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A NEW GENUS AND SPECIES OF PYROSEJIDAE
(ACARI: MESOSTIGMATA: TRIGYNASPIDA) FROM MEXICO
WITH A NEW DEFINITION OF THE FAMILY

by CHEOL-MIN KIM

(Accepted November 2005)

INTRODUCTION

The mesostigmatid mite family Pyrosejidae, proposed by Lindquist & Moraza (1993), belongs to the suborder Cercomegistina and is found in leaf litter in Central America and Colombia. Although Lindquist & Moraza mentioned nine other undescribed species, including an undescribed genus, the family, at present, is monotypic, represented by a sole species, Pyrosejus prionotus Lindquist & Moraza, 1993.

Recently, I was able to examine a few female and male specimens collected in southern Mexico. These specimens were already mounted on microscopic glass slides with Hoyer’s medium, and staining with crystal violet to examine the pores on sensilla on palptarsi and tarsi I (Foelix, 1985; Liu, 1988; Liu & Peng, 1990; Slifer, 1970; Slifer & Brescia, 1960), or an application of silver nitrate reduction reaction (or Agar/AgNO3/NH3 technique) (Krantz & Redmond, 1987) to locate idiosomal adenotaxy (and the remainder poroidotaxy) was not possible.

While these specimens carry many features of the family Pyrosejidae, several characters, such as the numbers and positions of setae on the appendages, do not agree with the family description given by

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2. It is a common taxonomic practice to use the suffix - INA for naming the suborders of Mesostigmata. The suffix - INA, however, is designated to the use of subtribe in the zoological nomenclature (ICZN, 1999: Article 29.2). Although the Code itself does not regulate the names of suprafamilial ranks, such practice can potentially add confusion to our discipline.
LINDQUIST & MORAZA (1993). This is perhaps due to the providing of a detailed diagnostic description of the family based on relatively a few number of specimens, and there is no reason for me to raise a new family to accommodate these new materials. Accordingly, I describe these new Mexican specimens as a new genus and species, and provide a revised diagnosis of the family Pyrosejidae, allowing inclusion of the new genus. A key to the genera in the family is also provided.

MATERIALS AND METHODS

Notations for idiosomal chaetotaxy follow LINDQUIST & MORAZA (1993, 1998), and those for leg chaetotaxy follow EVANS (1963a, 1965, 1969) and KIM & KLOMPE (2002). Terminologies for idiosoma follow KIM (2004). Olympus model BX51 compound microscope with 100X/1.35 (oil) UPlanApo objective lens with differential interference contrast (DIC) was used to examine the specimens.

DESCRIPTION

Pyroseiulus gen. nov.

TYPE SPECIES: Pyroseiulus kethleyi sp. nov.

DIAGNOSIS: Tarsi I without claws. Palp tibiae with 13 setae, palp tarsi with 17 setae. Palp tibiae and tarsi distinctly articulated. Pilus dentilis on fixed cheliceral digit absent (or at best vestigial). Seta J2 sensu LINDQUIST & MORAZA (1993) on opisthonal shield unpaired (Jx). Female: Presternal shield(s) paired or weakly coalesced. Sternal shield(s) weakly sclerotized, entire or weakly fragmented. Sternogynial shield absent. Paired latigynial shields right-angled triangular, weakly sclerotized; each shield with 1 smooth seta of similar size (15 µm). Mesogynial shield more or less pyriform, free from ventrianal shield. Ventral and anal shields fused to form ventrianal shield. Anteromedian margin of ventrianal shield with deep v-shaped incision (notch), reaching to anterior margin of anal opening. Ventrianal shield with reticulated ornamentation over entire surface, fused to metapodal, peritrematal elements, with 9 pairs of setae, including opisthonautal setae J5; Opisthonal setae J5, Z5, S5, R3 on ventral side. Seta ZV1 off ventrianal shield, on soft cuticle. Anal opening located in posterior end of ventrianal shield, bearing 2 anal valves lacking euanal setae; paired para-anal setae present, unpaired postanal seta absent. Stigmatal openings at middle of

Pyroseiulus kethleyi sp. nov. (Figs. 1-17)

DIAGNOSIS: Same as for genus.

FEMALE (Figs. 1-13). Body roundish; idiosoma 287 µm long, 260 µm wide at middle (at the line between coxae IV).

