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Identification and inventory of bagworms on oil palm (*Elaeis guineensis*) in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia

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Abstract. *Anggraini E, Purba H, Herlinda S, Susilawati S, Lau WH, Arinafril A. 2026. Identification and inventory of bagworms on oil palm (*Elaeis guineensis*) in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia. Asian J Agric 10 (1): g100128. https://doi.org/10.13057/asianjagric/g100128.* Oil palm (*Elaeis guineensis*) is one of Indonesia's most important plantation commodities and a major contributor to the national economy. However, productivity is often constrained by pest infestations, particularly bagworms (Lepidoptera: Psychidae), which damage palm fronds and reduce photosynthetic capacity. This study aimed to identify bagworm species and quantify their abundance and infestation intensity in oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, to provide baseline information supporting the development of appropriate integrated pest management strategies. Field observations were conducted using a diagonal sampling method across five plots, with 20 trees observed per plot (100 trees in total). Bagworms were collected manually and identified based on morphological characteristics. Four species were recorded: *Pteroma* sp., *Metisa plana*, *Pteroma pendula*, and *Mahasena corbetti*. *Pteroma* sp. was the dominant species (912 individuals), whereas *M. corbetti* had the lowest abundance (137 individuals). The overall mean infestation intensity across the five plots was 62%, calculated using the Townsend-Heuberger index, indicating severe foliar damage. Higher infestation levels were observed in edge plots and areas exposed to greater sunlight. These findings indicate a high level of bagworm infestation in the study area and variation in abundance across plots, possibly influenced by microenvironmental factors. This study provides baseline information on bagworm species composition, abundance, and infestation intensity, which is important to support the implementation of appropriate integrated pest management strategies in oil palm plantations.

Keywords: *Mahasena corbetti*, *Metisa plana*, oil palm plantations, pest management, *Pteroma* sp.

INTRODUCTION

Oil palm (*Elaeis guineensis*) is one of Indonesia's most economically important plantation crops and a major global source of vegetable oil used in the food, cosmetic, and industrial sectors (Murphy et al. 2021). Its high oil yield per hectare compared to other oilseed crops makes palm oil a cost-efficient and strategically important commodity. Global demand continues to increase due to population growth and rising consumption of processed products. Indonesia and Malaysia are the largest producers of Crude Palm Oil (CPO), contributing approximately 85-90% of global production (Zakaria et al. 2023). Palm oil is widely utilized, accounting for 71% in food products, 24% in cosmetics and personal care, and 5% in biofuel and other industrial uses (Nabila et al. 2023). Despite its economic importance, oil palm productivity has declined in some areas due to various limiting factors, including pest infestations, diseases, nutrient deficiencies, and environmental stress, affecting both immature and mature plants (Egonyu et al. 2022).

Insect pests are commonly found in oil palm plantations and represent a major threat to sustainable production. Among these pests, bagworms (Lepidoptera: Psychidae) are recognized as one of the most destructive defoliators of oil palm (Yussoff et al. 2024). Bagworms are classified as oil palm leaf-eating caterpillars and feed on leaf tissues, reducing the photosynthetically active area of the plant. High bagworm population density is associated with rapid reproductive rates, short life cycles, and strong adaptability to diverse environmental conditions (Johari et al. 2023). Their feeding activity causes progressive damage, beginning with small perforations on leaf surfaces and eventually leading to severe defoliation under heavy infestation. When bagworm populations exceed the economic threshold level, significant yield losses can occur due to reduced photosynthetic capacity and impaired plant physiological processes. Previous studies have reported that bagworm infestations may result in fresh fruit bunch

(FFB) yield losses of up to 40%, accompanied by leaf loss rates ranging from 10% to 13% (Kamarudin et al. 2021).

Symptoms of bagworm infestation are typically visible on leaf blades, which exhibit perforations and tissue loss, initially affecting younger fronds and gradually spreading to older leaves (Zulkefli et al. 2021). Severe infestations can result in extensive canopy defoliation, disruption of photosynthesis, reduced carbohydrate production, and long-term yield decline (Che et al. 2025). The reduction in photosynthetic capacity limits the plant's ability to produce and allocate assimilates necessary for fruit development, ultimately affecting productivity. In addition to biological factors, improper pest management practices, including excessive reliance on chemical insecticides and limited farmer awareness of Integrated Pest Management (IPM) approaches, have contributed to the resurgence and persistence of bagworm outbreaks (Desa et al. 2021).

