The Evaluation of Pheromone Traps Glue Formula for Monitoring of *Spodoptera exigua* Hubner (Lepidoptera Noctuidae) in Shallot Fields

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Abstract. *Spodoptera exigua* is considered as one of the most important pests in shallot plant. The objective of the research was to evaluate activity of synthetic pheromone which diluted in glue (glue formulation) for monitoring the *Spodoptera exigua* moth populations. This research was conducted from November until December 2021 in Tanah Datar, Bukittinggi Regency, West Sumatera. A sex pheromone glue formula was spread on yellow board trap and applied on shallot at 14 days after planting. This research was done using a randomized design, consist of sex pheromone glue formula treatments, with different amount of active components of adhesive glue (in 100 mL) i.e. A (50 μg), B (100 μg), C (200 μg), D (300 μg), and one trap without sex pheromone as control (E). Each treatment was repeated five times. The observation was made by counting the number of moths caught in the sex pheromone trap. The results showed that an effective sex pheromone formula to attract male moths was the B formula. The B (100 μg) formula can catch more male moths higher than that of other formulas and recommended further to utilize for monitoring of *S. exigua.*

Keywords: Monitoring · Pheromone Trap · Shallot · *Spodoptera exigua*

1 Introduction

Shallot (Allium ascalonicum L.) is an important and popular vegetable grown in Indonesia being used as the main ingredients in cooking spices. One of the constraints that can reduce the production of shallots is insect pests infestation. In Indonesia, the Spodoptera exigua Hubner (Lepidoptera: Noctuidae), also known as the beet armyworm, is reported as the most important pest insect causing low productivity of shallots.. Low shallot productivity caused by S. exigua. Was reported in several regions in Indonesia, including Brebes and Cirebon [1], Bantul [2] and Kulon Progo [3].

T. D. Larasati et al. (Eds.): ICTROPS 2022, ABSR 31, pp. 418–422, 2023.
https://doi.org/10.2991/978-94-6463-180-7_44

The total generation time of S. exigua on shallots was about 23 days, consisting of several stages i.e. incubation period about 3 days, larval period about 9–14 days, pupal period about 8 days, and adult longevity about 3–10 days. During the larval growth stages (5 instars), they grow larger and darker [4], and the larval stage of S. exigua has high feeding activity by eating all parts of the leaf. The larvae of S. exigua feed on the undersurface of leaves and then the upper epidermis leave, so that the leaves seems transparent, droop and dry up [5], and further causing crop failure and low productivity.

Generally, farmers used synthetic insecticides to minimize losses and control S. exigua. During shallots cultivation, farmers usualy controlled S.exigua insects by the application of insecticides, with an interval of three times a week [6]. Excessive pesticide usage not only leads to pest resistance but also has a negative impact on the environment and human health, hence the risks can be avoided by reducing pesticide application. The development of ecologically friendly pest management as an alternative control techniques is necessary to decrease the negative effect of using synthetic pesticides to control pest insects. Integrated Pest Management (IPM) practices can be used for effective pest control that aims to reduce pesticide application [7]. Using pheromone technology like sex pheromone traps is the the method of choise to control pest insect which consider as more cheap and safe to the environment. [2, 8]. Based on the above mention, our study aimed to evaluate four different sex pheromone glue formulas on the capture of S exigua male adults..

2 Methods

The research was conducted from November until December 2021 in the shallot field cultivation in Tanah Datar, Bukittinggi, West Sumatera. This research uses a Randomized Design with five treatments. Four sex pheromone glue formulas were used for the research, with different amounts of active components (Z,E-9,12-tetra decadienyl acetate and Z-9-tetradecenol) in 100 mL of adhesive glue i.e. A (50 μg), B (100 μg), C (200 μg), D (300 μg), and one trap without sex pheromone as control (E). Each treatment was repeated five times. A sex pheromone was spread on the yellow board trap. The yellow sticky board trap is tied to a bamboo stick with a size of 150 cm x 5 cm. The traps were installed in the field at a distance of 40 m between the traps and total of sample was 25 traps. The yellow sticky board was changed every 14 days. The observation parameter was the number of S. exigua male moths caught. Male moth catches were recorded at weekly intervals.

