*Research Article*

# Artropod Community Structure in Oil Palm Nurseries

## *Struktur Komunitas Artropoda di Pembibitan Kelapa Sawit*

**Siska Efendi[1]*, Puji Setiawati [1], Yaherwandi[2]**

[1] Agroecotechnology Department, Agriculture Faculty, Andalas University, Padang, Indonesia

[2] Plant Protection Department, Agriculture Faculty, Andalas University, Padang, Indonesia

***Abstract:*** Nurseries are one of the essential agronomic activities in oil palm cultivation. Oil palm seedlings are cultivated on a large scale, different from nurseries for other plantation commodities. The nursery expanse comprises various biotic components, one of which is Arthropods. This study aims to determine the Artropod community and its function in oil palm nurseries. The research was carried out at two nurseries, Nagari Gunung Medan and Nagari Kurnia Selatan, Dharmasraya Regency, West Sumatra Province. Sampling using the pitfall trap, yellow pan trap, insect nets, and direct collection methods. The results showed that the Arthropods that make up the oil palm nursery ecosystem were insects and spiders. Arthropods in oil palm nurseries act as phytophages, predators, parasitoids, and detrivores. Phytophage insects found in oil palm nurseries were 700 individuals consisting of 4 orders, nine families, and 14 genera/species. Predatory insects, parasitoids, and detritivores were found in as many as 466 individuals consisting of 5 orders, 14 families, and 16 genera/species. There are two species of spiders in oil palm nurseries: *Pardosa* sp and *Oxyopes javanus*. *Valanga* sp was the species with the highest number of individuals in oil palm nurseries.

*Keywords:* Araneae, Parasitoids, Predators, *Valanga* sp.

***Abstrak:*** Pembibitan adalah salah satu kegiatan agronomis penting pada proses budidaya kelapa sawit. Bibit kelapa sawit diusahakan dalam skala besar berbeda dengan pembibitan pada komoditi perkebunan lain. Hamparan pembibitan tersebut disusun beragam kombonen biotik salah satunya adalah Arthropoda. Penelitian ini bertujuan untuk mempelajari komunitas Arthropoda dan fungsionalnya pada pembibitan kelapa sawit. Penelitian ini berbentuk survei pada dua lokasi pembibitan yakni Nagari Gunung Medan dan Nagari Kurnia Selatan, Kabupaten Dharmasraya, Provinsi Sumatera Barat. Pengambilan sampel menggunakan metode *pitfall trap, yellow pan trap*, jaring serangga, dan koleksi langsung. Hasil penelitian menunjukkan bahwa artropoda penyusun ekosistem pembibitan kelapa sawit adalah serangga dan laba-laba. Artropoda pada pembibitan kelapa sawit berperan sebagai fitofag, predator, parasitoid, dan detrifor. Serangga fitofag yang ditemukan pada pembibitan kelapa sawit sebanyak 700 individu yang terdiri dari 4 ordo, 9 famili, 14 genus/spesies. Berikutnya serangga predator, parasitoid, dan detritivor ditemukan sebanyak 466 individu yang terdiri dari 5 ordo, 14 famili, dan 16 genus/spesies. Laba-laba pada pembibitan kelapa sawit sebanyak 2 spesies yakni *Pardosa* sp. dan *Oxyopes javanus*. *Valanga* sp. adalah spesies artropoda dengan jumlah individu terbanyak pada pembibitan kelapa sawit

*Kata kunci:* Araneae, Parasitoid, Predator, *Valanga* sp.

*Email:
Siskaefendi@agr.unand.ac.id

Received: February 2023
Accepted: March 2023
Published: May 2023

p-ISSN: 2723-7974
e-ISSN: 2723-7966
doi: 10.52045/jca.v3i2.415

Website:
https://ojs.untika.ac.id/index.php/faperta

## INTRODUCTION

Arthropods are one of the biotic components that make up the oil palm agro-ecosystem. Oil palm plantations provide suitable habitats for various types of arthropods. Although oil palm plantations have been known to be one of the causes of the loss or reduction of diversity, It turns out that several artropod species were able to survive the changes in complex ecosystems (forests) to much simpler agro-ecosystems (oil palm plantations). Even during the

***Citation:***
Efendi S, Setiawati P, Yaherwandi. 2023. Artropod community structure in oil palm nurseries. *Celebes Agricultural*. 3(2): 115-127. doi: 10.52045/jca.v3i2.415

process of establishing the oil palm agro-ecosystem, the presence of several artropod species has never been reported in this ecosystem. Herbivorous insects, in particular, that feed on oil palm plants. Almost all parts of the oil palm plant can be a food source for insects. Besides providing food, oil palm is also a habitat for several arthropods. Because of the long period of oil palm cultivation (20-30 years), this agro-ecosystem is more stable than other agricultural agro-ecosystems. In general, the pattern of oil palm cultivation is classified as a monoculture. Still, if you look closely, the agro-ecosystem of oil palm turns out to be more complex due to the presence of undergrowth consisting of various types of flowering and non-flowering weeds. This condition is also suspected to be a driving factor for the existence of arthropods in oil palm plantations.

