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A new species of *Hemipteroseius* (Acari: Otopheidomenidae) parasitic on *Dysdercus* (Hemiptera: Pyrrhocoridae) in India

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Abstract

A new species of ectoparasitic mite, *Hemipteroseius vikrami* **n. sp.** (Mesostigmata: Otopheidomenidae), collected on *Dysdercus koenigii* (Fabricius) in New Delhi and *D. cingulatus* (Fabricius) in Varanasi, India is described. It is distinguished from other species of the genus in having the dorsal shield divided, podonotal shield with nine pairs and opisthonotal shield with four pairs of setae; setae j6, s6 and Z5 with bulbose/spatulate tips; tritosternum with two short slightly barbed lacinae; venter with four pairs of sternal setae, one pair on the sternal shield and three pairs placed posterolaterally; anus terminal; one pair of preanal setae; movable digit of chelicera with two teeth distally; macrosetae on genu I–IV and femur I–II with bulbose/spatulate tip. A list of species of Otopheidomenidae with details of distribution and hosts, key to species of *Hemipteroseius* and comparison of morphological characters of species are also provided.

Key words: Mesostigmata**,** ectoparasite, Hemiptera, Pyrrhocoridae, checklist, India

Introduction

Mites of the family Otopheidomenidae (Acari: Mesostigmata) are ectoparasites of insects, primarily Hemiptera, Orthoptera and Lepidoptera. The family Otopheidomenidae was erected by Treat (1955) for *Otopheidomenis zalelestes* Treat, collected from beneath the tegulae and in the metascutellar regions of a moth of the genus *Zale* Hubner. Krantz & Khot (1962) reviewed the family and recognised two new genera, namely, *Dicrocheles* Krantz & Khot for *Myrmonyssus phalaenodectes* Treat (1954) and *Treatia* Krantz & Khot for *Treatia indica* and *Laelaptonyssus phytoseioides* Baker & Johnston (1959). Evans (1963) revised the concept of the family with reference to external morphology and specialisation in chaetotaxy associated with the parasitic mode of life. In his key to genera he dealt with *Otopheidomenis* Treat, *Treatia*, and *Hemipteroseius* Evans. He described two new species, *Treatia dysderci* and *Hemipteroseius womersleyi* and proposed the combination *H. indicus* for *Treatia indica* Krantz & Khot (1962). However, he did not consider *Dicrocheles* Krantz & Khot in his key because it was more similar to Laelapidae than to Phytoseiidae. Chant (1965), in his generic revision of the family Phytoseiidae, included Otopheidomenidae as a subfamily and added another genus, *Entomoseius* Chant, with *Treatia dysderci* Evans (1963) as its type species, and provided a key to the four genera recognised under the subfamily Otopheidomeninae.

Chant & Lindquist (1965) modified the key to genera in this subfamily to include the genus and species, *Nabiseius duplicisetus*. Treat (1965) and Costa (1968) described five new species of *Hemipteroseius* (four and one respectively) under Otopheidomenidae. Prasad (1968) described the genus and species, *Noctuiseius treati*, in the Otopheidomeninae, but later (1970b) moved it into *Otopheidomenis*. Treat (1969) reviewed the behavioural relationship between *Dicrocheles* species and their moth hosts. Wainstein (1972), in his revisionary account of the family, synonymised *Entomoseius* and *Hemipteroseius* with *Treatia*, erected the subfamily Treatiinae under Phytoseiidae for *Treatia* and *Nabiseius* Chant & Lindquist, revived *Noctuiseius treati* Prasad, and proposed a new genus *Prasadiseius* to incorporate *O. cocytes* Prasad (1970a), *O. donahuei* Prasad (1970a), *O. kayosiekeri* Prasad (1970b) and *O. pholusis* Prasad (1970b). He proposed that the family Otopheidomenidae included only three genera, *Otopheidomenis*, *Prasadiseius*, and *Noctuiseius*. Ramsay (1973) tabulated 17 species in the subfamily Otop-

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heidomeninae (Phytoseiidae) along with their hosts and distributions, described *Treatia dieuches*, and provided a key to genera based on males. Treat (1975) observed that Chant's proposal of Otopheidomeninae was not followed or accepted by some researchers on this group. He expanded the host and locality records for the species in the genus *Otopheidomenis* and suggested that *O. achlora* Prasad (1972), *O. aporodes* Prasad (1972) and *O. indicus* Prasad (1973) should probably be assigned to *Prasadiseiu*s.

Prasad (1975b) gave an account of parasitic Otopheidomenidae that occur on sphingid moths. Amitai & Swirski (1980) followed Wainstein (1972) and described *Nabiseius rivnayae*, placing it in the subfamily Treatiinae of the family Phytoseiidae. Syed & Goff (1983) described *Otopheidomenis ascalaphae* and provided a key to species. Fain & Lukoschus (1983) described the genus and species, *Katydiseius nadchatrami* in the new subfamily Katydieseiinae under Otopheidomenidae, and agreed with Wainstain in his placement of Treatiinae in the Phytoseiidae. Ghai & Gupta (1984) described *Treatia indica* from India, but this name was a junior homonym of *Treatia indica* Krantz & Khot (1962) (now transferred to *Hemipteroseius*). Prasad (1987) agreed with Wainstein's classification and further divided the genera *Noctuiseius* Prasad and *Prasadiseius* Wainstein into the following subgenera: *Noctuiseius (Noctuiseius)* Prasad and *Noctuiseius (Subnoctuiseius)* Prasad; *Prasadiseius (Prasadiseius)* Prasad, *Prasadiseius (Neoprasadiseius)* Prasad, and *Prasadiseius (Subprasadiseius)* Prasad. He also described the new species *Noctuiseius (Subnoctuiseius) batoridgi*.

Farrier & Hennessey (1993) in their annotated checklist of the soil-inhabiting and free-living Mesostigmata, proposed the new combinations *Treatia ageneia, T. antillea, T. parvula* and *T. sabbatica*, based on the generic synonym proposed by Wainstein (1972). Halliday (1994) described the new species *Nabiseius melinae*, gave a brief historical review, and provided a list of all species in this family. Zhang (1995), in his comprehensive review of systematics and biology of Otopheidomenidae, described *Eickwortius termes* under Katydiseiinae, treated the subfamily Treatiinae under Otopheidomenidae, considered *Hemipteroseius* and *Entomoseius* as distinct from *Treatia* in the subfamily Treatiinae, and proposed a new name, *Treatia ghaiguptaorum* for *Treatia indica* Ghai & Gupta. He disregarded the subgeneric classification of Prasad (1987) for the genera *Noctuiseius* and *Prasadiseius*, provided a key to the subfamilies and genera, and gave an account on their biocontrol potential.

