

SURVEY OF THE ONYCHIURIDAE (COLLEMBOLA) FROM THE NEOTROPICAL REGION¹

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RESUMEN

Se reúne la información sobre Collembola de la familia Onychiuridae de la Región Neotropical y se proporcionan 13 nuevos registros de México, uno de Brasil y otro de Nicaragua; además, se incluyen numerosas localidades nuevas de México, Cuba, Guatemala y Brasil, de 24 especies, así como la morfología de *Protaphorura yolandae* y *P. sensilata*. Se presenta una clave para los géneros más representativos de la familia en América.

Palabras clave: Collembola, Onychiuridae, taxonomía, *Onychiurus*, *Protaphorura*, *Tullbergia*, Región Neotropical.

ABSTRACT

Information on the Onychiuridae (Collembola) of the Neotropical Region is here compiled. We include 13 new records from México, one from Brazil and another from Nicaragua, as well as many new localities from México, Cuba and Guatemala for 24 species. A key for the more common American genera of the family is included, and structures of *Protaphourra yolandae* and *P. sensilata* are presented.

Key words: Collembola, Onychiuridae, taxonomy, *Onychiurus*, *Protaphorura*, *Tullbergia*, Neotropical Region.

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INTRODUCTION

Members of the Onychiuridae are widely distributed. Their bodies are generally white, they lack eyes and, with one exception, lack or have a vestigial furcula. Representatives of this family occur in caves and other subterranean environments (under stones, loose bark of trees, in litter, humus-soil) but they are mainly found in mineral soils. They are small and unable to jump. Their length varies from 1 to 2,5 mm.

Their importance as indicators has been shown by Dunger (1986) who cites *Mesaphorura krausbaueri* as an indicator of warm soils without excess of humidity, and a possible indicator of soil fertility. It is also a pioneer in primary succession on recultivated soil. Other species such as *Onychiurus armatus* have been used in studies of ecological processes such as the effects of pollution and human activities (Fjellberg, 1985).

Records of Onychiuridae (Collembola) in the Neotropical Region were compiled by Mari-Mutt & Bellinger (1990) who cited 44 species. In this paper, we add 34 taxa. This includes 13 new records for México, one for Nicaragua, one for Brazil and many new localities.

We include information about the specimens of this family deposited in the Collection of Microarthropods of the Facultad de Ciencias, UNAM. Some of these were collected more than 15 years ago, and other materials have been recently obtained from several projects in México, Cuba, Nicaragua and Brazil. We also include a key for the common genera of the Neotropical Region and a additional information concerning *O. yolandae* and *O. sensilata*.

The family Onychiuridae is represented in the Neotropical Region by 13 genera: *Onychiurus* Gervais, 1841; *Protaphorura* Absolon, 1901, *Tullbergia* Lubbock, 1876; *Anaphorura* Izarra, 1972; *Tullbergiella* Izarra, 1965; *Mesaphorura* Börner, 1901; *Neotullbergia* Bagnall, 1935; *Dinaphorura* Bagnall, 1935 *Pachytullbergia*, Bonet, 1947; *Fissuraphorura* Rusek, 1991; *Rotundiphorura* Rusek, 1991; *Scaphaphorura* Petersen, 1965; *Doutnacia* Rusek, 1974 and *Metaphorura* Bagnall, 1936.

Onychiuridae includes two well defined Subfamilies: Onychiurinae and Tullberginae. The first is represented by four genera in the Nearctic Region: *Sensiphorura*, *Lophognathella*, *Onychiurus* and *Protaphorura*; the last two genera have cosmopolitan distribution, and are well represented in the Neotropical Region, but apparently with low diversity.

The *Onychiurus* previously recorded from the region are *O. acuitlapanensis*, Palacios-Vargas & Deharveng, 1982 from México; *O. bunsteri* Lobsa & Rubio, 1966, from Chile; *O. cunhai* Arlé, 1970 from Brazil, Cuba, Guadeloupe and Martinique; *O. "fimetarius group"* (Linnaeus, 1767) and *O. folsomi* (Schäffer, 1900) from México; *O. gloriensis* Gruia, 1987 from Venezuela; *O. pseudojusti* Thibaud & Massoud, 1980 from Guadeloupe; *O. sexpunctatus* (Schäffer, 1897) from Chile and *O. subcadaverinus* Denis, 1931 from Costa Rica, Chile and México.

The *Protaphorura* recorded from the region are: *P. armata* (Tullberg, 1869) from Argentina, Chile and México; *P. cryptopyga* (Denis, 1931) from Brazil, Costa Rica, Dominicana, Guadeloupe and Martinique; *P. encarpata* (Denis, 1931) from Argentina, Costa Rica and México; *P. fimata* (Gisin, 1952) from Argentina and Chile; *P. sensilata* Thibaud & Massoud, 1980 from Dominicana and Guadeloupe; and *P. yolandae* Izarra, 1971 from Venezuela.

The Tullberginae are more diversified in the region with twelve genera (*Tullbergia*, *Anaphorura*, *Tullbergiella*, *Mesaphorura*, *Neotullbergia*, *Dinaphorura*, *Pachytullbergia*, *Fissuraphorura*, *Rotundiphorura*, *Doutnacia*, *Metaphorura* and *Scaphaphorura*). Few species have been described.