Currently, the government is still imposing a moratorium on opening oil palm plantations, so efforts to increase palm oil production are focused on replanting old plantations that are no longer producing. Replanting was carried out on a large scale in several oil palm centers in Indonesia, especially in Sumatra and Java. The replanting program needs to be supported by the provision of seeds so that in several locations, it can be seen that the provision of oil palm seeds is carried out on a large scale on land with an area of tens of hectares. Nurseries are essential agronomic activities in the oil palm cultivation process. The quality of the seeds produced in the nursery will determine the success when the seedlings are transferred to the field. According to Sunarko (2014), oil palm nurseries are known as "double-stage" or "two-stage" nursery systems. These stages are the initial nursery (prenursery) and the main nursery (main nursery). Seedling maintenance is carried out for nine months, where the prenursery phase takes place at 1-3 months and the seedlings are transferred to the main nursery phase at four months.

Oil palm nurseries, on a large scale, mean the availability of abundant food sources for several artropod species, especially those that act as pests. This availability lasts a long because the nursery phase lasts up to 12 months. In addition, differences in the characteristics of oil palm in the field and nurseries will result in differences in the Artropod species that make up the ecosystem. Some arthropods found in nurseries turn out to be pests of oil palm seedlings. On a large scale, oil palm nurseries also contribute to high pest attacks due to abundant food sources with uniform ages of seedlings. Pests that attack oil palm seedlings will result in reduced quality; besides that, attacks in nurseries are likely to continue in the field because several types of problems can attack oil palm plants both in nurseries and in the area. Oil palm damage in the nursery will result in growth delays when transferred to the field.

Some pests from the Lepidoptera Order lay eggs in nurseries, and these eggs will hatch when the plants are moved to the field. Sorting the seeds before they are transferred to the area is sometimes ineffective because the workers are not careful. In addition, oil palm nurseries are generally carried out on a large scale, which makes control even more difficult. This condition causes some seeds that are attacked by pests to be transported to the field during planting. For this reason, pests that attack oil palms in nurseries must be controlled before the plants are transferred to the area. It is just that information on insect pests in oil palm nurseries is still limited because there are more research reports on oil palm pests in the field. In the area, there is much of information about insect pests that attack oil palm, including *Thosea asigna*, *Setora nitens*, *Darna trima*, *Thosea bisura* (Febriani *et al.* 2020), *Metisa plana* and *Mahasena corbeti* (Riady *et*

*al.* 2020), *Rattus* sp. (Tarmadja *et al.* 2018), *Oryctes rhinoceros* (Andre et al., 2020; Efendi 2020; 2021), *Valanga nigricornis* (Susanto *et al.* 2010).

The natural enemies of these pests will naturally follow the presence of problems in nurseries. This condition will certainly make the composition of the arthropods in the nursery more diverse because they are composed of various arthropods with different functionalities. Comprehensive knowledge about arthropods in oil palm nurseries will provide information on managing pests by utilizing natural enemies in these ecosystems. Control of pests that attack oil palm plants in nurseries must begin with identifying the type of pest. Information on the type of pest and the attack level will determine the appropriate control method. Pest control in nurseries is less intensive than in the field, and pest control in oil palm plantations is known to be identical to using various pesticide formulations. This condition opens up opportunities to control pests by optimizing the natural control factors available in nurseries, namely predatory and parasitoid arthropods.

For this reason, information on natural enemy communities in nurseries also needs to be studied. Introducing pests and natural enemies will be the foundation for assembling the control technology, particularly biological control. Previously, insect communities in oil palm had been reported by Safitri et al. (2020), and information about oil palm pests had been written by Nushasnita et al. (2020) and Febriani et al. (2020). However, this information was for observations in plantations, whereas information on artropod communities in nurseries still needs to be available. This study aims to study the artropod community and determine its function in oil palm nurseries.

## MATERIALS AND METHODS

### Determination of Observation Blocks

This research took the form of a survey in the oil palm nursery. The area of nursery land in the UPTD of the Dharmasraya Regency Agriculture Service is ± 2 Ha. In that area, the oil palm seeds were arranged in blocks. In the nursery area, there are ± 80 nursery blocks. In one block, there were 200-500 seedlings, a total of 40,000 seedlings, in the BPTP nursery area of ±1 Ha, located in Nagari Gunung Medan, Sitiung District, Dharmasraya Regency, West Sumatera. In the nursery, there were ± 20 blocks. One block consists of 200-250 seedlings. The total number of seedlings is 5000 stems. The determination of sample plants begins with the selection of observation blocks. At each location, five observation blocks were selected with the same number of seeds, namely 200 stems/block. Of the 200 oil palm seedlings, 10% of the sample plants were established. The determination of the sample plants was carried out systematically with a spacing system between polybags. Determination of the first sample plants was carried out randomly. For subsequent plants, it was determined systematically based on the distance between polybags, where the distance between sample plants was ten polybags, so a total of 20 sample plants were obtained. Sample plants were used for direct observation and trap placement. Insect collection was carried out three times with a sampling interval of once a month.

### Insect Collection

A sampling of insect pests and natural enemies was conducted using four methods: pitfall traps, yellow pan traps, insect nets, and direct collection. Of the four methods described below, the pitfall trap was commonly used to collect active insects on the soil surface (Yenti *et al.* 2020). The pitfall trap was installed in a plastic cup measuring 7.5 cm in diameter and 10.5 cm in height, which was placed parallel to the ground. The plastic cup is filled with water and detergent, then placed parallel to the soil surface near the sample plant polybag. The traps were incubated for 24 hours. The trapped insects were stored in a collection bottle filled with 96% alcohol.