Mo (1996) described the genus and species, *Orthopteroseius sinicus* in the subfamily Katydiseiinae. Prasad (2011a), gave a new host record for *Prasadiseius cocytes* (Prasad), commented on its host distribution, host-plant association of the insect-host, and provided several reasons for host-specificity and preferential attachment to certain parts of host body. Prasad (2011b) redescribed the species of *Prasadiseius*, proposed a system of nomenclature of the idiosomal setae with a discussion on setae to be considered fixed and variable, in addition to providing a key to known species. Prasad & Walker (2011) conducted scanning electron microscopic studies of idiosomal structures of *Prasadiseius kayosiekeri* (Prasad) and identified the setae according to the nomenclature of Prasad (2011b). Finally, Prasad (2011c) recently summarised the classification of the family and the methods used for their study. The present paper describes a new species of *Hemipteroseius* collected from under the wings of *Dysdercus koenigii* in New Delhi and *D. cingulatus* in Varanasi.

Material and methods

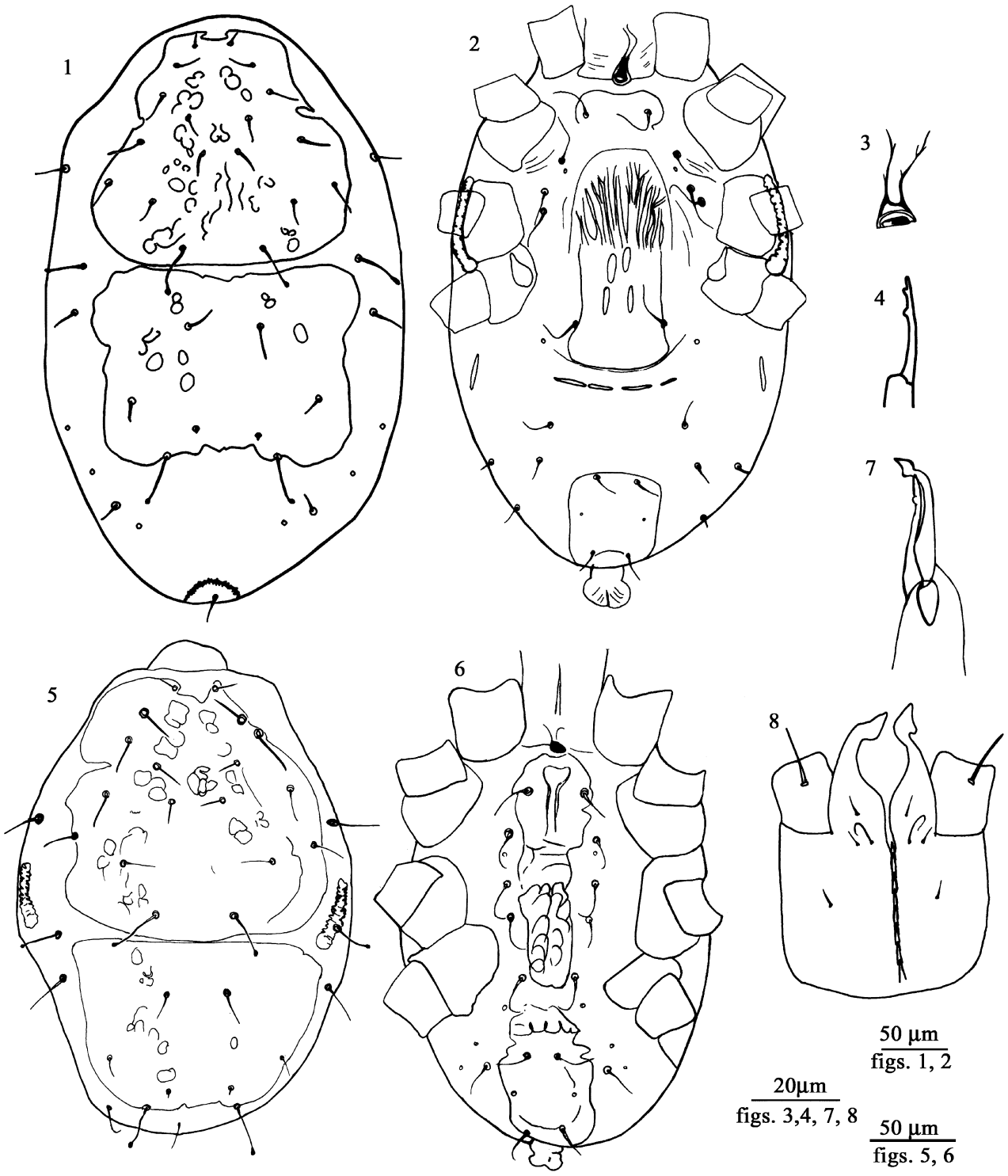
The genus identification is based on Evans (1963) and the setal nomenclature follows Chant & Yoshida-Shaul (1991,1992), Chant (1993) and Prasad (2011b). All measurements indicated are mean values in micrometres (μm) followed by standard deviation; length of the body is the distance from the anterior margin of the dorsal shield to the posterior margin of the body in dorsal view while width of the body is the broadest region of the podosoma at the level of the third pair of legs.

Hemipteroseius vikrami Menon n. sp.