Eight species of *Tullbergia* are known from the region: *T. bisetosa* Börner, 1902 from Chile and Islas Malvinas; *T. inconspicua* Izarra (1965) from Argentina; *T. meridionalis* Cassagnau & Rapoport, 1962 from Argentina; *T. minensis* Arlé, 1959 from Brazil; *T. paranensis* from Argentina; *T. quadrispina* (Börner, 1901) from Argentina; *T. trisetosa* (Schäffer, 1897) from Argentina and Chile; and *T. ventanensis* Rapoport, 1963 from Argentina.

The genus *Anaphorura* has only one species: *A. lavadori* (Izarra, 1972) from Argentina. *Tullbergiella* is represented in the same country by two species described by Izarra: *T. allendei* and *T. humilis*.

Mesaphorura has species widely distributed in the Neotropical Region, as *M. krausbaueri*, Börner, 1901. *M. iowensis* (Mills, 1932) was cited from México and Cuba, and six other species have been recorded from México: *M. foveata* Bonet, 1944; *M. granulata* (Mills, 1934); *M. incisa* Bonet, 1944; *M. mexicana* (Handschin, 1928); *M. tuberosa*, Bonet, 1944 and *M. yosiii* Rusek, 1967. *M. macrochaeta* recorded by Palacios & Granados, 1990.

Neotullbergia has only two described species, one from México, *N. americana* Bonet, 1944 and the other from Chile, *N. pusilla* (Giard, 1895).

Dinaphorura is found only in South America; one species occurs in Argentina, *D. spinosissima* (Wahlgren, 1906), three species are known from Chile: *D. magellanica* Rubio, 1974; *D. jarai* Najt & Rubio, 1978 and *D. pefauri* Rubio & Najt, 1979; *D. americana* Rapoport, 1962, occurs in both Argentina and Chile.

Pachytullbergia is monospecific (*P. scabra* Bonet, 1947), and known from Argentina and Chile. Recently Rusek (1991) described *Fissuraphorura cubanica* and *Rotundiphorura habanica* from Cuba, and Thibaud (1994) recorded *Doutnacia xerophila* Rusek, 1974 from Cuba.

Recently *Scaphaphorura cubana* was described from Cuban sand by Thibaud (1994). This represents the first record of the genus in the Neotropical Region.

ANNOTATED LIST ¹

ONYCHIURIDAE Börner, 1913

ONYCHIURINAE Börner, 1901

Onychiurus Gervais, 1841

- O. acuitlapanensis* Palacios-Vargas & Deharveng, 1982. **Material examined.** MÉXICO. GUERRERO: "Grutas de Acuitlapán" 1,470 m *ex* soil; J. Palacios, 21.VI.80, 12.XII.81; 2 specimens.
+ *O. ca. antheuili*. **Material examined.** MÉXICO. MORELOS: Tepoztlán, "Cueva del Diablo", M. Jiménez, 8.X.77; one specimen.
- O. bunsteri* Lobsa & Rubio, 1966 Chile ç
- O. cunhai* Arlé, 19 Brasil, Cuba. Guadeloupe, Martinique ç
- O. fimetarius* (Linnaeus, 1767) México (NL) ç
- O. folsomi* (Schäffer, 1900) México (DF, GRO) ç
- O. "folsomi"* (Schäffer), 1900. **Material examined.** MÉXICO. AGUASCALIENTES: Rancho San Francisco del Arenal; M. Vázquez and M. Ojeda, 18.IV.84; 2 specimens. GUERRERO: Grutas de Acuitlapán and Aguacachil; soil and detritus; J. Palacios and F. Moedano, 25.I.81, 2 specimens. JALISCO: Guadalajara; pots with *Adiantum*; J. Palacios, 17.IV.77, 6 specimens.
- O. ca. folsomi*. **Material examined.** CUBA. Pinar del Río, Sierra del Rosario; *ex* tree bark; J. Palacios, 17.VI.88; one specimen.
- O. gloriensis* Gruia, 1987 Venezuela ç
- * *O. janus* Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. MÉXICO: Popocatepetl, 4,000 m; *ex* sandy ground; J. Palacios, 2.VII.82; one specimen.
+ *O. ca. janus*. **Material examined.** MÉXICO. JALISCO: Chamela; soil and litter; J. Palacios, 13.X.91, 16.XI.91, 22.IX.91; 3 specimens.
- O. lagunensis* Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. BAJA CALIFORNIA SUR: Sierra La Laguna; 840 m, *Populus brandegeei* litter and 1,020 m mixed forest of *Quercus* sp. and *Pinus* sp.; M. Vázquez, 14.XI.86; 2 specimens.
- This species was cited as *O. ca. encarpatus* by Vázquez & Palacios-Vargas (1990).
- O. lotius* Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. JALISCO: Chamela Biology Station, UNAM; litter and soil; J. A. Gómez, 24.VIII.91, 16.XI.91; 8 specimens.
- This species was cited as *O. ca. opus* by Palacios-Vargas & Gómez (1993) from the type locality.
- * *O. opus* Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. MÉXICO: Popocatepetl, 3,800 m. D.F.: Ajusco, close to Volcán Xitle, 2,975 m; soil; 4.XI.82, 22.XII.91, J. Palacios and V. Vidal, 2 specimens.

¹ Abbreviations. Mexican states: DF (Distrito Federal), GRO (Guerrero), JAL (Jalisco), MEX (Estado de México), MICH (Michoacán), MOR (Morelos), NL (Nuevo León), SLP (San Luis Potosí), VER (Veracruz). Countries: ARG (Argentina), CR (Costa Rica), CHI (Chile), DOM (Dominique), GUAD (Guadeloupe), GUAT (Guatemala), JAM (Jamaica), MG (Marie Galante), MAR (Martinique), P. RICO (Puerto Rico), VEN (Venezuela).

