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Insect Pest Diversity of Corn Plants (*Zea mays*) in Baringeng Village, Soppeng Regency, South Sulawesi Province

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Abstract

Background: Baringeng is a corn-producing village in Soppeng Regency, South Sulawesi. The main problem for corn farmers in the town is insect pests. Insect pests damage the plant, which has an impact on decreasing yields. Control of insect pests must be by the type of insect pests. This study aims to calculate the diversity of insect pests of corn in Baringeng Village and the damage they cause. **Methods:** Data was collected in Takku Hamlet, Baringeng Hamlet, and Tanjonge Hamlet. with a systematic plot sampling method with the help of light traps, sweep nets, and direct collection of pests. Observations included the number of individuals and types of insect pests. Data were analyzed by the Shannon-Wiener diversity index (H'), evenness index (E), dominance index (C), and similarity index. **Results:** There were three types of insect pests with a total of 153 individuals that attacked corn in Baringeng Village, namely grasshoppers (*Oxya sp.*), planthoppers (*Peregrinus maidis*), and armyworm (*Spodoptera frugiperda*). The diversity index is included in the low category (H'=0.89), the evenness index (E) is in the high sort (E=0.81), the dominance index is in the low sort (C=0.44), and the lowest similarity index shown between Dusun Baringeng and Dusun Takku (IS=50%). **Conclusions:** The types of insect pests found in Baringeng Village come from three different orders, namely Orthoptera, Lepidoptera, and Hemiptera. Each problem shows other attack characteristics, but all attack the leaves. So that pest control can use natural materials by spraying on leaves, polyculture, crop rotation, or taking pests directly.

Keywords: Baringeng Village; Corn Pests; Insect Pests; *Zea Mays*

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Introduction

Corn (*Zea mays*), often maize or field corn, is the world's most significant crop, with yearly worldwide production exceeding wheat and rice. While corn is the primary food source in some regions of the world, it also has numerous other uses. It is utilized in industrially produced nonfood items such as starches, acids, and alcohol and in foods that have been industrially processed, fed to livestock, and used directly for human consumption (Chavas & Mitchell, 2018).

South Sulawesi is Indonesia's fifth-largest corn-producing province, producing 1.82 million tons of corn in 2020 (Kementan, 2021). Soppeng Regency is a contributor to corn production in South Sulawesi. Lilirilau District is an agricultural area that is quite extensive in Soppeng Regency, which is a center for corn farming. Lilirilau District produces the highest corn production, namely 26,451.00 tons, with a planting area of 3,198.00 ha, and its productivity reached 4.58 tons in 2017 (BPS Kabupaten Soppeng, 2018).

Corn is one of the commodities whose production is at risk. An irrigation system and sufficient rainfall are needed for corn plants to develop healthily throughout the planting. But during their life cycle, corn plants are vulnerable to diseases and pests, from seed

through corn ready for harvest. They can lower production and product quality (Resti et al., 2022).

Waliha et al. (2021) found pests that attack corn plants in Rupit Village, Rupit District, Regency Musi Rawas Utara, South Sumatra were armyworms (*Spodoptera frugiperda*) and wandering grasshoppers (*Locusta migratoria*). Moreover, Nurmaisah & Purwati (2021) reported that there are 12 species of insects found on corn plants in Tarakan city namely *Papilio demoleus*, *Acraea violae*, *Macrodiplax cora*, *Locusta migratoria*, *Cochliomyia macellaria*, *Musca domestica*, *Atherigona soccata*, *Tachinidae* sp, *Braconidae* sp, *Ichneumonidae* sp, *Apidae* sp and *Coccinella arcuate*.

Studies on the presence of insect pests on corn plants in Soppeng Regency, especially in Baringeng Village, are still limited. Recognizing insect pests that attack corn plants can contribute to proper pest management based on identification results. Therefore, early detection of pests will reduce the possibility of additional crop damage, preserving both the quality and quantity of yield. This study aimed to calculate the diversity of insect pests of corn in Baringeng Village.

Methods

This research was conducted in September 2020 in Baringeng Village, Lilirilau District, Soppeng Regency, South Sulawesi Province. Three hamlets from Baringeng village that are used as observation stations are Takku hamlet (4°27'4"49 E, 120°02'09"48 S), Baringeng hamlet (4°30'37"68 E, 120°01'18 "12 S) and Tanjonge hamlet (4°51'81"23 E, 119°86'66"24 S). Because only these three hamlets have corn gardens, this study used an experimental design with a quantitative approach (Creswell, 2014). The method used is systematic plot sampling with the help of three traps: light traps, sweep nets, and direct pieces. The data collected in this study are the diversity of insect pests and the damage they cause.

