Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

Percentage Attacks of *Plutella xylostella* and Parasitization of the Parasitoid *Diadegma semiclausum* on Cabbage in Kintamani District

Dicky Marsadi [1*], Dewa Ayu Ari Febriyanti[2]

[1]Faculty of Agriculture and Business, Dwijendra University, Denpasar, Indonesia
[2] Faculty of Agriculture and Business, Dwijendra University, Denpasar, Indonesia
[1]Email: dickymarsadi14@gmail.com
[2]Email: dewaayuarifebriyanti@gmail.com

ABSTRACT

Cabbage plants are one of the horticultural commodities that many farmers cultivate in Indonesia because they have economic value, because apart from being able to meet domestic needs, cabbage also has the opportunity to become an export commodity. This study aims to determine the percentage of attacks by the cabbage leaf caterpillar *Plutella xylostella* and the level of parasitization of the parasitoid *Diadegma semiclausum* in Kintamani District. This research was carried out in Sekaan Village and Kedisan Village. The research method uses a survey method. Sampling of cabbage plants in the field was carried out diagonally so that 5 sample points were obtained, 10 plants were observed at each sample point. The research results showed that the percentage of *P. xylostella* pest attacks in Sekaan Village and Kedisan Village ranged from 12% to 28%. The average population of *P. xylostella* larvae in Sekaan Village ranges from 0.98 individuals/plant to 1.82 individuals/plant and the highest average population of *P. xylostella* larvae in Kedisan Village ranges from 0.7 individuals/plant to 1.66 individuals/plant. The level of parasitization of the parasitoid *D. semiclausum* in Sekaan Village ranges from 32% to 56% and the level of parasitization of the parasitoid *D. semiclausum* in Kedisan Village ranges from 24% to 48%. The highest peak of parasitization was found in the fourth observation (4 WAP).

Keywords: *Cabbage, Diadegma semiclausum, Percentage of Attack, Plutella xylostella*

*Corresponding Author:
E-mail: dickymarsadi14@gmailcom (Dicky Marsadi)
Faculty of Agricuture, Dwijendra University, Denpasar, Indonesia

1. INTRODUCTION

Cabbage plants are one of the horticultural commodities that are widely cultivated by farmers in Indonesia because they have high economic value, and are known as a source of vitamins A, B, C, carbohydrates, protein and minerals such as calcium, iron, phosphorus and sulfur which humans need (Sembiring & Hohanna, 2023). Cabbage plants have great potential to be developed in Indonesia, because apart from being able to meet domestic needs, cabbage also has the opportunity to become an export commodity. Indonesia itself is the fifth largest country in terms of vegetable supplies to Singapore, after Malaysia, China, Australia and India (SME Business, 2009 in Nurfajriani *et al.*, 2022). According to data from the Central Bureau of Statistics (BPS), in 2024 cabbage production in Indonesia will reach 1,399,005 tons.

Bali Province is one of the cabbage producing regions in Indonesia. Cabbage production in Bali province from 2022-2023 will decrease from 33,730 tonnes in

Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

2022 to 24,729 tonnes in 2023 (BPS, 2024). The decline in cabbage production in Bali Province was caused by attacks by Plant Pest Organisms. According to Gustiana *et al.*, this pest attack that can cause damage to cabbage plants and result in reduced production is the attack of *P. xylostella* larvae.

P. xylostella is an important pest that often attacks cabbage plants both in the highlands and lowlands (Lestariningsih, 2020). *P. xylostella* is classified as an oligophagous insect pest which only attacks one type of plant in the Cruciferae family (Pivnick, 1994).

P. xylostella receives special attention because this pest can attack cabbage plants from seed to harvest, thereby causing economic losses for farmers (Susniahti *et al.,* 2017). According to Irawati (2017), various methods have been taken to overcome *P. xylostella* attacks, such as using resistant varieties, rotating crops, planting simultaneously and using pesticides. The use of pesticides, especially synthetic ones, is growing widely because they are considered the fastest and most effective in dealing with pest problems. The use of synthetic pesticides can have a negative effect on agricultural products, pest resistance, pest resurgence, killing of natural enemies and environmental pollution problems. To overcome the problem of using synthetic pesticides, appropriate control techniques are needed to overcome *P. xylostella* pest attacks.