ç previously recorded, * new record for the country, + new undescribed taxa.

O. pseudofimetarius Folsom, 1917. **Material examined.** MÉXICO. D.F.: Xochimilco, Barrio Asunción; soil; J. Moreno, 31.VII.88, 2 specimens.

O. pseudojusti Thibaud & Massoud, 1980 Guadalupe ç

O. sexpunctatus (Schäffer, 1897) Chile ç

O. subcadaverinus Denis, 1931. Costa Rica, Guatemala, P. Rico ç

O. trilobatus Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. JALISCO: Chamela Biology Station, UNAM; litter and soil; A. Rodríguez and J. A. Gómez, 22.IX.91, 16.XI.91, 16.II.92, 14.III.92; 10 specimens. GUERRERO: Aguacachil cave; detritus and soil; J. Palacios, 25.I.81; one specimen.

+ *O. ca. voegtlini*. **Material examined.** MÉXICO: TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.87; 2 specimens.

Protaphorura Absolon, 1901

P. armata (Tullberg, 1869) Argentina, Chile, México (MOR, DF) ç

P. armata (Tullberg, 1869). **Material examined.** MÉXICO. PUEBLA: Los Organales; *Abies religiosa* forest 2,680 m, litter; N. García, 29.VIII.91; 6 specimens. TAMAULIPAS: Rancho El Cielo; soil, rain forest; F. J. Villalobos, XI.87; 9 specimens. MORELOS: San Juan cave; soil; J. Palacios, 14.I.79; 2 specimens. D.F.: Xochimilco, Barrio Asunción; soil; J. Moreno, 31.VII.88; one specimen. Contreras, Primer Dinamo, soil; J. Palacios, 10.I.76; one specimen.

P. cryptopyga (Denis, 1931) Brazil, CR, DOM, GUAD. MAR. ç

P. encarpata (Denis, 1931) Argentina, México (MOR, DF) ç

P. encarpata (Denis, 1931). **Material examined.** MÉXICO. SAN LUIS POTOSÍ: Cueva "Doña Casimira", Mpio. San Cirilo de Acosta; C. Lazcano, 28.II.85; one specimen. GUERRERO: Zatecolotla, Taxco; on moss; J. Palacios, 20.VII.80, one specimen. COLIMA: Socorro Island, 700 m, soil, J. Palacios, 16.X.77; one specimen. Aguacachil cave, Taxco; soil; J. Palacios, R. García, and I. Caballero, 20.VII.80, 29.XI.80, 18.I.81, 4. II.83, 7 specimens; VERACRUZ: "Los Tuxtlas" Tropical Biology Station; evergreen forest, 200 m, soil, 10-20 cm; R. López, 19.XI.78; one specimen. D.F.: Xochimilco, Barrio Asunción; soil; J. Moreno, 31.VII.88; one specimen. MORELOS: Tepoztlán, "Cueva de San Juan", litter and soil; J. Palacios, 29.X.78; one specimen. QUERÉTARO: "Sótano de Otates"; soil; H. Guzmán, 7.IV.81; one specimen. *idem*: Jalpan "Sótano Tilaco", soil 50 m deep; H. Guzmán, 21.XII.80; one specimen. DURANGO: La Michilía; pine-oak forest, 2,490 m; soil, litter and waste wood; J. Palacios and J. Najt, 22.V.85; 3 specimens. La Michilía, "Cañada del Taray", 2,350 m; waste wood; J. Palacios and J. Najt, 22.V.85; one specimen. La Michilía, "Mesa Larga", 2,525 m; soil, J. Palacios, 21.V.85; 3 specimens.

P. fimata (Gisin, 1952) Argentina, Chile ç

* *P. hera* Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. SAN LUIS POTOSÍ: Nacimiento del Río Chichihuayan; litter; J. R. Toledo, 22.X.84; one specimen. GUERRERO: Acuitlapán cave; soil; F. Moedano, 24.I.81; one specimen. JALISCO: Guadalajara; from pot of *Adiantum*; J. Palacios, 17.IV.77; one specimen. COLIMA: Pozo s/n 30 m, Mpio. Minatitlán; soil washing *in situ*; J. Palacios, 25.X.88; one specimen. CHIAPAS: San Cristobal de las Casas, cave; soil, tree trunk with fungi; J. Palacios, 24.XII.83; one specimen. TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.87; 7 specimens. * PUERTO RICO. El Yunque; one specimen. +*P. ca. hera*. **Material examined.** MÉXICO. TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.87; 2 specimens.

P. hoguei Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. BAJA CALIFORNIA SUR: Cabo San Lucas; sand washing, in beach; J. G. Palacios, 4.XII.87; 4 specimens.

P. macrodentata Hammer, 1953. **Material examined.** MÉXICO. D.F.: Park "Desierto de los Leones", 2,800 m; soil; I. Sánchez, 9.VI.88; one specimen.