Diversity of insect pests

Data collection on diversity in each hamlet used plots measuring 3x3 meters with a distance of 10 meters between actions. Collecting data on the variety of insect pests in Plot 1 used a light trap, plot 2 used a sweep net, and Plot 3 used a direct sampling technique (Figure 1).

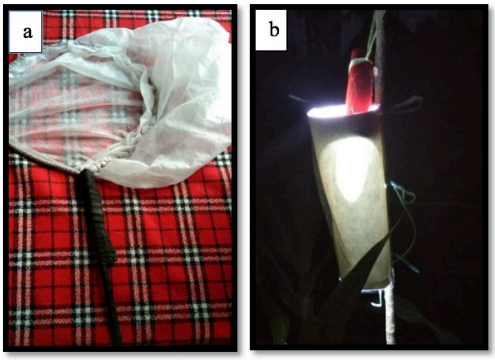

Figure 1. The traps used are (a) sweep net and (b) light trap

Catching insect pests using a sweep net is carried out by swinging the sweep net from 07.00 – 17.00. At the same time, the light trap is done by setting traps starting at 18.00. Insects attached to the stem are taken using tweezers. Pest insects were caught in the web and then collected in bottles containing alcohol to be identified. Identification was carried out at Laboratorium Terpadu Universitas Sulawesi Barat. The data were then analyzed by calculating the Shannon-Wiener diversity index (H'), evenness index (E), dominance index (C), and similarity index (IS).

Damaged caused by insect pest

Data on the damage caused by insect pests were collected by direct observation techniques, namely observing each problem found on the plant. The data was then analyzed descriptively concerning the damage score Mokodompit et al. (2018).

Table 1. The level of damage caused by insect pests (Mokodompit et al., 2018).

No	Symptoms in Plants	Score
1	There was no attack, or there was an attack on the leaves, but the number of leaves affected and the area of attack was minimal compared to the total number/area of the leaves	0
2	The number of leaves that are attacked is small, and the number of attacks on each leaf is slightly affected, or the leaves fall or have little chlorosis	1
3	The number of leaves affected and the number of attacks on each affected leaf is relatively large, or the leaves fall, or chlorosis is quite large	2
4	The number of leaves affected and the number of leaves attacked by each leaf that is slammed a lot or leaves fall or much chlorosis	3
5	All leaves fall off or have no signs of life	4

Result

The results showed three types of pests with 153 individuals that attacked corn plantations in Baringeng Village, namely *Oxya* sp., *Peregrinus maidis*, and *Spodoptera frugiperda* (Figure 2). Three problems come from the class Insecta: Orthoptera, Hemiptera, and Lepidoptera. These three pests are found in different traps (Table 2).

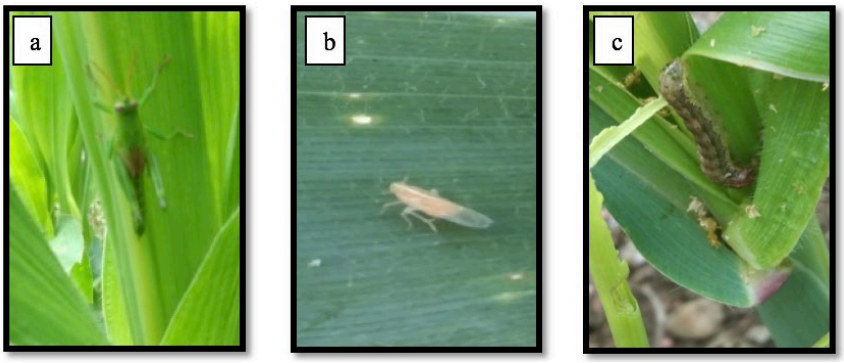

Figure 2. Inscets pests in Baringeng village

Table 2. Types of insects and their traps

Types of insect pests	Types of traps
Oxya sp.	*Sweep net trap*
Peregrinus maidis	*Yellow light trap*
Spodoptera frugiperda	*Direct observation*

The diversity of types of pests in each hamlet is different. In Tanjonge Hamlet and Takku Hamlet, two types of pests were found. However, the number of individual pests in Takku Hamlet was the highest, namely 103 individuals (80 individuals *Peregrinus maidis* and 23 individuals *Spodoptera frugiperda*). In Tanjonge Hamlet, two types of pests were found, with 13 individuals (11 of Oxya sp. and two of *Spodoptera frugiperda*). Meanwhile, in Baringeng Hamlet, there were only *Peregrinus maidis* pests, but the number of individuals (39 individuals) was more than the total number of individual pests in Tanjonge Hamlet. This data relates to the results of the analysis of the diversity index (H'). Namely, in each observation, Hamlet is classified into low diversity, namely in Tanjonge Hamlet several 0.42, Baringeng Hamlet several 0 and in Takku Hamlet several 0.53 (H' <1.5

) meanwhile, the total diversity index (H') was classified as high diversity, namely 0.89 (H'>3.5) (Table 3).

