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Holotype female of *Paraphytoseius scleroticus* after 33 years: voucher photos, comments and description of a new genus (Acari: Phytoseiidae)

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Abstract

Paraphytoseius scleroticus (Gupta & Ray, 1981) known only from the holotype female and having some unique morphological features, was examined and photographed in the Zoological Survey of India, Kolkata, India. Voucher photos included in the present study indicate the presence of setae z2 and z4 on the dorsal shield that are serrated and much longer than in any other known species of the genus *Paraphytoseius*. Seta S5, unique for representing the *cracentis* species group Chant & McMurtry, 2003, to which *P. scleroticus* belongs, is clearly evident lateral to seta Z5. Lyrifissure idm5, not discussed or illustrated by Gupta & Ray (1981), is also present posteromedial to base of seta S5. As type specimens of many mites deteriorate over the years and often no longer show important morphological features, or are not available for study by acarologists, or are lost due to various reasons, taking voucher photos of the important features of type specimens, especially of soft bodied mites, is strongly suggested. These may be placed online for use by the phytoseiid taxonomists. A new genus, *Paraphytoevanseius* Prasad **gen. nov.**, is described and a key for the identification of different genera of the subtribe Paraphytoseiina, including the new genus, and *Paraphytoevanseius arjunae* (Sadanandan, 2006) **comb. nov.** are given.

Key words: *Paraphytoseius scleroticus*, *Paraphytoevanseius* Prasad **gen. nov.**, voucher photos, seta S5, poroid idm5, *Paraphytoevanseius arjunae* (Sadanandan, 2006) **comb. nov.**

Introduction

The genus *Paraphytoseius* consists of the following 19 species: (1) *P. apocynaevagrans* Chinniah & Mohanasundaram, 2001; (2) *P. arjunae* (Sadanandan, 2006); (3) *P. bhadrakaliensis* (Gupta, 1969); (4) *P. camarae* (Chinniah & Mohanasundaram, 2001); (5) *P. chihpenensis* Ho & Lo, 1989; (6) *P. cracentis* (Corpuz & Rimando, 1966); (7) *P. ghanaensis* Moraes, Zannou & Oliveira, 2007 (*in Moraes et al.* 2007); (8) *P. hilli* Beard & Walter, 1996; (9) *P. horrifer* (Pritchard & Baker, 1962); (10) *P. hualienensis* Ho & Lo, 1989; (11) *P. hyalinus* (Tseng, 1973); (12) *P. nicobarensis* (Gupta, 1977); (13) *P. orientalis* (Narayanan, Kaur & Ghai, 1960); (14) *P. parabilis* (Chaudhri, 1967); (15) *P. santurcensis* De Leon, 1965; (16) *P. scleroticus* (Gupta &

Ray, 1981); (17) *P. seychellensis* Schicha & Corpuz-Raros, 1985; (18) *P. subtropicus* (Tseng, 1972); and (19) *P. urumanus* (Ehara, 1967) (Demite *et al.* 2014).

Paraphytoseius scleroticus (Gupta & Ray, 1981: 42) was described as *Amblyseius* (*Paraphytoseius*) *scleroticus* based on a single female collected on September 3, 1979 from an unidentified host in Barkot town, Uttarkashi district, state of Uttarakhand, India. The town is located on the banks of the Yamuna river and is surrounded by wooded hills at an average elevation of 1,220 metres (above sea level). The month of September in this area is fall season with temperatures ranging from 20–35 °C. Since the original collection and publication of this species, it has not been collected again in spite of extensive collections of numerous phytoseiid species from all over India by Gupta (1986, 2003).

