Defence Life Science Journal, Vol. 10, No. 2, April 2025, pp. 85-89, DOI : 10.14429/dlsj.19881

Incidence of Insect Pests on Vegetable Crops in Trans-Himalayan Ladakh, India: A Survey

Sonam Yangdol, Nadeya Khaliq, Devraj, Rohit Kumar, Anand K Katiyar, OP Chaurasia, and Tsering Stobdan*

DRDO-Defence Institute of High Altitude Research (DIHAR), Leh, UT Ladakh - 194 101, India

**E-mail: stobdan.dihar@gov.in*

ABSTRACT

Insect pests are among the most critical constraints limiting vegetable production in trans-Himalayan Ladakh. However, there is limited information about the extent of crop damage, which hinders the development of effective pest management approaches for vegetable growers. The present study, therefore, aimed to identify farmers' perceptions of the most damaging insect pests of vegetable crops and the extent of crop damage in the Ladakh region. A standard questionnaire was used to interview individual vegetable growers (n=586) about their perception regarding insect pests in four major vegetable-producing valleys in the region. Most farmers (87.9 %) perceived insect pest attacks on vegetable crops have increased in the past ten years. Among the insect pests reported by the growers, onion maggot was ranked the most damaging by 58.4 % of the respondents, followed by aphids (22.7 %), the caterpillar of cabbage butterfly (16.0 %), and cutworms (2.9 % of the respondents). Of the farmers surveyed, 35.5 % of vegetable growers reported that the onion maggot caused over 70 % damage to onion crops. The result of the study will enable the researchers, extension personnel, administrators, and policymakers to prioritize developing strategies for managing these key insect pests in the region. To our knowledge, no such data for the region is available.

Keywords: *Agrotis*; *Delia antique*; Cutworm; Insect pest; *Pieris*

1. INTRODUCTION

The incidence of insect pests and diseases is low in the trans-Himalayan Ladakh region due to low temperatures and relative humidity. The high mountain natural geographical barrier restricts the spread of insect pests and diseases in the region. However, the incidence of cutworms (*Agrotis* spp), onion maggots (*Delia antique*), aphids, and cabbage butterfly (*Pieris* spp) emerged as the primary pest of vegetables in the region, inflicting a substantial economic loss on the growers[1]. The incidence of insect pest attacks has become a serious problem in recent years. Due to the low incidence of insect pests and diseases in earlier times, farmers' awareness of the problem is low. A survey conducted among 500 apple growers in the Leh district found that over 90 % of the respondents could not mention the name of a single insect pest or disease of apples[2]. Today, the extent of the infestation, the seasonal abundance of the pests, methods for forecasting pest attacks, and management strategies are unknown. This implicates problems with decision-making for the management of the pests[3]. Since the emergence and population dynamics of pathogens and insects are linked to abiotic and biotic factors, it is expected that the crop disease and insect pest problems of the high mountain region of Ladakh would be different from those of the plains. Therefore, there is a need for a detailed study of the quantitative data on the extent of damage by insect pests in the region.

Assessing growers' perceptions of crop production constraints has been used to document pest status and design pest management options suitable for a particular community[4-5]. Unless an extensive study at the grassroots level is undertaken, the status of the pest and its crop damage may differ significantly from what research scientists had usually assumed. The present study, therefore, aimed to identify farmers' perceptions of the most damaging insect pests of vegetable crops and the extent of crop damage in the Ladakh region. With the data at hand, our goal was to present the position of the incidence of insect pests on vegetable crops to enable the researchers, extension personnel, administrators, and policymakers to take necessary actions to manage the pests. To our knowledge, no such regional data is available with any agencies.

2. METHODOLOGY

The study was carried out through face-to-face interviews with 586 vegetable growers (male=210; female=376) spread across 18 villages in the Union Territory of Ladakh. A total of six questions were structured. Ladakh comprises six valleys, and

Received : 06 Feburery 2024, Revised : 22 December 2024
Accepted : 17 January 2025, Online published : 07 April 2025

the present survey was undertaken in four valleys- Leh (n=323), Nubra (n=91), Sham (n=148) and Suru (n=24). Changthang and Zanskar valleys were not covered since vegetables are not grown on a large scale in these valleys because of extremely high altitude conditions. The authors visited the villages and held face-to-face interviews with the growers. The survey was started on 13 October 2023 and ended on 10 January 2024. The survey respondents included 376 females and 210 males. The respondents ranged from 18 to 93 years old, with an average age of 49.2±14.8. Two respondents were below 20 years old.

