BIOVALENTIA: Biological Research Journal
Vol. 10 No. 1 (2024)
DOI: https://doi.org10.24233/biov.10.1.2024.371
ISSN Online: 2477-1392
Pages: 75-85

Arthropods Diversity in Chili (*Capsicum annum* L.) Cultivation in Pagaralam, South Sumatra

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Peer review under responsibility of Biology Department Sriwijaya University

Abstract: Red chili (Capsicum annuum L.) is one of important types of vegetables and also has many varieties that have distinctive colors and shapes, chili is also considerd as one of vegetable that has high economic value. Chili is usually consumed in from of fresh, dried and processed as vegetables and also seasonings, in addition to functioning as a food flavor enhancer. Many obstacles faced by farmers in chili cultivation are plant disturbing organisms such as pests and diseases. Some important pests that commonly attack chili plants are fruit flies (*Bactrocera* spp), armyworms (*Spodoptera litura*) and aphids (*Aphis gossypii*). The purpose of this field practice was to determine the diversity of arthropods and the intensity of pest attacks in Pagaralam City on ten chili fields with different ages. This field practice is expected to provide information about arthropod diversity and attack intensity, especially to farmers as the main actors in agriculture. This insect observation method is carried out using the Diagonal sampling method, Scan sampling (Visual observation) and observing the intensity of the attack. The results of the observations obtained are that the chili farmers have carried out the concept of integrated pest management, but they are not aware of it, and the pests obtained in the field are fruit flies (Bactrocera spp), armyworms (Spodoptera litura) and aphids (Aphis gossypii), and for arthropod diversity it varies on each land.

Keywords: Arthropods, Attack rate, diversity and Symptoms of attack

Received: 8 May 2024, Accepted: 31 July 2024, Publish: 9 Agustus 2024

1. INTRODUCTION

Red chili (Capsicum annuum L.) is one of the important types of vegetables and also has many varieties with various colors and shapes. Chili is also included in one type of vegetable that has high economic value, chili has various types of compounds that are useful for human health, one of which contains antioxidants and antimicrobials [1], [2]. In addition, chilies also contain Lasparaginase and Capsaicin which function as anti-cancer substances [3]. Chili (Capsicum annuum L.) is consumed in fresh, dried and mixed into dishes, as a food flavor enhancer [4], [5]. Chili has nutrients which include protein 1.0 g, fat 0.3 g, carbohydrates of 7.3 g, calcium 29 mg, phosphorus, iron, vitamin C 18 mg, vitamin B 0.05 mg and also alkaloid compounds [6], [7]. Chili production alone in Indonesia in 2008 to 2010 is estimated to reach 311 million tons. (Sepwanti et al., 2016). Pests are one of the obstacles faced by farmers in chili cultivation. Pest attacks can cause a decrease in production and yield loss [9]. The dominant insect pests are Bactrocera spp, Spodoptera litura, mites and Aphis gossypii [10]-[15]. These insect pests are insects that have mandibular

mouthparts and piercing sucking [10], [12].

Integrated pest and disease management is one way to suppress pest growth in the field. Integrated Pest Management is a way or control that uses all techniques and methods in easy ways and also pays attention to the population of pest attacks that cause damage in the land environment (Sugiyono et al., 2014). One way that can be done to increase crop production is to choose the right planting pattern because basically farmers have different planting patterns (Warsiyah & Basuki, 2013). Intercropping can reduce farmers from failure because if one crop is not good because of pests and diseases there are still other crops that can provide benefits (Guruh & Riajeng, 2018). The purpose of this study was to determine the diversity of arthropods and the intensity of pest attacks in Pagaralam City on chili fields.

2. MATERIALS AND METHODS

This research was conducted on chili fields owned by farmers in the city of Pagar Alam, South Sumatra Province. The tools and materials used are stationery, cameras, vials, cellphones and macro lenses and chili plant land, 70% alcohol. This study used a survey method of 10 chili fields in Pagar Alam City and a direct observation method (Scan sampling) by observing insect diversity and population size. Observation is one of the techniques used to see and observe the land used for research, as well as to see what plants are widely planted in the area and used for research. This interview was conducted by conducting direct communication and question and answer with farmers. This interview was conducted with farmers or landowners and also how farmers cultivate their land and the reasons for choosing plants. Documentation is carried out as a way of collecting data, documentation is carried out as evidence of what is being researched and also documentation strengthens the data that has been obtained in the field using a Hand Phone. The results of the documentation are in the form of photographs in the field.

