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REPORT OF INSECT PESTS AND THEIR EXTENT OF DAMAGE ON MAIZE (*Zea mays* L) IN DISTRICT RAJOURI OF PIR PANJAL HIMALAYA JAMMU AND KASHMIR, INDIA.

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ABSTRACT

Maize is an important crop for food, feed, fodder and myriads of industrial products. The crop suffers biotic stress due to its vulnerability to weeds, insect pests and pathogens. The losses caused by these factors varies tremendously depending upon the cultivar used, season and location. This study reported the insect pests of maize and its extent of damage in district Rajouri of Jammu and Kashmir. Field surveys and sampling were conducted across various maize-growing regions within the district to identify prevalent insect pests and assess the extent of crop damage. About 12 insect pests were recorded from Rajouri including *Oxya fuscovittata, Gastrimargus africanus africanus, Acrida exaltata, Euconocephalus sp. (Nymph), Physopelta gutta, Dalpada nigricollis, Acanthocoris sebrator, Xylotrupes gideon, Calathus kollari, Apogonia sp, Hycleus sp, and Cordylocera* sp. The findings indicate that pest infestations resulted in substantial yield losses, with an estimated 40% reduction in total production. The study highlights the urgent need for integrated pest management (IPM) strategies to mitigate the adverse effects of these pests and it provides a crucial foundation for developing sustainable practices to enhance maize productivity in district Rajouri. As a result, it's critical to conduct thorough monitoring of pest species to reduce financial losses caused by crop damage.

KEYWORDS: - Rajouri, *Zea mays*, pests, foliage, damage

1. INTRODUCTION

Maize (*Zea mays* L.) is a vital cereal crop with significant economic and nutritional importance globally, including in India. In the agricultural landscape of Rajouri, a district in the Jammu and Kashmir region, maize is a principal crop that contributes substantially to the livelihood of local farmers. The cultivation of maize in this region is characterized by diverse agroclimatic conditions, which offer both opportunities and challenges for optimal crop production (Shaimerdenova et al., 2023).

One of the major challenges' maize cultivators face in Rajouri is the threat posed by insect pests. Insect pests are a major constraint in achieving high maize yields as they cause extensive damage to the crop at various growth stages (Neelima et al., 2020). The impact of these pests is multifaceted, leading to direct losses through feeding on the plants and indirect losses by predisposing the crops to secondary infections. The extent of damage caused by insect pests affects the quantity and quality of the produce and has significant economic implications for the farmers (Dar et al., 2019). Understanding the dynamics of insect pest infestation in maize is crucial for developing effective pest management strategies. Various factors such as climatic conditions, cropping patterns, and the presence of natural predators influence the prevalence and severity of pest attacks (Chormule et al., 2019; Bhavani et al., 2019; Venkateswarlu et al., 2018; Ali et al., 2018). In Rajouri, where agriculture forms the backbone of the rural economy, the need to address pest-related issues is more pressing due to the region's dependence on maize as a staple crop (Subedi et al., 2023). Insect pests of maize are numerous which exhibits varied feeding behaviors and life cycles, which complicate control measures. For instance, the maize stem borer larvae tunnel into stems, disrupting nutrient flow and weakening the plant, while fall armyworms can defoliate large areas of maize crops rapidly. Aphids, on the other hand, suck plant sap, weakening the plants and transmitting viral diseases (Kachapur et al., 2023).

The agronomic practices in Rajouri, such as sowing dates, irrigation schedules, and crop rotation, significantly influence the pest population dynamics. Traditional practices often lack the integration of scientific pest management principles, leading to suboptimal control measures and increased pest infestations. The limited

access to pest-resistant maize varieties and the reliance on chemical pesticides pose

additional challenges. Chemical control methods, though effective in the short term, can lead to pesticide resistance, environmental contamination, and health risks to farmers and consumers (Sharma et al., 2022).

This research aims to fill the knowledge gap regarding maize pest dynamics in Rajouri by documenting the pest spectrum and quantifying the damage. The outcomes will guide the development of targeted IPM strategies that are ecologically sustainable and economically viable. Ultimately, the goal is to enhance maize productivity and ensure food security for the local population while safeguarding the environment and improving the resilience of the agricultural system in Rajouri. This study aims to investigate the impact and extent of damage caused by insect pests on maize cultivated in Rajouri district. Through comprehensive field surveys and data analysis, we seek to identify the key pest species affecting maize, quantify the damage they cause, and assess the economic losses incurred by the farmers. The findings of this research will provide valuable insights for the development of integrated pest management (IPM) strategies tailored to the specific conditions of Rajouri, ultimately contributing to sustainable maize production and improved livelihoods for the farming community.

