JPPIPA 10(4) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Influence of Several Host Types on the Balance of Life *Sitophilus Sp*

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Received: January 11, 2024
Revised: March 21, 2024
Accepted: April 25, 2024
Published: April 30, 2024

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DOI: 10.29303/jppipa.v10i4.6925

Abstract: Sitophilus sp is a warehouse pest that attacks grain. In its life cycle, Sitophilus sp requires hosts such as rice, corn and sorghum for its survival process. This warehouse pest can damage crops in the form of pods or seeds in the field or in storage. This research aims to determine the life cycle of Sitophilus sp on several different types of hosts. This research used a single factor Completely Randomized Design (CRD) consisting of six levels which were repeated 10 times. The results of the study showed that the fastest development of Sitophilus sp was in local white rice (35.00 days), and the longest development was in Lamuru corn (46.00 days). In the life balance table, local white corn produces the highest growth and development (proportion) of live Sitophilus sp. Meanwhile, the lowest live proportion is found in lamuru corn.

Keywords: Balance of life; Host type; Sitophilus sp

Introduction

Sitophilus sp is a warehouse pest that attacks grain. In its life cycle, Sitophilus sp requires hosts such as rice, corn and sorghum for its survival process (Azrai et al., 2021). One of the inhibiting factors and obstacles in storing harvested crops is warehouse pest attacks. This warehouse pest can damage crops in the form of pods or seeds in the field or in storage (Demis, 2022; Rifath et al., 2022). One type of warehouse pest on corn is the Sitophilus sp pest or corn powder pest (Sitophilus zeamais) (Classen et al., 1990). Apart from being the main warehouse pest on corn, the powder pest or Sitophilus sp pest is also the main warehouse pest on rice, sorghum, wheat, soybeans and green beans (Caliboso et al., 1986). Sitophilus sp or in corn called Sitophilus zeamais damages corn in tropical and subtropical areas (Danho et al., 2002). Sitophilus zeamais is the same as Sitophilus oryzae (Sitophilus on rice) which is found in hot and humid areas and attacks various types of cereals, but mainly corn, rice and sorghum (Juniarti, 2022; Morallo-Rejesus & Rejesus, 2001).

A life balance (life table) is information about the development of an organism's life from the egg to the age of maturity of the organism (Venarsky et al., 2023). Each organism has its own age and life stages. Life balances are needed as basic data in determining management and policies to achieve the sustainability of an organism or population regulation. Through the life balance, demographic data is known, namely population size, population growth, age structure, life chances, life expectancy and the organism's ability to survive. The way to make it is by observing a group of individuals or populations from egg or birth, hatching to adulthood (Skujina et al., 2021).

One effort to handle harvest results is storage (Amir, 2021; Yanti et al., 2022). The custom of the people of North Central Timor (TTU) is generally to store harvests, such as corn and sorghum, by smoking them in the kitchen and storing them in a lopo or barn. This habit has been a tradition passed down from generation to generation. It is believed that the storage model in the lopo/granary and in the kitchen can increase the shelf life of corn and sorghum for longer and protect against powder pests. The determining factor for the quality of

How to Cite:
Nik, N., & Rusae, A. (2024). The Influence of Several Host Types on the Balance of Life Sitophilus Sp . *Jurnal Penelitian Pendidikan IPA*, *10*(4), 1916–1924. https://doi.org/10.29303/jppipa.v10i4.6925

cereal foods during storage is water content. If the water content is more than 12%, powder pests will easily attack the food. According to Paulsen et al. (2019; Wei et al. (2023) the water content of corn grains that is safe to store for a long time ranges from 12% - 14%, while for sorghum it ranges from 10-12% (Dejene et al., 2004; Wahyuni, 2021), and for rice it ranges from 13-15% so that it is not easily attacked by weevils powder (I. U. Firmansyah et al., 2007). Meanwhile, according to Apriyanto (2022), food substrates with a water content greater than 12% have begun to break down and fungi can grow.