Three types of corn plant pests found in Baringeng Village are spread over three hamlets. The kind of *Spodoptera frugiperda* was found in three hamlets, namely Tanjonge Hamlet (2 individuals), Baringeng (39 individuals), and Takku (23 individuals). The total number of individuals is 62, while the Oxya sp. and Peregrinus maidis types were only found in Tanjonge Hamlet (11 individuals) and Takku Hamlet (80 individuals). This data relates to the results of the evenness index analysis, namely the evenness index value (E) in Tanjonge Hamlet of 0.61 belongs to the moderate evenness category (E ≥ 0.50 to close to ≤ 0.75), in Baringeng Hamlet, several 0 belong to in low evenness (E ≤ 0.50). In contrast, in Takku hamlet, several 0.76 belong to high evenness (E ≥ 0.75). Meanwhile, the total evenness index (E) is in the high category, namely 0.81 (E ≥ 0.75) (Table 3).

The number of pests in the three corn-planting hamlets in Baringeng Village differed. In Tanjonge Hamlet, two types of pests were found. However, *Oxya* sp. was the most dominant pest, with 11 individuals. In Takku Hamlet, only Peregrinus maidis was found with 80 individuals, while *Spodoptera frugiperda* was found in all corn-planting hamlets but with different amounts. In Tanjonge Hamlet (2 individuals), in Takku Hamlet (23 individuals), while the most common were found in Baringeng Hamlet (39 individuals). This data is related to the dominance index (C), namely the dominance index (C) in each observation of hamlet, which is in a category of habitat dominated by certain species, namely in Tanjonge Hamlet several 0.73, Baringeng Hamlet several one and Takku Hamlet several 0.65 (C close to 1) while the total dominance index (C) value is in the category of habitat not dominated by certain species, namely 0.44 (C close to 0) (Table 3).

Table 3. Diversity of Insects pests in Baringeng Village

Order Family Species	Number of individuals Tanjonge Hamlet	 Baringeng Hamlet	 Takku Hamlet	Total	Percentage (%)
Orthoptera Acrididae *Oxya* sp.	11	0	0	11	7. 19 %
Hemiptera Delphacidae *Peregrinus maidis*	0	0	80	80	52. 29%
Lepidoptera Noctuidae *Spodoptera frugiperda*	2	39	23	62	40.52 %
Total	13	39	103	155	100 %
Total species	2	1	2		
Diversity index (H')	0.42	0	0.53	0.89	
Evenness index (E)	0.61	0	0.76	0.81	
Dominance index (C)	0.73	1	0.65	0.44	

The three types of pests found in Baringeng Village were spread over three corn-planting hamlets. *Spodoptera frugiperda* was found in all hamlets, Oxya sp. is only found in Tanjonge Hamlet, and the Peregrinus maidis species is only in Takku Hamlet. The pest similarity index (IS) value in Tanjonge vs. Baringeng Hamlet was 66.7%, Tanjonge vs. Takku Hamlet was 66.7%, while in Baringeng vs. Takku Hamlet was 50% (Figure 3). This data relates to the similarity index (IS) in the similar category.

