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Inventory and Identification of Pests on Corn Plants (*Zea mays* L.) In Moncongloe Subdistrict, Maros Regency

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ABSTACT

Corn (*Zea mays* L.) is a vital global crop, providing essential carbohydrates and protein. However, fluctuating productivity, particularly in Moncongloe District, Maros Regency, Indonesia, poses challenges for sustainable cultivation. This study aimed to identify and quantify pest populations affecting three corn varieties: Kumala F1, NK Sumo, and Arumba F1. Field observations and pest collections were conducted from April to July 2023 using diagonal sampling plots across three locations. Pests were identified morphologically using insect determination keys and relevant literature. The study revealed six key pests: *Menochilus sexmaculatus, Micraspis crocea, Atherigona exigua, Spodoptera frugiperda, Dacus* sp., and *Oxya* sp. Spodoptera frugiperda was the dominant pest, particularly affecting NK Sumo, with peak populations observed 6-8 weeks after planting. Shannon-Wiener diversity index calculations indicated low to moderate insect diversity (H' = 1.5–2.7) across varieties, while Simpson's dominance index highlighted the prevalence of dominant pest species. Integrated pest management (IPM), including biological control and resistant crop varieties, was identified as essential for mitigating pest impacts. Findings underscore the need for region-specific pest management strategies to enhance productivity. Future research should focus on the impact of emerging pests and the efficacy of IPM approaches tailored to local agricultural conditions.

INTRODUCTION

Corn (*Zea mays* L.) is a staple food crop globally, serving as a primary source of carbohydrates and protein, second only to rice. The escalating demand for corn, driven by population growth and the expansion of the food and livestock industries, underscores its critical role in global food security (Sari et al., 2023). However, regions like Maros District in South Sulawesi, Indonesia, have faced challenges in meeting this growing demand, as evidenced by significant fluctuations in corn productivity over recent years. Data from the Central Statistics Agency of Maros District reveals that while productivity increased from 2016 to 2018, it subsequently declined in 2019 and 2020, highlighting the difficulties in maintaining consistent production levels (Daud et al., 2020).

Several factors contribute to low corn yields in this region, including physical and biological. Physical factors such as climate, soil type, and water availability are crucial determinants of corn productivity, with studies indicating that heat and moisture significantly influence yield outcomes (Carlson et al., 2018). Biological constraints, particularly pest infestations and diseases, are major contributors to yield losses. Notably, pests like the corn borer (*Ostrinia nubilalis*) and cutworm (*Agrotis ipsilon*) have been identified as significant threats, affecting corn at various growth stages and leading to substantial yield reductions (Pintilie et al., 2023). Socioeconomic factors, including farmers' access to resources, knowledge of agricultural practices, and market conditions, also play a crucial role in determining corn yields (Pes et al., 2020). Recent studies emphasize the need for a multifaceted approach to address these challenges effectively (Vudhironarit et al., 2024).

To mitigate the impact of pests on corn production, Integrated Pest Management (IPM) is a recommended strategy. IPM involves routine field monitoring and understanding the bioecology of

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pests, enabling farmers to make informed decisions regarding pest control (Bryant et al., 2023). Early detection of pest symptoms is crucial, as timely interventions can prevent significant crop damage (Moore & Tracy, 2020). Research into the types and levels of pest infestations in specific regions is essential for developing effective management strategies. Recent literature highlights the effectiveness of IPM in reducing pest populations while maintaining or enhancing crop yields through conservation practices (X. Li et al., 2023). For instance, studies have shown that the application of entomopathogenic fungi, such as Beauveria bassiana, can effectively control pests like the fall armyworm (*Spodoptera frugiperda*) while promoting corn plant health (Gassmann et al., 2019).

Despite advancements in pest management strategies, gaps remain in research regarding specific pest pressures faced by corn farmers in different regions. While IPM has been widely adopted, the effectiveness of various pest control methods in specific local contexts requires further investigation (Rowen et al., 2022). Additionally, the impact of emerging pests, such as the fall armyworm, on corn production in Indonesia has not been thoroughly studied, highlighting the need for targeted research in this area (Kim et al., 2018).

