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A new species of *Neoseiulella* Muma (Parasitiformes: Phytoseiidae) from Northwestern India

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Original research

ABSTRACT

This study describes a new species of phytoseiid mite, *Neoseiulella pentaporus* Döker, Robin, and Kaur **sp. nov.** (Parasitiformes: Phytoseiidae). The new species was discovered in the Northwestern region of India, specifically in the state of Himachal Pradesh, at an elevation of 2700 meters. This new species is characterized by distinct morphological features, including the presence of five pairs of solenostomes on the dorsal shield and only two knobbed macrosetae on leg IV. A differential diagnosis is provided, comparing the new species to closely related species within the *tiliarum* species group, including *N. vollsella* (Chaudhri, Akbar & Rassol) and *N. prunus* (Denmark & Rather), to highlight the taxonomic differences.

Keywords predatory mites; Typhlodromini; morphology; dorsal solenostomes; new species; Indomalayan realm

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Introduction

Phytoseiid mites (Parasitiformes: Phytoseiidae) are a diverse and important group of predatory mites, playing a crucial role in controlling pest mite populations across various ecosystems, including both agricultural and natural environments (McMurtry *et al.* 2013). Despite the significance of phytoseiid mites, the biology and feeding habits of almost all species within the genus *Neoseiulella* Muma, 1961, remain poorly understood. Among them, *N. tiliarum* (Oudemans, 1930), the oldest and most widely distributed species in the genus, is known to inhabit pubescent domatia (Kabicek 2008; Kolodochka 2009). A total of 49 nominal species of *Neoseiulella* have been described globally, with 42 of them currently considered valid (Ferragut and Peña-Estévez 2003; Kanouh *et al.* 2012; Demite *et al.* 2025). Many of these species are widely distributed across diverse geographical regions, inhabiting various habitats such as forests, wetlands, and other natural environments (Stathakis *et al.* 2016; Döker 2018). The current study aims to describe a new species, *Neoseiulella pentaporus* Döker, Robin, and Kaur **sp. nov.**, discovered in the northwestern region of India, specifically in the state of Himachal Pradesh.

Material and methods

Plant leaves were carefully examined using a 10x hand magnifier to identify those colonized by phytoseiid mites. Adult phytoseiid mites were collected from apple trees by beating the

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branches over a plastic plate with a dark background using a wooden stick. In the field, mites were dislodged and collected on a plate. Dislodged mites were immediately picked up using a fine camel hair brush (size 000) and transferred into 2 mL screw-cap glass vials which were filled with 70% ethyl alcohol. For further preservation, the mites were then stored in 60% lactic acid. Specimens preserved in cavity slides with 60% lactic acid were heated on a hotplate set to 50 °C for 24 hours. The mites were then mounted on microscope slides under a stereozoom microscope (Olympus, Magnus) using Hoyer's medium. The slides were dried at 50-55 °C in a hot air oven for 48 hours and sealed with nail polish. All essential morphological characters, commonly used in phytoseiid mite descriptions, were measured with an Olympus® CX-41 microscope. Illustrations were prepared using a *Camera Lucida*, and final image adjustments were made in Adobe Photoshop® (version CS6). The classification system proposed by Chant and McMurtry (2007) was followed. The setal nomenclature for the dorsal idiosoma follows Lindquist and Evans (1965), as modified for phytoseiid mites by Rowell *et al.* (1978), while the ventral idiosomal setal nomenclature follows Chant and Yoshida-Shaul (1991). The adenotaxy and poroidotaxy of the idiosoma were interpreted according to Athias-Henriot (1971, 1975), and the chaetotaxy of the legs was based on the system described by Evans (1963), and Evans and Till (1979). Measurements are given in micrometers (µm) and are presented as the mean with the range in parentheses. The length of the dorsal shield was measured along the midline, from the anterior to the posterior margin. The ventrianal shield was measured along the midline, including the cribrum. The length of the legs was measured from the basal margin of the coxa to the apex of the tarsus, excluding the ambulacrum.

