



## NEW RECORD OF THE GENUS *PARANTHRENELLA* STRAND (LEPIDOPTERA: SESIIDAE) FROM INDIA AND ITS INFESTATION ON AVOCADO

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### ABSTRACT

A member of the genus *Paranthrenella* Strand (Lepidoptera: Sesiidae) is reported for the first time from India. This is also the first report of *Paranthrenella* sp. on avocado (*Persea americana* Miller). Time of occurrence, nature and intensity of damage as well as biology details are discussed. Symptoms of infestation were confirmed from several places in Idukki district, with an extent of 70% at Attappallam area, Kumily Panchayath, Idukki district, Kerala (9°37'12" N, 77°9'6" E); 76.24% of the branches showed symptoms of drying.

**Key words:** Clear wing moth, Sesiidae, Synanthedonini, *Persea americana*, pest, biology, symptoms, infestation, damage, genitalia

Avocado (*Persea americana* Miller) (Lauraceae) evolved in the eastern and central highlands of Mexico, Guatemala, and the Pacific Coast of the Central America (Knight, 2002). Its fruits are low in sugar, high in fiber and fat-soluble vitamins in addition to high levels of protein, potassium, and unsaturated fatty acids (Comerford et al., 2016; Duarte et al., 2016). This fruit tree has not yet gained popularity in Asia (Papademetriou, 2000). In a very limited and scattered way, it is grown in Tamil Nadu, Kerala, Maharashtra, Karnataka, South-central India and the Eastern Himalayan state of Sikkim (Ghosh, 2000). At present avocado is one of the most popular “super foods”, and its consumption in Asia-Oceania region has increased rapidly (Huang et al., 2023). The number of insect pests on avocado is increasing considerably. De Villiers and Van den Berg (1987) lists 18 potential insect pests, four times the number recorded by Annecke and Moran (1982). Dennill and Erasmus (1992) explained the increasing pest complexity as well as changes in the relative importance of the pests on avocado. Wysoki et al. (2002) reviewed more than 150 insect pests, and the USDA-APHIS (2016) enlisted nearly 200 insect pests of which the Hemiptera, followed by Lepidoptera, are the two predominant orders. More than 150 lepidopteran pests in 21 families have been reported from avocado (Wysoki et al., 2002; Hoddle and Brown, 2010; Gilligan et al., 2011; USDA-APHIS, 2016; Robinson et al., 2023). Clearwing moths, which belong to the family Sesiidae, are small to medium-sized moths notable for their stunning mimicry of hymenopterans. Sesiid

members like *Synanthedon resplendens* Edwards and *Bembecia chrysidiformis* Espar had been reported in avocado (Robinson et al., 2023). Synanthedonini is the largest tribe of the clearwing moth, with 739 species under 38 genera (Liang and Hsu, 2015; 2019). The genus *Paranthrenella* was established by Strand (1916) on the basis of *Paranthrenella formosicola* Strand, 1916, from Taiwan, China. As per the review and the study of Yu et al. (2021), 20 species were recognized in *Paranthrenella*, of which eight were recorded from China. The occurrence of *Paranthrenella* sp. in India and its infestation on *P. americana* is reported herein as a new record.

### MATERIALS AND METHODS

During 2023 and 2024, infestations of sesiid borers were noticed on avocado in different panchayaths of the high ranges of Idukki district, Kerala viz., Kumily (9°37'12" N, 77°9'6" E), Pampadumpara (9°47'51" N, 77°9'41" E; 9°47'52" N, 77°9'45" E), Konnathady (9°56'35" N, 77°1'24" E), Chakkupallam (9°40'33" N, 77°10'44" E; 9°40'20" N, 77°9'59" E) and Vandanmedu (9°41'38" N, 77°11'35" E). The infestation was first observed in Attappallam, Kumily Panchayat. Infestation, immature stages and intensity of attack were noted from the first observed farm with more than ten bearing trees. Field visits were carried out at an interval of two months, and a total of six field visits were made; intensity of the attack was quantified in terms of % of branches showing clear symptoms of

