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Discovery of a New Species of Mite Pest (Acari: Eriophyidae) on a Plant of Medicinal and Culinary Significance from Sub Himalayan Region of India: Taxonomic Diagnosis and Damage Caused to Plant

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Abstract **– Eriophyoid mites, which are among the smallest plant feeders, are characterized by the intimate relationships they have with their hosts and the restricted range of plants upon which they can reproduce. They are exclusively plant parasites in all stages of their development. During feeding some species inject saliva to the plant tissues that affects plants in various ways.Due to their feeding habit many eriophyoid species are potentially harmful to crop plants and vegetables. In general eriophyoids cause mechanical damage to plant tissue by their feeding. During the general surveys for eriophyoid mites from present study area a new species, *Paratetramurrayacola*sp. nov. of the class Acariof the family Eriophyidae was found as vagrants on tender shoot of *Murryakoengii* Spr. This new phytophagous mite species was described and illustrated from the specimens collected at Malda, Sub Himalayan region of West Bengal (25° 0' 39.0276'' N and 88° 8' 27.9528'' E.), India. To establish this species as a new to Science, its comparison with other closely related species are also provided in this article. After proper diagnosis of the species it apparently appears to be the second eriohyoid mite species described from *Murrayakoengii* Spr. in India and added new to science as a seventh species under the genus *Paratetra.* This mite causes visible damage symptoms to the host plant and appeared as a potential pest of Curry leaves in India. For proper control of the mite pest, the taxonomic study of this mite and their relation to the host plant is very much essential. Taxonomic descriptions of the new species and its nature of damage are discussed in this article.**

Keywords **– New Mite Species, Eriophyidae, Taxonomy, *Murraya*, Pest, India.**

I. INTRODUCTION

The Acari comprising ticks and mites form one of the largest and biologically most diverse groups of Arachnida. Some of them are potential pest of crop and other agricultural and forest plants, while some others like ticks are parasites on wide range of vertebrate hosts. Among the Acari, Eriophyoid mites are second largest group with regard to their economic importance as phytophagous pest throughout the world [1]. A point of interest of these mites, potentially much more serious than direct losses to agriculture, is that a few species are known to be vectors of certain viral diseases of different crop plants [2]. The transmission of 21 pathogens by 13 species of phytophagous mites to at least 34 plants has been reported in the literature [3-8]. Most mite species that are known to vector plant pathogens are in the Eriophyidae. As a result of their tiny size and very short stylets feed only the epidermal cells of their plant hosts where they may acquire and transmit disease agents to these plant cells [9]. These mites are drawing the attention of biologist all over the world for their morphological and biological specializations. Due to their obligatory phytophagous mode of nutrition they exhibit marked host specificity. The great diversity of these tiny plant feeders is related to their extreme host specificity and intimate host relationships. Their impact as specialized phytophagous mites is well known and strongly accented in each of their involvements as direct plant pests, plant pathogen vectors, agents of control of weeds, and food sources for predators. During the general surveys for eriophyoid mites in Sub Himalayan regions of West Bengal, India

(25° 0' 39.0276" N and 88° 8' 27.9528" E.), a new species was collected from *Murrayakoengii* and is described here. *Murayakoengii*, being indigenous to India, Srilanka and many south East Asian countries is known by several vernacular names such as Kadi Patta or Meetha Neem in Hindi, Kariveppilai in Tamil, Karivepaaku in Tamil or Karivempu in Malayalam. Derived from the Tamil word "Kari" meaning spicy, curry leaves are mentioned in ancient Tamil scriptures dating back to the 4th century AD for its amazing benefits and culinary significance. Curry leaves that quintessential aromatic ingredient, found in the Indian households have innumerable health and therapeutic benefits [10].

So far, only one eriophyoid mite species has been reported on this host plant in the world namely *Paratetramurrayae* by Channabasavanna, from India in 1966 [11]. Present paper describes and illustrates another new species on this plant and also elucidates on the damage produced by the new mite on the host plant. The mite genus *Paratetra* was established by Channabasavanna [11] from India in 1966. Type species is *Paratetramurrayae* 1966. So far, under the genus *Paratetra*, 6 species including 5 from India are known [12-16]. One new species is added to this list from the area of present study.

