

**IDENTIFICATION AND PARASITIZATION OF PARASITIDS
AGAINST *Setothosea asigna* IN OIL PALM PLANTATIONS IN
DHARMASRAYA DISTRICT, INDONESIA**

***IDENTIFIKASI DAN PARASITISASI PARASITOID TERHADAP
Setothosea asigna DI PERKEBUNAN KELAPA SAWIT
DI KABUPATEN DHARMASRAYA, INDONESIA***

**Zahlul Ikhsan^{1*}, Hidrayani², Willy Friddo Sianturi¹, Sholih Kurniawati¹, Aulia Oktavia³,
Erise Anggraini⁴**

¹ Department of Agroecotechnology, Faculty of Agriculture, Universitas Andalas, West Sumatra, Indonesia

² Department of Plant Protection, Faculty of Agriculture, Universitas Andalas, West Sumatra, Indonesia

³ Department of Electrical Engineering, Padang State Polytechnic, West Sumatra, Indonesia

⁴ Department of Plant Pests and Diseases, Sriwijaya University, South Sumatra, Indonesia

Email korespondensi: zahlulikhshan@agr.unand.ac.id

ABSTRACT

Setothosea asigna poses a significant threat to oil palm plantations, necessitating effective control measures. This survey-based research, utilizing Purposive Sampling, identifies parasitoids and evaluates their effectiveness in Dharmasraya oil palm plantations, a crucial palm oil-producing region in Indonesia. The selected criteria encompass plantations aged 6-15 years with a considerable *Setothosea asigna* infestation, providing a comprehensive overview of the pest's impact. The study establishes five sample points diagonally, each comprising five randomly chosen plants, totaling 25 samples per site, ensuring diverse representation. The predominant larval parasitoids exhibit noteworthy efficacy, primarily from the Hymenoptera order, Braconidae family, Genus *Apanteles*, and *Spinaria*. Among the 110 larvae observed, five were parasitized, resulting in the emergence of 65 parasitoids. The parasitization rate varies from 0 - 9.09%, with prominent contributions from *Apanteles* sp. and *Spinaria* sp., belonging to the endoparasitoid type. This research significantly contributes to sustainable agriculture practices and the palm oil industry, offering insights into targeted pest control for *Setothosea asigna*. Despite its focus on Dharmasraya, the study provides a valuable foundation for broader applications and invites further research for generalization.

Keywords: *Setothosea asigna*, oil palm pests, parasitoids, Hymenoptera, pest control

INTRODUCTION

Oil palm plantations (*Elaeis guineensis* Jacq.) play a central role in the economies of Indonesia and other tropical countries. Palm oil's significant contribution to export earnings and job creation makes it an important agricultural commodity (Smith, 2020). Indonesia has the land suitability

desired by oil palm plantations stretching from eastern to western Indonesia. Indonesia had around 16.38 million hectares of oil palm plantations spread across all provinces in Indonesia in 2019 (Ministry of Agriculture, 2019). However, the palm oil industry also faces various challenges, one of which is pest

attacks that can threaten the productivity and quality of its production.

One pest that significantly attacks oil palm plantations is the fireworm (*Setothosea asigna*), a lepidopteran insect that specifically attacks oil palms. *Setothosea asigna* attacks oil palm leaves starting from nurseries, immature plants, and yielding plants. Sahari (2012) reported that fireworms are more commonly found in oil palm plants under three years old. *Setothosea asigna* attacks can cause severe damage to oil palm leaves, which can reduce the yield of the photosynthesis process and inhibit plant growth. In addition, this pest can also reduce the yield of palm oil, which is very reliable.

The caterpillars found on oil palm plantations in Dharmasraya Regency consisted of 2 species: *Setora nitens* and *Setothosea asigna*. The average percentage of infected plants, infected midribs, and attack intensity at the four study locations was 43.47, 40.71, and 19.86 % (Ikhsan et al., 2023).

Research on the control of *Setothosea asigna* is still limited. Therefore, deepening knowledge about the control of *Setothosea asigna* is very important to maintain the productivity and quality of palm oil production (Tan & Ng, 2021). Chemical pesticides often used to control *Setothosea asigna* can hurt the environment and human health. Biological control techniques, such as parasitoids, can reduce reliance on chemical pesticides, which align with sustainability principles increasingly gaining attention worldwide.

