



FIRST RECORD OF MAYFLY *POVILLA (LANGUIDIPES) TAPROBANES* HUBBARD FROM KARNATAKA

SACHIN G PAI¹, C M KALLESHWARASWAMY^{2*}, KRISHNAMOORTY VARANASHI³, M RANJITH² AND M RAJKUMAR¹

¹ICAR-Central Plantation Crops Research Institute, Kasaragod 671124, Kerala, India

²Department of Entomology, University of Agricultural and Horticultural Sciences, Shivamogga 577204, Karnataka, India

³Varanashi Development and Research Foundation, Adyanadka 574260, Karnataka, India

*Email: kalleshwaraswamycm@uahs.edu.in (corresponding author): ORCID ID 0000-0002-1752-0841

ABSTRACT

Mayflies are important as macroinvertebrates of aquatic ecosystems and are reliable bioindicators of water quality. Most mayfly nymphs feed by scraping algae from underwater rocks or by extracting food particles in the littoral and benthic zones of the water bodies. The mayfly *Povilla (Languidipes) taprobanes* originally described from Sri Lanka was observed in plastic lined ponds in coastal Karnataka. Not only, this is the first report of the species from Karnataka, but the unique case making behaviour of this species is also described for the first time. Additionally, the species was found damaging plastic tarpaulins of 750 gsm thickness used as lining for water storage in the tank by chewing. This chewing behaviour was responsible for damage of plastic sheets leading to water leakage. The possible loss caused and a need of alternate strategies to store water is discussed.

Key words: Mayflies, Polymitarciidae, *Povilla (Languidipes) taprobanes*, plastic feeding, naiad, aquatic, water tanks, plastic lining, earthen cases, microplastics

Mayflies (Ephemeroptera), with aquatic larvae and with a short terrestrial adult life play an important role in the food chain. The group comprises of about 3200 species under 410 genera and 42 families (Bauernfeind and Soldan, 2012; Selvakumar et al., 2019), of these 390 species are from the Oriental region (Selvakumar et al., 2019). Ephemeroptera comprises of 142 species from 56 genera under 15 families (Sivaramakrishnan, 2016). Mayflies are soft-bodied paleopterans widely distributed across the Indian subcontinent. Larvae are confined to lentic and lotic freshwater habitats. Most larvae feed by scraping algae from underwater rocks and higher plants or by extracting food particles from mud. Not much is known about their biology and systematics. Only few families such as Baetidae, Ephemeridae, Heptageniidae, Leptophlebiidae and Potamanthidae have received some attention (Balachandran et al., 2011). Most species are free-living in adult stage with lifespan of only one or two days, but the aquatic naiad lasts up to a year or more. Among its families, lesser-known family Polymitarciidae is represented by only two genera with 13 species. Among these, three species are known only by naiads. Polymitarciidae are commonly called burrowing mayflies which burrow in rivers under rocks or in clay banks (Bouchard, 2004). Herein included is

the first record of a species from the coastal Karnataka. Its behaviour that leads to the damage of plastic pond lining is described here highlighting the loss of water from such water conservation ponds.

MATERIALS AND METHODS

In February 2020, one of the authors (KV) observed declining water levels in an on-farm irrigation pond at the campus of Varanashi Farms, Adyanadka, Bantwala Taluk, Dakshina Kannada District, Karnataka, India (12.69N, 75.10E). The pond is approximately 4.7 m deep and with a capacity of 600 m³ and lined with 750 gsm tarpaulin sheet. Careful inspection of the ponds over successive days revealed loss of water only in those ponds where the lining had not been properly stretched and had developed folds. The transfer of fishes from the leaking pond to another pond measuring 23x 17x 4.8 m also developed water leakage. Suspecting the transfer of invertebrates from the first pond, the second pond was emptied between January and February 2021 and closely examined for damage. Close examination the plastic folds revealed several soil lined burrows and earthen cases with aquatic invertebrates. Specimens of the invertebrates from the specific sites of damage were collected and identified to ascertain the cause of damage to the pond lining.