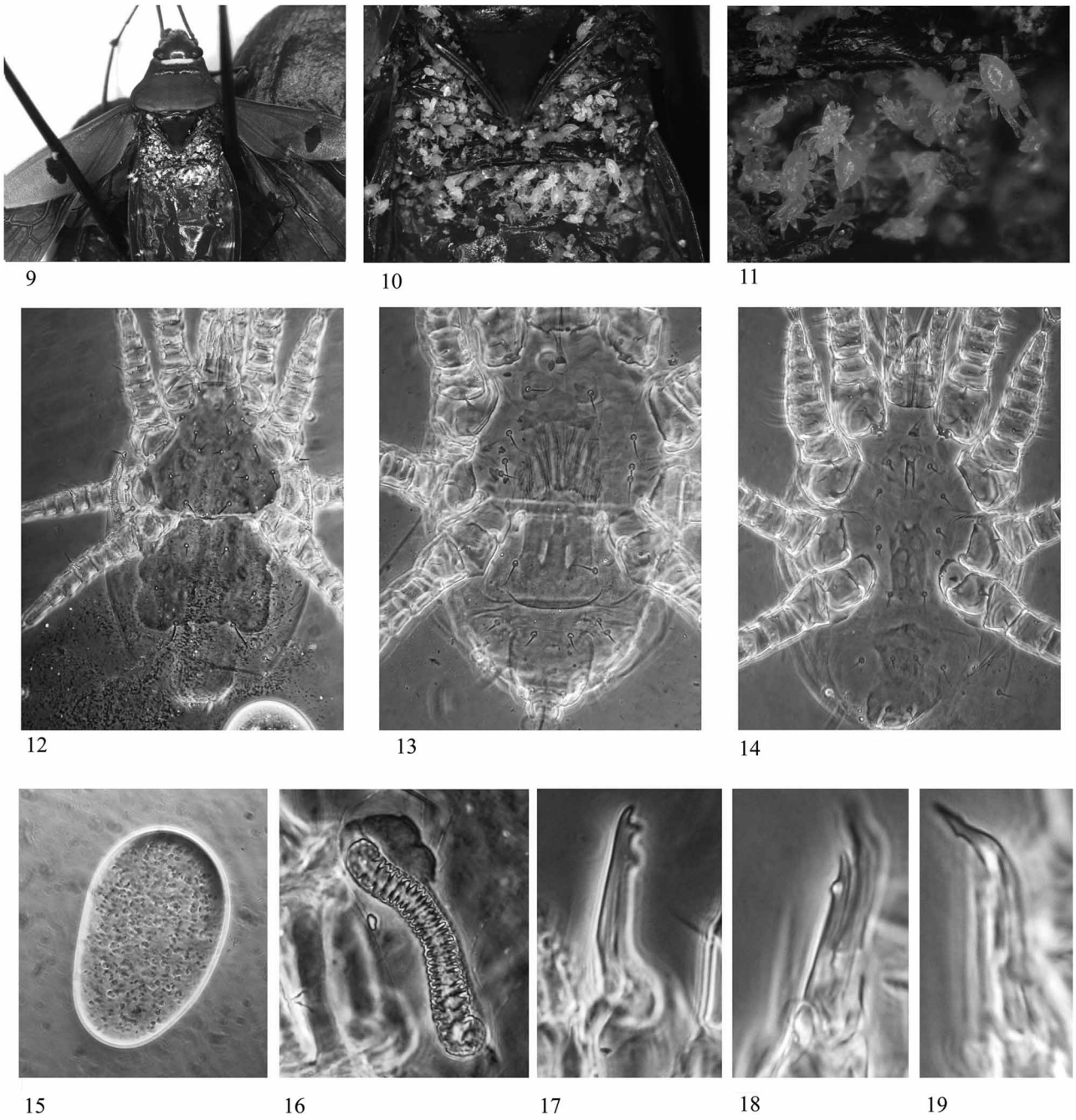
Female (n=10, Figs 1–4, 8, 12, 13, 17, 20–27)

Dorsal idiosoma approximately 403±26 long and 254.5±11.5 wide, dorsum bearing two subequal shields, weakly ornamented. Podonotal shield roughly triangular, partly incised anteriorly, with posterior margin rectangular; opisthonotal shield roughly rectangular with posterior corners rounded and extended (Figs 1, 12, 20). Podono-

tal shield 155±3.5 long, bearing nine pairs of setae, some with bulbose/spatulate tips, others with simple blunt tips: j1 11±2.2, j3 17±2, j4 15±1.7, j5 15.5±2, j6 29.5±2.7, z2 21±2.2, z4 20.5±2, z5 18±2, s4 20±2; j6 with bulbose/spatulate tips (Fig. 21). Opisthonotal shield 134.5±10.1 long, bearing four pairs of setae: J2 20.5±2.7, J5 2.5±0, Z4 14±1.3, Z5 38±2; J5 minute and Z5 the longest pair of setae with bulbose/spatulate tips. Dorsal integument striated with four pairs of setae: r3 18±1.1, s6 28.5±3.3, R1 17±1.1, JV5 18±2; s6 with bulbose/spatulate tip; three pairs of pores present lateral and posterior to opisthonotal shield (Fig. 22).



FIGURES 1–8. *Hemipteroseius vikrami* **n. sp.** 1. Female, dorsal view; 2. Female, ventral view; 3. Tritosternum; 4. Female chelicera with bidentate digit; 5. Male, dorsal view; 6. Male, ventral view; 7. Male chelicera with unidentate digit and spermatodactyl process; 8. Gnathosomal region showing harpoon shaped corniculi and capitular setae.



FIGURES 9–19. *Hemipteroseius vikrami* **n. sp.** 9. Mites on abdominal region under wings of *Dysdercus* sp.10. Close-up of infested region showing eggs and adults; 11. Close-up of mites on *Dysdercus* sp.; 12. Female, dorsal view; 13. Female, ventral view; 14. Male, ventral view; 15. Egg; 16. Peritreme; 17. Female, movable digit with two denticles; 18. Male, movable digit with one denticle; 19. Male, spear-shaped spermatodactyl process.

Ventral idiosoma. Tritosterum 42±3.8, biramous, lacinae slightly-pilose, simple and small, unfused (Fig. 3). Sternal shield poorly sclerotised, 67.4±2.5 long, 72±1 wide, slightly wider than long, and bearing one pair of setae attenuated distally and inserted on antero-lateral angles of sternal shield; sternal setae st2, st3 and st4 similar in shape and size to sternal setae st1, but inserted in the integument, lying posterior and lateral to sternal seta st1 and present within the limits of coxa III. Metasternal shields absent. Epigynal shield fenestrated, its anterior extension bearing many finely branched thickenings, shield parallel-sided medially, expanded posteriorly and somewhat convex on its posterior border, 103±2.5 long, 77.2±5 wide at the region of the epigynal setae; epigynal setae similar to sternal setae and inserted on posterolateral edges of shield. All sternal setae and epigynal setae approximately 35.5±2 long (Figs 2, 13, 24, 25). Ventral area striated transversally; metapodal plates present, narrow and elongate. Ventrianal shield mostly truncate anteriorly, sometimes slightly concave, 75±3.8 long, 72±3 wide, with a pair of

pre-anal setae JV2 25.4±0.5 long; anal opening terminal, surrounded by the usual three anal setae, para-anal seta 26.8±2.1 long, post-anal seta dorsal, 24.5±3.7; four pairs of opisthogastric setae inserted on the striated integument, JV1 22.4±3.2, ZV2 18.8±2.1, ZV3 16.6±2.3 and JV4 16.2±1.3 (Figs 2, 13, 26). Peritreme short 77.2±4.1, intestiniform; stigmata originating lateral to coxa IV, with peritreme extending anteriorly only to level of coxa II; peritremal plate prominent at the anterior tip only (Fig. 16). Spermatheca 35±3, paired, typical in form for the genus, distal canals terminating on or near posterior margins of coxa III.

Gnathosoma with harpoon-shaped corniculi (Figs 8, 23), distal end markedly swollen. All four pairs of capitular setae present. Chelicera (from base to tip without the digits) 73±5.7, fixed digit rudimentary, movable digit 38.8±1.7, bidentate, with a distal hook (Figs 4, 17, 27).

