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Identification of White Grub (*Coleoptera: Scarabaeidae*) on Six Sweet Potato (*Ipomoea batatas* L.) Cultivars

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ABSTRACT

Sweet potato (*Ipomoea batatas* L.) is one of the agricultural commodities that serves as an alternative food source. Uret (white grubs) are among the significant pests that attack sweet potato plants and can reduce the visual quality of the tubers. This study aimed to identify the species of uret pests that infest six sweet potato cultivars. The research was conducted from July to November 2024 on farmland owned by local farmers. The method used was an experimental method with a Randomized Block Design (RBD), consisting of six cultivars as treatments, each repeated four times, resulting in 24 experimental units. The treatments were K1 (Lato-lato), K2 (Cilembu), K3 (Tailand), K4 (Kentang), K5 (Ase), and K6 (Ungu). The results of the study identified two species of uret pests that infested all sweet potato cultivars. These pests were *Phyllophaga* sp. and *Leucopholis* sp., both belonging to the family Scarabaeidae, order Coleoptera. The Ungu cultivar showed the lowest average population of 8.5 grubs, while the Ase cultivar had the highest average population of 16 grubs. The infestation by uret pests only affected the external appearance of the sweet potatoes, so the tubers were still suitable for consumption.

INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is one of the major food crops widely cultivated and serves as an important source of carbohydrates after wheat, rice, maize, and cassava. In addition to being a staple food, sweet potato offers various health benefits, including anti-infective, anticancer, anti-inflammatory, antidiabetic properties, and it aids in the healing of atherosclerotic wounds (Elmaniar & Muhtadi, 2017). According to Ji *et al*. (2015), based on the color of its tubers, sweet potato is classified into four types: white, yellow, orange, and purple.

According to the Agricultural Data and Information Center (2023), sweet potato production in Indonesia has declined over the past five years. In 2018, sweet potato production reached 1,806,389 tons, but it decreased to its lowest point in 2022, amounting to 1,511,041 tons. Based on NTB Satu Data (2023), sweet potato production in West Lombok Regency also experienced a decline during the 2018–2022 period. This decline is evident from the production volume, which dropped from 1,000.50 tons to 886.04 tons. This may be due to a decrease in the harvested area of sweet potatoes and the presence of attacks by plant pests and diseases (PPD).

The market demand for sweet potatoes is generally quite high; however, current production has not been able to meet this demand. According to Erari (2022), one of the main factors contributing to the low production of sweet potatoes is the high incidence of pest and disease attacks. As stated by Saleh *et al*. (2015), various types of pests such as insects, mites, and aphids can attack the leaves, stems, roots, and even the tubers of the plant.

White grubs are one of the pests that attack sweet potato plants during the generative phase. White grubs are the larval stage of beetles from the Scarabaeidae family, which live in the soil and attack the plant's tubers. Infestation by this pest can cause serious damage to sweet potato plants, especially during the tuber formation phase, leading to a direct decline in harvest quality (Virman, 2016). The most severe damage to sweet potatoes caused by white grubs generally results from third instar larvae. These pests damage the plants by chewing on the tubers. According to Saragih (2009), symptoms of white grub infestation are

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characterized by bite marks on the surface of the tuber skin, which reduce both the quality and market value of the sweet potatoes.

Morphological variation among different sweet potato cultivars can influence their level of resistance to white grub infestation. Cultivars with tubers that have hard-textured skin are generally more resistant to attacks compared to those with softer skin. In addition, tuber size and shape also play a role, where small and uniform tubers tend to experience less damage than large and irregularly shaped ones. The skin and flesh color of the tubers is also suspected to affect the feeding preference of white grubs. Based on field surveys and interviews with sweet potato farmers in West Lombok Regency, it was found that there are six commonly cultivated cultivars in the area: Ase, Tailand, Lato-lato, Ungu, Cilembu, and Kentang (Yasmin ***et al***., 2024).

In Indonesia, research on the identification of white grub pests in sweet potato plants is still relatively limited. However, high-intensity larval infestations of this pest can cause severe damage, leading to a decline in both the external appearance and yield quality of the crop (Saragih, 2009). Based on this issue, a study was conducted under the title: "Identification of White Grub (Coleoptera: Scarabaeidae) Pests on Six Sweet Potato (*Ipomoea batatas* L.) Cultivars".