Results

***Neoseiulella pentaporus* Döker, Robin and Kaur sp. nov.**

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Type material and depository

Eight females collected on apple tree, *Malus domestica* L. (Rosaceae), Kukumseri, Udaipur, Lahaul and Spiti, Himachal Pradesh, India, 32°42'03.48"N, 76°41'19.83"E, 30 September 2024, 2753 m above sea level, collectors Paramjit Kaur and Robin.

The holotype female and two paratype females were deposited in PC Unit Repository, UAS, GKVK, Bangalore, India; two paratype females in Acarology Laboratory, Punjab Agricultural University, Ludhiana, India; and three paratype females in Acarology Laboratory, Department of Plant Protection, Cukurova University, Adana, Türkiye.

Diagnosis

Idiosomal setal pattern 12A: 9B/15 JV:ZV (*r3* and *R1* off shield). Dorsal shield strongly reticulated with five pairs of solenostomes (*gd2*, *gd4*, *gd6*, *gd8* and *gd9*). Dorsal setae smooth, except *Z4* and *Z5* serrated and *Z5* knobbed apically, most setae arising on small tubercles. Peritremes long, extending between setae *j1*. Solenostomes *gd3* present on peritrematal shield. All ventral shields smooth; sternal shield with three pairs of setae (*ST1*–*ST3*). Ventral seta *ST4* on soft integument. Ventrianal shield pentagonal with four pairs of pre-anal setae (*JV1*, *JV2*, *JV3*, and *ZV2*); one pair of small crescentic solenostomes. Spermatheca with calyx bell-shaped with large nodular atrium attached to calyx. Fixed digit of chelicera with six-seven teeth and movable digit with two teeth. Trochanter I with six (1 0/1 1/2 1) and genu II with seven setae (2 2/0 2/0 1). Seta *al* on trochanter I subulate. Leg IV with two macrosetae on genu and basitarsus each knobbed apically; other legs without macroseta.

Description

Female (n = 8)

