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INDIAN TROMBICULID MITES — RE-DESCRIPTIONS
OF THREE SPECIES AND DESCRIPTION
OF A NEW SPECIES OF *ODONTACARUS*
(ACARINA, TROMBICULIDAE) ¹

BY

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One of us (A. K. J.) in 1964 described three new species of trombiculid mites collected from rats in Bombay. All three of them were described in the broad genus *Trombicula*. However, since these species do not conform to recent views on chigger classification, opportunity is taken herewith to transfer these species to their respective genera. *Trombicula kajutekrii* is properly placed in the genus *Microtrombicula* Ewing, 1950, subgenus *Scapuscutala* Vercammen-Grandjean, 1960. *T. bhattipadensis* and *T. multisetosa* are transferred to the genus and subgenus *Leptotrombidium* Nagayo et al., 1916. In addition to providing full descriptions and illustrations for the above species, a new species of *Odontacarus* Ewing, 1929, is here described for the first time.

Opportunity is also taken to designate the holotypes and paratypes for the previously described species since at that time the type slides contained mixed species or several specimens on a slide. The type material has subsequently been remounted, one specimen to each slide.

Holotypes are deposited in the Bishop Museum, Honolulu, while paratypes are deposited as follows : Institute for Medical Research, Kuala Lumpur, Malaysia ; Zoological Survey of India, Calcutta ; U. S. National Museum, Washington ; British Museum (N. H.), London ; Hooper Foundation, University of California, San Francisco ; and the Rocky Mountain Laboratory, Hamilton, Montana.

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Microtrombicula (Scapuscutala) kajutekrii (Joshee) n. comb.
(Figs. 1-8).

Trombicula kajutekrii Joshee, 1964. *Ind. J. Biol. Sci.*, 7 : 46.

Diagnosis of larva : Barbed setae on palps weak, palpal formula b/b/NNb + 6b ; claw 3-pronged ; galeal seta nude. *Scutum* subquadrate with biconvex anterior margin and convex posterior margin ; mid-portion of posterior margin broadly angulate ; punctae small, numerous and densely spread below SB, anteriorly pittings less numerous and scattered at random. *DS* 26-28, arranged 2,8,6,4,4,2. *Legs* with 3 genualae I and 2 short mastitarsalae III. This species is close to *M. munda* (Gater, 1932) from which it is separated in the shape of scutum, number of *DS* and structure of chelicera.

Re-description of larva : Idiosome of engorged larva small, broadly oval, 260-290 × 200-230 μ. *Eyes* 2 + 2, on ocular plate.

Gnathosome : Palpal formula b/b/NNb + 6b ; barbed setae on palp with only a few barbs and these weak. Claw short, 10-11 μ, trifurcate. Chelicera 24 μ long, with a small pointed subapical dorsal tooth and a large tooth proximal to the small one. The usual pair of coxal setae short, with 4-5 long barbs.

Scutum subquadrate with anterior margin biconvex, posterior margin convex with its apex broadly angulate. Punctae small, numerous, dense below SB, few and uneven anterior of SB. Scutal setae short, PL > AM > AL. AM seta marginal, AL setae distinctly submarginal and PL setae at PL corners. SB small, round and situated halfway between AL and PL setae. Sensilla short with 4-5 distal barbs, proximal stem lightly serrated.