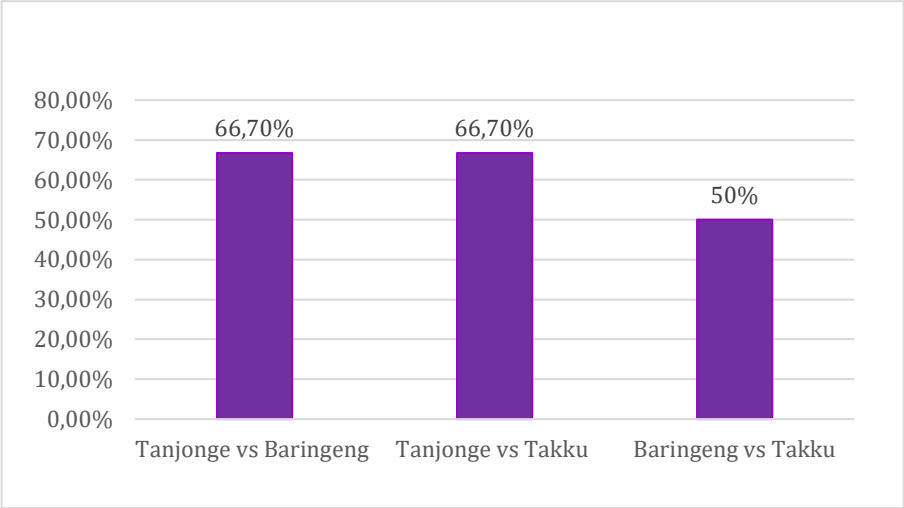

Figure 3. Similarity index of Baringeng village

Oxya sp. attacked the leaves of corn plants in Tanjonge Hamlet 52 days after planting. The damage caused is in the form of biting on the edge of the leaf and eating almost the entire leaf of the plant. The damage score is 2, unhealthy (more than half of the leaves are attacked, and the leaves fall off) (Figure 4).

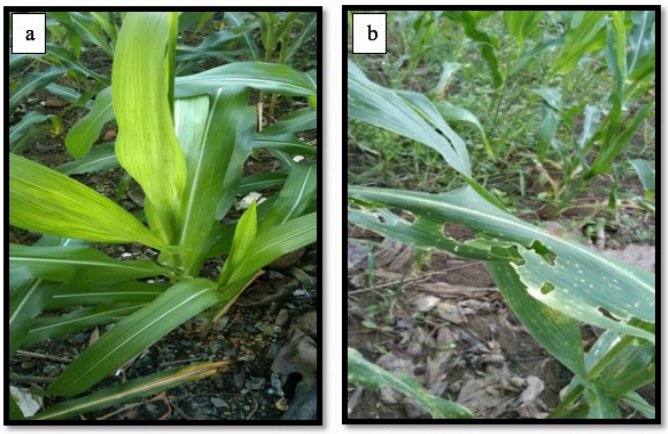

Figure 4. Healthy plants (a) and the damage caused by *Oxya* sp. (b)

Peregrinus maidis attacks corn plants in Baringeng Hamlet which is 31 days after planting, causes damage to the leaves in the form of yellow streaks and can cause the plants to become stunted, withered, and dry. The damage score is 3, very unhealthy (an attack of the whole leaf and resulting in leaf loss) (Figure 5).

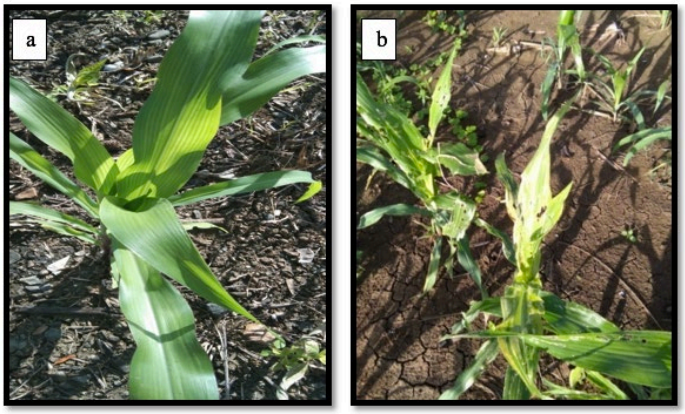

Figure 5. Healthy plants (a) and the damage caused by *Peregrinus maidis* (b)

Spodoptera frugiperda attacks corn plants in three hamlets in Baringeng Village: Tanjonge Hamlet, Baringeng Hamlet, and Takku Hamlet. These pests feed on leaf tissue, make drill holes and eat the leaves from the edge to the inside. The damage score is 1, unhealthy (an attack from the whole leaf) (Figure 6).