This research focuses on the issue of identifying white grub pests that attack six sweet potato cultivars. The objective of this study is to determine the species of white grub pests that infest the six sweet potato cultivars. The hypothesis of this research is that there are several species of white grub pests suspected to be attacking the six sweet potato cultivars.

MATERIALS AND METHODS

This research was conducted from July to November 2024 in Sigerongan Village, Lingsar Sub-district, West Lombok Regency. The method used was an experimental method with direct field observations. The experimental design applied was a Randomized Complete Block Design (RCBD), with cultivar (K) as the treatment factor. The treatments included: K1 (Lato-lato), K2 (Cilembu), K3 (Thailand), K4 (Kentang), K5 (Ase), and K6 (Purple). In total, there were six treatments with four replications, resulting in 24 experimental units.

The tools used in this research included wooden boards, bamboo, sickle, hoe, digital camera, stationery, plastic rope, knife, measuring tape, microscope, analytical balance, digital caliper, 200 ml thin-walled plastic cups, tweezers, and petri dishes. The materials used included seedlings of six sweet potato cultivars: Lato-lato, Cilembu, Tailand, Kentang, Ase, and Ungu, as well as NPK 16-16-16 fertilizer, label paper, and 70% alcohol.

The research implementation included land preparation, plot construction, seedling preparation, planting, maintenance, and harvesting. Land preparation was carried out by clearing the field of weeds and tilling the soil using a hoe to loosen soil clumps. Experimental plots (raised beds) were constructed for planting sweet potato seedlings, with a height of 30 cm, length of 100 cm, width of 88 cm, and a spacing of 30 cm between beds. Seedling preparation was done by selecting healthy and normal sweet potato plants that were at least two months old, then cutting stem cuttings of 25–30 cm in length or 3–4 nodes from the tip of the stem, with a maximum of 3 cuttings per stem, using a sharp knife. Planting was conducted in the afternoon by inserting the cuttings at a slanted angle. Each raised bed was planted with 8 cuttings, with a spacing of 20 cm between plants and 20 cm from the edge of the bed.

Plant maintenance included fertilization, irrigation, replanting, weeding, and flipping of stems and shoots. Fertilization was conducted before planting (initial fertilization) and after planting (follow-up fertilization) when sweet potatoes were 45 days after planting. The fertilizer used was NPK 16-16-16 at a rate of 40 grams per bed. Irrigation was done four times at one-month intervals and was carried out manually by channeling water from the ditches to the planting area. Replanting was done no later than 2 weeks after planting to replace dead or non-growing plants. Weeding was carried out at 1, 2, and 3 months of plant age, depending on the number of weeds growing in the sweet potato planting area. Flipping of stems and shoots was performed at 6 weeks after planting, at three-week intervals. Harvesting was done when sweet potatoes were 3.5 to 4 months old, indicated by the maturity of the tubers (physiological maturity).

Sampling was conducted once after the sweet potato harvest using a zigzag method, resulting in four sample plants. The observed parameters included pest population, symptoms of infestation, and the intensity of white grub attacks. Observation of attack intensity was carried out by identifying tubers showing damage symptoms caused by white grubs, counting the number of infested tubers, and determining the damage scale. The white grub population was observed by digging up the harvested planting beds, then collecting and

counting the number of pests found. The collected white grub samples were then reared to confirm species identification.

The following formula was used to calculate the percentage of relative damage according to the Directorate of Food Crop Protection (2018):

$$IS = \Sigma \frac{(ni \times vi)}{N \times Z} \times 100\%$$

Description:
IS = Intensity of infestation (%)
ni = Number of infested plant tubers
vi = Scale value of each infestation category
N = Total number of observed plant tubers
Z = Highest scale value of the defined infestation categories

After calculating the intensity of infestation, the scale, infestation category, and damage description can be determined (Table 1).

