BirEx JOURNAL
Budapest International Research in Exact Sciences
Medical, Biological, Argiculture, Engineering
Science and other related areas
e-ISSN : 2655-7827
p-ISSN : 2655-7835
http://www.bircu-journal.com/index.php/birex

Development of the Parasitoid Trichogramma Sp. And It's Parasitization Capability Population Pest Spodotera Furgiperda In Plantation Corn Please, Tomohon City

Maxi Lengkong[1], Moulwy F. Dien[2], Meisye H. B. Paruntu[3]
[1, 2,3]*Faculty of Agriculture, Sam Ratulangi University Manado*

Abstract: *Spodoptera frugiperda is a new pest that entered Indonesia around 2018 and is the primary pest that damages young corn plants and causes them to experience growth problems. It is known that there is a natural enemy, namely the parasitoid Trichogramma sp., which can attack S. frugiperda eggs. The research objectives were to 1) determine the development and multiplication of Trichogramma sp., which is bred on an alternative host of Corcyra cephalonica eggs in the Laboratory, and 2) the percentage of parasitization of the parasitoid Trichogramma sp. on the pest population of S. frugiperda on corn plants in the Field. The research method can be carried out by developing and multiplying the parasitoid Trichogramma sp. in the Laboratory using a previously cultured population of C. cephalonica eggs as a host. Observation of the life cycle of Trichogramm sp. Since the egg is laid on the host's egg, the larval and pupal stages of development until they emerge into adult insects continue to be carried out daily so that the shape and time of development can be known. Parasitization observation experiments were carried out using the technique of releasing Trichogramm a sp parasitoid populations. Results of laboratory multiplication of the egg stage population of S. frugiperda in the Field in corn plantations. The percentage of parasitoid parasitization of the S. frugiperda egg population can be determined by showing symptoms. Results showed that the multiplication of the egg parasitoid Trichogramma sp. with alternative host C. cephalonica can be done in the Laboratory. Biological development in the form of the life cycle of the parasitoid Trichogramma sp. can be known based on observations, namely the egg stage is around 14-15 hours, the first instar larva stage is 22 hours, the second instar is 24 hours, the third instar is 25 hours, the fourth instar is 26 hours, the pupa stage is 28 hours, the lifespan of adult female insects is 10-12 days while the male 10-11 days. The percentage of parasitization of Parasitoid Trichogramma sp. in The population of the S. frugiperda pest egg group in the Field was relatively high, ranging from 68.5 – 87.3 per cent with an average of 76.5 per cent.*
Keywords: *Parasitoid, Trichogramma sp., Spodoptera frugiperda, Corn Plants*

I. Introduction

Currently, pest attacks on the growth of corn plants are worrying because the damage they cause can cause plants to experience growth delays. There is a new invasive pest, Spodoptera frugiperda, which attacks corn plants in North Sulawesi province and has caused severe damage to the growth of corn plants cultivated by farmers. Efforts to control pests carried out chemically have yet to provide good results because S. frugiperda is insect-resistant to insecticides.

The developing control method combines various pest control methods to reduce the target pest population below the economic threshold. According to Kasumbogo (2006), biological control is a clever method of exploiting the potential of natural enemies of insect pests. This control is very effective because the control technique exploits potential natural enemies. Biological control efforts using the parasitoid Trichogramma sp. have been widely developed, with parasitization capabilities reaching 80%. This method must be supported by

preparations to develop parasitoid populations in the Laboratory, and it can be released in the Field in corn crop areas.

The problem is that the attack of the S. frugiperda pest on corn plantation areas in the corn development area of North Sulawesi Province has been very detrimental because farmers depend on the use of pretty expensive insecticides. If not sprayed with insecticide, young plants will be seriously damaged. To find a solution, you must choose a form of control that is effective, cheap and environmentally friendly. The control method chosen is to utilize potential natural enemies, such as the parasitoid Trichogramma sp., which can suppress the population of S. frigider. Using biological control methods to suppress the pest population is an innovative and environmentally friendly choice.

Research purposes

This research aims to find out:

a. Life cycle and biology of Trichogramma sp., which lives on the alternative host Corcyra cephalonica in the laboratory
b. Parasitization Ability of Trichogramma sp. on the population of the pest S. frugiperda in corn crop areas in the Field

II. Research Methods

2.1. Place and time of research

This research will be carried out at 2 research sites, namely: Research on the breeding and maintenance of the parasitoid Trichogramm sp. in the BLPTPH Kalasey laboratory, Minahasa Regency and research on the release of Trichogramma parasitoids in corn plantations, Matani sub-district, Tomohon City. The study will be conducted in Selma for 8 months, from April to November 2021.

