



RESEARCH NOTE

First report of invasive soft scale, *Fistulococcus pokfulamensis* Hodgson & Martin (Hemiptera: Coccidae), in Kerala, India

DESAVATH GOUTHAMI¹, HASEENA BHASKAR^{1*}, SUNIL JOSHI², VIDYA, C. V.¹ and DEEPTHY, K. B.¹

¹Department of Agricultural Entomology, College of Agriculture, Kerala Agricultural University, Vellanikkara, KAU PO, Thrissur, 680 656, Kerala, India.

²Division of Germplasm Collection and Characterization, ICAR- National Bureau of Agricultural Insect Resources, Bellary Road, Bengaluru 560 024, Karnataka, India.

*E-mail: haseena.bhaskar@kau.in

ABSTRACT: The soft scale, *Fistulococcus pokfulamensis* Hodgson & Martin (Hemiptera: Coccidae) is an invasive pest recently reported from Karnataka, India. During the field surveys conducted in Kerala, *F. pokfulamensis* was recorded on two host plants, *Jatropha integerrima* Jacq. (Euphorbiaceae) and *Mangifera indica* L. (Anacardiaceae). This new geographical distribution record warrants special attention to prevent further spread and its impact on horticultural crops in the country.

Keywords: Coccinae, Horticultural crops, Invasive pest, Soft scale

The superfamily Coccoidea includes at least 55 families (35 extant and 20 extinct), among which Coccidae (Soft scale insects) is the third largest, with over 1,200 described species (García Morales, 2016). Soft scales are significant pests of agricultural and horticultural crops as well as ornamental plants. They feed by sucking plant sap and excrete honeydew that allows sooty mould fungus to grow on plant surfaces, and also attracts ants. The sooty mould severely interferes with the plant photosynthesis and vigour. In addition to direct damage to plant, the presence of scale insects is a major phytosanitary issue, as they are often intercepted during international trade. The quarantine authorities are on high alert to prevent the introduction and spread of scale insects to new countries through trade.

Recently, a pest alert was given by ICAR-NBAIR, Bengaluru, with regards to a soft scale species, *Fistulococcus pokfulamensis* Hodgson & Martin (Hemiptera: Coccidae) (Joshi *et al.*, 2023). It was first reported in India from Bengaluru district, Karnataka, on two host plants (Joshi *et al.*, 2022), which later spread to many economically important host plants within the district as well as in neighbouring districts. In this paper, we report a new distribution of the scale species, *F. pokfulamensis* from Kerala.

During the routine field surveys conducted in November, 2024 to collect soft scales associated with agricultural ecosystems, scale insect specimens were collected on the ornamental plant, *Jatropha integerrima* Jacq. (Euphorbiaceae) from Olavakkode (10.80032°N, 76.64378°E) and on *Mangifera indica* L. (Anacardiaceae) from Muthalamada (12.21055°N, 75.42872°E), in Palakkad district. The infested plant parts were cut with secateurs, kept in polythene cover and secured with rubber band. Ants and natural enemies associated with the soft scales were also collected. The location details viz., latitude and longitude, were noted using GPS Map Camera Lite app. The field photographs were taken using mobile camera. On return to the laboratory, parasitized specimens were kept in a rearing jar covered with wire mesh, until the emergence of adults. The infested plant parts were observed under the stereo-binocular microscope (ZEISS Stemi 305), the soft scale specimens were picked up using a camel hair brush, and preserved in 70 per cent ethyl alcohol for slide mounting. The specimens were also preserved in 90 per cent ethyl alcohol and stored at -20°C in a refrigerator for molecular studies. The specimens were slide mounted by following the method developed by Hodgson and Henderson (2000).

For molecular studies, the DNA was isolated using Qiagen DNeasy blood and tissue kit method, except lysis for about 16-18 h at 65°C. Amplification of the 658 bp region near the 5 terminus of the mitochondrial protein-coding gene, *mt CO I* was carried out by polymerase chain reaction (PCR). The initial denaturation at 94 °C for 3 min. followed by 48 °C for 1 min. for annealing and 72 °C for 5 min for final extension using 20 µl reaction volume containing 10 µl EmeraldAmp® GT PCR Master Mix (Takara), 6 µl of molecular water, 2 µl template DNA, and 1 µl each forward primer and reverse primers. Forward and reverse primers specific to the COI locus (PCOF-10 & LEP-R1), developed by Amouroux *et al.* (2019) were used for the amplification. The amplicons were sequenced by outsourcing at GeneSpec Private Limited, Cochin. The sequence analyses were carried out using *In-silico* tools (BLASTn, MEGA XI) and the sequences were submitted to NCBI GenBank and BoLD.