This research is land owned by farmers in Pagar Alam City by planting chili commodities that have a land area ranging from ¼-½ ha. How to determine the sample plants starts by calculating the number of mounds in the field, then to take plant samples the Purposive Sampling method is used and 5 mounds or 5 points are taken with each mound of 10 plant samples and a total of 50 chili plants per field. Observations were made once on each field at 08.00 WIB by counting the population and intensity of pest attacks in the field. Attack intensity to see the level of attack in the field using a score [19].

The score levels used are:

0 : No symptoms
1 : 25% Mild symptoms
2 : 50% Moderate symptoms
3 : 75% Severe symptoms
4 : 100% Very severe symptoms

Data Analysis. Data obtained from the results of the study are presented in the form of descriptions, pictures, graphs and tables. The diversity of arthropods was analyzed using the formula of Diversity Level (H'), Distribution of Individuals of Each Species (E), Dominance Proportion (D) [20].

3. RESULTS AND DISCUSSION

Based on the results of interviews conducted with chili farmers in Pagaralam City, the characteristics of farmers' land based on land ownership status are obtained, namely, owners, cultivators and tenants, land area

1/4 - ½ ha / farmer. Chili varieties used in cultivation are Kastilo F1, F1 Hybrid, root, electra and local. The selection of seeds is one way for farmers to increase chili production [21]. Based on observations in the field, which was carried out in chili Pagaralam City. Farmers' land is self-owned land, but there are also those who rent and cultivate. The type of land used is dry on average, but there are some lands that use wet land types. Chili farmers' land topographic conditions are flat on average, but there are three fields whose land topography is sloping and also has a different land area. Based on observations in the field, the vegetation around the land has different variations, the chili farmer's land has vegetation around the land of coffee and rice plants, besides that there are also some lands that plant vegetation around the land with horticultural crops, namely tomato plants, carrots, celery, chilies and leeks [22]. The reason farmers choose the chili commodity is because of the high selling price in the market, besides that there are also those who choose to plant chilies because it is hereditary and also a hobby of planting these chilies. The chili farmer's reason for choosing a variety is due to the high selling price and good quality of the chili. Farmers' land processing uses hoes and tractors.

These farmers on average have a deep land depth because the plants are sturdy, but there is one farmer whose land depth is shallow [21]. Seed preparation is usually bought in agricultural shops and some buy online. The seeds before sowing are first treated by soaking in warm water and pesticides. The treatment aims to accelerate the process of breaking the epidermis of the seeds, so that the seeds grow and avoid organisms that exist in the seeds [23]. The use of pesticides in seed treatment to reduce the seeds experiencing microorganism disorders, such as diseases and pests carried by seeds. The seeds that grow into seedlings around the age of ± 1 month, the seedlings are transferred to the diguludan using a planting distance of 40-70 cm. The chili planting distance is most widely applied by farmers, because it depends on the land area. However, planting distances that are too close can cause the spread of plant disrupting organisms quickly [24].

Plant maintenance by farmers in cleaning the land has different frequencies, ranging from those who clean their land once a week, once every two weeks, and even some up to once a month, these farmers usually clean their land using sickles. The average farmer does not know the economic threshold, there are only two people who know the economic threshold, the farmers actually know what the economic threshold is, but in a different language. Observations made on farmers' land, the average type of land used is dry land, but there are some lands that use wet land types. It has flat and sloping land topography conditions, with different land areas. The farmer's land, on average, has implemented the concept of Integrated Pest Management, IPM itself is a way or control that uses all techniques and methods in easy ways and also pays attention to the population of pest attacks that cause damage in the land environment [25]. The types of pesticides used by farmers are various, such as insecticides, fungicides and herbicides, the three types of pesticides are most widely used to suppress the growth of pests in the field. Pesticides are used by farmers in suppressing pests, because they are easy to obtain and the results can be seen quickly.