II. MATERIALS AND METHODS

The shoots of plants were collected and placed in individual polythene bag. Care had been taken to avoid accumulation of moisture within the bags. These were finally stored in a refrigerator. The plant samples were examined under stereomicroscope within a short time to confirm whether there is infestation of mites or not. With the aid of a stereomicroscope the mites were picked up from the infested plant material with the help of a needle and placed onto a grooved slide containing Kono's medium. The slide was then placed on a hot plate having temperature of 50º C and cooked enough to clear the mites. The mites upon being cleared enough were mounted in Hoyer's medium after a bath in the same medium. The ingredients of Kono's mixture are cholral hydrate 100 g, Glycerin 10 g, water 50ml, concentrated HCI 1 ml. The mites were studied under a Leitz Dialux 20 microscope with provision for phase illumination. Camera lucida drawings were prepared using a built in draw tube type prism camera lucida attached to the microscope. The morphological terminologies and abbreviations used here were given by Lindquist [1] and the generic classification system followed is that of Amrine*et al*. [12].

Measurements were taken at (10 x 100X) magnification and strictly under phase contrast using an ocular micrometer. 10 specimens including the holotype were measured. The following measurements were taken during this study: i) length of body: distance from the anterior tip of the prodorsal shield to the posterior end of the body, ii) width of body: maximum width just behind rear prodorsal shield margin, iii) length of shield: distance from the tip of anterior lobe to rear prodorsal shield margin, iv) width of prodorsal shield: maximum width along rear shield margin, v) length of gnathosoma: length from base of proximal segment to end point of terminal segment, vi) length of legs: distance from base of trochanter to the tip of tarsus, vii) length of epigynum: maximum width across mid transverse line, viii) length of seta: distance from the socket to its tip. All measurements were taken as recommended by de Lillo *et al*. [17] and are given in micrometer (µm) referring to the length unless specified otherwise. In the text, measurements of holotype are followed by the range of measurements of the paratypes in the parentheses. Slides after being properly labeled with all relevant data were stored suitably. All slides bearing the type specimens were deposited in the Entomology Research Unit, Department of Zoology, Serampore College, Serampore, 9, William Carey Road, West Bengal, India. **New**

species has been registered in Zoo bank Account: 7DD19865-3A9B-473A-816F-00F9B9A555BD. *Paratetrabengalensis* Sarkar, 2011: 81. [18] and *Paratetrasubhimalayana* Sarkar, 2022 are Invalid name, as they were appeared in thesis of Author and a pre-print preliminary report in Research Square respectively.

Type materials studied: **Holotype**-Female (marked) on slide (no.1382/79/2019), India: West Bengal: Malda, 14.x.2019. from*Murryakoengii* Spr. (Rutaceae) Coll. S. Sarkar. **Paratypes:** 9 females on slide bearing holotype and 48 females on 6 slides (nos. 1383-1388/85/2019); collection data same as in holotype.

III. Result and Discussion

Paratetramurrayacolasp. nov. on Murryakoengii (Fig. 1)

Zoo Bank Account: 7DD19865-3A9B-473A-816F-00F9B9A555BD.

Based on taxonomic procedure for this particular group of mite, descriptions of the newly found mite species are discussed elaborately here to establish the new species of the genus *Paratetra* and relation to the host plant is also mentioned here. The etymology of the new name of the species is given following the Nomenclature Rules of International Code of Zoological Nomenclature. ***Paratetramurrayacolasp.* nov. on** *Murryakoengii*(Fig 1) is found new to science as this species has following unique taxonomic characteristics.

