Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(3): 273-277

Received: 26-03-2019
Accepted: 28-04-2019

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Infestation of jumping plant lice, *Megatrioza hirsuta* (Crawford): A threat to tasar host plants in Jharkhand

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Abstract
Central Tasar Research & Training Institute, Ranchi has been conducting survey on regular intervals for assessment of any new pest emergence or loss of any pest due to climate change and extreme weather conditions or any other reason in Jharkhand, which contributed more than 80% tasar cocoon production in India. In the year 2018, infestation of jumping plant lice, *Phylloplecta hirsuta.* [syn. *Megatrioza hirsuta* (Crawford) (*Trioza hirsuta*)] was observed in primary tasar food plants *Terminalia arjuna* (Arjun) and *T. tomentosa* (Asan) at CTR&TI, Ranchi research farm and Pilot Project Centre, Kharswan, Singhbhum region of Jharkhand. The insect belongs to order Hemiptera, superfamily Psylloidea and family Triozidae. Symptom of pest on tasar food plants was noticed on the terminal leaves in the form of complete curling of the leaves. The nymphs having white waxy skin feed on the dorsal side of the leaves and fold them outside in. Adults of the pest have a light shining yellowish body with white transparent wings that extend well beyond pointed abdomen. Members of the family Triozidae are commonly called jumping plant lice and form galls on plants by their feeding action. Basic information about this insect will be helpful for easy identification of pest symptom and preparation of IPM package for the management of pest in tasar food plants in a changing environment.

Keywords: Climate change, primary tasar food plants, curling and crumpling, insect feeding, *Trioza hirsuta*

1. Introduction
Tropical tasar silkworm, *Antheraea mylitta* (Lepidoptera: Saturniidae) is a commercially important insect and a valuable component of non-mulberry silk industry. It is a unique gift of India to the rest of the world and are widely distributed in India from sea level to sub Himalayan ranges. It is reared on the important food plants, *Terminalia arjuna* (Arjun) & *T. tomentosa* (Asan). Both plants are attacked by a large number of insect pests. These insect pest populations are affected by climate change and extreme weather conditions at regional level, because climate change influences the ecology and biology of insect pests. Increased temperature causes migration of insect species towards higher latitudes, while in the tropics higher temperatures might adversely affect specific pest species. Likely impacts of any change in climate on population of pests are manifold. They range from expansion in the geographical range, increased risk of invasion in the new area, change in overwintering patterns, change in crop pest synchrony, change in pest complexes on spatial and temporal bases and finally a pests management strategy [6].

A number of psyllids insects are known to induce gall on their host plants. Galls are often considered as more or less localized growth reactions of the host plant to pest attack. A major part of the life cycle of gall insect is closely associated with the formation of gall guild in which the insect almost completes its development. Gall formation is the consequence of the interaction between the offensive stimulus of the insect and the defensive response of the plant [16]. The psyllids, *Trioza fletcheri minor* Crawford and *T. hirsuuta* (Crawford) induce galls in the leaves of their common host plant, *Terminalia arjuna* Wight & Arn., but mor-phology and locations of galls on the leaves are quite different. Small blister galls induced by *T. flecheri minor* occur scattered on the laminar surface of leaves whereas *T. hirsuta* induces leaf roll galls on leaf margins only [3]. Leaf gall *Trioza fletcheri minor* (Hemiptera: Psyllidae) is the most important gall forming insect on the leaves of primary tasar food plants [17, 5] causing 40-50% crop loss during peak period (August) of tasar silkworm [18].

In tasar culture insect pest management of the host plants of *A. mylitta* is essential. In this article information deals with the infestation of leaf roll galls on *Terminalia arjuna* (Arjun) & *T. tomentosa* (Asan) attacking *T. arjuna* and *T. tomentosa* in Jharkhand which caught attention.

2. Materials and Methods

The survey was done at the Pilot Project Centre (PPC)-Kharsawan and in the research farm of Central Tasar Research & Training Institute, Ranchi (Jharkhand). The curled and crumpled leaves were plucked randomly from the host plants and taken to the laboratory in plastic bags and kept in rectangular transparent white plastic boxes (30x20x10cm) to close vigil for locating nymphs and emergence of the adults in the laboratory at room temperature. Galls of different sizes were also observed in the laboratory by cut open to study the developing psyllids in each such gall and the observations were taken and collected. Besides, galls were also studied on host plants itself without detaching the infested leaves.

