



Inventory of Pests on Local Potato Plants from Soe in South Central East District, Province of East Nusa Tenggara

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Abstract: Sub-districts Kie and Fatumnasi are two sub-districts in mainland West Timor that cultivate local potatoes from Soe. This germplasm needs to be preserved and developed to diversify non-rice alternative food. One of the main obstacles in cultivating potatoes is the presence of pests, but so far there have been no reports of pests on local potato plants from Soe from the two sub-districts, so this research needs to be done. This study aimed at an inventory of important pests on local potato plants from Soe as a database for early detection to prevent the occurrence of explosive pests. This research was conducted on potato plantations in Fatuulan Village, Ayofanu Village, Nunleu Village, and Nenas Village. The method used is a purpose survey at a specified sample point. A sampling of insect pests is done by direct observation and insect nets. The pests found were put in a killing bottle or 70% alcohol, collected, and identified. Observation variables include the type of pest, symptoms of pest attack, and morphological characteristics of the stadia found. The data obtained were analyzed descriptively. The results showed that five species of pests damaged local potatoes from Soe. The five pests were *Spodoptera litura*, *Henosepilachna vigintioctomaculata*, *Liriomyza* sp., *Phthorimaea operculella*, and *Nezara viridula*. The identification results showed that in Kie District there were three pest species, namely *S. litura*, *H. vigintioctomaculata*, and *Liriomyza* sp. Meanwhile, in Fatumnasi District, there were four types of pests, namely *H. vigintioctomaculata*, *Liriomyza* sp., *P. operculella*, and *N. viridula*.

Keywords: Pest; Patatoes; Inventory.

Introduction

Potato (*Solanum tuberosum* L.) is the fourth major food crop in the world after rice, wheat, and maize (Jin et al., 2019; Gea et al., 2017) and plays an important role in food security in the world because of its versatility and high carbohydrate content. complex. In Indonesia, this commodity is a non-rice local food diversification besides corn, sorghum, cassava, sago and bananas which are intended to meet the food needs of the Indonesian people of 267 million people. Potato tubers as an alternative food to replace rice because they contain carbohydrates, protein and fat and vitamin C which is quite high (Ashari, 1995).

Pests are one of the factors that can reduce the quantity and quality of potatoes because the population is above the economic threshold and for a long time will

cause losses and affect the economic income of farmers. Several types of important pests on potato plants, namely tuber borer and potato leaf borer *Phthorimaea operculella* (Zeller), leafhoppers namely *Empoasca* sp., (Alyokhin et al., 2012), leafminer *Liriomyza* sp. (Kroschel et al., 2020); Colorado potato beetle *Leptinotarsa decemlineata* (Foster, 2017; Kroschel et al., 2020), *Myzus persicae*, *Bemisia tabaci*, *Henosepilachna vigintioctomaculata*, Yellow mite (*Polyphagotarsonemus latus* Banks.) (Kroschel et al., 2020).

The diversity of species of pests that damage plants needs to be known early to prevent their spread from spreading and efforts to control them are needed. This information can be known through the results of monitoring on agro-ecosystems that aim to suppress the development of pest populations and damage to plants

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at a non-harmful stage and minimize the use of synthetic pesticides which in turn obtain high and quality yields (Scherr & McNeely, 2012). The success of control efforts is through the results of monitoring and the accuracy of identifying attack symptoms and the morphology of each species.

On the mainland of West Timor, only Kie and Fatumnasi Districts, South Central Timor cultivate potatoes. Every year farmers cultivate twice, namely in January-March and in July-September. However, cultivating potatoes cannot be separated from the problem of pest attacks and until now no information has been reported about the types of important pests on local potato plants from Soe in the two sub-districts, so this research is important to do. The purpose of this study was to inventory the types of pests on local potato plants from Kie and Fatumnasi Districts, TTS Regency, East Nusa Tenggara (NTT).

Method

Place and time of research

This research was carried out on potato plantations in Kie and Fatuulan Districts, TTS Regency. This research took place from June - October 2021.

The research was carried out using a purposive sampling survey method, in each selected location several sample points were taken according to the land area. Identification of the pest specimens obtained was carried out at the Plant Pest Laboratory.

Research Methods and Procedures

Sampling was carried out using a purposive sampling survey method at potato production centers in Kie and Fatumnasi Districts. Kie District has three observation point villages namely Fatuulan Village, Ayofanu Village, and Nunleu Village. Meanwhile, in Fatumnasi District, samples were only taken from Pineapple Village.