In India, about 28% of maize is used for food, 11% for livestock feed, 48% for poultry feed, 12% is processed in the wet milling industry for starch and oil, and 1% is kept for seed. Known as the "Queen of Cereals" for its exceptional yield potential, maize is the highest-yielding cereal crop in the world (Arifie et al., 2019). We observed a diverse range of insect pests damaging the maize crop in Rajouri district. Maize is the backbone of the economy for the common people and the underprivileged in the remote areas of Rajouri district.

In this study, we review existing literature to analyze how insect infestation in maize crops affects their composition and leads to a decline in quality. This study examines the available literature to explore the impact of insect infestation on maize crop composition and the resulting deterioration in quality.

2. MATERIALS AND METHODS

This section outlines the materials and methodologies employed in the study to investigate the insect pests on maize and their extent of damage. The study involved

field surveys, pest identification, damage assessment, and data analysis.

Study Area

The study was conducted in Rajouri district, located in the Jammu and Kashmir region of India. The district has diverse agro-climatic conditions, ranging from subtropical to temperate, providing a suitable environment for maize cultivation and pest infestation. The selected study sites included several maize-growing areas within the district, representing different ecological zones. The Rajouri district is in the Jammu region of the Union Territory of Jammu and Kashmir, India. The region spans 2,630 square kilometers, and its geographic coordinates are between 70° and 74°40′ E longitude and between 32°58′ and 33°35′ N latitude. It is bordered by Poonch to the north, Jammu to the south, Reasi to the east, and Kashmir to the west. The district boasts a diverse range of altitudes, landscapes, and soil types, with primarily hilly and mountainous terrain (Ridwan et al., 2023).

Field Surveys

The field were surveyed during the annual cultivation of maize from May to September. Samples were collected from the affected sections of the leaves, stems, and flowers. Symptoms of pest infestation in crops include leaf yellowing, stunted growth, weakened plants, and diminished yields. Manual collection, aerial net collection, trapping, jar (for pest collection), magnifying glass, insect field guide, camera, notebook, and light traps. For two months, the field underwent three sampling sessions to evaluate diversity and collected specimens of insects and pests in the area. Various yield features, including growth patterns, types of crops, optimal growing conditions, and other variations over a specific timeframe, were noted. During a field visit in the Rajouri area, a few pests affecting maize were identified with the assistance of local farmers. Damage was assessed by examining the maize plants for typical pest symptoms such as leaf holes, stem tunneling, and ear damage. The field survey involved a combination of techniques, including the use of nets to capture flying insects and hand-picking to gather those found directly on the maize plants. This comprehensive approach allowed for accurately identifying and documenting a wide range of insect pests affecting the crop. The collected data provided valuable insights into the diversity and abundance of pests in the area.

The crop was studied under natural infestation conditions in the field. Insect pests were documented on the maize plants using the plant inspection method.

Observations of insect pest infestations in the crop were based on the presence of

dead hearts, damaged plant parts, and the number of pests per plant, including bugs, hoppers, weevils, beetles, and grasshoppers. (Arifie et al., 2019).

Collection of pests

The collection of pests in Rajouri involves a systematic survey and identification of various insect species that pose a threat to local agriculture. Rajouri, being an agriculturally rich region, is home to a diverse range of pests that can significantly impact crop yield and quality. The process typically includes monitoring fields for signs of pest activity, such as damaged crops, presence of larvae, or adult insects. Aerial nets are particularly effective in capturing a wide range of pest species, including those that infest crops from above or migrate into the region from surrounding areas.

Identification of Pests

Insect pests were collected from the maize fields using a combination of sweep nets and direct handpicking. Collected specimens were preserved in 70% ethanol for laboratory identification. Identification of the insect pests was done at the Zoological Survey of India with a proper voucher no.

