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BIOLOGY OF TURNIP APHID, *Lipaphis pseudobrassicae* DAVIS (HOMOPTERA: APHIDIDAE) ON DIFFERENT *Brassica* HOST PLANTS

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ABSTRACT

The biology of *L. pseudobrassicae* were studied on different three brassica hosts viz., knol-khol (*Brassica oleracea* var. *gongylodes*), broccoli (*Brassica oleracea* var. *italica*) and cauliflower (*Brassica oleracea* var. *botrytis*) under laboratory conditions. The total life span ranged from 15.40 ± 2.16 , 15.44 ± 2.57 , and 14.56 ± 2.10 days on knol-khol, broccoli and cauliflower, respectively. The total nymphal period was highest on knol-khol (7.40 ± 1.00 days) and lowest on cauliflower (6.52 ± 0.92 days). The pre-reproductive period (1.28 ± 0.46 , 1.32 ± 0.48 & 1.24 ± 0.44 days), reproductive period (6.08 ± 1.29 , 6.24 ± 1.13 & 5.84 ± 0.85 days) and post-reproductive period (1.32 ± 0.48 , 1.44 ± 0.51 & 1.24 ± 0.44 days) was recorded on knol-khol, broccoli and cauliflower, respectively. The longevity period (8.86 ± 1.41 , 9.00 ± 1.22 & 8.32 ± 1.18 days) was observed on knol-khol, broccoli and cauliflower, respectively.

Keywords : Biology, *L. pseudobrassicae*, knol-khol, broccoli and cauliflower

Introduction

India is blessed with diverse agro-climatic zones with distinct seasons making it possible to grow a wide range of vegetables. Vegetables occupy an important place in the food basket of Indian consumers, a majority of whom are vegetarian by either choice or lack of access. Vegetables are the fresh and edible portions of herbaceous plants and contain high carbohydrates, vitamins and minerals (Robinson, 1990). India is the second largest producer of vegetables in the world after China (Singh *et al.*, 2021). It accounts for 11.95% of the total global vegetable production. In the year 2025, India produced 215.68 million tonnes of vegetables across 11.70 million hectares of land (Anon., 2025). Cruciferous vegetables belong to the Brassicaceae family, also known as Cruciferae. Commonly consumed crops include broccoli, knol-khol, brussels sprouts, kale, mustard, cabbage, turnips, cauliflower, bok choy and chinese cabbage (Higdon *et al.*, 2007). Among them, knol-khol is one of the most popular cruciferous

vegetables. Knol-khol is an anciently cultivated vegetable and commonly known as Ganth Ghobi or kohlrabi in India, is a cool-season cruciferous vegetable consumed in both tropical and temperate regions worldwide. knol-khol is widely cultivated in states such as Himachal Pradesh, Assam, Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, West Bengal, Maharashtra and is particularly popular in Kashmir. The crop is characterized by a swollen, sweet and juicy stem that develops entirely above ground and serves as a storage organ for starches and sugars. When consumed raw, it possesses a mildly sweet taste and a delicate aroma (Arolkar *et al.*, 2023). Despite its nutritional and economic importance knol-khol production is constrained by several biotic and abiotic factors, among which insect pests are major yield-limiting agents. The crop is susceptible to pests such as *L. pseudobrassicae*, *Plutella xylostella* (L.) and *Spodoptera litura* (Fab.). Among aphid, *L. pseudobrassicae* is a globally distributed and destructive pest of knol-khol, causing direct damage through sap feeding that results in leaf deformation and

yellowing and indirect damage by transmitting plant pathogenic viruses (Maia *et al.*, 2020). *L. pseudobrassicae* are small to medium sized yellowish green, grey green or olive-green aphids, with a slight white wax bloom. Sexual morphs have been found, but in warm climates it is predominantly anholocyclic (Anon., 2006). The losses in yield caused by mustard aphid on Brassica crops ranged from 9 to 95% at different places of India (Singh and Singh, 2014).