Idiosoma. Dorsum (Fig. 1). Covered by ornamented two subequal podonotal and opisthonal shields. Podonotal shield, slightly covering opisthonal shield at posterior margin, holotrichous with setae of similar size (ca. 40-50 µm long). Setae z1, z2, s3, r3, r4, r5 minute (5 µm long); r1, r2 absent. Opisthonal shield hypotrichous with 11 setae. Seta J2 sensu LINDQUIST & MORAZA (1993) unpaired, located in median line of body (Jx). Setae Z1, SI absent. Venter (Fig. 2). Tritosternal base narrow, arising from anteromedian area of presternal shield(s); laciniae (30 µm) fused, reaching almost to anterior margin of dorsum; distal end of tritosternal laciniae (2 µm) separated, unfused. Presternal shield(s) unornamented, paired or weakly coalesced, bearing a pair of smooth setae st1 (12 µm); sternal lyri fissures stp1 vestigial or absent. Sternal shield(s) weakly sclerotized, unornamented, entire or weakly fragmented, roundish-rectangular, with 3 smooth setae, st2-st4 (15 µm). Sternal lyri fissures stp2 and stp3 vestigial or absent. Sternogynial shield absent. Paired latigynial shields right-angled triangular, weakly sclerotized; each shield with 1 smooth seta of similar size (15 µm). Mesogynial shield more or less pyriform, free from ventrianal shield. Ventral and anal shields fused to form ventrianal shield. Anteromedian margin of ventrianal shield with deep v-shaped incision (notch), reaching to anterior margin of anal opening. Ventrianal shield with reticulated ornamentation over entire surface, fused to metapodal, peritrematal elements, with 9 pairs of setae, including opisthonautal setae J5; Opisthonal setae J5, Z5, S5, R3 on ventral side. Seta ZV1 off ventrianal shield, on soft cuticle. Anal opening located in posterior end of ventrianal shield, bearing 2 anal valves lacking euonal setae; paired para-anal setae present, unpaired postanal seta absent. Stigmatal openings at middle of

ETYMOLOGY: The genus name is derived from Pyrosejus, the type genus of the family.

Figs. 8-10: *Pyroseiulus kethleyi* gen. et sp. nov., female leg I, dorsal view. 8. — Overview; 9. — Tarsus I (s: falcate seta); 10. — Tarsus I, dorso-distal blunt-tipped sensilla.
base of coxae IV. Peritremes normal, reaching to middle of base of coxae II.

**Gnathosoma** (Figs. 3-4). Anterior end of gnathotectum more or less triangular, with serrate margin; ventromedian keel absent. Ventrally all 4 pairs of gnathosomal setae smooth. Hypostomal setae *hs1* and *hs2* equal in length (20 μm), but twice longer than *hs3* and palpcoxal setae. Corniculi small (12 μm), strong, horn-like. Paralaciniae serrate.

**Palpi** (Figs. 5-6). Trochanters 20 μm long, without distinct apophysis, each with 2 setae; femora 28 μm long, each with 5 setae; genua 20 μm long, each with 6 setae, lacking a ventral seta; tibiae 22 μm long, each with 13 setae; tarsi 10 μm long, each with 17 setae. Palp tibiae and tarsi slightly articulated. Palptarsal claw (apotele) paraxial, 3-tined.

**Chelicerae** (Fig. 7). Chelate. Movable digit dentate, fixed digit with row of 6-7 teeth. Excrences on movable digit proximal, hyaline, dendritic. Pilus dentilis on fixed digit absent (or at best vestigial).

**Legs** (Figs. 8-13). Leg chaetotaxy of coxae, trochanters, femora, genua, tibiae, and tarsi of legs I-IV as in Table 1. Setal notations as figured. Seta *av* on coxae IV vestigial. Coxae I with lyriform pores in ventro-proximal position. Base of femora I-IV with circumsegmental fissure. Tarsi I without claw or ambulacrum, with 1 falcate seta (*s* in Fig. 9) along with 5 slightly curved blunt-tipped and 2 peg-like sensilla (solenidiform sensilla) at dorso-distal end (Fig. 10). Tarsi II-IV each with paired claws with fan-like pulvillus. Tarsi II-III each with ventral intercalary sclerite in circumsegmental fissure with no setae. Tarsi IV with setae *av4* and *pv4* on ventral intercalary sclerite in circumsegmental fissure.

**Male** (Figs. 14-17). Body shape and size same as female.

**Idiosoma.** Dorsum (Fig. 14). Similar to female. Opisthonal setae *sl*, *rl*, *r2* absent.

Venter (Fig. 15). Presternal shield(s) fused to holoventral (hologastric) shield. Sternal setae *st1*-*st4* simple, not barbed, equal in size (12 μm). Genital opening roundish (15 μm long), between coxae III, covered by a single valve, lacking eugenital setae. Sternal and ventrianal region fused, but a thin line may be observed. Seta *ZV1* *sensu* Lindquist & Moraza (1993) asymmetrically present, located posterior to base of left coxae IV. Metapodal, exopodal, peritrematal elements broadly fused.

**Gnathosoma** (Fig. 16). Gnathotectum similar to female. Palpi and Chelicerae (Fig. 17): As in female.

**Legs:** Chaetotaxy as in female.

**Immatures:** Unknown.

**Etymology:** Specific epithet is given in honor of the late John Bryan Kethley (October 18, 1942 – April 29, 2004), one of the great acarologists of our time.

