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ANOTE ON *ATHERIGONA ORIENTALIS* SCHINER INFESTING TOMATO IN INDIA

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ABSTRACT

***Atherigona orientalis* Schiner which had been earlier reported on rotten tomato as saprophagous, is reported as new record with field infestation on fresh tomato from India. Its identity with salient morphological details, confirmed with mtCOI-5P is explained herein.**

Key words: *Atherigona* **(***Acritochaeta***)** *orientalis,* tomato, field surveys, diagnostics, mtCo1, oviposition

Pepper fruit fly *Atherigona* (*Acritochaeta*) *orientalis* Schiner often can be a primary pest of few agricultural crops (Hibbard et al., 2012), although usually considered saprophagous (Pont, 1972). Worldwide it had been reported to infest vegetable crops like pepper, tomato (Nwankiti, 1977; Ogbalu et al., 2005), cereals like sorghum (Pont, 1972; Meksongsee et al., 1968; Avidov, 1961; Rivnay, 1962; Ramachandra Rao, 1923; Ogbalu et al., 2005) and maize (Pont, 1972; Grist and Lever, 1969). Sangjae and Jung (2016) reported the pest from greenhouse tomato in Korea where it is considered a quarantine pest. Cabbage and cauliflower (*Brassica olicaceae*), orange (C*itrus sinensis*), melon (*Cucurbis melo*), beans (*Phaseolus* spp.) are the other host plants (Ogbalu et al., 2005).

In India, *A. orientalis* had been reported to infest maize (Panwar and Sorup, 1985), wheat (Singh, 1975), sorghum (Ramachandra Rao, 1923), melon (Chughati et al.,1985) and soyabean (Singh and Chibber, 1972). Though *A. orientalis* is known to infest tomato elsewhere in the world there is no report of infestation on tomato from India. Earlier reports of the fly on tomato were on its saprophytic nature (Ramachandra Rao, 1923). It is a widely known pest of tomato in many parts of the world. Hence, this study with surveys undertaken to assess the field infestation, if any, of *A. orientalis* on tomato in India. Morphological and molecular analysis were used for species identification.

MATERIALS AND METHODS

Tomatoes with minute punctures which fell prematurely were collected from April to May 2017 in the experimental fields of the Division of Entomology, ICAR- Indian Agricultural Research Institute (IARI), New Delhi (28.6377°N, 77.1571° E). It is to be noted that the tomatoes were fresh and had no sign of rotting. The punctured fruits were transferred to two translucent PVC jars of 20 cm height and eight cm dia filled with sterilised sand up to six cm height and the jars covered with muslin cloth. The set up was maintained at 26 ° C. The flies emerged were collected and about 15 flies were preserved in 99% ethanol and ten of them pinned on minuten pins. Rest of the flies were released in jars containing fresh tomatoes for mating and rearing. The observations of adult oviposition behaviour were made.

For identification the flies where taken out of ethanol and were relaxed in a petri plate with cotton wetted with 1:1:1 mixture of distilled water, ethanol (99%) and ethyl acetate (99%) overnight and stretched, pinned and labelled next day. To observe taxonomic characters, genital segment or distal abdominal segments were removed with entomological pin with hooked tip. The genital parts were cleared with 10% KOH by overnight treatment. The genital segments were observed using Leica EZ24 stereozoom microscope. The photographs of the pinned adult fly and the genitalia were captured using Leica DFC 425 digital camera mounted on a Leica M205FA stereozoom microscope and processed with Automontage© software. Identification of the species was done following key by Pont and Magpayo (1995).

The whole insect was used to isolate the Genomic DNA by a DNeasy animal tissue kit following the manufacturer's instructions (Qiagen, Valencia, CA). The DNA extraction method followed Shashank et al. (2014). The study used the universal barcode primer described by Folmer et al. (1994) (LCO-50 -GGT CAA CAA ATC ATA AAG ATA TTG G-30; HCO-50 -TAA ACT TCA GGG TGA CCA AAA AAT CA-30) specific to mitochondrial cytochrome oxidase I (COI). Purified PCR product was sequenced in an automated sequencer (ABI Prism 3730; Applied Biosystems, USA) at the specific commercial facilities (SciGenome, India). One DNA barcode (mitochondrial cytochrome oxidase subunit I 5' region, mtCOI-5P) was generated. The sequences obtained were aligned with original sequence from NCBI database and verified as COI using BioEdit software (Altschul et al., 1990). The % identity between sequences were analysed by multiple sequence alignment (option: align two or more sequences) by BLASTN tool of NCBI (https://blast.ncbi.nlm.nih.gov/BlastAlign.cgi). The DNA sequences were submitted to GenBank of NCBI database (accession no. MH155275).

RESULTS AND DISCUSSION

Diagnostics: Based on important morphological features the species identity was confirmed as *Atherigona (Acritochaeta) orientalis* Schiner. Mitochondrial cytochrome oxidase I (COI) analysis confirmed the morphological identification. The % identity between sequence generated and the sequence of *A. orientalis* available in NCBI analysed by multiple sequence alignment using BLASTN tool of NCBI showed 98% similarity. This is the first report of field infestation of *A. orientalis* on tomato from India. This species can be taxonomically identified with its subgeneric characters viz., Basal lateral setae of scutellum almost half as long as the subbasal lateral setae (Fig. 1B); Presutural acrostichal setae often in 4-5 rows at suture (Fig.1A); Cross vein r-m usually at or beyond middle of cell dm (Fig.1C) and genitalia without a trifoliate process.