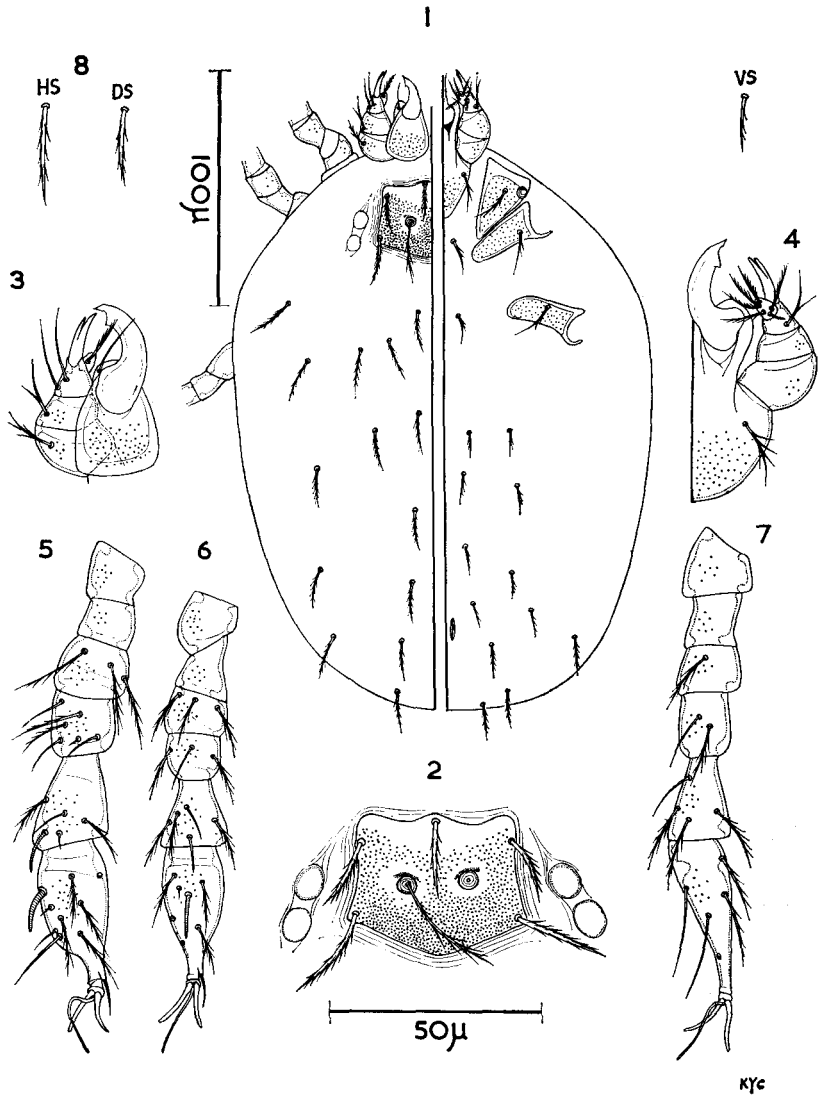
Standard data, in micra, of *M. (S.) kajutekrii* (Joshee).

	AW	PW	SB	ASB	PSB	SD	AP	AM	AL	PL	Sens.
Holotype	39	47	17	17	17	34	19	20	14	26	32
Mean of 8.....	37	47	16	17	19	36	19	20	17	22	29
Observed range :											
Min.	34	44	15	17	17	34	18	16	13	20	26
Max.	40	48	17	19	19	38	20	23	20	26	32

Body setae : HS 26 μ ; DS 19 μ ; VS 13 μ ; CS 17 μ long. DS with short cilia-tions, 26 in number, arranged 2,8,6,4,4,2,2(0) or 6,4,6,4,4,2,2(0). VS 12 + 8 CS. Sternal setae 2 + 2, very short, anterior pair only 15 μ long.

Legs 7-7 segmented, segments short. Total lengths of legs I-III 450-480 μ. Ordinary setae weakly barbed. Coxae I-III unisetose ; seta on coxa I with 4-5 barbs, but coxal setae II and III with 1-2 basal barbs only. Claws slender, normal ; expodium longest. Measurements, type and number of barbed and sensory setae as follows.

Leg I 160 μ long ; tarsus plus pretarsus 36 \times 14 μ ; tarsala blunt and 11 μ long ; a distal microtarsala ; a subterminala ; a short, nude parasubterminala ; a pretarsala and 20-22 weakly barbed setae. Tibia with 2 tibialae, distal stouter and longer than proximal ; a microtibiala and 8 barbed setae. Genu with 3 genualae ; a distal microgenuala and 4 barbed setae. Remaining segments with 5-1-1 barbed setae.



FIGS. 1 to 8. — *Microtrombicula (Scapuscutala) kajutekrii* (Joshee).

1, dorsal and ventral aspects of idiosome ; 2, scutum ; 3 and 4, dorsal and ventral aspects of gnathosome ; 5, 6 and 7, legs I, II and III ; 8, humeral, dorsal and ventral setae.

Leg II 140 μ long ; tarsus plus pretarsus 31 \times 13 μ . Tarsala slender, blunt, 11 μ long ; microtarsala slightly proximal to tarsala ; a pretarsala and 14 barbed setae. Tibia with 2 tibialae, distal one stouter and longer than proximal and 6 barbed setae. Genu with 1 genuala and 3 barbed setae. Remaining segments with 4-2-1 barbed setae.

Leg III 160 μ long ; tarsus plus pretarsus 40 \times 12 μ . 2 fine mastitarsalae on distal half of tarsala, 1 dorsal the other dorsolateral, and 12-13 barbed setae. Tibia with 1 tibiala and 6 barbed setae. Genu with 1 genuala and 3 barbed setae. Remaining segments with 3-2-1 barbed setae. Coxa 43 \times 23 μ .

Material examined : 8 specimens remounted from a single slide (Type No. 3) ex *Rattus rattus*, Kajutekari, Bhandup Area, Bombay, India, 26.XI.1959. Slide MZ110455 is designated holotype and the remaining 7 slides as paratypes. Another slide (No. 6) labelled *Trombicula kejutekrii* n. sp. in fact contains specimens only of *M. (S.) munda* (Gater, 1932).