Parasitoids are insects that live on or in other insects' bodies and cause their host's death. In oil palm plantation ecosystems, parasitoids can play an essential role in controlling the population of *Setothosea asigna* Tan and Ng (2021). Hymenoptera is an insect order with a very high abundance of parasitoid species. The Hymenoptera family of parasitoids that have been used in

plantation crops are Braconidae (Sahari, 2012; Ikhsan, 2022; Hanysyam et al., 2013), Ceraphronidae (Kamarudin et al., 1996), Eulophidae and Ichneumonidae (Mariau, 1999), Encyrtidae and Aphelinidae (Blumberg, 2008) and Trichogrammatidae (Rao et al., 1971). Hymenoptera parasitoids found in oil palm plantations in Dharmasraya Regency were 1,267 individuals, consisting of 23 families and 142 morphospecies (Ikhsan et al., 2023).

This research will focus on identifying parasitoids in oil palm plantations in Dharmasraya District, West Sumatra Province. Dharmasraya Regency is one of the vital palm oil-producing areas in Indonesia. This study will fill this knowledge gap by discovering the parasitoid types present in Dharmasraya oil palm plantations. The knowledge gained from this research is expected to provide better insight into the biological control potential of *Setothosea asigna* in oil palm plantations and support efforts to increase the productivity and sustainability of the palm oil industry.

This study aims to identify parasitoids and determine their parasitizing power in Dharmasraya oil palm plantations. This includes collecting data on existing parasitoid species and their distribution in the study area. This is important because different types of parasitoids can have varying effectiveness in controlling pests, and a deeper understanding of these types will help develop more precise and efficient control strategies.

This research also has significant relevance in the context of environmental conservation. Biological controls, such as parasitoids, can help reduce dependence on chemical pesticides that negatively impact the environment and human health. Therefore, this research will positively contribute to sustainable management practices in oil palm plantations in

Dharmasraya District and similar areas throughout Indonesia.

A comprehensive study by Tan and Ng (2021) delves into the biology and control measures of *Setothosea asigna*, a notorious pest in oil palm plantations. The research emphasizes the critical need for effective pest control strategies to safeguard the productivity of the oil palm industry. The study explores various control methods, including the utilization of parasitoids, to mitigate the impact of *Setothosea asigna* on oil palm crops.

In an article by Ikhsan et al. (2023), the escalating challenges posed by *Setothosea asigna* infestation in oil palm plantations are discussed. The research sheds light on the increasing percentage of infected plants, emphasizing the urgency to identify and implement robust control measures. The study hints at the potential role of parasitoids in curbing *Setothosea asigna* populations, underlining the importance of further research in this direction.

Addressing the broader context of tropical agriculture, Smith (2020) explores pest management strategies explicitly focusing on *Setothosea asigna*. The article discusses the economic significance of oil palm crops and the detrimental effects of pest infestations. Smith emphasizes the need for innovative approaches, such as the implementation of parasitoids, in sustainable pest control practices for the long-term health of oil palm plantations.

MATERIALS AND METHODS

This research was carried out in oil palm plantations in Dharmasraya Regency and the Integrated Pest Management Laboratory, Faculty of Agriculture, Andalas University. The materials used in this study were *Setothosea asigna* larvae taken from oil palm plantations, 70% alcohol, aquades, and tissue. The tools to be used in this study are

plastic containers, gauze, microscopes, scissors, insect surgical equipment, cameras, and insect identification books.

The research used survey methods on oil palm plantations, Padang Laweh District and Timpeh District, Dharmasraya Regency, West Sumatra Province. The determination of the location of the study was carried out by the Purposive Sampling method, namely by choosing a location by the criteria needed for research, namely oil palm plantations with a plant age of 6-15 years and which experienced a high attack of *Setothosea asigna* and allowed as a place of association of natural enemy insects such as parasitoids characterized by the presence of ground cover plants and flowering wild plants as their habitat.

The research was conducted on one stretch of oil palm plantation area of ± 5 hectares in each sub-district. The sample plants are determined at 5 sample points according to the diagonal line. Each sample point has been determined, and 5 sample plants are randomly taken to obtain 25 sample plants per location / sub-district. Each predetermined sample plant was taken with two sample fronds. The criteria for the sheath of the sample are fronds that show symptoms of fireworm attack with characteristics of damage to the lower epidermis of the leaves, starting from the lower leaves to the remaining part, only the leaf bone (symptoms of melidi). The observations made were the identification of parasitoids, the number of parasitoids obtained, and their parasitizing power against *Setothosea asigna*.

RESULTS AND DISCUSSION

Location Description

This research was conducted in two community-owned oil palm plantation areas in Dharmasraya District, namely in Padang Laweh District (0 059' 31.76" S, 101025' 37.23" E) and Timpeh District (0052' 12.15"

S, 101033' 17.35"E). Each stretch of oil palm plantation area has an area of ± 5 hectares and is 6-15 years old.