The use of pesticides by farmers has a different frequency and dose in using pesticides, usually farmers spray pesticides in the morning. Farmers must fertilize so that their plants become fertile and get satisfactory harvests, some examples of fertilizers commonly used by farmers are manure, urea, NPK, TSP and ZPT. The reason farm-

ers use manure and urea fertilizer is as a soil fertilizer, NPK fertilizer as a basic fertilizer, fertilize plants and fruit, satisfy the results and also accelerate plant growth, TSP fertilizer so that the fruit or flower does not fall off easily and thicken the fruit, ZPT fertilizer as spending acid in the soil, destroying chunks of soil and good for plant development [26], [27].

Farmers harvest chili fruit marked by red fruit, using direct harvesting and not using tools at all. The labor used is usually from the farmer's own family and some invite others / hired (Non-Family), after the harvest process some farmers treat the harvested chilies, starting from cleaning rotten fruit, then post-harvest treatment starting from cleaning rotten fruit in the plant and spraying pesticides, after harvesting the chilies are put into sacks before being sold on the market or with middlemen. One approach that can be done to increase crop production is to choose the right planting pattern because basically farmers have different planting patterns. The cropping pattern is divided into 2 patterns, namely monoculture cropping patterns by planting only one type of plant on the land and polyculture cropping patterns by planting many types of plants on the land [15]. Observations made on chili farmers' land, using a polyculture pattern, because planting intercropping can reduce farmers from failure and get more income, because if one plant is not good results due to pest and disease disorders there are still other plants that can provide benefits [28], [29]. Plant spacing in intercropping systems must be considered, the potential yield of intercropping crops can be achieved by setting the planting distance, the use of planting distance also affects pests that attack in the field, because the distance is too close can facilitate the movement of pests from one plant to another, the ten chili farmer's land in Pagaralam City have all used planting distances with different distances, ranging from 40 cm to 70 cm [30].

In addition, the use of superior varieties is also one of the important components to increase the production and business income of chili farmers, the chili farmers in Pagaralam City have used superior varieties on average, for example the Kastilo F1, F1 Hybrid, Root and Electra varieties. There are three groupings of chili varieties, namely hybrid varieties, superior varieties and local varieties, various superior varieties are available and can be selected according to regional conditions and market desires. Superior chili varieties have many advantages over other varieties, such as high production, pest and disease resistance, early maturity and longevity after harvest [24]. Based on observations made in the field, insects were found with various orders, namely, Hymenoptera, Diptera, Coleoptera, Odonata, Orthoptera, Homoptera, Hemiptera, Lepidoptera, Dermaptera and Araneae. With a diversity index of 2.48, the distribution of individual species is 0.71, the proportion of dominating species is 0.37 and there are 32 arthropod species with different roles from the ten fields. The diversity of arthropods obtained in chili land is moderate with a value of 2.48, the distribution of individual species is moderate with a value of 0.71 and the proportion of dominating species is low with a value of 0.37.

The diversity of arthropods on chili plants in Pagaralam can be influenced by plant vegetation, pesticide use and environmental conditions. The difference in vegetation on each land is most important because it can increase the diversity of arthropods in the field [31]. The chili land obtained 10 orders of arthropods, with 20 different families and for the species obtained 32 kinds of arthropod species that have different roles. In addition to insect pests found in the field, there are also predatory arthropods that can reduce the population of insect pests because their food source is the pest. Examples of predatory arthropods are beetles,

dragonflies, Oxyopidae and Lycosidae families (Table 1).

Table 1. Species and number of insects on chili pepper plants obtained during visual observation in the field.