drying in the infested trees. Number of larvae/ 1 ft height of the infested tree trunk (just above the ground level) was also recorded. Biology of the pest was studied at the station's laboratory at room temperature. Suspected egg masses and larvae collected from the tree trunks were reared in glass containers with fresh pieces of bark along with wooden portions. When the larvae stopped feeding and entered the pupal stage, they were transferred into another glass container for adult emergence. The emerged adults were fed with honey solution and the adult longevity was worked out. Habitat of the immature stages was also observed in the field. The emerged adults were sent to the Division of Entomology, Indian Agricultural Research Institute, New Delhi, for identification. High-resolution images were captured using a Leica DFC425C digital camera mounted on a Leica M205FA stereozoom automontage microscope,

with subsequent editing in Adobe Photoshop PS (Version 24.0.0). The abdomen was carefully removed from each specimen and submerged in 10% potassium hydroxide (KOH) overnight. The following day, the specimens were transferred to 10% ethanol to clear internal contents, genitalia dissection was done using micro scissors and forceps and the dissected genitalia were placed onto glass slides for imaging purposes and then preserved in glycerol.

## RESULTS AND DISCUSSION

Infestation was first noticed as signs of wilting of the branches on few avocado trees at the study site on February 6, 2023. Light cream sawdust-like materials were noticed on the bark and the frass-like excrements were seen more close to the ground level (Fig. 1). The infested trees look unhealthy with immature fruits and



Fig. 1-10. Nature of infestation of *Paranthrenella* sp. on avocado and its life stages. 1. Sawdust-like excrements on the bark, 2. Infested unhealthy tree, 3. Tunnels made by the larvae under the bark portion, 4. Extruded pupal skin, 5. Tree with dried branches, 6. Tree with regained foliage, 7. Later instar larva, 8. Prepupa, 9. Pupa, 10. Adult (female)

half-dried shoots (Fig. 2). The field conditions and crop health were severely affected and more than 70% of the trees on the study site were infested by the moth on June, 2023. Behind the bark portion, the larvae made deep tunnels (Fig. 3) with their strong mandibles and fed within the tunnels that led to dark brown discoloration of the fed area and wilting of the branches. The larvae fed mainly on the soft wood portion just below the bark leaving the hard wood portion. Pupation occurred in between the tunnels in separate chamber with provision for adult exit through the bark of the tree trunks. By the middle of August, 2023, remnants of adult emergence were observed at the base of the tree trunk as extruded pupal skin (Fig. 4). Most of the branches in the severely infested trees were dried out completely (Fig. 5) and the trees with mild infestation were recovered and regained their foliage (Fig. 6). There were no further infestations noticed on the field up to February, 2024. Out of the ten trees that we observed in the study site, seven trees were infested with the sesiid borer larvae. Average number of larvae per one foot of the infested tree trunk (just above ground level) was noted as  $2.70 \pm 1.90$ . The average of the percentage of branches showing symptoms of drying in infected trees was recorded as 76.24%.

Egg masses collected from the bark of the tree trunks were not hatched inside the lab. Early instar larvae were translucent,  $7.40 \pm 1.02$  mm in length and pale pink in color. The fully developed larval instars were opaque,  $21.20 \pm 0.75$  mm in length with a pinkish-white color (Fig. 7). Mandibles were well sclerotized both in the early and later stages and five pairs of prolegs were noticed in the larvae (Fig. 7). Early instar larvae (6-9 mm) collected from the tree trunk took  $90.20 \pm 3.43$  days to construct cocoons and enter the prepupal stage (Fig. 8). The internal layer of the cocoon was spun with white silken threads, and the outer layer was filled with wooden frass and debris. Within a period of three days, it moulted into pupa (Fig. 9). Pupal period was  $30.4 \pm 1.74$  days. Pupal skin was brown,  $9.80 \pm 0.75$  mm in length, and slightly transparent, allowing the monitoring of internal transformations. The pupal skin remained extruded from the emerging hole after adult emergence. The adults were mimicking hymenopteran wasps with membranous wings and yellow and black-striped abdomen and legs (Fig. 10). In the laboratory rearing, a typical phenomenon was observed that once the pupae exposed from the cocoons, it will not emerge as adults. The adult longevity was recorded as  $15.60 \pm 2.73$  days.