Observation of pests was carried out using direct observation techniques and using insect nets. Each specimen of pest animal stage obtained was put into a killer bottle (containing HCN) for adult insects with hard bodies and alcohol for soft-bodied insects. These insects were collected, identified using literature including Pest & Diseases On Patato and Insect Pest Affecting Patatoes in Tropical, Sutropical and Temperate Regions. Observations were also made of the attack symptoms of each specimen.

Observation Variable

Observation variables included species of pest stadia found, symptoms of pest attack and morphological characterization of pests. Secondary data are cultivation cropping patterns, control technology

carried out by farmers, and seed sources. Secondary data obtained by interviewing farmers.

Data analysis

The data obtained were analyzed descriptively by comparing the data in the manual. Attack symptoms and species morphology are shown in pictures.

Result and Discussion

This research was conducted in Kie District and Fatumnasi District. In Kie District, it was observed in Fatulan Village, Ayofanu Village, and Nunleu Village. Meanwhile, in Fatumnasi Subdistrict, observations were only made in Pineapple Village. These villages were used as research objects because they cultivate local Soe potatoes. The results of discussions and observations in the field showed that there were two types of potatoes in the area, namely potatoes with red and light brown tuber skin. In terms of size, the red-pink potatoes are bigger than the brown ones. Both types of potatoes are cultivated by potato farmers in TTS District.

Cultivation activities include land preparation, seed preparation, planting, and maintenance. Potato cultivation is carried out in January-March (first growing season) and in July-September (second growing season). Land preparation is done manually, namely clearing the land from nearby litter such as corn and red bean planting waste, which is collected and burned. The cropping pattern is carried out using the crop rotation method so that it is very easy to cultivate the land and also the condition of the physical properties of the soil is quite loose. Crop rotation, namely potatoes - kidney beans - potatoes or potatoes - cauliflower / mustard greens - potatoes or corn-potatoes.

The potato seeds used by farmers are local seeds which have been separated during harvest. Before planting, the potato tubers are still sorted again which are pest-free, smooth, or without defects. Then the tubers are put into the container, placed in a cool place, and left for 4-5 days until the tubers grow shoots. If there is more than one shoot, then it is cut into two parts. Shoots measuring 5-6 cm were planted in the prepared land, with a spacing of 10 x 10 cm.

Maintenance activities include watering and pest control. Meanwhile, fertilization was not treated either chemically or organically. In Kie District, farmers do not water the plants, only use rainwater both during the first and second planting seasons. Meanwhile, in Fatumnasi Subdistrict, farmers water the plants in the second planting season if it doesn't rain for a week.

Pest and disease control is carried out by farmers using mechanical techniques, in which symptomatic plants are immediately revoked, but farmers leave the plantings around. This can affect the spread of pathogens and the observations found that many plants

were symptomatic of the pathogen *Phytophthora* sp, especially in Nunleu and Fatumnasi Villages. While cultivating potatoes, farmers do not treat them with chemical pesticides.

The results showed that there were five types of pests found in potato plantations in TTS District. The five types of pests are *Spodoptera litura*;

Henosepilachna vigintioctomaculata; *Liriomyza* sp; *Phthorimaea operculella*, and *Nezara viridula*. Three species were found in Kie District, namely *S. litura*, *H. vigintioctomaculata*, and *Liriomyza* sp. Meanwhile, in Fatumnasi District, there were four types of pests, namely *H. vigintioctomaculata*, *Liriomyza* sp, *P. operculella*, and *N. viridula* (Table 1).

Table 1. Types of Pests on Potato Plants Based on Observation Locations

Species	Kee District		Kecamatan Fatumnasi	
	Fatulan Village	Ayofanu Village	Nunleu Village	Nenas Village
<i>Spodoptera litura</i>	v	v	-	-
<i>Henosepilachna vigintioctomaculata</i>	v	v	v	v
<i>Liriomyza</i> sp	v	v	v	v
<i>Phthorimaea operculella</i>	-	-	-	v
<i>Nezara viridula</i>	-	-	-	v

