 1988. — A review of the Macrochelidae (Acari: Mesostigmata) of the British Isles. — Bull. Brit. Mus. (Nat. Hist.) Zool., 54: 63-125.

KRANTZ G.W., 1981. — Two new *glaber* group species of *Macrocheles* (Acari: Macrochelidae) from southern Africa. — Int. J. Acarol., 7: 3–16.

KRANTZ G.W., 1983. — Mites as biological control agents of dung-breeding flies, with special reference to the Macrochelidae. pp. 91-98. *In*: HOY M. A. CUNNINGHAM G. L. & KNUTSON L. (eds) *Biological Control of Pests by Mites.* — University of California Special Publication. no. 3304.

LOBO J. M., MARTIN-PIERA F. & VEIGA C. M., 1988. — Las trampas pitfall con cebo, sus posibilidades en el estudio de las comunidades coprofagas de Scarabaeidae (Col.). I. Caracteristicas determinantes de su capacidad de captura. — Rev. Ecol. Biol. Sol, 25: 77-100.

NIOGRET J., LUMARET J.P. & BERTRAND M., 2006. — Review of the phoretic association between coprophilous insects and macrochelid mites (Acari: Mesostigmata) in France. — Elytron, 20: 99-122.

NIOGRET J., NICOT A., DE STORDEUR E. & BERTRAND M., 2007. — Combination of morphological characters and ITS-sequence to characterize a new *Macrocheles* species (Acari: Mesostigmata). — Zootaxa, 1386: 19-29.

SPRINGETT B.P., 1968. — Aspect of the relationship between burying beetles, *Necrophorus* spp. and the mite *Poecilochirus necrophori* Vitz. — J. Animal Ecol. 37, 2: 417-424.

VEIGA C. M., LOBO J.M. & MARTIN-PIERA F., 1989. — Las trampas pitfall con cebo, sus posibilidades en el estudio de las comunidades coprofagas de Scarabaeidae (Col.). II. Analisis de efectividad. — Rev. Ecol. Biol. Sol, 26: 91-109.

WALTER D. E. & KRANTZ G. W., 1992. — A review of *glaber*-like species with reduced sclerotization and ventral ornamentation: the *scutatus* subgroup (Acari: Macrochelidae: *Macrocheles*). — Int. J. Acarol., 18: 241-249.