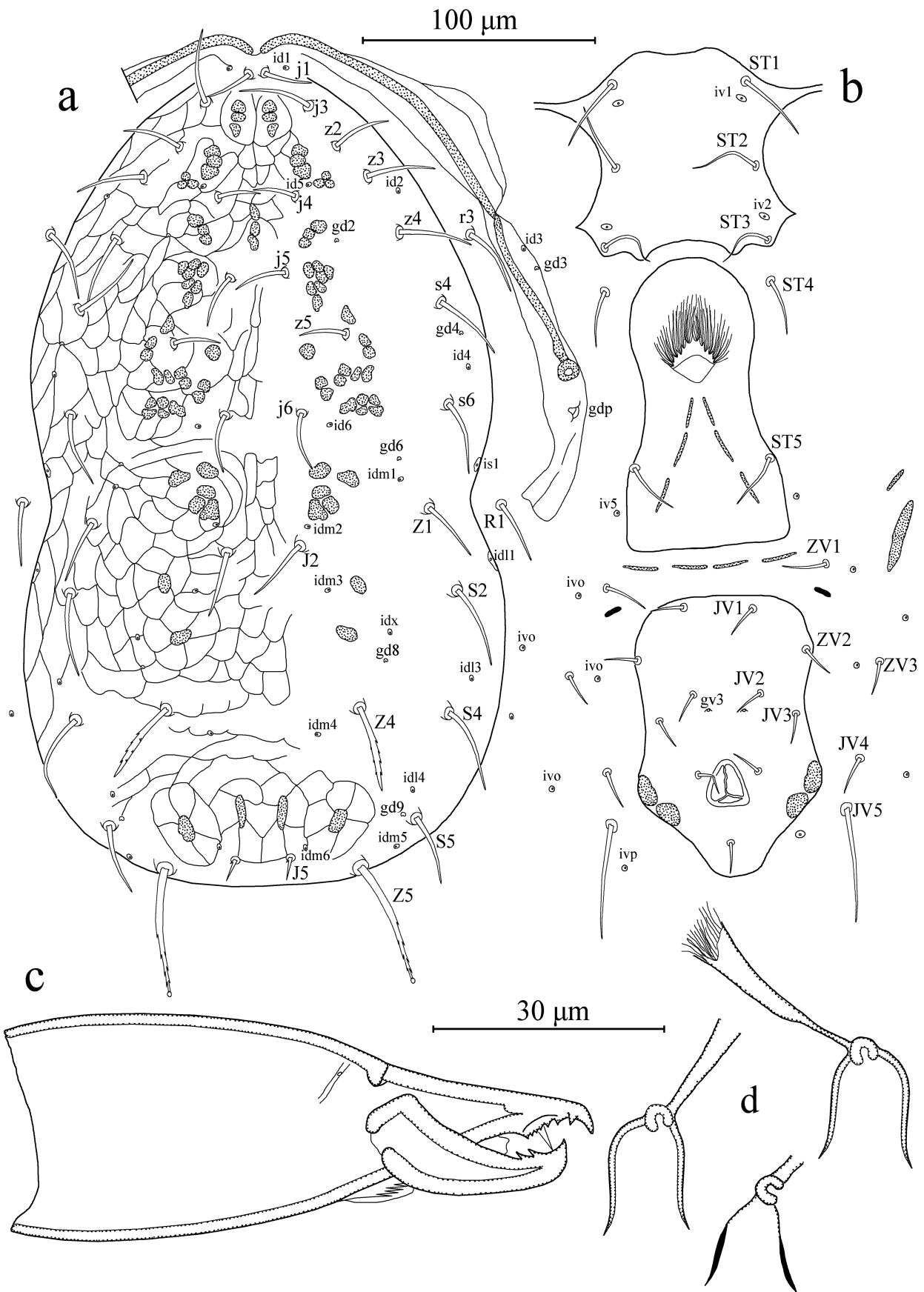


Figure 1 *Neoseiulella pentaporus* Döker, Robin, and Kaur sp. nov., female. a – dorsal idiosoma; b – ventral idiosoma; c – chelicera; d – spermathecae.