The morphological and molecular characterisation of the scale insect specimens collected on *J. integerrima* and *M. indica* from two different locations in Palakkad district, Kerala revealed that the species is *F. pokfulamensis*. The species was identified using the taxonomic keys developed by Hodgson and Martin (2005), Joshi *et al.* (2022) and Joshi *et al.* (2023). It was first described by Hodgson and Martin (2005) on *Gnetum luofuense* (Gnetaceae) from Hong Kong and Papua New Guinea. The symptoms, diagnostic characters, and taxonomic characteristics of *F. pokfulamensis* are detailed below.

Field symptoms: The scale insect congregated on the undersurface of the leaves along the midrib and main veins, covered with white waxy material (Plate 1J). Sooty mould growth was noticed on the upper surface of the leaves lying below the infested leaves. The severely affected leaves showed yellowing and premature dropping. The infestation was severe on *J. integerrima* compared to mango.

Diagnostic characters: Body completely flat, with a slight median longitudinal ridge present anterior to the anal plates. Dorsum covered with white waxy dusting, giving the body a frosted appearance in life. White wax filaments or threads arise near the margin. Body becomes transparent yellow, with brownish alimentary canal clearly seen through the derm, on removal of wax.

Taxonomic description: Dorsum: Body broadly oval, membranous, with the anterior end slightly pointed and broadest at posterior, occasionally asymmetrical in shape

(Plate 1A); dorsal setae numerous, typically grouped in clusters of 3-6, arranged in crescent shaped pattern between submarginal chambered ducts (Plate 1E); dorsal pores of three distinct types: small microduct associated pores, frequent at submarginal areas, large concave pores, more substantial than those associated with dorsal microducts, located submedially and submarginally (Plate 1F); preopercular pores abundantly arranged in two longitudinal bands originating from the anal plates and extending towards head; submarginal chambered ducts are pipe like and restricted to submargin, each consists of a prominent tubular duct with approximately 8–12 satellites of funnel-shaped pores forming a U-shaped area of sclerotization at the duct opening, typically associated with 3–9 setae (Plate 1E). **Margin:** Marginal setae with blunt apices (Plate 1B); stigmatic clefts highly sclerotized and constricted at the body margin, lacking stigmatic setae (Plate 1C). **Venter:** Antennae 6 segmented but with indistinct segmentation (Plate 1H); legs highly reduced, without clear segmentation between tibia and tarsus (Plate 1I); spiracle without sclerotic plate (Plate 1D); multilocular pores very sparse; anal plate quadrate, each bearing four apical setae (Plate 1G).

Measurements (µm): Body length: 1876. Body width: 1313. Anal plate: anterolateral margin- 472-475; posterolateral margin- 775-780.

Molecular identification: The homology analysis of the *mtCO I* gene sequence of the specimen showed 98.32 per cent similarity with the sequence of *F. pokfulamensis* (Accession OR515185.1) in NCBI database, confirming the species identity. The sequence generated in this study was submitted in the NCBI, GenBank under the accession number - PV765913.1. The assembled sequence submitted to BoLD with process ID: KGBC003-25.

Associated ants and natural enemies: The ant species, *Oecophylla smaragdina* (Fabricius) (Hymenoptera: Formicidae) was found associated with the scale insect. The natural enemies recorded were the parasitoid, *Blepyrus insularis* (Cameron) (Hymenoptera: Encyrtidae) (Plate 1L) and the two predators, an unidentified cecidomyiid (Plate 1K) and *Spalgis epius* (Westwood) (Lepidoptera: Lycaenidae) (Plate 1M). The ant, *O. smaragdina* and the predator, *S. epius* have been reported earlier to be associated with this scale species (Joshi *et al.*, 2022; Sampathkumar *et al.* 2024). *Blepyrus insularis* is known to be associated with Pseudococcidae and Signiphoridae (UCD Community, 2023) and has not been reported from Coccidae. Further studies on the rearing of this parasitoid