Materials and Methods

The biology of *L. pseudobrassicae* was studied on knol-khol, broccoli and cauliflower in laboratory conditions from December, 2025 to January, 2026. The initial culture of *L. pseudobrassicae* was obtained by collecting aphids from the knol-khol crop grown at Entomology Farm, BACA, AAU, Anand. These aphids are reared on 5 potted knol-khol plants each individually covered with a glass chimney (14 × 5 × 7 cm). The top end of chimney is covered with muslin cloth in the net house of Department of Plant Protection, College of Horticulture, AAU, Anand. Thus, laboratory culture was maintained. The newly produced nymphs collected from the potted plants were transferred individually into each Petri dishes (9 cm diameter & 2 cm height) containing blotting paper with the help of fine moist hair brush. Leaves of knol-khol, broccoli and cauliflower were provided separately as food. Food was replaced daily in the morning. A total of 25 sets for each of the three host plants were prepared for the study. Observations were recorded daily at 24-hour intervals using a magnifying lens and a stereo zoom microscope (Radical ProCAM).

Results and Discussions

Nymph

The nymph passed through four distinct instars before attaining adult stage. The instars were determined from the presence of exuviae of each moult.

First instar

Freshly borne first instar nymph was elongated, wingless, delicate, transparent and pale yellowish or light greenish in colour. Compound eyes were small, placed just behind the base of the antennae. Later, the body shape became oval and colour changed from light green to green. The antenna was setaceous type with six segments. Three pairs of thoracic legs were well developed and colourless. The length of fore and middle legs were nearly same and hind leg was little larger. A pair of small cornicles was visible laterally near the tip of abdomen (Fig. 1). The duration of first instar nymph was 1 to 2 days with an average of 1.52 ± 0.51 , 1.40 ± 0.50 and 1.48 ± 0.51 on knol-khol, broccoli and cauliflower, respectively (Table 1). The present findings are supported by Aziz *et al.* (2016), who observed that the first-instar nymphal duration of the cabbage aphid on broccoli averaged 1.50 ± 0.95 days. Qayyum *et al.* (2018) observed that first instar nymphal duration of *L. erysimi* on knol-khol had a mean period of 1.82 ± 0.08 days. Saleesha and Kennedy (2019) reported that the mean duration of the first instar of *M. persicae* on cauliflower was 1.46 ± 0.50 days.

Table 1: Duration of life stages of aphid, *L. pseudobrassicae* on different host plants under laboratory conditions

Life Stages	Hosts								
	Knol-khol (n=25)			Broccoli (n=25)			Cauliflower (n=25)		
	Duration in day(s)								
	Min.	Max.	Mean ± S. D.	Min.	Max.	Mean ± S. D.	Min.	Max.	Mean ± S. D.
Nymph									
I instar	1.0	2.0	1.52 ± 0.51	1.0	2.0	1.40 ± 0.50	1.0	2.0	1.48 ± 0.51
II instar	1.0	2.0	1.72 ± 0.46	1.0	2.0	1.64 ± 0.49	1.0	2.0	1.68 ± 0.48
III instar	1.0	2.0	1.80 ± 0.41	1.0	2.0	1.76 ± 0.44	1.0	2.0	1.60 ± 0.50
IV instar	1.0	3.0	2.36 ± 0.57	1.0	3.0	2.40 ± 0.65	1.0	2.0	1.76 ± 0.44
Total nymphal period	4.0	9.0	7.40 ± 1.00	4.0	9.0	7.20 ± 1.26	4.0	8.0	6.52 ± 0.92
Adult									
Pre-reproduction period	1.0	2.0	1.28 ± 0.46	1.0	2.0	1.32 ± 0.48	1.0	2.0	1.24 ± 0.44
Reproduction period	4.0	8.0	6.08 ± 1.29	5.0	8.0	6.24 ± 1.13	5.0	7.0	5.84 ± 0.85
Post-reproduction period	1.0	2.0	1.32 ± 0.48	1.0	2.0	1.44 ± 0.51	1.0	2.0	1.24 ± 0.44
Longevity	6.0	12	8.68 ± 1.41	7.0	12	9.00 ± 1.22	7.0	11	8.32 ± 1.18
Fecundity (No. of nymphs/female)	13	35	25.48 ± 5.91	16	37	27.40 ± 5.53	15	33	26.32 ± 5.76
Total life span	8.0	21	15.40 ± 2.16	10	21	15.44 ± 2.57	09	19	14.56 ± 2.10