Various control measures have been implemented to manage bagworm populations, including biological and chemical approaches. Biological control involves conserving and enhancing natural enemies such as parasitoids, predators, and entomopathogenic microorganisms, which help regulate pest populations (Thaer et al. 2021). Chemical methods, including insecticide spraying and stem injection, are widely applied during severe outbreaks due to their rapid effectiveness (Radzil et al. 2024). However, excessive chemical use may disrupt ecological balance, reduce natural enemy populations, and increase the risk of pest resistance. Therefore, sustainable management emphasizes integrated pest management strategies combining monitoring, biological control, and selective chemical intervention.
Bagworms exhibit high reproductive capacity, rapid dispersal, and strong feeding activity, highlighting the importance of early detection and continuous monitoring. Effective management requires accurate species identification, assessment of population abundance, and evaluation of infestation intensity, as species may differ in biological characteristics and response to control measures (Masri et al. 2022). Such baseline information is essential for determining economic thresholds and selecting appropriate management strategies.

However, baseline data on bagworm species composition, population abundance, and infestation intensity in oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia, are currently unavailable, limiting the development of effective and site-specific pest management strategies. Preliminary observations indicated severe leaf damage and active infestations, suggesting significant bagworm presence. Therefore, this study aimed to identify bagworm species and quantify their abundance and infestation intensity in oil palm plantations in Sungai Rengit Village, South Sumatra, to support the development of appropriate integrated pest management strategies.

MATERIALS AND METHODS

Study area and plot delineation

The study was conducted in an oil palm plantation located in Sungai Rengit Village, Talang Kelapa Sub-district, Banyuasin District, South Sumatra, Indonesia (Figure 1). The total study area was subdivided into five observation plots to facilitate spatial assessment of bagworm distribution. Each plot represented a defined section of the plantation with relatively uniform planting age and management practices. Plot boundaries were determined based on visible field demarcations and plantation block layout. The plots were distributed across the plantation area to capture spatial heterogeneity, including areas near roads, irrigation channels, and interior plantation zones. Each plot served as an independent sampling unit for bagworm identification, abundance assessment, and infestation intensity evaluation.

Sampling

Field sampling was conducted using a diagonal sampling method to ensure representative spatial coverage of the plantation. The study area was subdivided into five observation plots of comparable size based on the existing plantation block layout. Each plot represented a distinct section of the plantation with relatively uniform palm age and management practices. Within each plot, an imaginary diagonal transect was established from one corner to the opposite corner to capture spatial variability from edge to interior areas. Oil palm trees located along this transect were considered sampling candidates.