Method

The tools used in this research were: insect jar/container, small brush, microscope, calculator, gauze, binder (rubber), analytical scale, digital camera, magnifying glass (loupe), tweezers, sieve/sifter, writing tools (book and pen). The ingredients used are local white sorghum 250 grams, super 1 sorghum 250 grams, local white corn 250 grams, Lamuru corn 250 grams, local white rice 250 grams, Inpari rice 250 grams, water, label paper, tissue, and Sitophilus sp (eggs).

Conducting research

Seed Preparation

The materials used in this research were local white rice, inpari rice, local white corn, lamuru corn, local white sorghum, and super sorghum - 1. 250g each for each replication. Taken from Umalor village, West Malaka District, Malacca Regency. Meanwhile, super 1 sorghum was taken from Naresa Village, Belu Regency, Inpari rice was purchased from an agricultural shop in Kefamenanu City.

Preparation of tools and materials

The tools and materials used in this research are: a jar with a volume of 500 grams, (diameter 13.5 cm, height 7.5 cm) which is used as a place/container for the host and pest Sitophilus sp. Analytical balance for weighing rice, corn and sorghum. The microscope used to observe the eggs of the pest Sitophilus sp. Small brush or tweezers to take the eggs from the rearing into the insect container. Gauze to cover the top of the jar so that the powdered pests don't get out easily and can breathe. Tie/rubber to tie the top of the mosquito net so it doesn't open easily and the pests don't come out. A loupe/magnifying glass is used to see and observe Sitophilus sp pests from egg to imago. Tissue is used to line the bottom of the jar to keep it damp. Ingredients used: 250 grams of local white rice, 250 grams of Inpari rice, 250 grams of local white corn, 250 grams of Lamuru corn, 250 grams of local white sorghum, 250 grams of super 1 sorghum, 20 Sitophilussp pest eggs per each replication, and water as a moisturizer.

Rearing insect / pest powder

Sitophilus sp pests are taken from the storage area as much as possible (Tesfaye et al., 2021). Both male and female, namely in corn, sorghum and rice seeds. Then put and breed in 6 insect containers/jars (17 cm high and 15 cm in diameter) which have been filled with local white rice, local white corn, lamuru corn, local white sorghum, super 1 sorghum, and inpari rice. The top surface of the insect container was covered with gauze and tied with a rubber band so that the Sitophilus sp imago did not fly out, then reared for ± 4 weeks to collect 20 eggs for each replication.

Insect investment

Invest in 20 Sitophilus sp eggs from the rearing results, for each replication. Sitophilus sp pest eggs are put into the insect container using a small brush.

Research Experimental Design

The experimental design used was a single factor completely randomized design (CRD) consisting of 6 levels which were repeated 10 times (Srinivasan et al., 2023). Cedar (1) local white sorghum (pen buk' muti), cedar (2) sorghum super 1, cedar (3) local white corn (pen muti), cedar (4) lamuru corn, cedar (5) local white rice (mnes muti), and the (6th) level of inpari rice, each level of 250 grams, so there were 60 experimental units.

Observation of the life balance of Sitophilus sp

Observations on the survival of Sitophilus sp were carried out in insect containers with a volume of 1,500 ml (width 16 cm, height 7.5 cm) and the bottom was covered with damp tissue. Observations are made every day, to see the life table calculations (Manueke et al., 2012), the data needed includes:

ax (Number of individuals for each age/age structure); dx (Number of individuals who died in age group x); qx (Proportion of individuals who die in age group (x) to the number of individuals who live in age group x), qx = dx/Ix; Ix survival proportion = number of individuals alive at age x divided by the total number of standardized eggs; and Ex (life expectancy in each age class x (ex = Tx/Ix)

The qx and ex components in population dynamics are used or useful for predicting the population of an organism in the future. If qx > ex then the population will decline (leading to extinction; qx = ex then the population is static/fixed; qx < ex then the population will increase/develop.

