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Shahida Altaf
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Hilal Ahmad Malik
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Jauhar Rafeeq
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Manzoor Ahmad Khatana
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Ravi Kumar
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Corresponding Author:
Jauhar Rafeeq
Krishi Vigyan Kendra, Dawar
Gurez (Bandipora II), SKUAST-K,
Jammu & Kashmir, India

Diversity of insect pests infesting Maize (*Zea mays* L.) in the high-altitude ecosystem of Gurez Valley, A retrospective analysis

Shahida Altaf, Hilal Ahmad Malik, Jauhar Rafeeq, Manzoor Ahmad Khatana and Ravi Kumar

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Abstract

Maize (*Zea mays* L.), widely recognized as the “Queen of Cereals,” is one of the major food crops cultivated in Jammu and Kashmir, ranking third in importance after rice and wheat. Its significance extends beyond human consumption, as it serves as an important source of feed for livestock and poultry and provides raw material for various industrial uses. However, maize production in the region is frequently affected by insect pests, with the problem being particularly important under the distinctive high-altitude conditions of Gurez Valley, Jammu and Kashmir. The present investigation was conducted during the 2025 cropping season to characterize the insect pest complex associated with maize cultivation in different maize-growing areas of Gurez Valley. Systematic field visits, regular crop monitoring and visual assessments were carried out at successive crop growth stages to document pest occurrence and associated damage symptoms. The observations indicated the presence of a varied insect community representing five major orders, namely Lepidoptera, Hemiptera, Coleoptera, Diptera and Neuroptera. The principal pest species documented during the survey included maize stem borer (*Chilo partellus*), fall armyworm (*Spodoptera frugiperda*), black cutworm (*Agrotis ipsilon*), corn leaf aphid (*Rhopalosiphum maidis*), shield bug (*Dolycoris baccarum*), tarnished plant bugs (*Lygus* spp.), black and red bug (*Corizus* sp.), stink bug (*Cletus punctiger*) and flea beetles (*Chaetocnema* spp.). Alongside these phytophagous insects, several beneficial arthropods, particularly ladybird beetles, green lacewings and robber flies, were also encountered, suggesting the presence of a naturally occurring predator complex within the maize ecosystem. The occurrence and intensity of individual pest species differed across crop developmental stages and elevation gradients. Overall, the study demonstrates that maize cultivated under the high-altitude agroecosystem of Gurez Valley is exposed to a diverse insect pest complex, which may adversely influence crop productivity and, consequently, contribute to concerns regarding local food and livelihood security.

Keywords: Maize, Gurez Valley, insect pests, diversity, high-altitude ecosystem

Introduction

Maize (*Zea mays* L.) is among the major cereal crops cultivated across diverse agro-ecological regions of the world and ranks as the third most important grain crop globally. It is commonly referred to as the “Queen of Cereals” because of its broad adaptability, remarkable genetic variability, and high yield potential. The extensive genetic diversity of maize enables its cultivation under a wide range of environmental and agro-climatic conditions. In Jammu and Kashmir, maize occupies a prominent position among food crops and ranks third after rice and wheat. Nutritionally, maize is an important source of carbohydrates, proteins, minerals, vitamins, iron and other essential nutrients, with an energy value of approximately 365 Cal per 100 g. Its utility extends beyond direct human consumption, as it is extensively used as feed for livestock and poultry. Maize also serves as an important raw material for various industrial processes, particularly for the extraction of starch and oil.

From an Indian agricultural perspective, maize is an economically important crop whose production and demand have shown a steady upward trend. The rate of increase in maize production has been reported to be approximately three times that of wheat and twice that of rice^[10]. In high-altitude areas such as Gurez Valley, maize assumes additional importance because

of its contribution to household food requirements and livestock and poultry production. Its nutritional richness, combined with its adaptability, makes it an important component of the traditional subsistence farming system practiced in the valley.