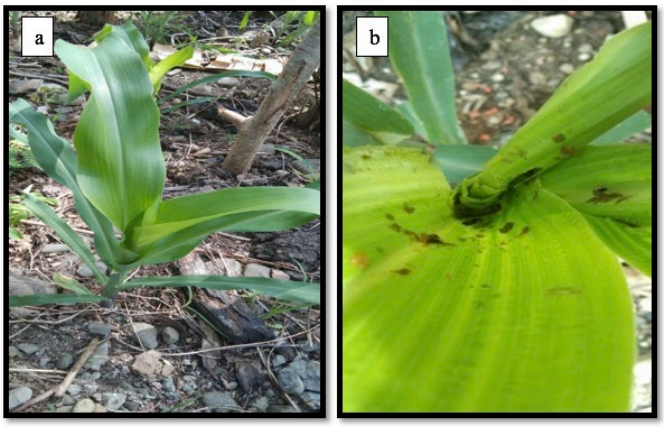

Figure 6. Healthy plants (a) and the damage caused by *Spodoptera frugiperda* (b)

Discussion

Baringeng village farmers also reported the three insect pests found in this study. These insect pests are found in all seasons, both rainy and dry. This is because these insect pests have a high adaptation. It was also reported by Rondo et al. (2016) that these three insect pests are corn pests in tropical climates. However, these three insect pests were caught in different traps (Table 2). This is due to differences in our way of life. *Oxya* sp. is caught with a net sweep trap because this species lives attached to corn leaves and will jump and fly if threatened. *Peregrinus maidis* was detected using the yellow light trap because this species is an active insect pest at night (nocturnal), so it will come because of the light. *Spodoptera frugiperda* was taken directly using tweezers because this species lives attached to the leaf's top, edges, and bottom.

Data from this research are diversity and abundance data, including the number of individuals and species. Internal and external factors influence the abundance of pest populations—internal factors such as good breeding ability and short life cycle. Meanwhile, external factors are influenced by physical environmental factors, abundant food which is continuously available. Ecological factors influence pest diversity, including rainfall patterns, temperature, protection from external enemies, and vegetation structure. The higher the variety of vegetation in a habitat, the higher the food source for pests in a habitat (Prakoso, 2017). Climatic parameters (temperature, humidity, day length/duration of irradiation) influence the development of pests both directly and indirectly. Climate significantly affects insect pests' life cycle and diapause ability (Susanti et al., 2018).

The results of data analysis on the index calculation show that the Diversity Index (H') of corn pests in Baringeng Village and three hamlets belongs to low diversity (H'=0.89). This is due to the few pests in Baringeng Village and the three observation hamlets. It is said that species diversity is low if a community comprises only a few species (Idriyanto, 2015). Karanggayam District (Prakoso & Kurniawan, 2021) and Subak Kenderan (Marsadi et al., 2021) also reported a low pest diversity index.

Although the diversity index value of Baringeng Village and its hamlets is low, the evenness index value (E) of Baringeng Village is in the high category (E=0.81). In contrast, the Hamlet evenness index varies (Table 3). The pattern of distribution of types of pests causes this. The stability of the number of individuals and species or differences in the number of individuals and species in each hamlet influences the distribution pattern. Some

species have high numbers and vice versa, causing evenness variations (Lailatussholiha et al., 2019).

Oxya sp. is an insect pest that has a wide host range. This type of pest eats plant leaves starting from the edges of the leaves (Irma et al., 2013). Symptoms of damage often caused by locust pest attacks are nibbling on the edges of the leaves and eating almost the entire leaf, including the leaf veins, if the attack is severe (Dhena et al., 2011). These conditions are by the data collected (Figure 4). Symptoms of damage often caused by Peregrinus maidis attacks are causing plants to die from drought-like burning (Susilo et al., 2017). The characteristics of the attack are in the form of yellow-striped spots, especially on the leaf sheaths. Planthopper pest attacks can cause stunted plant growth. Plants become stunted, withered, and dry (Surtikanti, 2011). These conditions are to the data collected (Figure 5).

The results of this study support the theory that the type of pest is closely related to the age of the plant. *Peregrinus maidis* is only found in Takku Hamlet but attacks corn plants at the age of 31 days after planting. Surtikanti (2011) also reported that in the vegetative phase (0-14 days after planting), the types of pests that often attack corn plants are *Atherigona* sp., *Agrotis ipsilon,* and *Phyllopaga hellen*. While in the vegetative phase (15-42 days after planting), the types of pests that often attack corn plants are *Ostrina furnacalis, Spodoptera frugiperda, Spodoptera litura,* and *Peregrinus maidis*.

Conclusions

This study concludes that three pests attack Baringeng Village: *Oxya* sp., *Peregrinus maidis,* and *Spodoptera frugiperda*. The diversity index (H') in Baringeng Village was 0.89, including the low category. Evenness index (E) = 0.81, including the high category. The dominance index (C) = 0.44, including the low category, and the lowest similarity index was shown between Baringeng and Takku Hamlet. The characteristics of the damage caused are different for each type of pest, but all attack the leaves of corn plants.

Declaration statement

The authors reported no potential conflict of interest.

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