Data Analysis

Data regarding the time required for each phase, and the demographic parameter values of Sitophilus sp between replications were tested using a completely randomized design of variance (Anova). This was followed by further testing using the Duncan multiple range test (DMRT) at α 5% according to instructions (Gomes and Gomes, 1984). Data analysis using the SAS 9.1 program.

Result and Discussion

Development time of Sitophilus sp in several different types of hosts

The results of the ANOVA variance show that there were significant differences between each host in terms of imago survival for each development phase as shown in Table 1. Local white rice gave the fastest development of Sitophilus sp, namely (35.00 days), which was significantly different from lamuru corn (46.00 days). And not significantly different from other hosts. This is because in Lamuru corn, the surface of the seeds is smooth and hard making it difficult for Sitophilus sp to hoist the corn seeds. This is in line with Ren et al. (2024) which states that corn feed has a higher level of grain hardness compared to rice feed. Furthermore, by Edy (2022) that Lamuru corn is resistant to powder beetle insects.

Table 1. Average time required for each phase by Sitophilus sp to complete its life cycle on several different types of hosts

Phase	Time Required (Days)					
	White local corn	Lamuru corn	Super sorghum 1	Local white sorghum	Local white rice	Inpari rice
Egg	7.00a	7.00a	7.00a	7.00a	7.00a	7.00a
1st instar larva	3.00b	4.00a	3.00b	4.00a	3.00b	4.00a
2nd instar larva	4.00b	5.00a	4.00b	5.00a	4.00b	5.00a
3rd instar larva	5.00a	5.00a	4.00b	5.00a	4.00b	5.00a
4th instar larva	5.00ab	6.00a	4.00b	5.00ab	4.00b	5.00ab
Pupa	8.00ab	9.00a	6.00c	6.00c	7.00b	7.00b
Young imago	4.00ab	5.00a	4.00ab	5.00a	3.00b	4.00ab
Adult imago	4.00ab	5.00a	4.00ab	5.00a	3.00b	4.00ab
Long Live Imago imago	40.00ab	46.00a	36.00ab	42.00ab	35.00b	41.00ab

Note: The average value in the same column followed by the same letter indicates not significantly different (tn), different letters indicate significantly different (*) according to the 5% DMRT test.

According to Juliano (1985) stated that local white rice has a thin seed layer and is not as thick as corn. And the grains calcify, causing the starch granules to be less dense, and causing the texture of local white rice to become brittle and soft, which makes it easier for insects to damage the rice and the development of pests more quickly. Rice that is soft and has a rough surface is consumed more by Sitophilus sp insects than clear rice such as inpari rice (Pei et al., 2018). Local white rice contains 354.00 calories, 7.10g protein, 0.50g fat, 77.80g carbohydrates, 14.00g water and 12-20% amylose. Meanwhile, inpari rice has a higher amylose content, namely 16 .6 - 23.46 %. Rice which has a high amylose content will be more resistant to S. Oryzae insects compared to rice which has a lower amylose content (Borror & White, 1970). According to Ojo & Omoloye (2016) the life cycle of Sitophilus sp on rice reaches 34 days. Furthermore, Arrahman et al. (2022; Singano et al. (2020) stated that the life cycle of Sitophlius zeamais is 30-45 days in shelled corn. Whether or not the development time is long is a parameter to determine the susceptibility of cereals to post-harvest pests. The short development time of Sitophilus sp indicates that cereals such as rice are susceptible to Sitophilius sp. The chemical component that influences the development period of S. zeamais is protein content. This is because protein is an essential element needed by female insect imagos for egg production. Furthermore, Askanovi (2011) explains that the feed chosen by Sitophilus sp for its development is influenced by seed hardness and the nutritional content of the feed such as protein, amylose, fat, water content and carbohydrates. Based on the research results of Firmansyah (2005) the content of lamuru corn consists of 6.90% protein, 2.60% crude fiber, 2.29% fat, 69.30% carbohydrates and 7.80% water content. Anatomically, the structure of corn seeds consists of pericarp (5.3%), endosperm (82.9%), body (11.1%) and seed base cap (0.8%) (Wulandari et al., 2014). The largest part of the corn kernel is the endosperm which consists of two parts, namely the hard endosperm and the soft endosperm. Hard coating has a protein of 1.5 - 2.0%. Even though corn has a low carbohydrate content, it has a higher protein content.