Agriculture in Gurez is shaped by its distinctive high-altitude environment, characterized by a relatively short crop-growing period, low temperatures and unique agro-climatic conditions. Under such circumstances, successful maize production is both challenging and essential for rural livelihoods. The crop contributes to household food requirements, feed and fodder resources, and local economic activities. Farmers, therefore, depend on maize for multiple aspects of their farming system. Nevertheless, its productivity is affected by several biotic and abiotic constraints, among which insect pest infestation represents a major production challenge. Pest attack at different stages of crop development can cause considerable damage to various plant parts and ultimately reduce attainable yield. Although maize cultivation forms a major component of agriculture in developed countries such as the USA, its productivity in India remains comparatively low. The considerable difference between achievable yield and actual productivity highlights the potential for improving crop production and protection technologies^[18].

The ecological characteristics of Gurez, together with ongoing changes in climatic conditions, may influence the occurrence, abundance and distribution of insect pests associated with maize. Consequently, understanding the constraints affecting maize production in this high-altitude ecosystem is important for developing location-specific crop protection strategies. Documentation of the existing pest complex can provide essential baseline information for designing integrated pest management approaches, thereby supporting sustainable maize production and strengthening food security in the valley.

Maize is susceptible to attack by a diverse range of insect pests throughout its growing period, beginning from seedling establishment and continuing until crop maturity and storage. Different insect species may feed on or damage almost every major plant structure, including roots, stems, leaves, tassels, silks and grains. Approximately 140 insect species have been reported to infest maize and cause varying levels of damage, although only a relatively small proportion are considered economically important^[14]. Among these, nearly ten species have been reported to inflict substantial damage from crop establishment through the post-harvest storage phase^[3]. The pest complex associated with maize is not static, however, and its composition and distribution may change in response to environmental and climatic factors. Alterations in global climatic patterns can modify pest development, host association, geographic distribution and seasonal incidence. Consequently, insect species that were previously uncommon or not reported as pests of maize have increasingly been observed utilizing the crop, while shifts in the geographical distribution of several insect pests have also been documented^[7].

In view of the increasing cultivation of maize in newer and relatively unexplored areas, along with the potential influence of changing climatic conditions on insect pest dynamics, systematic documentation of the pest complex has become important. The present investigation was therefore undertaken to assess the diversity and occurrence of insect pests associated with maize in Gurez Valley. Information on pest incidence and distribution is essential for identifying potentially damaging species and developing appropriate, timely and environmentally compatible management interventions. Such knowledge can contribute to minimizing pest-induced yield losses and improving the productivity and sustainability of maize cultivation in the high-

altitude agroecosystem of Gurez Valley.

Materials and Methods

Study Area

The present investigation was carried out at Gurez Valley, located in the high Himalayas of north Kashmir, at an altitude of about 8,000 feet (2,400 meters) above sea level. It is characterized by a short growing season where maize and other temperate crops are cultivated. The high altitude and cool climate influence crop diversity, productivity, and pest dynamics in the region. The crop was observed under natural infestation conditions in the field.

Methodology

Weekly visual observations were taken from maize plants in addition to catches from yellow sticky traps. The crop observations for infestation by insect pests were taken on the basis of presence of dead hearts, presence of damaged plant parts, number of insect pests per plant in case of bugs, beetles, etc., and number per centimetre square of leaf or cob sheath in case of aphids^[13]. For soil-borne insects such as cutworm, the status was ascertained by digging a soil pit in dimensions of 20 × 20 × 10 cm^[6], and for white grubs and wireworms, soil was excavated in dimensions of 20 × 20 × 21 cm^[17].

Results and Discussion

The data presented in Table 1 indicate the occurrence of nine insect pest species associated with maize at different phenological stages in Gurez Valley. These pests belonged to three insect orders, namely Lepidoptera, Coleoptera and Hemiptera, and were distributed among seven families. In addition to the phytophagous insects, three groups of beneficial natural enemies—ladybird beetles, green lacewings and robber flies—were also observed in the maize ecosystem.

