



Correlation of Sex Ratio and Population of *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) in Mung Beans

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Abstract. One of the important pests on mung beans is the warehouse pest *Callosobruchus chinensis* (Coleoptera: Bruchidae). These pests can cause yield losses of up to 90%. Populations of adult *C. chinensis* have a close correlation in influencing the development of this pest in mung bean storage. This study aims to determine the correlation between the sex ratio of the population and its development in *C. chinensis* and to see its preference for mung beans. This research was conducted at the Plant Breeding Laboratory, Brawijaya University. The method was carried out by investing adult *C. chinensis* in mung beans based on the sex ratio, there are four sex ratio comparisons observed. Observations were made every week to see the number of eggs, larvae, adults and dead insects. Based on the results of the study, the sex ratio of 2 males and 3 females resulted in the highest number of populations, a total of 72 eggs and 46 adult *C. chinensis*. Our hypothesis is that a high sex ratio leads to an increase in the population of *C. chinensis*. The vima variety is resistant mung beans compared to consumption varieties because it has lower seed weight loss. The results of this study are preliminary results that can be used for further research to evaluate the correlation between sex ratio, population and development of *C. chinensis*.

Keywords: *Callosobruchus chinensis*, mung beans, sex ratio, warehouse pest

(Received 2021-10-06, Accepted 2021-10-26, Available Online by 2021-10-31)

1. Introduction

Storage of post-harvest results is the final stage of the plant cultivation system which has the main problem of attack by warehouse pests. Warehouse pests are one of the main problems in the seed storage

process. Various types of agricultural products are attacked by warehouse pests, which are mung beans (*Vigna radiata*). The quality of mung bean seeds must be considered to make a healthy plant. One of the things that underlie the quality of mung bean seeds is seed resistance. Each seed has a different resistance depending on the variety and cultivation environment. Seed resistance can be seen from resistance to diseases and pests. Decreases in agricultural commodity yields can occur before harvest, after harvest and during storage. An important warehouse pest that attacks mung beans is *Callosobruchus chinensis* (Coleoptera: Bruchidae). Yield losses due to *C. chinensis* on mung beans can reach 90% [1], even up to 96% so that mung beans cannot be used for consumption or seeds in agricultural cultivation [2]. This pest is one of the most serious pests of stored beans, which has been widely distributed in many countries and carried over to bean exports [3].

The host preference of *C. chinensis* depends on several factors. Pest preferences include pest habits, pest response to color and light intensity, physical structure and plant surface, the presence of chemical compounds produced by the host, and plant morphological structures such as hairs on the tissue surface and hard and thick leaf skin [4], [5]. Nutritional stress during their developmental life made the size of the imago *C. chinensis* smaller. This may result in smaller eggs because egg size is positively correlated with body size in various insect taxa [6], [3]. The newly hatched larvae of *C. chinensis* feed on the seeds, causing loss of nutrition and seed germination [7], [8].

The behavior of *C. chinensis* based on population in stored beans has not been widely carried out. Adult have habits in their life, like host selection, finding a mate, egg placement, and self-defense [9]. The difference between the two sexes of *C. chinensis* is that males have larger and more intricately shaped antennae, while females have serrated antennae [10]. *C. chinensis* females produce larger eggs when there is a competitor, than without competition [3]. The purpose of this study was to determine the correlation between sex ratio and the population of *C. chinensis* in mung beans, and also to determine their preferences for two different varieties, vima and consumption.

2. Methods

This research was conducted at the Plant Breeding Laboratory, Faculty of Agriculture, Brawijaya University. The tools needed are analytical scales, vials, bottles, gauze, Petri dishes and tweezers. Whereas the materials needed are mung bean seeds, vima and consumption varieties, and adult of *C. chinensis*.

2.1 Population correlation with development of *C. chinensis*

Adult of *C. chinensis*. invested in a film fial containing 15 gr of mung beans. Then the film is covered with gauze. Observe the population *C. chinensis* every week. The treatments include (a): *C. chinensis* with the composition of 1 male 1 female, (b): *C. chinensis* with the composition of 1 male 2 females, (c): *C. chinensis* with the composition of 1 male 3 females, (d): *C. chinensis* with the composition of 2 males 3 females.