Table 1. Infestation Scale and Plant Damage Level

Scale	Infestation Category (%)	Damage Description
0	0%	Healthy
1	≤ 25%	Mild
2	> 25% - ≤ 50%	Moderate
3	> 50% - ≤ 75%	Severe
4	> 75% - ≤ 100%	Very Severe

The data were then analyzed using Analysis of Variance (ANOVA), and if the results showed significant differences among treatments, further testing was conducted using the Honestly Significant Difference (HSD) test at a 5% significance level. The following is the formula for the Honestly Significant Difference (HSD):

$$HSD\ (\alpha) = q\ (p.v)\ \frac{\sqrt{KTG}}{r}$$

Description:
MSE = Mean Square Error
q (p.v) = Correlation value from the table
p = Number of treatments
v = Degrees of freedom for error
r = Number of replications
α = Significance level of 5%

RESULTS AND DISCUSSION

1. Identification of White Grubs

Based on the identification that has been conducted, two species of white grubs were found attacking the six sweet potato cultivars (Figures 1 and 2). These uret pests belong to the family Scarabaeidae, order Coleoptera. This classification is based on the morphological characteristics of the beetles, where the larvae are curved like the letter C with dark brown heads. In the pupal stage, they are oval and elongated in shape, classified as exarate pupae in which the head (caput), thorax, and abdomen are clearly segmented. In the imago stage, they have an oval shape with two pairs of antennae that resemble a fan when spread.

According to Boror *et al.* (1992) as cited in Salea *et al*. (2022), beetles of the Scarabaeidae family generally have an oval-shaped body. Their tarsi consist of five segments, although in some species, the front tarsi may be absent. Their antennae expand into plate-like structures that can either spread open or close together to form a compact club at the tip.

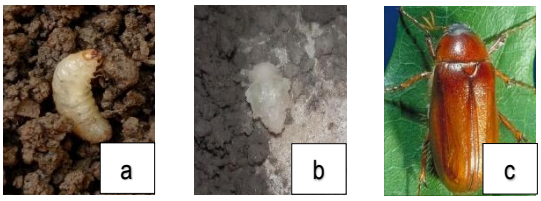

Figure 1. *Phyllophaga* sp.
Description: a. Larva, b. Pupa, c. Imago

The first species, *Phyllophaga* sp. (Figure 1), in the larval stage has a white body with three pairs of legs located on the thorax. The pupa is white, and the imago measures 8–25 mm in length, with a slightly rounded body, reddish-brown coloration, and a shiny surface. The forewings (elytra) are hardened and cover the entire abdomen (Setiawati *et al*., 2014). In Indonesia, although specific data on sweet potatoes is limited, *Phyllophaga* sp. poses a serious potential threat to agriculture. According to Martian (2004), *Phyllophaga* sp. has been reported to attack forestry crops, including young teak trees.

The life cycle of *Phyllophaga* sp. begins when the adult beetle lays eggs in the soil. The eggs hatch into larvae in about three weeks, and these larvae can remain in the soil for up to three years before metamorphosing into adult beetles. They actively feed on plant roots and tubers, especially during the dry season when soil moisture is low.

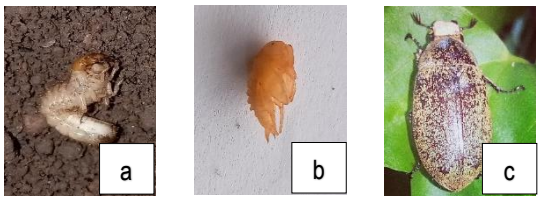

Figure 2. *Leucopholis* sp.
Description: a. Larva, b. Pupa, c. Imago

The second white grub species identified was *Leucopholis* sp. (Figure 2), characterized by yellowish-white larvae and yellow pupae. In the imago stage, it measures approximately 2–3 cm in length, with a dark brown to blackish-brown body. The elytra (hardened forewings) are smooth or slightly ridged, featuring yellow punctation (small dots) on the pronotum and elytra. Its front legs (protibiae) are strong and equipped with teeth used for digging soil during the larval stage and when the adult emerges from the ground. This finding supports previous research indicating that *Leucopholis* sp. is a pest of sweet potatoes, along with sweet potato weevils (*Cylas formicarius*) and rodents, as sweet potatoes serve as host plants for these pests (Virman, 2016).

The female beetle has a body length ranging from 2.4 to 3.5 cm and a width of 1.3 to 1.8 cm. Meanwhile, the male beetle is smaller, with a length of 2 to 3 cm and a width of 1 to 1.6 cm. The larva, commonly known as a white grub, can grow up to 5 cm in length.