* *P. parvicornis* Mills, 1934. **Material examined.** MÉXICO. COLIMA: Socorro Island, 700 m; forest, litter; J. Palacios, 16.X.77; 3 specimens. MORELOS: Tepoztlán San Juan cave; litter and soil; J. Palacios and G. López, 29.X.78; one specimen. TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.88; 3 specimens. CHIHUAHUA: Barranca del Cobre, 2,100 m; I. Rivas, 25.VIII.83. GUERRERO: Taxco, Aguacachil cave, soil; M. Ojeda and R. García, 20.VII.80, 6.VI.81; 2 specimens. VERACRUZ: Palma Sola; "Sótano de Alpapaluca", San Sebastián Zongolica; Jilotepec, Finca El Rincón; clay soil savanna 800 m, coffee plantation with *Inga leptoloba*, litter; V. Granados, 14.V.88, 4.IX.76, 12.II.83; 6 specimens.

+ *P. ca. parvicornis.* **Material examined.** MÉXICO. OAXACA: 2 km Montes Vista Hermosa (Km 74) to Cerro Pelón, 1,350 m; C. Castillo and P. Reyes, 1.III.88; 2 specimens. VERACRUZ: "Sótano" de Alpapaluca, San Sebastián Zongolica; V. Granados, 12.II.83; one specimen.

P. sensilata Thibaud & Massoud, 1980 Dominicana, Guadeloupe ç

The species was originally described with few figures. Given the importance of new taxonomic characters, the senior author illustrated the type material to complement the original description (Figs. 4-13).

P. yolandae Izarra, 1971 Venezuela ç.

The species was described in 1971, but the body chaetotaxy was not included. Figs. 1-3 show the chaetotaxy taken from type material studied by the senior author.

+ *P. ca. yolandae.* **Material examined.** MÉXICO. COLIMA: Minatitlán, Pozo s/n 30 m, La Escondida; V. Granados, 29.III.83; one specimen.

TULLBERGIINAE Bagnall, 1935

Tullbergia Lubbock, 1876

T. aliciae Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. JALISCO: Chamela Tropical Biology Station, UNAM, litter and soil; J. A. Gómez, 16.IX.91, 12.I.92, 16.II.92; 19 specimens.

T. bassolsae Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. VERACRUZ: Los Tuxtlas, "Playa Montepío" ex sand, J. Palacios, 21.II.89; 2 specimens. "Playa Escondida", under detritus; J. Palacios, 21.II.89; one specimen. Tecolutla, sand beach under tree trunk, I. Vázquez, one specimen.

T. bisetosa Börner, 1902 Chile, Islas Malvinas ç

T. inconspicua Izarra (1965) Argentina ç

T. javieri Palacios-Vargas & Díaz, 1996. **Material examined.** MÉXICO. TAMAULIPAS: Rancho El Cielo 1,250 m; soil; F. J. Villalobos, IX and XI.87; 8 specimens.

T. meridionalis Cassagnau & Rapoport, 1962 Argentina ç

T. minensis Arlé, 1959 Brazil ç

T. paranensis Izarra, 1969 Argentina ç

T. quadrispina (Börner, 1901) Argentina ç

T. trisetosa (Schäffer, 1897) Argentina, Chile ç

- * *T. vancouverica* (Rusek, 1976). **Material examined.** MÉXICO. TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.87; 3 specimens.
T. ventanensis Rapoport, 1963 Argentina ç

Anaphorura Izarra, 1972

- A. lavadori* (Izarra, 1972) Argentina ç

Tullbergiella Izarra, 1965

- T. allendei* Izarra, 1975 Argentina ç
T. humilis Izarra, 1965 Argentina ç

Mesaphorura Börner, 1901

- * *M. clavata* Mills, 1934. **Material examined.** MÉXICO. VERACRUZ: Palma Sola, 800 m; pasture; J. Palacios, 1.IX.76; one specimen. MÉXICO: Tequesquináhuac, La Era; soil, (*Vicia faba*); 22.VI.87; 3 specimens.
 * *M. collis* Bacon, 1917. **Material examined.** MÉXICO. BAJA CALIFORNIA: Cedros Island; *Juniperus* forest, under stone; J. Palacios and M. Vázquez, 15.XI.87; one specimen.
 + *M. ca. collis*. **Material examined.** MÉXICO. CAMPECHE: Xtancumbilxu-naan cave; soil; 23.VIII.91; one specimen.
M. foveata Bonet, 1944 México (SLP) ç
M. foveata Bonet, 1944. **Material examined.** MÉXICO. VERACRUZ: Palma Sola 200 m, tropical deciduous forest; P. Lavelle, 1.IX.76, one specimen. *Idem*: Palma Sola, 800 m; pasture, P. Lavelle, 1.IX.76, 2 specimens.
M. granulata (Mills, 1934) = *M. silvicola* (Folsom) México (GRO) ç
M. granulata (Mills, 1934). **Material examined.** MÉXICO. VERACRUZ: Palma Sola, 800 m, pasture; P. Lavelle, 1.IX.76; 13 specimens. *Idem*, 200 m, tropical deciduous forest, P. Lavelle, 1.IX.76; one specimen. GUERRERO: Taxco, Aguacachil cave, soil, I. Caballero, 18.I.81; 4 specimens. MÉXICO: Tenancingo, El Salto, tropical deciduous forest; stem, J. Palacios, 11.V.77; one specimen. Tequesquináhuac, La Era, soil, *Vicia faba* culture; A. Miranda, one specimen. CHIHUAHUA: Juárez, Samalayuca, shrub root; J. Palacios, 2.VI.87; one specimen.
M. hades Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. MÉXICO: Tequesquináhuac, La Era; soil of *Vicia faba*; A. Miranda; 22.VI.87; one specimen. GUERRERO: Acuitlapán cave; soil; C. Morales, 15.XI.80; one specimen.
M. incisa Bonet, 1944 México (MOR, VER) ç
M. iowensis (Mills, 1932) México (DF., MOR, MEX, MICH, JAL, NL) Cuba ç
M. iowensis (Mills, 1932). **Material examined.** MÉXICO. GUERRERO: Taxco, Aguacachil cave, 1,700 m, soil; J. Palacios col; 29.XI.80; one specimen. GUERRERO: Juxtlahuaca cave; soil; M. L. Jiménez, 29.IX.80; one specimen. NUEVO LEÓN: Bustamante: Bustamante cave (on rock); J. Palacios, one specimen. BAJA CALIFORNIA: Cedros Island, litter; J. Palacios and M. Vázquez, 15.XI.87; one specimen. CHIHUAHUA: Juárez, Tres Jacales, soil under pasture; J. Palacios, 16.VI.87. Col.: La Escondida, El Terrero, 2 300 m; washing soil, cave; J. Palacios, 5.V.89; one specimen. CUBA. LA HABANA: Boyeros, Lab. Doc. Biol., UH.; soil, 5 cm; M. Díaz and V. González, 16.X.91, 9.VI.92, 25.III.92, 30.IV.92, 3.VI.93; 7 specimens. + BRASIL. SAO PAULO: Ipo-