The plastic folding where the lining was damaged with punctures had small tunnels or burrows and earthen cases made of fine silt with very small fragments of the plastic lining (Fig. 1 a-c). These tunnels and cases were found to harbour larvae of mayflies (Fig. 1 d-e) and often the disturbance forced out the larvae from their resting places enabling collection. Invariably the plastic lining of the pond was damaged wherever there was an aggregation of the larvae. Samples of free-living larvae were also taken from the pond using an aquatic net. The larvae were collected in 90% ethyl alcohol from the second pond and identified to species level based on the keys provided by Hubbard (1984) and Rathinakumar et al. (2019) and also confirmed by a taxonomist specialising in Ephemeroptera (Dr. Boonsatien Boonsoong, Bangkok, Thailand). Further, efforts were also made to collect information from Mr Sebastian, Proprietor Shakthi Tarpaulin in Kerala who supply tarpaulin sheet for farmers and also people who previously encountered holes in tarpaulins installed in rain water harvesting units. The information obtained is also represented to indicate the importance of correct diagnosis.

RESULTS AND DISCUSSION

Based on the characters examined, the specimens were identified as *Povilla (Languidipes) taprobanes* Hubbard 1984. The identification characters of *Povilla (Languidipes) taprobanes* Hubbard as follows: Length: 15-17 mm, body yellowish, dark brown dorsally, streamlined with series of gills directed backwards and placed dorsally on the abdomen (Fig. 2a,c). Head yellowish with brown reticulation (Fig. 2b); frontal process moderately developed, semi-circular; mandibles brown in distal half, yellowish in basal half; mandibles lacking incisors (Fig. 2b,d); antennae yellowish white (Fig. 2d). Thorax: pronotum golden yellow; mesonotum brownish; pleura and sternum whitish. Legs white, with whitish to yellowish setae. Forelegs with scattered hairs (Fig. 2e) whereas hind legs with a row of setae on femur and tibia (Fig. 2f). Abdomen yellowish brown dorsally with paired brown irregular blotches on each segment and a medium pale stripe running across the segments; abdomen laterally yellow and whitish ventrally; gill 1 uniramous (Fig. 2 g, h); gills 2-7 biramous (Fig. 3b), white, median line and fringe lined with black. In males, the cerci are longer with fewer spines than median caudal filament. In females (Fig. 3a) the median caudal filament is longer than the cerci, and all three terminal filaments are heavily spinose.

Material examined: Mature naiads: Farm-pond, Varanashi Farms, Adyanadka, Bantwala Taluk, Dakshina Kannada District (12.69N; 75.10E). Coll. Kalleshwaraswamy CM. 28.i.2021 and Sachin G. Pai on 17.ii.2021.

Povilla (Languidipes) taprobanes was originally described from Sri Lanka (Hubbard, 1984) and later observed from Tamil Nadu (Rathinakumar et al., 2019). Herein its occurrence from Karnataka is reported for the first time. The larvae when disturbed were observed to come out of the cases made of mostly silt and sand with tiny fragments of plastic (Fig. 4 a, b). The holes were found with cases on the plastic sheets folding, strongly implicating the larvae in the damage to the lining. It is presumed that the damage could have been caused due to larvae burrowing in the fold, and chewing or clawing through the plastic lining to build earthen cases. It is also possible that the larvae used the folds as an 'enemy free space' to hide from their natural predators in the aquatic habitat (Gallitelli et al., 2021). The loss appears to be though less, considering that large number of farmers following this system of water conservation, where plastic sheets are laid on the dug pits of different sizes and water is stored the damage can be critical. Hence, there is a need of ascertaining case making and chewing behaviour. At this juncture, it is not clear, whether there is any ingestion of plastic by the mayflies. Recently, the ingestion of microplastics by Ephemeridae (Baetidae, Heptageniidae) was proved in riverine habitats (Windsor et al., 2019).

To prevent the seepage and other losses from the water body, ponds should be lined with suitable material. Various design and materials are being used to prevent seepage from the farm ponds. Plastic can be used very effectively in lining the ponds. But, lining the ponds with plastics as a barrier material, sufficient care is required in selecting the proper material and laying of plastics material and saving it from the damage (Kumar and Singh, 2010). Polyethylene lining is the cheapest among all the lining materials, which are conventionally being used. Without any lining the usual seepage loss is 18.56 l/ hr/ m² indicating the need of lining material (Deepika and Rao, 2018). They also reported that with the polythene sheet lining, seepage loss was reduced to 0.32 litre/ht/m² indicating which was better than the cement+ soil plastering indicating the importance of polythene sheet lining. However, this viable strategy under risk due to mayfly damage.