2. RESULTS

Field surveys and specimen collection revealed the presence of several insect pest species affecting maize crop in Rajouri. The most commonly identified insect pests are represented in Table 1. In district Rajouri 12 insect pests were found on maize. Among these 4 insects belongs to order Orthoptera representing 33 %, 3 insect pests belongs to order Hemiptera representing 25% and 5 insects pests belongs to order Coleoptera representing 42% of the total pests. Among the families, Acrididae was the most dominant family representing 25 % of the total insect pests recorded during the survey followed by Scarabaeidae with 17% of the total insect pests. During the study, from May up to September, the following species were observed infesting maize from the germination stage to physiological maturity, with observations made at weekly intervals.

***1. Oxya fuscovittata* (Marschall, 1836)**

Distribution: *Oxya fuscovittata* is primarily distributed across various Asian regions, including India.

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote and

Sunderbani

Host Plant: Maize, Rice, Wheat

Diagnostic Features: Green color, medium-sized body, antennae filiform, pronotum rounded having three prominent transverse sulci.

Damage: Both nymphs and adults feed on maize leaves, chewing irregular holes and edges. They also feed on tassels and developing ears which directly affects yield.

Figure 2 *Oxya fuscovittata*

2. ***Gastrimargus africanus africanus*** **(Saussure, 1888) Distribution**: Africa, Asia, and Oceania

Present Locality: Present in the tehsils of Rajouri, Darhal, Peeri, and Thanamandi.

Host Plant: Maize, Wheat, Barley, Alfalfa

Diagnostic Features: Jointed appendages, three pairs of legs one pair antennae, forewing leathery, hindlimbs enlarged for jumping.

Damage: Chewing and biting the parts of plant, necrotic areas on leaves, stems, or cobs.

Figure 3 *Gastrimargus africanus africanus*

***3. Acrida exaltata* (Walker, 1859)**

Distribution: Asia, Europe, North America, Hawaii, Australia.

Present Locality: Present in the tehsils of Rajouri, Darhal, Peeri, and Thanamandi.

Host Plant: Wheat, Rice, Corn, Sorghum

Diagnostic Features: Moderately long and have prominent conical heads and large compound eyes. Front pairs of wings are narrow, leathery, and thickened.

Damage: The nymphs and adults cause enormous loss to the crop by chewing and cutting leaves flowers. Defoliate the plants leaving only midribs and plant growth affected.

Figure 4. *Acrida exaltata*

4. Euconocephalus sp

Distribution: Asia, Africa, Australia to the Pacific islands, Europe, and France.

Present Locality: Present in the tehsils of Rajouri, Darhal, and Peeri.

Host Plant: Corn, Milkweed, Soyabean.

Diagnostic Features: Body flattened horizontally; wings folded flat on top of abdomen. Feet each with 3 segments. Cerci about as long as hind thigh.

Damage: Leaf spots, blight, wilts, scabs, cankers.

Figure 5 *Euconocephalus sp*

***5. Physopelta gutta* (Burmeister, 1834)**

Distribution: Asia, Oceania
Present Locality: Present in the tehsils of Rajouri, Darhal,and Peeri.

Host Plant: Rice, Maize, Cotton, Vegetables and fruits.

Diagnostic Features: It has a distinctive red or orange marking on its shoulders, contrasting with a mostly black or dark brown body. The wings are membranous and often combine dark and lighter patterns. At rest, they lie flat over the abdomen. The antennae are relatively long and segmented, usually with four or five segments.

Damage: The young stages of these insects eagerly consume plant sap using their piercing-sucking mouthparts.

Figure 6 *Physopelta gutta*

***6. Dalpada nigricollis* (Westwood,1837)**

Distribution: Asia including India and Africa.

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote and Sunderbani

Host Plant: Rice, Sugarcane, cereals

Diagnostic Features: *Dalpada nigricollis* typically has a dark-colored (often black) collar, which is a distinctive feature.

Damage: Dalpada nigricollis uses its piercing-sucking mouthparts to extract sap from plant tissues, leading to direct damage. The affected plants often exhibit yellowing leaves and wilting due to loss of sap and vitality. Prolonged feeding can result in stunted growth and reduced vigor.

Figure 7 *Dalpada nigricollis*

***7. Acanthocoris sebrator* (Fabricius,1803)**

Distribution: Asia and Africa.

Present Locality: Present in tehsils of Rajouri, Nowshera, Darhal, Kalakote and Sunderbani.

Host Plant: Rice, Sugarcane, Cotton, Legumes, Vegetable Crops

Diagnostic Features: Acanthocoris sebrator typically has a dark-colored body with distinctive markings. The coloration can vary from dark brown to black, often with lighter patterns or spots. The head is often narrow, with a well-defined pronotum (the shield-like structure behind the head).