Gupta & Ray (1981) described and illustrated *Paraphytoseius scleroticus* poorly. Their description of the species is brief; however, they illustrated all dorsal idiosomal setae very well and included measurements of these setae and various structures. They also illustrated seta S5 lateral to seta Z5. Unique for this species in the genus *Paraphytoseius* Swirski & Schechter, 1961, they stated and illustrated long and serrated setae z2 and z4 and illustrated its short bell-shaped calyx and atrium. They also illustrated 4 pairs of pore-like structures on the dorsal shield (medial to z2, medial to z5, anteromedial to Z1, and anteromedial to Z4). The anterior end of peritreme extended to the level of the base of seta j3 in this species, whereas it extended anteriorly to base of j1 in other species of the genus. They did not describe the presence of any short, stout setae on legs I-IV except for the knobbed-tip macrosetae on genu, tibia, basitarsus, and distitarsus (telotarsus) IV. Considering several unique features of this species in the genus *Paraphytoseius*, Chant & McMurtry (2003, 2007) tried to borrow the holotype female for their studies from the Zoological Survey of India, Kolkata, state of West Bengal, India, where the holotype (# 3176/17) was deposited but could not succeed as ZSI (a Central Government of India survey, collection, and preservation organization of zoological specimens since 1875) had a policy of not lending any specimen outside the ZSI building in Kolkata.

Because of unique morphological features of *P. scleroticus* in this genus, the senior author (VP) of this paper visited ZSI, Kolkata in 2011 but could not study the holotype female. In 2013, he asked the junior author (KK), a friend of the senior author and faculty Acarologist at the Bidhan Chandra Viswavidyalaya (BCKV) Agricultural University, Kalyani, Nadia district, West Bengal state, India, to study and take some photos and measurements of the holotype female and send them to the senior author for study. In spite of being 33 years old and distorted, and in dried and shrunken Hoyer's medium, many important characteristics of the female were very clearly evident. Since voucher photos of this female have never been taken and many important characteristics were still evident, the present paper was prepared to redescribe and illustrate the species. Suggestions are made that acarologists include voucher photos of important morphological features of type specimens, especially of soft-bodied mites, as type specimens of many mites deteriorate over the years making important morphological features no longer visible, type specimens are not available for study by acarologists working in other institutions, or are lost due to various reasons. Thus, these may be placed online for use by phytoseiid taxonomists.

A new genus, *Paraphytoevanseius* Prasad **gen. nov.**, is described for *Amblyseius* (*Paraphytoseius*) *arjunae* Sadanandan, 2006, known from *Ipomoea muricata*, collected

in state of Kerala, India. In addition, a revised key for the identification of different genera of the subtribe Paraphytoseiina, including the new genus, is given.

Material & methods

Gupta & Ray (1981) did not state how the female of this species was collected by Gupta on September 3, 1979, or what medium was used to mount the female. At that time, he was working as an acarologist at ZSI in Kolkata. He was using locally prepared Hoyer's medium for mounting mites on the glass slides (Gupta 1986). It is evident from Fig. 1 that female was mounted under a squared coverslip and ringed, possibly, with locally available red nail polish.

Photos of the holotype female were taken by the junior author in November 2013 with help of the ZSI staff member from attached camera of Nikon 80i phase contrast microscope located in ZSI. Measurements (in μm) of the large setae were also taken and recorded using the same microscope. The photos were sent to the senior author who enhanced them (for clarity) in Photoshop 5.0™ and imported them into the Adobe InDesign CS5 program in which the setae were labeled appropriately. All of the photos are shown in Figs. 2–5. Some of the photos have the actual magnification noted on them whereas others are very much enlarged to show the important characteristics and the exact magnification may not be given.

Taxonomy

Paraphytoseius scleroticus (Gupta & Ray, 1981) (Figs. 1–5)

Amblyseius (*Paraphytoseius*) *scleroticus* Gupta & Ray, 1981: 42, (Fig. 1).

Amblyseius (*Paraphytoseius*) *scleroticus* Gupta & Ray; Gupta, 1986: 126, (Figs. 276–279).

Paraphytoseius scleroticus (Gupta & Ray); Moraes *et al.*, 1986: 106.

Amblyseius (*Paraphytoseius*) *scleroticus* Gupta & Ray; Gupta, 2003: 60, (Figs. 289–292).

Paraphytoseius scleroticus (Gupta & Ray); Chant & McMurtry, 2003: 220.

Paraphytoseius scleroticus (Gupta & Ray); Moraes *et al.*, 2004: 164.

Paraphytoseius scleroticus (Gupta & Ray); Chant & McMurtry, 2007: 53.

Paraphytoseius scleroticus (Gupta & Ray); Prasad, 2012: 857.

Paraphytoseius scleroticus (Gupta & Ray); Prasad, 2013: (Fig. 1005).

Paraphytoseius scleroticus (Gupta & Ray); Demite *et al.*, 2014: October 2014.