Integrated Pest Management is a combination of several control techniques that prioritize agroecosystem management and natural resource-based pest control technology including the use of Biological Agents, Vegetable Pesticides and Specific Control Technology (Wati, 2022). According to Yanti *et al.,* (2014) the parasitoid *Diadegma semiclausum* is a biological agent that is effective in controlling *P. xylostella*. This study aims to determine the percentage of attacks by the cabbage leaf caterpillar pest *P. xylostella* and the level of parasitization of the parasitoid *D. semiclausum* in Kintamani District.

2. METHODS

This research was carried out at the cabbage production center in Bali Province which is located in Kintamani District, Bangli Regency. Sampling will be carried out in two locations, namely in Sekaan Village and in Kedisan Village. The research method uses a survey method. Sampling of cabbage plants in the field was carried out diagonally so that 5 sample points were obtained, 10 plants were observed at each sample point. The first observation began when the plants were 2 weeks after planting. Observations were carried out once a week with the aim of knowing the percentage of attacks, *P. xylostella*, the population of *P. xylostella* larvae and the level of parasitization of *D. semiclausum*.

The percentage of *P. xylostella* attacks is calculated using the formula (Sembiring & Johanna, 2023):

$$P = \frac{n}{N} \times 100$$

Information
P = Percentage of attacks
n = Number of plants attacked
N = Observed plant population

The population of *P. xylostella* is calculated using the formula (Sembiring & Johanna, 2023):

$$P = \frac{n}{N}$$

Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 | p-ISSN: 2722-919X

Information
P = *P. xylostella* population
n = Number of *P. xylostella* larvae on plants/plot
N = Observed plant population
The percentage of parasitization of the parasitoid *D. semiclausum* is calculated using the formula (Baehaki, 2010):

$$P = \frac{A}{A+B}$$

Information :
P : Parasitization
A : Number of parasitized eggs
B : Number of eggs that are not parasitized

3. RESULT AND DISCUSSION

3.1 *Plutella xylostella* Attack Percentage

Based on the results of observations of the percentage of *P. xylostella* pest attacks in Sekaan and Kedisan villages, it shows that there are differences in the percentage of attacks in the two places (Figure 1). The percentage of *P. xylostella* pest attacks in Sekaan Village was higher compared to Kedisan Village from the first observation to the last observation. There was a difference in the peak of *P. xylostella* pest attacks in the two places. The peak of pest attacks in Sekaan Village occurred in the fourth observation (5 WAP), while the peak of attacks in Kedisan Village occurred in the fifth observation (6 WAP).

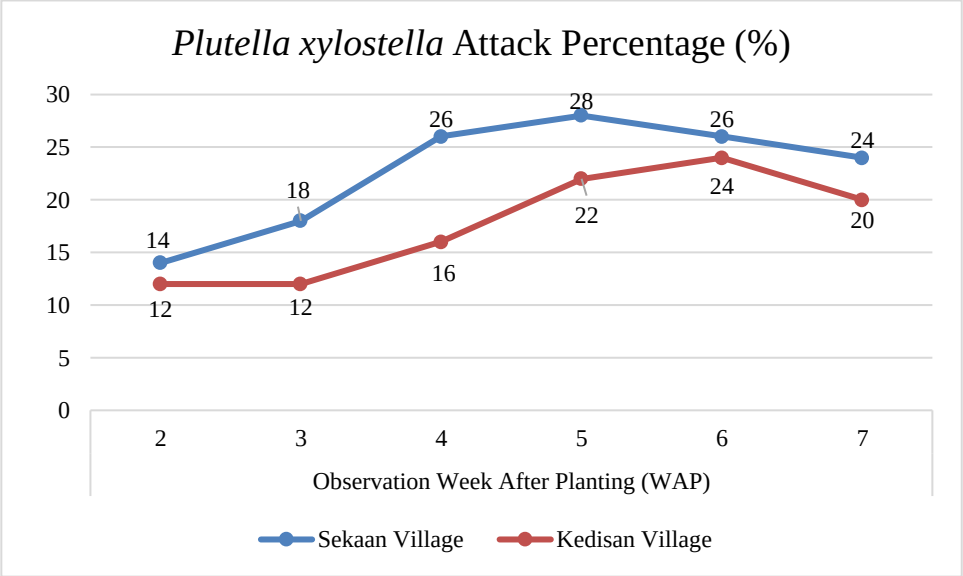

Fig. 1 *Plutella xylostella* attack percentage

The development of the intensity of pest attacks is closely related to the density of pest populations on cabbage plants. When the number of pests increases, the level of leaf damage or intensity of attack also increases, resulting in a reduction in the leaf area of the plant. This reduction in leaf area will disrupt the photosynthesis process, which will ultimately reduce yields or reduce plant productivity Kartina *et al.*, (2015). According to Sembiring & Johanna (2023) the percentage of *P. xylostella* attacks is influenced by the intensity of insecticide use.