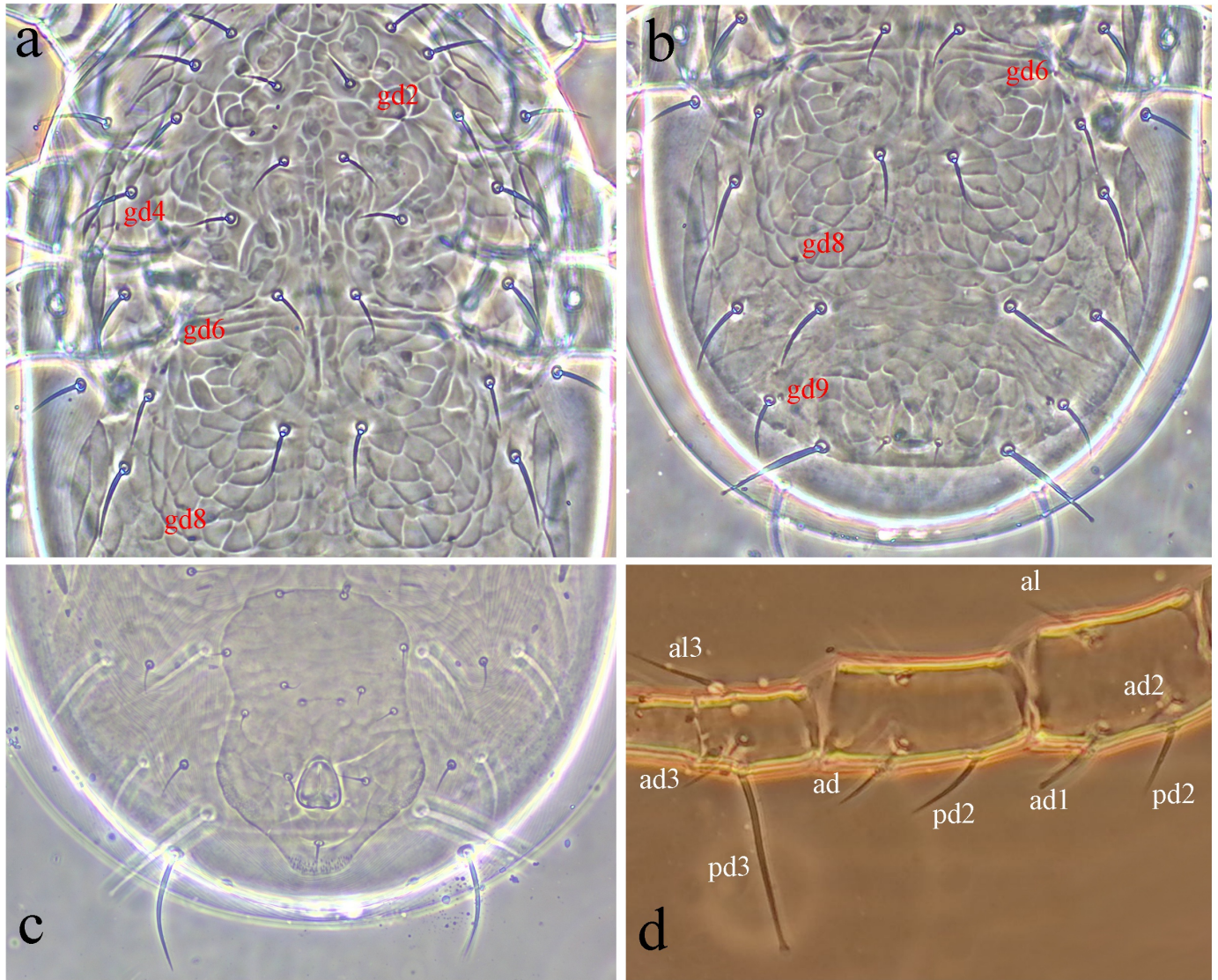


Figure 2 *Neoseiulella pentaporus* Döker, Robin, and Kaur *sp. nov.* female; a – partial view of dorsal shield with solenostomes *gd2*, *gd4*, *gd6* and *gd8*; b – partial view of dorsal shield with solenostomes *gd6*, *gd8* and *gd9*; c – ventrianal shield and caudoventral region; d – dorsal view of genu, tibia and basitarsus IV, with two knobbed macrosetae, *SgeIV* and *StIV*.

(Figures 1–4)

Dorsal idiosoma (Figures 1a, 2a-b). Dorsal setal pattern 12A:9B (*r3* and *R1* off shield). Dorsal shield strongly reticulated; with five pairs of solenostomes (*gd2*, *gd4*, *gd6*, *gd8*, and *gd9*) and 16 pairs of poroids (*id1*, *id2*, *id4*, *id5*, *id6*, *idm1*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *is1*, *idl1*, *idl3*, and *idl4*). Muscle-marks (sigilla) visible mostly on podosoma, length of dorsal shield 343 (335–348), width at level of *s4* 195 (188–200), width at level of *S2* 209 (200–213). Dorsal setae smooth except *Z4* and *Z5* serrated and *J5* with one barb; seta *Z5* knobbed apically. Measurements of dorsal setae as follows: *j1* 20 (18–22), *j3* 28 (26–30), *j4* 20 (19–20), *j5* 20 (18–22), *j6* 23 (22–24), *J2* 28 (27–29), *J5* 11 (10–12), *z2* 24 (23–25), *z3* 28 (25–29), *z4* 29 (28–29), *z5* 21 (20–22), *Z1* 26 (25–27), *Z4* 36 (35–37), *Z5* 52 (51–53), *s4* 31(30–32), *s6* 32 (32–33), *S2* 35 (34–37), *S4* 37 (35–38), *S5* 27 (25–28), *r3* 29 (28–30), and *R1* 26 (25–27). Peritremes extending between setae *j1*; solenostome *gd3* and poroid *id3* visible on peritrematal shield; solenostome *gdp* large, posterior to the stigmatic opening.

