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Research paper

Taxonomic study of a new species of sap sucking mite (Acari:Eriophyidae) found on a medicinal plant- *Mitragyna parvifolia* (roxb.) Korth (rubiaceae) from Indo-Gangetic plain of India

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Abstract

During general surveys for eriophyoid mites in the Indo-Gangetic Plain of India, a new species, *Abacarus indogangeticus* n. sp. of the family Eriophyidae, was found on the ventral and dorsal surfaces of the leaves of *Mitragyna parvifolia* (Roxb.). Korth (Rubiaceae). *Mitragyna parvifolia* is a medium to large deciduous tree, and it is recommended in Ayurveda for the prevention and treatment of many health issues. After a thorough study, this mite species appears to be new to science, so the morphometric and diagnostic features of this new mite species are well described and illustrated from the area of the present study. A brief discussion on the genus *Abacarus* and the relationships of new species with other eriophyoid species is also provided. This new mite species causes damage to this economically important medicinal plant by its sap sucking habit and produces leaf rusting and brown patches on leaves as visible damage symptom. Due to the infestation of this mite, the leaves become unsuitable for medicinal use. The etymology of the new name of the mite is mentioned here. The holotype and paratype specimens are deposited in a national repository, and registration of new species in the Zoo-Bank Account is done following the International Code of Zoological Nomenclature. For proper control and eradication of the mite pest, the taxonomic study of this mite and their relation to the host plant is very much essential.

Keywords: *Abacarus indogangeticus; Eriophyidae; India; New Mite Pest; Mitragyna parvifolia.*

1. Introduction

Eriophyoids are morphologically and biologically highly specialized group of sap sucking mites (Shukla, 2021, Vervaet, 2021) on various plant species and are considered as a serious pest throughout the world (Abdel-Khalek & Momen, 2022; Brown et al., 2021). They produce various damages to the plant parts and are responsible for the transmission of many viruses to the plant tissues during their feeding on them (Druciarek et al., 2019; Sarwar, 2020; Stephan et al., 2008; Hajizadeh and Hosseini, 2023). A survey is conducted for these mites in the Indo-Gangetic plain of the sub-Himalayan belt of India during July and August 2024. A detailed study of the collection made on *Mitragyna parvifolia* yields a new species of the genus *Abacarus* Keifer, 1938 (Keifer 1938) from the area of the present study. *Mitragyna parvifolia* is a medium to large deciduous tree (Fig.1A and Fig. 1 B) with a rounded crown up to 25 m tall. It is found throughout the greater parts of India up to an altitude of 1200 meters. This plant is recommended in Ayurveda for the prevention and treatment of many health issues such as Anti-arthritic, Antipyretic, Anticonvulsant, Anthelmintic, Antimicrobial, Anti-inflammatory, Anti-nociceptive, Anti-proliferative and Antioxidant activity (Ashutosh Pal Jain et al. 2016; Gupta et al. 2009). A range of indolic and oxindolic alkaloids have been reported from *Mitragyna parvifolia* leaves and stem barks (Shellard et al. 1969; Seki et al. 1993; Pandey et al. 2006). This new mite species is found along the ventral and dorsal surface of the leaves as vagrants (Fig.3) producing brown rusty patches (Fig 4.). According to a working Catalog of the Eriophyoidea of the World, Version 1.0 - The Catalog of the Eriophyidae by Joel Hallan (biocat@ccms.net) as of 2024, 59 species including 11 species from India under the genus *Abacarus* Keifer, 1938 are known (Li *et al*. 2023, Lotfollahi et al. 2023, Amrine *et. al*., 2003, Mohanasundaram 1980 and 1986). However, based on morphological differences from other closely related species, a new species *Abacarus* indogangeticus n. sp. has been discovered through analysis of specimens collected from the area of the present study. As a result of this study, 12 species of *Abacarus* have now been identified in India's Eriophyoid fauna.

