

A tarsonemid mite feeding on uredospores of linseed rust in West Bengal, India

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The study of plant inhabiting mites (Acari) in India has increased in the last two decades due to growing recognition of their importance both as pestiferous species and natural enemies (Gupta, 1985; Singh and Raghuraman, 2011; Gupta & Karmakar, 2015). However, there is still a general lack of knowledge of the biology, reproduction, behaviour, ecological associations, symptomatology and taxonomy of these mites. The family Tarsonemidae (Acari: Heterostigmata) consists of 45 genera and more than 600 species worldwide but only a handful of species have been reported from India (Mondal *et al.*, 2021; Ganguly *et al.*, 2021). Tarsonemid mites are very tiny (90-300 μm in length) with shiny, translucent oval-shaped bodies, sometimes having yellowish to dark brown tinges, generally inhabiting cryptic microniches, preferably the humid areas. They play a diverse role in terrestrial ecosystems by feeding on plants, epiphytotic microbes, predated on mite eggs, parasitizing insects, using insects for phoresy and also functioning as parasitoids of insects (Lindquist, 1986; Mondal & Karmakar, 2021). Among the plant-associated tarsonemid mites, two species viz. *Polyphagotarsonemus latus* (broad mite/yellow mite) and *Steneotarsonemus spinki* (sheath mite) have drawn lots of attention due to their yield-reducing potential and havoc infestation on several agri-horticultural crops and rice respectively

while the rest of the species remains unnoticed (Karmakar, 2008; Gupta, 2012).

Very recently in March, 2022 we have observed a fairly large population of *Tarsonemus mondouriensis* Karmakar & Ganguly, 2021 feeding on uredospores of *Melampsora lini* (Fungi: Basidiomycotina) on leaves of linseed (*Linum usitatissimum* L.) and also the necrotic parts of infected leaves (Figure 1). The fungus *M. lini* is the causal organism of the linseed rust disease which appear late in the season drastically reducing seed yield, oil content and fibre quality (Singh *et al.*, 2017). Historically, *M. lini* is the 'famous' plant pathogen that led Harold Flor to postulate the "gene-for-gene" hypothesis in 1942 which revolutionized inheritance studies in host-parasite interaction systems. Till now, no mite species has been reported to be feeding on or associated with the uredospores of *M. lini*. However, it is not surprising to find *T. mondouriensis* feeding on its spores as many of the *Tarsonemus* species have already been reported to feed on plant-parasitic fungal spores (mycophagous) worldwide (Lindquist, 1986; Lin & Zhang, 2002). Hofsetter and Moser (2014) showed that in some species of *Tarsonemus* the lateral enlargement of tergite C makes a flap-like structure ventrolaterally which serves as a pocket to store and transport fungal spores, often termed as 'sporotheca'. A similar

structure can also be observed in the original illustration of this species by Mondal *et al.* (2021) although it is not described as sporotheca. However, their statement regarding locating this species in fungus infested rice grains indicated towards a trophic association with plant pathogenic fungus.

We further observed that males were very low in numbers (only 2) compared to females (23 approx.) in 80 infested leaves sampled during this study demonstrating a female-biased sex ratio that commemorates with the sex ratios (from 2.3:1 to 8.4: 1) found in other *Tarsonemus* and *Steneotarsonemus* spp. by Karl (1965) and White & Sinha (1981). During our observation, some female mites were found depositing eggs inside the pustules surrounded by uredospores but the exact cause could not be determined (see supplementary video uploaded on website).

We hope this field note will help the plant protection workers to look for more tarsonemid mites occurring in the prevailing agroecosystems of our region and understand their relationship with other organisms.

Author's contribution:

AM, SHR & LCP observed the mites on rust infected linseed leaves for the first time. AM & SHR took population count. PM & KK investigated further both in field and laboratory, identified the mite specimens and prepared the manuscript.

