

Natural enemies of walnut aphids, *Chromaphis juglandicola* Kalt. and *Panaphis juglandis* Goeze ((Hemiptera: Aphididae) in Kashmir, India

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Abstract: Two species of aphids colonize walnut orchards in Kashmir valley, Walnut green aphid (*Chromaphis juglandicola* Kalt.) and Dusky veined aphid (*Panaphis juglandis* Goeze). *P. juglandis* colonizes the top side of the walnut leaf, establishing the characteristic colonies along the main nerve. This aphid is much larger than common walnut aphid, *C. juglandicola* which feeds on lower surface of leaves. *P. juglandis* and *C. juglandicola* are potential pests of walnut orchards in Kashmir valley. Present study was carried out to know the natural enemies of walnut aphids in Kashmir valley and their population dynamics & bio-control potentiality vis-a-vis aphids. Two sites were selected falling in two major zones of the valley and monitoring was done following UC-IPM protocol for monitoring walnut aphids & natural enemies. Populations of these aphids are controlled at low by natural enemies in orchards of Kashmir valley. During present study, Syrphid fly larvae were the most important predators encountered in this study.

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1. Introduction

Walnut trees are susceptible to pests and diseases such as walnut weevil (*Alcidodes Porrectirostris* Marsha), walnut blue beetle (*Monolepta erythrecephale*), Sanjose scale (*Quadraspidiotus perniciosus* Comst), Dusky veined aphid (*Panaphis juglandis* Goeze) and walnut green aphid (*Chromaphis juglandicola* Kalt). Among the different pests prevalent in the walnut-producing areas, walnut aphids viz. *P. juglandis* and *C. juglandicola* damage walnut orchards most seriously. Their feeding reduces tree vigour, nut size, yield, and quality. In addition to direct feeding damage, they excrete copious amounts of honey-dew that falls onto nuts, leaves and shoots. Honey-dew supports growth of the black sooty mould fungus. This fungus reduces light penetration to the leaf surface reducing its photosynthetic capacity. Being black, it also absorbs heat to predispose nuts to sunburn and subsequent kernel quality loss due to high temperatures. High populations of aphids may also cause leaf drop, exposing more nuts to sunburn. If heavy populations are allowed to develop (i.e. > 15 aphids per walnut leaflet) and remain for as little as 14 days uncontrolled, current season's nut quality is reduced along with a substantial reduction in the following season's crop (Barnes & Sibbett, 1990).

The walnut aphid, *Chromaphis juglandicola* (Fig.1) is a serious pest known in different parts of the world. It is yellowish in colour and feeds on the lower surface of leaves and is a sap feeder. The dusky

veined aphid, *P. juglandis* (Fig.2) is another walnut pest in the valley. The life cycle of dusky veined aphid is similar to walnut aphid. It overwinters in the egg stage on twigs. Eggs hatch as soon as leaf buds begin to open where the young aphids settle on the leaflets, and they mature into larger, yellow aphids with dusky black spots, and reproduce without mating, giving birth to live nymphs. The aphids pass through many generations a year, depending upon temperature. In fall, wingless females mate with smaller, winged males and lay the overwinter eggs. In contrast to walnut aphid however, dusky veined aphids feed on the upper sides of leaves at the midrib. If 25% of a leaflet sample contains colonies of dusky veined aphids, economic quality damaged has been measured. As walnut aphids decrease the vigour of walnut trees so there is a need to study and manage these serious pests in all its respects. Natural enemies play an important role in the natural control of walnut aphids. As these two aphids feed on exposed parts (leaves), they are susceptible to a variety of natural enemies such as predators and parasitoids.

2. Material and Methods

Two sites were selected viz. Danwethpora in Anantnag and Batpora in Srinagar. These sites were visited on alternate days or weekly for whole of the year. Monitoring was done at each site by selecting 20 trees randomly in an orchard. For each tree 5 leaves were sampled accounting a total of 100 leaves at one site. Number of aphids and natural enemies on

every leaflet was recorded on monitoring form at each sampling site. This primary data was then transferred to MS-Excel for further processing.



Fig. 1. Heavy infestation of *C. Juglandicola*



Fig. 2. Winged *P. juglandis* Females and IV instar larvae feeding along midvein

3. Statistical Analysis

Raw data obtained from the field observations was subjected to MS Excel 2007 and means calculated for statistical significance.

4. Results and Discussions

During the present study following natural enemies were recorded- Brown lacewing, Convergent ladybeetle, Green lacewing, Syrphid flies and *Trioxys pallidus*. Syrphid fly larvae were the most frequently encountered natural enemy with peak number in the month of July (Table 1 & 2). Population dynamics of various natural enemies showed fluctuations round the year. However during first three months i.e; January, February and March and last month (December) population was almost negligible as these are the winter months in Kashmir. Aphids start appearing during 2nd week of April on walnut trees and natural enemies were reported in last week of April. Given below is brief description about the

natural enemies encountered and their population dynamics.