Note: S. D. = Standard Deviation; n= No. of observation

Second instar

Freshly moulted second instar nymph was distinguishable from the first instar by its relatively larger size and altered appearance. It appeared slightly dark green on the lateral sides of the abdomen and showed a somewhat bulged body form. The compound eyes remained similar to those of the first instar in both colour and shape. Second instar nymph was highly active and exhibited light avoiding behaviour. Antennae were found to be six segmented (Fig. 1). Duration of second instar nymph ranged from 1 to 2 days with an average of 1.72 ± 0.46 , 1.64 ± 0.49 and 1.68 ± 0.48 days on knol-khol, broccoli and cauliflower, respectively. This was supported by Saleesha and Kennedy (2019), who observed that the mean duration of the second instar nymph of *M. persicae* on cauliflower was 1.68 ± 0.59 days. Mathur and Barad (2024) revealed that duration of second instar nymph of *L. pseudobrassicae* on broccoli ranged from 1 to 2 days with an average of 1.77 ± 0.42 days. Chavada (2020) found that duration of second instar nymph of *L. erysimi* on cauliflower ranged from 1 to 2 days with an average of 1.28 ± 0.45 days.

Third instar

The third instar nymph exhibited a dark yellowish to green coloration. Its compound eyes were round slightly larger than those of the second instar and blackish in colour. The antennae consisted of six segments (Fig. 1). Nymphal period of third instar of aphid, *L. pseudobrassicae* varied from 1 to 2 days with an average of 1.80 ± 0.41 , 1.76 ± 0.44 and 1.60 ± 0.50 days on knol-khol, broccoli and cauliflower, respectively (Table 1). More or less similar findings earlier confirmed by Raval (2021) found that duration of third instar nymph ranged from 1 to 2 days with an average of 1.80 ± 0.40 days on radish. Jiang *et al.* (2022) reported that the first instar nymphal period of *M. persicae* on chinese cabbage had a mean duration of 1.67 ± 0.07 days.

Fourth instar

Fourth instar nymph was dark green in colour with an elongated body form. The compound eyes were further enlarged and appeared deep black. This instar was highly active and closely resembled the adult stage, except for the absence of a deep green coloration and fully developed wings. The cornicles were distinctly visible with naked eye (Fig. 1). The nymphal period of fourth instar of *L. pseudobrassicae* varied from 1 to 3 days with an average of 2.36 ± 0.57 and 2.40 ± 0.65 days on knol-khol and broccoli, respectively. While, on cauliflower nymphal period of fourth instar varied from 1 to 2 days with an average of

1.76 ± 0.44 days. More or less similar findings earlier confirmed by Qayyum *et al.* (2018) revealed that the fourth instar nymphal duration of *L. erysimi* on knol-khol had a mean period of 2.06 ± 0.11 days. Similarly, Mathur and Barad (2024) reported a fourth instar period ranging from 1 to 2 days on broccoli, with an average duration of 1.90 ± 0.30 days.

Total nymphal period

Total nymphal period was calculated on the basis of birth of first instar to the end of fourth instar and total nymphal period was ranged from 4 to 9, 4 to 9 and 4 to 8 days with an average of 7.40 ± 1.00 , 7.20 ± 1.26 and 6.52 ± 0.92 days on knol-khol, broccoli and cauliflower, respectively. The present finding on the total nymphal period are more or less in agreement with Patel (2015) who recorded a duration of 4 to 8 days with a mean of 6.03 ± 0.89 days on cauliflower. Aziz *et al.* (2016) recorded a mean total nymphal period of *B. brassicae* 6.33 ± 0.225 days on knol-khol. Similarly, Chandrashekara *et al.* (2024) noted a mean total nymphal period of 8.80 ± 0.89 days on broccoli.