The yellow trap sampling method collects insects attracted to bright colors. The trap is made of a plastic container measuring 22 cm x 14 cm x 4 cm, filled with a solution of water added with detergent as much as half the container's height. Installation of yellow trays placed as high as 40 cm from the ground so that the traps are parallel to the polybag seeds. Yellow traps are installed in 3 pieces in one block, proportionally one block. This trap was set in the morning from 09.00 to 16.00 WIB.

These traps were made of light and robust materials such as gauze. Easy to swing and visible insects caught. The swing was executed in blocks from the longest side twice back and forth, starting in the second row and back in the opposite direction of the fourth row. The caught insects were collected, separated, and put into a sample bottle for identification. The direct collection was carried out by observing the sample plants using tools such as brushes and tweezers. Insects were found stored in a sample bottle filled with 96% alcohol.

### Identification

Insect pests and natural enemies that have been collected were identified down to the species level. Identification for order and family levels refers to Borror et al. (1992); Borror & White, (1970); CSIRO (1990; 1991). Precisely the order Hymenoptera referred to Goulet & Huber, (1994); (Nazarreta *et al.* 2021); Bolton, (1994); the order Orthoptera refers to Rentz & Su, (2019); the order Odonata refers to Watson et al. (1991), the order Coleoptera family Carabidae was identified according to Bousquet (2010). To determine pest status, refer to Susanto et al. (2010).

### Data analysis

Insect species diversity was analyzed using the Shannon-Wienner diversity and evenness index. Data were analyzed with the Primer Version 5 for Windows application.

## RESULTS AND DISCUSSION

Composition of arthropods in oil palm nurseries

Most of the arthropods that make up the oil palm ecosystem are insects. Insects in oil palm nurseries were grouped into phytophages, predators, parasitoids, and detritivores. Phytophagous insects found in oil palm nurseries were 700 individuals consisting of 4 orders, nine families, and 14 genera/species (Table 1). This composition is less than that reported by

Safitri et al. (2020) there were six orders, 12 families, and 18 species of herbivorous insects in oil palm, except that this research was carried out in oil palm plantations and not nurseries.

For predatory insects, parasitoids, and detritivores, there were 466 individuals consisting of 5 orders, 14 families, and 16 genera/species (Table 1). The diversity and evenness index of predatory, parasitoid, and detritivore insects was higher (1.52 and 0.45) than those of phytophagous insects (1.41 and 0.39). The diversity index of arthropods in oil palm nurseries is moderate. Even though it was reported by Pebrianti et al. (2016) that oil palm plantations have a high diversity of parasitoid insects and predators, this indicates that oil palm nurseries are simple agroecosystems even though they are cultivated on a large scale.

Table 1. Composition of artropods in oil palm nurseries.

| Composition/Indeks | Phytophagy | Predators/Parasitoids/Detritivores |
|---|---|---|
| Ordo | 4 | 5 |
| Family | 9 | 14 |
| Genus/Species | 14 | 16 |
| Number of Individuals | 700 | 466 |
| Diversity Index | 1,41 | 1,52 |
| Evenness Index | 0,39 | 0,45 |

**Artropod community in the oil palm nursery ecosystem**

The artropod community that makes up the oil palm nursery ecosystem consists of insects and spiders. The artropod community consists of phytophages, predators, parasitoids, and detritivores. The phytophagous insect community in oil palm nurseries is composed of four orders: Coleoptera, Hemiptera, Lepidoptera, and Orthoptera. Most phytophagous insects come from the order Orthoptera, consisting of 2 families and six species (Table 2). Next is the order of Hemiptera, with four families and five species (Table 2). Orthoptera and Hemiptera orders have been reported to have the highest number of phytophagous insects compared to other orders of the Hexapoda class. The same thing was also written by Safitri et al. (2020) that Orthoptera and Hemiptera were the most common orders found in oil palm plants. It is undeniable that oil palm planted in monoculture is an abundant food source for herbivorous insects. The lower vegetation, composed of various weeds, is a food source and habitat for multiple insects, including herbivores.

The community of predators, parasitoids, and detritivores is composed of four orders Coleoptera, Diptera, Hymenoptera and Mantodea, and Araneae Table 2). Predator and parasitoids in oil palm plantations from this order have previously been reported by Muhammad et al. (2019); Yenti et al. (2020); Danial et al. (2020); Hakiki et al. (2020) and Melketa et al. (2022). In this study, more predatory insects were found than parasitoids. It indicates that the community of predatory insects was oil palm nurseries is more complex than parasitoids. The predatory insects consisted of 7 families and 9 species, namely Carabidae, Coccinellidae, Asilidae, Dolichopodidae, Formicidae, Vespidae, and Thespidae (Table 2). The insect families that act as predators in oil palm plantations have previously been reported by Azhar et al. (2022), consisting of Formicidae, Coccinellidae, Carabidae, Reduviidae, Anthocoridae, Mantidae, Chrysopidae, Staphylinidae, Mantispidae, and Libellulidae. Means that only three families of predatory insects are not found in oil palm nurseries.