Systematics

The absence of seta S4 and presence of some dorsal idiosomal setae on the tubercles or humps (along with some other features) places *P. scleroticus* in the tribe Kampimodromini Kolodochka, 1998, of subfamily Amblyseiinae Muma, 1961. The presence of the notch or incision in the dorsal shield lateral to the base of seta s4 places *P. scleroticus* in the subtribe Paraphytoseiina Chant & McMurtry, 2003. The absence of setae J2 and S2 and presence or absence of seta S5 are key features of the genus *Paraphytoseius* Swirski & Schechter, 1961. Thus, *P. scleroticus* is correctly placed in genus *Paraphytoseius*.

Unique features of the species

The long and serrated setae z2 and z4 and presence of seta S5 are unique features

for this species. In addition, its short funnel-shaped calyx is also different as most species have dish or disc-shaped calyx. None of these features are present in other species belonging to the genus *Paraphytoseius*.

Results

Description [based on Gupta & Ray (1981)]

Dorsum - Idiosoma with 16 pairs of setae of which 14 pairs are on the dorsal shield having the following measurements: $j_1 = 25$, $j_3 = 56$, $j_4 = 8$, $j_5 = 8$, $j_6 = 8$, $J_5 = 4$; $z_2 = 11$, $z_4 = 20$, $z_5 = 7$, $Z_1 = 9$, $Z_4 = 45$, $Z_5 = 69$; $s_4 = 69$, and $S_5 = 11$ and 2 pairs of setae are on the lateral integument beside dorsal shield (Figs. 3–4) having the following measurements: $r_3 = 20$ and $R_1 = 16$; dorsal shield length = 260, width = 135, with 4 pairs of pores and poroids. Setae j_1 , j_3 , z_2 , z_4 , Z_4 , Z_5 , s_4 , r_3 , and R_1 serrate; seta Z_5 (= 69) as long as s_4 (= 69), followed by j_3 (= 56) and Z_4 (= 45).

Venter - Sternal shield length = 90, width = 72, with 3 pairs of setae (ST1, ST2, ST3); 1 pair of small metasternal shields with 1 seta on each (ST4). Genital shield width = 69, with 1 pair laterally placed setae (ST5). Ventrianal shield length = 90, width = 50, with 3 pairs of preanal setae on one side (JV1, JV2, ZV2) and only 2 pairs on the other side (JV1, JV2); paired paraanal setae (PAA) and single postanal seta (POA) are in the usual location near the anal opening. Metapodal shield thin, elongate, 1 pair, on ventral integument. Ventral integument around ventrianal shield with 4 pairs of setae (JV4, JV5, ZV1, ZV3) of which heavy and serrated posteriormost JV5 = 56 long.

Other structures - Spermathecal calyx short funnel-shaped. Dentition of chelicerae not evident. Length of knob-tipped primary macrosetae on leg IV (see remarks below), $P_{geIV} = 15$, $P_{tiIV} = 29$, $P_{bta} = 34$, and $P_{dta} = 34$.

Remarks

There are 2 kinds of macrosetae on legs I–IV in species of *Paraphytoseius*. One kind is short, rod-shaped, capitate, or blunt-tipped, commonly present on the genu of legs I–II (occasionally, also on legs III–IV), while the second kind is usually large, spatulate or clubbed and are commonly present on the genu, tibia, basitarsus and distitarsus of leg IV. Some acarologists have called the first kind as "non-macrosetae", including the one present on femur IV (Ehara *et al.*, 2000; Ehara, 2002). The second kind of macrosetae traditionally have been called as "macrosetae" by most phytoseiid researchers. However, some acarologists have referred to both kinds of differentiated setae on legs I–IV as "macrosetae". We have called the first kind of macrosetae as "secondary macrosetae (SgeI, SgeII, etc.)" and have called the second kind of macrosetae as "primary macrosetae (P_{geIV} , P_{tiIV} , P_{btaIV} , etc.)" in this work. Gupta & Ray (1981) did not report the small secondary macrosetae on legs I–IV in their description of *P. scleroticus*. This was and is very unusual since they are present in remaining species of the genus and may be an error on the part of Gupta & Ray (1981). The holotype female, if ever remounted, reexamined or recollected, must be checked for this character.

