



## THE PREFERENCE OF PARASITOID *Telenomus remus* ON *Spodoptera litura* EGGS AS AN ALTERNATIVE HOST IN ITS PROPAGATION

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**Abstract.** *Spodoptera frugiperda* is an invasive pest which caused plant shoots damage on corn plants. Some control techniques have been applied to control this insect, but the population growth and development of this pest was massively spread in Indonesia. One of the effective indigenous natural enemies to control *S. frugiperda* was *Telenomus remus*. Parasitoid *T. remus* could naturally parasitized the egg of *S. frugiperda* at about 85%, thus this parasitoid was potential to be used as a biological agent. The rearing method of parasitoid *T. remus* still relies on the use of native host, *S. frugiperda*, but the larvae of *S. frugiperda* was cannibalism. Regarding of this insect behaviour, it should be considered to use this insect as a rearing host, thus the alternative host was needed. One of the alternative hosts is *Spodoptera litura*. This research aimed to test the suitability of *S. litura* eggs as an alternative host of *T. remus*. The research conducted by test the parasitization level of *T. remus* on various aged of *S. litura* eggs (1, 2, and 3 days aged) and 1-aged day eggs of *S. frugiperda* as the control. Every treatment was repeated seven times. Data were analysed by calculating the level of parasitization of *T. remus* on *S. litura* and *S. frugiperda* eggs. Results showed that the three ages of *S. litura* eggs were not parasitized by *T. remus*, while 50% of *S. frugiperda* eggs were parasitized.

**Keywords:** parasitoid, preference, *Spodoptera frugiperda*, *Spodoptera litura*, *Telenomus remus*

### 1. Introduction

Corn cultivation is unrestrained by the pest attack and one of the key pests on corn nowadays is *Spodoptera frugiperda*. This insect causes detrimental loss ranging from 8.3 to 20.6 million tons per year in 12 corn producing countries [1]. The pest infestation was reported in more than 30 countries [2]. *S. frugiperda* is a polyphagous larva and could attack 353 plant species, consisting of 76 families [3]. This insect was firstly discovered in Central and West Africa in early 2016 [4], then the distribution of this pest was reported in India [5–7], Bangladesh, Thailand, Myanmar, China and Sri Lanka in 2018 [8–10].

In Indonesia, *S. frugiperda* was firstly reported in March 2019, in West Pasaman Regency, West Sumatra. This insect damage on corn plants with a heavy level of attack, with a larval population ranging from 2-10 larvae/plant. In Lampung, larvae were reported to damage all parts of the corn plant (roots, leaves, male flowers, female flowers and cobs) [11]. Trisyono et al. (2019) reported an explosion of this pest in Sumatra. *S. frugiperda* larvae cause up to 100% damage on young corn plants around two weeks old. According to the findings of [13], the pest *S. frugiperda* was discovered in some corn growing areas in Banyumas Regency. According to the identification results based on the symptoms of attack and the morphological characteristics of this larva, the *S. frugiperda* pest is widely spread to the Banyumas Regency. *S. frugiperda*



population in Banyumas ranged from 0.24 to 1.26 larvae/plant, with the attack intensity ranging from 0.34 to 62.2%.

The absence of natural enemies that co-evolved with the pests is one of the reasons of invasive pest epidemics. Biological control is an effective technique for reestablishing balance in invasive pest control [14]. *Telenomus remus* was reported as an egg parasitoid of *S. frugiperda*. The parasitoid *T. remus* needs an alternative host which more acceptable and easier to reproduce in order to spread as a biological agent, because *S. frugiperda* larvae are cannibalistic [15,16]. The rearing method of *T. remus* on *S. frugiperda* egg was not practical because it must be placed separately in order to propagate *S. frugiperda* larvae as *T. remus* hosts. To acquire viable alternative hosts, testing of alternative hosts is required. This study aimed to test three different ages of *S. litura* eggs as an alternate host for *T. remus* mass propagation.

