

Parasitization of Parasitoids  
Diadegma semiclausum Hellen  
(Hymenoptera: Ichneumonidae)  
against Plutella xylostella (L)  
(Lepidoptera: Plutellidae) on  
Cabbage Plants in Rurukan  
Tomohon North Sulawesi

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# 1 Parasitization of Parasitoids *Diadegma semiclausum* Hellen (Hymenoptera: Ichneumonidae) against *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) on Cabbage Plants in Rurukan Tomohon North Sulawesi

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1  
**Abstract.** *Plutella xylostella* L. (Lepidoptera: Plutellidae) is the main pest that attacks cabbage plants. One of the pest control techniques *P. xylostella* is to use the natural enemies parasitoid *Diadegma semiclausum*. This study aims to find out the percentage of parasitoid parasitization rate *D. Semiclausum* against *P. xylostella*. This study was conducted on a cabbage area of 500 m<sup>2</sup>. Sampling of larvae and pupa *P. xylostella* is done by purposive sampling, which is a sample collected on plants affected by *P. xylostella* pests. Sampling is done on plants aged 21 dap, 35 dap and 49 dap (dap = days after planting). Samples were then bred and observed whether the imago coming out of the pupa was *P. xylostella* or parasitoid *D. Semiclausum*. The results showed the rate of parasitization of parasitoid *D. Semiclausum* ranged from 55% to 68% with an average parasitization of 62%.

Keywords: *Plutella xylostella*, cabbage, natural enemy, parasitoid, *Diadegma semiclausum*

## INTRODUCTION

*Plutella xylostella* (L.) (Lepidoptera: Plutellidae) or cabbage leaf caterpillar is a major pest of cabbage plants spread throughout the world [1]. This pest is widespread in Europe, America, Africa, Australia, New Zealand and Asia [2]. *P. xylostella* is a pest that is very damaging to plants, especially the Brassicaceae family. In Indonesia, it was reported that *P. xylostella* damages Brassicaceae plants, especially cabbage, mustard greens, cauliflower, pakchoi, lettuce, and caisin. This pest attacks the shoots and leaves of cabbage plants from seedling to harvesting. The part of the plant that it attacks is the leaf with symptoms of holes [3].

*P. xylostella* pest control was carried out both biologically and chemically. Biological control through integrated pest control (IPM). One of these control techniques is to take advantage of the presence of natural enemies. The use of natural enemies in the application of IPM has been proven to suppress the attack of plant-disturbing organisms. Naturally, natural enemies are always on agricultural land and play a role in controlling host and prey populations [4]. Natural enemies known to be associated with *P. xylostella* include the parasitoid *Diadegma semiclausum*. *D. semiclausum* makes *P. xylostella* as its host by laying its eggs on *P. xylostella* larvae. As a result, the growth of *P. xylostella* larvae becomes stunted and dies.

In North Sulawesi *D. semiclausum* was first released in 1990 in Tomohon and managed to spread, but due to the eruption of Mount Lokon in 1991 the presence of *D. semiclausum* has not been found. The second release of *D. semiclausum* in Tomohon was carried out in 1993 using the same parasitoid from Lembang, West Java. The results of the evaluation carried out in 1996 that the parasitization of *D. semiclausum* in Tomohon has reached 71-89% [1]. The presence of a well-established parasitoid *D. semiclausum* causes a reduction in *P. xylostella* pest attacks so that cabbage production increases every year. Cabbage agricultural production in North Sulawesi, especially in the Tomohon agricultural center, was reported to have increased production successively from 2014-2016, namely 44913 kw, 47900 kw, and 136300 kw. However, in 2017 there was a sharp decline in cabbage production, which

was only 45705 kw [5]. The presence of *P. xylostella* pest attack is the cause of the decline in cabbage production in Tomohon. The aim of this study was to obtain up-to-date data on the level of parasitoid parasitoid *D. semiclausum* on *P. xylostella* pests that attack cabbage plants.

## 6 MATERIALS AND METHODS

The research was carried out in Rurukan Tomohon from February to March 2021. Research tools and materials include jars, rubber bands, gloves, counters, tongs, azahi cloth, loops, scissors, brushes, vials, label paper, millimeter block paper, plastic bags, 70% alcohol, glue.

### 9 Sampling

Sampling of *P. xylostella* was carried out on a cabbage field of 500 m<sup>2</sup> with 10 beds. Sampling was done by purposive sampling, namely samples taken from plants that were attacked by pests. Sampling was carried out 3 times, starting when the plants were 21 DAP, 35 DAP, 49 DAP (days after planting). The samples collected were pupae which were placed in plastic containers, each containing 5 pupae. The container is then closed and labeled with the age of the plant, location and date of sampling.