2. Symptoms of White Grub Infestation

White grub infestations on sweet potato plants generally target the tuber parts located underground (Figure 3).

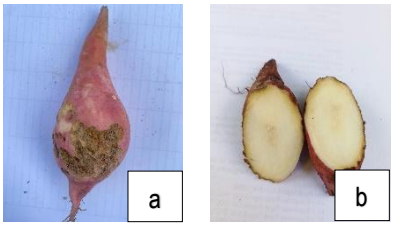

Figure 3. Symptoms of infestation
Description: a. External view, b. Internal view

Symptoms of white grub infestation on sweet potatoes are visible as bite marks on the surface of the tuber skin. This finding is consistent with the report by Virman (2016), which mentions the presence of dark

brown feeding scars on the sweet potato skin. Such damage reduces the visual quality of the tubers, which in turn lowers their market value (Saragih, 2009). However, the inner part of the tubers remains in good condition without any signs of damage. Therefore, although there is physical damage on the outer surface, the taste of sweet potatoes is not affected, making them safe and suitable for consumption. In addition to damaging surface tissues, grub attacks can also hinder the plant's ability to absorb water and nutrients, ultimately affecting productivity and the quality of the harvest.

3. Tuber Morphological Characteristics of Six Sweet Potato Cultivars

Each sweet potato cultivar exhibits different tuber morphological characteristics in terms of both color and shape (Figure 4).

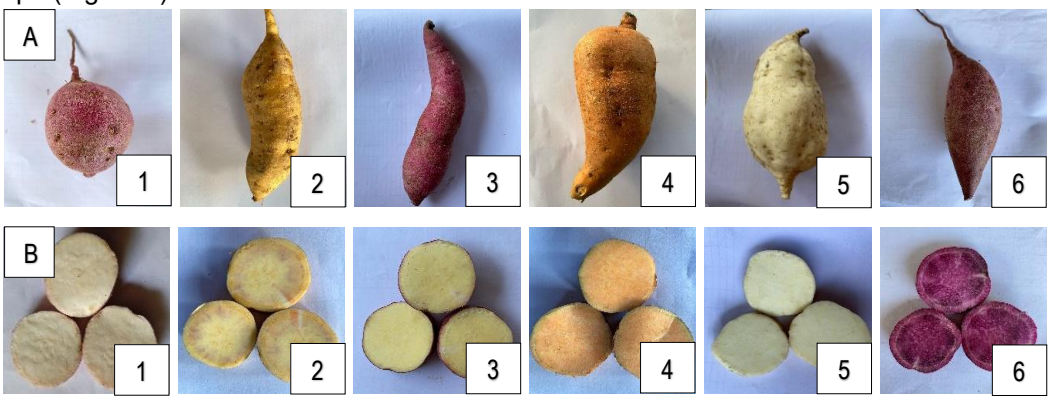

Figure 4. Skin and Flesh Color of Sweet Potato Tubers
Keterangan: A. Color of Tuber Skin, B. Color of Tuber Flesh, 1. Ungu, 2. Kentang, 3. Lato-lato, 4. Cilembu, 5. Ase, 6. Tailand

The Lato-lato cultivar has purple tuber skin and white flesh. This characteristic aligns with the description by Bugis *et al*. (2024), which states that white-fleshed sweet potatoes typically have round-shaped tubers with purple skin and white flesh. These tubers have a soft texture and tend to be uniform in size.

The Cilembu cultivar is characterized by cream-colored skin and flesh. Cilembu is known for its long and elongated tubers. A distinctive feature of this cultivar is its ability to develop a honey-like sweetness when roasted due to its high natural sugar content. This sweet potato has a soft and sticky texture (Putri *et al*., 2024).

The Thailand cultivar has reddish-purple skin and pale yellowish flesh. These characteristics are consistent with the report by Pujiastuti *et al*. (2024), which states that yellow-fleshed sweet potatoes typically have yellow interiors, an elongated shape, and a soft texture.

The Kentang cultivar has long and slender tubers. It has both orange-colored skin and flesh. This characteristic supports the statement by Bugis *et al*. (2024), which mentions that orange-fleshed sweet potatoes usually have oblong or slender tubers with orange skin and flesh. The bright orange flesh indicates a high beta-carotene content.