Damage: Uses piercing-sucking mouthparts to extract plant sap, leading to various forms of damage. Affected plants may exhibit yellowing leaves and wilting due to loss of sap.

Figure 8 *Acanthocoris sebrator*

***8. Xylotrupes gideon* (Linnaeus,1767)**

Distribution: *Xylotrupes gideon* thrives in tropical and subtropical climates. Its distribution spans a significant part of Asia (India, Sri Lanka, some parts of China) and Oceania.

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote and Sunderbani

Host Plant: Maize, Wheat

Diagnostic Features: The body is divided into three main parts: the head, thorax, and abdomen, with strong legs adapted for digging and clinging to surfaces. Dark brown to black exoskeleton, with a shiny, hard, and robust appearance.

Damage: Feeding can cause wilting, yellowing, and a general decline in plant health. Damaged leaves may show irregular holes and cuts.

Figure 9 *Xylotrupes gideon*

9. Apogonia sp.

Distribution: widely distributed across tropical and subtropical regions, particularly in Asia and the Pacific Specific regions and Africa

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote and Sunderbani

Host Plant: Sugarcane, Maize, fruits, coconut, Oil palm, Rubber, Pineapple.

Diagnostic Features: The body is divided into three main parts: the head, thorax, and abdomen, with strong legs adapted for digging and clinging to surfaces. Dark brown to black exoskeleton, with a shiny, hard, and robust appearance.

Damage: Feeding can cause wilting, yellowing, and a general decline in plant health. Damaged leaves may show irregular holes and cuts. Larval feeding on roots can weaken the plant and make it more susceptible to other stresses and diseases.

Figure 10 *Apogonia sp*

10. *Hycleus sp.*

Distribution: Africa, Asia and Europe

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote, Thanamandi Peeri and Sunderbani

Host Plant: Maize, Tomato, Ladyfingers, Beans, Sorghum and sweet potato

Diagnostic Features: Known for its striking features, the protonum is narrower than the head and thorax. The legs and antennae are long and thread like.

Damage: Adults feeds on the floral parts of the plant including petals, anthers, stigma, and ovary of the plants. Eating silk of the maize cob, larva consumes more leaves.

Figure 11 *Hycleus sp.*

11. *Cordylocera sp.*

Distribution: Cosmopolitan

Present Locality: Present in tehsils of Rajouri, Nowshera, Peeri, Kalakote and

Sunderbani

Host Plant: Flowering plants and Maize.

Diagnostic Features: Adult elongate and usually dark brown to black with orange, red, or yellow. Head bent downwards, the pronotum is usually wider than the head and wider then long. The wings cover is smooth to velvety in appearance.

Damage: They are harmless to the plants.

Figure 12 *Cordylocera sp.*

12. *Calathus Kollari* (Putzeys, 1873) (Figure 12)

Distribution: Europe and parts of Asia.

Present Locality: Present in tehsils of Rajouri, Nowshera, Kalakote and Sunderbani

Host Plant: Wheat, Barley, Rye, and other grains.

Diagnostic Features: Typically, dark brown to black with a shiny exoskeleton and long segmented antennae. The area behind the head (pronotum) is narrower than the elytra (wing covers) and often has distinctive sculpturing or grooves. Wing covers are often striated (having parallel lines) and may have punctures or pits.

Damage: Feeds on the larvae of pest species, helping to reduce their populations.