3 Results and Discussion

The results showed that the average cumulative number of *S. exigua* moths caught was highly significantly different between treatments including control (P-value < 0.05). The observations were made four times from November until December 2021 in Tanah Datar, Bukit Tinggi Regency, West Sumatra. The average cumulative number of moths caught in the control treatment has a significant difference compare with the other treatments (A, B, C, and D sex pheromone glue formula). In the control treatment, no moths were caught in the trap, while in the other treatments the average number of moths caught

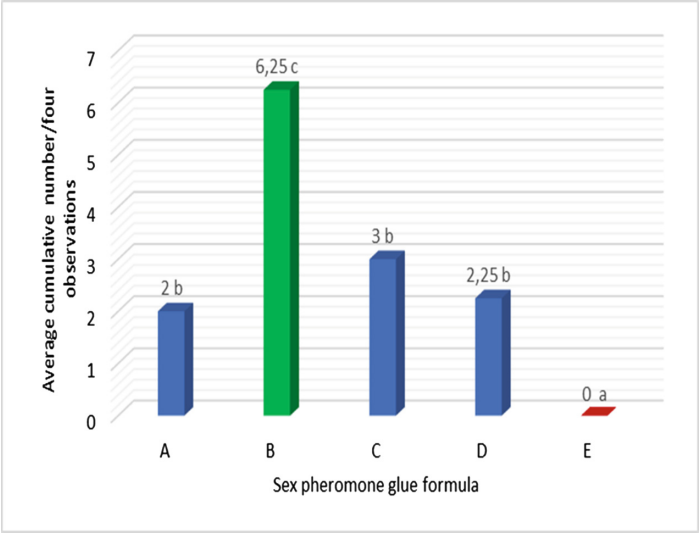

Fig. 1. Effect of sex pheromone glue formula on *S. exigua* moth catches in shallot

were 2 to 6.25 moths/trap (Fig. 1). This showed that sex pheromone compounds are more effective to catch *S. exigua* male moths than yellow sticky traps without sex pheromone compounds.

Spodoptera exigua (Lepidoptera: Noctuidae) is one of the noctuid moths, that moths are mostly more active at night than during the day. Family Noctuidae is mostly nocturnal in habit, and most moths are attracted to lights at night [9]. As a nocturnal insect, the female moth S. exigua releases sex pheromone compounds into the air to attract the male moth for copulation at night. Chemicals released by females into the air to attract conspecific males for mating are called sex pheromones. Males follow the sex pheromone upwind to locate and mate with the female [10]. The result showed there were no moths trapped on control treatment. This indicated the male moths especially at night to attracted sex pheromone compounds compared to the yellow color (control).

The average cumulative number of a moth caught in the sex pheromone glue of A, C, D, and E (control) formula was significantly lower than B formula (Fig. 1). B formula can average the number of moths caught until 6.25 male moths higher than the three other formulas. Differences concentration of sex pheromone compounds can affect the number of moths trapped. However, the higher concentration of sex pheromone compounds did not affect the number of moth catches, because the composition of the sex pheromone compounds released was very specific for each species. Sex pheromone compounds released by females consist of 2 or more compounds. The eleven compounds associated with sex attractant activity were isolated from female Spodoptera exigua [11], The feasibility of synthetic sex pheromone for the control of the beet armyworm, Spodoptera exigua, in the field was a 7:3 mixture of (Z, E)-9, 12-tetradecadienyl acetate and (Z)-9-tetradecen-1-ol [12]. Sex pheromone for S. exigua Indonesian population consist of (Z, E)-9, 12-tetradecadienyl acetate and (Z)-9-tetradecen-1-ol with ratio 90:10 [13]. Therefore, the formulation of sex pheromones must have the right ratio between

compounds. The right ratio between compounds is useful to determine the reasons behind the success and failure of various formulations. The results showed that an effective sex pheromone formula to attract male moths of *S. exigua* was the B (100 μg) formula.

4 Conclusion

The present investigation revealed that the population of pest insect of S. exigua at Bukittinggi, West Sumatera based on moth catches in traps were influenced by the sex pheromone formula, namely B (100 μg) formula. Further study can be recommended that the B formula can be used as a monitoring as early warning of *S. exigua* infestation, so that the timing of this pheromone application can be predicted.

Acknowledgement. The authors are thankful to The Indonesian Agency for Agricultural Research and Development for providing financial support for conducting research RPIK in 2021.

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