Holotype slide details - Figure 1 of the slide gives the following identification details on the left label - *Amblyseius (Paraphytoseius) scleroticus* sp. nov. (female), Det: S.K. Gupta & S. Ray, Dt: 27. V. 1980, HOLOTYPE, Reg. No. 3176/17. The collection record on right label states - Loc: India, U.P., Barkot; Host: Unidentified. Dt: 3. IX. 1979; Coll.: S.K. Gupta. The coverslip of the slide is square-shaped and has red ringing material along its 4 edges.



Figures 1–2. *Paraphytoseius scleroticus* (Gupta & Ray) - 1. (Top), Slide with holotype female; 2. (Bottom), Holotype female in low magnification - Large setae j1, j3, Z4, Z5, s4, and macrosetae on leg IV (pointed by arrows).

Voucher photos of holotype female - In spite of being 33 years old and distorted in dried and shrunken Hoyer's medium, the female shows major characteristics very well, even in the photo (Fig. 2) shows the female chelicerae and palps of the gnathosoma at low magnification. The idiosoma has 4 pairs of legs and the landmark setae j1, j3, Z4,

Z5, and s4 are clearly seen as labeled. Dorsal shield is not evident clearly which is usually very soft or poorly sclerotized in *Paraphytoseius* species. Leg IV also shows primary macroseta on genu, tibia, basitarsus, and distitarsus. Setae z2, z4, S5, and r3 are not evident at this low magnification.



Figure 3. *Paraphytoseius scleroticus* (Gupta & Ray) - Holotype female in high magnification showing idiosoma with peritreme (PE) on left, seta r3 on right to PE, and lightly sclerotized dorsal shield with landmark setae j1, j3, z2, z4, Z4, Z5, s4, and S5. Seta R1 on integument barely seen.



Figures 4–5. *Paraphytoseius scleroticus* (Gupta & Ray) - 4. (Top), Holotype female in high magnification showing anterior idiosoma with peritreme (PE) on left, seta r3 on right to it, and lightly sclerotized dorsal shield with landmark setae j1, j3, z2, z4, and s4 (seta r3 on integument); 5. (Bottom), Same female showing posterior dorsal shield with setae Z4, Z5, S5 and barely visible lyrifissure idm5 posteromedial to S5.

Figure 3 is an enhanced photograph which shows the entire idiosoma of the female with seta r3 on the integument beside the dorsal shield near the peritreme. The dorsal

shield is lightly sclerotized and shows setae j1, j3, z2, z4, Z4, Z5 and s4 clearly. Seta S5 is also evident at this magnification. The minute setae (less than 10 μm long) j4, j5, j6, z5, and Z1 are not evident at this magnification.

The large, round solenostome (gd5), about the size as seta z5 and usually located just posteromedial to the base of the z5 seta in other *Paraphytoseius* species, is not evident. Figure 4 is an enlarged and enhanced photograph of the anterior idiosoma which shows setae j1, j3, z2, z4, s4, and r3 very well. All these setae are serrated but serrations on setae j3 and s4 are more pronounced than those of j1, z2, z4, and r3. Figure 5 is an enlarged and enhanced photograph of the posterior region of the dorsal shield which shows large and stout setae Z4 and Z5 very well. Seta S5 is also clearly evident lateral and posterior to the base of seta Z5. A very tiny and barely visible poroid (idm5) is present slightly posterior and medial to the base of seta S5.

Measurements of dorsal setae and macrosetae on leg IV - Our measurements of the dorsal setae and macrosetae on leg IV [that of Gupta & Ray, 1981, in bracket] are as follow: j1 = 21 [25], j3 = 51 [56], z2 = 11 [11], z4 = 30 [20], Z4 = 37 [45], Z5 = 65 [69], s4 = 59 [69]; r3 = 28 [20], PgeIV = 17 [15], PtiIV = 29 [29], Pbta (macroseta on basitarsus) = 33 [34], and Pdta (macroseta on distitarsus) = not measured [34]. The short to minute setae j4, j5, j6, J5; z5, Z1 were not visible and therefore could not be measured. Also, we could not measure seta S5 which was barely visible on left.

Remarks

According to Gupta & Ray (1981), the apices of the macrosetae of leg IV were knob-shaped. We could not examine the tips clearly.