Leptotrombidium (Leptotrombidium) bhattipadense (Joshee), n. comb.

(Figs. 9-16).

Trombicula bhattipadensis Joshee, 1964. *Ind. J. Biol. Sci.*, 7 : 47.

Diagnosis of larva : Palpal formula B/N/NNB + 7B ; claw 3-pronged ; galeal seta barbed. Scutum rectangular with anterior margin straight, posterior margin slightly biconcave or sinuate. SB in line with PL setae. AM and AL setae subequal, PL setae longest. DS 32-34 arranged 2,8,6,6,6,4,2(0). Legs with 2 genualae I and I genuala each on legs II and III.

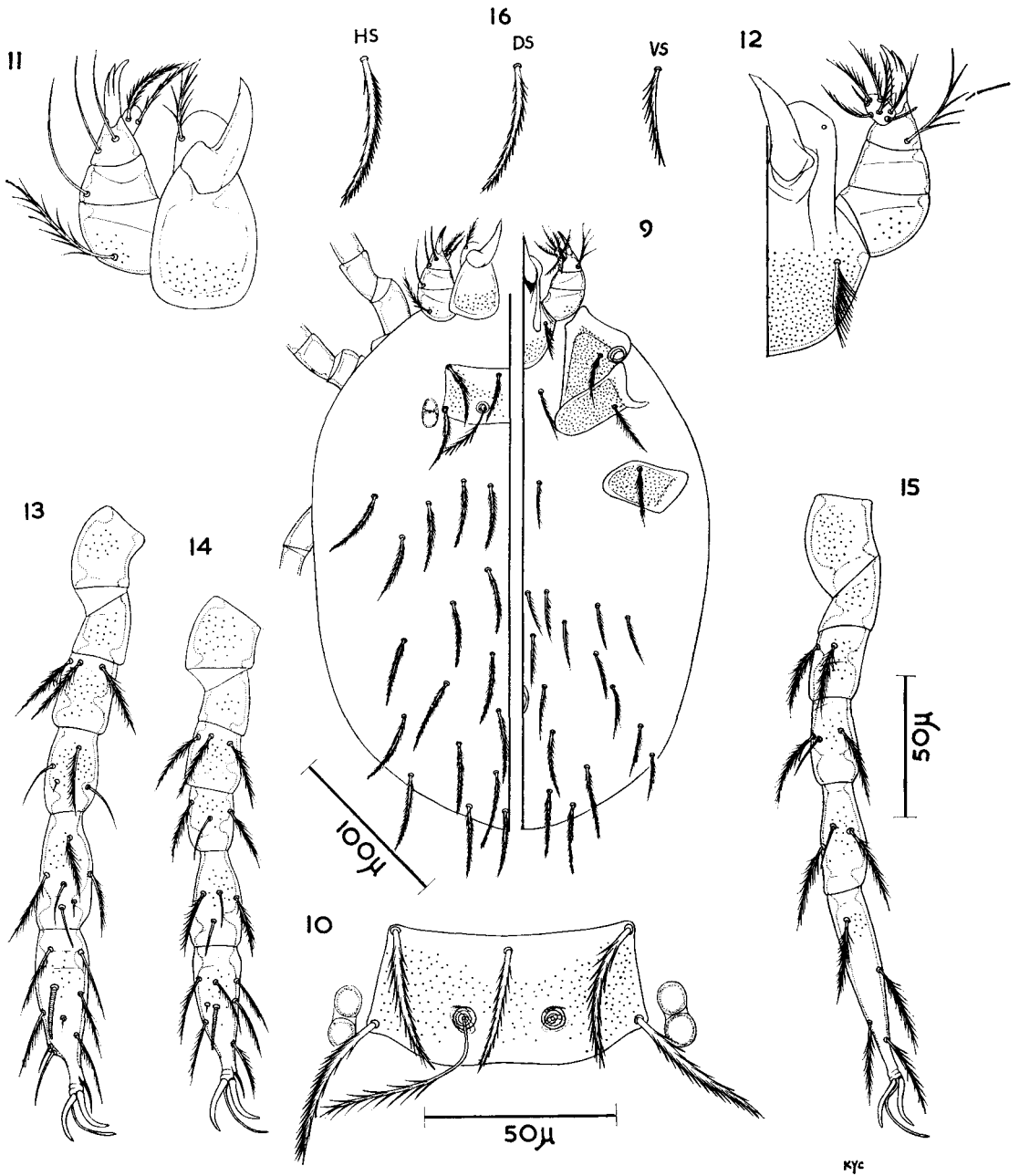
Close to *L. pelta* (Womersley) in having similar palpal formula and equal number of DS, but scutum of *bhattipadense* is distinctly bigger and somewhat different in shape ; punctate are also more numerous.