Parasitoids were only composed of one family and two species, even though Tawakkal et al. (2019) reported that there were 12 families of parasitoids in oil palm plantations. Nursery and host conditions were the cause of the low number of parasitoids in oil palm nurseries. Parasitoids were host specific. Means that parasitoids were only present in one ecosystem if a suitable host was available in that habitat. The oil palm nursery ecosystem is also relatively simple because it only has one main component, oil palm. Parasitoids need more food, namely pollen and nectar produced by flowering plants. Some flowering weeds in oil palm nurseries were controlled by managers using herbicides or mechanically.

Table 2. Artropod community in oil palm nurseries

| Order | Family | Genus/Species | Number of Individuals |
|---|---|---|---|
| Araneae | Lycosidae | *Pardosa* sp | 18 |
| | Oxyopidae | *Oxyopes javanus* | 3 |
| Coleoptera | Crysomelidae | *Dicladispa armigera* | 6 |
| | Carabidae | *Cicindelidia nigrocoerulea* | 54 |
| | Coccinellidae | *Coccinella transversalis* | 13 |
| Diptera | Asilidae | *Efferia bryanti* | 7 |
| | Dolichopodidae | *Condylostylus comatus* | 72 |
| | | *Condylostylus crinitus* | 16 |
| | Stratiomyoidea | *Hermetia illucens* | 84 |
| | Tachinidae | *Cholomyia inaequipes* | 10 |
| Hymenoptera | Ichneumonidae | *Rhyssa persuasoria* | 23 |
| | Formicidae | *Odontoponera denticulate* | 33 |
| | | *Tetraponera rufinigra* | 44 |
| | Tiphiidae | *Tiphia vernalis* | 64 |
| | Vespidae | *Polistinae* sp | 9 |
| Hemiptera | Alydidae | *Leptocorisa acuta* | 57 |
| | Cicadelidae | *Bothrogonia ferruginea* | 94 |
| | Coreidae | *Riptortus liniearis* | 72 |
| | | *Gonocerus acuteangulatus* | 37 |
| | Scutelleridae | *Chrysocoris* sp | 20 |
| Isoptera | Rhinotermitidae | *Captotermes* sp | 5 |
| Lepidoptera | Noctuidae | *Plusia chalcites* | 4 |
| | Psychidae | *Mahesena corbetti* | 5 |
| Mantodea | Thespidae | *Thesprotia graminis* | 11 |
| Orthoptera | Acrididae | *Dissosteria carolina* | 59 |
| | | *Leptysma* sp | 36 |
| | | *Phlaeoba fumosa* | 4 |
| | | *Schistocerca nitens* | 84 |
| | | *Valanga* sp | 197 |
| | Gryllidae | *Gryllus bimaculatus* | 25 |

**Phytophagous insect community in oil palm nurseries**

This study found six grasshoppers from two families, Acrididae and Gryllidae (Figure 1). Only two species of phytophages have been reported to be the main pests of oil palm, namely Valanga sp and pocket caterpillar *Mahasena corbeti*. *Valanga* sp. became a pest of oil palm in the nursery phase, but there have been few reports of this pest on oil palm that has been transferred to the field. In this study, it can be seen that the abundance of the *Valanga* sp population was higher than that of the other phytophages. In general, as Kalshoven (1981) reported, the high abundance of *Valanga* sp was influenced by the rate of production, vegetation conditions, and the surrounding environment. Culturing large-scale oil palm seedlings with a uniform age was an abundant food source for *Valanga* sp and several other Orthoptera species. Another factor that caused the high abundance of *Valanga* sp and other Orthoptera species was the availability of spawning grounds in oil palm nurseries. *Valanga* sp lays eggs in the ground, where most of the nursery consists of open land with no vegetation. Valanga sp females can lay as many as 158 eggs in one life cycle. This land is very suitable for laying eggs for Valanga sp and other Orthoptera species.