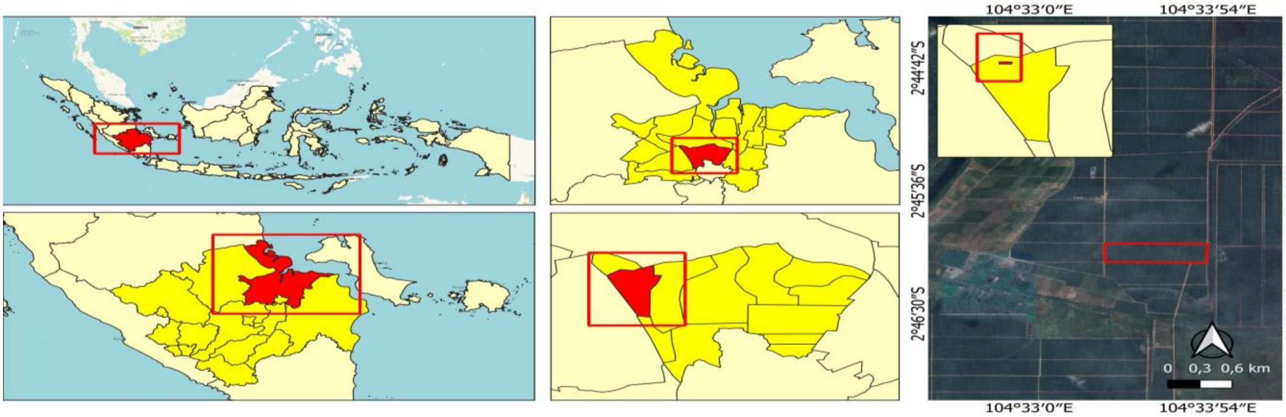

Figure 1. Oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia

Twenty trees per plot were selected at regular intervals along the diagonal line to reduce spatial clustering and sampling bias, resulting in a total of 100 sampled trees (20 trees × 5 plots). For each selected tree, a fixed number of fronds were examined to assess bagworm infestation intensity. The survey was conducted over one month, with infestation scoring performed during the final two weeks of observation (Figure 2).

Observations were carried out in the morning between 06:00 and 09:00 a.m. Bagworms were collected manually from palm fronds using gloves and placed in zip-lock bags. Each specimen was photographed using a smartphone camera equipped with a macro lens. The collected bagworms were subsequently transferred into labeled vial bottles according to species for identification and population counting.

Identification

Bagworm specimens were identified based on external morphological characteristics observed using a macro lens, following available taxonomic keys and published descriptions of Psychidae species (Holloway 1986; Lelana et al. 2022). Diagnostic characters examined included bag shape and size, larval coloration, head capsule morphology, and structural composition of the protective case. *Pteroma* sp. could not be identified to species level due to the absence of sufficient diagnostic characters. After identification, the morphological characteristics of each species were documented, and the number of individuals per species on each observed tree was counted to determine population abundance. When multiple species occurred on a single tree, individuals were recorded and counted separately for each species.

Evaluation of bagworm attack severity on oil palm fronds

The level of bagworm infestation was assessed by visually examining affected oil palm fronds on each observed tree. Each tree was assigned an infestation score using a five-point scale: 0 (no infestation), 1 (very mild), 2 (mild), 3 (moderate), and 4 (severe), based on the extent of visible leaf damage (Table 1).

The intensity of bagworm infestation was calculated using the Townsend-Heuberger (1943) formula:

$$I\ (\%) = \Sigma(n \times v) / (N \times Z) \times 100$$

Where:
I: Infestation intensity (%),
n: Number of fronds in each damage category,
v: Damage score,
N: Total number of fronds observed,
Z: Highest damage score (4)

During field observations, the location of each sampled tree within the plantation landscape was noted, including whether trees were situated near plantation edges, irrigation ditches, access roads, or interior areas. The presence of bagworms on surrounding vegetation adjacent to oil palm trees was also recorded. Early infestation signs were assessed through visual inspection of fronds, focusing on subtle feeding scars and the presence of protective bags attached to leaf surfaces. Particular attention was given to detecting small or newly formed bags that closely resembled dried palm leaf fragments.

Data analysis

Bagworm species composition and abundance were summarized descriptively across the five observation plots. Infestation intensity was calculated for each tree using the Townsend-Heuberger formula and subsequently averaged per plot to obtain the mean infestation intensity value.

All data were summarized descriptively using Microsoft Excel. Species abundance was expressed as total individuals and percentage composition, and infestation intensity was calculated using the Townsend-Heuberger index and averaged per plot. No inferential statistical tests were performed, as the study was designed as a field inventory and baseline assessment of bagworm species composition, abundance, and infestation levels.