Re-description of larva : Idiosome of engorged larva oval to broadly oval, 320-410 \times 260-340 μ . Eyes 2 + 2 on ocular plate, anterior eye more sclerotized.

Gnathosome : Cheliceral base with very few punctae ; blade 40 μ long with one small dorsal dentition. Palpal femur rounded ; formula B/N/NNB + 7B, femoral and ventrotibial setae distinctly barbed. Claw 3-pronged, axial prong 17 μ ; galeal seta with 7-10 barbs. Gnathosomal coxa with numerous small punctae, the pair of coxal setae with long fine barbs.

Scutum rectangular with PW/SD ratio usually 1.9 ; anterior and lateral margins almost straight ; posterior margin shallowly convex, with mid portion sometimes slightly concave. Scutal setae with strong, short barbs, almost plumose.

AL and PL setae marginal, AM seta 6 μ below anterior margin. AM and PL setae subequal, PL setae only slightly longer. SB in line or only slightly ante-



FIGS. 9 to 16. — *Leptotrombidium (L.) bhattipadense* (Joshee).
9, dorsal and ventral aspects of idiosome ; 10, scutum ; 11 and 12, dorsal and ventral aspects of gnathosome ; 13, 14 and 15, legs I, II and III ; 16, humeral, dorsal and ventral setae.

rior to PL setae. Sensillae unexpanded with 12-14 barbs on distal 2/3 of stem. Punctae distinct, numerous, but not dense.

Standard data, in micra, of *L. (L.) bhattipadense* (Joshee).

	AW	PW	SB	ASB	PSB	SD	AP	AM	AL	PL	Sens.
Holotype	63	73	25	25	11	36	23	35	43	43	56
Mean of 6.....	63	70	22	26	12	38	23	35	42	45	59
Observed range :											
Min.	60	68	21	24	9	35	21	33	40	43	57
Max.	67	73	25	28	14	40	26	38	44	46	60

Body setae : Dorsal setae similar to scutal setae, strongly barbed. HS 43 μ ; DS 46 μ ; VS 31 μ ; CS 44 μ . DS 32-34 in number, arranged 2,8,6,6,6,4,2(0). VS 14 + 14-16 CS. Sternal setae 2 + 2, anterior pair 35 μ and longer than posterior pair.

Legs : 7-7-7 segmented. Total lengths of legs I-III 720-750 μ . Coxae I-III unisetose. Terminal claws of normal contour and of subequal length ; empodium slender and slightly longer. Ordinary setae with numerous, long, tapering barbs. Measurements, type and number of sensory and barbed setae as follows :

Leg I 250 μ long ; tarsus plus pretarsus 66 \times 20 μ ; tarsala blunt, 17 μ long ; microtarsala distal to tarsala ; a subterminala ; a nude parasubterminala ; a pretarsala and 21 barbed setae. Tibia with 2 tibialae in tandem ; 1 microtibiala and 8 barbed setae. Genu with 2 tapering genualae, a microgenuala and 4 barbed setae. Remaining segments with 5-1-1 barbed setae.

Leg II 225 μ long ; tarsus plus pretarsus 50 \times 18 μ ; tarsala slender, 16 μ long ; a microtarsala lateral to and in line with base of tarsala ; a pretarsala and 16 barbed setae. Tibia with 2 tibialae in tandem and 6 barbed setae. Genu with 1 genuala and 3 barbed setae. Remaining segments with 4-2-1 barbed setae.

Leg III 270 μ long ; tarsus plus pretarsus 70 \times 13 μ with 14 barbed setae. Tibia with 1 tibiala and 6 barbed setae. Genu with 1 genuala and 3 barbed setae. Remaining segments with 3-2-1 barbed setae. Coxa 61 \times 35 μ .

