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Inventory of Insects in Land Water Spinach Cultivation Using the Insecticide Abamectin

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ABSTRACT

Land kale in a cultivated has an obstacle, namely the presence of insects. Based on their there are beneficial and harmful insects. To deal with harmful insects, insecticides are used which contain the active ingredient abamectin which causes insect skin irritation and eliminates appetite. The aim of this research was to see the presence of insects in the use of abamectin in land kale plantings in West Sidomulyo Village. This study was conducted in May and September 2024 in West Sidomulyo Village and identification was carried out at the Pathology Laboratory, Entomology, Microbiology, and Soil Science, Faculty of Agriculture and Animal Science, Sultan Syarif Kasim State Islamic University, Riau. The samplin was by catching directly using nets and yellow traps found on land kale plants. Insects are stored in collection bottles. The research results showed that there were 3 ordo, 7 family dan 8 genera of insects. There are 4 insect pests namely Anasa sp., Gonocerus sp., Bemisia sp., and Aspidimorpha sp., there are 3 predatory insect namely Verenia sp., Menochilus sp., and Paederus sp., and there 1 migrant insect namely Musca sp. The insects found have haustelata (piercin, sucking) and mandibulata (biting, chewing) mounth types. The intensity of insect pest attack increased after the application of abamectin insecticide, allegedly due to the inappropriate application time, where the application was carried out in the morning toward noon with a fairly high temperature so that evaporation occured and the effectiveness of the insecticide was reduced.
Keyword: abamectin, climate, land kale, pest attacks, predator.

INTRODUCTION

Water spinach (*Ipomoea reptans* L.) is one of the most widely cultivated leafy vegetables in Indonesia due to its short growth cycle, ease of cultivation, and affordability for consumers. The crop contributes significantly to local vegetable production and household food security. According to data from the Central Statistics Agency (BPS), the cultivation area of water spinach in Tuah Madani Subdistrict reached 150 ha in 2022, with an annual production of 403 tons (UPTDPP Tuah Madani, 2023). The increasing demand for water spinach has encouraged farmers to intensify production; however, pest infestations remain one of the major constraints affecting crop yield and quality.

In agricultural ecosystems, insects play diverse ecological roles. Some insect species act as phytophagous pests that damage crops through feeding, oviposition, and sap-sucking activities, thereby reducing plant growth and marketable yield (Untung, 2010). In contrast, beneficial insects, including predators and parasitoids, contribute to the natural regulation of pest populations and help maintain ecosystem balance (Price et al., 2011; Maulani, 2015). Therefore, understanding the composition and functional roles of insect communities is essential for developing sustainable pest management strategies.

To minimize crop losses caused by insect pests, farmers commonly rely on insecticides. Several active ingredients frequently used in vegetable production systems include dimethoate, deltamethrin, spinosad, and abamectin (Arfan et al., 2016; Arfan et al., 2018). Among these, abamectin is a broad-spectrum insecticide and acaricide derived from the soil actinomycete *Streptomyces avermitilis*. It acts primarily by disrupting neurotransmission through stimulation of glutamate-gated chloride channels, resulting in paralysis and death of susceptible insects and mites (Lasota & Dybas, 1991; Aljedani, 2017). Due to its effectiveness against a wide range of insect pests, abamectin has become one of the most commonly applied insecticides in vegetable cultivation.

Although abamectin is effective in suppressing pest populations, its application may also influence non-target insects, including natural enemies that contribute to biological control. Information regarding the diversity and ecological roles of insect communities associated with upland water spinach cultivation under abamectin application remains limited, particularly in Pekanbaru, Riau Province. Therefore, this study was conducted to inventory and classify insect species based on their ecological roles in upland water spinach fields treated with abamectin in Sidomulyo Barat Village, Tuah Madani District, Pekanbaru City. The results are expected to provide baseline information for the development of environmentally sound and sustainable pest management practices.

RESEARCH METHODOLOGY

Time and Location of the Study

This study was conducted in Sidomulyo Barat Village, Tuah Madani District, Pekanbaru City, Riau Province, Indonesia. Field observations and interviews were carried out on a water spinach (*Ipomoea reptans* L.) cultivation area managed by Mr. Supardi. Identification of insect specimens was conducted at the Laboratory of Plant Pathology, Entomology, Microbiology, and Soil Science, Faculty of Agriculture and Animal Science, State Islamic University of Sultan Syarif Kasim Riau, Pekanbaru. The research was conducted from May to September 2024.