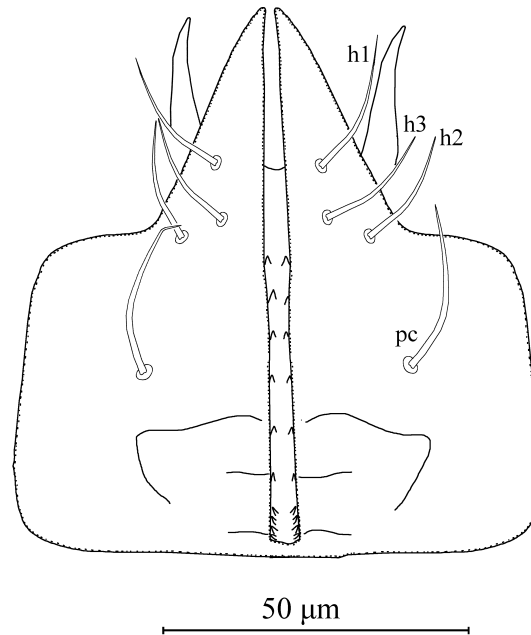


Figure 3 *Neoseiulella pentaporus* Döker, Robin, and Kaur sp. nov., female, subcapitulum.

Ventral idiosoma (Figures 1b, 2c). Ventral setal pattern 15:JV:ZV. Sternal shield poorly sclerotized, smooth; with three pairs of setae (*ST1–ST3*) and two pair of poroids (*iv1* and *iv2*); distance between *ST1–ST3* 67 (65–68), distance between setae *ST2* 60 (59–62); metasternal setae *ST4* on soft integument, and poroids *iv3* indiscernible. Genital shield smooth, with one pair of setae *ST5*; width at level of *ST5* 60 (59–61); one pair of para-genital poroids *iv5* on soft cuticle. Ventrianal shield pentagonal, smooth, with a slight waist; with four pairs of pre-anal setae (*JV1*, *JV2*, *JV3*, and *ZV2*); one pair of para-anal setae *PA*, unpaired post-anal seta *PST*, and a pair of small crescentic pre-anal solenostomes *gv3* posteromesad *JV2*, distance between solenostomes 16 (15–16). Length of ventrianal shield 114 (110–118), width at level of *ZV2* 78 (76–80), width at level of muscle marks (widest point) 82 (79–85), width at level of waist (narrowest point) 68 (64–70). Four pairs of caudoventral setae (*ZV1*, *ZV3*, *JV4*, and *JV5*) and five pairs of poroids (four pairs of *ivo*, and *ivp*) on soft cuticle surrounding ventrianal shield. Setae *JV5* smooth, 47 (44–49) in length.

Gnathosoma (Figures 1c, 3). The hypostomal groove narrow, with seven transverse rows of denticles; basal row consists of four to five denticles, vertically aligned; other six rows each contain two denticles. Subcapitular setae *h1* 23 (22–24), *h2* 21 (19–22) and *h3* 21 (19–22), slightly shorter than palp coxal setae (*pc*) 26 (25–27). Fixed digit 28 (27–29) long, with six–seven teeth, and pilus dentilis; movable digit 27 (26–29) long, with two teeth.

Spermatheca (Figure 1d). Calyx bell-shaped, flaring distally, 12 (10–14) long; atrium large nodular, attached to calyx; major duct broad and minor duct not visible.

