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Identification and Distribution of Damage Intensity Caused by *Sanurus* spp. on Cashew Plants in East Flores Regency, Indonesia

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Abstract. Cashew is one of Indonesia's leading commodities as an exporting country because it has a positive trade specialization index. The main pest of cashew plants that affects production and can cause crop failure is the Cashew Planthopper (WPM). Cashew Planthopper has several species. Therefore, monitoring is needed to determine the types of WPM in the field and their distribution areas on the mainland of East Flores Regency. This study was conducted from May 2024 to July 2024 by directly capturing WPM imago. The results of a survey of cashew plantation locations in East Flores Regency, 5 locations were determined with high levels of attack due to WPM, which caused crop failure, namely: Ile Mandiri District, Lewolema District, Tanjung Bunga District, Titehena District, and Demon Pagong District. The trapped WPM were then identified by looking at the characteristics of the wings, thorax, and abdomen. The identification results obtained 2 types of WPM from the genus Sanurus, namely, Sanurus flavovenosus and Sanurus indecora. The distribution area of the attack and the level of damage to Sanurus from each district have different intensities with different levels of damage, namely the intensity of heavy damage in red is in Titehena District 53.04%, the intensity of moderate damage in yellow is in Lewolema District 20.65%, Ile Mandiri District 36.91% and Demon Pagong District 36.94% while the intensity of light damage in green is in Tanjung Bunga District 0.55%.

Keywords: cash plants; damage intensity; distribution area; mete shoot planthopper

INTRODUCTION

Cashew is one of the commodities that makes Indonesia an exporting country because it has a positive trade specialization index (Zahir 2017). Cashew is one of the plantation commodities that also provides input for national income. In 2017, the plantation sub-sector was the first in the agricultural sector as a supplier of national income of 3.47% or IDR 471 trillion (Ditjenbun 2017). East Flores Regency (Flotim) is one of the regencies that is a center for cashew development and the largest producer of cashew nuts in NTT, and is one of the mainstay commodities of the Flotim community, because cashew commodities can improve the economy of the Flotim community. So far in Flotim Regency, cashew plants (*Anacardium occidentale*) are considered one of Flotim's leading commodities. The illustration is that the productivity of East Flores cashew reaches 400kg/tree. For the sake of optimizing cashew production. The East Flores Regency Government has disbursed IDR 2 billion for a rejuvenation program, land expansion, and thinning of plantations, namely reducing branches or twigs.

Cashew nuts have become the focus of attention of the East Flores Regency Government, considering that this commodity once raised the name of East Flores, in the period 2004 - 2006. At that time, foreign entrepreneurs flocked to buy cashew nuts directly from local farmers. However, after that the glory of cashew nuts faded. The first step taken by the government was to rejuvenate cashew plantations, thin out trees, expand planting areas, and provide organic fertilizer. In this way, 1 hectare of cashew land which previously produced 500-600 kg, now produces 400 kg/tree, or around 11 tons per hectare. With a calculation of 276 trees per hectare and a planting distance of 6 x 6 meters. Currently, the area of cashew plantations in East Flores is 18,000 hectares (ha) of a total potential land area of 47,000 ha (Ditjenbun 2020). Before expanding the land, the District Government together with farmers are trying to increase production

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through the process of pruning, thinning, and replanting old or dead trees. In essence, all kinds of efforts are made by the local government to preserve the cashew plantations in Flotim district.