Materials and Equipment

The equipment used in this study included collection bottles, label paper, a digital camera, insect identification guides, stationery, a hand lens, a microscope, forceps, a knife, gloves, questionnaire sheets, a ruler, yellow sticky traps, and insect nets. The material used for specimen preservation was 70% ethanol.

Research Method

This study employed an observational survey method, which involved systematic, objective, and accurate observations of field conditions followed by laboratory identification of collected insect specimens. The preliminary stage consisted of a field survey to collect information through direct observations and interviews with farmers regarding pest incidence and management practices.

Sampling locations were determined using a simple random sampling method based on a diagonal sampling pattern. Five observation plots were established along the diagonal line of the cultivation area. Observations were conducted weekly by collecting insect samples from each observation plot. The sampling layout is presented in Figure 1..

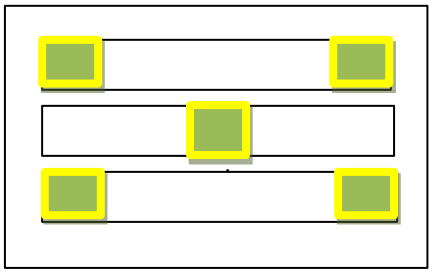

Figure 1. Diagonal Plot (Data Primer,2024)

Description : plot area (2x1 m)
: land area of 3 raised beds (9x17)

Sampling

Sampling was conducted by manually capturing pests and using yellow sticky traps placed on the water spinach plants. Each pest collected was stored in a collection bottle containing 70% alcohol.

Research Observation Parameters

a. Number of Pest Insects
   Pest counts were conducted on 100 sample plants in each observation plot. Observations were performed before and after the application of the insecticide Abamectin. At the 3-week-old plant stage, observations were conducted by counting the number of pests on leaves, stems, and yellow sticky traps at 5 points.
b. Role of Insect Types
   Observations of the role of insect types were categorized as follows:
   1. Phytophagous Insects (Pest Insects)
   2. Predatory Insects (Natural Enemies)
   3. Non-target Insects

Data Analysis

Data obtained from field observations, interviews, and questionnaires were tabulated and analyzed descriptively using Microsoft Excel. The collected data were used to determine insect abundance and diversity based on their functional roles within the water spinach agroecosystem. Results were presented in the form of tables, figures, and descriptive explanations to address the research objectives.

RESULTS AND DISCUSSION

Inventory of Insect Numbers

Based on the observations conducted, the number of insect pests on land-grown water spinach plants in the Sidomulyo Barat sub-district revealed that there were 4 insect pests attacking and damaging each plot. The number of major pests attacking the water spinach plants in each plot is shown in Table 1.

Table 1 shows that the most abundant insect species found in May was *Gonocerus* sp., with a total of 20 individuals. An increase in the pest insect population was observed from before spraying to after spraying. This is believed to be due to the untimely application of the abamectin insecticide. The spraying of the abamectin insecticide, brand name Agrimec 18 EC—a concentrated yellow liquid—was carried out by farmers in the late morning around 10:45 AM local time, with temperatures ranging from 29–33 °C, where high temperatures cause faster evaporation, thereby reducing its effectiveness, and pest insects tend to hide during the day. According to Novizan (2002), spraying in the morning or evening allows the insecticide solution to be absorbed more quickly by the plants and makes it easier for pest insects to come into contact with the insecticide.

Table 1 shows that the most common insect found on land-grown water spinach in September was *Verenia* sp., with 23 individuals. The high number of predatory insects during the rainy season is likely due to environmental factors, specifically temperature and humidity, which influence the development of predatory insects.

Table 1. Number of Insect Pests Attacking Land-Grown Water Spinach Plants

Month	Insect	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Sum
		B	A	B	A	B	A	B	A	B	A	
MAY	*Anasa* sp.	0	0	0	5	0	6	0	0	0	0	11
	Gonocerus sp.	0	4	0	6	0	8	0	1	0	1	20
	Aspidimorpha sp.	1	1	0	2	0	5	0	1	0	0	10
	Bemisia sp.	0	1	0	1	2	3	0	0	0	3	10
	Verenia sp.	0	0	0	3	0	0	0	0	0	0	3
	Menochilus sp.	0	0	0	0	0	2	0	0	0	0	2
	Musca sp.	0	2	0	2	3	3	2	3	2	3	19
SEPTEMBER	*Gonocerus* sp.	0	2	0	2	0	0	0	0	0	0	4
	Anasa sp.	0	3	0	3	0	0	0	0	0	0	6
	Verenia sp.	1	18	0	2	0	2	0	0	0	0	23
	Menochilus sp.	0	3	0	2	0	1	0	0	0	0	6
	Paederus sp.	1	5	3	6	0	0	0	0	0	0	15
	Musca sp.	3	5	4	4	0	0	0	0	0	0	16