Syrphid flies: The larva of this fly was found feeding on walnut green aphid. It kills the larva by sucking them. The larva is leg less and maggot shaped. It can be distinguished from caterpillar larva by its tapered head, lack of legs and opaque skin. It is the most abundant natural enemy of walnut aphids in Kashmir. Its population showed variations round the year with peak numbers during month of July.



Fig. 3. Syrphid fly larva feeding on *Chromaphis juglandicola*

Convergent ladybeetle: It was found with dusky veined aphid as well as walnut green aphid, but more frequently with walnut green aphid. Adults have orange to red forewings and upto 13 black spots. Many individuals have fewer margin and 2 convergent white lines. Eggs are yellow coloured and are laid on leaves in clutches (Fig. 4,5,6). It was the second most abundant natural enemy found during present study.



Fig. 4. Convergent ladybeetle



Fig.5. Eggs of Convergent lady beetle

Brown lacewing: Brown lacewing larva was found preying on walnut green aphid, *C. juglandicola*. The larva resembles a tiny alligator, flattened, tapered at the tail and has distinct legs and prominent mandibles with which it attacks its prey. (Fig 6)



Fig. 6. Brown lacewing feeding on *C. juglandicola*

Green lacewing: It feeds on Dusky veined aphid. Larva is pale with dark markings, looks like a tiny alligator.

***Trioxys pallidus*:** The female wasp lays an egg inside an aphid nymph. The eggs hatch into larvae that consume the internal contents. Eventually the larva pupates and becomes an adult, which chews out an emergence hole. Parasitized aphids are swollen, brown to gray, and are called mummies. This wasp was the least encountered natural enemy. (Fig. 7)

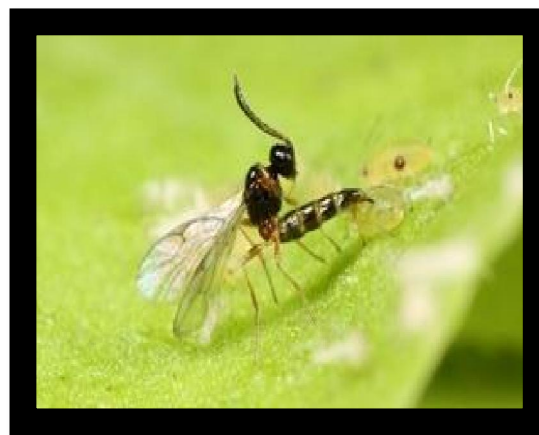


Fig. 7. *Trioxys pallidus* ovipositing on aphid

Table 1. Population dynamics of natural enemies of walnut aphids (Danwethpora site, 2012)

	Mean no. of individuals per 100 leaves											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Syrphid fly larvae	-	-	-	5	16	17	21	17	15	-	-	1
Green lacewing	-	-	-	2	1	1	1	5	2	3	1	4
Brown lacewing	-	-	-	4	3	6	6	4	3	3	-	-
Convergent ladybird beetle	-	-	-	3	4	8	8	9	8	4	2	-
<i>Trioxys pallidus</i>	-	-	-	0	0	0	0	2	0	2	3	1

Table 2. Population dynamics of natural enemies of walnut aphids (Batpora site, 2012)

	Mean no. of individuals per 100 leaves											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Syrphid fly larvae	-	-	-	1	8	17	20	18	16	2	-	-
Green lacewing	-	-	-	-	4	5	11	8	5	1	-	-
Brown lacewing	-	-	-	1	6	5	5	5	3	-	-	-
Convergent ladybird beetle	-	-	-	6	19	11	12	12	11	3	3	-
<i>Trioxys pallidus</i>	-	-	-	-	2	2	3	1	-	-	1	-

5. Conclusion

Both predators and parasitoids can maintain aphid population below thresholds for causing plant damage so that an insecticide application is not warranted. In present study five natural enemies of aphids were found preying on aphids inferring that aphid population is maintained low by these predators. Syrphid fly larvae were among the most common predator found in abundance at both sites (Table 1, 2 & Fig 1). These larvae were very active in feeding on aphids and are potential controlling agents. Convergent lady beetles were the second most abundant natural enemy encountered during the present study. Wherever present, these beetles were more in number than any other predator. Green lacewings were seen feeding on dusky veined aphid, but their numbers were very low. *T. pallidus* was reported on few trees and their population was almost negligible. The use of conventional insecticides to control aphids may not only kill these natural enemies but also significantly impact those of other plant feeding pests. As a result secondary outbreak may take place. The presence of natural enemies provides free aphid control, so before spraying with an insecticide, it is customary to check and be sure that existing natural enemies are not already taking care of business.

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