Table 2. Influence of the host on the size of Sitophilus sp on several different types of hosts

Phase						Size (mm)
	Lamuru corn	White local corn	Local white sorghum	Super sorghum 1	Local white rice	Inpari rice
Egg	0.5b	0.5b	0.5b	0.5b	0.5b	0.5b
1st instar larva	1.5a	1.4a	1.1a	1.3a	1.2a	1.3a
2nd instar larva	1.8a	1.6a	1.2a	1.4a	1.5a	1.7a
3rd instar larva	2.6a	2.3a	2.1a	2.2a	2.4a	2.5a
4th instar larva	3.2a	3.1a	2.9ab	3a	3a	3.1a
Pupa	4.2a	3.8ab	3.1ab	3.6ab	3.7ab	4a
Young imago	4.5a	4.3a	3.7ab	3.9ab	4.1ab	4.2a
Female adult imago	5a	4.9ab	3.9ab	4ab	4.2ab	4.3ab
Male adult imago	4.6a	4.2a	3.1ab	3.5ab	3.7ab	3.8ab

Note: The average value in the same column followed by the same letter indicates not significantly different (tn), different letters indicate significantly different (*) according to the 5% DMRT test.

The Sitophilus sp insect is a group of insects that undergo complete metamorphosis (homometabolism), from the egg phase to becoming an imago (Ferrarini et al., 2023). The growth and development of this insect goes through four stages of development (stages), namely the egg, larva, pupa and imago stages. The research results show that the size of Sitophilus sp in each host varies from egg to adult imago, see table (3). Egg size is 0.5 mm for each host. Sitophilus sp eggs are clear white, oval in shape, soft and slippery. After investment, the eggs hatch on the 7th day (7 day egg stage) while the larvae consist of 4 more stages, namely 1st instar larvae, 2nd instar larvae, 3rd instar larvae and 4th instar larvae. Each instar has a different size. In the 1st instar, the length is around 1.1- 1.5 mm, the second instar from 1.2 - 1.8 mm, the 3rd instar, from 2.1- 2.6 mm, the fourth instar 2.9-3, 2 mm, pupa 3.1- 4.2, young imago 4.1- 4.5 mm, adult female imago 3.9- 5 mm, and adult male imago 3.1-4.6 mm. The size of Sitophilus sp larvae and imago depends on where they live. Sitophilus sp which lives on corn is larger than Sitophilus sp which lives on rice and sorghum. This is because the size of corn seeds is larger than rice and sorghum so that the size of Sitophilus sp adapts to the place where it lives. This agrees with Adiredjo et al. (2021) who explained that the size of Sitophilus sp depends on the breeding place. if they live on corn, their body size is larger than those that live on rice and sorghum.

Life Balance of Sitophilus sp on several different types of hosts

Based on the life balance table (table 4.), local white corn produces the highest proportion of life. Starting from (Eggs = 0.93%, 1st instar larvae = 0.92, 2nd instar larvae = 0.89 % 3rd instars = 0.86, 4th instars = 0.84%, pupae = 0.83%, young adults =0.80%, Adult imago = 0.79%). This shows that local white corn is a suitable host for the development of Sitophilus sp. This high proportion of living values indicates that there is the highest contribution to the future population (Jiménez-Galindo et al., 2023). Local white corn has good nutritional value which can support the growth and development of Sitophilus sp. Local white corn has quite good nutritional components, namely crude fiber 2.80%, fat content 4.60, protein 9.20%, carbohydrates 73.00% (FAO, 1995).