The Ase cultivar has white skin and flesh, with oval-shaped tubers. The tubers of this cultivar tend to be larger in size compared to the others (Yasmin *et al*., 2024). The pale flesh color indicates a low beta-carotene content.

The Ungu cultivar has slender and slightly elongated tubers with pointed ends. The skin is dark purple, while the flesh is deep purple. These features are in line with the findings of Bugis *et al*. (2024), which reported that purple sweet potatoes typically have purple flesh due to their anthocyanin content.

4. Population of White Grub Pests on Six Sweet Potato Cultivars

The white grubs found attacking sweet potatoes showed varying numbers across each cultivar (Table 2).

Table 2. White Grubs Attacking Six Sweet Potato Cultivars

Sweet Potato Cultivars	White grubs	Total
Lato-lato	*Phyllophaga* sp.	19
	Leucopholis sp.	25
Cilembu	*Phyllophaga* sp.	32
	Leucopholis sp.	17
Tailand	*Phyllophaga* sp.	26
	Leucopholis sp.	11
Kentang	*Phyllophaga* sp.	27
	Leucopholis sp.	13
Ase	*Phyllophaga* sp.	42
	Leucopholis sp.	22
Ungu	*Phyllophaga* sp.	22
	Leucopholis sp.	12
Total		268

The white grub pests found across all sweet potato cultivars totaled 268 individuals. Two species of white grubs belonging to the family Scarabaeidae were identified in each cultivar. *Phyllophaga* sp. was found in the highest number, totaling 168 individuals, while *Leucopholis* sp. accounted for 100 individuals. The dominance of *Phyllophaga* sp. is attributed to a combination of strategic advantages such as a long life cycle with strong environmental adaptability, *polyphagous* behavior with a wide range of host plants, high reproductive capacity with precise oviposition preferences, broad geographic distribution, and resistance to control measures. All of these factors make *Phyllophaga* sp. more dominant and capable of forming larger populations compared to *Leucopholis* sp.

5. Population and Infestation Intensity of White Grub Pests

The population and infestation intensity caused by white grub pests showed varying values across each sweet potato cultivar (Table 3).

Table 3. Average Population and Infestation Intensity of White Grub Pests

Cultivars	Population (individuals)	Infestation Intensity (%)
K1 (Lato-lato)	11[a]	23,63[b]
K2 (Cilembu)	12,25[a]	26,34[ab]
K3 (Tailand)	9,25[a]	20,32[b]
K4 (Kentang)	10[a]	21,03[b]
K5 (Ase)	16[a]	40,23[a]
K6 (Ungu)	8,5[a]	15,82[b]

Note: Numbers followed by the same letter in the same column are not significantly different based on the 5% HSD test.

The Ase cultivar showed the highest average population of 16 larvae, with the highest average infestation intensity of 40.23%, which falls into the moderate damage category. These results are in line with the findings of Virman (2016), who reported the highest infestation of white-fleshed sweet potatoes and the lowest in red-fleshed ones. This indicates that white-fleshed sweet potatoes, which have lower phenolic and anthocyanin content, are more susceptible to pest attacks. The large tuber size of the Ase cultivar is suspected to provide more space for larval development.

In the Ungu cultivar, the lowest average population of white grubs was recorded at 8.5 larvae, with the lowest average infestation intensity of 15.82%, which falls into the light damage category. The high anthocyanin content in the Ungu cultivar (Husna *et al*., 2013) plays a role in reducing white grub infestation

due to its function as an antioxidant and a natural pest repellent. Genetic factors, particularly tuber color and size, appear to significantly influence the feeding preference of white grubs.

White grubs are generally more attracted to sweet potatoes with white-colored skin or flesh. White tubers usually contain lower levels of phenolic compounds and anthocyanins, which act as natural repellents to pests. The white color also indicates a lower content of protective pigments against biotic stress, including pest attacks (Virman, 2016).

CONCLUSIONS

The study found two species of white grub pests that attacked all sweet potato cultivars. These pests, *Phyllophaga* sp. and *Leucopholis* sp., belong to the family Scarabaeidae and the order Coleoptera. The Ungu cultivar showed the lowest average population of 8.5 individuals, while the Ase cultivar had the highest average population of 16 individuals. The white grub infestation only reduced the external appearance quality of the sweet potatoes, so the tubers were still suitable for consumption.

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