A short survey in Kerala state brought out one

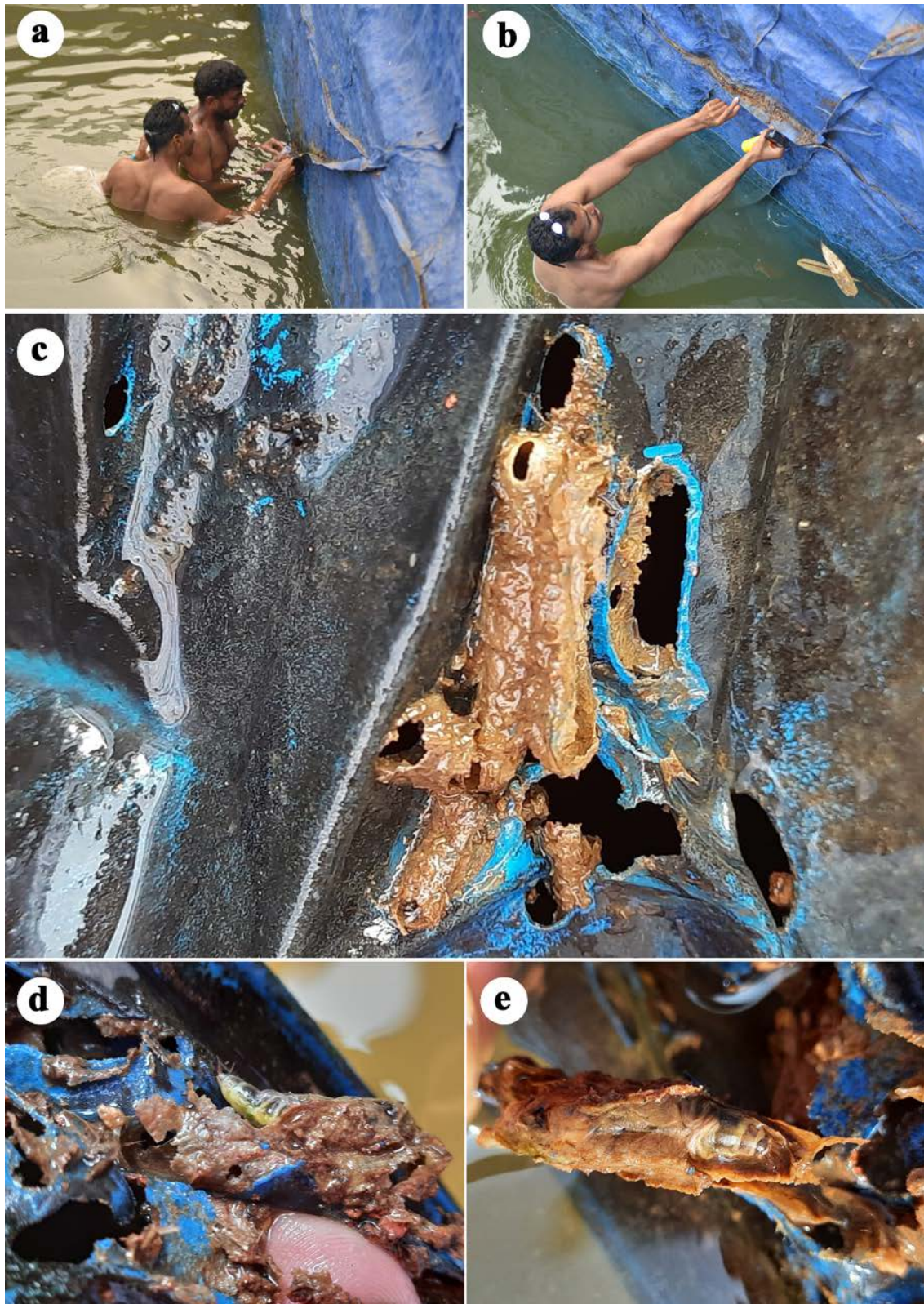


Fig. 1. Sample collection; a-c) Larval case with larvae; c-e) Damaged folds of tarpaulin sheet



Fig. 2. *P. (L.) taprobanes*- larvae, dorsal view: a. body; b. head; Lateral view: c. larvae; d. head; e. Hind leg; f. Fore leg; g. Dorsal view, first abdominal segment; h. First abdominal gill (uniramous gill)