Carbohydrates are generally a source of energy for insects, while fats are for normal growth and reproduction. This is in accordance with the opinion of de Carvalho et al. (2020) that the growth and development of insects will be higher if they receive appropriate food. Furthermore, according to Oonincx & Finke (2021), the nutritional ratio of protein and carbohydrates is important for the growth and survival of insects (Behmer, 2009). Meanwhile, the lowest proportion is found in lamuru corn. Starting from (Eggs = 0.81%, 1st instar larvae = 0.78%, 2nd instar larvae = 0.76%, 30.73% instar larvae, 4th instar larvae = 0.71%, pupae = 0.68%, young imago = 0.64%, mature imago = 0.62%. This is because Sitophilus sp does not develop well in lamuru corn, because the surface of the seeds is slippery and the content is not suitable so that Sitophilus sp cannot hoist the seeds properly. good and fast so that development becomes slow and less good.

Based on the research results of Putri (2018) the content of lamuru corn consists of 6.90% protein, 2.60% crude fiber, 2.29 fat, 69.30% carbohydrates and 7.80% water content. This is in line with Nurkholis (1995) explaining that Sitophilus sp imago mortality can be caused by inappropriate feed, such as feed granules that are too hard or the nutritional content in the feed is inappropriate. In super 1 sorghum and local white sorghum feed, the proportion tends to increase in super 1 sorghum, starting from instar larvae 1, 2, 3, 4, pupae, young imago and adult imago. In Super 1 Sitophilus sp sorghum feed you also get good food with sufficient quality so that it supports its growth and development. The super 1 variety sorghum has a carbohydrate content of 71.3%, a protein content of 12.9%, a sugar content (brix) of 13.5% and a tannin content of 0.11%. Meanwhile, local white sorghum has a carbohydrate content of 83.74%, protein 10.11%, fat 3.65%. Local white sorghum has relatively higher tannin content than other varieties, namely around 3.67-10.60%.

The tannin compounds in sorghum act as anti-nutrients, causing sorghum to have an unpleasant and slightly bitter "astringent" taste, which results in low digestibility of sorghum protein by the Sitophilus sp pest so that insect feeding activity is disturbed/reduced and its development is hampered. In local white rice and inpari rice, Sitophilus sp tends to be higher in local white rice because of the rough surface of the seeds and the appropriate nutritional content. In every phase of its development, Sitophilus sp always experiences mortality (death). The level of egg mortality in each host is because the egg stage is very sensitive to environmental factors such as temperature and humidity and natural enemies that can damage/eat Sitophilus sp eggs.

Apart from that, the humidity factor also greatly influences the egg mortality rate. At low humidity, 30, 40 and 50% can cause quite high mortality in the egg stage (Sitepu et al., 2014) because the relative humidity for egg development is 70%. Mortality at the larval stage is caused by natural enemies, such as bacteria, pathogens and predators. This is because at the larval stage they are already active in looking for food, so they are easily attacked by natural enemies, easily infected by bacteria, or disturbed by other climatic factors. At the pupal stage, because it is no longer active/silent and undergoes physiological processes, at this stage of development there is a complete overhaul of the complete body as an adult insect, so it requires a very large amount of energy. The pupa stage usually experiences mortality due to being attacked by these natural enemies, this is because the pupa stage is very vulnerable to natural enemies. The life balance table shows that the life expectancy of eggs in each host is greater than that of larvae and pupae, this is because the eggs have not been contaminated much by external factors because they have not yet hatched and are not yet active. This indicates that the Sitophilus sp population tends to increase with each generation.

