



REPORT OF GREEN APPLE APHID *APHIS POMI* DE GEER FROM KARGIL

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ABSTRACT

In this study, the green apple aphid *Aphis pomi* de Geer (1773) (Hemiptera: Aphididae), is reported infesting apples for the first time from Kargil, Ladakh from May 2020 to October 2021. The potential pest was trapped along with woolly apple aphid, *Eriosoma lanigerum* (Hausmann) rosy apple aphid *Dysaphis plantaginea* (Passerini) using yellow sticky trap and green water trap. It has been found that all the three aphid species cause significant damage to apple orchards in this particular region.

Keywords: *Eriosoma lanigerum*, *Dysaphis plantaginea*, yellow sticky traps, green water traps, potential pest, apple orchard

The Ladakh Union Territory comprises the Trans-Himalayan region (cold arid desert). With an average elevation of 2,987 m, it is the highest plateau in the northern part of India and the land of high passes, located between 34°10' N latitude and 77°48' E longitude, and it extends from the main Great Himalayas to the Siachen Glacier in the Karakoram Range. The horticultural economy of Ladakh is depends on the cultivation of apricots and apples because it provides employment opportunities in hilly and mountainous regions where other agricultural activities are challenging because of unfavourable environmental and topographical conditions. Due to their high sugar content, the apricots are well-known worldwide (Angmo et al., 2017). Kargil emerged as the top producer of apricots, peaches, plums, cherries, and grapes in this region (Rayees et al., 2021). The woolly apple aphid, *Eriosoma lanigerum* infests apple tree and is considered as a significant commercial pest of apples around the world (Bergh and Short, 2008; Foottit et al., 2009; Kacho et al., 2020). Green apple aphid *Aphis pomi* de Geer first time reported from Trans-Himalaya Ladakh, is a monoecious, and holocyclic species. This oligophagous insect feeds on trees and shrubs of the plants under Rosaceae family (Dampc et al., 2020). A serious infestation can weaken, stunt and curl the terminals, which increases the chance of winter mortality of the apple trees (Blommers, 1994; Khan and Riyaz, 2018). *A. pomi* is recognized as an economically significant pest of apples (Lowery et al., 2006; Khan, 2015; Foottit et al., 2009; Shah, 2015; Erdogan et al., 2023). Apple trees in Ladakh were also susceptible to infestations by the yellow-tail moth *Euproctis similis*, and codling moth *Cydia pomonella*. These pests can cause considerable damage to the apple crop if left

unchecked (Panday and Namgyal, 2014; Khan et al., 2018; Ahmad et al., 2020; Hussain et al., 2021; Stobdan et al., 2021). There is a research gap regarding the aphid pests that infest apple orchards in Ladakh, with limited previous investigations conducted in this area. This study documents the diversity of aphid pests affecting apple orchards in Ladakh.

MATERIALS AND METHODS

A survey was carried out from May 2020 to October 2021, in ten different sites from apple-growing areas having different geography, topography, and climatic conditions of Ladakh, to explore its dispersal in Ladakh. Five sites each from districts Kargil (K) and Leh (L) were selected and from each site 20 trees were observed. These sites include Suru (K1), Minjee (K2), Karkichuu (K3), Poyen (K4), Darchiks (K5), Nimoo (L1), Khaltsi (L2), Saspol (L3), Dah (L4) and Hanu (L5). The aphidspecies were collected using a camel hair brush, beating the twigs with a stick, yellow sticy traps (Garcez et al., 2015), and green water traps. A total of 6415 samples of *A. pomi* were collected. The collected samples were stored in 70% ethyl alcohol. Aphid species were identified by making slides (Foottit et al., 2009) and following the key by Blackman and Estop 1994, 2000. The morphological characters were studied under a Leica S9 D+ stereomicroscope with an MC170 HD camera and digital microscope (QUASMO) model; DIGI ELITE. For further confirmation, the preserved specimens were sent to Dr. Abas Shah ICAR-Central Institute of Tropical Horticulture Srinagar. All the sites were visited fortnightly to collect the sample and record the pest incidence. The result of infestation

from each site was analyzed by the following formula: $PI = \frac{n}{N} \times 100$ where, PI= percent infestation, n=No. of infested plants and N=Total number of plants observed.

RESULTS AND DISCUSSION

A total of three aphid species namely *A. pomis*, *E. lanigerum* and *D. plantaginea* were collected from almost all the sites and *A. pomi* was detected and collected in May 2020 at site K3 and K5 of district Kargil. Along with these aphid (*C. pomonella*) and (*E. similis*) were also observed infesting apple orchards. Throughout summer, *A. pomi* typically persist on apple plants and reproduce parthenogenetically. The winged viviparous individuals were first observed in May 2020 on the apple trees, and a heavy infestation was observed between June to August and remained active till October. The apical parts of the plants exhibited a higher infestation. *A. pomi* follows a seasonal cycle. During the temperate months from May to October, environmental conditions are favourable for their reproduction and survival. These months provide optimal temperatures, food availability, and suitable habitat for the aphids to thrive on apple trees. However, as the weather changes and temperatures drop from late October till April, the conditions become less suitable for *A. pomi*. The cold temperatures and reduced food sources, combined with the natural life cycle of the aphids, lead to their disappearance from apple trees. The egg stage of aphids typically overwinters, hatching in the spring into females that reproduce parthenogenetically and give birth to offspring. In the current study area, we have observed that *A. pomi* undergoes various forms of life phases, including eggs, wingless viviparous females, winged viviparous females, males, and oviparous females. The adults observed were found to be characterized by the following morphometrics Body length 1.60 to 1.77 mm with nearly 1.00 to 1.03 mm as maximum width. Brown head with small antennal tubercles that hardly extend over the vertex with smooth dorsum clothed with medium-sized hairs. Antennae is 6 segmented, and 0.43-0.49 times as long as the body.