The questionnaire was pre-tested with five vegetable growers in Leh Valley two weeks before the study. After the pilot test, changes were made in the expression of some questions to be asked. Farmers were shown colored photographs and vials of ten different insect larvae specimens in alcohol to ensure they correctly identified the pest. All interviews were conducted in the local language.

3. RESULTS AND DISCUSSION

3.1 Perception of Change in Insect Pest Damage

Of the growers surveyed, 83.6 % of respondents reported that insect pest attacks on vegetable crops have increased during the past ten years (Table 1). A small section (4.3 %) of the growers perceived that pest attacks had risen significantly in recent years. The rise in the incidence of pest attacks may be due to the introduction of new crops, changing cropping patterns and intensity, and climate change in the region. However, it is important to note that farmers tend to have a high perception of damage caused by insect pests, ranking them highly damaging[6]. In Nubra Valley, 96.3 % of the respondents reported an increase in insect pest infestation, while in Suru Valley, 58.3 % perceived that insect infestation has increased in vegetable crops. Very few farmers (6.1 %) perceived that the insect pest infestation had decreased, while 6 % of the respondents reported no change in the insect pest attack.

3.2 The Most Damaging Insect Pests

Among the vegetable insect pests reported by the growers, onion maggot was ranked the most damaging pest by 58.4 % of the respondents, followed by aphids (22.7 %) and caterpillars of cabbage butterfly (16.0 %). Cutworms occasionally appeared in the region and thus ranked the most damaging insect pest by 2.9 % of the respondents. None of the respondents claimed any other insect as the most destructive pest of vegetable crops. Therefore, the perceived most damaging insect pests of vegetable crops in the order of pest severity are onion maggots, aphids, the caterpillars of cabbage butterfly, and cutworms. Onion maggot was perceived as the most damaging pest of vegetables in Leh, Nubra, and Sham valleys. In contrast, in Suru Valley, most respondents considered the aphid the most destructive. The Diamondback moth (*Plutella xylostella*), a severe pest of crucifer crops worldwide, which is reported to cause 21-100 % cabbage curd damage[7], has not been noted as a pest in Ladakh. However, its incidence was reported in greenhouses[1]. Similarly, the region did not observe tomato fruit borer, which is reported to cause 7-68 % fruit damage[7]. Therefore, the major insect pests of the Ladakh region are significantly different from those in the rest part of the country.

3.3 Crop Damage by Onion Maggot

Onion maggot, *Delia antique* (Meigen), has recently emerged as a severe pest in major onion-growing areas in Ladakh. Of the farmers surveyed, 24.1 % of respondents said that the maggot caused 70-90 % damage to onion crops. A significant (11.4 %) of respondents reported that the pest damaged over 90 % of the crop. An average of 50-70 % damage by 19.6 % and 30-50 % damage by 15.9 % of the respondents was recorded. Therefore, onion maggot is the most destructive insect pest of onion crop in the region.

To our knowledge, onion maggot has not been reported to be a significant pest in India. Regions with very hot summers are not suitable for the pest. The pest has now spread and is established in most villages in the Ladakh region. Quantitative data on the extent of damage to onion crops are not available. A preliminary survey conducted by the Agriculture Department, Leh, through extension personnel, found that of the 124 villages surveyed, severe damage was found in 56 villages, intermediate damage in 48 villages, and no damage to the onion crop in the remaining 20 villages[3]. Because single cropping is practiced in the region, most farmers grow onions on the same field, resulting in minimal rotations to other plant species. Natural dispersal of the maggot occurs mainly as an adult fly. Adults form wings and can move about 1.2 kilometers from the overwintering site[8]. Therefore, the chances of spreading the insect from one village to the nearby villages in Ladakh are minimal because of the high geographical barrier of the mountains and the long isolation distance. The introduction of the pest into new locations will most likely occur through human-aided dispersal, especially by transporting infested bulbs (Fig. 1A). Pupae and eggs are the most likely forms to be transported through seedlings raised in maggot-infested fields. Little is known about the biology and ecology of the pest in Ladakh, which implicates problems with decision-making for the management of the pest. Fast pest dispersal warrants a concrete plan to stop its spread to unaffected villages in the region[3].