A. *Description of Female:*

Body is 149.3 (147.4-149.3) long, 62.5 (61.4-62.5) wide, reddish in colour. Gnathosoma is 14.0 (13.0-14.0) long, curved down, dorsal pedipalpgenual seta d is 6.5 (5.6-6.5) long, prodorsal shield is 37.3 (36.2-37.3) long , 50.4 (48.9-50.4) wide with a shield lobe; prodorsal shield design presents pattern of ridges and carinae, median line is absent, admedian lines in shield lobe take a shape of 'Y' and then form a pentagonal cell and after that again diverge to touch the two ends of the 'V' shaped ridge between the dorsal tubercles, faint impression of submedian lines are present in shield lobe but distinctly run up to base of dorsal tubercles, from submedian lines two carinae come out to meet the lateral angular point of pentagonal cell, at each lateral margin of prodorsal shield 3 closed cells are found; dorsal tubercles is 7.4 (6.5-7.4) long, 21.4 (20.3-21.4) apart and present on rear shield margin, scapular seta *sc* is 23.2 (23.2-24.2) and knobbed terminally. Leg I from base of trochanter is 25.6 (24.2-25.6) long; femur is 9.3 (8.9-9.3) long, with basiventral femoral seta *bv* having length 11.2 (10.2-11.2); genu is 4.6 (3.7-4.6); tibia is 5.6 (4.6-5.6) long, without paraxial tibial seta *1*' ; tarsus is 5.6 (5.6-6.5) long; two identical tarsal setae-paraxial fastigial tarsal setae *ft*' and antaxialfastigial tarsal seta *ft*" are 18.6 917.5-18.6) long; paraxial unguinal tarsal seta *u*' is 3.7 (2.8-3.7) long, tarsal solenidion ω is curved knobbed and 8.4 (7.4-8.4) long, 5 rayed tarsal empodium*em* is 4.6 (4.6-5.1) long. Leg II from base of trochanter is 24.2 (23.2-24.2) long, femur is 9.3 (8.9-9.3) long, with basiventral femoral seta *bv* of 10.2 (10.2-11.2) long; genu is 4.6 (3.7-4.6) with antaxialgenual seta of 4.6(4.1-4.6)long, tibia is 4.6 (3.7-4.6) long, without paraxial tibial seta *1*'; tarsus is 5.6 (4.9-5.6) long, paraxial fastigial tarsal setae *ft*' is 18.6 (17.5-18.6), antaxialfastigial tarsal seta *ft*" is 5.6 (5.6-6.5), paraxial unguinal tarsal seta *u*' is 3.7 (2.8-3.7), tarsal solenidion ω is knobbed, curved and 11.2 (9.3-11.2) long; 5 rayed tarsal empodium*em* is 4.6 (3.7-4.6)long. Coxae I is 12.1 (12.1-13.0) long ,contiguous with distinct sernal line; coxal surface is smooth; 1b tubercles and seta present at anterior margin of coxa; 1a tubercles with seta present ahead of line across the 2a tubercles with seta; seta 1b is 9.3 (8.4-9.3), seta 1a is 19.6 (18.4-19.6) long; Coxa II is widely separated, smooth, at the junction between coxa and trochanter longitudinal parallel lines

are seen, and is 11.2 (10.2-11.2) long, seta is 2a 23.3 (22.4-23.3) long. Opisthosoma is with 38 (37-38) smooth dorsal annuli and 64 micro-tuberculeted ventral annuli; micro tubercles are rounded and located on ventral annular lines; last 9 ventral annuli have micro striation, lateral sides of 2nd and 3rd dorsal annuli beset with teeth like micro tubercles, first 3-4 dorsal annuli are not depressed dorsally but the rest form a broad, longitudinal trough flanked by narrow ridge on either side, last 4-5 dorsal annuli form complete rings; seta *c2*is 18.6 (18.6-19.6) on annulus 9 (8-9), seta *d is* 60.6 (59.6-60.6)long on annulus 23 (23-25); seta *e is* 8.4 (8.4-9.3)long on ventral annulus 38 (37-38); seta *f* is 15.8 (14.9-15.8) long on ventral annulus 58 (56-58); seta *h1* is 1.5 (1.5-2.1) long, seta *h2* is 56.0 (55.2-56.0) long. Genitalia is 9.3 (8.9-9.3) long, 10.2 (10.2-10.9) wide; epigynum is with 15 longitudinal scorings; seta *3a* is9.3 (8.9-9.3) long.

B. *Description of Male: Not Observed*

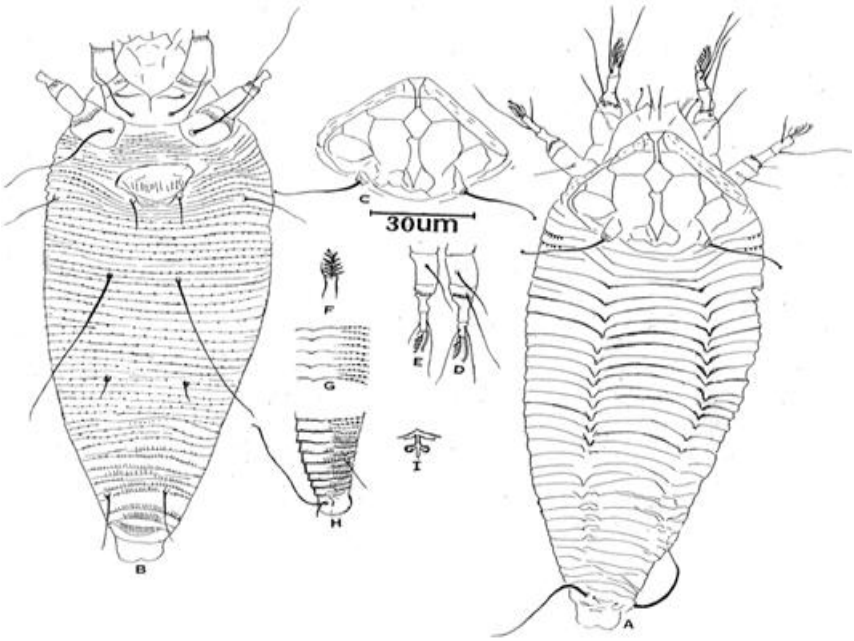

Fig 1.*Paratetramurrayacola*sp. nov.: A. Dorsal view of mite; B. Ventral view of mite showing coxalgenital region; C. Prodorsal shield; D. Leg I; E. Leg II; F. Tarsal empodium with solenidion; G. Lateral opisthosomal annuli; H. Lateral view of caudal end; I. Apodeme.