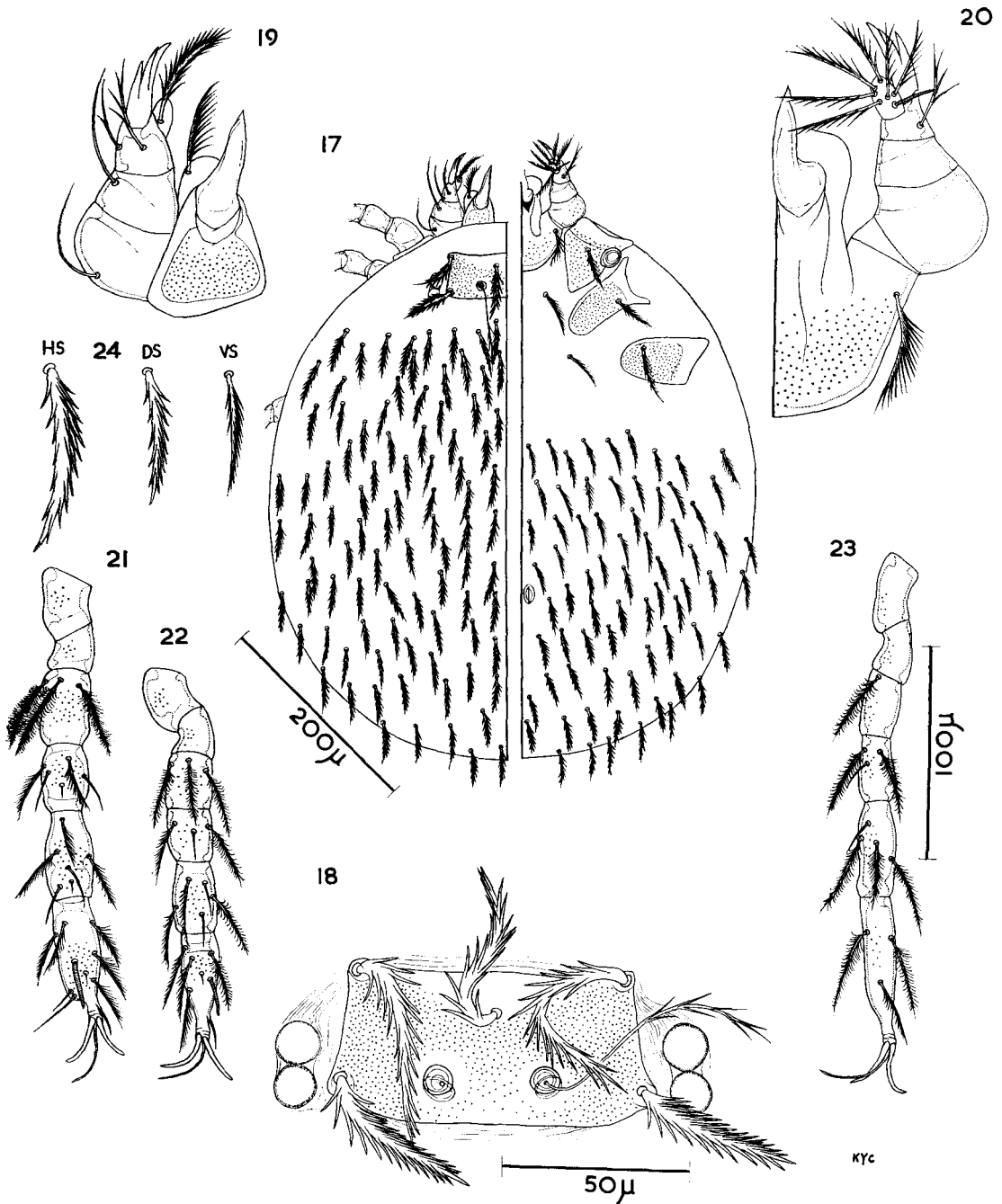
Material examined : Seven specimens remounted from a single slide (Type No. 4) ex *Rattus rattus*, Bhattipada, Bhandup Area, Bombay, India, 17.X.1959. One remounted from slide No. 2 ex *Rattus rattus*, Bhattipada, 16.IX.1959 and mixed with one *L. akamushi* (Brumpt, 1910) and 7 *L. multisetosum* (Joshee). Slide MZ110440 is designated holotype and remaining 7 slides as paratypes.

Leptotrombidium (Leptotrombidium) multisetosum (Joshee), n. comb.

(Figs. 17-24).

Trombicula multisetosa Joshee, 1964. *Ind. J. Med. Sci.*, 7 : 47.

Diagnosis of larva : Idiosome broadly ovoid to almost globose. Palpal formula N/N/BN(b)B + 7B. Claw 3-pronged ; galeal seta plumose. *Scutum* rectangu-



FIGS. 17 to 24. — *Leptotrombidium (L.) multisetosum* (Joshee).
17, dorsal and ventral aspects of idiosome ; 18, scutum ; 19 and 20, dorsal and ventral aspects of gnathosome ; 21, 22 and 23, leg I, II and III ; 24, humeral, dorsal and ventral setae.

lar ; SB in line with PL setae. Scutal setae stout and plumose. PL setae shortest. DS short, strongly barbed, 170-190 in number. Legs : Ordinary setae densely barbed, barbs long and tapering ; 2 genualae I, 1 genuala on legs II and III. Terminal claws stout, empodium long and slender.