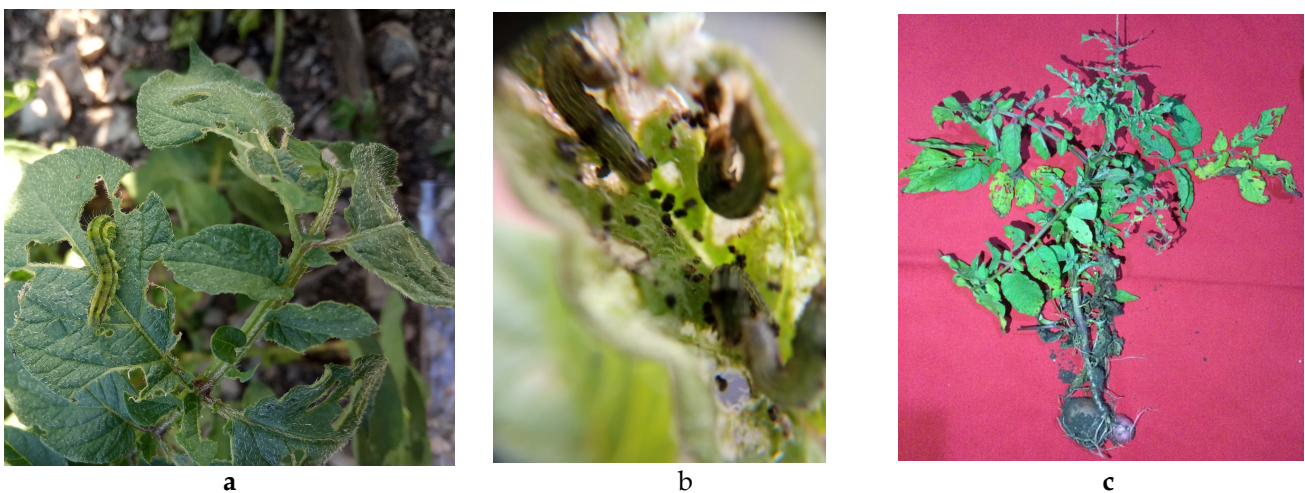


Figure 1. *Spodoptera* sp and its attack symptoms. Larvae (a and b); Attack symptoms (c)

Characteristics of Spodoptera litura (Lepidoptera: Noctuidae)

The results of observations in the potato planting area found larvae of *Spodoptera litura* in the 3rd and 4th instars (Figure 1a and b). The body color of the 3rd instar larvae is green (Figure 1a) and the 4th instar is brownish green (Figure 1b), the head is black, the fourth abdominal segment has a circular black line like a crescent and along the dorsal side there is also a black line to the end of the abdomen. The description of the morphological characters of the 3rd and 4th instar larvae is the same as that described by (Ramaiah and Maheswari, 2018). The results of the study found faeces left by the larvae on the surface of the leaf tissue (Figure 1b). The stool is round and black in color.

The destructive stage is the larvae. The larvae eat the potato leaves causing holes, torn and cut leaves to appear. Severe damage left the potato with only leaves (Figure 1c).

Characteristics of Henosepilachna vigintioctomaculata

The stadia found were larvae and imago (Fig. 2a and b). The characteristic feature of *H. vigintioctomaculata* larvae is that the entire body surface

is covered with long setae and branching apical ends (Figure 2a). The imago is pale orange and has black spots on the surface (Nosirova & Xalmirzayeva, 2022; Salles et al., 2020; Gorovaya, 2019) (Figure 2b). The morphological characterization of *H. vigintioctomaculata* adults and larvae was also studied by other researchers showing the same characteristics. Adults are round-convex, shiny orange in color, there are ± 13 black spots on each elytra, body length is ± 7 mm. The eggs are yellow, 1.5mm long, laid in clusters on the underside of the leaves. Larvae and pupae are oval in shape. The larvae are yellow green and there are setae on the body surface (Sanjaya et al., 2010). Larvae and imago feed on leaf tissue (Jamwal et al., 2013).

The larvae and imago eat the epidermis of the leaves so that the leaves appear transparent white and have holes (Figure 2c). This can affect the low photosynthesis so that it has an impact on tuber production. According to Kroschel et al (2020) due to the feeding activity of imago and larvae it causes defoliation and if the attack is heavy it causes the potato plants to die because photosynthesis is not going well. Its host range is in the families Solanaceae, Cucurbitaceae, and

Fabeceae (soybean and haricot bean) (Hossain et al., 2009).



Figure 2. *Henosepilachna vigintioctomaculata* and its damage symptoms. Larvae (a), Imago (b), Symptoms of Damage (c)

Characteristics of Liriomyza sp

Leafminer flies caused by *Liriomyza sp* damage potato leaf tissue by eating the mesophyll of the leaves because the larvae are in the leaf tissue (Atika, 2021) (Figure 3). Potato leaves appear white strip necrosis, over time the leaves dry out, have holes and interfere with photosynthesis. Imago lays eggs on the surface of the leaves. The larvae live by scraping the leaves so that winding grooves are found on the leaves. Several other researchers stated that crop damage also occurs due to the puncture of the female insect's ovipositor which causes symptoms of white spots (Ratonamo, 2021). Several larvae often attack the same leaf together, causing the leaves to wither prematurely and die (Mahendiran & Sharma, 2022; Minkenberg and Lenteren, 1986; Kroschel et al., 2020).