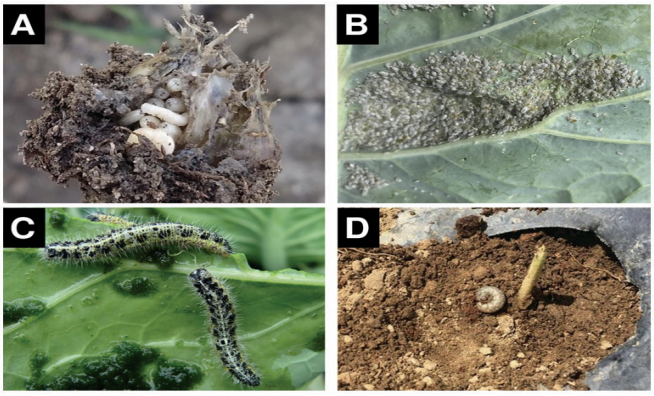

figure 1. The most damaging insect pest of vegetables in Ladakh: (A) onion maggot; (B) aphid; (C) caterpillar of the cabbage butterfly; (D) cutworm.

Table 1. Insect Pests of Vegetable Crops in Ladakh: Farmers' Perceptions of their Crop Damage (% respondents).

Questions/ information sought	Options	Valley				Total (n=586)
		Leh (n=323)	Nubra (n=91)	Sham (n=148)	Suru (n=24)	
The incidence of insect-pest attacks on vegetable crops has ____ during the last ten years	Decreased significantly	0.0	0.0	0.7	4.2	0.3
	Decreased	5.6	0.0	6.8	29.2	5.8
	No change	7.7	3.7	9.5	0.0	6.0
	Increased	83.9	96.3	79.0	58.3	83.6
	Increased significantly	5.2	0.0	4.0	8.3	4.3
Which is the most damaging insect pest on vegetables on your farm?	Onion maggot	67.1	51.6	48.0	29.2	58.4
	Cutworm	2.1	1.1	6.1	0.0	2.9
	Aphids	23.5	6.6	28.4	37.5	22.7
	Cabbage butterfly caterpillar	7.1	40.7	17.5	33.3	16.0
	Others	0.0	0.0	0.0	0.0	0
Percent onion crop damaged by onion maggot in your field	< 10%	21.6	2.2	19.6	33.3	18.6
	10-30%	6.5	15.4	16.9	4.2	10.4
	30-50%	5.8	33.0	23.6	37.5	15.9
	50-70%	13.3	45.0	18.2	16.7	19.6
	70-90%	33.7	4.4	17.6	8.3	24.1
	> 90%	18.8	0.0	4.1	0.0	11.4
Percent cole crops (cabbage, cauliflower, broccoli) crops damaged by aphids in your field	< 10%	3.4	1.1	9.5	4.2	4.6
	10-30%	22.6	28.6	24.3	16.7	23.7
	30-50%	50.7	65.9	33.1	45.8	48.5
	50-70%	18.8	3.3	24.3	16.7	17.7
	70-90%	4.0	1.1	7.4	12.5	4.8
	> 90%	0.3	0.0	1.4	4.2	0.7
Percent cole crops (cabbage, cauliflower, broccoli) crops damaged by cabbage butterfly caterpillars in your field	< 10%	13.3	3.3	18.2	25.0	13.3
	10-30%	39.9	13.2	32.4	25.0	33.1
	30-50%	35.2	52.7	25.0	16.7	34.8
	50-70%	10.8	26.4	16.2	29.2	15.4
	70-90%	0.6	4.4	8.1	4.2	3.4
	> 90%	0.0	0.0	0.0	0.0	0.0
Percent vegetable seedlings damaged by cutworms in your field	< 10%	76.4	58.2	53.4	41.7	66.4
	10-30%	16.4	37.4	23.0	37.5	22.2
	30-50%	5.2	2.2	17.6	16.7	8.4
	50-70%	1.8	2.2	5.4	4.2	2.9
	70-90%	0.0	0.0	0.7	0.0	0.2
	> 90%	0.0	0.0	0.0	0.0	0.0