Adult

Apterate

Apterous adults were dark to deep olive green in colour possessing a spindle shaped to elongated pyriform body. The compound eyes were prominent and black in colour. Antennae were composed of six segments. The legs were comparatively stout and elongated, bearing fine hairs with the third pair longer than the first and second pairs. The abdomen appeared light green in colour, glossy and slightly swollen. Cornicles a distinctive morphological character of adult aphids were present as a pair of long, greenish tubular structures. The cauda was also distinctly visible in the adult stage (Fig. 2).

Alate

The alate adult closely resembled the apterate form, differing mainly in the possession of wings. Both the forewings and hind wings were transparent and oblong; however, the forewings were longer and broader than the hind wings. The body size of the alate adult was comparatively smaller than that of the apterate adult. Alate were dark to deep olive green in colour with a spindle shaped to elongated pyriform body. The compound eyes were prominent and dark green in colour (Fig. 2).

Pre-reproduction, reproduction and post-reproduction period

Pre-reproduction period of aphid, *L. pseudobrassicae* ranged from 1 to 2 days (Avg. $1.28 \pm$

0.46, 1.32 ± 0.48 & 1.24 ± 0.44 days), reproduction period varied from ranged from 4 to 8, 5 to 8 and 5 to 7 days (Avg. 6.08 ± 1.29 , 6.24 ± 1.13 & 5.84 ± 0.85 days) and post-reproduction period ranged from 1 to 2 days (Av. 1.32 ± 0.48 , 1.44 ± 0.51 & 1.24 ± 0.44 days) on knol-khol, broccoli and cauliflower, respectively (Table 1). Present findings are more or less supported by Qayyum *et al.* (2018) observed that the reproduction period of *L. erysimi* on chinese cabbage had a mean period of 7.65 ± 0.25 days. Similarly, Mathur and Barad (2024) reported that the pre-reproductive, reproductive and post-reproductive periods of *L. pseudobrassicae* on broccoli ranged from 1 to 2, 5 to 8 and 0 to 2 days, with mean durations of 1.17 ± 0.37 , 6.63 ± 0.79 and 1.00 ± 0.68 days, respectively.

Longevity

The longevity of adult was ranged from 6 to 12, 7 to 12 and 7 to 11 days with an average of 8.68 ± 1.41 , 9.00 ± 1.22 and 8.32 ± 1.18 days on knol-khol, broccoli and cauliflower respectively (Table 1). Patel (2015) recorded longevity of *L. erysimi* on cauliflower ranged from 6 to 11 days with an average 8.63 ± 1.17 days. Aziz *et al.* (2016) on knol-khol observed the longevity of *B. brassicae* knol-khol had a mean period 8.80 ± 0.82 days. Thus, present findings are in close confirmation with this earlier reports.

Fecundity

The reproductive potential of the aphid ranged from 13 to 35, 16 to 37 and 15 to 33 nymphs per female with a mean of 25.48 ± 5.91 , 27.40 ± 5.53 and

26.32 ± 5.76 nymphs per female on knol-khol, broccoli and cauliflower, respectively (Table 1). The present finding supported by Qayyum *et al.* (2018) observed that Fecundity of *L. erysimi* on chinese cabbage had a mean period of 26.00 ± 0.85 nymphs per female. Chavada (2020) reported that fecundity aphid on radish was 12 to 31 nymphs per female with an average of 23.96 ± 5.55 nymphs per female ranging.

Total life span

The life span of aphid, *L. pseudobrassicae* varied from 8 to 21, 10 to 21, 9 to 19 days with an average of 15.40 ± 2.16 , 15.44 ± 2.57 and 14.56 ± 2.10 days, respectively (Table 1). More or less similar findings earlier reported by Raval (2021) found that total life span of aphid on radish was 12 to 17 days with an average of 15.70 ± 1.18 days. Similarly, Mathur and Barad (2024) reported that total life span of aphid on broccoli was 8 to 17.5 days with an average duration of 16 ± 0.48 days. Thus, present results is in close agreement with the earlier reports.