Legs shorter than body, leg I: 211±8.9, leg II: 177±5.9, leg III: 168±10.4 and leg IV: 205±16.9. Chaetotaxy: femur I: 2 2/1 2/2 1, genu I: 1 2/0 0/1 1, tibia I: 1 2/1 0/1 1, femur II: 1 2/1 2/0 1, genu II: 1 1/0 1/0 1, tibia II: 1 1/0 1/1 1, femur III: 1 2/1 2/0 0, genu III: 1 1/0 1/0 1, tibia III: 1 1/0 1/0 1, femur IV: 1 1/1 1/0 0, genu IV: 1 1/1 1/0 0, tibia IV: 1 1/1 0/0 0. Macrosetae present on genu I–IV and femur I–II; macrosetae on genu I antero-dorsal, 40±1.8, femur I postero-dorsal, 37.2±3.8, genu II postero-dorsal, 38.6±1.3, femur II postero-dorsal, 31.4±1.5, genu III antero-dorsal 37.2±1.7 and genu IV antero-dorsal 41.8±3.9. All macrosetae with bulbose/spatulate tips.

Male (n=3, Figs 5–7, 14,18, 19, 28–33)

Dorsal idiosoma 268±1.73 long, 199±2.8 wide. Dorsal shield shape and chaetotaxy similar to that of female (Figs 5, 28). Podonotal shield 151±2 long, bearing nine pairs of setae, all simple setae, j6 with spatulate tips (Fig. 30), j11 10±1, j3 20±1, j4 17.5±1, j5 14.2±0.5, j6 30.8±0.5, z2 20.8±0.5, z4 20.8±0.5, z5 17.5±1, s4 20.8±2. Opisthonotal shield 98.3±1.1 long, with four pairs of setae: J2 17.5±0, J5 2.5±0, Z4 12.5±0, Z5 35±2, J5 a microseta, Z5 longest, with spatula-like tip (Fig.31). Dorsal integument striated, with four pairs of setae: r3 22.5±1, s6 25.8±1.1, R1 18.3±1.1 and JV5 17.5±0, s6 with bulbose/spatulate tip.

Ventral idiosoma. Sternitogenital shield 150±3.5 long, 50 wide at the region of the first sternal setae; male genital opening distinct, on a level with anterior angles of coxa II; five pairs of simple setae on sternitogenital shield, 28.3±1.1, the most anterior pair inserted posterior to the genital opening; posterior edge of shield not clear, perhaps slightly convex (Figs 6, 14, 33). Anal shield 89.8±8.2 long, expanded anteriorly, constricted medially, 48.8±4.8 wide at the region of first pair of preanal setae; anal opening terminal; postanal setae 20±1 long. Tritosternum 25.8±2.8, palps, corniculi similar to female; spermadactyl process 26±2.7, spear shaped (Figs 7, 19, 32),

Gnathosoma. Chelicera (from base to tip without the digits) 71±13.5, movable digit 31.5±2.8, with single denticle apart from the distal hook (Figs 7, 18).

Legs. Leg I: 169±2, leg II: 149±2.5, leg III: 133±3.7 and leg IV: 158±1.5. Macrosetae present on genu I–IV and femur I–II; macrosetae on genu I antero-dorsal, 44.8±1.7, femur I postero-dorsal, 46.3±2.8, genu II postero-dorsal, 49±2.4, femur II postero-dorsal, 43.8±1.5, genu III postero-dorsal, 50.8±2.2 and genu IV postero-dorsal, 57.5±2.8. All macrosetae with bulbose/spatulate tips (Fig. 29).

Eggs ovoid, whitish, 224±4.4 long, 142±6.4 wide (Fig. 15).

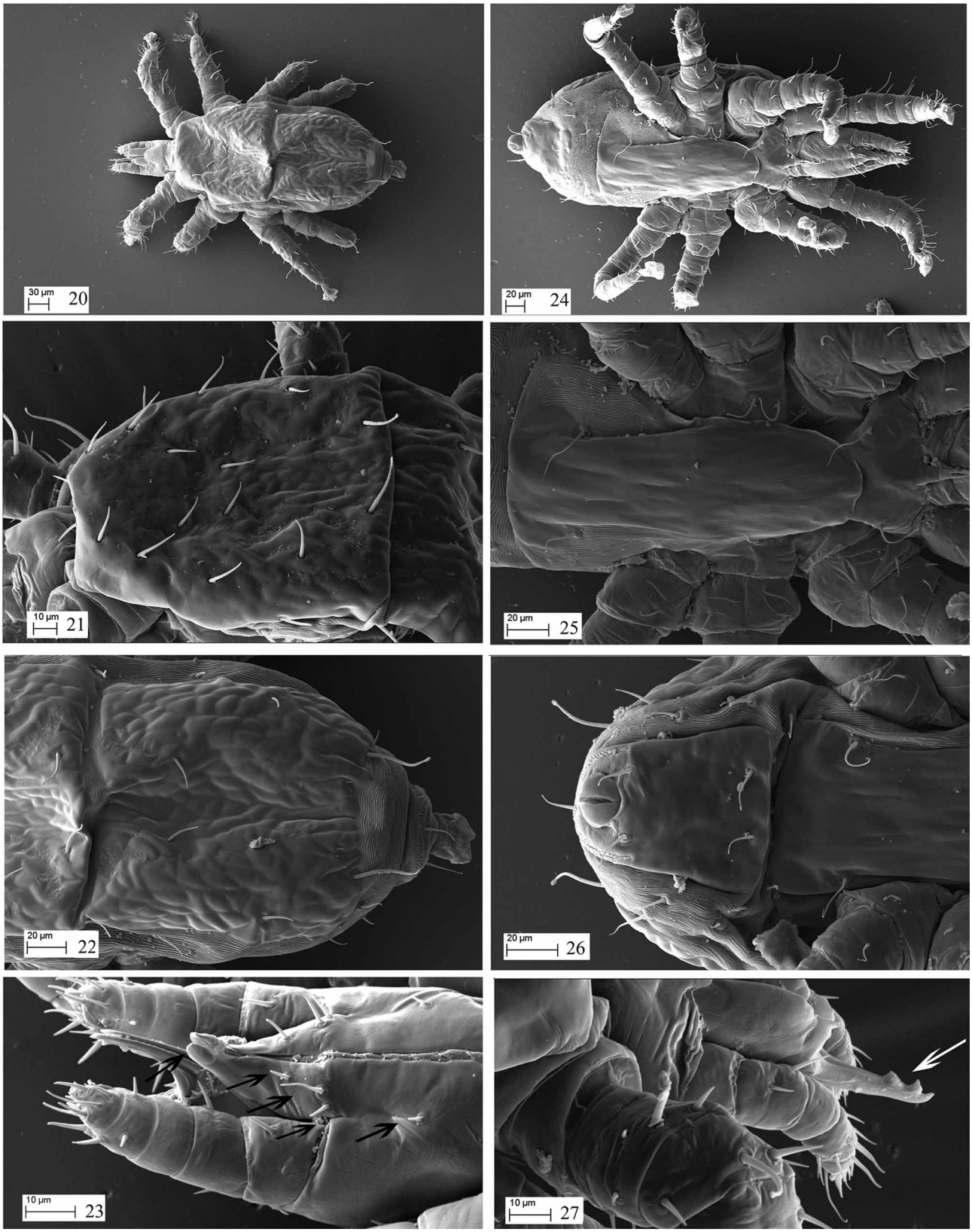
Type material. *Holotype*: female, ex: *Dysdercus cingulatus*, Varanasi, 15 December 2009, coll**.** Mohd Hussain**.** *Paratypes*: 10 females and 3 males on 7 microscopic slide preparations, data same as above; 2 females ex: *Dysdercus koenigii*, New Delhi, 5 December 2007, coll**.** Pratibha Menon. Specimens deposited in National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi.