Pest control is carried out using synthetic pesticides. The active ingredients of chemical pesticides applied are diverse, ranging from Deltamethrin, Dimehipo, and Sipermetrin. Meanwhile, control using natural enemy insects has never been used.

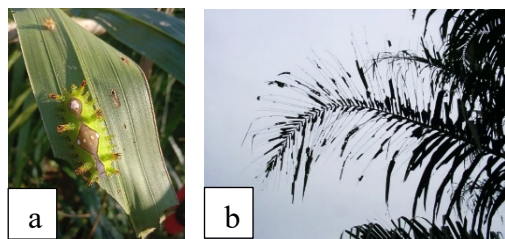


Figure 1. *Setothosea assigna* on palm leaves.
a) *Setothosea assigna*, b) Symptoms of *Setothosea assigna* attack on oil palm plants.

Identification of Parasitoids

Based on the laboratory research results, two species of parasitoids were found to come out of the body of fireworm larvae, namely *Apanteles* sp. and *Spinaria* sp. (Figure 2). Identification of parasitoids is carried out based on morphological characteristics, including wing, antene, thoracic, and abdominal organs.

Apanteles are characterized by hypopigium not being completely chelrotized, vanal lobes on the hind wings flattened or convex in a subapical direction, and petioles usually shortened posteriorly (Watanabe, 1932). The genus *Spinaria* has the following characteristics: the first tergite is not accessible to move and joins the second tergite, there is no occipital carina, pronotum

without teeth or with long spines, the fifth tergite tip with one tooth posterior, smooth scutellum in the subposterior, third and fourth tergite with median teeth or tubercles (Achterberg, 2007).

Apanteles sp., and *Spinaria* sp. What comes out of the larval body is classified as an endoparasitoid type. This can be seen based on where the parasitoid imago lays its eggs on the host. The type of endoparasitoid is a parasitoid that lays eggs on the inside of the host, and its progeny develops inside the host and sucks the host's body fluids as food.

This is also in line with several other research results that say that Hymenoptera parasitoids that have been known to associate with pests in oil palm plantations are *Apanteles* sp. (Hymenoptera: Braconidae) (Syed & Shaleh, 2003), *Spinaria spinator* (Guérin-Méneville) (Hanysyam et al., 2013), *Fornicia* sp. (Hymenoptera: Braconidae), *Euplectromorpha* spp. (Hymenoptera: Eulophidae) and *Chlorocryptus purpuratus* (Smith) (Hymenoptera: Ichneumonidae) (Duckett, 1971; Mariau, 1999). *Apanteles* sp. and *Spinaria* sp. belong to the Order Hymenoptera, Subordo Apocrita, and the Family Braconidae.

Braconidae has many hosts and is a family with considerable species richness worldwide. Braconidae are found in many larvae of the Orders Lepidoptera, Coleoptera, and Diptera (Goulet & Huber, 1993; Tomanovic et al., 2013). The family Braconidae has no climatic preference in either tropical or subtropical climates or specific habitat conditions such as dry or wet ecosystems, so members of this family can be found anywhere (Van Achterberg, 2007; Ikhsan, 2022; Ghahari et al., 2009).

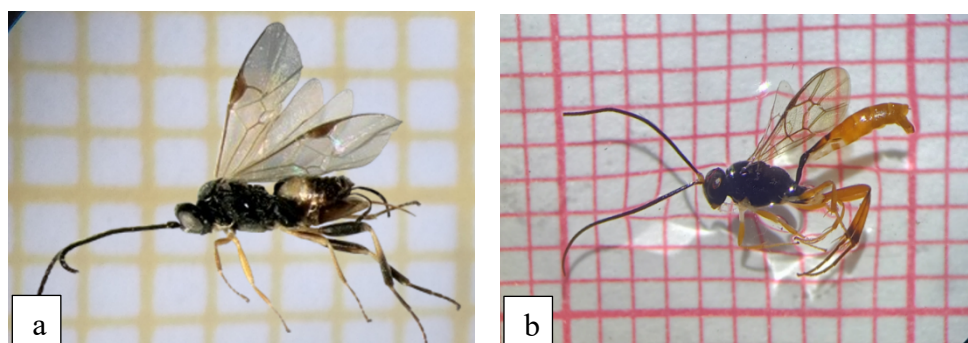


Figure 2. Parasitoids found in oil palm Plantations of Dharmasraya District.
a) *Apanteles* sp., b) *Spinaria* sp.