3.4 Crop Damage by Aphids

Aphid (Fig. 1B) was perceived as the second most damaging insect pest of vegetable crops in Ladakh. Most growers (48.5 %) reported that it caused 30-50 % damage to cole crops, while 23.7 % of respondents reported 10-30 % crop damage (Table 1). Severe damage, over 70 %, was said by 5.5 % of the growers. Maximum number of respondents reported 30-50 % crop damage in all the four valleys. Cabbage aphids (*Brevicoryne brassicae*) are reported as the most common aphid species that cause severe damage to crops under passive solar greenhouses. Infestation is seen in summer as well as in the winter season. Crops infested with the aphid species cause 41 % reduction in cauliflower yield and 35 % yield reduction in knol-khol and radish under protected cultivation[9].

3.5 Crop Damage by Cabbage Butterfly Caterpillar

The caterpillar of the cabbage butterfly (Fig. 1C) was perceived as the third most damaging insect pest of vegetable crops in Ladakh. Most growers (67.9 %)

reported that it caused 10-50 % damage to cole crops, while 15.4 % of respondents said 50-70 % crop damage (Table 1). Severe damage, 70-90 %, was informed by only 3.4 % of the growers. None of the growers reported more than 90 % crop damage. The population of the caterpillars of cabbage butterfly is reported to be low in eastern Uttar Pradesh, while the major pest of cabbage crops are the Diamondback moth, cabbage head borer (*Hullula updates* Fab.), and *Crocidolomia pavonana* F.[10]. Therefore, the major insect pests of cole crops in Ladakh are significantly different from those in the rest of the country, which may be attributed to the unique climatic conditions and single cropping season.

3.6 Seedlings Damaged by Cutworms

Cutworms (Fig. 1D) occasionally appeared in the region and thus ranked the most damaging insect pest by 2.9 % of the respondents. Most of the growers reported less than 10% seedling damage in all four valleys. Most growers (66.4 %) said it caused less than 10 % seedling damage, while 22.2 % of respondents reported 10-30 % damage (Table 1). Few farmers reported more than 50 % seedling damage by the pest.

4. CONCLUSION

The information about the major insect pests in a region is crucial for developing effective pest management approaches. The survey shows that onion maggot is the most damaging pest in the Ladakh region, followed by aphids, the caterpillars of cabbage butterfly, and cutworms. Onion maggot was not known as a major pest a decade back. However, the pest has recently emerged as a severe pest in major onion-growing areas in Ladakh. Of the farmers surveyed, 35.5 % of vegetable growers reported that the onion maggot caused over 70 % damage to onion crops. Therefore, Researchers and extension personnel need to focus on managing these key insect pests. The damage caused by insect pests and diseases is considered minimal in the region[11]. However, most farmers (87.9 %) in Ladakh reported that insect pest attacks on vegetable crops have increased during the past ten years. Therefore, there is a need to prioritise developing strategies for managing insect pests in the region.