Table 1. Assessment of infestation level based on a value scale and criteria for bagworm attacks

Scale	Description	Attack criteria
0	Asymptomatic frond	Not affected
1	≤10% of the frond area is damaged	Very mild
2	> 10% - ≤ 25% of the frond area is damaged	Mild
3	> 25% to ≤ 50% of the frond area is damaged	Moderate
4	More than 50% of the frond surface area is damaged	Severe

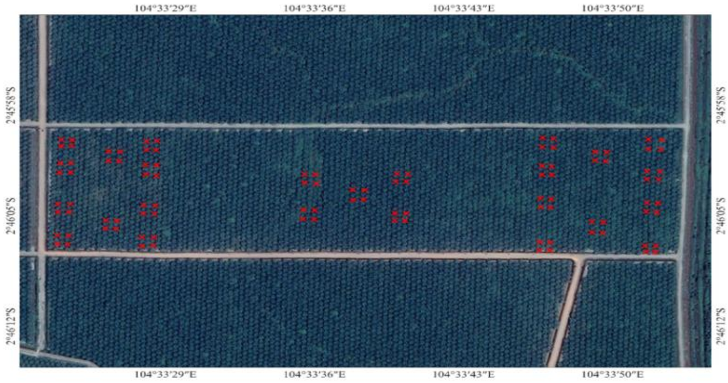

Figure 2. Sampling map

RESULTS AND DISCUSSION

Bagworm species observed

The survey conducted in oil palm plantations in Sungai Rengit Village, Banyuasin District revealed the presence of four bagworm species on palm fronds (Figure 3). The identified species were *Pteroma* sp., *Metisa plana* (Walker, 1883), *Pteroma pendula* (de Joannis, 1929), and *Mahasena corbetti* (Tams, 1928). These species differed in body size and bag morphology, ranging from small to relatively large individuals. Each species could be distinguished by the shape and size of its protective bag, with some exhibiting elongated and slender bags, while others had shorter or bulkier structures. These morphological differences facilitated species identification and reflected varying ecological adaptations to the oil palm environment.

Pteroma sp. was characterized by a long, cylindrical protective bag, brownish white to dark brown in color, resembling dried leaves and tapering toward the anterior end. The outer surface of the bag consisted of fragments of oil palm tissues, including leaf pieces, epidermal layers, fibers, and organic debris from the trunk, bound together by larval silk. Larvae were yellowish with light brown markings, giving a greenish appearance under sunlight. The body surface was smooth and slightly shiny, covered with fine setae, and lacked spines or sharp defensive structures.

The head capsule was relatively small, hard, and dark brown to black, equipped with chewing mouthparts. The thorax comprised three segments bearing paired legs with small claws for firm attachment to leaf surfaces during feeding. The abdomen consisted of ten segments with prolegs facilitating movement, allowing larvae to retract easily into the bag. Compared with *M. corbetti*, the bag of *Pteroma* sp. appeared slimmer and more elongated.

In the present study, *Pteroma* sp. exhibited a bag length of approximately 29 mm and a larval length of 11 mm. The protective bag was longer than the larval body (Figure 4). Individuals were predominantly found hanging from older oil palm fronds, particularly on the abaxial leaf surfaces. This species showed the highest population abundance among all recorded bagworms, with more than five larvae frequently observed on a single frond, resulting in conspicuous leaf damage. Populations were more abundant on older fronds than on younger leaves, facilitating population assessment. Although similar in appearance to *P. pendula*, the bag of *Pteroma* sp. was less regular in shape.

Figure 3. The bagworm species found on oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia. A. *Pteroma* sp., B. *Metisa plana* (Walker, 1883), C. *Pteroma pendula* (de Joannis, 1929), D. *Mahasena corbetti* (Tams, 1928)

Figure 4. *Pteroma* sp.

Metisa plana is a destructive bagworm species commonly found in oil palm plantations. Larvae possess elongated, cylindrical bodies. The bag is constructed from irregularly arranged fragments of oil palm leaves bound together by larval silk, giving it a grayish-brown to dark brown appearance resembling dried fronds. A large anterior opening allows the head and thorax to emerge during feeding, while the posterior end contains small apertures for waste excretion.

The head capsule is dark brown to black and relatively small compared with body size. The thorax bears three pairs of legs equipped with claws that facilitate attachment to leaf surfaces. Pupation occurs within the bag, with pupae ranging from light to dark brown. Sexual dimorphism becomes evident at the pupal stage, where males develop wing buds and subsequently emerge as winged adults, whereas females remain wingless and larva-like.