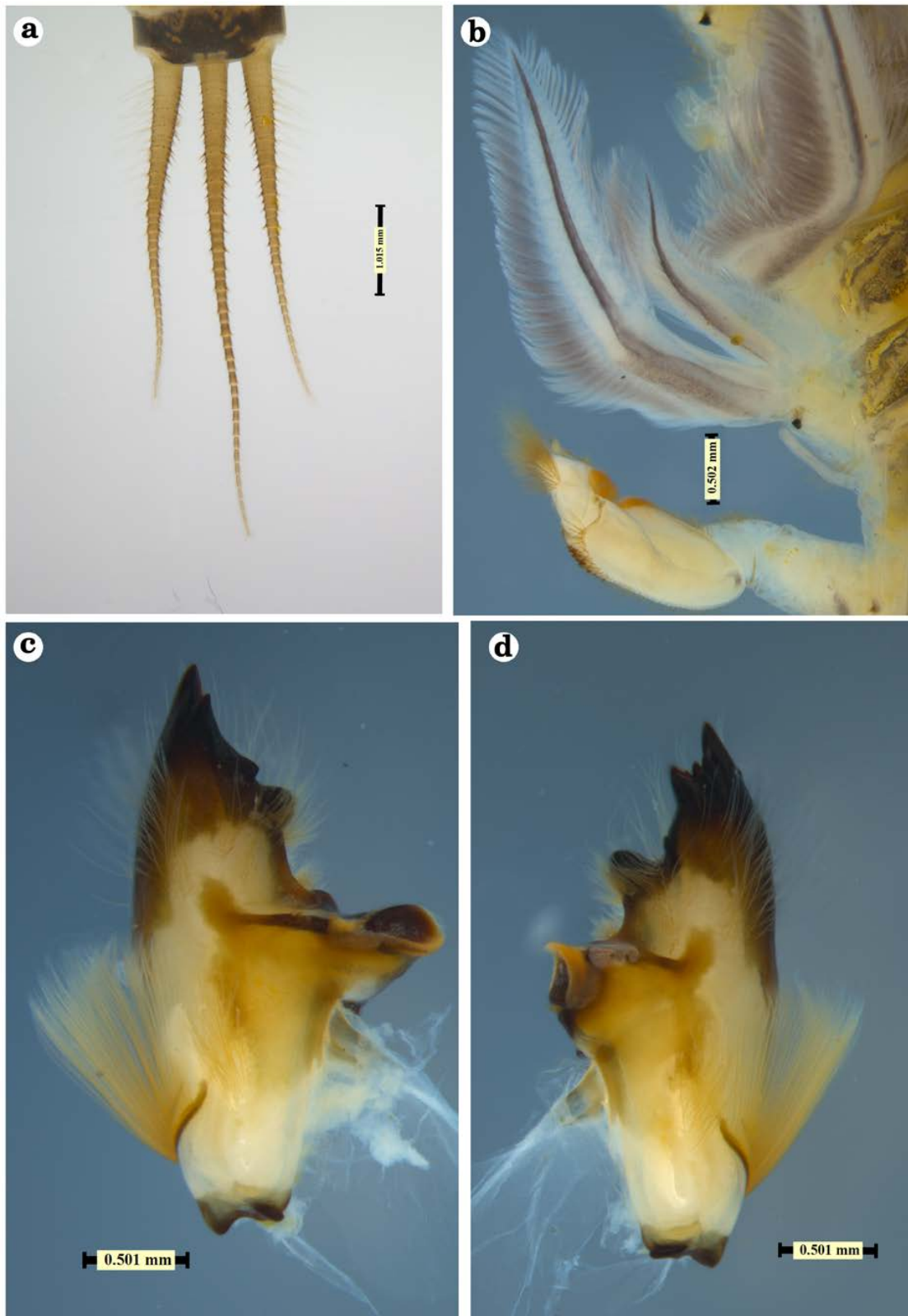


Fig. 3. *P. (L.) taprobanes* larvae; a. Cerci; b. Biramous gill of abdomen; c. Left mandible; d. Right mandible