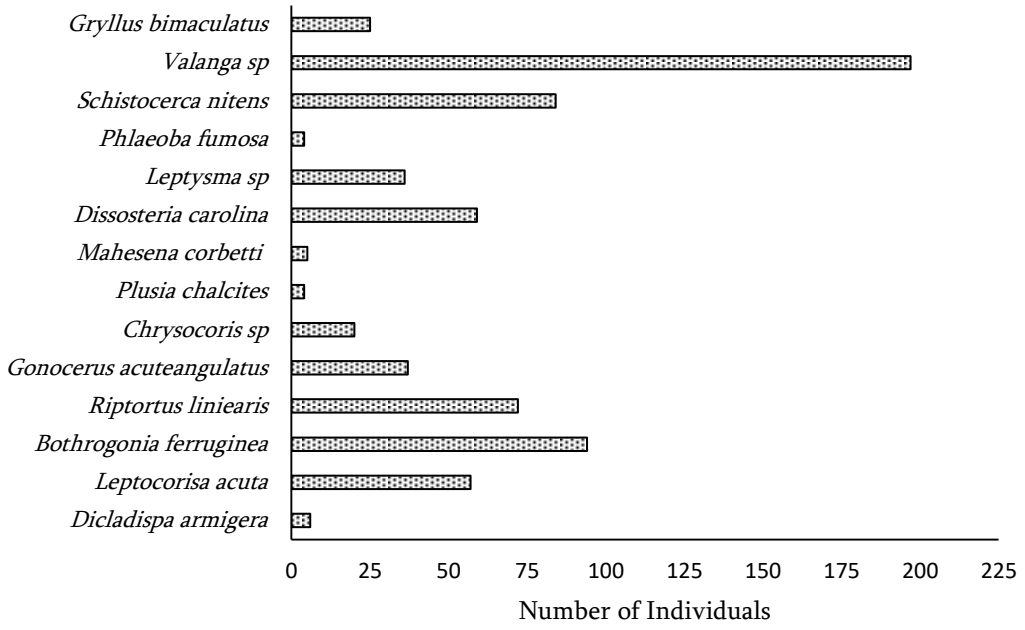


Figure 1. The abundance of phytophagous insects in oil palm nurseries

*Bothrogonia ferruginea* was a phytophagous insect with a high abundance in nurseries but not an oil palm pest. In nurseries, *B. ferruginea* was also reported to be abundant in mature oil palm plants (Safitri *et al.* 2020). *B. ferruginea* was an insect that included leafhoppers. Usually, these insects are found in various types of grass, shrubs, and trees. In addition, around the nursery, there are other host plants, such as eggplant and beans. Until now, there was no information about the damage caused by these insects to oil palm plantations. However, these insects have been widely reported in the oil palm ecosystem. According to Anwar (2020), *B. ferruginea* was found in several other plantation commodities, including tea. *B. ferruginea* was classified as a cosmopolitan insect in Indonesia. It was spread across Java, Sumatra, and Kalimantan. Although it did not cause damage to cultivated plants, *B. ferruginea* turned out to

be a vector for plant disease viruses. The type of virus transmitted by *B. ferruginea* has not been widely reported.

**Community of detritivore insects in oil palm nurseries**

The detritivore insect with the highest abundance was *Hermetia illucens* (Figure 2). It was an exciting finding because, so far, there have been no reports of *H. illucens* in oil palm plantations, including nurseries.

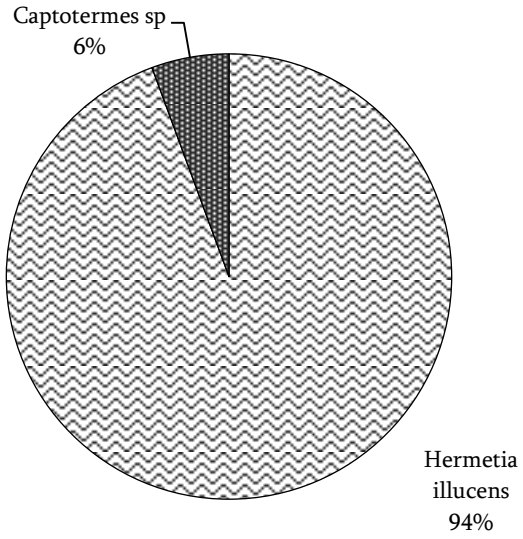


Figure 2. Detritivor insect abundance in oil palm nurseries

*H. illucens* can be found in landfills because the insect is a detritivore of organic materials. The factor suspected to cause the high abundance of these insects in oil palm nurseries is the empty fruit bunches of oil palm used as seedling media. Empty palm fruit bunches are palm oil mill waste, fresh fruit bunches that have been processed. Waste was widely used as a source of organic matter in the field and nurseries. In oil palm plantations, the waste was usually placed in a dish up to a height of 40-60 cm. For nursery media, empty palm oil fruit bunches are chopped into small pieces so they can be easily mixed with other planting media. Large-scale nurseries require many of these empty fruit bunches, so piles of organic matter can be found around nurseries. According to Bajra (2021), *H. illucens* is often found in empty oil palm bunches that have decayed naturally. There is even a potential for the use of *H. illucens* to accelerate the decomposition of empty oil palm fruit bunches, which are known to be challenging to decay.

In addition, this study also found other detritivore insect species, namely *Captotermes* sp. It is just that in oil palm plantations, *Captotermes* sp was widely reported as a pest. It was one of the most destructive termite species, especially on peatlands. In oil palm nurseries, there have not been many reports of the presence of termites. The existence of termites in oil palm plantations has been suspected of providing suitable habitat in the form of leftover leaf midribs usually arranged in oil palm canopies. In addition, the base of the fronds of the oil palm, which is still attached to the stem and weathered, becomes a more suitable habitat for termites. The

bottom of the fronds of the oil palm will remain attached to the trunk for 6-8 years, then naturally weather and detach from the trunk of the oil palm. In the oil palm nursery, the presence of termites is thought to have been carried during the transportation of soil to fill the oil palm nursery polybags. In this study, the number of termites found was also not significant. The termites were not collected directly from oil palm seedlings but from soil using a pitfall trap.