3. Results and Discussion

3.1 Report on infestation of jumping plant lice, *Megatrioza hirsuta* (Crawford) on *Terminalia arjuna* and *T. tomentosa*

This insect was identified as *Megatrioza hirsuta* attacking *Terminalia arjuna* and *T. tomentosa* and also known as jumping plant lice or big gall fly. However, a tiny insect called gall fly, *Trioza fletcheri* has been causing serious damage since long to Arjun and Asan plants by forming small galls on the leaves. During field visits, symptoms of curling and crumpling on *T. arjuna* & *T. tomentosa* leaves were observed in the form of small thickening of the terminal leaves which starts thickening almost after a fortnight due to the feeding action of the nymphs followed by the complete curling of the leaves (Fig. 1a,1b,1c). The nymphs feed on the dorsal side of the leaves and fold them outside in. The damage was noticed short as well as in long height plantations during October 2018 but insect remained undocumented. Close examination of the leaves showed the presence of woolly white sucking nymphs (Fig. 2c). They later became gallinaceous as they grew. Due to active sap sucking action of the nymphs, the leaves were rolled, thickened and get curled & crumpled. This provides a nearly stable surface for the nymphs to settle and feed comfortably. Such leaves catch the attention as they attain pinkish red colour (Fig. 1a). The curled leaves once exhausted became brown, hard and corky upon drying. Actively feeding nymphs urinate continuously. This fluid gets collected in the rolled portion of the leaf as milky fluid and honeydew globules (Fig. 2b). Besides milky fluid, the folded leaf contains powdery mass and exuviae of the moulted nymphs (Fig. 1c). Mature nymphs have white waxy skin (Fig. 2c). Similar observations and studies have also been documented by [4, 8].

a. Curling and puckering of leaves

b. Folding of the tender / mature leaves

C. Thickening, curling and puckering of terminal leaves

Fig 1: Thickening, curling and puckering of leaves in *Terminalia arjuna*

The emerged adult of the pest has a light shining yellowish body with white transparent wings that extended beyond pointed abdomen (Fig. 2d, 2e). The members of family Triozidae are commonly called jumping plant lice and form galls on plants by their feeding action. [1, 2, 14] have also reported *Megatrioza hirsuta*, a major pest of *Terminalia sps. T. hirsuta* on *T. alata* and *T. tomentosa* has also been reported by Dhiman and Singh, 2003 [7, 10] in U.P. [4] has also reported the occurrence of leaf curl of leaves of *T. arjuna* and its causal insect pest in Chandigarh, Haryana, Punjab and Himachal Pradesh as the first report from these region [12]. Observed the seasonal variation and reported that *T. hirsuta* infests plants during the last week of April [9]. Has reported that the eggs are laid on the ventral side of the leaves singly on either side of the leaf midrib and a female lays 48-180 ova during her lifespan, with an average of 98.6 ova. However, such observation on oviposition behaviour and fecundity of *M. hirsuta* needs to be studied from this region (Jharkhand) [15]. has reported in details the mechanism of leaf thickening which is similar to gall formation; the saliva of the insect contains hydrolyzing enzymes and soluble proteins, which induce lots of changes in the cellular contents. This acts as stimulus for the induction of galls. The stimulus weakens the defense mechanism of the plant. Actively feeding nymphs vigorously take oxygen from the site of the attack and bring the cells and tissues under stress. The hormonal balance changes and results in repeated cell division (hyperplasia) and enlargement of cell (hypertrophy). In response to this, the plant releases lot of phenolics which get deposited over the feeding nymphs [8]. Studied the moulting behaviour of nymphal instars of *Trioza hirsuta* and reported that only nymphal stages contribute in making the gall. Moulting of nymphs occurs inside the gall, but last instar nymphs come out of the gall. Before moulting, the instar powerfully clings the host surface with claws. After emergence, the exuvium is left attached with host surface leaf in case of last instar (Fig. 1c). The nymphs finally moult to become adult leaving its exuviae sticking to leaves. Similar observations on *Megatrioza hirsuta* has also observed in the present study which validates the report on infestation of *M. hirsuta* on Tasar host plants in Jharkhand.

Besides some parasitoids of *T. hirsuta* were also found and collected which were identified as *Psyllaephagus phylloplectae* (Hymenoptera: Chalcidoidea: Encyrtidae) by Dr. Sudhir Singh, Scientist-G, Systematic Laboratory, Forest Entomology Discipline, Forest Protection Division, Forest Research Institute, New Forest, Dehradun, Uttarakhand - 248 006, India [12]. Has also reported a parasitoid *Psyllaephagus phylloplectae* Sushil & Khan (Hymenoptera: Chalcidoidea: Encyrtidae) from Karnataka, with notes on its taxonomy and host, *Megatrioza* hirsuta (Crawford).

a. Young nymphs feeding inside the folded leaves

b Folded leaf containing powdery mass, exuviae of the moulted nymphs and honey dew globules

d. Adult siting leaf (dorsal view)

c. Mature nymphs with white waxy skin feeding inside the hard and corky upon folded leaves

e. Adult siting on leaf (lateral view)

Fig 2: Different stages of jumping plant lice, *Megatrioza hirsuta* (Crawford)

4. Conclusion

The feeding action of *Megatrioza hirsuta* harms tasar host plants by curling and crumpling of terminal leaves which later get dried and fall off. This also affects the photosynthetic activity of the plants and the terminal shoot becomes abandoned & dead. The infestation of leaf curls of leaves / leaf roll galls of *T. arjuna* & *T. tomentosa* and its causal insect pest in Jharkhand didn't get much attention since long from this region as the insect remained faceless and it could not be documented. However, proper vigil required for this insect pest in future to avoid its further invasion to the tasar host plants.

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