2.2 Materials and tools

The materials used are rice bran, Corcyra cephalonica insects, parasitoid Trichogramma sp., insect pest S. frugiperda, corn plants, vials, honey solution, water, glue, 70% alcohol, and sugar. In contrast, the tools used are tweezers, insect dissection, ATM, binocular microscope, camera, paper, marker, adhesive, gallows, loupe, maintenance box, observation box, gauze, plastic cup, raffia rope, rubber, scissors, machete, aspirator, Baking pan/maintenance container.

2.3 Research Implementation

The research was carried out in 2 forms: 1) laboratory research, including maintenance and breeding activities for C. cephalonica insects by selecting adult insects in rearing boxes to enter the mating period. Fine bran is provided as a laying medium and placed in the experimental container. The C. cephalonica egg population will be collected at the same age to serve as a host for the parasitoid Trichogramma sp. in the maintenance box. This maintenance method will continue so suppliers can observe Parasitoids' life cycle and biology. Observation of development time and measurement of the form of Parasitoids' pre-adult stage (egg-pupa) will be carried out in several repetitions. The size and shape of adult parasitoids with different sexes will continue to be observed. The availability of populations of Trichogramma sp. for release in the Field will be carried out until there is a sufficient population. 2) Field research is an observation of the parasitization ability of the parasitoid Trichogramma sp., which is released in vials in specific quantities. The placement of the vials in the Field will be adjusted to the area of the corn plants at the age of 2-3 weeks after

planting because, at that time, the population of S. frugiperda eggs is high. C. cephalonica eggs infected by the parasitoid Trichogramma sp. are ready to leave the host's body; on that occasion, the parasitization process will occur. The percentage of attacks on the number of S. frugiperda pest eggs can be calculated by observing groups of S. frugiperda eggs placed at the bottom of the leaves. If they have changed colour slightly black, the eggs have been parasitized. The release of parasitoids against insect pest populations will be carried out at 4 corn planting sites to help obtain an average value of parasitization percentage.

III. Results and Discussion

3.1 Development of the Parasitoid Trichogramma sp on Corcyra cephalonica Hosts

Based on the results of rearing the parasitoid *Trichogramma* sp on alternative host eggs *of C. cephalonica* in the Laboratory, observations of the biological development or life cycle of the parasitoid *Trichogramma* sp. from the egg, larva, pupa stage on the *C. cephalonica egg host* and until it becomes an adult insect, both male and female, are as follows:

a. Trichogramma sp. Egg Stage.

When *C. cephalonica eggs* are infected by the parasitoid *Trichogramma* sp., the shape and size of the parasitoid eggs are difficult to observe, so observations are only made by looking at changes in the colour of the *C. cephalonica host eggs*. Observation of the egg stages *of Trichogramma* sp. only about 14-15 hours since it was laid (Figure 4). During the development of parasitoid eggs on host eggs, it was seen that there was a change in the colour of C. cephalonica eggs, which turned slightly creamy white (Figure 5).

Figure 1. *Parasitoid Trichogramma sp. The female is temporarily laying eggs on C. cephalonica host eggs*

Figure 2. *View of C. cephalonica eggs that have just been parasitized by Trichogramma sp. on the first day*

b. Larval Stage *of Trichogramma* sp.

Morphological observations on the development of the larval stages *of Trichogramma* sp. It is difficult to do, so observations can only be carried out regarding the length of time the change in colour of *C. cephalonica* host eggs occurs. Observation of the first instar larval stage for 22 hours, which will then enter the second instar larval stage. The development of the first instar larvae shows a change in the colour of the host egg, which changes slightly to grey (Figure 6).

Figure 3. *C. cephalonica eggs parasitized by Trichogramma sp. On the second day*

Entering the second instar larval stage, the colour of the host egg changes to greyish cream and this colour change occurs approximately 24 hours after the change in the first instar (see Figure 7).