**Community of predatory and parasitoids in oil palm nurseries**

Predatory insects and parasitoids are important arthropods in the oil palm ecosystem, including in nurseries. *Tiphia veralis* is a parasitoid with the highest abundance compared to other species (Figure 3). The high abundance of these parasitoids is an exciting finding in this study, and it can also be said to be the first report on oil palm. According to King (1931), *T. vernalis* comes from China, Japan, and Korea. It was an endoparasitoid *Popillia* spp or Japanese beetle. This parasitoid has also been reported in Indonesia, Prayoga (2019) said *T. vernalis* on *Manihot esculenta* cassava. However, the host of this parasitoid was not yet known. According to Balock (1934), the Japanese beetle species that host *T. vernalis* were *Popillia quadriguttata* Fabricius in Korea, *Popillia chinensis* Frivaldsky and *Popillia formosana* Arrow in China, and *Popillia japonica* Newman in Japan. Added Reding & Klein, (2001) that the host of *T. vernalis* was *Anomala Orientalis* (Coleoptera: Scarabaeidae). Based on this, it can be seen that most of the hosts of *T. vernalis* were beetles. Beetles that have been reported as hosts for *T. vernalis* have never been reported on oil palm plantations. It is just that in the oil palm nursery, there were several pests from the Order Coleoptera, as reported by Devi et al. (2022) there were two species of night beetles that were pests of oil palm in nurseries, namely *Apogonia expeditionis* Ritsema and *Adoretus compressus* Webb. It is interesting to study the possibility of *T. vernalis* parasitizing the larvae of the two beetles that pests the oil palm seedlings. *Condylostylus comatus* and *Cicindelidia nigrocoerulea* were two predatory insects with the highest number of individuals.

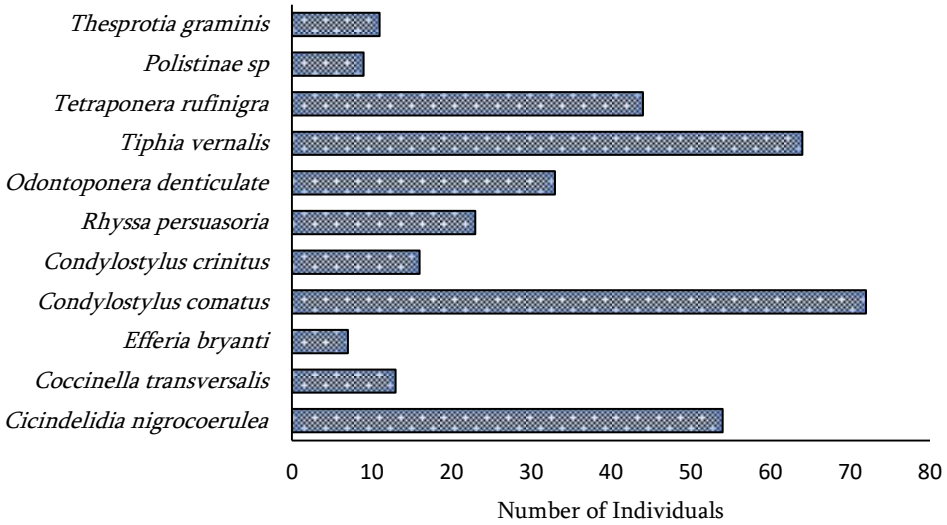


Figure 3. The abundance of predators and parasitoids in an oil palm nursery

**Spider community in oil palm nursery**

In this study, only two species of spiders were found, namely *Pardosa* sp and *Oxyopes javanus* (Figure 4). Both species belonged to the Lycosidae and Oxyopidae Families and were found on the soil surface and oil palm trunks. Oil palm was a suitable habitat for several species of spiders, as reported by Asih et al. (2018) there were 68 species of spiders in oil palm plantations bordering forests, where *O. javanus* and *Pardosa* sp. being the species with the highest abundance.

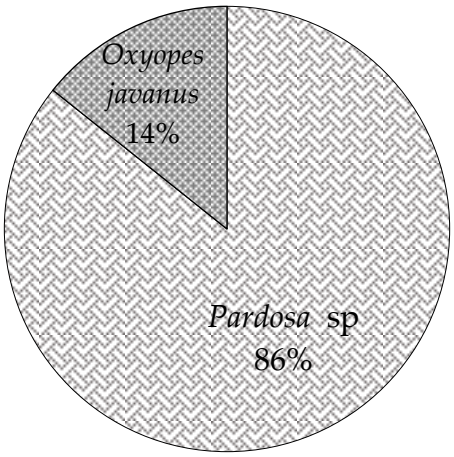


Figure 4. The abundance of predatory spiders in an oil palm nursery

Lycosidae were hunting spiders that had higher mobility than web-making spiders. Four species of spiders belonging to the Lycosidae family were found in the oil palm ecosystem *Hipposa* sp., *Pardosa* sp., *Pirata* sp., and *Schizocosa* sp. (Asih *et al.* 2018). *Pardosa* sp. which have been reported to prey on oil palm pests, namely bagworm and fireworm. In this study, one species of bagworm that became the spider's prey was found, namely *M. corbetti*. Previously the same thing was also reported by Riady et al. (2020) that Lycosidae were natural enemies of *M. corbetti* and *Metisa plana*. The population of bagworms found in this study was low. It may be the cause of the few *Pardosa* sp found in this study, 18 individuals.

Likewise, with *O. javanus*, only three individuals were found in this study. Even though the supporting factors for the abundance of the spider population were available in oil palm nurseries. According to Huseynov (2007) *O. javanus* was a polyphagous predator that preys on approximately nine species of arthropods, with the main prey being insects from the orders Diptera, Hymenoptera, Heteroptera, Orthoptera, and Lepidoptera. In this study, all orders that fell prey to the spiders were found in oil palm nurseries. Like *Pardosa* sp., oil palm *O. javanus* also acts as a predator for bagworm and fire caterpillars.