Table 3. Life balance of Sitophilus sp on several different types of hosts

Feed	Phase (x)	Living individuals (ax)	∑ individual dies (dx)	Life proportions (Ix)	Mortality Rate (qx)	Life expectancy (ex)
White local corn	Egg	18.50	1.50	0.93	0.08	7.27
	1st instar larva	18.40	0.10	0.92	0.05	6.35
	2nd instar larva	17.80	0.60	0.89	0.03	5.56
	3rd instar larva	17.20	0.60	0.86	0.03	4.74
	4th instar larva	16.90	0.30	0.84	0.01	3.84
	Pupa	16.60	0.30	0.83	0.01	2.89
	Young imago	16.10	0.50	0.80	0.03	1.98
	Adult imago	15.80	0.30	0.79	0.01	1.00
Lamuru corn	Egg	16.10	3.90	0.81	0.24	6.92
	1st instar larva	15.60	0.50	0.78	0.03	6.17
	2nd instar larva	15.20	0.40	0.76	0.02	5.32
	3rd instar larva	14.50	0.70	0.72	0.04	4.59
	4th instar larva	14.10	0.40	0.71	0.02	3.66
	Pupa	13.70	0.40	0.68	0.02	2.80
	Young imago	12.90	0.80	0.64	0.06	1.95
	Adult imago	12.40	0.50	0.62	0.04	1.00
Local white sorghum	Egg	17.50	2.50	0.87	0.14	7.19
	1st instar larva	17.20	0.30	0.86	0.01	6.27
	2nd instar larva	16.90	0.30	0.84	0.01	5.41
	3rd instar larva	16.40	0.50	0.82	0.03	4.53
	4th instar larva	15.90	0.50	0.79	0.03	3.69
	Pupa	15.30	0.60	0.76	0.03	2.82
	Young imago	14.60	0.70	0.73	0.04	1.93
	Adult imago	14.00	0.60	0.70	0.04	1.00
Super sorghum 1	Egg	18.00	2.00	0.90	0.11	7.31
	1st instar larva	17.70	0.30	0.88	0.01	6.46
	2nd instar larva	17.30	0.40	0.86	0.02	5.6
	3rd instar larva	16.90	0.40	0.84	0.02	4.72
	4th instar larva	16.70	0.20	0.83	0.01	3.78
	Pupa	16.20	0.50	0.81	0.03	2.86

Feed	Phase (x)	Living individuals (ax)	∑ individual dies (dx)	Life proportions (Ix)	Mortality Rate (qx)	Life expectancy (ex)
	Young imago	15.60	0.60	0.78	0.03	1.96
	Adult imago	15.20	0.40	0.76	0.02	1.00
	Egg	17.60	2.40	0.88	0.13	7.36
	1st instar larva	17.20	0.40	0.86	0.02	6.52
	2nd instar larva	17.00	0.20	0.85	0.01	5.6
	3rd instar larva	16.60	0.40	0.83	0.02	4.72
	4th instar larva	16.30	0.30	0.81	0.01	3.82
	Pupa	15.80	0.50	0.79	0.03	2.91
	Young imago	15.40	0.40	0.77	0.02	1.97
	Adult imago	15.20	0.20	0.76	0.01	1.00
Inpari rice	Egg	17.20	2.80	0.86	0.16	7.3
	1st instar larva	17.00	0.20	0.85	0.01	6.38
	2nd instar larva	16.80	0.20	0.84	0.01	5.46
	3rd instar larva	16.30	0.50	0.82	0.03	4.58
	4th instar larva	15.90	0.40	0.79	0.02	3.74
	Pupa	15.40	0.50	0.77	0.03	2.83
	Young imago	14.90	0.50	0.74	0.03	1.93
	Adult imago	14.20	0.70	0.71	0.04	1.00

Observation of the sex ratio for each commodity

The results of ANOVA variance showed that there was a significant difference in the treatment of host type in terms of sex ratio parameters for both males and females. The local white sorghum treatment gave the highest male sex ratio value, namely 7.10, not significantly different from super 1 sorghum and significantly different from the other hosts. Meanwhile, for females, the local white corn treatment gave the highest value, namely 7.80 females, significantly different from local white sorghum and not significantly different from other hosts.