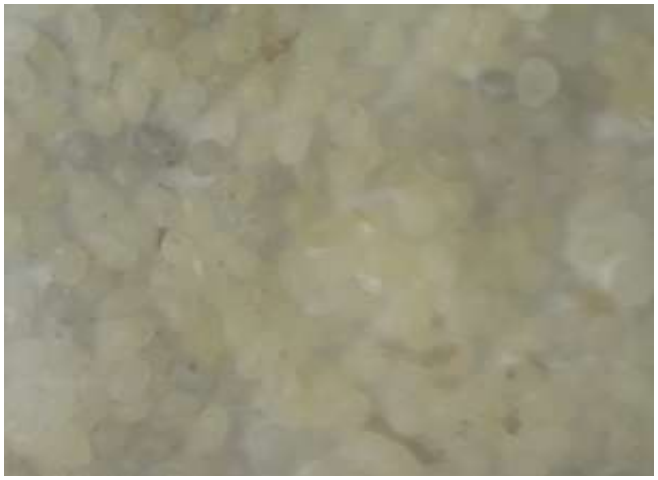

Figure 4. C. cephalonica eggs parasitized by Trichogramma sp.
On the third day

Observations on developing the third instar larval stage of the parasitoid *Trichogramm* a sp. In the *C. cephalonica* host eggs, it can be seen that fundamental colour changes are starting to occur where it appears that the colour of the host eggs has turned greyish black (Figure 8). The time required for this colour change to occur is around 25 hours in the third instar larval stage.

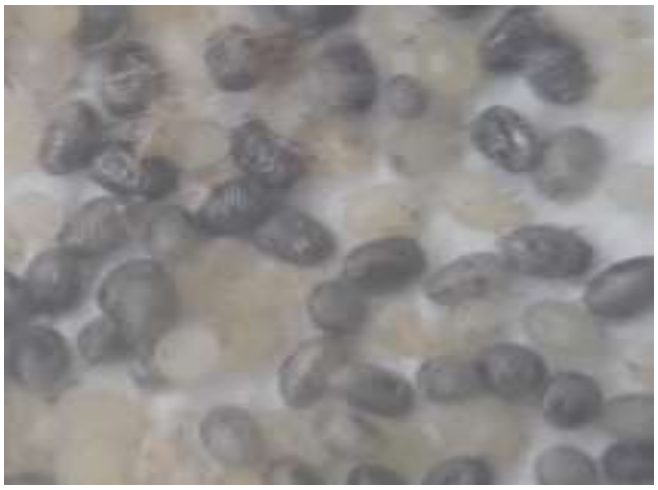

Figure 5. *C. cephalonica eggs parasitized by Trichogramma sp.*
On the fourth day

After further development of the larval stage of the parasitoid Trichogramma sp, the colour changes to a blackish colour on the C. cephalonica egg host. At a certain point, organisms can be seen living on the host egg. This development is the fourth instar larval stage or the final development in the larval stage, which was observed to occur around 26 hours (Figure 9).

Figure 6. *C. cephalonica eggs parasitized by Trichogramma sp. On the fifth day*

c. Pupal stage *of Trichogramma* sp.

Biological development or life cycle of the parasitoid *Trichogramma* sp. In the host egg, *C. cephalonica* will follow the development of complete metamorphosis, namely development from the egg and larval stages, and enter the pupal stage before becoming an adult insect. The host eggshell's colour changes due to the development of the last instar larval life stage and entering the stage. The observations showed that all the host eggs had changed colour to black, and there were points of life inside the host eggs. The development time required is 28 hours before emerging into an adult parasitoid (Figure 10).

Figure 7. *C. cephalonica eggs parasitized by Trichogramma sp. On the sixth day, it enters the pupal stage.*

d. Adult Stage *of Trichogramma* sp.

The C. cephalonica host egg for 7 days, and the adult parasitoid Trichogramma sp will emerge (Figure 11). A sign that an adult parasitoid insect will hatch from a host egg is that the host egg will turn pitch black, and the parasitoid will emerge by making a hole so that its body will come out. Adult parasitoids can be maintained by feeding them fresh honey so that

female parasitoids can live for 10-12 days while males live for 10-11 days (Figure 12). The female parasitoid will mate 1 day after emerging from the host's egg, and the female can lay eggs after the next 1-2 days. The female parasitoid can lay eggs on the host's eggs solitary and as many as 20 times. After 5 days of parasitization, the female parasitoid will die. Based on observations, unmated female parasitoids can lay eggs on hosts as a form of their ability to continue generations by parthenogenesis.