ranga, Caverna Casa de Pedra; frugivorous bat guano (feces); P. Gnaspini, 2.V.87; 2 specimens.

M. krausbaueri, Börner, 1901 ARG, CHI, GUAD, GUAT, JAM, MG, MEX, SL, VEN. ♂

M. krausbaueri Börner, 1901. **Material examined.** MÉXICO. GUERRERO: Acuitlapán cave, soil; F. Mata, 19.VII.80; specimens. VERACRUZ: Palma Sola; pasture, 800 m and tropical deciduous forest, 200 m; P. Lavelle, 1.IX.76; 6 specimens. PUEBLA: Popocatepetl; 4,000 m under stones, 3,700, in moss and soil, 4,050 m on *Draba*; 31.VII.76, 21.IX.76, 5.IV.82; J. Palacios, 6 specimens. NAYARIT: Isabela Island; sugar cane litter and pasture soil; J. Palacios, 1.II.76; 2 specimens. MORELOS: forest at Derrame Chichinautzin, 2,150 m litter, *Idem*: San Juan Tezoztlán, soil at 2,200 m, *Idem* Cuernavaca Km 72, soil, *Idem* "Cueva del Diablo", J. Palacios, L. R. Parada, M. González, M. L. Jiménez and C. Aguilar, 31. VI.76, 8.X.77, 22.I.78, 21.V.78, 12.XI.78; 5 specimens. MÉXICO: Cerro Tláloc, Tequesquináhuac; forest *Pinus* litter; M. C. Gispert, 24.VI.80; one specimen; Nevado de Toluca; 27.X.84; one specimen. D.F.: Park "Desierto de los Leones"; soil, 20-25 cm; M. L. Jiménez, 12.IX.76; one specimen. NUEVO LEÓN: Monterrey, soil; J. Palacios and R. Capistrán, 20.III.85; one specimen. TABASCO: Cunduacán; banana soil; C. Cramer, 22.V.78; one specimen. Huimanguillo; litter; J. Palacios, 10.IV.79; one specimen. MICHOACÁN: El Rosario, Ocampo; *Pinus* forest, soil; J. Palacios, 4.II.81; one specimen. * GUATEMALA. ALTA VERAPAZ: forest litter, 1,000 m; G. Kramer, one specimen.

* *M. macrochaeta* (Rusek, 1976). **Material examined.** MÉXICO. VERACRUZ: Palma Sola; tropical deciduous forest, 200 m and pasture, 800 m; P. Lavelle, 1.IX.83; 5 specimens. Cueva "Puente de Piedra"; detritus; J. Toledo, 2.VIII. 86; one specimen. MÉXICO: La Era, Tequesquináhuac; soil of *Vicia faba*; A. Miranda, 22.VI.87; 5 specimens. San Rafael, Cascada Diamantes, 2,600 m; moss/stones; J. Palacios, 28.VIII.76; one specimen. Popocatepetl, 3,000 m, soil; J. Palacios, 29.I.83; 22 specimens. CHIHUAHUA: Ocampo, 24 km N. Basaseachic and "Cascada de Basaseachic"; waste wood and litter; J. Palacios, 26.VII.87; 2 specimens. D.F.: Xochimilco, Rod to San Andrés 2 km from San Mateo; soil with *Cucurbita* sp.; O. Flores, 18.VIII.88; 3 specimens. Park Desierto de los Leones, 3,700 m; soil; I. Flores, one specimen. UNAM campus; *Eucalyptus* litter; J. Palacios, 10.VII.76; one specimen. PUEBLA: Popocatepetl, 4,000 m, under stones and 3,700 m in moss and soil; J. Palacios and G. González, 21.IX.76, 31.VII.76, 1.XI.81; 5 specimens. COLIMA: El Terrero, La Escondida, soil; J. Palacios, 4.V.89; one specimen. MORELOS: "Cueva del Diablo"; G. Muñoz and J. Palacios; 21.V.78; one specimen. GUERRERO: Taxco, Aguacachil cave, detritus and soil; J. Palacios and I. Caballero, 18 and 25.I.81, 2 specimens. Acuitlapán cave, soil; J. Palacios, 19.VII.80 and 26. VII.86; 4 specimens.