Adult of *A. orientalis* can be diagnosed with the following characters *viz*. Palpi elongate in male, broad and band-shaped in female. Male forefemur with a shallow preapical dorsal excavation, beset with dense black clothing-setulae. Basal scutellar setula stronger, the actual length at least one third as long as the sub-basal lateral seta. Small cross-vein placed at or beyond the middle of the discal cell. Male without hypopygial prominence and trifoliate process, with a normal cercal plate. Female ovipositor lacking the anterior paired plates on tergite 8. *Acritochaeta* can be separated from all known *Atherigona* by the more numerous presutural acrostichal setulae, which are quadriserial at suture and by the presence of a true dorsal preapical seta on hind femur, above the anterodorsal row (Pont, 1972; Pont and Magpayo, 1995).

Length: 0.89 mm Width: 0.37 mm

Specimens examined**:** Reared specimens were collected from fresh tomato.♂ 11♀ India: IARI New

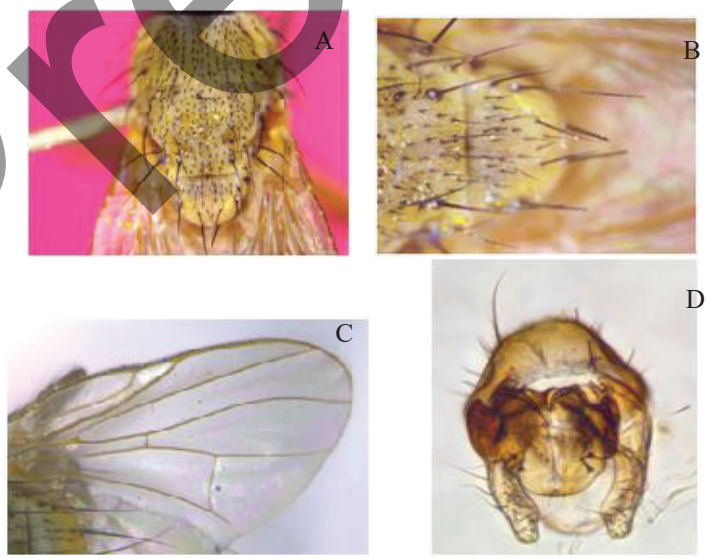

Fig. 1. (A to D A. orientalis) A. Presutural acrostichal setae often in 4-5 rows at suture, B. Basal lateral setae of scutellum almost half as long as the sub-basal lateral setae, C. Crossvein r-m usually at or beyond middle of cell dm, D. Male genitalia without trifoliate process.

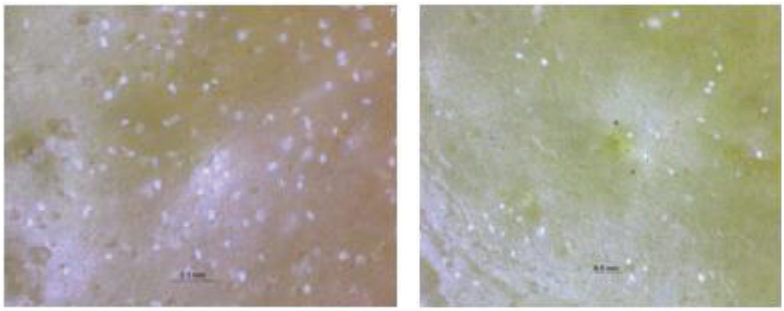

Fig. 2: Punctures caused by oviposition on surface of Tomato fruit (Scale 0.5 mm)

Delhi, 01.V.2017, Vinaya Kalia; Compared with 1♂ 1♀ India: IARI New Delhi, 13.ii.1943, larva from kitchen refuge, P V Issac.

Behaviour: Observations on the egg laying behaviour of adult in laboratory condition revealed that the adults can oviposit on any area on the fruit surface. Oozing of Sap in the form of small drops of transparent liquid was noticed at the site of oviposition. Punctures are formed at the site of oviposition (Fig. 2) which becomes sunken and produced yellow hallow. Each Fruits on an average had four to five sunken punctures.

Genus *Athergona* comprise of subgenus *Acritochaeta* Grimsaw and *Atherigona sens. strict.* whose larvae have different feeding strategies (Skidmore, 1985). Larvae of *Atherigona s*. *s*. are phytophagous and primary pests of various species of Poaceae, often causing economic loss in agriculture in the tropics and subtropics (Hibbard et al., 2012). Normally larvae of *Acritochaeta* are scavengers but from our study they are found infesting fresh tomatoes. Previous report from India suggested *A. orientalis* to be a saprophytic feeder of decaying tomato fruit (Ramachandra Rao, 1923) but our report confirms field infestation in India. Further investigations are needed to assess the extent of infestation of the species which needs extensive surveys across the country. Studies also need to be taken up on the mixed feeding behaviour, saprophagy and phytophagy in *A*. *orientalis*.

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