Ordo	Family	Species	Number	The role
Hymenoptera	Vespidae	*Vespa* sp	2	Polinator
Araneae	Oxyopidae	*Oxyopes papuanus*	4	Predator
	Lycosidae	*Pardosa* sp	2	Predator
Lepidoptera	Pieridae	*Eurema hecabe*	23	Polinator
	Noctuidae	*Spodoptera litura*	24	Pest
Dermaptera	Forficulidae	*Forficulidae* sp	1	Predator
Diptera	Tephritidae	*Bactrocera* spp	32	Pest
	Muscidae	*Musca domestica*	6	Pengurai
	Tipulidae	*Nephrotoma appendiculata*	1	Polinator
	Syrphidae	*Sphaerophoria scripta*	5	Pest
Coleoptera	Coccinellidae	*Coccinella transversalis*	27	Predator
	Chrysomelidae	*Crioceris duodecim punctata*	1	Pest
	Cerambycidae	*Xystrocera festiva*	1	Pest
	Chrysomelidae	*Aspidomorpha miliaris*	2	Pest
	Coccinellidae	*Adalia decempunctata*	3	Predator
	Cerambycidae	*Chlorophorus annularis*	11	Pest
	Coccinellidae	*Epilachna varivestis*	6	Pest
Odonata	Libellulidae	*Orthetrum sabina*	37	Predator
	Libellulidae	*Crocothemis servilia*	32	Predator
	Libellulidae	*Diplacodes trivialis*	12	Predator
	Libellulidae	*Pantala flavescens*	29	Predator
	Coenagrionidae	*Ischnura sanegalensis*	7	Predator
	Coenagrionidae	*Ischnura* sp	4	Predator
Orthoptera	Acrididae	*Oxya serville*	9	Pest
	Acrididae	*Oedaleus infernalis*	5	Pest
	Acrididae	*Valanga* sp	3	Pest
	Acrididae	*Acrida* sp	1	Pest
Homoptera	Cicadellidae	*Bothrogonia addita*	4	Pest
	Aphididae	*Aphis gossypii*	187	Pest
Hemiptera	Coreidae	*Riptortus linearis*	2	Pest
	Coreidae	*Gonocerus* sp	7	Predator
	Pentatomidae	*Nezara viridula*	8	Pest
Total species			498	
Total hight species			187	
Diversity Index			2.48	
Distribution of Individual Species			0.71	
Proportion of Dominating Species			0.37	

Based on observations on chilli plants carried out in the field, by making visual observations, a wide variety of athropod species are obtained that have different roles in the ecosystem. There are 16 species of insect pests found in chilli fields in Pagaralam. These insects are the most common insects on chilli plants (Figure 1).

Figure 1. Insect pests on chilli plants observed visually, A). *Spodoptera litura*, B). *Bactrocera* spp, C). *Sphaerophoria scripta*, D). *Nezara viridula*, E). *Crioceris duodecim punctata*, F). *Xystrocera festiva*, G). *Aspidomorpha miliaris*, H). *Chlorophorus annularis*, I). *Epilachna varivestis*, J). *Oxya serville*, K). *Oedaleus infernalis*, L). *Valanga* sp, M). *Acrida* sp, N). *BothRogonia addita*, O). *Aphis gossypii*, P). *Riptortus linearis*

There were 12 species of predatory arthropods found in the chilli field. The predators eat insect pests in the chilli plantation. The most common predator species found was the order odonatan (Figure 2). Based on observations made on chilli plantations, 4 species of pollinating and descrambling insects were visually found (Figure 4
.