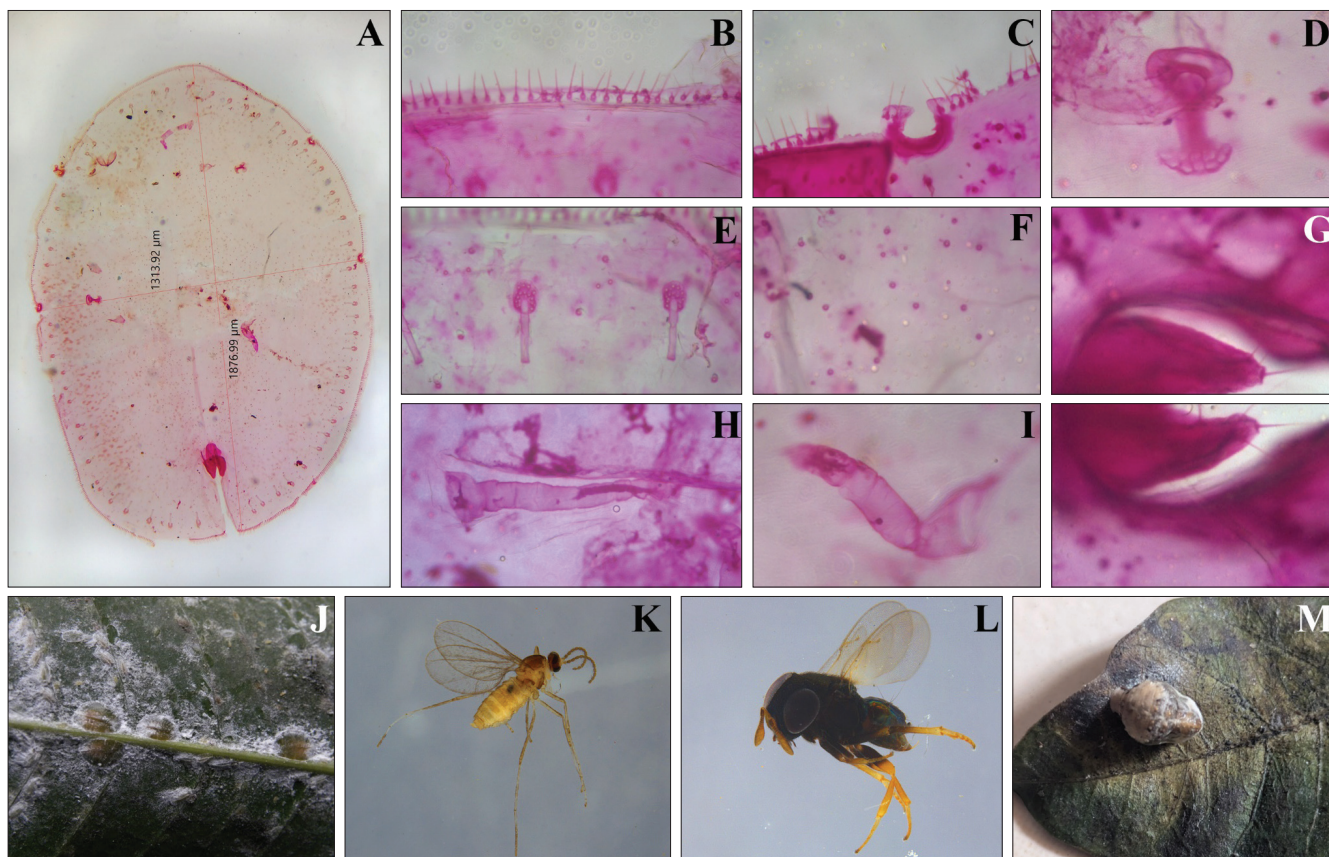


Plate. 1. Diagnostic characters of *Fistulococcus pokfulamensis* and associated natural enemies A. Habitus, B. Marginal setae, C. Sclerotised stigmatic cleft without setae, D. Spiracle, E. Submarginal pipe-like chambered ducts, F. Concave pores, G. Anal plate with four apical setae, H. Antenna, I. Reduced leg, J. Adult female, K. Unidentified cecidomyiid predator, L. Parasitoid, *Blepyrus insularis*, M. Pupa of *Spalgis epius*

on *F. pokfulamensis* as host are necessary to find out if this parasitoid-host association was accidental or if the scale insect was associated with some mealybug during collection, from which the parasitoid might to have emerged. Different species of Cecidomyiid predators have been reported on soft scales from Brazil (Culik and Ventura, 2013; Culik and Ventura, 2013a). Efforts are underway to collect and rear the cecidomyiid predator on *F. pokfulamensis* and to get identified.

This paper reports a new geographical distribution record of *F. pokfulamensis* in Kerala. The soft scale has been reported to spread on several economically important crops in Karnataka, within a short period of its first report in the state, indicating its invasive potential. As Muthalamada (Palakkad district) is the major mango growing belt in Kerala and located adjacent to Tamil Nadu, the scale insect may further spread within and across the state and negatively impact the horticulture crops. Strict vigilance is vital in early detection and containing the pest infestation through periodic surveillance and

monitoring in the horticultural/ agricultural ecosystems within the state and bordering areas.

ACKNOWLEDGEMENT

The ant species was identified by Dr. Himender Bharti, Punjabi University, Patiala, Punjab and the parasitoid was identified by Dr. Ramesh Kumar, Zoological Survey of India, Kolkata.

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MS Received: 20 April 2026
MS Acceptance: 25 June 2026