2. Materials and methods

Eriophyoid mites are examined with the help of a hand-lens (30X) on infested plant parts. The infested shoots of plants are collected and placed in an individual polythene bag. These bags are then brought to the laboratory. The collected plant parts are duly labeled, and herbaria are also prepared for their identification. To prevent the damage caused by desiccation or fungal degradation, mite-infested fresh plant samples are brought to the laboratory as soon as possible. They are not exposed to heat to avoid moisture accumulation within the bags and are contained in plastic bags and are contained in a cooler. To keep the material fresh, the samples are wrapped in a damp (not wet) paper towel, then sealed in a plastic bag, preventing them from drying out, and stored in a refrigerator. Fine holes are punched in the plastic bag to reduce humidity whenever necessary. The plant samples are examined under a stereomicroscope within a short time to confirm whether there is infestation of mites or not. With the aid of the stereomicroscope, the mites are picked up from the infested leaves with the help of a needle and placed onto a grooved slide containing Kono's fluid (Jepson et al., 1975). The slide is then kept on a hot plate at having temperature of 40ºC and cooked long enough to clear the mites. Upon being cleared, the mites are mounted in Hoyer's medium after a bath in the same medium. The ingredients of Kono's mixture are chloral hydrate 100 g, Glycerin 10 g, water 50 mL, concentrated HCl 1 ml. The mites are studied under a Leitz Dialux 20 microscope with provision for phase illumination. Camera Lucida drawings were prepared using a built-in draw tube type camera lucida attached to the microscope. The morphological terminologies and abbreviations used here were given by Lindquist (1996), and the generic classification system followed is that of Amrine et al. (2003).
Measurements were taken at (10 x 100X) magnification and strictly under a phase contrast microscope using an ocular micrometer. Sixty-nine specimens, including the holotype, were measured. The following measurements are taken during this study: i) width of body of the mite: maximum width just behind rear prodorsal shield margin, ii) length of body: distance from the anterior tip of the prodorsal shield to the posterior end of the body, 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 are taken as de Lillo et al. (de Lillo e.t al. 2010) recommended and are given in micrometres (μm) referring to the length unless specified otherwise. In the text, measurements of the holotype are followed by the range of measurements of the paratypes in parentheses. Slides, after being properly labeled with all relevant data, are stored suitably. The slide bearing the type specimen has been deposited in the Entomology Research Unit (A Biosystematics Research Unit. (After publication the same will be deposited in Zoological Survey of India, a national repository), Serampore College of the University of Calcutta, Serampore, 9, William Carey Road, West Bengal, India. Registration of this new species in the Zoo Bank account: LSID urn: lsid: zoobank.org: pub: 20D2B3B4-430A-4392-B978-E61165A70D3E.

3. Observation and results

Based on a morphometric study and differential diagnosis of the new species with other closely related mites, it appears as a new Eriophyoid mite that causes severe damage to the leaves of the host plant. So, the detailed taxonomic descriptions and illustrations of the new species are given here to establish the mite as a new species of the genus *Abacarus*, and its relation to the host plant is also mentioned here.

3.1. Description of the genus *Abacarus* Keifer: type species: *Abacarus acalyptus* (Keifer, 1939)

The body is usually flattened, fusiform in shape. Gnathosoma of moderate size; prodorsal shield subtriangular, with frontal acuminate lobe over gnathosoma; scapular tubercles on rear prodorsal shield margin, directing setae caudad; legs with all usual setae, empodium simple. Opisthosoma with almost equal number of dorsal and ventral annuli or ventral annuli slightly more; with one median and two lateral longitudinal wax bearing ridges on the dorsum; median ridge terminating ahead of the lateral ridges; ventral annuli micro tuberculated; ventral side of opisthosoma contains all usual setae. Female genitalia situated at moderate distance behind coxae II, epigynium longitudinally scored or smooth, anterior width. of the internal genital apodeme is of normal title and author details must be in single-column format and must be centered.

3.1.1. Remarks

Abacarus Keifer a phyllocoptinae genus, is characterized by the possession of three dorsal wax-bearing ridges of the opisthosoma. In this respect, it comes close to *Calepitrimerous* and *Callyntrotus*. Both these genera are easily separable from *Abacarus*. Since they possess scapular tubercles well ahead of the prodorsal shield margin, with the scapular setae pointing upwards. In addition, *Callyntrotus* has wax bearing ridges that are narrower and spiny. Roivainen (1951) sought to synonymize this genus with Phytocoptes on the ground that the only species described under the latter, *Phytocoptes dubius*, bears a very close resemblance to *Hystrix* Nalepa, placed by Keifer (1944) in *Abacarus*. Channabasavanna (1966) referred *Abacarus* as a separate genus given the non-availability of the original material described by Nalepa (1894) for comparison. Here, *Abacarus* is also treated as a distinct genus. So, 59 species under this genus are known from the world. Only 11 species are from India. In this work, one new species is found in the present area.

3.1.2. Family of the host plants attacked by this genus

Poaceae, Anacardiaceae, Combretaceae, Ericaceae, Malvaceae, Myrtaceae, Rubiaceae, Sapidaceae.

3.1.3. Distribution

India, Africa, China, Europe, North and South America, Thailand.