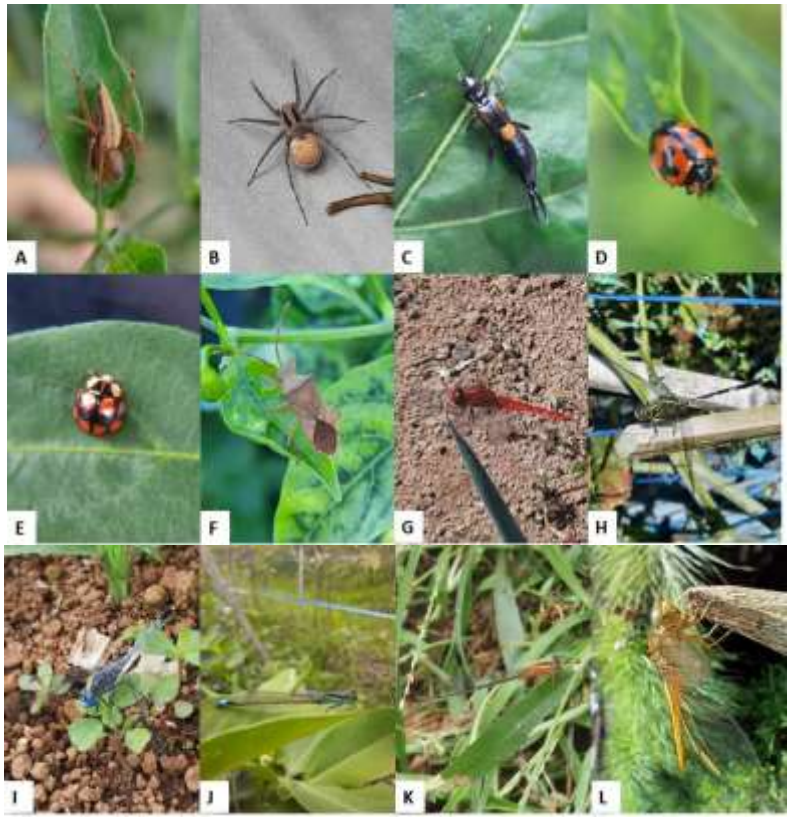

Figure 3. Predatory arthropods on chilli plants observed visually, A). *Oxyopes papuanus*, B). *Pardosa* sp, C). *Forficulidae* sp, D). *Coccinella transversalis*, E). *Adalia decempunctata*, F). *Gonocerus* sp, G). *Crocothemis servilia*, H). *Orthetrum sabina*, I). *Diplacodes trivialis*, J). *Ischnura sanegalensis*, K). *Ischnura* sp, L). *Pantala flavescens*.

Figure 4. Visually observed pollinating and decomposing insects on chilli plants, A). *Eurema hecabe*, B). *Vespa* sp., C). *Musca domestica*, D). *Nephrotoma appendiculata*

Pest attacks on chilli plants with mandibular mouthparts are Spodoptera litura, this caterpillar not only attacks plants, but also eats the leaves from the edges to the top or bottom. Symptoms of the attack caused on the leaves by Spodoptera litura pests are the emergence of irregular holes on the surface of the leaves, because the caterpillars eat the leaves until they are torn, perforated and cut, even until only the leaf bones remain. Heavy

attacks usually occur during the dry season [32] (Figure 5). Pest attacks on chilli plantations with haustelata mouthparts are Bactrocera sp, the larvae of this pest are known to gnaw on the inside of chillies so that sometimes the outside of the chilli looks smooth but the inside has rotted. This fruit fly also affects fruit quality especially when secondary infection by bacteria occurs which results in fruit rot in the affected fruit, high humidity and not too strong winds the intensity and population will increase [33] (Figure 6)

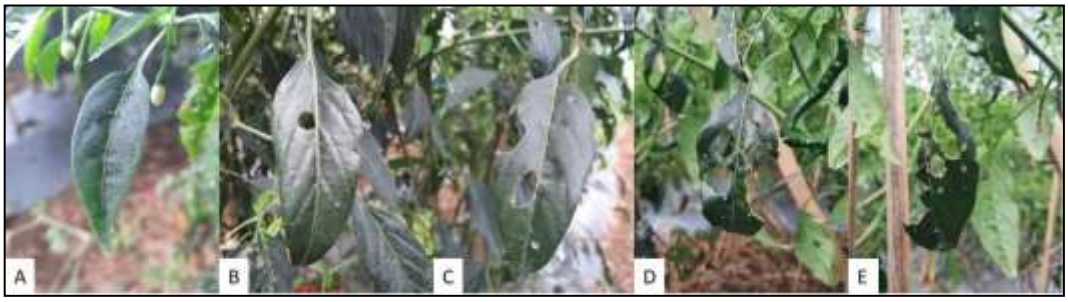

Figure 5 Symptoms of pest attack with mandibular mouthparts, (A). Score 0, No symptoms, (B). Score 1, Mild symptoms, (C). Score 2, Moderate symptoms, (D). Score 3, Severe symptoms, (D). Score 4, Very severe symptoms.

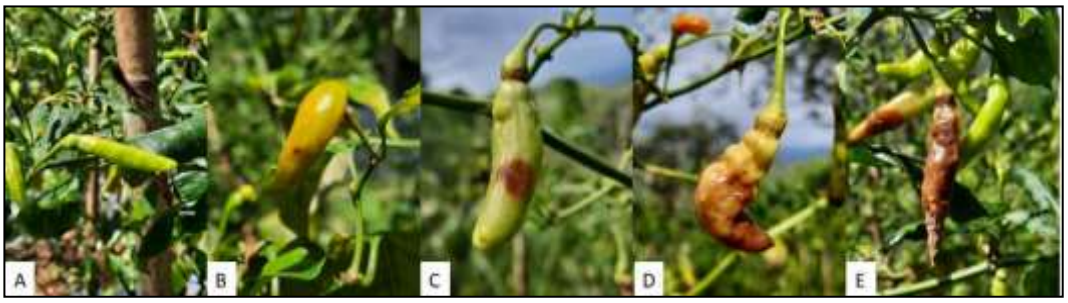

Figure 7. Symptoms of pest infestation with haustelate mouthparts, (A). Score 0, No symptoms, (B). Score 1, Mild symptoms, (C). Score 2, Moderate symptoms, (D). Score 3, Severe symptoms, (D). Score 4, Very severe symptoms.