In this study, the protective bag measured approximately 13 mm in length, and the larval body measured approximately 10 mm (Figure 5). Individuals were predominantly observed on young fronds, where the bags were attached directly to the leaf surface, with only a few hangings freely. Although its population was lower than that of *Pteroma* sp., *M. plana* caused more conspicuous leaf damage. The irregular bag structure and relatively large larvae facilitated field identification. Overall, *M. plana* showed moderate abundance but produced clearly visible feeding injury on oil palm leaves.

Pteroma pendula is a common bagworm species in oil palm plantations and may cause substantial economic losses if left unmanaged. This species is characterized by elongated, tightly packed protective bags constructed from dried palm leaf fragments, fibres, and larval silk. The bags typically hang from the abaxial surface of palm fronds, resembling dried leaf debris and thus requiring careful observation for detection. The bags are generally brown with a slight greenish to yellowish-brown hue. The protective bag of *P. pendula* measured approximately 15 mm in length, while the larval body measured approximately 13 mm (Figure 6). The bag appeared elongated and slender, with a tapered anterior end. The larva was cylindrical and brownish in coloration, with a darker head capsule clearly distinguishable from the body.

Mahasena corbetti was the last bagworm species recorded in the oil palm plantations of Sungai Rengit Village, Banyuasin District. This species is recognized as one of the most destructive bagworms due to its relatively large larval size and high leaf consumption capacity. Larval feeding often occurs in groups and, if unmanaged, may lead to population outbreaks, resulting in substantial defoliation and reduced Fresh Fruit Bunch (FFB) production.

The protective bag of *M. corbetti* is large and elongated, and is constructed from irregularly shaped fragments of dried oil palm leaves bound with larval silk. Unlike the more compact bags of other species, the pouch of *M. corbetti* resembles an aggregated mass of leaf debris and is typically dark brown to grayish brown in color, making it visually conspicuous.

Larvae are the largest among the recorded species, with elongated bodies and dark brown to blackish-brown coloration. The head capsule is darker than the body and equipped with strong mandibles. Larvae pass through several instars and may reach lengths of up to 25 mm. Similar to other species, the thorax bears three pairs of legs and the abdomen several pairs of prolegs. Pupation occurs within the bag, producing dark brown pupae with a relatively hard surface. Adult males are larger than those of *P. pendula*.

Figure 5. *Metisa plana* (Walker, 1883)

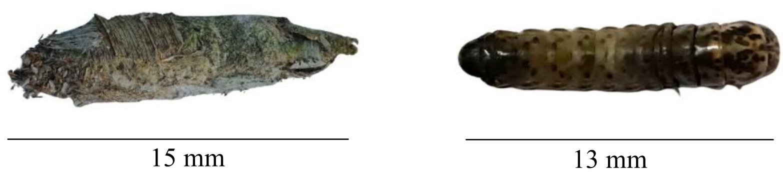

Figure 6. *Pteroma pendula* (de Joannis, 1929)

In the present study, the protective bag measured approximately 18 mm in length, whereas the larval body measured approximately 10 mm (Figure 7). Infestation typically initiated on lower fronds and progressed toward the canopy. Light infestations resulted in leaf perforations, whereas severe infestations caused complete defoliation, leaving only leaf veins. This species was frequently encountered near water edges and in areas with high sunlight exposure. Despite its high destructive potential, *M. corbetti* showed the lowest population abundance at the study site, possibly related to differences in ecological traits and detectability.

Characteristics of bagworm attacks

Bagworm attack patterns on oil palm were generally similar among species, with larvae gradually consuming leaf tissue and causing progressive defoliation that reduced photosynthetic capacity. Infestations typically began unevenly and spread from tree to tree, facilitated by overlapping fronds. Higher infestation levels were frequently observed on palms located at plantation edges, irrigation ditches, and access roads, and bagworms were also detected on surrounding vegetation. Early infestations were difficult to detect because the bags resembled dried palm leaves, allowing populations to increase unnoticed.

Infested leaves initially showed epidermal erosion and discoloration, followed by perforation and, under severe attack, complete defoliation, leaving only leaf veins. Feeding intensity increased with larval size, resulting in more extensive leaf damage. Such severe infestations negatively affected oil palm productivity and required extended recovery periods.