In the development of cashew plants in East Flores Regency, it was reported that various obstacles were encountered, such as pest and disease attacks. One of them is the Cashew Shoot Planthopper. WPM attacks in high populations cause the shoots, flower stalks or cashew fruits to dry out. Economic losses are even higher if the attack occurs during the flowering or fruiting season because it can cause crop failure. (Mardiningsih et al. 2020; Dima, A. O., 2023; Soesanthy, F., & Trisawa, I. M., 2011) reported that attacks by cashew shoot planthoppers caused a loss of cashew yields of 57.8%. The East Flores Regency area is starting to be overwhelmed by the cashew shoot planthoppers that attack hundreds of cashew plants. This pest attack affects the production of farmers' cashew crops and also decreases. The lack of information regarding the distribution of cashew shoot planthoppers is one of the obstacles in controlling planthopper pests in East Flores Regency. The results of a survey of cashew plant cultivation locations in East Flores Regency found 4 locations with high levels of attack due to WPM, causing crop failure. Farmers' knowledge of WPM attacks is still very minimal, so there needs to be data on the types of WPM in the cultivation location. To find out the types of WPM that attack cashew plants in East Flores Regency, it is necessary to identify WPM. By knowing the species of WPM in an area, the actions for prevention or control that are carried out will be more effective and efficient. Based on the above, it is necessary to conduct research to obtain data on the distribution of WPM species in East Flores Regency.

Therefore, it is necessary to identify the type of WPM that attacks cashew plants and their distribution areas as a reference for making decisions in controlling them. The purpose of making a distribution map is to map the extent of pest distribution and the level of damage caused. The level of damage varies from light, moderate to severe. According to Maulana, Harjono, and Ayu Fitriani 2020; Limbu, et al, (2024) distribution maps can provide information about plant pests such as planthoppers and how to control them, making it easier for officers from related agencies to update information about pests and find out the latest information on their distribution and population levels. Based on the explanation above, research on the study of WPM on cashew plants and their distribution areas in East Flores Regency needs to be carried out.

METHODS

Place and Time of Research

This research was conducted in two locations, namely the field and the laboratory. Traps were installed in 5 sub-districts in East Flores Regency and WPM Identification was carried out at the Plant Pest Laboratory, Faculty of Agriculture, Nusa Cendana University, Kupang. This research was conducted from May to July 2024 with activities including location surveys, trap installation and identification of WPM species.

Work Procedure

Location *Determination*

Traps were installed in 5 sub-districts in East Flores Regency, namely; Ile Mandiri District, Lewolema District, Tanjung Bunga District, Titehena District and Demon Pagong District. The determination of the location for installing traps was based on the number of cashew plantations in each sub-district and the high level of attack due to WPM which caused crop failure.

Making Cashew Shoot Planthopper Traps

The WPM trap used is an insect net. The net trap (sweep net) is made of light and strong material and is easy to swing. The net section uses gauze that is easy to swing and the captured insects can be seen.

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Setting Traps

WPM imago are active at night or in places that do not get much sunlight. WPM capture using insect nets is carried out starting in the morning at 09.00 WIT until noon at 16.00 WIT, because the imago is more still so it is easier to capture. WPM trapped in the insect net is then put into a specimen bottle that has been filled with silica gel and then labeled according to the location of the capture.

***Data* Analysis**

This study uses the WPM morphological observation method to identify species and explore different physical characteristics. In the initial stage, WPM samples were collected from various locations according to the survey results. These samples will be analyzed carefully using optical devices such as microscopes, and the morphological characteristics of the WPM observed in each species are recorded. This includes body color, wings, thorax and abdomen. The coordinates of the observation location are recorded using GPS or the KoBoCollect application which can be accessed via smartphone. Observation data for the distribution location and percentage of cashew shoot planthopper attacks at each observation location will be displayed in a map image using the QGIS mapping program.

According to (Leatemia and Rumthe 2011) and (Apriyadi et al. 2023), to calculate the intensity of damage with a non-absolute type of damage caused by *Sanurus* spp. pests, the formula is used as presented in Equation 1.

$$IK = \frac{\Sigma (n \times v)}{Z \times N} \times 100\ \% \ldots. (1)$$

Description:

IK = Damage Intensity (%)
n = Number of shoots observed from each attack category
v = Scale value of each attack category
Z = Scale value of the highest attack category
N = Number of shoots observed

The assessment scale for attack categories for shoot damage is determined as follows :

0 → no shoot damage
1 → level of shoot damage 1 – 20 %
3 → level of shoot damage 21 – 40 %
5 → level of shoot damage 41 – 60 %
7 → level of shoot damage 61 – 80 %
9 → level of shoot damage > 80 %