Table 4. Effect of host type on observed sex ratio

Host Type	Male	Female
White local corn	4.30b	7.80a
Lamuru corn	5.00b	7.50a
Local white sorghum	7.10a	5.20b
Super sorghum 1	5.60a	6.40ab
Local white rice	4.70b	7.20a
Inpare rice	4.70b	7.20a
Real Difference	*	**

Note: The average value in the same column followed by the same letter indicates not significantly different (tn), different letters indicate significantly different (*) according to the 5% DMRT test.

This is because the reproductive ability of females is higher than males. The more female imago, the taller the new individuals that will be produced in the next generation. Meanwhile, in local white sorghum, the male sex ratio is higher because the carbohydrate content is higher, allowing male adults to get a lot of energy for production. This is in line with Hill (1990) who stated that Sitophilus Zeamais male imagoes will be more numerous and have high reproductive power on grains that contain high carbohydrates so that the energy/ability of male imagoes to mate with female imagos is higher. According to, apart from the nutritional content, what determines the male to female sex ratio of Sitophilus sp is the insect's own genes.

Final Powder Percentage

The results of ANOVA variance showed that there were significant differences between each host in the final powder percentage. The local white corn treatment gave the highest powder value (8.76) which was significantly different from inpari rice (4.72%). And it is not significantly different from other treatment levels. This is because the number of living individuals/proportion alive (see table 4.) on local white corn is higher than on other hosts, so the larvae's feeding activity is higher. And it causes increased damage to corn, sorghum and rice grains both in quantity and quality during storage, resulting in the seeds having holes, quickly breaking and disintegrating into flour as well as losing the weight of each host. This is in line with the results of research by Hendrival & Melinda (2017), which explains that the higher the pest population, the higher the level of damage that occurs.

Meanwhile, in Inpari rice, the final percentage of powder is low, this is because the number of individuals living on Inpari rice is not too high, so the level of damage is low and the percentage of powder is smaller. This agrees with Hendrival & Melinda (2017) who stated that the smaller the pest population, the lower the level of damage that occurs. The weight loss of corn kernels in storage can reach 30-40% due to this pest attack (Arbogast & Throne, 1997). It was further stated by Cosmas et al. (2012), that local white corn seeds infested with Sitophilus zeamais and stored for 56 days experienced a reduction in seed weight of 80-100%. The damage caused caused by Sitophilus sp in rice ranges from 10-20% of total production. Losses due to post-harvest insect pests can also be influenced by the population density of insects and other post-harvest pests that are associated with food in storage, causing the grain in storage to become increasingly damaged and become powder. Furthermore, Prasad et al. (2015) stated that Sitophilus sp prefers large seeds for oviposition. Large seeds tend to be preferred because they contain more eggs than smaller seeds.

Table 5. Effect of host type on observations of final powder percentage

Host Type	Powder Percentage (%)
White local corn	8.76a
Lamuru corn	8.20a
Local white sorghum	7.14ab
Super sorghum 1	7.06ab
Local white rice	7.64ab
Inpari rice	4.72b
Real Difference	*

Note: The average value in the same column followed by the same letter indicates not significantly different (tn), different letters indicate significantly different (*) according to the 5% DMRT test.

Conclusion

Based on research results, local white corn produces the highest growth and development (proportion) of life. The fastest development of Sitophilus sp occurred in local white rice (35.00 days), and the slowest development occurred in Lamuru corn (46.00 days).

Acknowledgments

Thank you to the University of Timor Research and Community Service Institute for supporting and funding this activity.

Author Contributions

This article was prepared by two authors, namely N.K and A.R. All members of the author jointly carried out this research at each stage.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

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