Legs (Figures 4a–e). Length of legs I–IV 301 (295–310), 258 (250–265), 261 (250–270), and 333 (325–340), respectively. Chaetotaxy of legs as follows; leg I: coxa 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2. Leg II: coxa 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/0 2/0 1, tibia 1 1/1 2/1 1. Leg III: coxa 0/1 0/1 0/1 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg IV: coxa 0/1 0/1 0/0 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/0 1. Most of dorsal setae arising on tubercles. Seta *al* on trochanter I subulate; two macroseta present on genu and basitarsus of leg IV, both knobbed apically; *SgeIV* 21 (20–22) and *StIV* (*pd3*) 42 (39–45) in length. Distance between *pd3* and dorsal slit organ (lyrifissure) 43 (41–43).

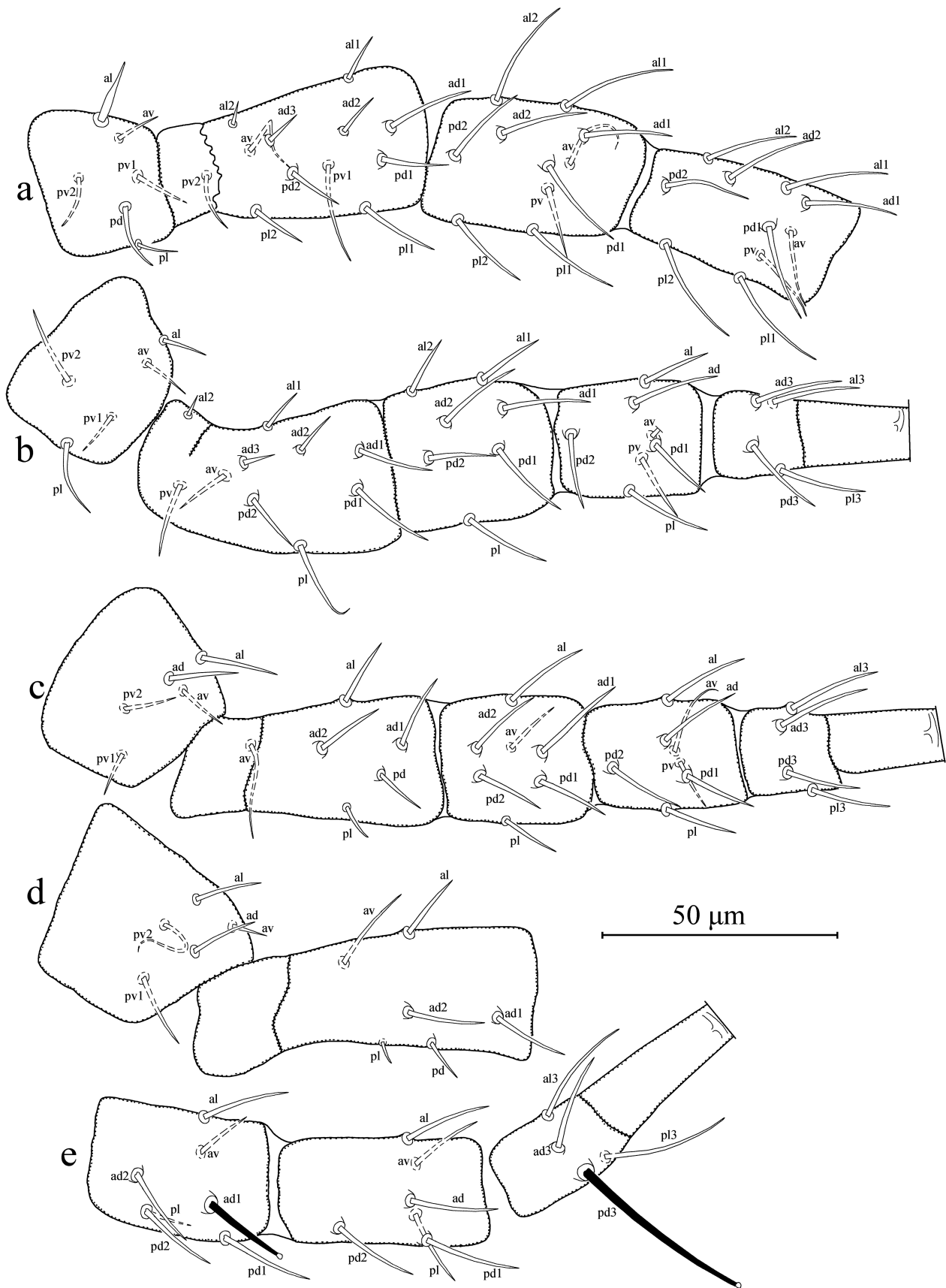


Figure 4 *Neoseiulella pentaporus* Döcker, Robin, and Kaur **sp. nov.**, female, right legs. a – Leg I (trochanter-tibia); b – Leg II (trochanter-basitarsus); c – Leg III (trochanter-basitarsus); d – Leg IV (trochanter-femur); e – Leg IV (genu-basitarsus).

Etymology

The name of the species is derived from the Greek word “πέντα- (penta-)” + porus (pore) due to the presence of five pairs of solenostomes on the dorsal shield. Noun in apposition.

Differential Diagnosis

Neoseiulella pentaporus Döker, Robin, and Kaur **sp. nov.** belongs to the *tiliarum* species group of Chant (1959) due to its dorsal setae of approximately uniform length and the presence of ventral seta *JV3*. Among the 30 nominal species in this group, the new species shows close affinity to *N. vollsella* (Chaudhri, Akbar and Rassol, 1974), *N. prunus* (Denmark and Rather, 1984), *N. celtis* Denmark and Rather, 1996, and *N. transitans* (Gupta, 1981) in terms of the nature of dorsal and ventral aspects, including the ventrianal shield and chelicera dentition (Chant and Yoshida-Shaul 1989; Kanouh *et al.* 2012; Stathakis *et al.* 2016; Döker 2018). The former was described from Pakistan, while the latter three were described from Jammu & Kashmir, India. However, *N. prunus* and *N. transitans* are both considered junior synonyms of *N. vollsella* (Chant and Yoshida-Shaul 1989; Kanouh *et al.