High bagworm abundance at the study site may have been influenced by environmental conditions, including dry weather and high sunlight exposure, as well as plantation management practices. The spread of bagworms was further facilitated by wind dispersal, contact between palm crowns, and the flight activity of adult males. In addition, repeated chemical control may have contributed to reduced efficacy, as several trees were observed to host more than five larvae per frond despite stem injection treatments.

At the observation site, infestation intensity reached the highest severity level (score 4), characterized by widespread leaf perforation and defoliation. Initial symptoms appeared as yellowish-white spots on older fronds, which later developed into extensive damage and leaf drop, leaving only the midribs (Figure 8). Overall, higher bagworm populations were associated with increased infestation severity on individual trees.

Figure 7. *Mahasena corbetti* (Tams, 1928)

Figure 8. Symptoms of bagworm infestation on oil palm fronds

Bagworm population by species

Observations of bagworm populations across five plots revealed variation in species abundance among all observation plots (Figure 9). The species distribution map (Figure 9) shows that *Pteroma* sp. was the most abundant bagworm species, accounting for 57.72% of the total population, followed by *P. pendula* (20.25%), *M. plana* (13.35%), and *M. corbetti* (8.67%) (Table 2). In contrast, *M. corbetti* exhibited the lowest abundance. Multiple bagworm species were occasionally observed on the same oil palm tree, particularly in plots with higher infestation levels. However, the abundance values presented represent the total number of individuals recorded per species across all sampled trees.

Four bagworm species were recorded in the oil palm plantations of Sungai Rengit Village, Banyuasin District, with varying levels of infestation intensity. Bagworm abundance was positively associated with infestation severity, and species distribution appeared to vary among plots. *Pteroma* sp. was the most abundant species, with a total of 912 individuals, accounting for 57.72% of the overall bagworm population. Higher populations were observed in Plots 1, 2, 4, and 5, whereas Plot 3 exhibited the lowest abundance. These differences may be related to plot location, as edge plots receiving greater sunlight exposure tended to support higher populations.

Pteroma pendula was the second most abundant species, with 320 individuals (20.25% of the total population). The highest population was recorded in Plot 5 (122 individuals). This species showed a relatively even distribution across plots and shared similar habitat preferences with *Pteroma* sp., particularly in areas with higher light exposure. *Metisa plana* ranked third in abundance, with a total of 211 individuals (13.35%). Higher populations were observed in Plot 4, while lower densities occurred in plots located toward the plantation interior. Although less abundant than *Pteroma* sp. and *P. pendula*, *M. plana* produced conspicuous feeding damage on palm fronds. *Mahasena corbetti* exhibited the lowest population, with 137 individuals (8.67%). This species was primarily observed along plot edges and older fronds, with minimal presence in interior plots. Despite its lower abundance, *M. corbetti* is recognized for its high destructive potential due to its large larval size. Overall, the dominance of *Pteroma* spp. indicates that this genus represents the primary bagworm threat in the study area, highlighting the need for targeted monitoring and management strategies.

Table 2. Bagworm population by species across observation plots

Species	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Total
Pteroma sp.	235	217	97	249	114	912
Metisa plana (Walker, 1883)	47	38	25	68	33	211
Pteroma pendula (de Joannis, 1929)	61	54	20	63	122	320
Mahasena corbetti (Tams, 1928)	37	29	12	22	37	137