* *M. mala* Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. VERACRUZ: Palma Sola, 800 m; pasture, soil 20-30 cm; J. Palacios, 1, 4 and 10.IX.76; 14 specimens.

M. mexicana (Handschin, 1928) México (MEX) ♂

+ *M. ca. pacifica*. **Material examined.** MÉXICO. VERACRUZ: Coatzacoalcos; sand, J. Palacios, 23.II.89; one specimen.

M. tuberosa Bonet, 1944 México (MOR) ♂

M. ruseki Christiansen & Bellinger, 1980. **Material examined.** MÉXICO. VERACRUZ: Palma Sola; tropical deciduous forest, 200 m; P. Lavelle, 1.IX.76; one specimen. * CUBA. LA HABANA: Boyeros, Lab. Biol. Doc., UH. litter; V. González and M. Díaz, 16.I.91, 3.VI.93; 4 specimens.

M. yosiii Rusek, 1967 México (VER, GRO) ♂

M. yosiii (Rusek, 1967). **Material examined.** MÉXICO. DURANGO: La Michilía; pine-oak forest, 2,490 m; *ex* litter and waste wood; J. Palacios & J. Najt, 22.V.85; 5 specimens. MÉXICO: Valle

de Bravo; *Pinus-Quercus*; A. Hoffmann, 6.XI.76; 2 specimens. La Era, Tequesquináhuac; soil of *Vicia faba*; A. Miranda, 22.VI.87; one specimen. CHIHUAHUA: Juárez, Tres Jacales; soil under pasture; J. Palacios, 16.VI.87; one specimen. Baja California: Cedros Island; *Cupressus* and *Juniperus* forest, El Morro; J. Palacios and M. Vázquez, 15 & 16.XI.87; 3 specimens. COLIMA: Minatitlán "Sótano La Escondida" soil 40 m deep; J. Palacios, 4.V.89; one specimen. JALISCO: Chamela Tropical Biology Station UNAM, litter; J. Palacios, 11.XI.90; one specimen. NUEVO LEÓN: Bustamante, Bustamante Caves, soil; J. Palacios and R. Capistrán, 20.III.85; one specimen. MÉXICO: Chapingo; Alfalfa soil; J. Palacios, 7.VII.80; one specimen. GUERRERO: Aguacachil cave, Taxco; 1,700 m; detritus at 16 m deep; J. Palacios, 4.VIII.80; one specimen. BAJA CALIFORNIA SUR: Sierra de La Laguna; Valle Encino Blanco; M. Vázquez, 8.II.85; one specimen. SAN LUIS POTOSÍ: Hoyo de Guaguas, Aquismón; soil 200 m deep; H. Guzmán, 6.II.81; one specimen. VERACRUZ: Palma Sola; tropical deciduous forest, 200 m; P. Lavelle, 1.IX.76; 4 specimens. "Gruta de Atoyac" soil; V. Granados, 6.XII.81; one specimen. MORELOS: "Cueva del Diablo" waste stem; J. Palacios, 4.XII.77; one specimen. YUCATÁN: Chuburná beach; sand washing; J. Palacios, 25.VIII.91; 2 specimens. TAMAULIPAS: Rancho El Cielo; soil; F. J. Villalobos, XI.87; 3 specimens; PUEBLA: Popocatépetl; J. Palacios, 29.I.83; 2 specimens; * BRASIL. SAO PAULO: Iporanga, Caverna Casa de Pedra; frugivorous bat guano (feces); P. Gnaspini, 2.V.87; 3 specimens.

Metaphorura Bagnall, 1936

M. knowltoni Wray, 1950 México ♂

M. knowltoni Wray, 1950. **Material examined.** MÉXICO. MÉXICO: Tequesquináhuac, La Era, soil of *Vicia faba*; A. Miranda, 22.VI.87; 11 specimens.

Neotullbergia Bagnall, 1935

N. americana Bonet, 1944 México (DF) ♂

N. pusilla (Giard, 1895) Chile ♂

Dinaphorura Bagnall, 1935

D. spinosissima (Wahlgren, 1906) Argentina ♂

D. magellanica Rubio, 1974 Chile ♂

D. jarai Najt & Rubio, 1978 Chile ♂

D. pefauri Rubio & Najt, 1979 Chile ♂

D. americana Argentina and Chile ♂

Rotundiphorura Rusek, 1991

R. habanica Rusek, 1991 Cuba ♂

Fissuraphorura Rusek, 1991

F. Cubanica Rusek, 1991 Cuba ♂

F. Cubanica Rusek, 1991. **Material examined.** * NICARAGUA. Posoltesa; 14.IV.84; one specimen. CUBA. LA HABANA: Boyeros, Lab. Doc. Biol., UH; soil, 5-10 cm; V. González and M. Díaz, 9.VI.92; 2 specimens.

Originally described from Cuba, this species is recorded for the first time from the continent.

PACHYTULLBERGIINAE Stach, 1954

Pachytullbergia Bonet, 1947

P. scabra (Bonet, 1947) Argentina, Chile ♂

CONCLUSIONS

The Onychiuridae are represented by 76 species in the Neotropical Region, some of them still undescribed. The more diverse genera are *Onychiurus* with 20 species and *Protaphorura* with 13 species. Some genera such as *Dinaphorura*, *Anaphorura* and *Tullbergiella* are restricted to southern South America.