Previous investigations on the ecology and population fluctuations of maize insect pests have primarily focused on economically important species such as *Chilo partellus*, *Mythimna separata*, *Agrotis ipsilon*, *Helicoverpa armigera*, *Rhopalosiphum maidis*, *Corizus* spp., *Dolycoris baccarum* and *Cletus punctiger*. The increasing cultivation of maize in new geographical areas, together with changing climatic conditions, may alter the abundance, distribution and damaging potential of these insect pests. In the present investigation, *Chilo partellus* and *Mythimna separata* emerged as the most prominent pests under field conditions. Differences in pest abundance among observations may be associated with variations in maize genotype, local environmental conditions and other agro-climatic factors.

Although nearly 250 species of insects and mites have been reported in association with maize, only a limited number attain sufficient abundance to cause economically significant damage^[16]. Important pests include the maize stem borer (*Chilo partellus* Swinhoe), pink stem borer (*Sesamia inferens* Walker), two species of shoot flies, armyworm (*Mythimna separata* Walker), maize cob borer (*Helicoverpa armigera*) and maize aphid (*Rhopalosiphum maidis* Fitch). Depending on the season and geographical region, these pests can inflict substantial losses in maize production across the country^[11].

The observations obtained in the present study are comparable with those reported by Yogesh *et al.*^[19], who documented the occurrence of several insect pests during different developmental phases of maize. Their study recorded pink stem borer (*Sesamia inferens*), green stink bug (*Nezara viridula*), leafhoppers (*Cicadulina* spp.), black aphids (*Rhopalosiphum maidis*) and cob borer (*Helicoverpa armigera*) during the vegetative, tasselling

and cob-forming stages of the crop. The diversity recorded in the present investigation is also broadly consistent with earlier reports. Painter ^[12] documented 14 insect species associated with maize, while Boupha *et al.* ^[5] reported 22 species. Deole *et al.* ^[8] identified three lepidopteran species functioning as maize borers, whereas Erhan *et al.* ^[9] and Fischer *et al.* ^[10] recorded nine and 11 species, respectively. Patra *et al.* ^[13] reported a considerably higher diversity comprising 24 insect pest species, while Sekhar

et al. ^[15] documented three beetle species associated with maize. Similarly, Beres ^[4] reported seven aphid species, whereas Ahad *et al.* ^[1, 2] recorded five and 17 insect pest species, respectively, from maize ecosystems. The differences in pest diversity among these studies may reflect variations in geographical location, climatic conditions, maize genotype, cropping practices, sampling intensity and the stage of crop development at which observations were made.

Table 1: Insect pests infesting on maize crop

Common name	Scientific name	Order/Family	Status	Nature of damage
Maize stem borer	<i>Chilo partellus</i>	Lepidoptera/Pyalidae	Major	Nymphs and adults suck sap from leaves, tassel and cobs.
Armyworm	<i>Mythimna separata</i>	Lepidoptera/Noctuidae;	Major	Larvae feed on foliage of plant.
Cutworm	<i>Agrotis ipsilon</i>	Lepidoptera/Noctuidae;	Major	Larvae cut the seedling horizontally at the ground surface.
Gram pod borer	<i>Helicoverpa armigera</i>	Lepidoptera/Noctuidae;	Minor	Larvae feed on growing point inside central whorl and result in dead hearts.
Aphids	<i>Rhopalosiphum maidis</i>	Hemiptera/Aphididae	Minor	Nymphs and adults suck sap from leaves, tassel and cobs.
Black and red bug	<i>Corizus spp</i>	Hemiptera/Rhopalidae	Minor	Suck sap from kernels
Shield bug	<i>Dolycoris baccarum</i>	Hemiptera/Pentatomidae	Minor	Nymph and adults infesting foliage, leaves, ears and grain.
Stink bug	<i>Cletus punctiger</i>	Hemiptera/Coreidae	Minor	Suck sap
Flea beetles	<i>Chaetocnema pulicaria</i>	Coleoptera/Chrysomelidae	Minor	Adults feed on the chlorophyllous tissue of leaves leaving only leaf lamina intact.

Conclusion

It can be concluded that a larger number of insect pests infests maize crop in Gurez valley revealed diverse pest complex. Their activity at various stages leads to stunted growth, reduced grain yield and quality. These findings suggest the timely monitoring and effective integrated pest management strategies to increase maize productivity in this region.

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