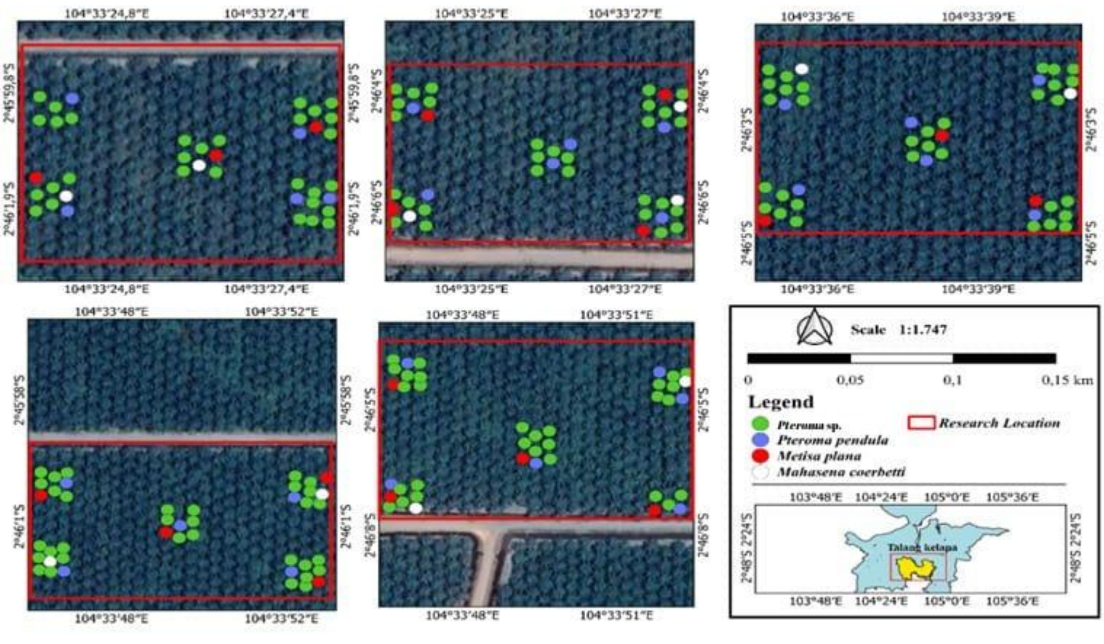

Figure 9. Distribution of bagworm individuals by species across plots on oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, Indonesia

Intensity level of bagworm infestation

The intensity of bagworm infestation in oil palm plantations in Sungai Rengit Village, Banyuasin District was determined by assigning infestation scores to each observed tree and calculating infestation intensity using the Townsend-Heuberger index. Infestation levels were classified into light, moderate, and severe categories based on the calculated percentage values.

The infestation intensity values for each observation plot are presented in Figure 10. Infestation intensity varied among plots, ranging from 40% to 81.25%. The highest infestation intensity was recorded in Plot 4 (81.25%), while the lowest was observed in Plot 3 (40%). Overall, the mean infestation intensity across the five plots was 62%, which falls into the severe infestation category**.** This result indicates that bagworm attacks were widespread and caused substantial damage to oil palm fronds across the study area.

Discussion

Four bagworm species were recorded in oil palm plantations in Sungai Rengit Village, Banyuasin District, South Sumatra, namely *Pteroma* sp., *M. plana*, *P. pendula*, and *M. corbetti*. All species exhibited protective bags larger than their larvae, a typical characteristic of Psychidae. Among these species, *Pteroma* sp. was the most dominant, accounting for 912 individuals (57.72% of the total population), followed by *P. pendula* (320 individuals), *M. plana* (211 individuals), and *M. corbetti* (137 individuals).

Higher populations of *Pteroma* sp. were observed in edge plots, particularly Plot 4, whereas lower abundance occurred in interior plots. This spatial pattern suggests that plot location and microenvironmental conditions may influence bagworm distribution. Similar trends were observed for *P. pendula* and *M. plana*, which also showed higher abundance in plots exposed to greater sunlight. Although *M. corbetti* exhibited the lowest population, this species remains ecologically important due to its larger larval size and high feeding capacity (Egonyu et al. 2022; Rozziansha et al. 2022).

Pteroma sp. larvae construct dense protective bags from leaf fragments bound with silk and feed by scraping the leaf epidermis, resulting in discoloration, perforation, and eventual defoliation (Wahyunita et al. 2022). This species has a relatively long developmental period (90-120 days), with multiple larval instars and a high feeding capacity, which may substantially reduce oil palm productivity under severe infestation conditions (Manurung and Anwar 2023).