Total number of species of Onychiuridae represented in the collection of the Facultad de Ciencias, UNAM by State (number of species in parenthesis) are the following: Guerrero (11), Morelos (7), Aguascalientes (1), Jalisco (5), México (9), Distrito Federal (7), Puebla (4), Tamaulipas (5), San Luis Potosí (3), Veracruz (10), Colima (6), Querétaro (1), Durango (2), Chiapas (1), Chihuahua (5), Nuevo León (3), Baja California Norte (3), Baja California Sur (1), Yucatán (1), Tabasco (1) and Nayarit (1).

Species widely distributed in México are (number of states in parenthesis): *M. yosiii* (15), *M. krausbaueri* (10), *M. macrochaeta* (8), *P. encarpata* (8), and *M. iowensis* (6); however, we have collections only from 21 states and many important regions have never been collected or studied for soil microarthropods.

KEY FOR THE COMMON NEOTROPICAL GENERA OF ONYCHIURIDAE

1. Sense organ Ant. III consists of 4 - 5 papillae, guarded by 4-5 stout setae; with two small sensory rods and two large sensory clubs 2
- 1'. Sense organ Ant. III consists of two small sensory rods and 2-3 sensory clubs, thick, cylindrical, rounded at the apex, strongly bent towards each other and with three guarding setae 3
2. With or without anal spines; postantennal organ (PAO) with 8 to 20 compound vesicles; sensory clubs smooth *Onychiurus*
- 2'. Always with anal spines; PAO with few or many simple vesicles (7 to 60); sensory clubs granulated *Protaphorura*

- | | | |
|------|--|------------------------|
| 3. | Empodial appendage well developed. (Sensory organ of Ant. III with a protecting integumentary papilla) | 4 |
| 3'. | Empodial appendage rudimentary or absent..... | 9 |
| 4. | Anal spines simple | 5 |
| 4'. | Anal spines branched | <i>Neotullbergia</i> |
| 5. | Abd. VI with two anal spines | 7 |
| 5'. | Abd. VI with more than two anal spines or spine-like setae | 6 |
| 6. | Abd. VI with 4 anal spines..... | <i>Anaphorura</i> |
| 6'. | Abd. VI with 6 or 8 spine-like processes | <i>Dinaphorura</i> |
| 7. | Tibiotarsi without capitate tenent hairs | 8 |
| 7'. | Tibiotarsi with capitate tenent hairs | <i>Pachytullbergia</i> |
| 8. | Postantennal organ elongated | <i>Mesaphorura</i> |
| 8'. | Postantennal organ circular | <i>Tullbergiella</i> |
| 9. | Sensory organ of Ant. III without protecting integumentary papilla; postantennal organ formed by 2 or 4 (rarely more) rows of round, simple vesicles..... | <i>Tullbergia</i> |
| 9'. | Sensory organ of Ant. III with 2 or 3 protecting integumentary papillae | 10 |
| 10. | Sensory organ of Ant. III with three large sensory clubs and three protecting integumentary papillae. Postantennal organ with six coffee-bean shaped vesicles with a longitudinal furrow | <i>Fissuraphorura</i> |
| 10'. | Sensory organ of Ant. III with two large sensory clubs and one protecting integumentary papilla. Postantennal organ with more than 50 small vesicles in a circular hollow | <i>Rotundiphorura</i> |

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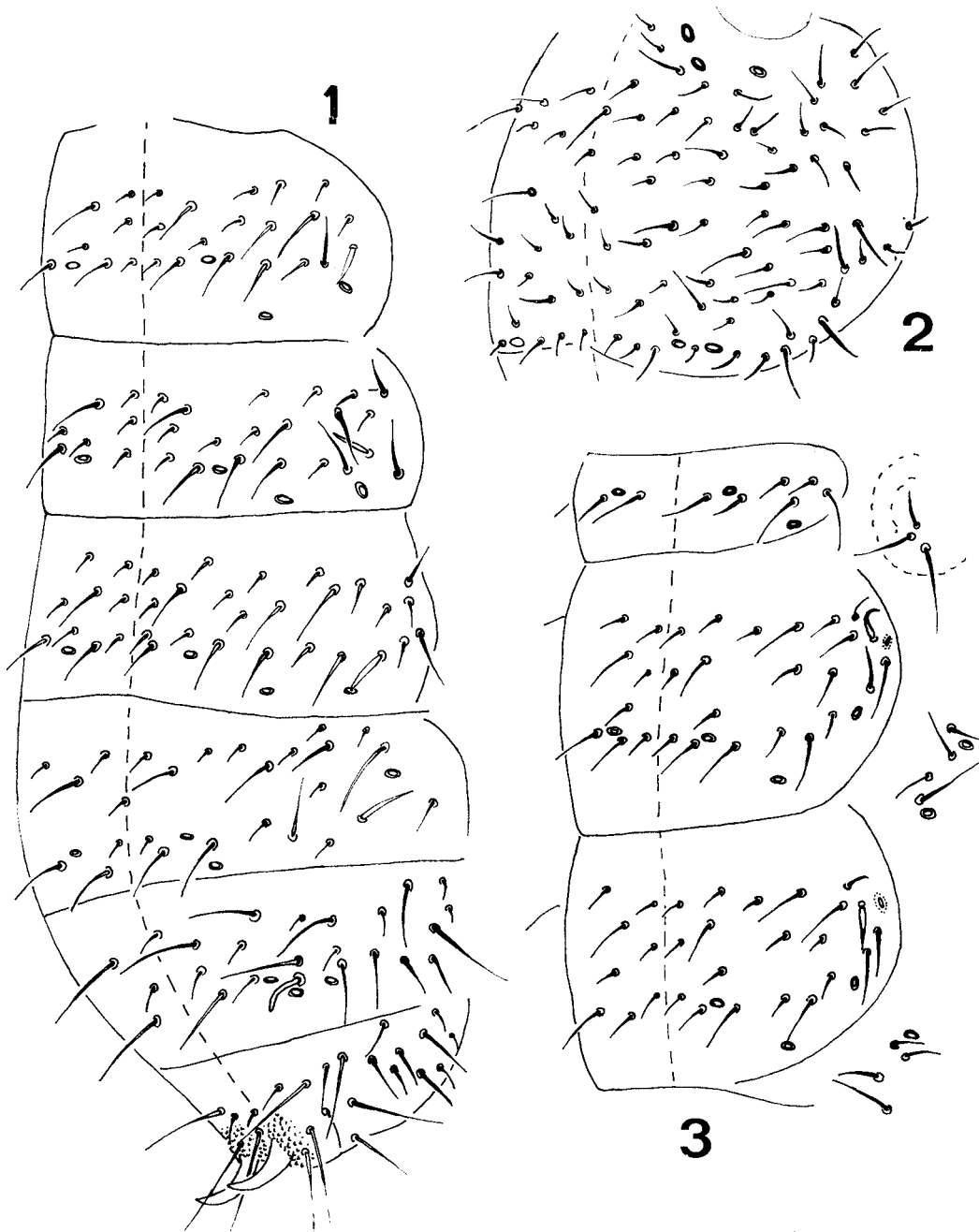
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Figs. 1-3. *Protaphorura yolandae*. 1. Abdominal chaetotaxy, 2. Cephalic chaetotaxy, 3. Thoracic chaetotaxy.