* 2012). The new species is distinctly different from all of these species by possessing five pairs of solenostomes (*gd4* and *gd6* present) on the dorsal shield and only two knobbed macrosetae on leg IV. In contrast, *N. vollsella* have only three pairs of solenostomes and three knobbed macrosetae on leg IV (Chant and Yoshida-Shaul 1989; Kanouh *et al.* 2012). Some of dorsal setae, ventral seta *JV5*, and macroseta on basitarsus IV of the new species are generally longer compared to the type material descriptions of other species. These setae are between 25–33% longer, with the new species falling outside the range previously considered as intraspecific variation but now falling within interspecific variation between the two species (Tixier 2012). In addition, *N. celtis* has only one pair of solenostomes (*gd9*) on the dorsal shield and a single knobbed macroseta on leg IV. The dorsal seta *Z4* in *N. celtis* (20) is conspicuously shorter than that of the new species (35–37). The significance of a single pair of solenostomes in distinguishing closely related species within the genus *Kampimodromus* Nesbitt and *Neoseiulus* Hughes, has been previously confirmed by molecular analyses in several studies (Döker *et al.* 2018; Khaustov *et al.* 2022). Moreover, variation in the number of knobbed macrosetae is linked to species complexes in the subgenus *Anthoseius* De Leon, another taxonomic group in the family Phytoseiidae, but still within the subfamily Typhlodrominae (Ueckermann *et al.* 2008, 2021; Döker *et al.* 2024a).

Remarks

Interestingly, our examination revealed that the anterolateral seta on the first trochanter of the new species is consistently modified into a subulate form in all type specimens, characterized by a robust base that gradually tapers to a fine point, as previously reported for several species belongs to the genus *Euseius* Wainstein (Döker *et al.* 2024b; 2025a, b; Tsolakis and Ranja-William 2025). While the function of these modified setae remains unclear, it seems that this modification is common in various groups within the family Phytoseiidae. Further investigations should confirm whether this feature is present in other *Neoseiulella* species as well as other groups within the family Phytoseiidae.

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