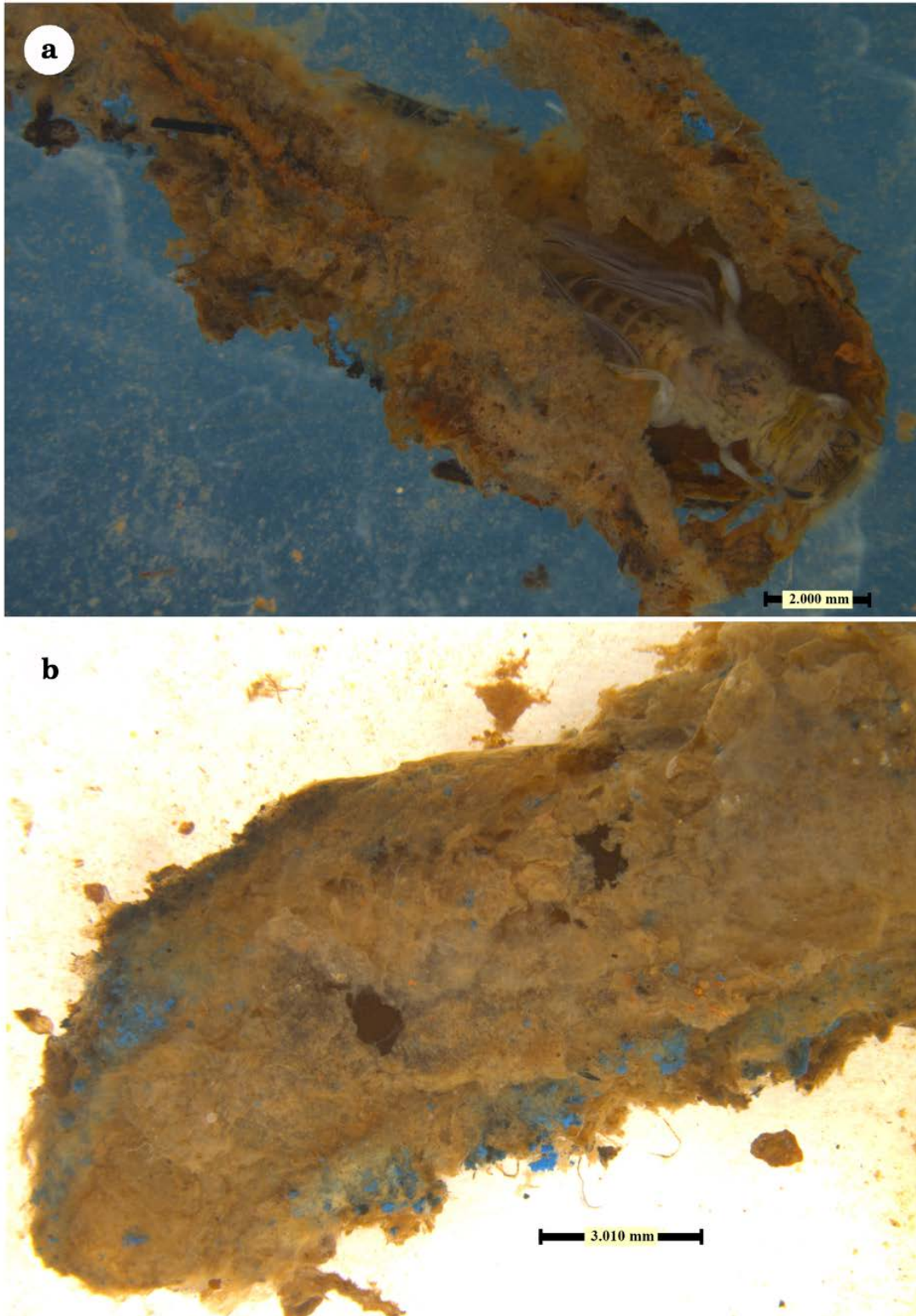


Fig. 4. *P. (L.) taprobanes* larvae; a. Larval case with naiad; b. Larval case with plastic particles

interesting information with respect to the tarpaulin damage installed in tanks for water conservation. Mr. Sebastian who was the proprietor of Shakthi tarpaulins, Payyanur, Kerala supplied polythene sheet to many farmers and organisations. The supplier regularly encountered complaints from the buyers and one organisation named, Chinmaya Mission, filed a lawsuit at the consumer court and the trial ran for around three years. The supplier got help from the officials of the previous case who produced the damage samples along with the insect. Finally, they came to terms that a new tarpaulin will be provided at the lowest cost. However, efforts made to identify the farmers who are now encountering this problem did not yield any result as many switched over to concrete lining. There is a need of observing the distribution of this species in India and damage caused if any to the plastic lining of water ponds.

ACKNOWLEDGMENTS

The authors thank late Dr K Chandrashekhara, former Professor of Entomology, UAS Bangalore for valuable suggestions. Authors also thank Dr Boonsatien Boonsoong, Bangkok, Thailand, for confirming the species identity.

AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

CONFLICT OF INTEREST

No conflict of interest.

(Manuscript Received: August, 2021; Revised: December, 2021;

Accepted: December, 2021; Online Published: April, 2022)

Online First in www.entosocindia.org and indianentomology.org Ref. No. e21187

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