Figure 8. *Parasitoid Trichogramma sp. emerging adults from C. cephalonica host eggs*

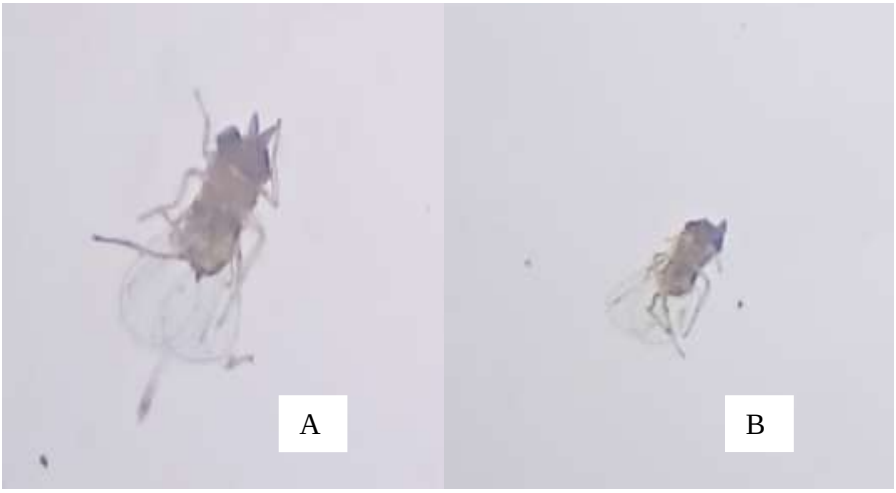

Figure 9. *Adult Trichogramma parasitoid (A. Female, B. Male)*

3.2 Parasitization Percentage of *Trichogramma* sp. on *S. frugiferda hosts* in Field

Field release of the parasitoid *Trichogramma* sp. 6 days old after emerging from *C. cephalonica eggs*. In the Field, it was seen that the adult parasitoid *Trichogramma* sp came out the day after being released. Groups of infected *S. frugiperda* eggs occurred on the 4th day after release, and the infected eggs would hatch on the 8th. The percentage of T *richogramma* sp parasitization at each observation location can be seen in the following table.

Table 1. Percentage of Parasitization *of Trichogramma* sp. on Host *S. Frugiperda* in the Field after Release

Location/point Release	Number of Eggs/group S . *frugiperda*	Amount Parasitized Eggs *of Trichogramma* sp.	Parasitization Percentage (%)
1	87	76	87.3
	64	51	79.6
	121	96	79.3
	75	58	79.3
	78	62	80.7
2	92	74	80.4
	54	37	68.5
	141	101	71.6
	88	64	72.7
	64	52	81.2
3	52	40	76.9
	77	61	79.2
	102	82	80.3
	85	66	77.6
	76	59	77.6
4	48	38	79.2
	52	41	78.8
	74	59	79.7
	62	45	72.5
	85	71	83.5
5	60	52	86.6
	87	69	79.3
	116	97	83.6
	64	51	79.6
	50	34	68.0
Range	**48-141**	**30-96**	**68.5-87.3**

Average	**76.5**

From Table 1, above, it can be seen that parasitization of the parasitoid *Trichogramma* sp. can parasitize the host group of *S. frugiperda eggs* in the Field. *The S. frugiperda* pest attacks young corn plants around 3 weeks after planting. Egg group *Trichogramma* sp. can be found under the surface of corn plant leaves and, after a few days, will hatch into larvae and damage the leaves of corn plants (Figure 13). The effectiveness of parasitization is achieved by releasing parasitoids in the Field by attaching eggs to vials. Then, the group of host eggs is infected with adult parasitoids that have mated and are ready to lay eggs in a parasitization process. Groups of host eggs that have been parasitized in the Laboratory after 6 days of age will be released in the corn planting area 3 weeks after planting. Groups of *S. frugiperda* eggs in the Field parasitized by *Trichogramma* sp. will turn black; this indicates that the pest egg group has been parasitized (Figure 14).