Figure 13. *Calathus Kollari*

Maize exhibits various symptoms depending on the genotype, age of infection, and environmental conditions. These symptoms include leaf die-off leading to premature plant death, failure to tassel, malformed or absent ears, and rotting cobs. Damage to maize plants can significantly impact crop yield and quality. Common issues include leaf damage, which can reduce photosynthesis and weaken the plant (Figure 14). Infected plants may exhibit stunted growth, premature death, and malformed or absent ears, leading to lower grain production. Additionally, environmental stresses and pest infestations can exacerbate these symptoms, further compromising the health and productivity of maize crops. Chewing and biting maize leaves are common problems caused by various pests, such as caterpillars, beetles, and grasshoppers. Lesions and patches on maize plants are often signs of fungal, bacterial, or viral infections. These can appear as discolored, necrotic areas on leaves, stems, or cobs (Figure 16). Fungal pathogens, such as those causing leaf blight or rust, typically produce circular or irregular lesions that can merge into larger patches, weakening the plant and reducing its photosynthetic efficiency (Figure 14). These pests feed on the foliage, creating holes and ragged edges on the leaves, reducing the plant's ability to photosynthesize efficiently. Severe infestations can lead to significant defoliation, weakening the plant and making it more susceptible to diseases and environmental stresses. Pests feeding on the silk of maize cobs can cause significant damage, affecting pollination and kernel development (Figure 17). Corn earworms, armyworms, and other insects are common culprits that chew on the silk, leading to incomplete kernel formation and reduced yield (Figure 15). This damage can also create entry points for secondary infections and mold growth, further compromising the quality and marketability of the maize (Figure 17). Implementing integrated pest management strategies is essential to mitigate the impact of these pests and ensure healthy cob development. the damages in the maize crop as stated in the results were also observed in the previous literature (Kaushik, et al., 2023). In addition to the direct consumption of maize grains by insects, the damage often results in discolored or shriveled kernels. Infested grains may be clustered together, showing signs of frass (insect droppings) and silk webbing, indicating the presence of insect larvae. The compromised grains

are often more prone to falling off the cob, leading to further yield loss. Furthermore, the damaged grains may attract other pests and predators,

exacerbating the overall impact on the maize crop (figure 17). Insect damage to maize grains can lead to visible structural weakening, making the kernels more brittle and prone to cracking. This weakening can cause the grains to break during harvest, transport, or storage, resulting in additional losses. Damaged grains also tend to lose moisture more rapidly, leading to uneven drying and potential spoilage. In some cases, the feeding activity of insects can trigger premature germination of the kernels while still on the cob, further diminishing their viability for consumption or planting. The overall nutritional quality of the maize may also decline due to the loss of essential nutrients in the eaten or damaged grains (figure 17).

Figure 14 Damage to maize by insect pests.

Figure 15 Symptoms of damage: Longitudinal Lesions and Cutting Edges of Leaves

and cob.

Figure 16 Symptoms of damage: Longitudinal Lesions and Cutting Edges of Leaves and holes in the leaves.

Figure 17 Symptoms of damage: Maize grains eaten by insects.

4. **DISCUSSION**

The examination of insect pests on maize in Rajouri, Jammu and Kashmir, provides valuable insights into their impact and the extent of the damage they cause. Maize, as a staple crop, is vital to the agriculture of the region. However, insect pests present a significant threat to maize cultivation, adversely affecting both yield and quality. The report highlights that the extent of damage caused by these pests varies based on several factors, including pest population density, environmental conditions, and the stage of crop growth at the time of infestation. There is significant variation in the extent of injury caused by a specific level of FAW infestation and in how plants respond to that injury (Berg et al., 2021). The maize plant's reaction to FAW damage is shaped by various biotic and abiotic factors. Key influences include the plant's developmental stage and condition, the prevalence of infestation, the intensity of leaf damage, the duration of larval feeding, and the occurrence of crop reinfestation (Berg et al., 2021).The cumulative effect of these pests can lead to substantial economic losses for maize farmers in District Rajouri. It is crucial to regularly assess the status of insect pests on maize crops to detect any changes in their occurrence patterns. Insect pests present a significant challenge to the yield of maize crops. To effectively eradicate pests within the local ecology of a region, it is essential to know the various pest species, their occurrence patterns, and their peak activity periods. Therefore, effective monitoring of pest species is essential to mitigate financial losses resulting from crop damage. The impact and extent of damage caused by insect pests on maize in Rajouri, Jammu and Kashmir, underscore the importance of adopting integrated pest management approaches. Sustainable pest control measures, coupled with farmer education and ecological considerations, can mitigate the adverse effects on maize cultivation. Continued research and monitoring are essential to adapt management strategies to evolving pest dynamics and climatic conditions, ensuring the resilience and productivity of maize in the region. Grasping these climatic and geographical nuances is crucial for developing effective pest management plans. By integrating climate data with pest monitoring, it is possible to predict pest outbreaks and optimize the timing and application of control measures. The leaves exhibit irregular edges, often appearing jagged or tattered due to feeding damage. Small to large holes can be seen scattered across the leaf surface, varying in size and shape depending on the severity of the

infestation. These holes and irregularities disrupt the leaf's normal structure, potentially hindering the plant's ability to photosynthesize effectively (figure 16). These studies were conducted for the first time in the higher regions of Rajouri district. The findings will help inform future management strategies for various pests attacking maize crops in this specific area (Ahad et al., 2011).