Source: Primary Data (2024)
Note: B: Before 5–13 days (Before Insecticide Application)
A: After 14–25 days (After Insecticide Application)

Types and Roles of Insects

a. Phytophagous Insects (Pest Insects)
Based on observations, there are 4 insects classified as pest insects, namely *Anasa* sp., *Gonocerus* sp., *Bemisia* sp., and *Aspidimorpha* sp., as shown in Table 1 The higher number of pest insects in May compared to September is due to environmental conditions, where temperature and humidity influence the development of pest insects.

b. Predatory Insects (Natural Enemies) Based on the observation results, there were 2 predatory insects, namely Verenia sp. and Menochilus sp., in May and 3 predatory insects, namely *Verenia* sp., *Monochilus* sp., and *Paederus* sp., in September, as shown in Table 1 The increase in September is suspected to be influenced by the temperature at the observation site; these insects can survive for up to nine months by utilizing their stored food reserves. The predatory insects can be seen in Figure 1.2.

Figure 2. Predatory insects : a. *Verenia* sp., b. *Menochilus* sp., c. *Paederus* sp. (Primary Data, 2024)

Other predatory insects, such as *Paederus* sp., are present in September; it is believed that their population surges typically occur during the rainy season. These insects are cosmopolitan (found everywhere) and inhabit moist soil with humidity levels ranging from 65% to 98%. In agricultural ecosystems, *Paederus* sp. (tomcat) acts as a generalist predator because it preys on insect pests such as aphids, fruit flies, and other soft-bodied insects.

c. Invasive Insects
Non-target insects are insects found on land water spinach plants; however, they do not act as pests that damage the plants nor as predators of pests on the plants. One such non-target insect is *Musca* sp. (housefly). *Musca* sp. is found on land water spinach plants due to the presence of yellow sticky traps; when exposed to sunlight, these traps attract houseflies. According to Puspitarani (2017), houseflies rely on the reflection of sunlight to detect objects in their environment while flying, searching for food, and seeking resting places. The optimal temperature for fruit fly development is around 25–28 °C. The invasive insect is shown in Figure 3.

Figure 3. Invasive Insects *Musca* sp. (Primary Data, 2024)

Identification of Insect Pests

A study on the identification of insect pests on land water spinach plants in the Sidomulyo Barat neighborhood identified four genera with distinct characteristics.

Anasa sp.

A sap-sucking pest that disrupts water flow and can cause wilting in land water spinach leaves is the pumpkin aphid (*Anasa* sp.). Anasa sp. is a pest belonging to the family Coreidae; it is an aphid with legs resembling leaves, as shown in Figure 4.

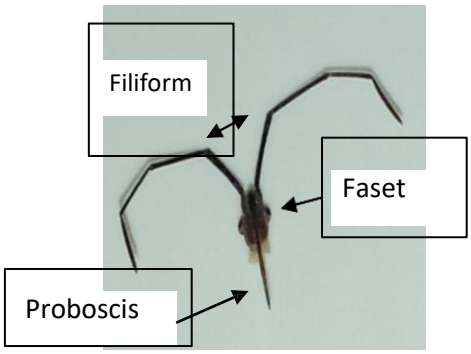

Figure 4. *Anasa* sp (Primary Data, 2024)

The classification of Anasa sp. is as follows: Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Hemiptera, Family: Coreidae, Genus: *Anasa*.

The morphology of Anasa sp. can be observed using a digital microscope; it measures 30 mm in length and 15 mm in width. The adult is grayish-brown in color and somewhat flattened. The hind legs are broad and leaf-shaped. The mouthparts are of the piercing-sucking type, consisting of a rostrum and equipped with a stylet. Anasa sp. feeds on plants by sucking sap, primarily from leaves, but occasionally from stems as well.

***Gonocerus* sp.**

In this study, the pest identified was *Gonocerus* sp., a species of Hemiptera classified in the family Coreidae. See Figure 5.

The classification of Gonocerus sp. is as follows: Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Hemiptera, Family: Coreidae, Genus: *Gonocerus*.