3.2 *Plutella xylostella* Pest Population

The results of observations of the *P. xylostella* larvae population in Sekaan

Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 | p-ISSN: 2722-919X

Village and Kedisan Village showed fluctuations in the *P. xylostella* larvae population during each observation (Figure 2). The highest average population of *P. xylostella* larvae was in the fourth observation (5 WAP) in both locations with 1.82 individuals/plant in Sekaan Village and 1.66 individuals/plant in Kedisan Village. The high and low population of *P. xylostella* larvae is influenced by several factors such as the life cycle, sex ratio and the number of eggs that the female insect can produce. The number of eggs produced by insect pests is influenced by food factors and environmental temperature (Susniahti *et al.*, 2017). According to Dadang (2006), if the population of female insects is greater than that of male insects, more eggs will be produced and the pest population will increase in that location.

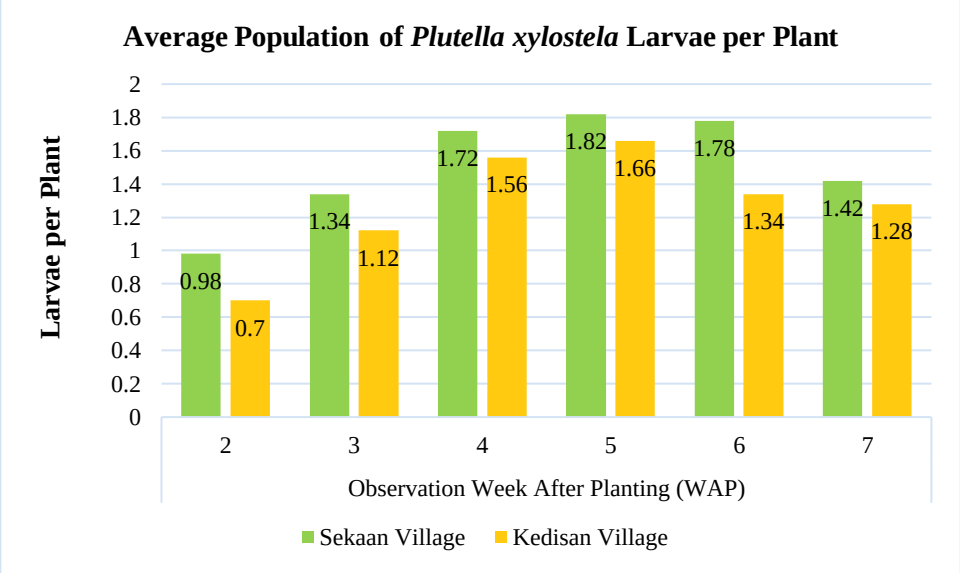

Fig. 1 Average Population of Plutella xylostella Larvae per Plant

3.3 Percentage of parasitization of the parasitoid *D. semiclausum*

The highest observation results for the percentage of parasitization of the parasitoid *D. semiclausum* were in Sekaan Village in the third observation (4 WAP) with a parasitization percentage of 56%, and the lowest was in Kedisan Village in the first observation (2 WAP) with a parasitization percentage of 24% (Table I). The high and low percentage of parasitoid parasitization is caused by several factors such as the environment which influences the development of parasitoids (Maharani, 2009). Environmental factors (external factors) play an important role in determining the population level of a parasitoid species. Pest populations are dynamic and can increase or decrease, depending on the magnitude of environmental constraints. The height of a place is closely related to the air temperature, where the higher the location above sea level, the lower the air temperature. This makes it more difficult for insects to reach their hosts (Junaedi *et al.*, 2016).

Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

TABLE I
Percentage of Parasitization Parasitoid *Diadegma semiclausum*

Location	Observation Week After Planting (WAP)					
	2	3	4	5	6	7
Sekaan Village	32	44	56	40	48	36
Kedisan Village	24	28	48	44	36	28

Source: primary data analysis (2024)

4. CONCLUSIONS

1. The percentage of *P. xylostella* pest attacks in Sekaan Village and Kedisan Village ranged from 12% to 28% with the peak attack occurring in the fourth week of observation.
2. The average population of *P. xylostella* larvae in Sekaan Village ranges from 0.98 individuals/plant to 1.82 individuals/plant and the highest average population of *P. xylostella* larvae in Kedisan Village ranges from 0.7 individuals/plant to 1.66 individuals/plant. The highest population was found in the fourth observation (5 WAP) at both locations.
3. The level of parasitization of the parasitoid *D. semiclausum* in Sekaan Village ranges from 32% to 56% and the level of parasitization of the parasitoid *D. semiclausum* in Kedisan Village ranges from 24% to 48%. The highest peak of parasitization was found in the fourth observation (4 WAP).