The criteria or categories of shoot damage are determined as follows (Priyanto, Purwanto, and Rahayu 2024):

No shoot damage → if value IK = 0%
Minor damage → if value IK > 0–25%
Moderate damage →if value IK>25–50%
Severe damage → if value IK> 50–90%
Very heavy damage → if value IK> 90–100 %

RESULTS AND DISCUSSION

The results of the identification of Cashew Shoot Planthopper in 5 sub-districts in East Flores Regency found 2 (two) types of Cashew Shoot Planthopper. The types of Cashew Shoot Planthopper found can be presented in Table 1

Table 1 shows that there are 2 WPM species that have been identified in 5 sub-districts. The species are *Sanurus flavovenosus* and *Sanurus indecora*. The WPM species were obtained from various cashew plant cultivation locations in East Flores Regency. The distribution map shows the intensity of damage caused by cashew shoot hoppers. The intensity of damage from the 5 sub-districts that were the research locations, one sub-district was categorized as severely damaged because the intensity of damage reached 53.04%, namely Titehena Sub-district, 2 other sub-districts were categorized as moderate damage, namely Ile Mandiri Sub-district at 36.91% and Demon Pagong Sub-district at 36.94% and 1 sub-district included light damage intensity of

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0.35%. The distribution of *Sanurus flavovenosus* and *Sanurus indecora* species from 5 sub-districts in East Flores Regency can be seen in Figure 1.

Table 1. Types of cashew shoot planthoppers in 5 sub-districts in East Flores Regency

No	District	Location	Types of Cashew Shoot Planthoppers
1	Ile Mandiri District	Watowiti Village	*Sanurus flavovenosus*
		Waimana Village	*Sanurus indecora*
2	Tanjung Bunga District	Painapang Village	*Sanurus flavovenosus*
		Balohering Village	*Sanurus indecora*
3	Lewolema District	Sinamalaka Village	*Sanurus flavovenosus*
		Ratulodong Village	*Sanurus indecora*
4	Demon Pagong District	Blepanawa Village	*Sanurus flavovenosus*
		Lewokluok Village	*Sanurus indecora*
5	Titehena District	Lewoingu Village	*Sanurus flavovenosus*
		Leworok Village	*Sanurus indecora*

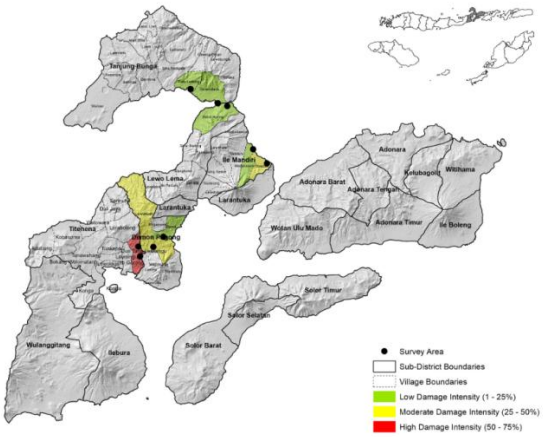

Figure 1. Map of the distribution of damage intensity of cashew treehoppers (*Sanurus spp.*) in East Flores Regency.

The results of the identification that have been carried out show that in cashew plants there are 2 types of cashew shoot planthoppers from the genus Sanurus, namely *Sanurus indecora* and *Sanurus flavovenosus*. Each species of cashew *shoot planthopper* obtained has its own characteristics that differentiate between species. To distinguish between Sanurus indecora and Sanurus flavovenosus, it can be observed macroscopically (direct visual observation), namely by looking at the difference in colour. *S. indecora* is brownish white while *S. flavovenosus* is green and along the edge of its wings there is an orange-brown line as shown in Figure 2. Cashew *shoot planthoppers* look like butterflies at first glance but the wing venation is not clearly visible as shown in Figure 2.

