

PAPER • OPEN ACCESS

Physical quality and imago population of corn infected with *Sitophilus zeamais* with the addition of cinnamon (*Cinnamomum burmannii*)

To cite this article: T Alawiyah *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **788** 012070

View the [article online](#) for updates and enhancements.

Physical quality and imago population of corn infected with *Sitophilus zeamais* with the addition of cinnamon (*Cinnamomum burmannii*)

T Alawiyah, A Mujnisa and J Jamilah

Animal Nutrition Department, Faculty of Animal of Science, Universitas Hasanuddin, Makassar, Indonesia.

Email: jamilahdoma@yahoo.com

Abstract. This study aimed to determine the ability of cinnamon (*Cinnamomum burmannii*) on corn infected by *Sitophilus zeamais*. The study was carried out by infecting corn with *Sitophilus zeamais* on each test and then adding cinnamon with different levels on each test then stored for 30 days. This study consist of 5 treatments and 4 replications i.e., P0: corn without *Sitophilus zeamais* (positive control), P1: corn infected by *Sitophilus zeamais* (negative control), P2 (corn infected by *Sitophilus zeamais* + 2% cinnamon flour), P3 (corn infected by *Sitophilus zeamais* + 4% cinnamon flour) and P4 (corn infected by *Sitophilus zeamais* + 6% cinnamon flour). The highest value of imago population was obtained at P1 (137.75) and the lowest was at P2 (84.00), the highest number of damaged seeds was P1 (8.61) and the lowest was P4 (5.08) and at seed weight loss value the highest is P1 (1.54%) and the lowest is P4 (0.15%). It concluded that the administration of cinnamon at the level of 2% in corn infected with *Sitophilus zeamais* with storage for 30 days affects the growth of the imago population and loss of seed weight in corn during storage.

1. Introduction

Corn is one of the energy source feed ingredients used in ration formulations. Generally, on farms, corn is bought in large quantities because it is very season-dependent. During the storage process, corn is prone to damage. Forms of damage can be physical, chemical, mechanical, biological and microbiological damage. One of the damages caused by insect pests in the form of *Sitophilus zeamais* can cause a decrease in the quality of raw materials. *Sitophilus zeamais* is classified as a major pest, capable of damaging and developing well on commodities that are still intact and completes its life cycle in the seeds, causing real damage [1].

Insect pests such as *Sitophilus zeamais* need to be controlled appropriately, so that the quality and quantity of feed raw materials, one of which is corn during storage does not decrease. One method of control is to use plants as plant-based insecticides. The vegetable insecticide is one of the pesticides intended to eradicate pests, especially insects [2].

One of the plants that are known to have insect repellent power is cinnamon. Cinnamaldehyde contains the largest component of cinnamon oil, which is about 70% which can resist insects. The content of these compounds in cinnamon plants is thought to kill or inhibit the growth of *Sitophilus zeamais*. This study aims to determine the ability of cinnamon (*Cinnamomum burmannii*) against corn infected with *Sitophilus zeamais* [3].



2. Materials and methods

The study used a completely randomized design with five treatments and four replications namely P0: corn without *Sitophilus zeamais* (positive control), P1: corn infected by *Sitophilus zeamais* (negative control), P2 (corn infected by *Sitophilus zeamais* + 2% cinnamon flour), P3 (corn infected by *Sitophilus zeamais* + 4% cinnamon flour) and P4 (corn infected by *Sitophilus zeamais* + 6% cinnamon flour).

2.1 Making cinnamon flour

Making cinnamon flour begins with cleaning cinnamon from dirt and dried leaves that stick to it and then cut into smaller pieces. After that, pour cinnamon using a blender until it is completely smooth and then sift using a sieve or filter.

2.2 Prepare sample

Preparing corn used in research obtained from farmers or ranchers harvests. The selected corn is whole corn and not damaged. Each plastic is filled with 1 kg of weighed corn. After that, infected with 10-tailed *Sitophilus zeamais* imago per experimental unit (except positive control). Cinnamon flour is weighed according to treatment and put into a tea bag, then placed in the middle of a plastic bag containing corn. The plastic that contains the sample according to the treatment is sewn up, then the storage process is carried out for 30 days in a room equipped with a digital temperature humidity meter clock to measure the humidity and temperature of the storage room. Temperature and humidity will be recorded every day.