This species is unique in the genus *Leptotrombidium* in having an extraordinarily multi-setosed idiosome.

Re-description of larva : Idiosome of engorged larva broadly oval to almost round, 530-560 × 500 μ. Eyes 2 + 2, sclerotized, on ocular plate.

Gnathosome : Palpal formula N/N/BN(b)B + 7B ; on tibia dorsal and ventral setae distinctly barbed, dorsolateral seta slender with 1-3 weak barbs, often nude. Claw 3-pronged ; axial prong 25 μ long ; accessory prongs unequal. Galeal seta plumose. Coxa densely punctate, with a pair of long barbed setae.

Scutum rectangular ; anterior and lateral margins slightly sinuate, posterior margin shallowly concave at mid portion. Punctae distinct, numerous and unevenly distributed. Scutal setae plumose. AL and PL setae in their respective corners ; AM seta submarginal being 12 μ below anterior margin. SB in line with PL setae. Sensilla slender with 8-10 barbs on distal 2/3 of stem, proximal stem smooth.

Standard data, in micra, of *L. (L.) multisetosum* (Joshee).

	AW	PW	SB	ASB	PSB	SD	AP	AM	AL	PL	Sens.
Holotype	78	94	34	35	11	46	30	63	57	43	70
Mean of 6.....	80	94	33	33	12	45	33	59	58	47	78
Observed range :											
Min.	74	86	30	28	11	40	30	56	53	43	70
Max.	85	100	36	37	13	49	34	63	60	49	78

Body setae : HS 54 μ ; DS 43 μ VS 30 μ ; CS 42 μ long. DS strongly spicate ; spikes short and blunt ; 170-190 in number and almost covering entire idiosome. VS pectinate, CS similar to DS. VS + CS 100-110 in number. Sternal setae 2 + 2, anterior pair 54 μ long.

Legs 7-7-7 segmented. Total lengths of legs I-III 900 μ. Terminal claws stout and strongly flexed ; empodium long and slender. Ordinary setae of legs very densely barbed, barbs long and tapering. Number of sensory and ordinary setae as for *L. bhattipadense*. Measurements follow :

Leg I 295 μ long ; tarsus plus pretarsus (64 × 23 μ ; tarsala elongate, 25 μ long. *Leg II* 280 μ long ; tarsus plus pretarsus 56 × 22 μ ; tarsala blunt, 16 μ long ; microtarsala proximal to tarsala and not in line as in *bhattipadense*. *Leg III* 330 μ long ; tarsus plus pretarsus 78 × 18 μ. Coxa III 75 × 42 μ.

Material examined : Seven specimens remounted from a single slide (Type No.2) ex *Rattus rattus*, Bhandup Area, Bombay, India, 16.IX.1959. Slide MZ110447 is designated holotype and remaining 6 slides as paratypes.

Note : This species was subsequently collected by Carl J. MITCHELL from a single species of insectivore in Madhya Pradesh, India at elevations between 2,000 and 3,000 feet.

Odontacarus indica Nadchatram and Joshee, n. sp.

(Figs. 25-33).

Diagnosis of larva : Palpal formula B/b/Bbb + 6B. Claw 3-pronged ; galeal seta with 1-2 barbs. Chelicera with a row of dorsal and ventral marginal teeth on its distal portions. *Scutum* subrectangular with outcurved lateral margins. DS 42-44, arranged 2(0), 6(8), 6,8,8,6,6,2(0). *Legs* : Subterminala and parasubterminala I absent ; tarsala I longer than tarsala II which is apically spathulate. Terminal claws with microsetae.