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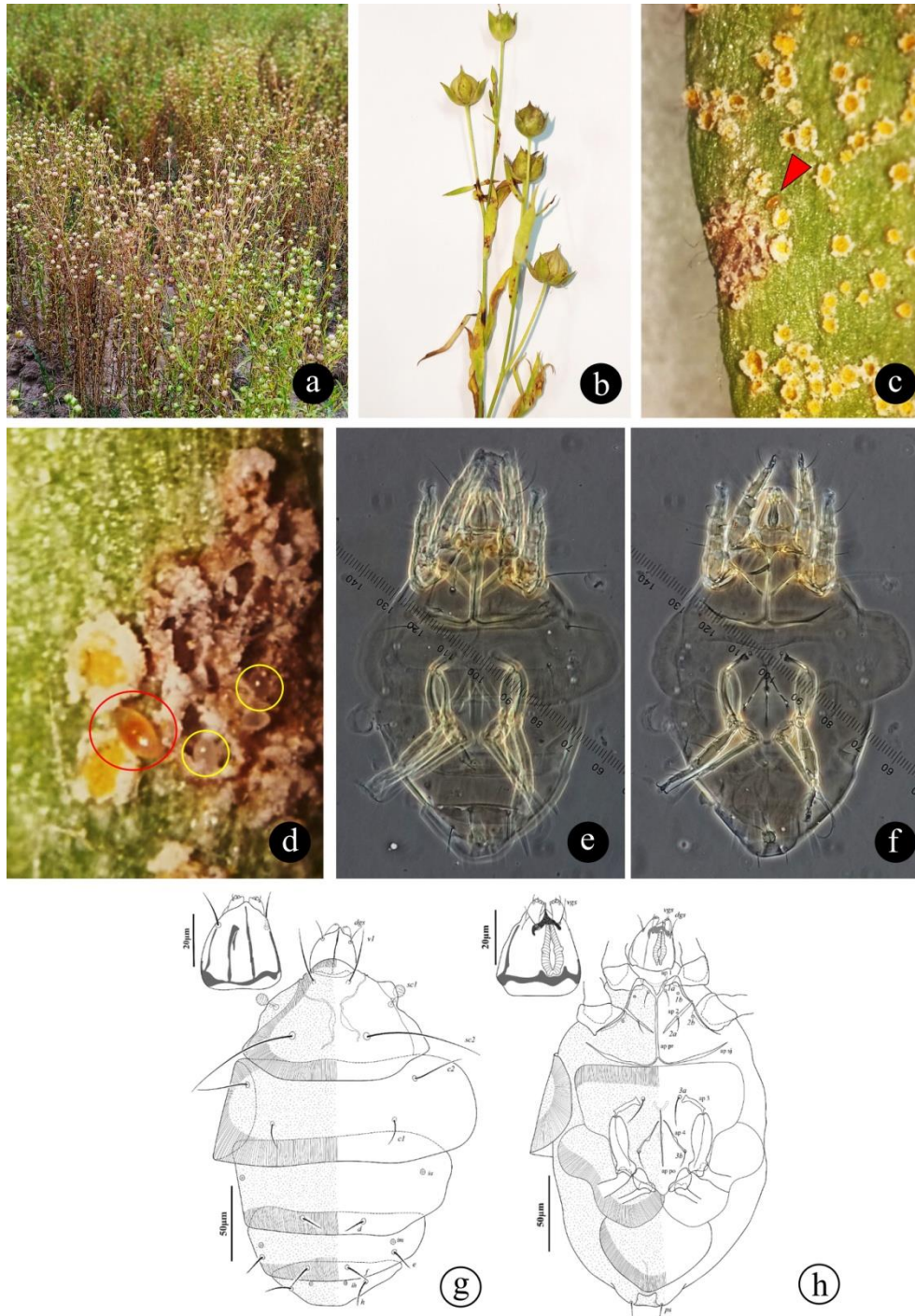


Fig. 1: a) Linseed field infested with *Melampsora lini*; b) rust infected linseed plant; c) uredopustules on leaf, red triangle indicating the female mite; d) a small colony of mites; red circle indicating adult female and yellow circles indicating translucent eggs; *T. mondouriensis* adult female phase micrograph dorsal (e) and ventral (f) (40X zoom, Olympus BX53); *T. mondouriensis* adult female vector illustration dorsal (g) and ventral (h), adapted from Mondal *et al.*, 2021

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