C. *Diagnosis as a New Species:*

So far, 6 species including 5 species from India under the genus *Paratetra* are known [12] (Amrine*et. al.*, 2003). The new species resembles *P. elephantae* and in having 5 rayed tarsal empodium and longitudinal scrings on epigynium, but differs from *P. elephantae* not having median longitudinal fold on prodorsal shield. The new species also resembles *P. integrifoliavagrance* in absence of median lines and having similar dorsal trough on opisthosoma but differs from it by having 5 rayed tarsal empodium (in *P. integrifoliavagrance*it is 4 rayed) and not having any granulation on the prodorsal shield and on epigynium base. The new species shows very close resemblance with *P. murrayae* by sharing common host plant, 5 rayed tarsal empodium. but differs from *P. murrayae* by sculpture of prodorsal shield in details, by presence of longitudinal scorings on lateral sides of first 3 dorsal annuli, presence of knob like structures at the tip of scapular setae and dorsal pedipalpgenual seta *d*. Presence of longitudinal scorings on lateral side of first 3-4 dorsal annuli, longitudinal scorings at joint between coxa and femur and femur and genu and prodorsal shield pattern make the species a new.

D. *Etymology of New Name:*

The specific epithet '*murrayacola'* derived from the generic name of the host plant '*Murraya'* and latin word *'cola'*means inhabitant. *Paratetrabengalensis* Sarkar, 2011: 81. [18] and *Paratetrasubhimalayana* Sarkar, 2022 are invalid name, as they were appeared in thesis of Author and a pre-print preliminary report in Research Square respectively.

E. *Relation to the Host Plant:*

Mites are found vagrants on tender shoots including leaves; may cause some browning of leaves. Infested leaves fall off eventually. Shoot becomes dry.

IV. Conclusion

*Paratetramurrayacola*sp. nov. is appeared new to science and second species under the genus *Paratetra.* This new mite belongs to the Class Acari of the Family Eriophyidae and found as a potential pest of the economically important plant *Murrayakoengii* commonly known as Curry leaves. This tiny plant feeder sucks nutrients from this plant and shoots become dry and brown and dry leaves fall of eventually. The new species appears as a potential pest of curry leaves. The basic necessity for the proper control or eradication of any harmful organisms is to know its systematics as well as its degrees of damages inflicted on the host. In this regard, the eriophyoid mites are needed to understand in greater details particularly in India as the study of Indian eriophyoid is still at infant stage and most of the workers are stray and mainly on taxonomy. Therefore, it requires exploring the eriophyoid fauna through faunistic surveys all over the country on zonal basis and subsequently the relevant biology, ecology etc. of the economically important species.

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AUTHOR'S PROFILE

Dr. Sanjay Sarkar, did his Ph.D. in the year 2011 from University of Kalyani. He is an Assistant Professor of the Department of Zoology (For UG & PG Studies), Serampore College (Affiliated to Calcutta University). Dr. Sanjay Sarkar has significantly contributed in the field of Entomology and Acarology. Dr. Sarkar started his research career in Taxonomy and Bio-Ecology of Parasitoids of aphids infesting cereal plants at Josimath in Uttarakhand. Following research on this line Dr Sarkar became interested in the Biosystematics of phytophagous mite. Dr. Sarkar discovered two new Genera of plant mites. He has reported altogether 51 species under 28 genera of Eriophyoid mite among which 19 species appear new to Science. Dr. Sarkar was awarded for his contribution on Eriophyoid taxonomy in International Sy--mposium on Acarlogy conducted by Acarology Development Foundation, USA. He was invited to deliver a talk on mite taxonomy in XV International Acarological Congress, Antalya, Turkey in 2018. Reseaarch Gate https://www.researchgate.net/profile/Sanjay-Sarkar-4?ev=hdr_xprf&_sg=_Cq3zx _X_z-8kyro-YKJMa0o9b G-G_9hmaKqh0dzeNHwt_7MkejkY2nwOOn-JIRqERAYAp0zPTPyyZ9zJ7bDaSiz