Solenostomes and lyrifissures on dorsal shield - Although Gupta & Ray (1981) illustrated the largest solenostome (gd5) located medially to seta z5, they also illustrated 3 additional pairs of small pore-like structures on the dorsal shield (medial to z4 which may possibly be gd2, anteromedial to Z1 which may possibly be gd6, and anteromedial to Z4 which may possibly be gd8). None of these 4 pairs of solenostomes are visible in the holotype female. However, lyrifissure idm5 [which Gupta & Ray (1981) did not illustrate] is evident slightly posterior and medial to the base of the seta S5 in Fig. 5.

Other structures - The cheliceral dentition, pores and poroids on the dorsal shield, seta R1, ventral structures such as the sternal shield, the genital shield, the ventrianal shield and the setae on and surrounding these on the integument, and the spermatheca, were not visible on the specimen. The long macrosetae on leg IV were clearly evident and were measured but the small, stout and capitate macrosetae on legs I-IV could not be observed as legs were in poor condition.

Discussion

Gupta & Ray (1981) reported that *P. scleroticus* lacked setae J2 and S2 which are key features of the genus *Paraphytoseius*. They also discussed and illustrated the notched and incised lateral margin of the dorsal shield at the level of seta s4 which is the key characteristic of the subtribe Paraphytoseiina Chant & McMurtry, 2003, which is in the tribe Kampimodromini Kolodochka, 1998, of the subfamily Amblyseinae Muma, 1961. Thus, the placement of *P. scleroticus* in the genus *Paraphytoseius* is valid.

Seta S5 - Gupta & Ray (1981) discussed and illustrated seta S5 lateral to Z5 in *P. scleroticus*. Matthyse & Denmark (1981), considered seta S5 (and some other characteristics such as the notch in lateral margin of dorsal shield lateral to the base of seta s4) variable in species of *Paraphytoseius* and, thus, synonymized several species

with *P. multidentatus* Swirski & Shechter, 1961 (now a junior synonym of *P. orientalis*) but not *P. scleroticus* as it had some unique morphological features not present in other species of this genus. Chant & McMurtry (2003) disagreed with this opinion. Also, they refrained from using S5 as a character to separate the genus into two subgenera, but rather established two species groups to incorporate the *Paraphytoseius* species known at that time. The 19 species currently known in the genus, can be placed in these 2 groups based on the presence or absence of the S5 seta as follows: (1) *cracentis* species group Chant & McMurtry, 2003 (S5 present: *P. cracentis*, *P. hualienensis*, *P. hyalinus*, and *P. scleroticus*); and (2) *orientalis* species group Chant & McMurtry, 2003 (S5 absent: *P. bhadrakaliensis*, *P. camarae*, *P. chihpenensis*, *P. hilli*, *P. horrifer*, *P. nicobarensis*, *P. orientalis*, *P. parabilis*, *P. santurcensis*, *P. scleroticus*, *P. subtropicus*, and *P. urumanus*). Although the presence or absence of seta S5 is currently used to separate the genus *Paraphytoseius* into these two species groups, it is possible that future phytoseiid researchers may consider these as subgenera of *Paraphytoseius*. A detail study of all of the species in this genus including solenostomes and lyrifissures is needed to determine whether there are other characters that support the elevation of these two species groups to the subgeneric level.

Remarks

Gupta (1986, 2003) discussed and illustrated seta S5 in the species he identified as *Amblyseius (Paraphytoseius) multidentatus* (Swirski & Schechter, 1961) [currently a junior synonym of *P. orientalis* (Narayanan, Kaur & Ghai, 1960)]. Accepting opinion of Matthysse & Denmark (1981), Gupta (1986) stated that seta S5 was variable and may be present or absent. However, Swirski & Schechter (1961) in their description of *Paraphytoseius multidentatus* Swirski & Schechter, 1961, had stated that S5 was absent. Beard & Walter (1996) also considered this seta to be absent in this species. Several other authors also did not find seta S5 present in specimens identified as *Paraphytoseius multidentatus* or *P. orientalis*. Corpuz & Rimando (1966) described *Ptenoseius cracentis* from the Philippines (later transferred to genus *Paraphytoseius*) which had seta S5. Apparently, Gupta (1986, 2003) had two different species [possibly *P. cracentis* and then described *P. orientalis* (= *P. multidentatus*)] in his collection. Thus, the identification of specimens of *A. (P.) multidentatus* having seta S5 by Gupta (1986, 2003) should be considered a misidentification, possibly of *Paraphytoseius cracentis*. It is interesting that Gupta & Ray (1981) noted the presence of seta S5 in *P. scleroticus* but Gupta (1986) did not consider the female specimens in his collection having seta S5 to be *P. cracentis*.

