Original Article

Incidence of *Spodoptera frugiperda* (J.E. Smith) infestation on corn (*Zea mays* L.) in Enrekang Regency

Asrini Asrini [1], Hikmahwati Hikmahwati [2,*], Muh. Achyar Ardat [1], and Suhardi Suhardi [1]

[1] Agrotechnology, Faculty of Scince and Technology, Universitas Muhammadiyah Enrekang, South Sulawesi, Indonesia
[2] Agrotechnology, Faculty of Science of Agricultural, Universitas Al-Asyariah Mandar, West Sulawesi, Indonesia
[*] Correspondence: hikmahwatihasen@gmail.com

ARTICLE INFORMATION

ABSTRACT

Corn continues to be a crucial food crop in Indonesia, often serving as a rice substitute. Additionally, it holds strategic importance due to its substantial impact on economic stability. Production in Enrekang Regency has experienced fluctuations. Several factors contribute to declining corn production, one of which is the invasion of new pests that cause severe crop damage, *Spodoptera frugiperda* (J.E. Smith), known as Fall Armyworm (FAW). The pest targets the plant's growing point, potentially causing shoot failure and stunted growth, leading to reduced corn productivity. Based on this background, research is needed on the pest attack rate. The FAW on corn as part of efforts to monitor its presence. This research was conducted in Enrekang Regency, which collected field data on infestation intensity, and then integrated them with pest damage intensity assessment criteria. The observation found that FAW infestation intensity in the Cendana, Maiwa, and Enrekang Districts of Enrekang Regency ranges from low to moderate. However, the resulting damage is significant, particularly during the vegetative phase of the plants.

Keywords: Corn; Enrekang; Fall armyworm; *Spodoptera frugiperda*

1. Introduction

Corn (*Zea mays* L.) is a significant agricultural commodity and a staple source of carbohydrates for communities, alongside rice and wheat (Hidayah et al., 2020). Corn continues to be a crucial food crop in Indonesia, often serving as a rice substitute. Additionally, it holds strategic importance due to its substantial impact on economic stability (Megesari & Nuryadi, 2019).

Per 100 grams of corn, the carbohydrate content is around 30.3 grams, while for sweet corn, it is 22.8 grams. Corn serves as an alternative food source in the Americas, while in Indonesia, it is a staple in regions such as Madura, East Nusa Tenggara, Sulawesi, and Central Java (Rumende et al., 2021).

In 2023, the harvested area of corn in Indonesia is projected at 2.49 million hectares, a decrease of 0.28 million hectares or 10.03% from the 2.76 million hectares harvested in 2022. Dry-shelled corn production with a 14% moisture content is estimated at 14.46 million tons in 2023, a reduction of 2.07 million tons or 12.50% from 16.53 million tons in 2022 (BPS Indonesia, 2023).

Corn production in Enrekang Regency has experienced fluctuations. In 2017, corn production was 99,467.7 tons, which decreased to 89,097.9 tons in 2018.

Production increased to 122,446.6 tons in 2019, followed by a decrease to 93,011.7 tons in 2020 (BPS Kabupaten Enrekang, 2020). In Enrekang Regency, notable corn production centers include the Districts of Enrekang, Anggera, and Maiwa, which contribute significantly due to large production areas (BPS Kabupaten Enrekang, 2022). Several factors contribute to declining corn production, one of which is the invasion of new pests that cause severe crop damage (Sartiami et al., 2020).

The fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) is a pest affecting corn in Indonesia. Originating in the Americas, this insect has spread across numerous countries and was first discovered on corn crops in Indonesia's West Pasaman Regency, West Sumatra, in early 2019 (Nonci et al., 2019). This invasive pest, from the order Lepidoptera, primarily attacks corn during its larval stage, particularly in instars 3 to 5 (Megesari & Nuryadi, 2019).

The pest affects corn from the vegetative to the generative stages, with the most severe damage occurring in the vegetative phase (Trisyono et al., 2019). The pest targets the plant's growing point, potentially causing shoot failure and stunted growth, leading to reduced corn productivity. Signs of an attack include visible larval trails

on the upper leaf surface or near the growing point, and coarse residue resembling sawdust. In cases of high larval populations, the ears of the corn may also be affected (Megesari & Nuryadi, 2019).