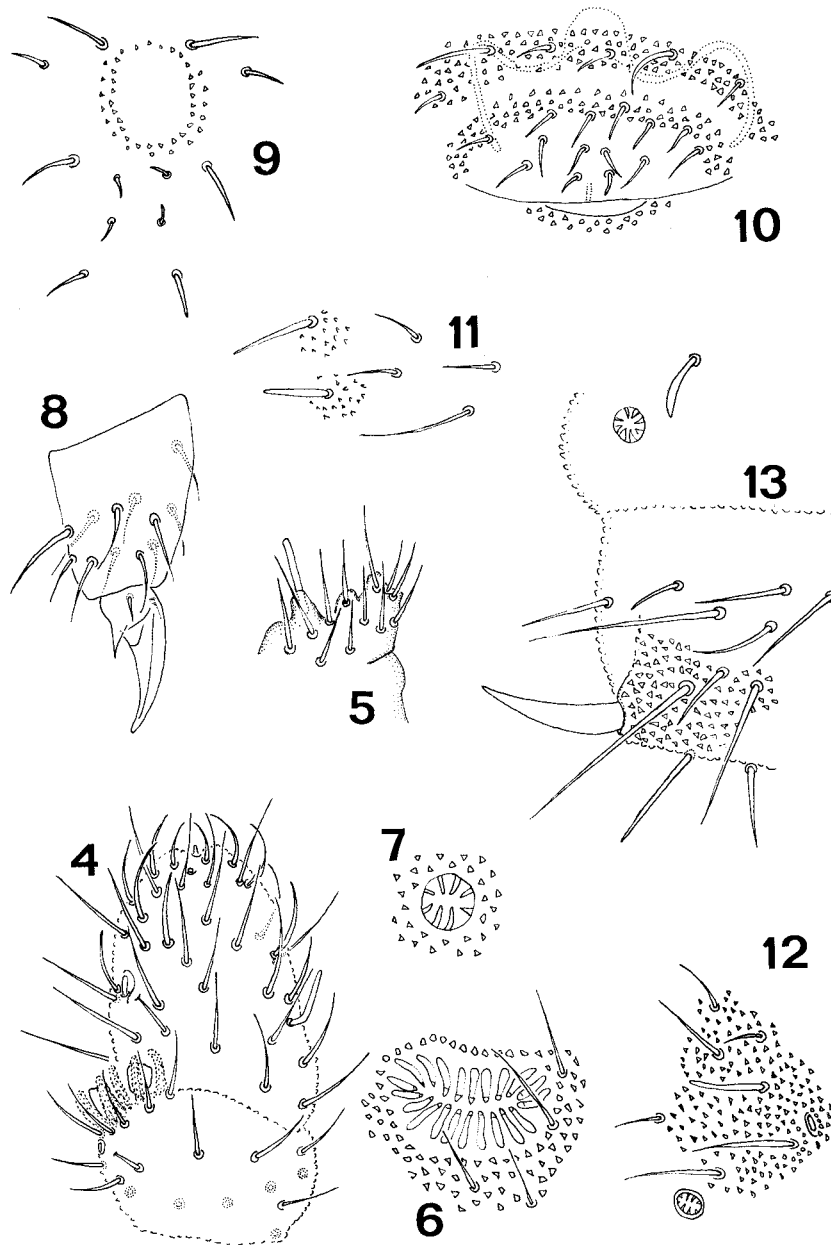


Fig. 4-13. *Onychiurus sensilata*. 4. Antennal segments III and IV, 5. Labial chaetotaxy, 6. Postantennal organ, 7. Pseudocellus, 8. Tibiotarsus III, 9. Furcula remnisce, 10. Genital plate of female, 11. Modified seta on abdominal segment IV, 12. Modified setae on abdominal segment V, 13. Abdominal V and VI with anal spine.