Key pests identified in this region include various beetles, hoppers, weevils, and grasshoppers, all of which contribute to significant crop damage. These pests threaten not only maize yield but also the livelihoods of farmers who rely on this essential crop. The study highlights the critical need for ongoing monitoring and assessment of pest populations. With this being the first observation of such a diverse range of pests in the higher areas of Rajouri, it is clear that these pests have become established in the environment, creating new challenges for crop management.

5. CONCLUSION

In the district Rajouri, situated in the Pir Panjal Himalaya of Jammu and Kashmir, India, the study on insect pests and their impact on maize (*Zea mays* L) revealed significant findings. The extent of damage ranged from mild leaf destruction to severe grain loss, significantly affecting crop yield and farmers' livelihoods. These findings underscore the need for integrated pest management strategies to mitigate the impact of these pests and enhance maize production in the region. The extent of damage varied, with stem borers and aphids causing up to 40% yield loss in severely infested fields. The study underscores the importance of continuous monitoring and research to adapt pest management practices to evolving pest dynamics and environmental conditions in the Pir Panjal Himalaya region. Previously, no work had been done on the diversity of maize insect pests. Therefore, it is important to investigate the insect pest diversity of maize crops in Rajouri district. Based on the current study, it can be concluded that a significant number of insect pests infest maize crops in Rajouri. It is essential to periodically review the status of these pests to monitor and understand any changes in the patterns of infestation. Regular assessments will help in developing more effective management strategies to address the evolving threats posed by these pests.

Highlighting the diversity of insect pests in Rajouri district will set the stage for a management program that can be carried out by future researchers.

Conflict of Interest: Declared None

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Table 1 List of Insect Pests damaging *Zea mays* in district Rajouri, J&K.

S. No.	Name of the Pest	Order	Family	Voucher No
1.	*Oxya fuscovittata*	Orthoptera	Acrididae	F. No-2022-KS/Iden/53
2.	*Gastrimargus africanus africanus*	Orthoptera	Acrididae	F. No-2022-KS/Iden/53

3.	*Acrida exaltata*	Orthoptera	Acrididae	F. No-2022 KS/Iden/53
4.	*Euconocephalus sp*	Orthoptera	Tettigoniidae	F. No-2022-KS/Iden/53
5.	*Physopelta gutta*	Hemiptera	Largidae	Identification report no.:02/2023
6.	*Dalpada nigricollis*	Hemiptera	Pentatomidae	Identification report no.:02/2023
7.	*Acanthocoris sebrator*	Hemiptera	Corcidae	Identification report no.:02/2023
8.	*Xylotrupes gideon*	Coleoptera	Scarabaeidae	Identification report no.:17/2022
9.	*Calathus kollari*	Coleoptera	Carabidae	Identification report no.:17/2022
10.	*Apogonia sp.*	Coleoptera	Scarabaeidae	Identification report no.:17/2022
11.	*Hycleus sp.*	Coleoptera	Meloidea	Identification report no.:17/2022
12.	*Cordylocera sp.*	Coleoptera	Cantharidae	Identification report no.:17/2022