MATERIALS AND METHODS

The research was conducted in Moncongloe District, Maros Regency, and the identification of pests on corn plants was carried out at the Makassar Agricultural Quarantine Center Laboratory. This research was conducted from April to July 2023. The materials used in this research were 70% alcohol, insect pests found in the field, and corn plants. The tools used in this research were raffia string, measuring tape, bamboo stakes, ruler, scissors, machete, marker, plaster, 5x10 cm plastic bags, sweep net, tweezers, jars, microscope, insect determination keys (Claridge, 1991), label paper, stationery, and camera.

This research used data collection methods (pest inventory) and pest identification methods.

1. Data Collection Method (Pest Inventory)

The method used to obtain data is through observation and interview techniques.

a. Observations were conducted at three different locations in Moncongloe subdistrict, Maros district, with varying corn varieties: Kumala F1, NK Sumo, and Arumba F1. Several methods were used for observation, including hand collection and sweep netting. The observation points were divided diagonally into five plots: four on the edges and one in the center, with 10 plants in each plot. Hand collection was used to collect pests found in each plot. This method involved manually collecting pests with bare hands. Sweep netting was used for pests that were active in the air. This tool was used three times in each plot.

b. Interviews were conducted by distributing questionnaires or asking farmers and landowners about the types of pests commonly found on corn plants.

2. Pest Identification Method

Pest identification was conducted by examining the morphological characteristics of the collected specimens and comparing them to descriptions in insect identification keys and relevant literature, including Kalshoven (1981), Borror et al. (1992), and Subyanto (1991).

3. Research implementation

a. Field Observation

Observasi dilakukan sebelum penelitian dimulai yang bertujuan untuk melihat langsung keadaan di lapangan dan untuk mengetahui letak sampel tanaman jagung yang akan diamati. Obsevasi dilakukan di Kecamatan Moncongloe pada Kabupaten Maros.

b. Creation of Sampling Plots

At each location, a corn plot measuring approximately 0.5 hectares was selected. This plot was then divided into 5 diagonal subplots. Each subplot contained 10 corn plants. The corn plants to be studied were selected based on the planting age as determined by the farmers.

c. Sample Collection

Insect samples were collected from each subplot, with 10 plants from each subplot taken for morphological identification in the laboratory. Thus, a total of 50 plants (5 subplots x 10 plants) were observed at each location. Sampling was conducted either in the morning or afternoon by visually inspecting each corn plant of three different varieties: Kumala F1, NK Sumo, and Arumba

F1. Sampling was conducted at seven-day intervals. Subsequently, samples were brought to the Central Quarantine Laboratory in Makassar and the Pest and Disease Laboratory of the Faculty of Agriculture, Universitas Muslim Indonesia Makassar for identification. Insect identification was based on morphological characteristics and compared with insect identification keys such as Borror (1992), Subyanto (1991), and Kalshoven, as well as supporting literature.

4. Observation Parameters

a. Dentifying Pests Found on Corn Plants

This study aimed to identify pests on corn plants belonging to farmers in Moncongloe District, Maros Regency. Samples were collected from three corn varieties: Kumala F1, NK Sumo, and Arumba F1. These samples were then brought to the laboratory for morphological examination, including measurements of size, color, body shape, wing shape, antennae, and overall morphology. Insect identification was carried out using insect identification keys by Borror (1992) and Subyanto (1991), as well as supporting literature.

b. Counting the Population of Pests Found on Corn Plants

Pest population monitoring was conducted by counting each pest found on corn plants belonging to farmers in Moncongloe District, Maros Regency. The study involved three different corn varieties: Kumala F1, NK Sumo, and Arumba F1. Observations were made at weekly intervals for a period of three months.

c. Insect species diversity index

Insect diversity was calculated using the Shannon-Wiener diversity index (H'), which measures the proportion of each insect species within a community. The formula for calculating the Shannon-Wiener index is as follows:

$$H' = -\sum(pi)(\ln pi)$$

Notes:

H’ : Shannon-Wiener diversity index

Pi : Proportion of the total sample belonging to species i

The value of H' ranges from:

1-2 : Low diversity

3 : Moderate diversity

4-5 : High diversity

Dominance index can be used to identify the dominant species in a community. Simpson's dominance index is:

$$D = \sum (ni/N)^2$$

Notets:

D : Simpson's dominance index

Ni : Number of individuals of the ith species i

N : Total number of individuals

S : Number of species

RESULTS AND DISCUSSION

1. Pests Found on Corn Plants

Based on a three-month study conducted at weekly intervals on farmers' fields in Moncongloe sub-district, Maros district, the results of pest observation and identification on corn plants, the observation and identification of pests on Kumala F1 corn variety yielded 4 species, comprising 3 families and 3 orders. The observation and identification of pests on NK Sumo corn variety yielded 5 species, comprising 4 families and 4 orders. The observation and identification of pests on Arumba F1 corn variety yielded 4 species, comprising 3 families and 3 orders. The identified pests on the three corn varieties are as follows:

a. Ladybird Beetle (*Menochilus sexmaculatus*) (*Coleoptera* : *Cocinellidae*)

Classification of Menochilus sexmaculatus according to Subyanto et al. (1991) is as follows:

Kingdom : Animalia

Phylum : Arthropoda

Class : Insecta

Order : Coleoptera
Suborder : Polyphaga
Family : Coccinellidae
Genus : Menochilus
Species : *Menochilus sexmaculatus*

Figure 1. Dome Beetle (*Micraspis crocea*)

Ladybugs, with their oval bodies and striking orange color, are characterized by zigzag black lines on their wings. These insects are crucial in maintaining the health of corn plants, especially during the early to mid-growth stages (Nelly et al., 2015; Rizal et al., 2018). Ladybugs can lay a large number of eggs when fed on A. craccivora aphids. This means that ladybugs can help reduce the number of aphids, especially when corn plants are still young (IJB, 2010; Pervez & Chandra, 2018). Ladybugs are very useful for controlling crop pests. Additionally, these beetles are resistant to several types of natural pesticides, so they can be used together with these pesticides to eradicate pests more effectively (Hutapea et al., 2020). Ladybugs not only interact with pests but also with other insects. These interactions can affect the number of ladybugs and pests in agricultural fields (Rakhshani & Saeedifar, 2012; Setiawati et al., 2013)

b. Ladybug (*Micraspis crocea*) (*Coleoptera: Coccinellidae*)

The classification of *Micraspis crocea* according to Subyanto et al. (1991) is as follows:

Kingdom : Animalia
Phylum : Arthropoda
Class : Insecta
Order : Coleoptera
Family : Coccinellidae
Genus : Micraspis
Species : Micraspis crocea

Figure 2. Dome Beetle (Micraspis crocea)

Ladybugs are small, red or orange insects often found on young corn plants. They have a domed body shape and black spots behind their heads (Xu et al., 2022). Ladybugs are polyphagous predators that can prey on various types of insect pests, including aphids, which are important pests on corn plants. Their ability to consume these pests makes ladybugs a potential biological control agent for corn crops (Chowdhury et al., 2023; Gong et al., 2023) . The aggregation behavior exhibited by ladybugs can increase their chances of survival in high-risk environments (Li et al., 2021)

c. Seed fly (Atherigona exigua) (Diptera: Muscidae)

The classification of *Atherigona exigua* according to Subyanto et al. (1991) is as follows:

Kingdom : Animalia
Phylum : Arthropoda

Class : Insecta
Order : Diptera
Family : Muscidae
Subfamily : Atherigoninae
Genus : Atherigona
Species : Atherigona exigua

Figure 3. Seed Fly (*Atherigona exigua*)

Atherigona exigua, or seed fly, is a major pest of corn during the early vegetative stage. This insect has a distinctive morphology, with a black body, yellow abdomen, and antennae. Damage caused by seed fly larvae can lead to plant death (Suh & Kwon, 2017).

Seed fly attacks on corn plants are very detrimental. The leaves of infested plants will turn yellow, and the damaged parts will rot. If not immediately controlled, this damage can continue and lead to a decrease in both the quality and quantity of the harvest (Salaki & Watung, 2022).

d. Fall armyworm (*Spodoptera frugiperda*) (*Lepidoptera: Noctuidae*)

classification of Spodoptera frugiperda according to Bhusal and Bhattarai (2019) is as follows:

Kingdom : Animalia
Phylum : Arthropoda
Subphylum : Hexapoda
Class : Insecta
Order : Lepidoptera
Family : Noctuidae
Genus : Spodoptera
Species : *Spodoptera frugiperda*

Figure 4. Fall armyworm (*Spodoptera frugiperda*)

Spodoptera frugiperda, or fall armyworm, has a specific morphology, characterized by an inverted Y on the head, four dark subdorsal spots on the eighth abdominal segment, and three longitudinal lines on the body. These morphological characteristics are important for accurate identification of fall armyworm in the field (Matos et al., 2010; Sueldo et al., 2010).