In several regions in Indonesia, the attack rate of FAW on corn crops ranges from 15–73% yield loss when 55–100% of plants are infested. For instance, in Tuban, East Java, in 2019, this pest was reported to cause up to 60% damage. Heavy infestations of FAW on corn occur when there are 2 to 10 larvae per plant (Megasari & Khoiri, 2021). Characteristic signs of FAW include an inverted "Y" shape on the head and four square-shaped spots on the second segment from the end. It is highly voracious and often damages the plant's growing point, hindering young leaf development. The adult moth has strong flight capabilities and a high dispersal potential, enabling rapid spread (Pu'u & Mutiara, 2021).

To mitigate the damage caused by FAW, measures such as morphological characterization and monitoring of the pest, particularly during the vegetative stage, are essential (Maharani et al., 2021). Based on this background, research is needed on the pest attack rate of FAW on corn as part of efforts to monitor its presence.

2. Materials and Methods

Observation of the incidence and damage severity of FAW infestation on corn plants was conducted from September 3–5, 2024, across three districts in Enrekang Regency: Cendana, Maiwa, and Enrekang (Table 1). Infestation observations involved identifying the presence of FAW eggs, larvae, and/or adult moths on 100 corn plants at each survey site, using an X-shaped diagonal sampling method. The infestation rate or percentage of incidence, was calculated using the following formula (1):

$$I = \frac{a}{b} \times 100\% \tag{1}$$

Whereas,
I   : Incidence (%)
a   : Number of infested plants
b   : Total number of observed plants

Table 1. Location of assessment.

Districts	Longitude; Latitude	Altitude (meter above sea level)
Cendana	3°36'03.5"S; 119°45'32.7"E	73
Maiwa	3°40'50.4"S; 119°52'44.9"E	397
Enrekang	3°32'47.5"S; 119°47'59.0"E	461

Plant damage observation was conducted by assessing damage severity on corn leaves, calculated by observing symptoms of FAW infestation and scoring them on a scale. The scale (Table 2) follows the Davis scale, as used by Megasari & Khoiri (2021). Damage severity then calculated using the following formula (2):

$$DS = \frac{\sum n \times v}{Z \times N} \times 100\% \tag{2}$$

Whereas,
DS   : Damage severity (%)
n   : Number of sample plants showing scale level
v   : Scale value from 1 to 9, based on the Davis scale
Z   : Highest score (9)
N   : Total number of observed plants

Scoring/scale determination is based on the Davis scale, as presented in the Table 3.

Table 2. Score/scale determination.

Score	Symptoms/Damage Description	Category
1	No visible damage on the leaves	Highly resistant
2	A few small holes (1–2) on older leaves	Resistant
3	Several small holes on leaves (<5)	Resistant
4	Some damage on leaves (6–8 small holes, lesions)	Moderately resistant
5	Small circular holes and a few small elongated lesions	Moderately resistant
6	Rectangular lesions, approximately 1.3 cm in length, on rolled leaves	Susceptible
7	Lesions on rolled leaves	Susceptible
8	Elongated lesions (>2.5 cm) on leaves (8–10), some irregularly shaped	Highly susceptible
9	Small to medium irregularly shaped lesions	Highly susceptible

Field data on infestation intensity were then integrated with category of damage severity, based on the technical guidelines for pest observation and reporting (OPT-DPI, 2018), as shown in Table 3.

Table 3. Damage intensity assessment criteria.

Scale	Damage Severity (%)	Category
0	0	Normal
1	$1 < X \leq 25$	Light
2	$25 < X \leq 50$	Moderate
3	$50 < X \leq 85$	Severe
4	$X \geq 85$	Very Severe/Total Loss

3. Results

Based on survey of FAW was observed infesting corn plants at three survey locations. Its presence was indicated by clusters of larvae, leaf damage symptoms, and frass (insect droppings) near feeding holes (Figure 1).

Based on the survey results and intensity attack of FAW across several districts in Enrekang Regency, the intensity attack levels varied, ranging from light to moderate damage category. According to Figure 2, the incidence and damage severity in the Cendana District were 46% and 39.44%, respectively, indicating a moderate

damage. In Maiwa District were 42% and 33.33%, also at a moderate damage level, while Enrekang District showed lower values with 25% intensity attack and 12.67% severity level, reflecting low damage. The highest incidence and damage severity were observed in the Cendana District, where infested plants fell into the moderate damage category, with intensity attack reaching 46% (Figure 2).