## CONCLUSIONS

The artropod community in the oil palm nursery is classified as simple, characterized by a moderate level of diversity. Insects were the main components of the Arthropoda phylum in oil palm nurseries. Insects act as phytophages, predators, parasitoids, and detritivores in oil palm nurseries. The community of phytophagous, predatory insects and parasitoids consists of four orders with different numbers of families. The detritivore insect community is only composed of two orders and spiders and only two families with low abundance. Some of the phytophagous insects in this study were the main pests of oil palm seedlings, namely *Valanga* sp. These phytophagous were the insects with the highest abundance in oil palm nurseries.

## REFERENCES

Andre M, Efendi S, Yaherwanti. 2020. Biologi Pradewasa Oryctes rhinoceros L (Coleoptera : Scarabidae) Pada Dua Jenis Limbah Organik Kelapa Sawit. Di dalam: *Seminar Nasional Fakultas Pertanian UPN "Veteran" Yogyakarta*. 117–132.

Anwar MS. 2020. Studi Keanekaragaman Serangga Tanah Di Perkebunan Teh Afdeling Wonosari Kabupaten Malang. Universitas Islam Negeri Sunan Ampel.

Asih US, Yaherwandi Y, Efendi S. 2021. Keanekaragaman laba-laba pada perkebunan kelapa sawit yang berbatasan dengan hutan. *Jurnal Entomologi Indonesia*. 18(2):115–126.doi:10.5994/jei.18.2.115.

Azhar A, Tawakkal MI, Sari A, Rizali A, Tarigan SD, Nazarreta R, Buchori D. 2022. Tree Diversity Enhance Species Richness of Beneficial Insect in Experimental Biodiversity Enrichment in Oil Palm Plantation. *International Journal of Oil Palm*. 5(2):39–49.doi:10.35876/ijop.v5i2.82.

Bajra BD. 2021. Black Soldier Fly ( Hermetia Illucens ) Sebagai Bioreaktor Alami Untuk Produksi Pupuk Organik Berbasis Limbah Pabrik. *Warta PPKS*. 26(2):103–116. https://doi.org/10.22302/iopri.war.warta.v26i2.56

Balock J. 1934. The status of Tiphia vernalis Rohwer, an imported parasite of the Japanese beetle, at the close of 1933. *J. Econ. Entomol*. 27:491–496. https://doi.org/10.1093/jee/27.2.491

Bolton B. 1994. *Identification Guide to the Ant Genera of the World*. Cambridge: Harvard University Press.

Borror DJ, Triplehorn CA, Johnson NF. 1992. *Pengenalan Pelajaran Serangga Edisi Keenam*. Yogyakarta: Gadjah Mada University Press.

Borror DJ, White RE. 1970. *Insects America North of Mexico*. New York: Houghton Mifflin Company Boston.

Bousquet Y. 2010. *Illustrated Identification Guide to Adults and Larvae of Northeastern North American Ground Beetles (Coleoptera: Carabidae)*. Sofia-Moscow: PENSOFT Publishers.

CSIRO. 1990. *Insects of Australia, Volume 1: A Textbook for Students and Research Workers*. Melbourne: Melbourne University Publishing.

CSIRO. 1991. *Insects of Australia, Volume 2: A Textbook for Students and Research Workers*. Melbourne: Melbourne University Publishing.

Danial A, Efendi S, Yaherwandi. 2020. Keanekaragaman Serangga Predator Pada Perkebunan Kelapa Sawit Di Lahan Bukaan Baru Dan Bukaan Lama. *Jurnal Riset Perkebunan*. 1(1):37–44. https://doi.org/10.25077/jrp.1.1.37-44.2020

Devi P, Busniah M, Ikhsan Z. 2022. Populasi Kumbang Malam (Coleoptera: Scarabaeidae) dan Persentase Tanaman Terserang Pada Pembibitan Kelapa Sawit (Elaeis guineensis Jacq.) Fase Main Nursery. *Jurnal Riset Perkebunan.* 3:93–100. https://doi.org/10.25077/jrp.3.2.93-100.2022

Efendi S. 2020. Aplikasi Pengendalian Semiokimia untuk Mengendalikan Kumbang Tanduk pada Areal Replanting Kelapa Sawit di Nagari Giri Maju Kabupaten Pasaman Barat Provinsi Sumatera Barat. *Panrita Abdi*. 4(3):335–348. https://doi.org/10.20956/pa.v4i3.7703

Efendi S. 2021. Aplikasi Pengelolaan Hama Terpadu Kumbang Tanduk (Oryctes rhinocerosl.) Pada Kelapa Sawit di Nagari Girimaju Kabupaten Pasaman Barat. *Jurnal Hilirisasi IPTEKS*. 4(3):149–159. https://doi.org/10.25077/jhi.v4i3.498

Febriani, Yusniwati, Efendi S. 2020. Inventarisasi Hama Kelapa Sawit ( Elaeis Guineensis Jacq.) Pada Daerah Endemik Serangan Di Kabupaten Dharmasraya. *Agrifor*. 19(1):1–10. https://doi.org/10.31293/af.v19i1.4476

Goulet H, Huber JT. 1994. *Hymenoptera of the World: An Identification Guide to Families*. Volume ke-40. Ottawa: Research Branch, Agriculture Canada.