Fig. 1: A. *Mitragyna pervifolia*, the Host Plant of the Mite

Fig. 1: B. Plate Showing Fresh and Tender Shoot of *Mitraygyna pervifolia*

3.2. Description of new species: *Abacarus indogangeticus* n. sp. (Fig. 2. Holotype)

Female (holotype and 65 specimens studied): Body 177.3 (176.4-177.3) long, 65.3 (65.3-66.2) wide, fusiform with 3 wax-bearing ridges up to the first 14 dorsal annuli, white. Gnathosoma (Fig.2A.- LM)19.6 (18.4-19.6) long, curved down, dorsal pedipalp genual seta d 5.6 (5.1-5.6) long, subepical pedipalp tarsal setae 3.7 (2.8-3.7). Prodorsal shield (Fig. 2B.-AD): 38.2 long, 59.7 (58.8-59.7) wide with a shield lobe; anterolateral region of prodorsal shield granulated, median line absent, ad median line run parallel at anterior margin of the shield and then sinuate touching each other by a transverse line, ad median lines divergently ends a little ahead of the rear shield margin, sub median lines run divergently and meet the rear margin, dorsal tubercles on rear shield margin and 26.0 (26.0-27.3) apart, scapular setae sc 6.5 (5.6-6.5). Opisthosoma (Fig.2A- LM) with 35 (33-39) smooth dorsal annuli and 61 (59-62) microtuberculeted ventral annuli; micro tubercles small bead like along annular margins tending to elongate on sternites of rear halfi; last 14 ventral annuli have micro striation, seta c2 28.0 (26.1-28.0) on annulus 12 (10-12), seta d 56.0 (53.0-56.0) long on annulus 26 (24-27); seta e 14.0 (13.0-14.0) long on ventral annulus 40 (39-42); seta f 21.4 (19.6-21.4) long on ventral annulus 55 (54-56); seta h1 3.7 (2.8-3.7), seta h2 49.4 (48.5-49.4) long. Leg I (Fig. 2C) from base of trochanter 28.0 (27.3-28.0) long; femur 10.2 (9.8-10.2) long, with basiventral femoral seta bv 9.3 (8.9-9.3); genu 4.6 (4.6-4.8), antaxial genual seta 1" 19.6 918.4-19.6); tibia 7.4 (6.5-7.4) long, paraxial tibial seta 1' 4.6 (3.7-4.6); tarsus 5.6 (4.6-5.6) long; paraxial fastigial tarsal setae ft' 17.7 (17.7-18.6) and antaxial fastigial tarsal seta ft" 14.0 (14.0-14.9) long; paraxial unguinal tarsal seta u' 3.7 (3.1-3.7) long, tarsal solenidion ω slightly curved and knobbed and 4.6 (3.7-4.6) long, 4 rayed tarsal empodium em (Fig. 2 E) 4.6 (3.7-4.6) long. Leg II (Fig. 2D) from base of trochanter 27.0 (26.6-27.0) long; femur 10.2 (9.8-10.2) long, with basiventral femoral seta bv 9.3 (8.4-9.3), genu 4.6 (3.7-4.6), antaxial genual seta 1" 5.6 (4.6-5.6),; tibia 5.6 (5.6-6.5))long, without paraxial tibial seta 1'; tarsus 5.6 (5.6-6.5) long, paraxial fastigial tarsal setae ft' 18.6 (17.4-18.6), antaxial fastigial tarsal seta ft" 3.7 (2.8-3.7), paraxial unguinal tarsal seta u' 2.8 (2.1-2.8), tarsal solenidion ω slightly curved and 4.6 (4.1-4.6) long; 4 rayed tarsal empodium em 4.6 (3.7-4.6) long. Coxal- genital region (Fig. 2 F.-CG): Coxae I 17.7 (16.8-17.7) long and contiguous, sternal line faint, coxal surface smooth except granulation along the sternal line, 1b tubercles with seta present; seta 1b 12.1 (11.2-12.1), 1a tubercles with seta present a little ahead of line across the 2a tubercles with seta; seta 1a 19.6 (18.4-19.6) long; Coxae II smooth except two wavy lines in lateral portion of both coax, coax II 14.0 (13.4-14.0) long, seta 2a 42.0 (41.3-42.0) long, coax I and coax II overlap with each other. Epigynium (Fig. 2F.-CG) 17.7 (15.8-17.7) long, 23.3 (22.4-23.3) wide; anterior side of epigynium shows 9 longitudinal scoring; seta 3a 14.9 (14.0-15.8) long. Internal genitalia (Fig.2G): internal genitalia show two clear spermatheca and a short, slightly curved oviduct.

Male: Not observed, since from the taxonomic point of view, the female of this group of mite varies greatly species to species. So, the description of the holotype specimen is solely based on the female mite.