When perched, the WPM wings cover the body in an upright position downwards forming a roof-like shape. The tegmen widens towards the tip approaching a triangle with the upper wingtip forming an angle and the lower wingtip curved (convex). The submarginal area has many transverse venation with strong reticulation, but the

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submarginal line is unclear. Three (3) longitudinal veins emerge from the basal node, the S vein branches into two, and the anal vein is Y-shaped at the tip of the clavus as shown in (Figure 3). According to (Jihadi et al. 2023., Octaviana, & Wiharti, 2025 other characteristics of this pest are on the tegmen, sometimes a red line is seen along the edge. The shape of the postclaval tegmen forms a perpendicular angle as shown in Figures 3a and 3b when perching, the wings cover the body in a downward position.

a. *Sanurus flavovenosus* b. Imago *Sanurus indecora*

Figure 2. Imago *Sanurus spp f*ound at the research location.

a. Wings of *Sanurus flavovenosus* b. Wings of *Sanurus indecora*

Figure 3. Differences in the wings of Imago *S. flavovenosus* and *S. Indecora*

The body color of *Sanurus flavovenosus* is pale yellow as shown in Figure 4a while the body of *Sanurus indecora* is brownish yellow as shown in Figure 4b. According to (Jihadi et al. 2023 Supeno, B., 2011), the body and legs of this planthopper are pale yellow and when it closes its wings, it is in an upright position downwards. The green and white WPM has a body length from head to tip of tegmen ranging from 7-11 mm as shown in Figures 4a and 4b. The characteristics of this WPM are also in accordance with the statement of (Astuti Y., Daniati C. 2018) which emphasized that the WPM imago has a body length from the tip of the head to the tip of the wings of around 8-10 mm.

The color of the legs of *Sanurus flavovenosus* is brighter (bright yellow) than the legs of *Sanurus indeco*ra and there is 1 lateral spine on the posterior tibia as shown in Figures 5a and 5b. The results of the study

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by (Saputra et al. 2024). Adult *Sanurus indecora* are shaped like small butterflies with pale yellow bodies and legs and there is 1 lateral spine on the posterior tibia.

a b

Figure 4. Difference in body length of Imago *S. flavovenosus* (a) *and S. Indecora* (b)

a b

Figure 5. Differences in the legs of S. flavovenosus (a) and S. Indecora (b)

Sanurus *flavovenosus* has a green head like the color of its wings, facet eyes are on the left and right sides of the head which are blackish brown as shown in Figure 6a. *Sanurus indecora* also has black eyes but at the base of the eyes are brown and located on the left and right sides of the head as shown in Figure 6b. According to (Jihadi et al. 2023), On the head there are blackish brown facet eyes and are located at the ends of the left and right sides of the head and under the two facet eyes, there are antennae. Both types of WPM have a bright white pronotum and the color of the scutellum is the same as the color of its body. In addition, both have the same carina shape like the letter U. The results of research by (Saputra et al. 2024). adult indecora are in the form of small butterflies with pale yellow bodies and legs. The adult head and wings have color variations, including white or reddish white. The side of the head has black eyes with a brown base. The pronotum and

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scutellum are different, with the pronotum being slightly translucent white and the scutellum being pale yellow, similar to the body color. Furthermore, the research results of (Mallarangen, Nurmas, and Asniah 2011; Wahyono, T. E., 2005) confirmed that the genus Sanurus can be distinguished from other species based on the shape of the carina on the frons and the shape of the aedeagus and spines. The frons of S. indecora with a comparison of length and width are approximately the same, on the dorsal part there is a U-shaped carina and a median carina.

a b

Figure 6 Differences between the caput of *S. flavovenosus (a)* and *S. Indecora (b)*

According to (Siswanto, *et al.* 2003; Supeno, Pudjianto, and Kartosuwondo 2009) the characters of adult WPM, such as the characters on the head tegmen, legs and male genitalia, indicate that green and white WPM are classified into the Samurus genus. The shape of the front carina (for Carina) which is shaped like the letter V or the letter 1 is one of the characters that can be used to distinguish species from the genus Sanurus. However, the results of observations of the carina shape of green and white WPM show the same shape, namely the letter-U. The morphology of the body and legs of *Sanurus* spp. imago is pale yellow while the color of the head and wings varies, namely white, pale green or reddish white. The position of the wings when resting covers the body in an upright position downwards, sometimes a red line is seen along the edge of the tegmen. The tegmen widens towards the tip in the shape of an elongated triangle, the upper end of the wing is slightly curved while the lower end forms an angle. Tegmen with venation and there are many cross veins. The anal vein forms the letter Y at the tip.