The morphology of *Gonocerus* sp. can be observed under a digital microscope. The adult *Gonocerus* sp. reaches a size of 14 mm. Its head is small and has two fairly long antennae; it has six legs, which are pale and slender. *Gonocerus* sp. is a leaf-eating insect with piercing-sucking mouthparts. *Gonocerus* sp. has a rough body surface with reddish-brown spots and a slightly widened abdomen.

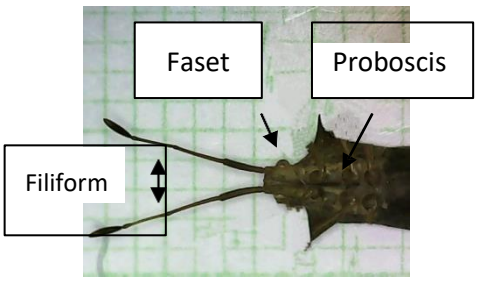

Figure 5. *Gonocerus* sp. (Primery Data, 2024)

***Aspidimorpha* sp.**

Research results from five plot sites of land water spinach revealed one species of the order Coleoptera; unlike the other three pests, this species is a tortoise beetle (*Aspidimorpha* sp.). An image of the *Aspidimorpha* sp. pest can be seen in Figure 6.

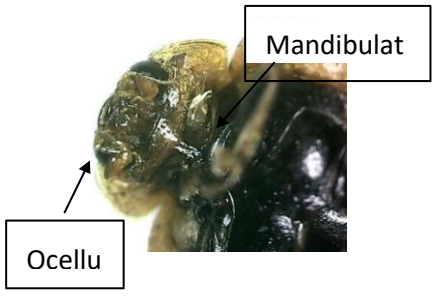

Figure 6. *Aspidimorpha* sp. (Primery Data, 2024)

Tortoise beetles are classified as follows: Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Coleoptera, Family: Chrysomelidae, Genus: *Aspidimorpha.*
The morphology of *Aspidimorpha* sp. can be observed using a digital microscope; it measures up to 15 mm in length and 5 mm in width. Its body is nearly round in shape, with a pair of hard wings on its back. The hard wings on its back are yellow-orange in color, with a pattern of black spots.The turtle beetle has short legs and a head that appears bent downward. This head position helps it when feeding. It has a biting-chewing mouthpart type.

***Bemisisa* sp.**

Bemisia sp. is also one of the pests that attack land-grown water spinach in the Sidomulyo Barat neighborhood*; Bemisia* sp. can be seen in Figure 7.

Whiteflies are classified as follows: Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Hemiptera, Family: Aleyrodidae, Genus: *Bemisia*.

The morphology of the *Bemisia* sp. adult can be observed using a digital microscope. The body size of the whitefly adult ranges from 1 to 2 mm. Its wings are of equal size, which is why the whitefly is classified within the order Hemiptera. The whitefly has piercing mouthparts; this pest attacks young shoots and leaves by inserting its stylet or mouth parts ***Verenia* sp.**

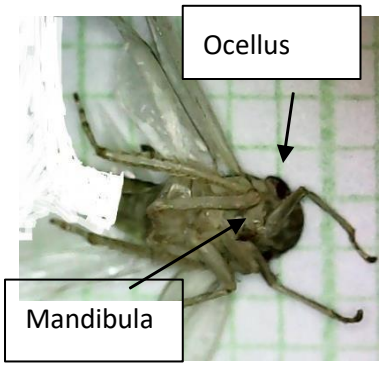

Figure 7. *Bemisia* sp. (Primery Data, 2024)

In addition to insect pests, the research also revealed the presence of predatory insects from the order Coleoptera, specifically the kosi beetle (*Verenia* sp.); this insect can be seen in Figure 8.

Figure 8. *Menochilus* sp., (Primery Data, 2024)

The classification of Verenia sp. is as follows: Kingdom: Animalia, Phylum: Arthropoda , Class: Insecta, Order: Coleoptera, Family : Coccinellidae, Genus: *Verenia*.

The morphology of the adult *Verenia* sp. can be observed using a digital microscope. *Verenia* sp. has an oblong body shape, with a body length of 5 mm and a wing length of 4 mm; its wings are brownish-orange in color. *Verenia* sp. has no spots on its wings; its head is triangular with a pointed tip and is brown in color, with a head length of 1 mm; it has three pairs of black legs.