**Type Series:** A holotype female (CMK-041001) and a paratype male (allotype; CMK-041002) deposited in Universidad Nacional Autónoma de Mexico (UNAM), Mexico City, Mexico. A paratype female deposited in U.S. National Mite Collection (USNM), Beltsville, Maryland, U.S.A. (CMK-041003).

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Table 1: Leg chaetotaxy of *Pyroseiulus kethleyi* gen. et sp. nov.
**Type Data:** MEXICO: Quintana Roo, Noh-Bec, 19°7′24″N 88°20′20″W, high tropical forest, El Husateco, Coll. M. Vázquez, 18 Jan. 1996.

**Discussion**

In the diagnosis of the family Pyrosejidae, Lindquist & Moraza (1993: 285) described, "the losses of setae pv-3 on femur I and al-2 on femur IV are unique to this family among described families of Cercomegistina". This interpretation, however, is not accepted here as the setae pv3 on femora I are present, and the loss of al2 on femora IV is not unique to the Pyrosejidae but rather synapomorphic to the entire Trigynaspida, including the Cercomegistina (see Kim, 2004). While the femora I have two pv setae, which may be referred to as pv1 and pv2, respectively, they are actually pv1 and pv3, and the seta in the middle whorl between the first (pv1) and the third whorl (pv3) is absent (Fig. 8). Similarly, for the genua II, it would be correct to describe that the setae pd3 are present, and pd2 are absent (Fig. 11); and pl (or simply p) on femora III and pv1 (or simply pv) on genua III are
also present (Fig. 12) in the family Pyrosejidae. This interpretation is compared to that of Lindquist & Moraza (1993: 287), in which they described, leg II lacking seta pd-3 on genu; leg III lacking .. pl-1 on femur, pv-1 on genu.

As to the ventral setae JV1 and ZV1, Lindquist & Moraza (1993: 286) described that the setae JV1 are inserted on soft cuticle off the ventrianal shield in the female, and the setae ZV1 are absent in the male Pyrosejidae. Pyroseiulus kethleyi gen. et sp. nov., however, carry the setae JV1 on the ventrianal shield in the female (Fig. 2), and the ZV1 in male are present asymmetrically (Fig. 15).

For the palp chaetotaxy of the adult Pyrosejidae, Lindquist & Moraza (1993: 286) described, “palpal chaetotactic formula, sensu Evans (1964), 2-5-6-12-16, with palptibia retaining larval-protonymphal complement of setae” The correct palp chaetotaxy for adults of the family Pyrosejidae, however, is: 2-5-6-13-17 (see Figs. 5-6). The palptarsi of Pyroseiulus kethleyi gen. et sp. nov. carry a total of 17 setae (plus a diagnostic 3-tined palptarsal claw of the Cercombegistina), in which an unpaired median seta (= sensillum) (x in Fig. 6; di-9 in Jackson, 1974) is surrounded by three layers of setae in a ring-shaped arrangement. The first two layers that surround an unpaired seta are composed of 6 setae each (bearing 12 setae), and the outer-most circular layer carries 4 setae: two ventral and two lateral setae. While most of adult trigynaspids that have unfused palptibiae and palptarsi carry 13 to 15 setae on palptibiae, species of Micromegistus (Parantennulidae), Neotenogynium malkini Kethley (Neotenogyniidae), and some uropodine mites (e.g., Oplitis, Trachyuropoda) carry 11 to 12 setae on palptibiae showing a neotenous (paedomorphic) condition.

In this standpoint, I thus propose a revised diagnosis of the family Pyrosejidae as follows:

Round mites with 2 subequal dorsal shields, bearing holotrichous podonotal and hypotrichous opisthonotal...
setae. Lateral idiosomal setae on marginal shields, not on platelets in soft cuticle. More than half (length) of tritosternal laciniae fused, often with separate distal end. Presternal shield(s) paired or weakly coalesced. Sternal shield(s) weakly sclerotized, entire or weakly fragmented; sternal lyrifissure (stp) on female vestigial or absent. Sternoventral shield absent. Sternal shield(s) weakly sclerotized, entire or weakly fragmented; sternal lyrifissure (stp) on female vestigial or absent. Sternogynial shield absent. Mesogynial shield free from large ventrianal shield; elongate triangular latigynial shields weakly sclerotized. Anteromedian margin of ventrianal shield often with v-shaped incision (notch). Ventrianal shield with reticulated ornamentation over entire surface, often fused posteriorly to opisthonotal and marginal shields. Palp tibia and tarsus articulated or slightly articulated; chelicerae dentate, movable digit with dendritic excrescences. Corniculi small. 'Para- laciniae' present. Tarsi I with or without claws. Chaetotactic formula of dorsal setae on genua I-IV, 5-5-6-6. Male eug enital setae absent.