Table 2. Intensity of damage WPM in 5 sub-districts in East Flores Regency

No.	Kecamatan	Pengamatan IK/Minggu (%)							
		1	2	3	4	5	6	7	8
1.	Lewolema	11.87	13.09	14.64	15.92	16.83	17.66	19.10	20.65
2.	Tanjung Bunga	0.22	0.22	0.26	0.31	0.34	0.46	0.48	0.55
3.	Ile Mandiri	4.01	6.87	11.31	15.37	21.13	27.28	32.18	36.91
4.	Demon Pagong	8.71	10.98	14.27	18.92	23.56	28.88	33.08	36.94
5.	Titehena	13.69	18.36	22.60	27.21	33.63	40.93	46.91	53.04

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Table 2 shows that the attack and level of damage to WPM from each sub-district have different intensities with different levels of damage, namely heavy in red is in Titehena Sub-district 53.04%, medium in yellow is in Lewolema Sub-district 20.65%, Ile Mandiri Sub-district 36.91% and Demon Pagong Sub-district 36.94% while light in green is in Tanjung Bunga Sub-district 0.55%. It can therefore be concluded that the average intensity of damage caused by WPM to cashew trees in East Flores Regency is 29.62%, which is classified as moderate damage. The results of the study can be assumed that the phenomenon found in East Flores Regency as the location of this study, it is known that the intensity of damage caused by WPM on cashew plantations always fluctuates in a stable state.

Many factors can affect the continuity of the intensity of damage at the research location. Some of the problems found, in fact, can cause frequent emergence of WPM and even become the main pest in cashew plants in East Flores Regency in recent years. Most of the sub-districts that are centers of cashew plantations in East Flores Regency, the production age of cashew plants reaches more than 10 years. This results in more branches and overlaps due to irregular planting distances and causes changes in the microclimate in the cashew planting area, especially humidity between the content or pressure of water vapor and changes in exposure to sunlight (luddin et al. 2023; Perlambang, et al, 2021). The age of cashew plants that reaches more than 10 years also causes the height of cashew plants to reach 10 meters and some are even higher. This will affect the ineffectiveness of pesticide spraying control measures carried out by the government which aims to control the population of leafhoppers. According to (Karmawati 2008)., (Pawar 2023) another problem found is the reluctance of farmers to carry out maintenance on cashew plants such as pruning unproductive branches. Cashew plants are simply abandoned and will be visited during the cashew seed harvest. These factors are most closely related to the increase in the intensity of damage and the population of cashew shoot hoppers. Efendi (2020) in (Awaludin et al. 2023) explained that garden sanitation is a key factor in managing pest organisms. Organic waste is used by pest organisms as a place to complete the preadult cycle. Sanitation or elimination of organic waste around cashew plantations can inhibit pest development. In addition to sanitation, thinning is also necessary to reduce the number of trees in a stand so as to spur growth, improve stand health by leaving healthy stands, reduce competition between trees; remove trees that have poor shape and performance, so that all future increments are concentrated only on the best trees.

CONCLUSION

Referring to the research objectives and in accordance with the results obtained and their discussion, it can be concluded that there are 2 types of WPM are *Sanurus flavovenosus* and *Sanurus indecora.* The distribution area of attacks and the level of damage to Sanurus from each sub-district have different intensities with different levels of damage, namely the intensity of heavy damage in red is in Titehena Sub-district 53.04%, the intensity of moderate damage in yellow is in Lewolema Sub-district 20.65%, Ile Mandiri Sub-district 36.91% and Demon Pagong Sub-district 36.94% while the intensity of light damage in green is in Tanjung Bunga Sub-district 0.55%.

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