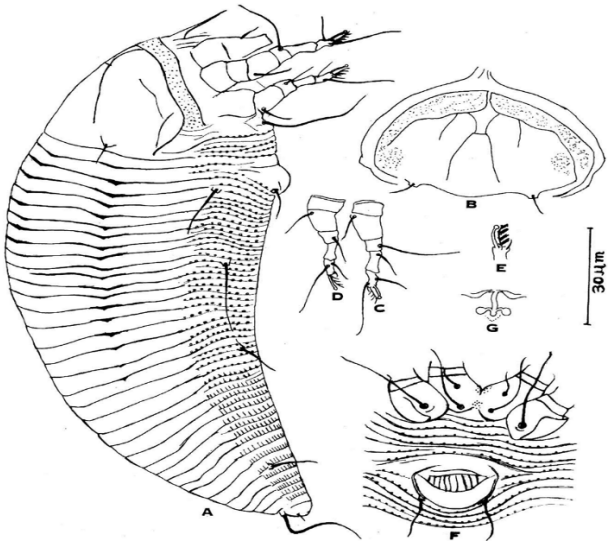

Fig. 2: Camera Lucida Line Drawing of *Abacarus indogangeticus* **n. sp.** (Holotype.), 1335/40/2024, A-Lateral Mite (LM); B- Antero-Dorsal Mite (AD); C- Leg I (L1); D- Leg II (L2); E- Tarsal Empodium of LI (Em); F- Coxal-Genital Region (CG); G- Internal Genitalia, Female.

3.2.1. Type material

Holotype: Female (marked) on slide (no.1335/40/2024), India: West Bengal: Malda, Englishbazar, 15.07.2024 from *Mytragyna parvifolia* (Roxb.) Korth (Rubiaceae) Coll. S. Sarkar. Paratypes: 10 females on slide bearing holotype and 56 females on 8 slides (nos. 1336-1343/40/2024); collection data same as in holotype. Type Locality: India: West Bengal: Malda, Englishbazar: Latitude: 24°50'40" N and Longitude: 87°55'50" E.

3.2.2. Etymology

The specific epithet '*indogangeticus*' is derived from 'Indogangetic plain', the type locality from which holotype specimen is collected and described. ZOOBANK Registration ID for new species: LSID urn:lsid:zoobank.org:pub:20D2B3B4-430A-4392-B978-E61165A70D3E.)
[*Abacarus mitragynae* sp. nov. Sarkar, 2011: 81. Invalid name, a thesis name]

3.2.3. Relation to the host plant and nature of damage

Mites are found as leaf vagrants on the ventral and dorsal surfaces of leaves (Fig.3), producing brown patchy areas and rust on leaves (Fig.4), causing premature fall of leaves. Infestation of this mite causes economic damage by making the leaves unsuitable for medicinal use.

Fig. 3: Plate Showing New Species of Mite on Ventral Surface of Tender Leaf of *Mitragyna parvifolia*.

Fig. 4: Plate Showing Brown Patches and Rust on Leaves of *Mitragyna parvifolia*.

4. Discussion

A working Catalog of the Eriophyoidea of the World. Version 1.0 - The Catalog of the Eriophyidae by Joel Hallan (biocat@ccms.net, Amrine & de Lillo, personal electronic data; Amrine et. al., 2003, Maity and mondal 2023) reflects that, as of 2024, the genus *Abacarus* includes 59 species including 11 from India. The new species shows similarities with A. *ureutae* keifer (1972) in its general shield pattern and shape of body but differentiated from it by the non-granular surface of coax II and 4 rayed tarsal empodium. It shows similarities with *A. goaensis* Mohanasundaram (1980) in having h1setae, presence of longitudinal scorings on epigynium and the location and direction of scapular setae is same in both species but differs from the *A. goaensis* by surface pattern of coxa I, prodorsal shield pattern and presence of smooth dorsal annuli. The new species shows very close resembles with *A. foliavagrance* Mohanasundaram (1986) by 4 rayed tarsal empodium, similar location and direction of scapular setae, smooth dorsal annuli, presence of h1seatae, scorings pattern on epigynium, but the new speciec is different from it by more numerous scoring on epigynium, presence of granulation on anterolateral region of prodorsal shield, presence of granulation along the sternal line and presence of transverse connection between admedian lines.

5. Conclusion

The necessity for the proper control or eradication of any harmful organisms is to know their Taxonomy and Systematics, as well as its degree of damage inflicted on the host. This group of phytophagous mites needs to be understood in greater detail, particularly in India, as the study of Indian eriophyoids is still at an infant stage. This Taxonomic study in this line reveals a new species of pest occurring on *Mitrygyna parvifolia*. These findings may be helpful to the plant pathologist in finding out the causes of damage symptoms of the plants. To save this medicinal plant from this mite pest, subsequent studies on the relevant biology, ecology, etc. of the economically important species are needed.

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