This pest is polyphagous. In Indonesia, this pest was reported to also attack chilies, potatoes, tomatoes, celery, red beans, cabbage, squash, peas, broccoli, lettuce, spring onions, spinach, shallots, green beans and several types of weeds such as water spinach (Yunxian and Le, 2001).



Figure 3. Damage Symptoms of *Liriomyza sp*

Characteristics of Phthorimaea operculella

The results of observations found eggs attached to the roots and tubers of potatoes (Syafii et al., 2018; Žibrat et al., 2021). While imago was found on potato stems. Eggs are white and oval in shape Figure 4a. Eggs are laid not in groups. This characteristic is supported by the research of Kroschel et al (2016), namely whitish eggs that are laid in groups or not in groups.

Adults have white brown markings on the wings and the wings are covered with scales (Figure 4b). Kroschel et al (2016) stated that the imago is brownish gray), the wings are in the form of wrinkles on the posterior edges of the forewings and hind wings (Arsi et al., 2022), the shape of the wings is like a roof when resting, measuring 7-9 mm, wide wing 12-16 mm (Kroschel et al., 2016).

Symptoms of attack from this pest are permanent wilting of plants due to the activity of the larvae (Ratnadass et al., 2021). The larvae drilled into the potato tubers causing the potatoes to be hollow, unstuffed and rotten (Figure 4c). As a result, the plants wither and die (Figure 4d). Another symptom described by other researchers is the presence of piles of faeces, in the tubers the larvae make irregular holes that damage the inside of the tubers or get under the skin of the tubers (Kroschel et al 2016). In this study, no piles of faeces were found around it, but eggs were found attached to the roots of the potato plant. Duan borers and potato tubers are oligophagous (Das & Raman, 1994).

This pest is only found in Pineapple Village. The results of interviews with farmers concluded that this pest is an important pest because from 2019-2020 yield losses reached 50-60%. In fact, many farmers do not want to cultivate potato plants because they have failed to harvest due to these pests.



Figure 4. Symptoms of *Phthorimaea operculella* damage. Egg (a), Imago (b), symptoms of damage (c and d)

Characteristics of Nezara viridula (Hemiptera: Pentatomidae)

Observations on potato cultivation in Pineapple Village found imago *N. viridula*. The entire surface of the imago is green, has a white line along the anterior part of the head and prothorax (Leu et al., 2021) (Figure 5a). Imagos use their stylets to take nutrients from young shoots by pinching, but at the same time imagos also secrete toxins contained in their saliva so that the affected parts show symptoms of necrosis, wilting or dieback (Figure 5b). The feeding activity of the imago and nymphs of *N. viridula* resulted in reduced branch formation and slower flowering.

This pest needs to be watched out for because several other researchers stated that the imago and nymphs of *N. viridula* are also vectors of plant pathogens from the fungi and bacteria groups (Esquivel et al., 2022; Rivers et al., 2022). These pests are on various plants such as chilies, long beans, soybeans, rice, and so on (Rivers et al., 2022).

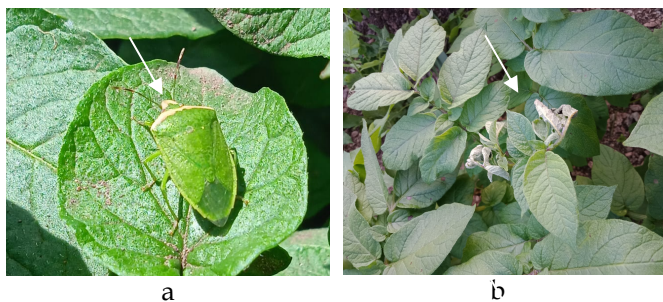


Figure 5. *Nilaparvata lugens* and its damage. Imago (a), Damage Symptoms (b)

Conclusion

The results showed that there were five pest species that interacted with potato plants in South Central Timor District. The five species are *Spodoptera litura*, *Henosepilachna vigintioctomaculata*, *Liriomyza* sp, *Phthorimaea operculella*, and *Nezara viridula*. In Kie District, three species of potato pests were inventoried, namely *S. litura*, *H. vigintioctomaculata*, and *Liriomyza* sp. In Fatumnasi District, there were four types of pests namely *H. vigintioctomaculata*, *Liriomyza* sp, *P. operculella*, and *N. viridula*.

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