ACKNOWLEDGMENT

The author would like to thank all parties who have helped carry out this research so that this research can be completed successfully.

REFERENCE

Badan Pusat Statistik. 2024. Vegetable Crop Production 2021-2023 in Indonesia. https://www.bps.go.id/id/statistics-table/2/NjEjMg==/produksi-tanaman-sayuran.html. Diakses Juni 2024.

Baehaki S.E. 2010. Evaluation of the Potential and Parasitoid Composition of White Rice Borer Eggs in Rice Plantations in Different Agroecosystems. Proceedings of the VI National Seminar of the Indonesian Entomology Association. 233- 249 Pg.

Dadang. 2006. Pest concepts and Population Dynamics. Workshop on castor oil pests and diseases (Jatropha curcas Linn). Bogor.

Gustiana, D. Cecep, H., Yati, S. 2019. Control Of *Plutella Xylostella* with Metarhizium Anisopliae in Reducing Damage Intensity and Maintaining Cabbage Results. Journal AGROSCRIPT. 1(1): 21-28.

Irawati, L. 2017. The Effect of Jarak Cina Rod (Jatropha Multifida Linn) as Botanical Pesticide for Plutella Xylostella Pest Controlan Mustard Plants (*Brassica juncea* L.). Biology. 6(6): 385-391.

Junaedi, E., Mohammad, Y., Hasriyanty. 2016. Parasitoids and it is Parasitisme on White Rice Stem Borer (*Scirpophaga innotata* WALKER) in Two Different Altitudes of Rice Fields (*Oryza sativa* L.) in District of Sigi. Journal Agrotekbis 4(3):280-287.

Kartina, Ferziana & Gunawan, I. 2015. The Level of Preference for *Plutella xylostella* and Grasshopper (*Locusta migratoria*) pests towards lowland flowering cabbage (*Brassica oleraceavar*. L.)

Journal of Sustainable Development Science
Vol. 6, No. 1, June 2024, pp. 30-35
e-ISSN: 2715-9140 **|** p-ISSN: 2722-919X

Plants Given Azolla Compost and NPK Fertilizer. Proceedings of the 2018 National Seminar on Agricultural Technology Development VII Polinela

Lestariningsih, S., Sofyadi, E., & Gunawan, T. 2020. Effectiveness of the Insecticide Emamectin Benzoate Against the Pest Plutella Xylostella L. and The Results of White Mustard Plants (*Brassica Pekinensis*) in the Field. Agroscience. 10(2).

Nurfajriani, F., Tarmizi., Ruths, S. 2022. The Attack Level of *Plutella xylostella* Pest on Cabbage (Brassica oleracea L.) with the Use of Protective Nets. Journal Ilmiah Mahasiswa AGROKOMPLEK. 1(1):21-28.

Pivnick, KA, JJ Blair, and GP Slater. 1994. Identification of olfactory cues used in hostplant finding by diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae). J. Chem.Ecol. 20: 1407 – 1427.

Sembiring, J & Johanna, M. 2023. Population and Intensity of *Plutella Xylostella* Linn. in Cabbage (*Brassica Oleracea* L.) Plant in Merauke District, Papua Province. Journal Sainsmat. 7(1): 1-8.

Susniahti, N., Tarkus, S., Sudarjat., Danar, D., Andhita, N. 2017. Reproduction, Fecundity and Period of Each Growth Phase of *Plutella xylostella* One Some Species of Crucifers. Journal Agrikultura. 28(1): 27-31.

Wati, H. D. 2022. Implementation of Integrated Pest Control (IPM) in Increasing the Income of Rice Farmer in Sindir Village, Lenteng District, Sumenep District. Journal Cemara. 19(2): 33-46.

Yanti, E. Susila, I.W., Yuliadi, A.K. 2014. The Diversity and Density of the Population Parasitoid who Associated with *Plutella xylostella* L. (Lepidoptera: Plutellidae) on Plantation Plants without and with Insecticide Application. Journal Agroekoteknologi Tropika. 3(1): 12-21.

.