Adults showed alar expanse of 16-18 mm. Head

black with crown of black scales in-between the antenna bordered by yellow pericephalic fringes; frons black dorsally and white laterally; labial palpus smooth, black dorsally, yellow ventrally; antennae long, black, reaching about  $2/3^{\text{rd}}$  of the forewing; thorax black scaled, with few bright yellow scales; forewing with black costal margin with several transparent regions; hindwing with narrow outer margin; legs yellow with black bands; abdomen black, with few yellow scales at the intersegmental region and a black and yellow scales in the anal tuft (Figs. 11,13). Male genitalia: Valva long and leaf-like, setose field on the inner surface of the valva; gnathos with lateral lobe setose and curved; saccus long and narrow; phallus simple with a broad base and narrow apex (Fig. 12). Female genitalia: Eighth sclerite relatively long; corpus bursae long and narrow, not distinctly separated from the ductus bursae; antrum straight and well-sclerotized; papillae anales relatively large; posterior apophysis longer than anterior apophysis; antrum well-sclerotized, long and in-line with corpus bursae; ductus bursae long, narrow and membranous; corpus bursae membranous without signum (Fig. 14).

Material examined: India: Kerala, Idukki, Kumily (9.620088 N, 77.151630 E, 879.65 mts MSL), 23.vi.2023, 1♂, 2♀, Nafeesa M (genitalia of both male and female; National Pusa Collection, Division of Entomology, New Delhi).

In India, avocado was brought during the first decade of the nineteenth century, and its cultivation has gained overwhelming popularity in the last decade due to the nutritional properties of the fruits (Tripathi et al., 2014). The pest list is highly complex for avocados. Out of more than 150 species of lepidopteran pests reported

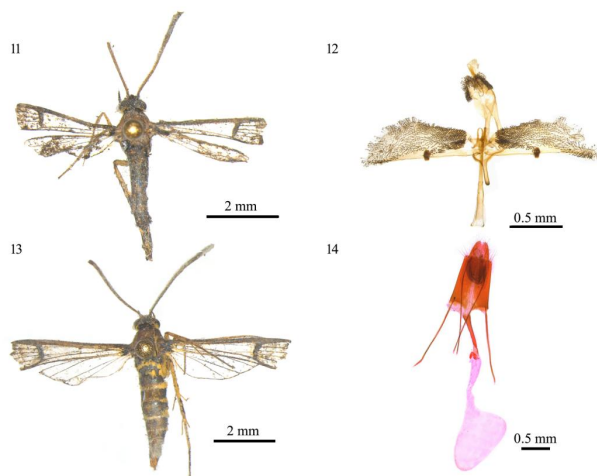


Fig. 11-14. *Paranthrenella* sp. 11. Adult male, 12. Male genitalia, 13. Adult female, 14. Female genitalia

worldwide, two members are from the family Sesiidae, viz., *Synanthedon resplendens* Edwards and *Bembecia chrysidiformis* Espar (Wysoki et al., 2002; Hoddle and Brown, 2010; Gilligan et al., 2011; USDA-APHIS, 2016; Robinson et al., 2023). This is the first report of a member of the genus *Parathrenella* Strand, 1916, under the tribe Synanthedonini (Lepidoptera: Sesiidae) on avocado trees. Year-round field inspection at an interval of two months and laboratory rearing indicate that the infestation is season-bound and there is not much overlapping of the life stages of this pest. In this study, early instars, later instars and pupae, and adult emergence occurred respectively during February – April, April – July and July – August. Here, the larval period is more than three months and the pupal period span almost one month. The occurrence of larvae in the tree trunks was not noticed during October 2023 to February 2024. The above results indicate that there is only one generation per year for this pest. One to two years life cycles of clearwing moths were reported by various researchers (Scott et al., 1979; Taylor et al., 2021; CSU Fact Sheets, 2024). Eight members of the genus *Paranthrenella* Strand, 1916, were reported from China (Yu et al., 2021), and the known life cycle of clearwing moths in China is one generation a year or two generations every three years (Jin et al., 2008). In the study site, intensity of infestation was very high, and if it is unnoticed and the management measures not taken, it will lead to the complete death of avocado trees.

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#### AUTHOR CONTRIBUTION STATEMENT

The authors, NM first observed the infestation, conceived and designed the study, performed the field and laboratory experiments and prepared the initial draft of the manuscript. SPR and ND performed the diagnosis part, identified the pest and revised the manuscript. MM involved in survey programme and revised the manuscript and SA involved in survey programme. All authors read and approved the manuscript.

#### CONFLICT OF INTEREST

No conflict of interest.

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