Etymology. The specific name *vikrami* is in honour of Dr. Vikram Prasad, in recognition of his contributions to acarology in general and Otopheidomenidae in particular.

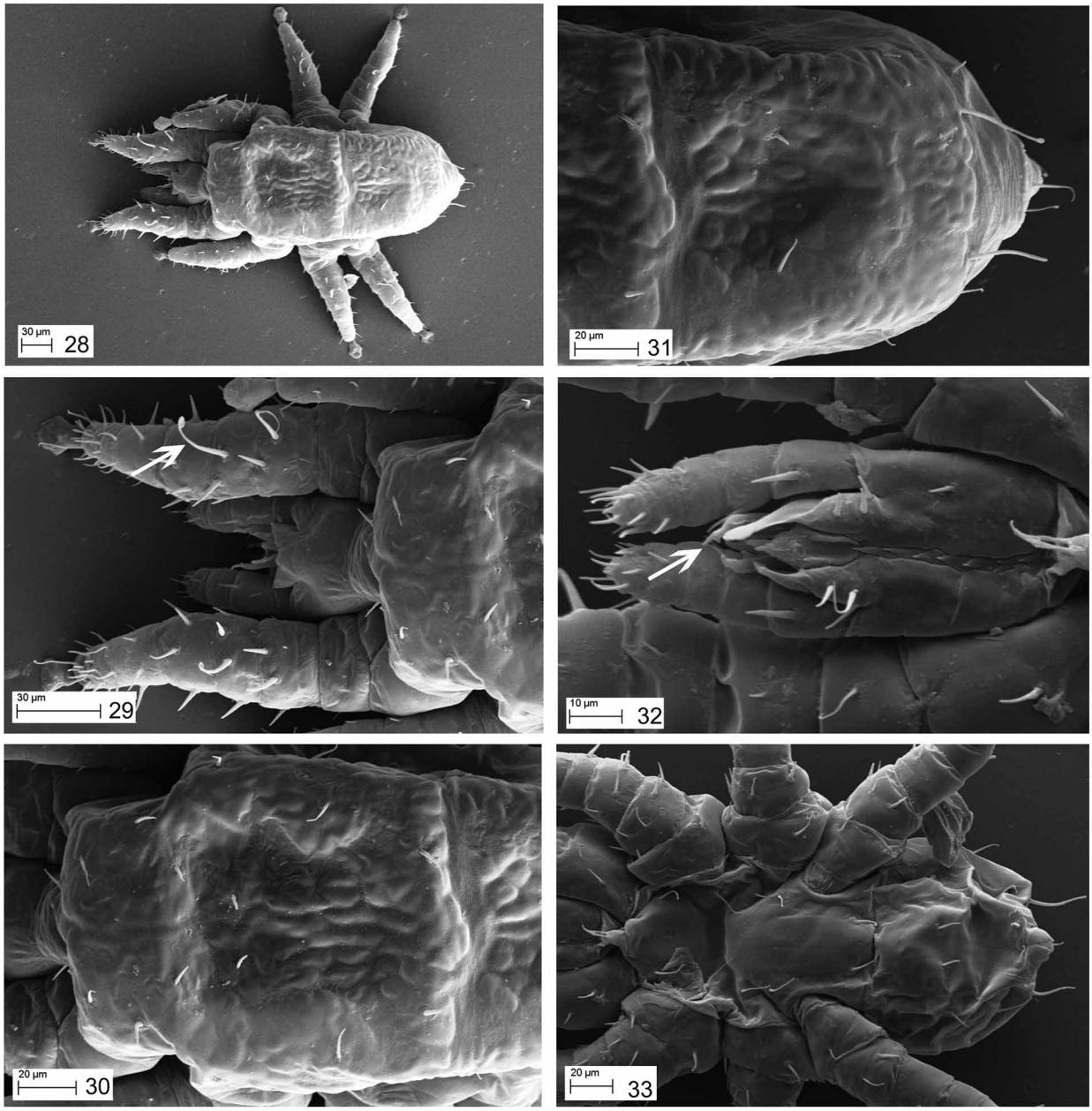
Remarks. The new species is an ectoparasite of *Dysdercus koenigii* and *D. cingulatus*. Specimens were seen adhering to the abdominal region under the wings (Figs 9–11) of the hosts. It has been found only at Delhi and Varanasi, India. *Hemipteroseius vikrami* **n. sp.** is distinct from other known species of *Hemipteroseius* in the following combination of characters: dorsal shield divided, setae j6, s6 and Z5 with bulbose/spatulate tips, seta J1 absent, four pairs of sternal setae present, one pair on the sternal shield and three pairs on the integument posterolateral to the sternal shield, all macrosetae on genu I–IV, femur I–II with bulbose/spatulate tips, with positions given here as consistently observed in six out of ten specimens observed; one pair of pre-anal setae and a terminal anus.

In his description and illustrations of *H. parvulus*, Treat (1965) showed the ventral shield with two pairs of pre-anal setae, while in the key he had placed this species in the couplet for species bearing one pair of pre-anal setae. Costa (1968) referred to *H. parvulus* with one pair of pre-anal setae. However, the present authors have accepted *H.*

parvulus with two pairs of pre-anal setae based on Treat's original description and illustrations. The essential morphological characters that distinguish *H. vikrami* from other species of *Hemipteroseius* are summarised in Table 1 and in the following key. Table 2 presents a list of all otopheidomenid mites with their distribution and hosts.