Symptoms of S. frugiperda infestation on corn plants are indicated by lesions on the leaves in the form of irregular holes. Severe infestations are characterized by the presence of frass (excrement) resembling sawdust on the leaf surface. In addition to attacking leaves, larvae can also attack corn cobs, resulting in reduced yield and quality (Irfan et al., 2023; Sari et al., 2023).

Fall armyworm is a highly adaptive and productive pest, making it difficult to control. Although it can feed on various types of plants, corn is the favorite host plant of fall armyworm.

Research shows that fall armyworm that feed on corn grow faster and larger compared to those that feed on other plants (Chen et al., 2020; Plessis et al., 2020). Therefore, effective control strategies are crucial to prevent more extensive damage.

Control of S. frugiperda generally relies on the application of insecticides. However, integrated pest management that combines chemical control with biological control is more recommended. The use of parasitoids such as Telenomus remus has proven effective in suppressing pest populations in the field. In addition, the application of resistant varieties is a sustainable long-term control strategy (Machado et al., 2022).

e. *Dacus* sp. (*Diptera: Tephritidae*)

classification of Dacus sp. according to Subyanto et al. (1991) is as follows:

Kingdom : Animalia
Phylum : Arthropoda
Class : Insecta
Order : Diptera
Family : Tephritidae
Genus : Dacus
Species : *Dacus* sp.

Figure 5. *Dacus* sp.

Dacus sp. is a pest that can attack corn plants, especially during the 7-10 weeks after planting stage. Morphologically, Dacus sp. has a yellowish-brown body, with a slightly oval-shaped head where the three-segmented antennae are attached. The abdomen of Dacus sp. also appears fused, which is a characteristic of insects in the Tephritidae family (Fattah et al., 2020; Moquet et al., 2024).

Dacus sp. attacks on corn plants can cause significant damage. This fruit fly is known to infect the fruits and leaves of plants, resulting in rotting and reduced crop quality. Symptoms of attack are usually seen on damaged leaves, as well as bite marks that can affect the overall growth of the plant. Research shows that Dacus sp. can cause significant economic losses in corn cultivation, especially if not managed properly (Pintilie et al., 2023).

Control of Dacus sp. can be done through several methods, including the use of insecticides and the introduction of natural enemies. Research shows that the use of appropriate insecticides can help significantly reduce Dacus sp. populations. However, it is important to consider the long-term impacts of insecticide use on the ecosystem and the presence of natural predators that can help control pest populations (Maine & Boyles, 2015). In addition, the development of corn varieties resistant to *Dacus* sp. attacks can also be a long-term solution in managing this pest (Zida et al., 2024).

f. Grasshopper (*Oxya* sp.) (Orthoptera: Acrididae)

Classification of *Oxya* sp. according to Subyanto et al. (1991) is as follows:

Kingdom : Animalia
Phylum : Arthropoda
Class : Insecta
Order : Orthoptera
Family : Acrididae
Genus : Oxya
Species : *Oxya* sp.

Figure 6. Grasshopper (*Oxya* sp)

Grasshoppers (*Oxya* sp.) are one of the pests that can attack corn plants, especially during the 5-10 weeks after planting stage. Morphologically, the grasshoppers found are generally green, with short antennae, a blunt abdomen tip, and a tympanum on the first abdominal segment. The dorsal part of the grasshopper's body is also black, which gives a distinctive characteristic to this species (Leksono et al., 2020, 2021).

Symptoms of grasshopper attacks on corn plants are clearly visible, where the edges of the leaves have been bitten. These symptoms are not specific and can vary depending on the type of plant attacked and the population level of the grasshoppers. In severe attacks, almost all of the leaves, including the leaf veins, can be eaten, resulting in significant damage to the plant (Maranda et al., 2024). Research shows that grasshoppers can cause significant losses in corn cultivation, especially if the pest population is not well controlled (Yasmin et al., 2024).