Conclusion

Overall, broccoli is the most favourable host for the aphid, *L. pseudobrassicae* followed by knol-khol and cauliflower. In terms of reproduction, the maximum number of young ones were produced on broccoli (Av. 6.24 ± 1.13 days), whereas the lowest ones was recorded on cauliflower (Av. 5.84 ± 0.85 days). Longevity was found longest on broccoli (Av. 9.00 ± 1.22 days) and shortest on cauliflower (8.32 ± 1.18), as reflected by its relatively higher reproductive potential and favourable biological parameters.

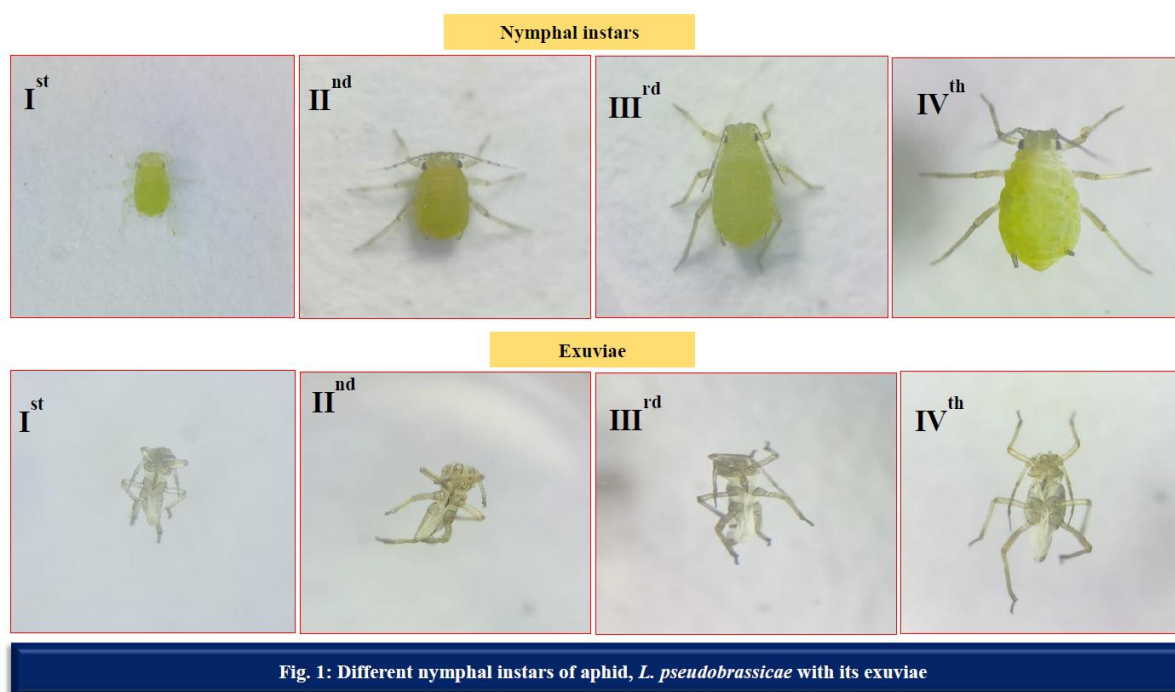
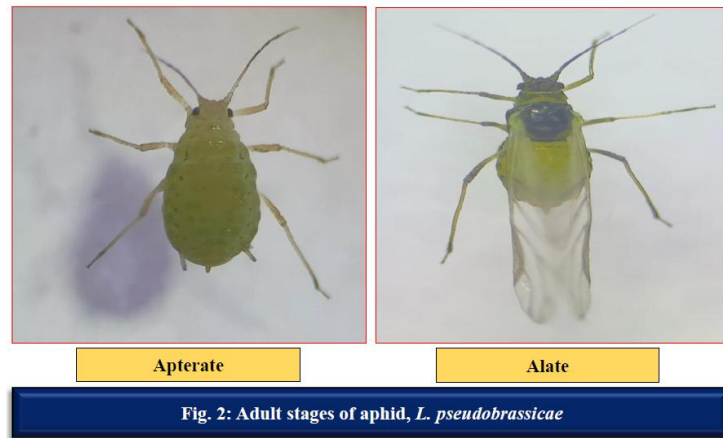


Fig. 1: Different nymphal instars of aphid, *L. pseudobrassicae* with its exuviae



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