2.2 *C. chinensis* preference Based oOn Two Mung Bean Varieties

Prepared materials for storage by weighing each mung beans weighing 100 grams, for each type. Prepared two glass bottles for the two types of mung beans. Put each storage material into a bottle by adding 10 adult *C. chinensis* in each treatment. Cover the bottle with gauze to ensure that *C. chinensis* remains alive. Observations were made every week by counting the number of *C. chinensis* and measuring the weight of mung beans.

3. Results and Discussion

Based on observations, there was a change in the population of *C. chinensis* invested in mung beans in all treatments. The occurrence of population changes occurred in addition to eggs, new adult and the number of adult deaths. The composition of several sex ratios is determined by the ratio of different males and females, observations were made on adults *C. chinensis* until maturity occurs, which is

observed at one to four weeks. In this observation no larvae and pupae were found, only the addition of eggs and adults of *C. chinensis*.

The results of the sex ratio of *C. chinensis* from Table 1, sex ratio with a composition of 1 male 1 female, all adult *C. chinensis* died in the second week and no additional eggs occurred. While in the composition of 1 male 2 female, new eggs and adult appeared. In the first to third week observations, the number of eggs was 42 eggs and adult became 30, however 8 adults died. The population also increased in the *C. chinensis* with a composition of 1 male 3 female, new eggs and adults were found. In the first to third week of 42 eggs, the adult increased to 35, and there were 9 adults died.

Table 1. *C. chinensis* with several sex ratio composition

Composition of the sex of <i>C. chinensis</i>	Observation	Σ Eggs	Σ Larvae	Σ Pupae	Σ Adults	Σ Death adults
1 male 1 female	1	-	-	-	-	-
	2	-	-	-	-	2
1 male 2 females	1	14	-	-	23	1
	2	38	-	-	30	2
	3	42	-	-	30	5
1 male 3 females	1	38	-	-	30	3
	2	38	-	-	35	2
	3	42	-	-	35	4
2 males 3 females	1	42	-	-	19	2
	2	50	-	-	28	2
	3	64	-	-	46	1
	4	72	-	-	46	2