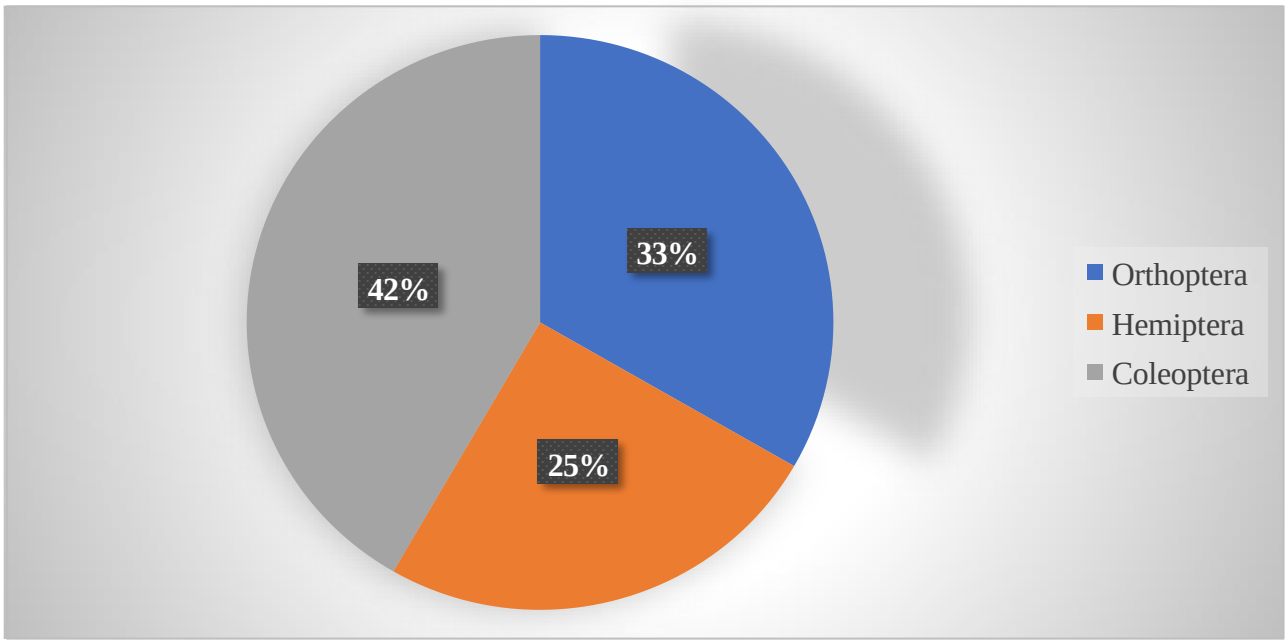

Figure. 1(a) Pie-Chart Representing the Percentage of Orders of Insect Pests

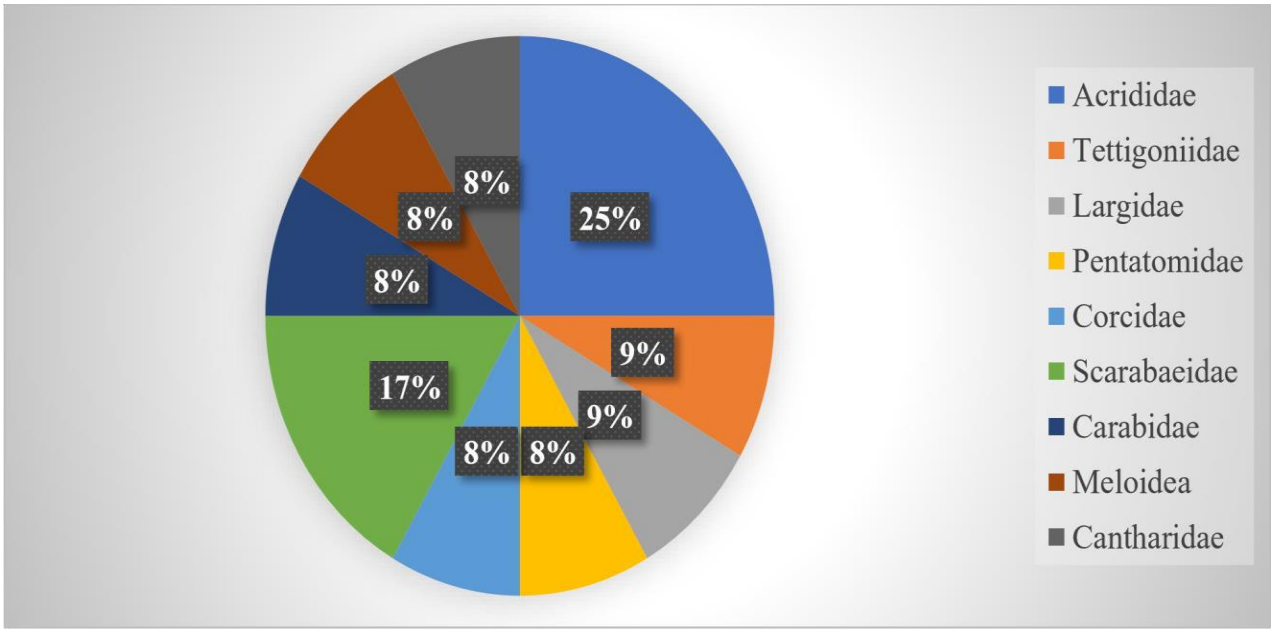

Figure. 1(b) Pie-Chart Representing the Percentage of Families of Insect Pests

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