***Monocilus* sp.**

Research findings indicate that *Monocilus* sp. is a predatory insect from the order Coleoptera etc. Classification from *Monochilus* sp. is kingdom : Animalia, Phylum : Arthropoda, Class : Insecta, Ordo : Coleoptera, Family : Coccinellidae, Genus : *Monochilus.*

The adult morphology of Monochilus sp. includes an oval-shaped body, a body length of 6–7 mm, a wing length of 5–6 mm, and orange-colored wings. The wings feature 6–9 groups of line-shaped spots that merge together, with the spots on the left and right wings arranged in parallel rows.

In the center of the wings, between the right and left wings, there is a black zigzag-like transverse line, and on the hindwings there is one spot on each side separated by a central line. The eyes of *Monochilus* sp. are black; the head is flattened, 0.4–1 mm long; there are three pairs of orange legs; and the wing surface feels smooth to the touch. *Monochilus* sp. can be seen in Figure 9.

Figure 9. *Paederus* sp. (Primery Data, 2024)

***Paederus* sp.**

Research findings on the presence of another predatory insect from the order Coleoptera on water spinach plants, namely Paederus sp. Classification of Paederus sp.: Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Coleoptera, Family: Staphylinidae, Genus: *Paederus*.

Morphology of the *Paederus* sp. adult: the head is black and has relatively large compound eyes. The antennae consist of 11 segments; the basal 3 segments are light brown, and the remaining segments are black. Each antenna segment bears fine hairs resembling spines. The prothorax and metathorax are black. The short elytra are black and wavy; the abdomen is elongated and wavy; the legs are black, while the base of the femur is brown. *Paederus* sp. can be seen.

House Fly (*Musca* sp.)

Houseflies are classified as follows: Kingdom: Animalia, Phylum: Arthropoda, Class: Hexapoda, Order: Diptera, Family: Muscidae, and Genus: *Musca*. Flies have segmented bodies with distinct body parts. Their body parts are paired symmetrically on the right and left, characterized by three distinct sections: the head, thorax, and abdomen, and they possess a pair of antennae, three pairs of legs, and one pair of wings (Indonesian Ministry of Health Regulation No. 50, 2017). Houseflies can reproduce at a temperature 25 °C with 75% humidity. Houseflies are shown in Figure 10.

Figure 10. *Musca* sp. (Primary Data, 2024)

Pest Infestation Intensity

Field observations revealed that the insect pests attacking land water spinach plants in the Sidomulyo Barat neighborhood are listed in Table 2.

As shown in Table 1.2, the intensity of insect pest infestations increased following the spraying; the average intensity of insect pest infestations in May was 11.5% (mild), with the average intensity of infestations by *Gonocerus* sp. (7.25%), *Aspidimorpha* sp. (6.125%), *Bemisia* sp. (5.25%), and *Anasa* sp. (4.375%). The average pest insect attack intensity in September was 3% (mild), with the average attack intensity of *Gonocerus* sp. (2.125%) and *Anasa* sp. (0.875%). Changes in pest insect infestation intensity are influenced by environmental conditions, as the environment affects both the growth and decline of pest insect populations. This aligns with

Setyolaksono (2011), who explained that daily temperature increases influence pest development. The average temperature and humidity during the observation period ranged from 22–33 °C, and humidity ranged from 65–98%. The ideal temperature for pest habitats is 25 °C (Pratiwi et al., 2018).

Table 2. Pest Infestation Intensity

Month	Insect Type Pest	IS		Criteria
		Before	After	
ME I	*Anasa* sp.	1,75 %	7 %	Lightweight
	Gonocerus sp.	2 %	12,5 %	Lightweight
	Aspidimorpha sp.	3 %	9,25 %	Lightweight
	Bemisia sp.	2,25 %	8,25 %	Lightweight
S E P	*Anasa* sp.	0,25 %	1,5 %	Lightweight
	Gonocerus sp.	1,5 %	2,75 %	Lightweight

Source: Primary Data (2024).

CONCLUSION

Based on the results of the study on insect presence in abamectin-treated water spinach crops in Sidomulyo Barat Village, a total of 3 orders, 7 families, and 8 genera of insects with distinct characteristics were identified. There were 4 insect pests, 3 predatory insects, and 1 non-native insect. In May, the most commonly found insect was Gonocerus sp., with 20 pest individuals. In September, the most commonly found insect was Verenia sp., with 23 individuals. The non-native insect found was *Musca* sp.

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