Solenostomes and lyrifissures - Gupta & Ray (1981) illustrated only 4 pairs of pore-like structures on the dorsal shield of *P. scleroticus*. Other authors have illustrated fewer, the same, or many more solenostomes and lyrifissures in other species of *Paraphytoseius* (De Leon 1965, 1967; Ehara 1967; Tseng 1973; Schicha & Corpuz-Raros 1985; Ho & Lo 1989; Beard & Walter 1996; Chinniah & Mohanasundaram 2001a, b; Ehara 2002; Moraes *et al.* 2007). Aponte & McMurtry (1987) and Beard (2001) illustrated, many more solenostomes and lyrifissures on the dorsum of *Amblyseius colimensis* Aponte & McMurtry, and the genus *Neoseiulus*, respectively. Whether these are species or genus specific, has not been studied or compared in the species of *Paraphytoseius* even though several have illustrated about 15–25 solenostomes and lyrifissures very well (Ho & Lo 1989; Moraes *et al.* 2007). Also, none of these authors have named these solenostomes and lyrifissures in species of *Paraphytoseius*. These, including idiosomal setae, have been studied extensively in

other species of Mesostigmata (Athias-Henriot 1969–1977; Krantz & Redmond 1987; Johnston & Moraza 1991; Lindquist & Moraza 1999, 2010).

Gupta & Ray (1981) illustrated *gd5*, a large solenostome located medial to the base of seta *z5*. This solenostome has always been reported and illustrated to be near the base of *z5* in all species of *Paraphytoseius* by phytoseiid researchers. However, Gupta & Ray (1981) did not discuss or illustrate the pair of pore-like structures near and posteromedial to setae *S5* which we found present and identified as *idm5* (Fig. 5). This lyrifissure, without giving any significance, has been illustrated in figures of females of several species of *Paraphytoseius* by different authors [(A) **idm5 present**: (1) De Leon 1967; *P. santurcensis*; (2) Tseng 1973; *P. hyalinus*; (3) Schicha & Corpuz-Raros 1985; *P. cracentis*; (*P. multidentatus*) = *P. orientalis*; and *P. seychellensis*; (4) Ho & Lo 1989; *P. chihpenensis*; (5) Beard & Walter 1996; *P. hilli* and *P. seychellensis*; (6) Ehara 2002; *P. seychellensis*; (7) Moraes *et al.* 2007; *P. ghanaensis*; *P. horriifer*; and *P. orientalis*]. It has been reported absent or not illustrated by other authors [(B) **idm5 absent**: (1) Ho & Lo 1989; (*P. multidentatus*) = *P. orientalis* and *P. cracentis*; (2) Ehara *et al.* 2002; *P. cracentis*]. However, other authors did report presence of *idm5* in same species when not seen by others as mentioned above. It is evident from the above that most phytoseiid researchers noted the presence of *idm5* (even when seta *S5* was absent) in their species they discussed or illustrated.

Variation in measurements of setae - It is evident from our measurements of some of the landmark setae on the dorsal idiosoma and the macrosetae on leg IV given in the result section, that our measurements are very close to those of Gupta & Ray (1981) [given in brackets]: *j1* = 21 [25], *j3* = 51 [56]; *z2* = 11 [11], *z4* = 30 [20], *Z4* = 37 [45], *Z5* = 65 [69]; *s4* = 59 [69]; *r3* = 28 [20]; *PgeIV* = 17 [15], *PtiIV* = 29 [29], and *PbtaIV* = 33 [34]. However, some of our measurements were different than those given by Gupta & Ray (1981). This kind of difference in the measurements of some setae by different authors examining the same specimen after years or decades is not uncommon.