Figure 10. *A group of S. frugiperda eggs that have just been laid on a leaf are visible Corn (3 weeks after planting) with parts that have not been parasitized*

Figure 11. *View of a group of S. frugiperda eggs parasitized by egg parasitoidsTrichogramma sp. in the Field*

The research results on the parasitoid *Trichogramma* sp.'s percentage of parasitization at 5 release points showed that all groups of eggs experienced parasitization ranging from 68.5 – 87.3 per cent with an average of 76.5 per cent. The results of this research can be said to be successful because using natural agents to control the insect pest *S. frugiperda* with the

egg parasitoid Trichogramma sp. is a good and effective control process. After all, insect pest populations can be suppressed before they damage corn plants. According to Kasumbogo (2006) and Nonci (2019), the use of parasitoids in the biological control of pest insect populations must have a parasitization capacity of above 70 per cent so that control effectiveness can continue to be developed. This control method is natural and environmentally friendly because it does not use toxic components or contain chemicals that can contaminate agricultural products.

IV. Conclusion

1. Propagation of the egg parasitoid Trichogramma sp. with alternative host C. cephalonica can be done in the Laboratory. Biological development in the form of the life cycle of the parasitoid Trichogramma sp. can be known based on observations namely the egg stage is around 14-15 hours; the 1st instar larva stage is 22 hours, the 2nd instar is 24 hours, the 3rd instar is 25 hours, the 4th instar is 26 hours, the pupa stage is 28 hours, the lifespan of adult female insects is 10-12 days while the male 10-11 days
2. Percentage of parasitization of the Parasitoid Trichogramma sp. The population of the S. frugiperda pest egg group in the Field was relatively high, ranging from 68.5 – 87.3 per cent with an average of 76.5 per cent.

References

Achmad Djunaedy. 2009. Biopesticides as Environmentally Friendly Controls for Plant Pest Organisms (OPT). UNIJOYO Faculty of Agriculture Journal.pdf.

Anonymous, 2020. Getting to know the Parasitoid Trichogramma sp. Accessed on 5 February 2021. http://cybex.pertanian.go.id/ mobile/article/80263/Mengenal-Trichogramma-Sp %20inang%20bagi%20trichogramma

Edy Junaidi, M. Yunus and Hasriyanty, 2016. Types and Levels of Parasitoid Parasitoid Eggs of the White Rice Stem Borer (Scirpophaga inn otata WALKER) in Rice (Oryza sativa L.) Plantations at Two Different Altitudes in Sigi Regency. Ej.Agrotechbis 4(3):280.ISSN:2338-3011

Kasumbogo, U., 2006. Introduction to Integrated Pest Management. UGM Press, Yogyakarta.

Ministry of Agriculture (2019). Spodoptera frugiperda as a New Pest. Directorate General of Plantations. Ministry of Agriculture. Accessed http://perlindungan.ditjenbun.pertanian.go.id/web/page/title /319980/waspada-spodoptera-frugiperda?post_type=information Date 26/01/2021

Maharani Y, Dewi V. K, Tri Puspasari L, Rizkie L, Hidayat Y and Dono, D. 2019. Cases of Fall Army Worm Spodoptera frugiperda JE Smith (Lepidoptera: Noctuidae) Attack on Maize in Bandung, Garut and Sumedang District, West Java. Cropsaver Journal 2019, 2(1): 38-46.

Nidrawati, et al. (2019). Identification of New Pests and Natural Enemies on Corn Plants in Sidomulyo Village, Seluma District, Bengkulu. Faculty of Agriculture, Bengkulu University (2019).

Ni Nyoman AA. 2012. Diversity of White Rice Stem Borer Egg Parasitoids (Scirpophaga innotata Wlk.) (Lepidoptera: Pyralidae) in Rice Plantations in Central Sulawesi Province. Thesis: Agrotechnology Study Program. Faculty of Agriculture. Tadulako University. Hammer.

Nonci, N, Sulistyo, M and Guntur. K (2019). Introduction of Fall armyworm (Spodoptera Frugiperda JE Smith), New Pest on Corn Crops in Indonesia. Cereal Plant Research

Institute.
Nurindah and Indrayani. 2002. Natural Enemies of Cotton Insects. Toddler Monograph. Book 2. Tobacco and Fiber Plant Research Institute:
Shylesha AN, SK Jalali, A Gupta, R Varshney, T Venkatesan, P Shetty, R Ojha, PC Ganiger , O Navik, K Subaharan, N Bakthavatsalam, CR Ballal. 2018. Studies on new invasive pest Spodoptera frugiperda (JE Smith) (Lepidoptera: Noctuidae) and its natural enemies. Journal of Biological Control. 32(3), DOI: 10.18311/jbc/2018/21707.
Sopialena, 2018. Biological Control by Empowering Microbial Potential. Mulawarman University Press, Samarinda.