The family Pyrosejidae shares the same chaetotactic formula of dorsal setae on genua I-IV (i.e., 5-5-6-6) with Asternoseiidae and Seiodidae. Asternoseiids, however, carry a holodorsal shield along with the presence of eugenital setae on male genital valve; and in the Seiodidae, anterior edge of gnathotectum is not serrate but smooth. These two families also carry free tritosternal laciniae, a character shared only by the Davacaridae in the Cercomegistina. While deutonymphs of Pyrosejidae and Davacaridae are morphologically similar, adult forms of these two families are quite different; i.e., adult davacarids carry 4 dorsal shields, free metapodal shields, eugenital setae on male genital valves 3, free tritosternal laciniae, and a 6-5-6-6 chaetotaxy of dorsal setae on genua I-IV. None of these characters are shared by adult Pyrosejidae (see Kim, 2004).

In many mesostigmatid mites, including the Trigynaspida, there appears several blunt-tipped or peglike sensilla on dorso-distal surface of tarsi I (Fig. 10; also see Coons & Axtell, 1973: 540; Davis & Camin, 1976: 443; Kim & Klompen, 2002: 45; Leonovich, 1985: 457, 1989: 470; Meng et al., 1984: 398; Moraza & Lindquist, 1998: 301). These sensilla (i.e., rod hairs sensu Foelix, 1985; dorsal field (df) setae sensu Jackson, 1974; solenidiform setae sensu Lindquist, 1984), often randomly curved, are smaller than adjacent setiform sensilla with tapered tips, and are not set in flexible sockets. Along with other adjacent setiform sensilla, they form a sensory field on the dorsal surface of tarsi I. While a detailed scanning or transmission electron microscopy or an electrophysiological study is necessary to understand the ultrastructure on walls, pores, dendritic innervation, or the functions of these sensilla of new species described here, ultrastructural studies on these sensilla on tarsi I in other mesostigmatid mites (e.g., Dermanysus, Hirstionyssus, Macrocheles, Mesonyssus, Spinturnix, Varroa, Phytoseius) indicate that they are chemoreceptors that have pores on their wall (i.e., wall-pore (WP) sensilla; olfactory-, thermo-, or hygroreceptors) or on their tip (i.e., terminal-pore (TP) sensilla; contact (gustatory) chemoreceptors) (Alberti & Coons, 1999; Jackson, 1974; Jagers op.

3. In the revision of the family Davacaridae, Walter (2004: 2040) erroneously described the absence of male eugenital setae in Davacarus gressitti Hunter, 1970, the type species of the family. All of the known members of this family, including D. gressitti, carry a paired eugenital setae on the edge of male genital valve. They are minute, and often are hardly discernible. The name D. gressetti used throughout Walter (2004) is considered an ‘incorrect subsequent spelling’ (ICZN, 1999: Article 33.3) and is unavailable.

Although the sensilla in ixodidan Haller’s organ are generally more diverse in form and numerous than the sensilla appearing in the tarsi I of Mesostigmata, those in Mesostigmata are positionally and functionally homologous to the sensilla in Haller’s organ of the Ixodida and Holothyrida, and to the blunt-tipped sensilla (telotarsal hollow setae) and telotarsal organ in the tarsi I of Opilioacarida (see Alberti & Coons, 1999; Altner & Prillinger, 1980; Coons & Alberti, 1999; Klompen & Oliver, 1993; Kontschán & Mahunka, 2004; Lehtinen, 1991; Van Der Hammen, 1983). It is not irrational to assume the homology between these wall-pore sensilla on tarsi I in the Parasitiformes sensu lato (= Anactinotrichida) and solenidia, non-birefringent sensilla appearing dorsally or dorsolaterally on the legs and palpi in the Acariformes (= Actinotrichida). These sensilla, often with slightly modified forms and different names, are also found in the legs and other appendages of several arachnid groups, such as, but perhaps not limited to, Ricinulei, Opiliones, Amblypygi, Araneae, and Scorpiones (Farley, 1999; Felgenhauer, 1999; FoeIix, 1985; FoeIix et al., 1975; Lindquist, 1984; Tichy & Barth, 1992; Van Der Hammen, 1979; personal observations). The fact that these sensilla appear in many different parts of body and appendages across the Arachnida implies that they have a multiple (polyphyletic) origin, and their phylogenetic significance in higher level Acari might need to be re-evaluated.

A KEY TO THE GENERA OF THE FAMILY PYROSEIDAE


   Pyrosoeus

1'. Tarsi I without claws. Seta J2 on opisthonotal shield unpaired (Jx). Male sternal setae st1-st4 simple, not stout, not barbed, equal in size. 

   Pyrosoelius

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