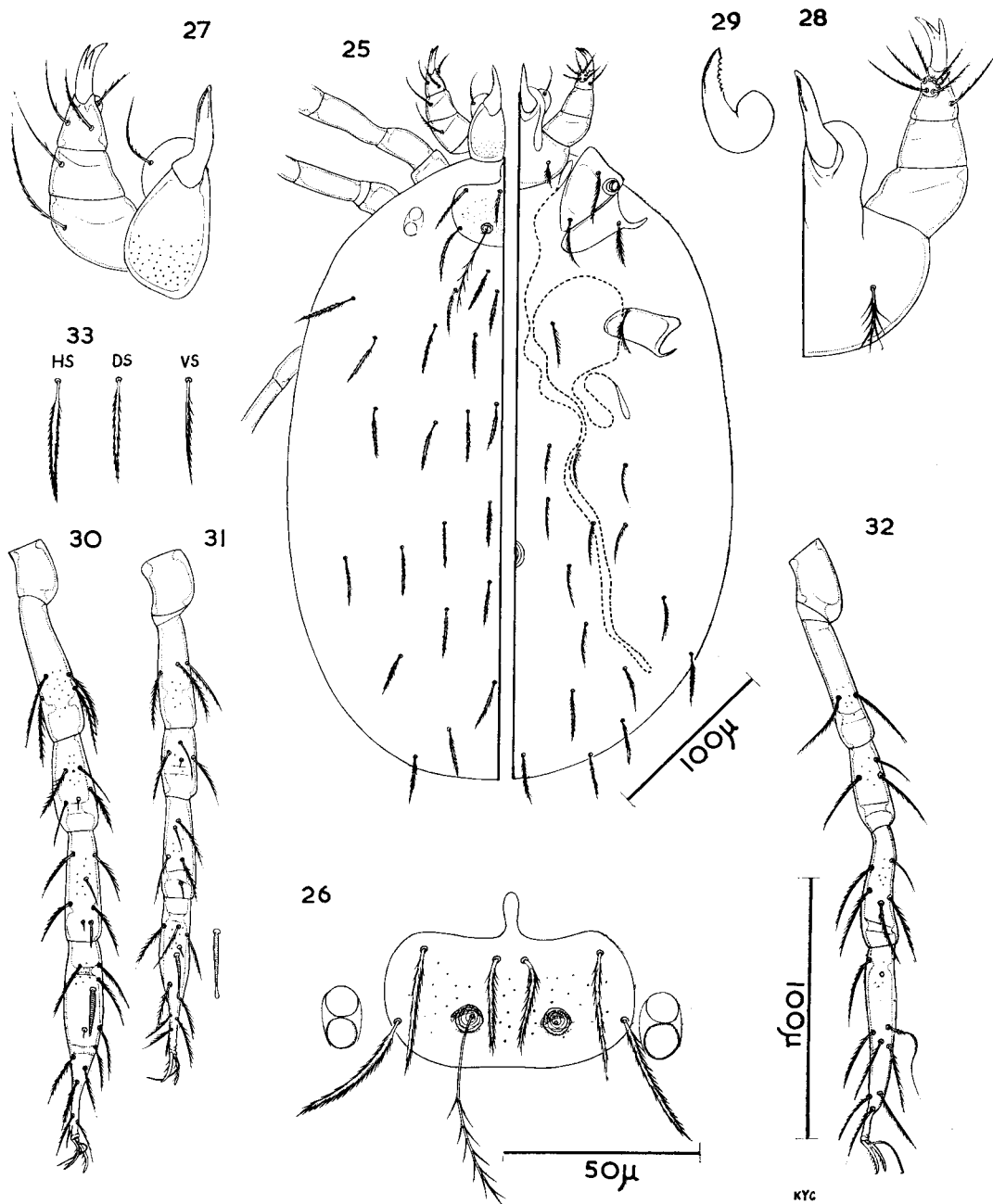
This species is intermediate between *Odontacarus agamae* Taufflieb, 1960 and *O. ediosi* Taufflieb, 1962. The new species is separated from the former in having tarsala I distinctly longer than tarsala II, in lacking a subterminala and parasubterminala, in having a row of 3-4 long microsetae on leg claws I-III. Separated from the latter in having a smaller scutum, dissimilar arrangement of DS ; in having a longer tarsala I and absence of subterminala and parasubterminala.

The new species is unrelated to *Odontacarus gymnodactyli* (Ewing, 1925). See comments at the end of description.

Description of larva : Idiosome of unengorged larva broadly oval with posterior margin greater than anterior margin, $200 \times 160 \mu$. Engorged larva broadly elongate, $600 \times 420 \mu$. Trachea visible. Eyes 2 + 2, as figured.

Gnathosome prominently displayed ; palp elongate, tarsus reduced ; claw slender. Palpal setae tapering, weak and inconspicuously barbed, formula B/b/Bbb + 6B ; claw 3-pronged, axial prong 16μ long, dorso-external prong short and hidden. Galeal seta appearing nude but with 1, seldom 2, short basal barbs. Cheliceral base elongate, weakly punctate ; blade 27μ long with a row of 6-7 small teeth on dorsal aspect and a short subapical row of a similar number of smaller teeth on ventral aspect. Coxa with usual pair of barbed setae.

Scutum subrectangular with lateral margins outcurved ; posterior margin broadly convex, the mid portion sometimes sinuate ; nasus or anteromedian projection $10-11 \mu$ long and anterior margin on either side almost straight. AM and AL setae in line and submarginal ; AM setal bases 7μ apart ; PL setae inserted at rounded PL corners. AM and AL setae strongly ciliated. PL setae somewhat peculiar in that basal stem of seta is slender and smooth and distal portion expended and strongly ciliated (fig. 33). SB approximately in line with PL setae. Sensilla unexpanded, slender with 10-12 distal barbs. Punctae few of unequal size and indistinct.