FIGURES 20–27. *Hemipteroseius vikrami* **n. sp.**, female. 20. Dorsal view; 21. Podonotal shield; 22. Opisthonotal shield; 23. Harpoon shaped corniculi and capitular setae; 24. Ventral idiosoma; 25. Sternal and genital shields; 26. Anal shield; 27. Bidentate chelicera and pedipalp.



FIGURES 28–33. *Hemipteroseius vikrami* **n. sp.**, male. 28. Dorsal idiosoma; 29. Macroseta of Leg I, gnathosomal region, tectum and part of podonotal region; 30. Podonotal region; 31. Opisthonotal region; 32. Ventral view with spear-shaped spermatophoral process, harpoon shaped corniculi, capitular setae and part of tritosternum; 33. Ventral idiosoma.

Key to species of *Hemipteroseius*

1. Dorsal shield divided; seta s6 present, not on shield. 2
- Dorsal shield undivided; seta s6 absent, if present then on shield 6
2. Seta J1 present; two pairs of sternal seta on shield and two pairs on integument; one pair of pre-anal setae . . . . . *H. womersleyi* Evans, 1963
- Seta J1 absent; sternal setae and position varying; one or two pairs of pre-anal setae 3
3. Two pairs of setae on sternal shield, two pairs of sternal setae in integument; two pairs of pre-anal setae . . . . . *H. antilleus* Treat, 1965
- Sternal setae not as above; one pair of pre-anal setae 4
4. One pair of sternal setae on shield and two pairs on integument, fourth pair absent; macrosetae on genu III and IV with spatulate/bulbose endings . . . . . *H. adleri* Costa, 1968
- Four pairs of sternal setae present, one pair on shield and three pairs on integument 5

5. Macrosetae of legs spine like; all dorsal setae simple. . . . . *H. indicus* (Krantz & Khot, 1962)
- All macrosetae and dorsal setae j6, s6 and Z5 with spatulate/bulbose endings . . . . . *H. vikrami* Menon **n. sp.**
6. Seta s6 absent; J1 absent; sternal shield distinct with one pair of sternal setae on shield and three pairs on integument; two pairs of pre-anal setae ; anus terminal . . . . . *H. parvulus* Treat, 1965
- Seta s6 present on dorsal shield; J1 absent; sternal shield indistinct posteriorly, first pair of sternal seta on shield, second, third and fourth pairs surrounded by striated cuticle; one or two pairs of pre-anal setae; anus ventral 7
7. Two pairs of pre-anal setae; three pairs of capitular setae . . . . . *H. ageneius* Treat, 1965
- One pair of pre-anal setae; four pairs of capitular setae . . . . . *H. sabbaticus* Treat, 1965

TABLE 1. Comparison of morphological characters in species of *Hemipteroseius* Evans (modified from Costa 1968).

	adleri	*womersleyi*	*indicus*	*antilleus*
Dorsal shield	divided	divided	divided	divided
Podonotal setae	9 pairs	9 pairs	9 pairs	9 pairs
Setae s6	on cuticle	on cuticle	on cuticle	on cuticle
Opisthonotal setae	4 pairs	5 pairs	4 pairs	4 pairs
Setae J1	J1 absent	J1 present	J1 absent	J1 absent
Sternal setae	3 pairs	4 pairs	4 pairs	4 pairs
Capitular setae	4 pairs	4 pairs	4 pairs	4 pairs
Preanal setae on shield	1 pair	1 pair	1 pair	2 pairs
Corniculi	smooth	smooth	barbed	smooth
Position of anus	terminal	terminal	terminal	terminal
Ventral opisthosomal setae on cuticle	3 pairs	5 pairs	4 pairs	4 pairs
Macrosetae	genu III, IV, setae with bulbose/ spatulate tips	*pd*1 of femur and genu I & II, *ad*1 of femur and genu III, IV longer and stronger	femur I, genu I & II, genu III & IV with strong dorsal seta	*pd*1 of femur and genu I & II, *ad*1 of femur and genu III, IV longer and stronger

continued.

	agenius	*parvulus*	*sabbaticus*	*vikrami*
Dorsal shield	entire	entire	entire	divided
Podonotal setae	10 pairs	9 pairs	10 pairs	9 pairs
Setae s6	on shield	absent	on shield	on cuticle
Opisthonotal setae	4 pairs	4 pairs	4 pairs	4 pairs
Setae J1	J1 absent	J1 absent	J1 absent	J1 absent
Sternal setae	4 pairs	4 pairs	4 pairs	4 pairs
Capitular setae	3 pairs	4 pairs	4 pairs	4 pairs
Preanal setae on shield	2 pairs	2 pairs	1 pair	1 pair
Corniculi	smooth	smooth	smooth	barbed
Position of anus	ventral	terminal	ventral	terminal
Ventral opisthosomal setae on cuticle	2pairs±1seta	4 pairs	4 pairs	4 pairs
Macrosetae	*pd*1 of femur and genu I & II, *ad*1 of femur and genu III&IV longer and stronger	not indicated	not indicated	all macroseta (genu I-IV, femur I-II) with bulbose/ spatulate tips

TABLE 2. List of Otopheidomenidae with distribution and hosts.