Metisa plana was frequently observed on young fronds, producing grayish feeding scars and perforations that disrupt photosynthesis (Asmaliyah et al. 2020; Ting et al. 2023). Leaf tissue consumed by *M. plana* larvae contributes both to growth and bag construction (Mulyani et al. 2024). Females deposit numerous eggs within their protective bags (Chi et al. 2024). This species shows high adaptability and reproductive potential, allowing rapid population increases under favorable conditions. Previous studies indicate that *M. plana* is a highly destructive bagworm species due to its high feeding capacity and ability to cause severe defoliation in oil palm plantations (Lelana et al. 2022), emphasizing the importance of biological control using natural enemies such as *Sycanus* sp. (Yuliadhi et al. 2021).

Pteroma pendula ranked second in abundance and is characterized by tightly packed bags and a relatively short life cycle (48-50 days), enabling rapid population expansion (Lelana et al. 2022). Early larval survival depends on rapid host plant colonization, and several parasitoids have been reported as natural enemies, including *Pediobius imbrues*, *Pediobius elasmi*, *Dolichogenidea metesae*, and *Aulosaphes psychidivorus* (Skendžić et al. 2021; Badrulisham et al. 2022; Yaakub et al. 2023).

Mahasena corbetti exhibited the lowest abundance but the highest destructive potential due to its large larval size and extended developmental period (110-140 days) (Lubis et al. 2024; Simanjuntak et al. 2025). Larvae scrape leaf tissue extensively, producing wide feeding scars and significant leaf area loss (Ikhsan et al. 2024; Simanjuntak et al. 2025). This species also shows high fecundity, producing large numbers of eggs per oviposition, which increases outbreak risk.

The overall infestation intensity across five plots reached 62%, classified as severe based on the Townsend-Heuberger index. Severe infestations were characterized by extensive perforation, browning, and defoliation, leaving only midribs on affected fronds (Hilmi et al. 2021; Dwi et al. 2025). Such damage reduces photosynthetic capacity and negatively affects fresh fruit bunch production (Anuar et al. 2021; Johari et al. 2023).

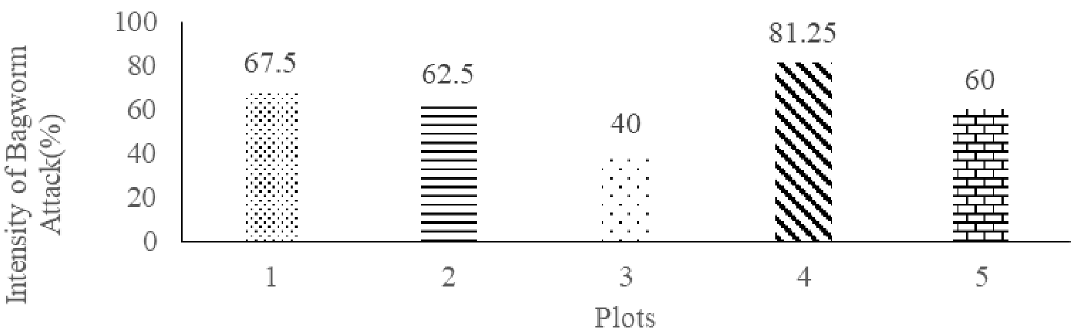

Figure 10. Bagworm infestation level (%) based on plot

Higher infestation levels were frequently observed along plantation edges, irrigation ditches, and access roads, suggesting that microclimatic factors such as sunlight exposure and humidity may influence bagworm development (Ahmad et al. 2021). Chemical control via stem injection remains widely applied but may contribute to reduced effectiveness when repeatedly used (Lubis et al. 2024). Therefore, integrated pest management strategies combining regular monitoring, manual removal, and biological control are recommended to reduce reliance on chemical treatments and suppress bagworm population outbreaks.

In conclusion, four bagworm species were recorded in oil palm plantations in Sungai Rengit Village, namely *Pteroma* sp., *M. plana*, *P. pendula*, and *M. corbetti*. Among these, *Pteroma* sp. was the most abundant species, indicating that this genus was the dominant bagworm during the study period. The infestation intensity was classified as severe (62%), indicating a high level of infestation in the plantation. Differences in abundance among plots suggest possible influences of microenvironmental factors, such as light exposure and proximity to plantation edges. These findings highlight the importance of integrated pest management practices, including regular monitoring, biological control, and careful use of chemical control, to support sustainable oil palm production.

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