### 8 Observation

Samples were taken to the laboratory to be maintained and observed until the pupae changed into imago. The imago that came out was collected and identified as referring to Kalshoven [2]. Then, the number of parasitoids was calculated by the parasitoid *D. semiclausum*. The calculation of the percentage of parasitization using the formula:

$$P = \frac{a}{b} \times 100 \%$$

A  
B

Description : P = Parasitization level of parasitoids (%)

a = Number of parasitized hosts

b = Number of observed hosts

## RESULT AND DISCUSSION

Found 1 type of parasitoid which is a solitary parasitoid endo-parasite because in 1 host pupa only 1 individual parasitoid was found. The identification results indicate that this parasitoid belongs to the Order Hymenoptera, Family Ichneumonidae, and Genus Diadegma and species *D. semiclausum*. The body of the female imago is blackish brown and has yellow stripes on the legs. On the front of the abdomen is blackish but the back is yellowish green. The ovipositor is elongated resembling a "tail". The male imago is blackish brown; while the legs are brown. The level of parasitoid parasitization of *D. semiclausum* against *P. xylostella* in each plant bed was different in percentage (table 1).

3  
TABLE 1. Percentage of parasitization of *D. semiclausum* to *P. xylostella* in Cabbage Plants in Rurukan Tomohon

Time	Bed 1			Bed 2			Bed 3			Bed 4			Bed 5		
	I	P	%	I	P	%	I	P	%	I	P	%	I	P	%
21	5	2	40%	4	1	25%	2	0	0%	5	4	80%	3	3	100%
35	7	4	57%	4	2	50%	5	5	100%	8	4	50%	6	2	33%
49	4	4	100%	6	4	67%	7	6	86%	5	3	60%	2	0	0%
Time	Bed 6			Bed 7			Bed 8			Bed 9			Bed 10		
	I	P	%	I	P	%	I	P	%	I	P	%	I	P	%
21	3	1	33%	6	2	33%	4	3	75%	6	5	83%	4	3	75%
35	5	4	80%	4	4	100%	5	3	60%	6	5	83%	6	4	67%

49    7    5    71%    7    3    43%    5    1    20%    5    3    60%    3    3    100%

Description : I = host; P = parasitoid

Table 1 shows the percentage of parasitoid parasitization found in Rurukan Tomohon at each sampling time ranging from 55% to 68%, with the overall average parasitization in Table 2 of 62%. This figure shows a fluctuating level of parasitization of *D. semiclausum* compared to previous research reports. In 2006 the parasitization rate of *D. semiclausum* in Rurukan Tomohon was 83.15% in the application of IPM and 70.82% in the application of Non IPM [6]. Meanwhile, in 2015 the parasitization rate of *D. semiclausum* in Rurukan Tomohon was 82.01% [7]. The parasitization rate found in Rurukan Tomohon is still higher than that found in other areas such as Donggala, Central Sulawesi, which is 22.2% [8]

**TABLE 2.** Average of Parasitization Percentage of *D. semiclausum* to *P. xylostella* in Cabbage Plants in Rurukan Tomohon

Time	Average % Parasitization
21	55%
35	68%
49	61%
<b>Average</b>	<b>62%</b>

The existence of fluctuations in the level of parasitization indicates the population dynamics that occur between the host and the parasitoid. Population dynamics that occur show the interaction between the host and the parasitoid that can cause one or both of them to survive or not. Survival of the parasitoid may depend on the dose of how often the host is attacked, or on the size of the clutch size in the parasitoid [9]. Clutch size in parasitoid can be defined as the number of eggs deposited on a host in a single oviposition bout. The decline in host quantity may also benefit the parasitoids due to weakened host defense mechanisms. In addition, like insects in general, adult parasitoids are also attacked by predators in a broad spectrum that can affect the population [10]. Excessive use of insecticides can also result in the death of natural enemies in addition to environmental pollution [11]. The presence of parasitoids as natural enemies is important to maintain the biological balance in agricultural ecosystems because they can suppress the development of pests themselves.

## CONCLUSION

The average percentage of parasitoid level of parasitoid *D. semiclausum* against *P. xylostella* at each sampling time ranged from 55% to 68% with an overall average percentage of 62%. A high level of parasitization indicates that the presence of parasitoids has been established on an agricultural land so that it can inhibit the development of pests.

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