In the growth of chilli plants there are many factors or obstacles faced by farmers, one of which is the attack of insect pests that are detrimental to chilli plants in Pagaralam City, as a result of the attack of insect pests it has an impact on the growth and development of chilli plants that cannot develop optimally due to the disturbance of the pest attack [34]. Chilli plants in Pagaralam City have main pests, namely, fruit flies (Bactrocera spp), armyworms (*S. litura*) and aphids (*A. gossypii*). Fruit flies (*Bactrocera* spp) are one of a group of insect pests that are important pests on some fruits and vegetables, even becoming a major plant disrupting organism (COP), because they cause rot in the affected fruit. The initial symptoms of fruit damage are black spots on the skin of the fruit as a result of the puncture of the ovipositor of female flies when laying eggs, in high populations the intensity of the attack can reach 100% [35]-[37].

Armyworm (*S. litura*) is one of the important leaf-eating pests and is a type of pest

that is polypagous, damage and yield loss due to armyworm attack is determined by the level of pest population, insect development phase. Apart from attacking plants, *S. litura* also eats the leaves from the edges to the top or bottom, which causes the leaves to be torn [32][38]. Aphids (*A. gossypii*) are an important pest of chilli plants, often seen on the leaves, twigs, branches, stems and fruit stalks of host plants. Aphid infestation can cause the leaves to shrink and curl, then gradually turn yellow and wilt, at the top the edges become curled. In addition, *A. gossypii* is able to suck nutrients from the host plant, its puncture marks can cause the appearance of chlorotic spots and is a carrier insect of virus vectors in chilli plants [11], [39]. Observations of the intensity of the armyworm (*S. liturra*) attack on farmers' fields where each of the ten farmers' fields has a different intensity of attack. Observations of the intensity of Fruit Fly (*Bactrocera* spp) infestation in farmers' fields where each of the ten farmers' fields has a different intensity of infestation (Figure 8).

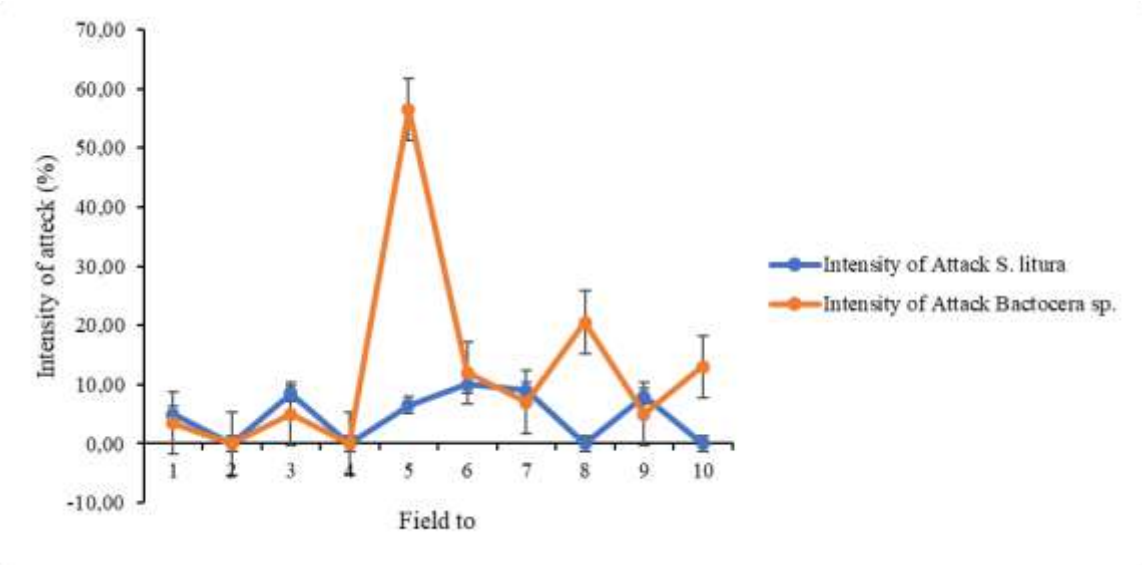

Figure 8. Infestation intensity of *Bactocera* Sp. and *Spodoptera Litura* on chilli plants in ten farmers' fields.