Voucher photos of type specimens - As seen from the present study, type specimens often get distorted in the dried, crystallized, and shrunken Hoyer's medium. Thus, many important characteristics may not be seen. Type specimens, in many cases, are lost, destroyed, or not available for other acarologists to study. Voucher photos are not available either for online identification to phytoseiid taxonomists. Many museums are now trying to take voucher photos of specimens in their collections. Acarologists are far behind in this respect. We were fortunate to examine and take voucher photos of the female holotype of *P. scleroticus*, the only specimen known of this species. In spite of being almost 33 years old in 2014, it still had many landmark characteristics clearly evident. Thus, as presented in this paper, voucher photos of type specimens which show important morphological characteristics, especially of soft bodied mites, may provide important information that can be easily shared with other phytoseiid taxonomists throughout the world.

***Paraphytoevanseius* Prasad gen. nov.**

<http://zoobank.org/urn:lsid:zoobank.org:act:A713C869-7086-4582-8D30-608CDB959093>

Classification: Subfamily Amblyseiinae, tribe Kampimodromini, subtribe Paraphytoseiina.

Type species: *Amblyseius (Paraphytoseius) arjunae* Sadanandan, 2006b: 188.

World distribution: India.

Genus diagnoses

This new genus is similar to the genus *Paraphytoseius* but has seta J2 present, seta S2 absent and seta S5 is present in the type species. The remaining characteristics as in the subtribe Paraphytoseiina and tribe Kampimodromini.

Etymology

The new genus is named after Dr. Gregory A. Evans, USDA, APHIS, BARC-West, Beltsville, MD, USA, in honor of his great contributions to the taxonomy of the family Phytoseiidae.

Remarks

The key to the genera of the subtribe Paraphytoseiina given in Chant & McMurtry (2007: 47) should be modified accordingly to incorporate the above new genus as follow:

1. Setae J2, S2, and S5 present *Neoparaphytoseius* Chant & McMurtry
– One or more of setae J2, S2 and/or S5 absent 2
2. Seta J2 present *Paraphytoevanseius* Prasad **gen. nov.**
– Seta J2 absent 3
3. Seta S2 present *Amblyseiulella* Muma
– Seta S2 absent *Paraphytoseius* Swirski & Schechter

Female

Generic description - ASP (Amblyseiinae Standard Pattern), - S2, - S4 (Denmark and Evans, 2011: 33). Dorsum with 17 pairs of setae: podosoma with 10 pairs of setae (j1, j3, j4, j5, j6; z2, z4, z5; s4; and r3) and opisthosoma with 7 pairs of setae (J2, J5; Z1, Z4, Z5; S5; and R1). Dorsal shield incised on each side lateral to s4. All 7 pairs of landmark setae j1, j3, Z4, Z5, s4, r3, and R1 serrated, much thicker and larger than remaining 10 pairs of smooth setae, and on small to large tubercles. Seta s4 longest of all dorsal idiosomal setae followed by Z4, j3, Z5, r3, j1, and R1.

Peritreme - Extending to level of j1.

Venter - Sternal shield longer than wide, with small posteromedial projection, with 3 pairs of sternal setae (ST1, ST2, and ST3). A pair of small, triangular metasternal shields, each bearing seta ST4 and a poroid. Genital shield truncate posteriorly, with pair of seta ST5 placed laterally and above the posterior margin of the shield. Ventrianal shield longer than wide, narrowly elongate, pentagonal in shape, and with 3 pairs of anterolaterally placed preanal setae (JV1, JV2, and ZV2) and pair of paranal and single postanal setae around anal shield. Ventral integument with 4 pairs of setae (JV4, JV5, ZV1, and ZV3) lateral to ventrianal shield of which JV5 longest, heaviest, and well serrated; remaining 3 pairs of setae small and smooth. Metapodal shield not seen clearly.

Chelicera - Fixed digit with 8 teeth and a pilus dentilis; movable digit with 3 teeth.

Spermatheca - Calyx long and trumpet-shaped.

Legs. Leg IV with 1 heavy, blunt-tipped, erect, secondary macroseta on femur and 4 large, very heavy, and spatulate primary macrosetae on genu, tibia, basitarsus, and distitarsus (telotarsus) of which longest on basitarsus IV.

Male - Unknown.