Conflict of Interest: None

REFERENCES

1. Stobdan, T. Agriculture in Ladakh: A step towards sustainable mountain development. Beeja House, New Delhi, 2023. 236p.
2. Dolker, T.; Katiyar, A.K.; Chaurasia O.P. & Stobdan, T. Farming practices, knowledge, and constraints in apple production in Ladakh: A survey. *J. Food Agric. Res*., 2022, **2**, 59-69. doi: 10.47509/JFAR.2022.v02i01.05
3. Stobdan, T.; Kanwar, M.S.; Namgial, D. & Dawa, T. Integrated management of onion maggot in Leh district, UT Ladakh. Ladakh autonomous hill development council, Leh, India, 2024, p.29.
4. Smit, N.E.J.M. & Matengo, L.O. Farmers' cultural practices and their effects on pest control in sweet potato in South Nyanza Kenya. *Int. J. Pest Manage*., 1995, **41**, 2-7. doi: 10.1080/09670879509371912
5. Obopile, M.D.; Munthali, C. & Matilo, B. Farmers' knowledge, perception and management of vegetable pests and diseases in Botswana. *Crop Prot*., 2008, **27**, 1220-4. doi: 10.1016/j.cropro.2008.03.003
6. Smit, N.E.J.M. Integrated pest management for sweet potato in Eastern Africa., Dissertation, Wageningen University, 1997
7. Haldar, J. & Rai, A.B. Emergence of new insect pests on vegetable during the last decade: A case study. *Curr. Hortic*., 2021, **9**, 20-6. doi: 10.5958/2455-7560.2021.00003.0
8. Martinson, T.E.; Nyrop, J.P. & Eckenrode, C.J. Dispersal of the onion fly (Diptera: Anthomyiidae) and larval damage in rotated onion fields. *J. Econ. Entomol.*, 1988, **81**, 508-14. doi: 10.1093/jee/81.2.508
9. Singh, N. & Dhiman, S. Quality and quantity loss by aphid infestation in vegetables grown under protected cultivation in Ladakh region. *Def. Life Sci. J*., 2018, **3**, 71-4. doi: 10.14429/dlsj.3.11516
10. Yadav, R.S.; Kumar, D.; Singh, U. & Singh, D.K. Insect-pests complex of cabbage in eastern Uttar Pradesh. *Veg. Sci*., 2015, **42**, 90-2.
11. Stobdan, T.; Angmo, S.; Angchok, D.; Paljor, E.; Dawa, T.; Tsetan, T. & Chaurasia, O.P. Vegetable production scenario in trans-Himalayan Leh Ladakh region, India. *Def. Life Sci. J*., 2018, **3**, 85-92. doi: 10.14429/dlsj.3.11661

CONTRIBUTORS

Ms. Sonam Yangdol was a Junior Research Fellow in the Horticulture Division at the DRDO-Defence Institute of High Altitude Research. She worked on key insect pests of vegetable crops in trans-Himalayan Ladakh. She holds an M.Sc in Botany from HNB Garhwal University, Uttarakhand.
She conducted the study, analysed the data, and contributed to literature collection and manuscript preparation.

Dr. Nadeya Khaliq is a Junior Research Fellow in the Horticulture Division of the DRDO-Defence Institute of High Altitude Research, Leh. She currently works on insect pest management of vegetable crops in trans-Himalayan Ladakh. She holds a Ph.D. in Entomology from SKUAST-Jammu.
She contributed to data collection, literature collection, and manuscript preparation.

Mr. Devraj is a Senior Technical Assistant at the DRDO-Defence Institute of High Altitude Research. He received his BSc (Agriculture) from Banaras Hindu University. He currently works on temperate horticultural crops.
He contributed to data collection.

Mr. Rohit Kumar is Technical Officer 'A' in the Horticulture Division at DRDO-Defence Institute of High Altitude Research, Leh. He holds an MSc in Botany from Uttarakhand Open University. His area of expertise is temperate horticultural crops. He contributed to data collection.

Dr. Anand K Katiyar is a Scientist 'E' at DRDO-Defence Institute of High Altitude Research, Leh. He obtained his MSc (Agricultural Extension) from Banaras Hindu University and Ph.D. from CSAUAT, Kanpur. He has research experience in agriculture extension in the Ladakh region.
He contributed to experimental design and manuscript preparation

Dr. O.P. Chaurasia is Scientist 'G' and Director, DRDO-Defence Institute of High Altitude Research, Leh. He obtained his PhD (Botany) from Magadh University Bodh Gaya, Bihar. He has extensively surveyed the Ladakh and Lahaul-Spiti trans-Himalayan belts and documented the fragile plant biodiversity and ethnobotanical wealth.
He contributed to experimental design and manuscript preparation.

Dr. Tsering Stobdan is Scientist 'F' and Head of the Horticulture Division at DRDO-Defence Institute of High Altitude Research, Leh. He received his PhD from the Indian Agricultural Research Institute, New Delhi. His areas of expertise are temperate horticultural crops and protected cultivation.
He conceived the study and contributed to manuscript preparation.