Siphunculi is dark, cylindrical, tapering from base to apex, with moderately developed flanges at the tip, 0.16-0.20 times as long as the body and 1.39- 1.78 times the length of dark cauda. Cauda elongated concolorous with siphuncle, spinose, slightly constricted near the middle or basal third, bearing 8-12 hairs. The second segment of the hind tarsuss with both primary and secondary hairs and legs are yellowish brown except for the tarsi which are black.

All of the newly hatched nymphs were female and were feeding on young growing leaves. They are first observed on terminal shoots before moving to the older cluster leaves. Adults apterous after feeding for around one to two weeks and undergo multiple moults. Adults reproduce rapidly without mating.

Production of apples and apricots has been quite profitable in Ladakh. The influx of tourists in the area has greatly raised the demand for these fruits (Gupta and Arora 2016). *A. pomi* is known for its substantial damage to apple nurseries and young orchards and infestations of this pest occur during the months of May and June, posing a threat to the health and productivity of apple trees (Marcic et al., 2013). Both nymphs and adults suck the sap from leaves, twigs, branches, and young fruits, causing leaf curling, shedding of affected blooms and premature fruit drop the quality of the fruits is affected. Severely infected plants exhibit stunted growth as reported by (Gupta and Tara 2015). According to Bhat et al. (2022), severe infestation causes stunting and weakening of plant terminals and also increases the risk of winter mortality. This species also acts as a vector for certain plant viruses (Erdogan et al., 2023). Although apple production has been essentially constant over the past ten years, apricot production has reduced. Since organic farming is practised in these regions improper cultural practices and lack of technical knowledge are responsible for the occurrence of economically significant insect pests including the *C. pomoneti*, *E. chrusorrhoea*, and aphids speices (Baba et al., 2011). About 60 to 80% of fruits are rendered inedible and falls

Table 1. Apple orchard pest composition at different sites in Ladakh

Pest	Kargil Ladakh (2020-2021)									
	K1	K2	K3	K4	K5	L1	L2	L3	L4	L5
Woolly apple aphid	-	+	+	+	+	+	+	-	+	-
Rosy apple aphid	+	+	+	+	+	+	+	+	+	+
Green apple aphid	-	-	+	-	+	-	-	-	-	-
Codling Moth	+	+	+	+	+	+	+	+	+	+
Yellow Tail moth	-	-	+	-	+	-	-	-	-	-

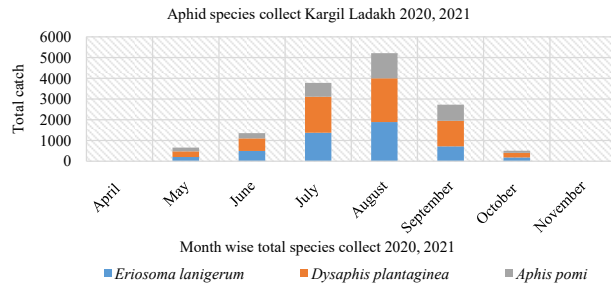


Fig. 1. Aphid pest collected from Kargil Ladakh 2020, 2021

to the ground soon after insect infestation. *A. pomi* inhibits tree growth and reduces the concentration of non-structural carbohydrates in young apple trees and decreased yield (Khan and Shah, 2018; Hamilton et al., 1986). *A. pomi* demonstrates varying defense responses and adaptive mechanisms in response to temperature increases caused by climate change (Dampc et al., 2020). Erdogan et al. (2023) provided clear evidence indicating that the primary mechanism of resistance to the carbamate insecticide, pirimicarb *A. pomi* is due to the increased activity of the esterase enzyme. The management of aphids should be carried out through biological means or by utilizing plant extracts as part of an integrated pest management (IPM) approach (Ali et al., 2023). The utilization of apple cultivars possessing resistance traits can contribute to the sustainable management of these pests in apple orchards (Stoeckli et al., 2008). The maximum infestation of *E. lanigerum* and *D. plantaginea* were found at Karkichuu, Darchiks, Poyen, Saspol, Khaltsi and Nimoo of Ladakh.

All these pests cause damage in the apple orchard, especially the nurseries and the newly grafted twigs. To safeguard the Ladakh apple sector, it is essential to develop management plans for this pest.

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CONFLICT OF INTEREST

No conflict of interest.

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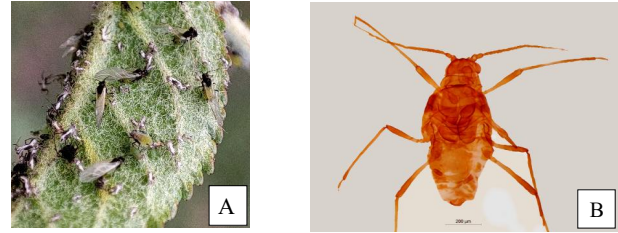


Fig. 2. (A) Showing apple orchard infestation in Ladakh showing the *Aphis pomi*, (B) *Aphis pomi*

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