Species	Localities	Hosts	References
Eickwortius termes Zhang	Kenya	Isoptera: Termitidae: *Macrotermes michaelseni*	Zhang, 1995
Entomoseius dysderci (Evans)	Trinidad	Hemiptera: Pyrrhocoridae: *Dysdercus howardi*	Evans, 1963
Hemipteroseius adleri Costa	Israel, Poland, Lithuania	Hemiptera: Pyrrhocoridae: *Pyrrhocoris apterus, Scanthius aegyptius*	Costa, 1968; Lewandowski & Szafranek, 2005; Chmielewski, 2006
H. ageneius Treat	Cuba, Haiti, Puerto Rico, Culebra, Mona, Antigua, Martinique, Guadeloupe	Hemiptera: Pyrrhocoridae: *Dysdercus andreae*, *D. discolor*	Treat, 1965; Farrier & Hennessey, 1993
H. antilleus Treat	Cuba, Haiti, Jamaica	Hemiptera: Pyrrhocoridae: *Dysdercus andreae*, *D. mimulus*	Treat, 1965, Farrier & Hennessey, 1993
H. indicus (Krantz & Khot)	India, Congo, Israel	Hemiptera: Pyrrhocoridae: *Dysdercus* sp.; Lygaeidae: *Caenocoris nerii*	Krantz & Khot, 1962; Evans, 1963; Costa, 1968; Prasad, 1975a, 1975b; Banerjee & Dutta, 1980; Shahi & Krishna, 1981; Sarkar *et al*., 1990; Gupta, 2001
H. parvulus Treat	Puerto Rico, Haiti	Hemiptera: Pyrrhocoridae: *Dysdercus andreae*	Treat, 1965; Farrier & Hennessey, 1993
H. sabbaticus Treat	Panama	Hemiptera: Pyrrhocoridae: *Dysdercus mimus*	Treat, 1965; Farrier & Hennessey, 1993
H. vikrami Menon **n. sp.**	India	Hemiptera: Pyrrhocoridae: *Dysdercus cingulatus, D. koenigii*	present work
H.womersleyi Evans	Nigeria	Hemiptera: Pyrrhocoridae: *Odontopus sexpunctatus*	Evans, 1963
Katydiseius nadchatrami Fain & Lukoschus	Malaysia	Orthoptera:Pseudophyllidae: *Chloracris brullei*	Fain & Lukoschus, 1983
Nabiseius duplicisetus Chant & Lindquist	Chile	Hemiptera: Nabidae: unknown nabid bug	Chant & Lindquist, 1965
Nabiseius melinae Halliday	Australia	Hemiptera: Miridae: *Creontiades* sp.	Halliday, 1994
Nabiseius rivnayae Amitai & Swirski	Israel	Caryophyllales: Tamaricaceae: *Tamarix* sp.	Amitai & Swirski, 1980
Noctuiseius batoridgi Prasad	Philippines	Lepidoptera: Noctuidae: unknown noctuid moth	Prasad, 1987
Noctuiseius treati Prasad	Austral Islands (Tubuai), Easter Islands, Hawaii, Society Islands	Lepidoptera: Noctuidae: *Achaea janata*	Prasad, 1968; Treat, 1975
Orthopteroseius sinicus Mo	China	Orthoptera:Tettigoniidae: *Elimea punctifera, Hexacentrus mundus*	Mo, 1996
Otopheidomenis ascalaphae Syed & Goff	Hawaiian Islands	Lepidoptera: Noctuidae: *Ascalapha odorata*	Syed & Goff, 1983
O. zalelestes Treat	USA, Canal Zone, Virgin Islands	Lepidoptera: Noctuidae: *Zale fictilis*, *Z. lunata, Z. galbanata, Z. undularis, Z. horrida, Z. minerea, Z. aeruginosa, Z. fictilis*	Treat, 1955, 1969, 1975
Prasadiseius achlora (Prasad)	Uganda	Lepidoptera: Sphingidae: *Antinephele achlora*	Prasad, 1972; Treat, 1975
P. aporodes (Prasad)	Uganda	Lepidoptera: Sphingidae: *Hippotion aporodes*	Prasad, 1972; Treat, 1975

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TABLE 2. (continued)

Species	Localities	Hosts	References
P. cocytes (Prasad)	Peru, Malaysia, Ecuador	Lepidoptera: Sphingidae: *Cocytis duponchel*, *Compsogene panopus*, *Manduca rustica*	Prasad, 1970a, 2011a; Wainstein, 1972; Treat, 1975
P. donahuei (Prasad)	Peru, Venezuela	Lepidoptera: Sphingidae: *Erinnyis obscura*	Prasad, 1970a; Wainstein, 1972; Treat 1975
P. indicus (Prasad)	India	Lepidoptera: Sphingidae: *Nephele* sp.	Prasad, 1973; Treat, 1975
P. kayosiekeri (Prasad)	Peru, Honduras, Panama Canal Zone, Michigan, USA	Lepidoptera: Sphingidae: *Pachylia darceta*, *Tripton lugubris*, *Pachylioides resumens*	Prasad, 1970b; Prasad & Walker, 2011; Wainstein, 1972; Treat, 1975
P. pholusis (Prasad)	Hondruas, Bolivia	Lepidoptera: Sphingidae; *Eumomorpha* sp., *E. anchemola*, *E. obliquus*	Prasad, 1970; Wainstein, 1972; Treat, 1975
Treatia dieuches Ramsay	Tanzania-East Africa	Hemiptera: Lygaeidae: *Dieuches* sp.	Ramsay, 1973
T. ghaiguptaorum (Ghai & Gupta)	India	Malformed mango inflorescence	Ghai & Gupta, 1984; Zhang 1995
T. phytoseioides (Baker & Johnston)	Florida, USA	Hemiptera: unknown family	Baker & Johnston, 1959; Krantz & Khot, 1962

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References

Amitai, S. & Swirski, E. (1980) Two new species of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. *Israel Journal of Entomology*, 14, 1–7.

Baker, E.W. & Johnston, D.E. (1959) *Laelaptonyssus phytoseioides*, a new species of laelaptonyssid mite from Hemiptera (Acarina, Mesostigmata). *Proceedings of the Entomological Society of Washington*, 61, 275–277.

Banerjee, P. & Dutta, S. (1980) Biological control of red cotton bug, *Dysdercus koenigii* Fabricius by mite, *Hemipteroseius indicus* (Krantz and Khot). *Indian Journal of Entomology*, 42, 265–267.

Chant, D.A. (1965) Generic concepts in the family Phytoseiidae (Acari: Mesostigmata). *The Canadian Entomologist*, 97, 351–374.

Chant, D.A. (1993) Adaptive radiation in the family Phytoseiidae (Acari: Gamasina) as reflected by adult idiosomal setation. *International Journal of Acarology*, 19, 203–231.

Chant, D.A. & Lindquist, E.E. (1965) *Nabiseius duplicisetus*, a new genus and species of Otopheidomenidae (Acarina: Phytoseiidae) from nabid bugs. *Canadian Entomologist*, 97, 515–521.

Chant, D.A. & Yoshida-Shaul, E. (1991) Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina). *International Journal of Acarology*, 17, 187–200.

Chant, D.A. & Yoshida-Shaul, E. (1992) Adult idiosomal setal patterns in the family Phytoseiidae (Acari: Gamasina). *International Journal of Acarology*, 18, 177–193.

Chmielewski, W. (2006) Occurrence of *Hemipteroseius adleri* (Acari: Mesostigmata: Otopheidomenidae) infesting *Pyrrhocoris apterus* (Insecta: Heteroptera: Pyrrhocoridae) in Pulawy and other localities in Poland and Lithuania. *Biological Letters*, 43, 157–161.

Costa, M. (1968) Notes on the genus *Hemipteroseius* Evans (Acari: Mesostigmata) with the description of a new species from Israel. *Journal of Natural History*, 2, 1–15.

Evans, G.O. (1963) Observations on the classification of the family Otopheidomenidae (Acari: Mesostigmata) with descriptions of two new species. *Annals and Magazine of Natural History*, 5, 609–620.

Fain, A. & Lukoschus, F.S. (1983) *Katydiseius nadchatrami* n.g., n. sp., (Acari: Otopheidomenidae) from the trachea of a Malaysian katydid *Chloracris brullei* Pictet & Saussure, 1892 (Orthoptera, Pseudophyllidae). *International Journal of Acarology*, 9, 173–178.