FIGS. 25 to 33. — *Odontacarus indica* n. sp.

25, dorsal and ventral aspects of idiosome ; 26, scutum ; 27 and 28, dorsal and ventral aspects of gnathosome ; 29, chelicera ; 30, 31 and 32, legs I, II and III ; 33, humeral, dorsal and ventral setae.

Standard data, in micra, of *Odontacarus indica* n. sp.

	AW	PW	SB	ASB	PSB	SD	AP	AM	AL	PL	Sens.
Holotype	46	66	24	33	14	47	18	26	34	38	55
Mean of 9.....	49	64	25	35	13	48	21	27	32	38	56
Observed range :											
Min.	46	60	24	32	12	45	17	21	30	36	52
Max.	52	67	27	41	16	53	25	30	34	42	61

Body setae : HS 32 μ ; DS 38 μ ; VS 20 μ , CS 24 μ long. HS and DS similar to PL setae in texture, 42-44 in number, arranged 2,6,6,8,8,6,6,2(0) or 8,6,8,8,6,6,2(0). VS pectinate ; VS + CS 22 in number. A single pair of sternal setae 30 μ long.

Legs : 6-6-6 segmented, segments elongate. Total lengths of legs I-III 800-850 μ . Ordinary setae with simple barbs and average 30 μ long. Coxae I-III with 2,1,1 setae. Tarsi elongate, somewhat constricted medially. Terminal claws slender with 3-4 long microsetae on each claw ; empodium without setae and longer than claws. Measurements, type and number of sensory and barbed setae as follows :

Leg I 290 μ long ; tarsus plus pretarsus 72 \times 14 μ . Tarsala blunt, 19 μ long ; a microtarsala distal to tarsala ; a pretarsala ; subterminala and parasubterminala absent ; and 18 barbed setae. Tibia with 2 tibialae in tandem ; a microtibiala inserted close to distal tibiala, and 8 barbed setae. Genu with 2 genualae ; a microgenuala and 4 barbed setae. Remaining segments with 6 and 1 barbed setae.

Leg II 260 μ long ; tarsus plus pretarsus 62 \times 14 μ . Tarsala 16 μ long, slender, with its tip spoon-shaped ; a microtarsala proximal to tarsala ; a pretarsala and 16-17 barbed setae. Tibia with 2 tibialae in tandem and 6 barbed setae. Genu with 1 genuala and an indistinct microgenuala. Remaining segments with 6 and 1 barbed setae.

Leg III 290 μ long ; tarsus plus pretarsus 78 \times 12 μ . A fine tapering, basally barbed mastitarsala on distal half and 14 barbed setae. Tibia with 1 tibiala and 6 barbed setae. Genu with 1 genuala and 4 barbed setae. Remaining segments with 5 and one barbed setae.

Type material : Holotype, MZ 110485, ex Gecko, *Hemidactylus brooki* Gray, 1845, Vihar Bhandup Hills, Bombay, India, 17.1.1960. A. K. J. coll. 14 paratypes, same data as holotype.

Comments : The senior author had the privilege of examining a cotype of *Odontacarus gymnodactyli* (Ewing, 1925) sent to him by Dr. Edward W. BAKER through Dr. R. E. CRABILL, jr. of the Smithsonian Institution, Washington, D. C. Although the specimen was badly damaged and distorted during mounting, and deteriorated through age, it is possible to ascertain the following features in *gymnodactyli*.

Palpal tarsus with 7 barbed setae in addition to tarsala ; on palpal tibia, dorsal seta barbed, lateral and ventral setae nude. Sensilla nude, 65 μ long. Chelicera with a row of 7 conspicuous ventral teeth ; dorsally with a row of 4 teeth in addition to tricuspid cap.

Acknowledgements.

The illustrations were prepared by Mr. Koong Yue CHEONG under the supervision of M. N. Drs. J. R. AUDY and P. H. VERCAMMEN-GRANDJEAN read the manuscript. Miss C. ESPECKERMAN typed the manuscript. We are thankful to them all. We are grateful to Drs. Edward W. BAKER and R. E. CRABILL, jr. of the Smithsonian Institution, Washington D. C. for sending us a cotype *Odontacarus gymnodactyli* (Ewing).

ABSTRACT.

Three Indian species described by Joshee (1964) in the broad genus *Trombicula* are fully re-described, illustrated and properly placed in their respective genera to conform with recent views in chigger classification.

In addition, a new species of trombiculid mite, *Odontacarus indica* from India is described for the first time.

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