## 2. Methods

### 2.1. *Spodoptera frugiperda* and *S. litura* egg preparation

Larvae of *S. frugiperda* and *S. litura* were collected from corn plantations and fed with baby corn until they pupated. The pupae were placed on a rearing cage covered with mesh walls (40 cm x 40 cm x 60 cm) to mate the insects and lay eggs. Corn plants were planted inside the cage in polybags. A 10% honey water solution (v/v) provided on the mating cage as a feed for *S. frugiperda* and *S. litura* adults. After the eggs laid, *S. frugiperda* and *S. litura* eggs were removed from corn plants in the cage and replaced with new plants. The egg mass of 24, 48, and 72 hours old of *S. frugiperda* and *S. litura* eggs were used for preference test.

### 2.2. Preference of *T. remus* on *S. litura* and *S. frugiperda* eggs

Corn plants containing *Spodoptera frugiperda* and *S. litura* eggs were placed in corn plantations that had not been sprayed with insecticides, and previous exploratory experiments reported the presence of the parasitoid *T. remus*. Corn plants were taken after 24 hours from the field and transported to the laboratory. The egg mass from the corn plant were taken and put into a test tube. The egg mass was checked every day. If any caterpillars hatch, brush them immediately with a soft brush. Larvae often appear between the third and fifth days, while the parasitoid would appear on 10-12 days.

#### Data analysis

The parasitoid was identified using insect determination keys. The level of parasitization was calculated by the formula:

$$P = \frac{A}{A+B} \times 100\%$$

P : Parasitization

A : Number of parasitoid eggs

B : Number of unparasitized eggs

## 3. Results And Discussion

Parasitoids parasitize their hosts in several of stages i.e. finding the host's habitat, locating the host, identifying the host, and eventually accepting the host. Parasitoid find their hosts used chemical and/or physical clues. Results revealed that *T. remus* only parasite on *S. frugiperda* eggs of 24-hours-old, while *S. litura* egg was not parasitized at all. The mean level of parasitization of *T. remus* on *S. frugiperda* was 50%. This research showed that *T. remus* preferred to parasitize on 24-hours-old of *S. frugiperda* eggs as a main host, while rejecting 48- and 72-hours-old of *S. frugiperda* eggs and *S. litura* in all ages of egg (Table 1).

**Table 1.** Level of *T. remus* parasitization on *S. frugiperda* and *S. litura* eggs of 24, 48 and 72-hours age (%)

Egg masses	Eggs age					
	Eggs of <i>S. frugiperda</i>			Eggs of <i>S. litura</i>		
	24 h	48 h	72 h	24 h	48 h	72 h
1	0	0	0	0	0	0
2	100	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	100	0	0	0	0	0
8	100	0	0	0	0	0
9	100	0	0	0	0	0
10	100	0	0	0	0	0
<b>Average</b>	<b>50</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

During the larval stage, parasitoid insects rely solely on their hosts, thus the host quality has a significant influence on offspring fitness and determines the occurrence of oviposition by female parasitoids. One of the most important elements that influence the ability of a parasitoid to parasitize the host is the morphology of the host. *S. frugiperda* and *S. litura* cover their eggs with their wing scales after laying eggs as a physical barrier for egg parasitoids to parasitize their hosts. Because of the scales of *S. litura* eggs were thicker than *S. frugiperda* eggs, the *T. remus* parasitoid more preferred to parasitize *S. frugiperda* eggs as its host. The thickness of the scales could protect the eggs and prevent parasitoids from laying their eggs. Besides that, another affected factors on the parasitization were the host quality which depend on host species, host size, and host age. External semiochemical cues include the chemical compound from the covering egg structure, the form and/or color of the egg, and the content or quantity of the egg [17]. Female parasitoids typically more prefer on young eggs over old eggs, and also the parasitoid was develop faster on young eggs than on old eggs [18].

#### 4. Conclusion

Based on the findings and discussions, it could be inferred that *S. litura* eggs are not suitable as propagation host of *T. remus*. Parasitoid *T. remus* preferred to choose 24-hours-old of *S. frugiperda* eggs as its host with the level of parasitization of 50%.

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