In controlling pests in the field, the ten chilli farmers in Pagaralam City use a variety of controls, namely, mechanical control by removing pests directly, by hand or with the help of tools, chemical control by using pesticides that are sprayed on plants to reduce pests in the land, and mechanical control by carrying out environmental management by combining appropriate cultivation techniques to improve pest control, regulating planting and harvesting time, planting resistant varieties, planting barrier plants such as refugia, regular irrigation systems, crop rotation and cropping pattern arrangements, sanitising other plant residues that can be used as hosts [40].

4. CONCLUSION

Based on the results of observations and interviews conducted on ten chilli farmers in Pagaralam City, the chilli farmers have implemented the concept of integrated pest control (IPM), but they are not fully aware of it because they are more concerned with production. Technical culture applied as part of IPM is more based on the need for crop production so that the results are not optimal and farmers still use pesticides.

The use of pesticides is not based on the economic threshold although a small number of farmers are familiar with the economic threshold. Farmers prefer pesticides because the results are quickly visible and they do not experience directly the adverse effects of pesticides. The intensity of pest attacks in the ten fields did not differ too much, only in the number of populations, the dominant pests were Bactrocera spp, Spodoptera litura and Aphis gossypii.

The diversity of arthropod species found visually was also different due to the different age of the plants, different plant spacing and different plant vegetation. The diversity of arthropods in chilli fields is classified as moderate with a value of 2.48, the distribution of individual species with a value of 0.71 and the proportion of dominating species of 0.37. In the ten fields, there were 10 orders of arthropods, with 20 families, and 32 kinds of arthropod species that have different roles.

5. ACKNOWLEDGEMENTS

Thanks to the research team, LPPM Unsri,Study Program Plant Protection , Faculty of Agriculture, Universitas Sriwijaya.

REFERENCES

[1] I. G. B. T. Ananta and D. G. A. Anjasmara, "Antioxidant and antibacterial potency of red chillies extract (*Capsicum annum* var. Longum)," *J. Ilm. Medicam.*, vol. 8, no. 1, pp. 48–55, doi: 10.36733/medicamento.v8i1.3170. 2022

[2] K. Kusumiyati, I. E. Putri, W. Sutari, and J. S. Hamdani, "Kandungan karotenoid, antioksidan, dan kadar air dua varietas cabai rawit pada tingkat kematangan berbeda dan deteksi non-destruktif," *J. Agro*, vol. 8, no. 2, pp. 212–225, doi: 10.15575/14650. 2022

[3] R. Prasetyo, "Pemanfaatan berbagai sumber pupuk kandang sebagai sumber n dalam budidaya cabai merah (*Capsicum annum* L.) di tanah berpasir," *Planta Trop. J. Agro Sci.*, vol. 2, no. 2, pp. 125–132, , doi: 10.18196/pt.2014.032.125-132. 2014

[4] P. Wahidah, "Peningkatan nilai jual usaha masyarakat desa padamulya melalui pemanfaatan cabai hijau untuk variasi olahan produk rangginang," *J. Pengabdi. Masy.*, vol. 1, no. 2, pp. 74–77, doi: 10.30997/almujtamae.v1i2.2920. 2021

[5] A. I. Maharani, F. Riskierdi, I. Febriani, K. A. Kurnia, N. A. Rahman, N. F. Ilahi, and S. A. Farma, "Peran antioksidan alami berbahan dasar pangan lokal dalam mencegah efek radikal bebas," *Pros. Semin. Nas. Bio*, vol. 1, no. 2, pp. 390–399, 2021.