2. Pest Population on Corn Plants

a. Kumala F1 variety

A study was conducted to observe pest populations on three different corn varieties: Kumala F1, NK Sumo, and Arumba F1, grown on farmers' fields. The results of the pest population observations are presented below:

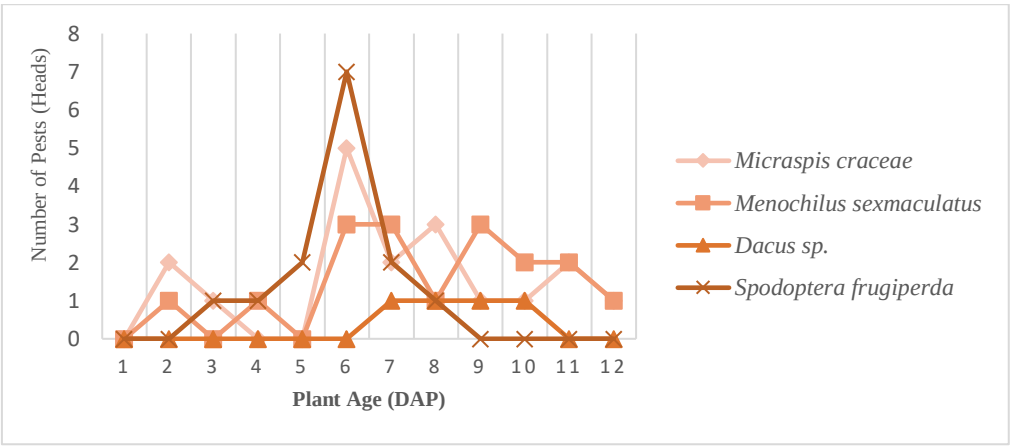

Figure 7. Graph of pest population density at the age of Kumala F1 corn plants

Field observations revealed several pests attacking Kumala F1 corn variety during the 3-12 weeks after planting stage. Spodoptera frugiperda was the most dominant pest, reaching a peak population of 7 individuals at 6 weeks after planting. Despite the high population, the attacks did not significantly disrupt plant growth. This might be due to the resistance of the Kumala F1 variety to pest attacks, or possibly due to environmental factors that supported plant growth even with pest infestations (Sari et al., 2023).

Spodoptera frugiperda, or fall armyworm, is known as a highly destructive pest of corn. This pest is found from 3-8 weeks after planting and can cause serious damage if not well managed. Symptoms of S. frugiperda attacks include leaf feeding, which can result in holes in the leaves and reduced yield. Research has shown that effective control of this pest is crucial for maintaining corn productivity (Maine & Boyles, 2015).

In addition to S. frugiperda, other pests detected were Micraspis crocea, found from 2-12 weeks after planting. This pest acts as a natural predator and can help control the population of other pests, including aphids and larva (Friamsa et al., 2018). Menochilus sexmaculatus was also found during the same period, acting as a predator that can reduce the impact of pest

attacks. The presence of these natural predators highlights the importance of integrated pest management, where a combination of biological and chemical control can increase the overall effectiveness of pest control.

Dacus sp. was also detected from 7-10 weeks after planting, which is a pest that can damage the fruits and leaves of plants. Attacks by Dacus sp. can lead to rotting and reduced yield quality, making it important to monitor and control the population of this pest effectively (Li et al., 2023).

b. NK Sumo variety

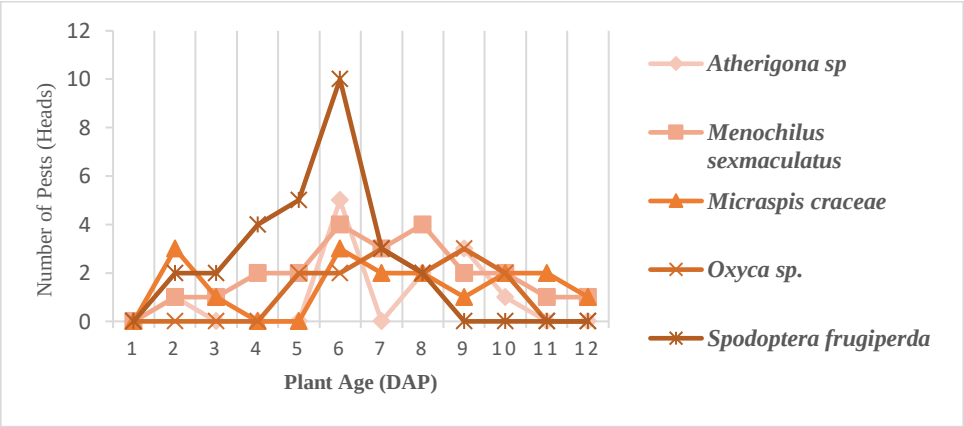

Figure 8. Graph of pest population density at the age of NK Sumo corn variety plants

Based on observations, the highest pest population on NK Sumo corn variety was Spodoptera frugiperda, reaching 10 individuals at 6 weeks after planting. This pest was found from 2-8 weeks after planting and significantly disrupted plant growth. S. frugiperda, or fall armyworm, is known as one of the major pests that can cause significant damage to corn plants. The pest attacks resulted in leaf damage, characterized by bite marks, and can affect overall yield (Rowen et al., 2022).