Remarks

The presence of some thickened and serrated dorsolateral setae arising from tubercles or humps on the dorsal shield, indicates that *Paraphytoseius arjunae* (Sadanandan) belongs to the tribe Kampimodromini Kolodochka. The presence of a distinct notch or incision on the lateral margin of dorsal shield near the base of the seta s4 and absence of seta Z2 places this species in the subtribe Paraphytoseiina Chant & McMurtry, 2003. Seta J2 is present, seta S2 is absent and seta S5 is present in *Paraphytoseius arjunae*. Thus, this species does not belong to any of the three known genera (*Amblyseiulella* Muma, *Paraphytoseius* Swirski & Schechter, or *Neoparaphytoseius* Chant & McMurtry, 2003) of the subtribe Paraphytoseiina. Therefore, a new genus is created to accommodate this species.

***Paraphytoevanseius arjunae* (Sadanandan, 2006) comb. nov.**

Amblyseius (*Paraphytoseius*) *arjunae* Sadanandan, 2006b: 188. Type: Adult female, India: Kerala, known from *Ipomoea muricata*, deposited in the Department of Zoology, University of Calicut, Kerala, India.

Paraphytoseius arjunae (Sadanandan); Prasad, 2012: 514.

Paraphytoseius arjunae (Sadanandan); Demite, Moraes, McMurtry, Denmark & Castilho, 2014, accessed October 2014.

Remarks

Sadanandan (2006) described *Amblyseius* (*Paraphytoseius*) *arjunae* poorly. Setae z2 and z4 were not illustrated but their measurements of z2 = 6 µm and z4 (erroneously called z3) = 10 µm were given. Setae Z1 and S5 were illustrated but their measurements were not given. The spermatheca has a long and tubular, trumpet-shaped calyx. Information on the macrosetae if present on the genu of legs I and II of this species was not provided. The senior author contacted the Head, Department of Zoology of Calicut University, Calicut where types were said to be deposited, but, they could not be found. Dr. Mary Sadanandan did not respond (Personal communication).

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ماده هولوتیپ *Paraphytoseius scleroticus* پس از ۳۳ سال: عکس‌های مستند،
تفسیرها و توصیف جنس جدید (Acari: Phytoseiidae)

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چکیده

گونه *Paraphytoseius scleroticus* (Gupta & Ray, 1981) تنها شاخه شده از ماده هولوتایپ و دارای چند ویژگی ریخت‌شناسی منحصر به فرد، در مؤسسه جانورشناسی کلکته هند مورد بررسی و عکسبرداری قرار گرفت. تصاویر مستند آورده شده در مطالعه حاضر، وجود موهای Z2 و Z4 را روی صفحه پشتی نشان می‌دهد که اره‌ای بوده و بسیار بلندتر از دیگر گونه‌های جنس *Paraphytoseius* هستند. موی S5 که منحصر برای گروه گونه‌ای *cracentis* Chant & McMurtry, 2003 که گونه *P. scleroticus* به آن تعلق دارد به روشنی در ناحیه پهلویی موی Z5 دیده می‌شود. روزنه idm5 نیز که توسط گوپتا و ری (۱۹۸۱) مورد بحث و ترسیم قرار نگرفته در ناحیه عقبی میانی پایه موی S5 وجود دارد. از آنجا که نمونه‌های تایپ بسیاری از کنه‌ها در طول سال‌ها تخریب می‌شود و اغلب ویژگی‌های ریخت‌شناسی مهم را نشان نمی‌دهند، یا برای مطالعه در دسترس کنه‌شناسان نیستند، یا به دلایل مختلف از بین رفته‌اند، عکسبرداری مستند از ویژگی‌های مهم نمونه‌های تایپ، به ویژه از کنه‌های دارای بدن نرم، به شدت سفارش می‌شود. این تصاویر می‌تواند به صورت برخط برای استفاده تاکسونومیست‌های فیتوزئیدها قرار داده شود. جنس جدید *Paraphytoevanseius* Prasad gen. nov. ایجاد شده و کلیدی برای شناسایی جنس‌های مختلف زیرقبیله *Paraphytoseiina* شامل جنس جدید ارایه شده است.

واژگان کلیدی: *Paraphytoseius scleroticus* ، *Paraphytoevanseius* Prasad gen. nov. ،
تصاویر مستند، موی S5، روزنه idm5.

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