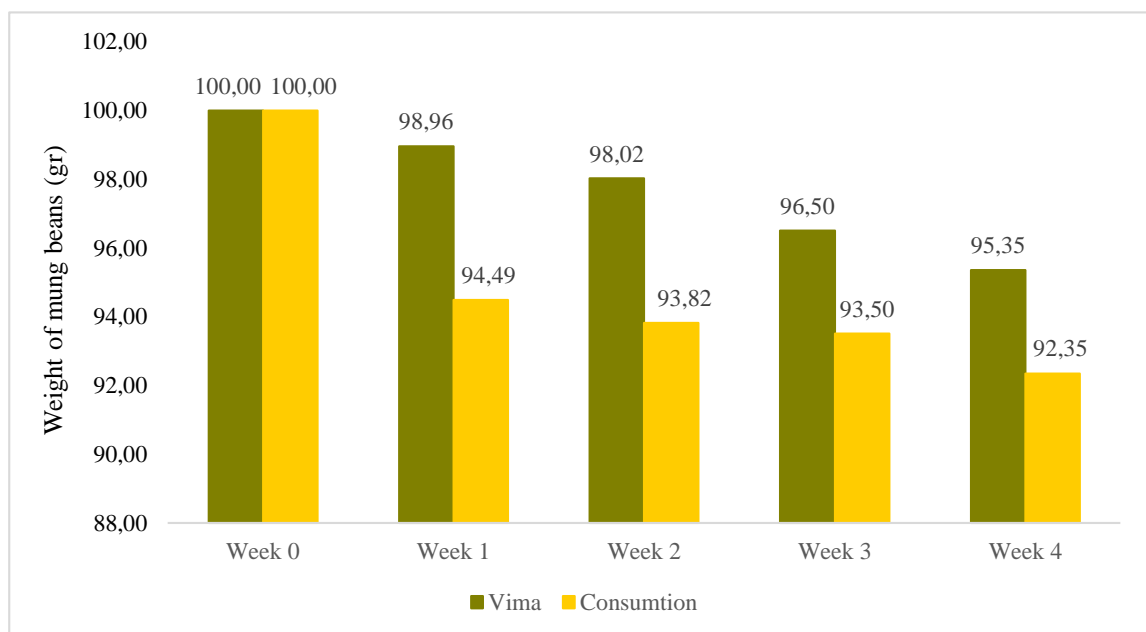


Figure 1. Weight of mung beans invested with *C. chinensis*

Based on all the data, the results showed that the composition of the comparison of *C. chinensis* 2 males and 3 females at the final observation had a larger population of 72 eggs and 46 adults. This result occurred because the comparison of the number of *C. chinensis* adult invested affected the *C. chinensis*

population from the number of eggs and new adult. The greater number of males and females will affect the potential for increased egg laying and population growth. This is supported by [11] sex ratio affects the number of insects that exist so that the population is increasing. The results of the number of eggs produced by *C. chinensis* in this study were in accordance with studies which stated that the egg laying of *C. chinensis* produced 78 eggs on average [12].

Population development of *C. chinensis* is caused by several factors. The presence of internal and external factors influenced the development of *C. chinensis* populations, such as seasonality and population density, which means that the sex ratio may change the development of insects [13]. Environmental influences such as temperature and humidity also affect the laying condition of *C. chinensis*. According to [14] The female lays eggs on the surface of the host seed about 4-5 days later at a temperature of 26-28°C, then has a life cycle of between 21-31 days [5]. The eggs found in this study were oval and transparent. This is in accordance with [5] which states that *C. chinensis* has oval, transparent and yellow eggs. The incubation period for eggs is between 4-5 days. The larvae are clear yellow with a brown head and undergo skin changes to become pupae. Adults initially yellowish white on the head will form brown spots which gradually turn black. This collection of spots will become compound eyes. Then the whole body starting from the head gradually turned brown.

In the study of *C. chinensis* preferences for mung beans. At 4 weeks of observation, the weight of all mung bean seed varieties decreased (Fig. 1). The largest number of declines occurred in consumption varieties than vima varieties. This can be seen from the difference in initial weight and final weight where the decrease is smaller than the consumption variety. The difference in seed weight at the beginning of the observation until the 4th week for consumption mung beans reached 7.65 and 4.65 g for vima variety. The greater the difference in the weight of mung bean, the more susceptible it is to *C. chinensis*. This is in accordance with the statement [15] and supported by [16] which said that the value of the difference in weight of 100 seeds before and after insect investment was getting bigger, it was stated that the variety was susceptible to *C. chinensis* attack. The decrease in seed weight in all varieties was not only caused by *C. chinensis*, it may also be the presence of moisture stored in the seeds. The higher the water content, the greater the weight of 10 grams of seed [15]. This study also revealed that the type of seed affects the development of the pest population. If the seeds are susceptible and not resistant to *C. chinensis*, the seeds can be used as hosts for these pests and reduce the quality of mung bean seeds. According to [17] mung bean seeds that have been attacked by insect pests have an unpleasant or distinctive smell which is the result of secretions from insects.

4. Conclusion

The results showed that *C. chinensis* which consisted of 2 males and 3 females in mung beans at the final observation had a larger population of 72 eggs and 46 adults. Vima has a fairly good resistance to *C. chinensis* compared to the consumption mung beans. This research is a preliminary study, it needs more observations and stages of research to explain further about the sex ratio of *C. chinensis* and its population in mung beans.

Acknowledgements

Thanks to the Faculty of Agriculture Brawijaya University for facilitating this research. We cannot thank you enough to dear Miss Nanda Ulfa Rizki, a practicum assistant of seed production technology who has helped us, may her soul rest in peace, we will never forget what she has done. We would also like to thank Agroecotechnology 2014 colleagues who have helped us during the research.

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