2.3 Imago population parameters

The work procedure for calculating an imago population is to count all the *Sitophilus zeamais* imago that lives on each test. The number of imagos observed and counted at each end of the test period after 30 days of storage.

2.4 Number of damaged seeds

The working procedure is to count the number of damaged seeds by separating the damaged and whole seeds in each repetition. Damaged and whole seeds are counted for each amount.

2.5 Seed weight-loss parameters

Its working procedure is to separate emerging insects, damaged seeds and whole seeds. Then the number and weight of each whole and damaged seed were observed.

3. Results and discussions

3.1 Imago population

The imago population was observed to see the intensity of the *Sitophilus zeamais* attack calculated based on the population size. The population shows the estimated number of insects indirectly from the estimated level of product damage [4]. Results of the research that has been done, it is found that the average population of *Sitophilus zeamais* imago during storage with the addition of cinnamon flour at different levels can be seen in table 1.

Table 1. The average population of imago *Sitophilus zeamais*, the number of seeds damaged and the percentage of seed weight loss in different treatment.

Treatment	Population of imago <i>Sitophilus zeamais</i>	Number of seeds damaged (%)	Losing seed weight (%)
P0	56.75 ^a ± 13.150	7.56 ^{ab} ± 0.57	0.47 ^a ±0.16
P1	137.5 ^b ± 41.242	8.61 ^b ± 0.81	1.54 ^b ±0.39
P2	84.00 ^a ± 22.301	6.59 ^{ab} ± 1.44	0.84 ^{ab} ±0.21
P3	90.50 ^a ± 9.883	5.39 ^a ± 0.92	0.71 ^a ± 0.31
P4	86.75 ^a ± 14.431	5.08 ^a ± 0.83	0.15 ^a ± 0.12

^{ab}Superscript in the same column shows the real difference.

Based on the results of the analysis of variance in table 1 it can be seen that the treatment has a significant effect ($P < 0.05$) on the total population of imago. Duncan's test results showed that the imago population obtained at P1 treatment was significantly higher than all treatments because at the beginning of the study had been infected with *Sitophilus zeamais* without the addition of cinnamon powder. The P0 treatments were not significantly different from P2, P3 and P4. This showed that the addition of cinnamon powder (P2, P3 and P4) could affect the growth of *Sitophilus zeamais*. Syahrizal [5] the largest content of cinnamon bark is an essential oil which has the main content of cinnamaldehyde (60.72%), eugenol (17.62%) and coumarin (13.39%) and it has the potential to resist insects.

Table 1 shows the treatment that was not infected with *Sitophilus zeamais* (P0) there was still visible growth of insects during the study even though it was not significantly different from the treatment infected with *Sitophilus zeamais* with the addition of cinnamon (P2, P3, and P4). This can be caused by the presence of innate pests from raw materials that infect in storage or the field before harvest. [6] The presence of warehouse pests is caused by the introduction of innate pests from raw materials, or the condition of the storage space.

The mechanism of action of cinnamon to suppress insect growth through the aroma released from cinnamon flour which is then inhaled by *Sitophilus zeamais* can disrupt the sensory system of *Sitophilus zeamais* during storage. Hasyim et al [7] insects have a chemical receptor sensitivity to some very high substances so that they can detect special odors at very low concentrations up to several miles from the source of the odor. Essential oils that have volatile characteristics can easily stimulate the chemical receptors of insects in their activities.

3.2. Number of damaged seeds

A large number of damaged seeds can affect the quality of corn. Wagiman [8] damage caused by *Sitophilus zeamais* on corn kernels can cause nutritional loss and decrease the quality of corn. Based on the analysis of variance in table 1, it can be seen that the treatment has no significant effect ($P > 0.05$) on the percentage of the number of damaged seeds. This is because the water content of corn is still relatively good or below 14% so that *Sitophilus zeamais* is difficult to damage corn. Suprpto [9] the level of water content that is safe for storing shelled corn is 13-14%. Because the water content above 14% is a good condition for fungus growth. Fungal contamination can produce various toxins, including aflatoxins and warehouse pests, causing damage.

Another factor that can cause the percentage of the number of damaged seeds has no significant effect is the storage time which is only around 30 days so that the percentage of the number of damaged seeds is not too high. Tandiang [10] *Sitophilus zeamais* in corn stored for 6 months caused 85% seed damage and 17% seed weight loss, as well as a powdered beetle attack or *Sitophilus zeamais* can reduce the nutritional quality and weight of seeds.