Figure 1. Damage symptoms and presence of *Spodoptera frugiperda* on corn plants.
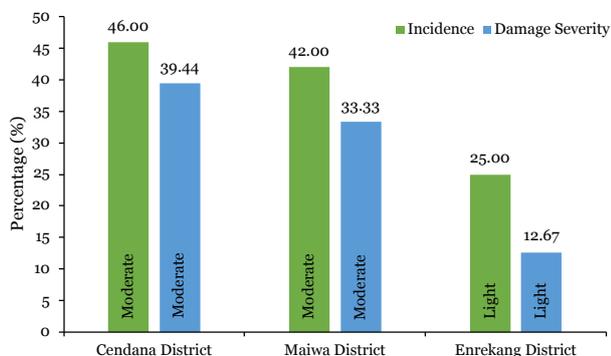

Figure 2. The incidence and damage severity of *Spodoptera frugiperda* on corn plants.

4. Discussion

The survey on FAW infesting corn plants showed by leaf damage symptoms, and frass (insect droppings) near feeding holes. The adult moth stage is typically nocturnal, making sightings rare during observations. The observed damage symptoms mainly appeared on young leaves and at the plant's growing point, which can impede plant growth (Pu'u & Mutiara, 2021).

The incidence and damage severity of FAW across several districts in Enrekang Regency was varied, ranging from low to moderate damage. The incidence and damage severity in the Cendana District were 46% and 39.44%, respectively, indicating a moderate damage level. In Maiwa District, these rates were 42% and 33.33%, also at a moderate damage level, while Enrekang District showed

lower values with 25% intensity attack and 12.67% severity level, reflecting light damage. Reports on FAW infestation rates also vary; for instance, in Ganjar Sabar Village, damage levels ranged from 10 to 50%, with current control methods involving mechanical and chemical approaches (Maharani et al., 2021).

In Garut and Tasikmalaya, intensity attack reached 52.78% with 100% damage in severely affected areas (Asfiya et al., 2020), while in Takalar Regency, rates ranged from 97% (Noerfitryani et al., 2023). In this study, intensity attack is generally correlated with damage severity level, indicating that more infested plants lead to increased damage risk. However, these results are influenced by various factors, including cultivation techniques, planting patterns, and pest control methods practiced by local farmers (Asfiya et al., 2020).

The study shows that FAW infestations predominantly occur during the vegetative phase, with observed plants averaging 3, 6, and 8 weeks after planting. FAW attacks corn plants within the age range of 30–45 days post-planting (Pu'u & Mutiara, 2021).

The highest incidence and damage severity were observed in the Cendana District, where infested plants fell into the moderate damage category, with infestation intensity reaching 46%. Several factors influence damage levels, including environmental conditions, cultivation techniques, planting patterns, and local pest control practices. Farmers often apply insecticides more intensively to young corn plants, which has contributed to the lower infestation intensity observed in the Enrekang District (Figure 2).

High infestation rates may be attributed to delays in handling and improper spray timing, whereas lower rates resulted from early insecticide applications, administered three times weekly during initial signs of FAW larvae infestation (Noerfitryani et al., 2023).

Other factors contributing to higher infestation levels include the availability of sample host plants, staggered planting times, high nitrogen fertilizer use, and a lack of natural predators, often due to high, non-selective pesticide application by farmers. Additionally, FAW is a new pest for corn crops (Pu'u & Mutiara, 2021). The choice of corn variety also affects infestation rates. Among the three varieties studied, FAW was equally attractive to all; however, the highest consumption rate was recorded for the Bisi 18 variety (Novita et al., 2021). Climatic conditions also affect pest infestation rates, with rainfall being the most influential climate factor for pest development (Mufidha, 2022). The practice of monoculture corn cultivation facilitates population growth and high infestation intensity, likely due to the continuous, abundant food supply. The nutrient content and morphology of corn make it highly attractive to FAW (Arfan et al., 2020).

The absence of nearby oil palm plantations, which can serve as alternative hosts for FAW, helps limit pest proliferation through natural means (Andini & Daya, 2023). Other contributing factors include weed control, soil management, and crop intercropping, as certain weeds can serve as alternative hosts and thus help suppress FAW populations (Baudron et al., 2019).

5. Conclusion

Survey results indicate that FAW infestation intensity in the Cendana, Maiwa, and Enrekang Districts of Enrekang Regency ranges from low to moderate. However, the resulting damage is significant, particularly during the vegetative phase of the plants. An improvement in pest control techniques through more environmentally friendly methods and the selection of crop varieties with higher resistance to this pest is recommended to mitigate infestation levels.

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