In addition to S. frugiperda, other pests detected were Micraspis crocea, found from 2-12 weeks after planting. This pest acts as a natural predator and can help control the population of other pests, including aphids and larvae (O'Rourke et al., 2011). Menochilus sexmaculatus was also found during the same period, acting as a predator that can reduce the impact of pest attacks. The presence of these natural predators highlights the importance of integrated pest management, where a combination of biological and chemical control can increase the overall effectiveness of pest control (Jakka et al., 2016).

Oxyza sp. was detected from 5-10 weeks after planting, which can cause damage to plant leaves. Symptoms of Oxyza sp. attacks are usually seen as bite marks on the leaves, which can reduce the quality of corn plants. Additionally, Atherigona exigua was found from 2-10 weeks after planting, known as the seed corn maggot, and can cause damage to the leaves and fruits of corn plants. Attacks from Atherigona exigua can lead to rotting and reduced yield quality (Maine & Boyles, 2015).

c. Aruma F1 variety

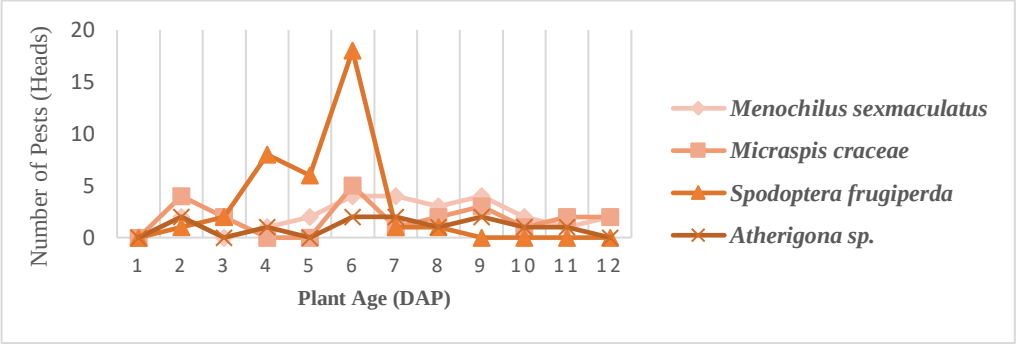

Figure 9. Graph of pest population on Arumba F1 corn variety at different plant ages

Fall armyworm (Spodoptera frugiperda) is the most common pest found on Kumala F1 corn variety, especially at 6 weeks after planting. This caterpillar severely damages corn leaves and can significantly reduce crop yield (Jiang et al., 2023).

With its high adaptability and rapid reproduction, research shows that corn is the most preferred host as fall armyworm larvae feeding on corn grow faster compared to other food sources (Chen et al., 2020; Lourenço et al., 2017). Damage caused by fall armyworm attacks varies and can result in significant yield losses, especially if the attack is severe (Pittarate et al., 2021).

Both of these insects prey on other pests such as aphids and insect larvae, thus reducing the number of these pests (Nurkomar et al., 2023). The presence of natural predators indicates that pest control will be more successful if we combine biological control (using natural enemies) with chemical control (using pesticides).

CONCLUSIONS

A survey of corn pests in Moncongloe sub-district, Maros district, revealed that Micraspis crocea, Menochilus sexmaculatus, Dacus sp., Spodoptera frugiperda, Atherigona exigua, and Oxya sp. were commonly found on Kumala F1, NK Sumo, and Arumba F1 corn varieties. Spodoptera frugiperda dominated pest populations in NK Sumo and Arumba F1, while Micraspis crocea and Menochilus sexmaculatus were prevalent in Kumala F1. The diversity index indicated a relatively low pest diversity in all three varieties, with values of 1.278, 1.561, and 1.315 for Kumala F1, NK Sumo, and Arumba F1, respectively

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