3.3. Seed weight loss

Seed weight loss to see the level of damage from damaged seeds, [11] symptoms can be seen by the existence of a hole, exit hole, the emergence of lumps due to scratching on the seeds, dust powder, and

the presence of dirt. Based on the results of the analysis of variance in table 3 it can be seen that the treatment has a significant effect ($P < 0.05$) on the percentage of seed weight loss. Duncan test results showed that the highest weight loss of seeds was obtained at treatment P1 that was significantly different from P0, P3 and P4 which had the lowest weight loss of seeds. In the P2 treatment, it is not significantly different from all. This shows that there is a significant difference between corn which is given cinnamon flour and which is not given cinnamon flour. Hertika [12] The results of laboratory tests on cinnamon oil for pest control showed the effect of toxicity, reject, inhibit growth, in pea pests *Callosobruchus chinensis*. Cinnamaldehyde compounds also provide antifeedant effects to fight pests during storage processes such as *Tribolium castaneum* and *Sitophilus zeamais*. The results showed that the population density of the imago *Sitophilus zeamais* also affected seed weight loss. The higher population density of *Sitophilus zeamais* causes the higher weight loss of seeds in corn due to attacks caused by *Sitophilus zeamais*. Tefera et al [13] The damage of corn due to attacks by *Sitophilus zeamais* and *P. truncatus* has increased up to 20/200 g imago tide density during corn storage.

4. Conclusion

Based on the results of the study, it can be concluded that giving cinnamon flour to corn that is infected with *Sitophilus zeamais* with storage for 30 days can reduce the population of imago and the number of damaged seeds.

References

- [1] Pranata R I 1985 *Mengamankan Hasil Panen dari Serangga Hama* (Ciawi: Balai Informasi Pertanian)
- [2] Kardinan A 1998 Prospek penggunaan pestisida nabati di Indonesia *Litbang Pertanian* **17** 1–8
- [3] Thomas J and Duethi P P 2001 *Cinnamon Handbook of Herbs and Spices* (New York: CRC Press)
- [4] Harahap I 2006 *Ekologi Serangga Hama Gudang* (Bogor: Seameo Biotrop)
- [5] Syahrizal 2017 Pemanfaatan bubuk kayu manis (*Cinnamomum verum*) sebagai insektisida alami untuk mengusir lalat rumah (*Musca domestica*) *Jurnal Kesehatan Ilmiah Nasuwakes* **10** 126–34
- [6] Charoen Pokphand Indonesia 2008 *Kualitas Keselamatan dan Kesehatan Kerja* (Balaraja: PT Charoen Pokphand Indonesia)
- [7] Hasyim A W, Setiawati H, Jayanti and Krestini E H 2014 Repelensi minyak atsiri terhadap hama gudang bawang *Ephestia cautella* (Walker) (Lepidoptera: Pyralidae) di Laboratorium *Journal Hort.* **24** 336–45
- [8] Wagiman F X 2019 *Hama Pascapanen dan Pengelolaannya* (Bogor: UGM Press)
- [9] Suprpto 1985 *Bertanam Jagung* (Jakarta: Penebar Swadaya)
- [10] Tandilabang J 1998 *Kehilangan Hasil Jagung Oleh Kumbang Bubuk Sitophilus zeamais Pada Berbagai Umur Simpan dan Wadah Penyimpanan* (Maros: Badan Penelitian dan Pengembangan Pertanian)
- [11] Hendrival and Melinda L 2017 Pengaruh kepadatan populasi *Sitophilus oryzae* (L.) terhadap pertumbuhan populasi dan kerusakan beras *Jurnal Biospecies* **10** 17–24
- [12] Hertika C 2011 *Aktivitas Insektisida Minyak Atsiri Daun Cinnamomum Spp. (Lauraceae) terhadap Crocidolomia pavonana dan Pengaruh Fitotoksisitas pada Bibit Brokoli* Skripsi (Bogor: Institut Pertanian Bogor)
- [13] Tefera T S, Mugo and Likhayo P 2011 Effects of insect population density and storage time on grain damage and weight loss in maize due to the maize weevil *Sitophilus zeamais* and the larger grain borer *Prostephanus truncatus* *African J. Agric. Res.* **6** 2249–54