[6] D. N. Edowai, S. Kairupan, and H. Rawung, "Mutu cabai rawit (*Capsicum Frutescens* L.) pada tingkat kematangan dan suhu yang berbeda selama penyimpanan," *Agrointek*, vol. 10, no. 1, p. 12, 2017,

doi: 10.21107/agrointek.v10i1.2021.
[7] D. A. Cahyani and A. A. Suhastyo, "Addition of soaking material to vitamin c contents of chili powder," *J. Ilm. Media Agrosains*, vol. 6, no. 1817478, pp. 93–97, 2020.
[8] C. Sepwanti, M. Rahmawati, and E. Kesumawati, "pengaruh varietas dan dosis kompos yang diperkaya *Trichoderma harzianum* terhadap pertumbuhan dan hasil tanaman cabai merah (*Capsicum annuum* L.)," *J. Kawista*, vol. 1, no. 1, pp. 68–74, 2016.
[9] D. B. Cahyono, H. Ahmad, A. R. Tolangara, and S. M. A. M. Subaim, "Hama pada cabai merah," *TECHNO*, vol. 06, pp. 15–21, 2017.
[10] A. Arsi, W. Wagiyanti, S. Shk, Y. Pujiastuti, and S. Herlinda, "Inventory of insect insfesting chili cultivation in sub district Air Salek, District Banyuasin," in *Prosiding Seminar Nasional Lahan Suboptimal ke-8 Tahun 2020, Palembang 20 Oktober 2020*, pp. 138–147. 2020.
[11] A. Arsi, N. Octariati, S. SHK, B. Gunawan, S. Herlinda, Y. Pujiastuti, Suwandi, C. Irsan, H. Hamidson, R. A. Efendi, and L. Budiarti, "Effect of cultural technique on disease of cayenne pepper (*Capsicum frutescens* L.) in Sub District Lempuing, Distict Ogan Komering Ilir," *J. Planta Simbiosa*, vol. 2, no. 2, pp. 41–52, 2020
[12] K. N. Sari, A. Ayu, D. Wahyuni, D. Faraszahy, P. Aristva, T. Intania, A. Umayah, B. Gunawan, A. Arsi, P. Studi, P. Tanaman, F. Pertanian, U. Sriwijaya, and S. Selatan, "Identification of Insect Pests on Chili in Ogan Ilir South Sumatera," in *Prosiding Seminar Nasional Lahan Suboptimal ke-10 Tahun 2022, Palembang 27 Oktober 2022*, pp. 824–831. 2022.
[13] M. B. Suhada, B. B. Baihaq, M. A. Ghozi, Z. Uary, S. Ningrahayu, N. A. Putri, A. Umayah, B. Gunawan, and A. Arsi, "Inventory of Mites on Chili in Ogan Ilir District, South Sumatera," in *Prosiding Seminar Nasional Lahan Suboptimal ke-10 Tahun 2022, Palembang 27 Oktober 2022*, 2022, pp. 1049–1056.
[14] B. A. Febrianti, J. Carolin, F. Nabila, C. G. Ginting, T. M. Sinaga, M. Aziz, A. Umayah, B. Gunawan, and A. Arsi, "Population of Fruit Flies (*Bactrocera* spp.) Sampled Using Methyl Eugenol on Eggplant (*Solanum melongena* L.) in Ogan Ilir Regency, South Sumatra," in *Prosiding Seminar Nasional Lahan Suboptimal ke-10 Tahun 2022, Palembang 27 Oktober 2022*, pp. 759–767. 2022.
[15] Arsi, A, A. G. S., Putra, G. Fitra, I. Irmawati, SHK. Suparman, H. Harman, I. Chandra, S. Suwandi, P, Yulia, K, Khodijah, N. Nurhayati, U. Abu, G. Bambang, S. A. Tiara, C. B, Kevin, "The Effect of Intercropping Chili with Cabbage on Pests and Plant Disease in Kerinjing Village Pagar Alam City," in *Prosiding Seminar Nasional Lahan Suboptimal ke-9 Tahun 2021, Palembang 20 Oktober 2021*, pp. 101–113. 2021
[16] B. R. Sugiyono, G. Mudjiono, and R. Rachmawati, "Studi Kelimpahan Populasi *Thrips* sp. pada Perlakuan Pengelolaan Hama Terpadu dan Konvensional pada Tanaman Cabai (*Capsicum annuum* L.) di Desa Bayem Kecamatan Kasembon Kapubaten Malang," *J. HPT*, vol. 2, no. April, pp. 67–78, 2014.
[17] Warsiyah1 and Basuki, "Pola Tanam Masyarakat Di Sekitar Hutan Bunder Gunung Kidul," *J. Rekayasa Lingkung.*, vol. 13, no. 2, pp. 16–30, 2013.