Farrier, M.H. & Hennessey, M.K. (1993) Soil-inhabiting and free-living Mesostigmata (Acari-Parasitiformes) from North America. An annotated checklist with bibliography and index. *North Carolina Agricultural Research Service Technical Bulletin*, 302, 1–408.

Ghai, S. & Gupta, S.K. (1984) A new species of *Treatia* Krantz & Khot (Acari: Otopheidomenidae) with a new record of *Amblyseius* Berlese (Acari: Phytoseiidae) from India. *Bulletin of the Zoological Survey of India*, 6, 171–175.

Gupta, S.K. (2001) A conspectus of natural enemies of phytophagous mites and mites as potential biocontrol agents of agricultural pests in India. *In*: Halliday, R.B., Walter, D.E., Proctor, H.C., Norton, R A. & Colloff, M.J. (eds) *Acarology*: *Proceedings of the 10th International Congress*, CSIRO Publishing, Melbourne, pp. 484–497.

Halliday, R.B. (1994) First record of the family Otopheidomenidae (Acarina: Mesostigmata) in Australia, with description of *Nabiseius melinae* sp. n. *Australian Journal of Entomology*, 33, 347–350.

Krantz, G.W. & Khot, N.S. (1962) A review of the family Otopheidomenidae Treat 1955 (Acari: Mesostigmata). *Acarologia*, 4, 532–542.

Lewandowski, M. & Szafranek, P. (2005) Ectoparasitic mite *Hemipteroseius adleri* (Acari: Otopheidomenidae) on the red firebug *Pyrrhocoris apterus* (Heteroptera: Pyrrhocoridae). *Experimental and Applied Acarology*, 35, 251–257.

Mo, C.F. (1996) A new genus and new species of the Otopheidomenidae (Acari: Mesostigmata) from longhorned grasshoppers. *Systematic and Applied Acarology*, 1, 199–204.

Prasad, V. (1968) *Noctuiseius treati*, a new genus and species of the moth mite from Hawaii and Easter Island. *Annals of the Entomological Society of America*, 61, 411–413.

Prasad, V. (1970a) Two new species of *Otopheidomenis* mites from South America (Acarina: Phytoseiidae). *Acarologia*, 12, 28–33.

Prasad, V. (1970b) Two new species *of Otopheidomenis* (Acarina: Phytoseiidae) ectoparasitic on sphingid moths with a note on *Noctuiseius*. *Canadian Entomologist*, 102**,** 1209–1215.

Prasad, V. (1972) New species *of Otopheidomenis* (Acarina: Phytoseiidae) ectoparasitic on sphingid moths from Uganda. *Acarologia*, 14, 345–349.

Prasad, V. (1973) A new species *of Otopheidomenis* (Acarina: Phytoseiidae) from India. *Acarologia*, 15, 193–196.

Prasad, V. (1975a) Biology of *Treatia indica* Krantz and Khot (Acarina: Phytoseiidae), a mite parasite of the red-cotton bug in India. *Acarologia*, 17, 30–35.

Prasad, V. (1975b) Ectoparasitic mites. (Acarina: Otopheidomenidae) on sphingid moths. *Acarologia*, 17, 375–383.

Prasad, V. (1987) A new species of otopheidomenid mite from the Philippines with comments on *Noctuiseius* Prasad and *Prasadiseius* Wainstein (Acarina: Otopheidomenidae). *International Journal of Acarology*, 13, 245–250.

Prasad, V. (2011a) An unusual case of very heavy infestation of *Prasadiseius cocytes* (Prasad, 1970) (Acari: Otopheidomenidae) in *Manduca rustica* (Fab.) (Lepidoptera: Sphingidae) collected in Ecuador. *International Journal of Acarology*, 37, 31–41.

Prasad, V. (2011b) Proposed nomenclature for idiosomal setae in otopheidomenid mites (Acari: Otopheidomenidae) known from sphingid moths (Lepidoptera: Sphingidae). *International Journal of Acarology*, 37, 11–30.

Prasad, V. (2011c) Phytoseiidae and Otopheidomenidae (Acari: Mesostigmata) of the World: a Self Study Guide. Indira Publishing House, West Bloomfield, Michigan. 208 pp.

Prasad, V. & Walker, G. (2011) Scanning electron microscopy studies on *Prasadiseius kayosiekeri* (Prasad, 1970) (Acari: Mesostigmata: Otopheidomenidae): idiosoma. *International Journal of Acarology*, 37, 43–52.

Ramsay, G.W. (1973) A new species of *Treatia* (Acari: Phytoseiidae) from East Africa. *Acarologia*, 15, 1–9.

Sarkar, P.K., Das, T.K. & Mohansundaram, M. (1990) Seasonal fluctuation of the ectoparasite *Hemipteroseius indicus* on *Dysdercus koenigii*, a pest of okra in West Bengal. *Acarology Newsletter*, 17–18, 18–19.

Shahi, K.P. & Krishna, S.S. (1981) A new host of *Hemipteroseius indicus. Experientia*, 37, 1072.

Syed, A.R. & Goff, M.L. (1983) A new species of *Otopheidomenis* (Acari: Otopheidomenidae) ectoparasitic on *Ascalapha odorata* (Lepidoptera:Noctuidae) in the Hawaiian Islands, with a key to the species in the genus. *International Journal of Entomology*, 25, 316–320.

Treat, A.E. (1954) A new gamasid (Acarina: Mesostigmata) inhabiting the tympanic organs of phalaenid moths. *Journal of Parasitology*, 40, 619–631.

Treat, A.E. (1955) An ectoparasite (Acarina: Mesostigmata) from moths of the genus *Zale*. *Journal of Parasitology*, 41, 555–561.

Treat, A.E. (1965) Otopheidomenids from the Antilles and elsewhere. *Acarologia*, 7, 1–16.

Treat, A.E. (1969) Behavioural aspects of the association of mites with noctuid moths. *In*: Evans, G.O. (ed.). *Proceedings of the 2nd International Congress of Acarology,* Akadémiai Kiadó, Budapest, pp. 275–286.

Treat, A.E. (1975) *Mites of Moths and Butterflies*. Cornell Univ. Press, Ithaca, New York, 362 pp.

Wainstein, B.A. (1972) On the system of ectoparasitic mites of the family Otopheidomenidae Treat, 1955 (Parasitiformes). *Parazitologiya*, 6, 451–456 [in Russian].

Zhang, Z.-Q. (1995) Review of the systematics and biology of the Otopheidomenidae (Acari: Mesostigmata) with a description of *Eickwortius* gen. n. from a termite (Isoptera: Termitidae). *Systematic Entomology*, 20, 239–246.