Research also found that the Braconidae family is associated with Lepidoptera pests that attack oil palm plants. Siburian (2008) found insects from the family Braconidae, the genus *Apanteles*, that parasitize fireworms *Sethotosea asigna*. Sahari (2012) also found that Braconidae has several species that act as parasitoids in oil palm plantations. Generally,

three important genera of the Braconidae Family are associated with oil palm pests: *Apanteles*, *Spinaria*, and *Fornicia*. *Fornicia* and *Apanteles* are known to attack several species of fireworms (Limacodidae), while *Spinaria* is also found to associate with *S. nitens*.

Table 1. Number of infested plants, larvae, and parasitoids found in Oil Palm Plantations of Dharmasraya Regency

Location	Infested plants	Number of larvae	Parasitized larvae	Number of parasitoids
KPL 1	5	14	1	15
KPL 2	4	9	0	0
KPL 3	4	12	1	11
KPL 4	4	11	1	12
KPL 5	4	11	0	0
Total	21	57	3	38
KT 1	4	12	1	13
KT 2	4	11	0	0
KT 3	3	9	0	0
KT 4	3	11	0	0
KT 5	5	10	1	14
Total	19	53	2	27

Parasitizing Percentage

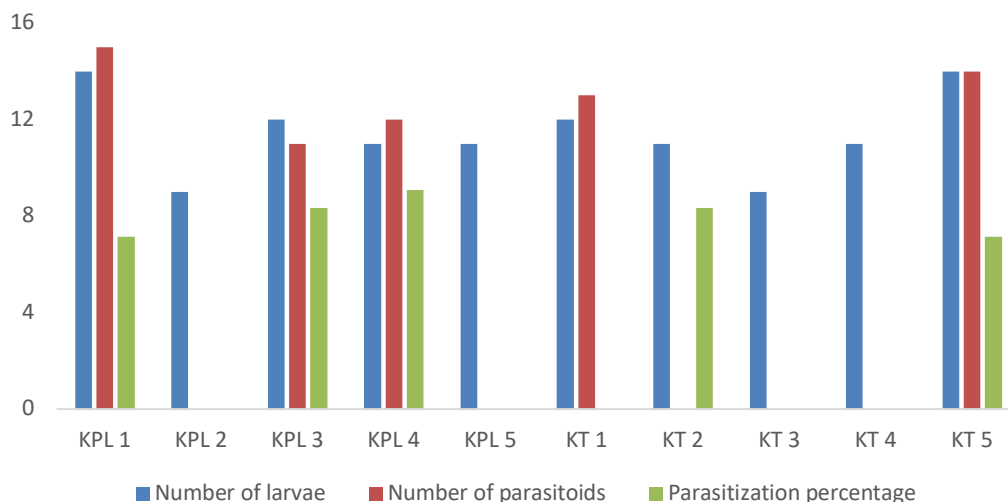
The percentage of parasitizing power of parasitoids is obtained by calculating the number of parasitized larvae per number of observed larvae. The results of observing the parasitoid parasitization rate found that the

parasitization rate against fireworms ranged from 0% to 9.09% (Figure 3). The high and low parasitization values occur not due to the large number of parasitoids that parasitize but because of comparing the number of

parasitized larvae with the number of larvae found at each sample point.

This shows that the balance factor between the number of parasitoids and the

The level of parasitization is also influenced by the diversity of parasitoid insect species found in plants. The combination of several parasitoid species will



number of hosts affects the parasitization rate. The higher the parasitoid population, the higher the parasitization rate, but the parasitization rate decreases if the pest population is higher. This follows the opinion of Hasriyanty (2008), who states that parasitization will increase in parasitoid conditions and the number of hosts will be balanced and vice versa.

CONCLUSION

The larval parasitoid *Setothosea asigna* found in Dharmasraya oil palm plantations comes from the Order Hymenoptera, Family Braconidae, Genus *Apanteles*, and *Spinaria*. Of the 110 larvae collected, five parasitized larvae and 65 parasitoids emerged from parasitized larvae. The percentage rate of parasitization of parasitoids against larvae of *Setothosea asigna* ranges from 0 - 9.09%.

SUGGESTION

Further studies are needed on *Apanteles* and *Spinaria*, parasitoids of *Setothosea asigna*. Bioecological studies of parasitoids are needed to improve their effectiveness in playing a role as biological control agents.

positively affect the level of parasitization. This is based on Sahari's (2012) study, which states that the combination of parasitoid types increases overall parasitization. Braconidae and *Euplectrus* together provide a reasonably good parasitization rate in *D. trima*. In this study, two parasitoid species were found in the body of the host larvae, namely *Apanteles* sp. and *Spinaria* sp.

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