Hakiki AF, Yaherwandi, Efendi S. 2020. Serangga Predator dan Parasitoid di Daerah Endemik Serangan Ulat Api Pada Perkebunan Kelapa Sawit Rakyat. *Jurnal Agrin*. 24(1):23–37. http://dx.doi.org/10.20884/1.agrin.2020.24.1.497

Huseynov EF. 2007. Natural prey of the lynx spider Oxyopes lineatus (Araneae: Oxyopidae). *Entomologica Fennica.* 18(3):144–148.doi:10.33338/ef.84391.

Kalshoven LGE. 1981. The Pest of Crops in Indonesia. Revised and Translated By P.A. Van der laan. Jakarta: PT. Ichtiar Baru-Van Hoeve.

King J. 1931. The present status of the established parasites of Popillia japonica Newman. *Journal of Economic Entomology*. 24:453–462.

Melketa DP, Satria B, Efendi S. 2022. Keanekaragaman Serangga Predator Dan Parasitoid Pada Beberapa Tipe Ekosistem Perkebunan Kelapa Sawit. *Jurnal Riset Perkebunan.* 3(2):66–76.doi:https://doi.org/10.25077/jrp.3.2.66-76.2022.

Muhammad A, Yaherwandi Y, Noferta A, Efendi S. 2019. Keanekaragaman Coccinellidae Predator Pada Beberapa Ekosistem Perkebunan di Kabupaten Dharmasrata. *Jurnal Tadris Biologi.* 10(2):157–168. https://doi.org/10.24042/biosfer.v10i2.5558

Nazarreta R, Buchori D, Hashimoto Y, Hidayat P, Scheu S, Drescher J. 2021. *A Guide to the Ants of Jambi (Sumatera, Indonesia)*. Jakarta: LIPI Press.

Nushasnita, Yaherwanti, Efendi S. 2020. Survei Hama Pada Perkebunan Kelapa Sawit Rakyat di Kecamatan Sembilan Koto Kabupaten Dharmasraya. *Agriprima*. 4(1):6–17.doi:10.25047/agriprima.v4i1.347.

Pebrianti HD, Maryana N, Winasa IW. 2016. Keanekaragaman Parasitoid Dan Artropoda Predator Pada Pertanaman Kelapa Sawit Dan Padi Sawah Di Cindali, Kabupaten Bogor. *Jurnal Hama Dan Penyakit Tumbuhan Tropika.* 16(2):138.doi:10.23960/j.hptt.216138-146.

Prayoga AD. 2019. Keanekaragaman dan Kelimpahan Musuh Alami pada Tanaman Ubi Kayu Manihot esculenta di Kecamatan Ponjong Kabupaten Gunungkidul.

Reding ME, Klein MG. 2001. Tiphia Vernalis ( Hymenoptera : Tiphiidae ) Parasitizing Oriental Beetle , Anomala Orientalis ( Coleoptera : Scarabaeidae ) in a Nursery. T*he Great Lakes Entomologist.* 34(2):67–68.

Rentz D, Su YN. 2019. *A Guide to Crickets of Australia*. Clayton South: CSIRO Publishing.

Riady K, Anwar A, Efendi S. 2020. Ulat Kantung (Lepidoptera : Acrolophidae) Hama Utama Kelapa Sawit: Kelimpahan Populasi, Tingkat Serangan dan Musuh Alami Pada Perkebunan Rakyat. *Crop Agro : Jurnal Ilmiah Budidaya Pertanian.* 13(1):54–61. https://doi.org/10.29303/caj.v13i1.502

Safitri D, Yaherwandi Y, Efendi S. 2020. Keanekaragaman serangga herbivora pada ekosistem perkebunan kelapa sawit rakyat di kecamatan sitiung kabupaten dharmasraya. *Menara Ilmu*. 14(01):19–28. https://doi.org/10.31869/mi.v14i1.1640

Sunarko. 2014. *Budidaya Kelapa Sawit di Berbagai Jenis Lahan*. Jakarta: Agro Media Pustaka.

Susanto A, Purba R., Prasetyo A. 2010. *Hama dan Penyakit Kelapa Sawit Volume 1*. Ed ke-1. Medan: CV. Mitra Karya.

Tarmadja S, Servasius D, Ngidha A, Pertanian F, Stiper P, Nangka YJ. 2018. Efikasi Tiga Jenis Rodentisida Antikoagulan Terhadap Hama Tikus Pada Perkebunan Kelapa Sawit. *Agroista Jurnal Agrotechnology*. 2(1):10–19. https://doi.org/10.55180/agi.v2i1.23

Tawakkal MI, Buchori D, Rizali A, Sari A, Pudjianto. 2019. Parasitoid Diversity and Host-Parasitoid Interaction in Oil Palm Plantations. *Jurnal Perlindungan Tanaman Indonesia.* 23(1):39–46.doi:10.22146/jpti.31232.

Watson J, Günther T, Abbey H. 1991. *The Australia Dragonflies a Guide to the Identifications Distributions and Habitats of the Australia Odonata*. Canberra and Melbourne: CSIRO Publishing.

Yenti N, Juniarti, Efendi S. 2020. Pengaruh Penggunaan Lahan Kakao Yang Diintegrasikan Dengan Kelapa Sawit Terhadap Keanekaragaman Serangga Predator Dan Parasitoid. *Journal of Socio Economics on Tropical Agriculture.* 2(1):44–53.doi:10.25077/joseta.v2i1.