Entomology, Ornithology & Herpetology: Current Research

OPEN ACCESS Freely available online

Research Article

Identification of Post-harvest Insect Pests and Determination of their Losses on Some Stored Spices at Teppi, Southwestern, Ethiopia

Wakjira Getachew[1], Merga Jibat[2*]

[1]Department of Crop Protection, Jimma Agricultural Research Center, Jimma, Ethiopia;[2]Department of Crop Protection, Teppi Agricultural Research Center, Teppi, Ethiopia

ABSTRACT

Deterioration of the grain quality during storage can be due to improper storing conditions, which leads to contamination with fungi or insect infestation. Insects are a major cause of postharvest grain losses (J. M. Adams and G. G. M. Schulten, 1976). This study was conducted during the year 2018-2019 for two years at Teppi Agricultural Research Center for the objective of identifying the major insects causing postharvest loss on the selected spices, to know the economic significance of these postharvest insect pests and to initiate appropriate control measures for post-harvest insect pests. Black pepper weight loss due to moisture was the least and Turmeric weight loss due to insect pest was the highest. This shows that the highest turmeric weight loss was due to its high moisture content. The minimum weight loss and no insects were observed on Black pepper. This indicates that Black pepper with proper storage practices can stay without any insect damage for many years. The other two spices are infested by insect pests and highly loss their weight. The insect observed on this storage period was only two species (Cigarette beetle (Lasioderma serricorne) and Red flour beetle (Tribolium castaneum) and the economic significance on cardamom and turmeric is very high. In the future control measures must design for the identified insect pest.

Keywords: Postharvest; Stored spices; Insect pests; Teppi

INTRODUCTION

Crop products are eventually stored for varied periods of time depending on market demand, size of production and the farmer's needs. Storage is the most important and critical postharvest operation. Deterioration of the grain quality during storage can be due to improper storing conditions, which leads to contamination with fungi or insect infestation. The major depredating agents affecting the market value of spices are the insects and microorganisms. Besides contaminating with their excreta and body fragments, the stored product insects are known to disseminate microorganisms in spices. Tribo/ium spp. is known to carry conidia of Aspergillus spp. on their body surfaces and conidia were also observed in the digestive tract of the insects [1]. In infested cardamom the bulk' density decreased by 50% and 5-26% weight loss also has been recorded. The loss in essential oil is around 25-30% [2]. Most of the spices, raw or processed and whole or ground are prone to insect infestation during storage. However, there are a few spices which have shown insecticidal properties. Extractives of chilies and black pepper have been found toxic to the adults of rice weevil, Sitophilus oryzae and cowpea weevil, Callosobruchus maculatus [3,4]. Stored spices are infested by two predominant pests viz., cigarette beetle, L. serricorne and drugstore beetle, S. pan; ceum besides numerous minor pest. Insects are a major cause of postharvest grain losses. By boring within the kernels and feeding on the surfaces, they remove food, selectively consume nutritive components, encourage higher moisture in the grain, and promote the development of microorganisms [5]. Therefore the objective of this study was identifying the major insects causing postharvest loss on the selected spices, to know the economic significance of these postharvest insect pests and to initiate appropriate control measures for post-harvest insect pests.

MATERIAL AND METHODS

Description of the study area

Sheka Zone: Sheka zone lies between 7012'-7089' latitude and 35024'-37090' longitudes, with an elevation ranging 1001-3000 masl. The zone has 3 Woredas with a total population of 198406 (CSA, 2007) this zone, out of the total land size 55.6% is Kolla, 41.4% Weinadega and 3% Dega. The annual mean temperature

Correspondence to: Merga Jibat, Department of Crop Protection, Teppi Agricultural Research Center, Teppi, Ethiopia; E-mail: wakjira_getachew@yahoo.com

Received: February 05, 2021; **Accepted:** February 19, 2021; **Published:** February 26, 2021

Citation: Jibat M, Getachew W(2021) Identification of Post-harvest Insect Pests and Determination of their Losses on Some Store Spices at Teppi, Southwestern, Ethiopia. Entomol Ornithol Herpeto. 10-238.

ranges between 15.1-27.5oc and the annual mean rainfall ranges 1201- 1800mm.

The experimental materials: Seeds of three spices: Black pepper (Piper nigrum), Turmeric (Curcuma longa) and Cardamom were collected from different sources. The experiment was arranged in CRD with four replications.

Identification of post-harvest insect pests: The collected seed samples of 500g for each replicate was put in to a container and was covered with rubber band and stored for eighteen to twenty months from January 2018 to March 2019 under room temperature in the laboratory [5].

Insect count: The jars were monthly examined for the presence of insect pests. The number of adults for each insect species per jar were counted and recorded to calculate the mean number of insects per month. Data on insect count was taken by carefully emptying the content of each jar on a white sheet of paper and observing the presence. Insects were counted and removed using a soft brush and kept in a vial containing 75% alcohol for preservation and identification. The content of each jar was returned and kept in its original position. Insect species collected was identified and conformation was done using different sources.

Estimating the weight loss of seeds: The percentage weight loss in seeds of Black pepper, Cardamom and Turmeric was calculated by the "count-and-weight" method described by Harris and Lindblad. The grains were separated into undamaged and damaged categories. Grains in each category were counted and weighed. The resultant data was substituted in the formula .

Table 1: Three spices result after 18 months storage.

No	Spices	Measurements	R1	R2	R3	R4
1	Black pepper	Means Wt of Undamaged Seed	471	478	489	483
		Mean Number of Undamaged seeds	14900	14865	14886	14892
		Mean Wt of damaged seed	0	0	0	0
		Mean Number of damaged Seeds	0	0	0	0
		Number of insects observed per month	0	0	0	0
		Species of insects observed per month	0	0	0	0
2	Cardamom	Mean Wight of Undamaged Seed	33	45	39	41
		Mean Number of Undamaged seeds	135	200	170	188
		Mean Wight of damaged seed	430.95	419	439.38	434.054
		Mean Number of damaged Seeds	2665	2600	2630	2612
		Number of insects observed per month	18	9	15	14
		Species of insects observed per month	1	1	1	1
3	Turmeric	Mean Wight of Undamaged Seed	31	22	36	13
		Mean Number of Undamaged seeds	8	6	11	4
		Mean Wt of damaged seed	409.23	416.03	401.43	427.899
		Mean Number of damaged Seeds	142	146	132	157
		Number of insects observed per month	39	41	34	45
		Species of insects observed per month	1	1	1	1

Where,

W_u=means weight of undamaged seeds

N_d=means number of damaged seeds

W_d=means weight of damaged seeds and

N_u=means number of undamaged seeds.

Statistical Analysis: The obtained data was subjected to analysis of variance (ANOVA), with the means separated using Duncan's Multiple Range criterion ($P<0.05$).

RESULTS AND DISCUSSSION

Identification of post-harvest insect pests

On the stored samples of spices two species: Cigarette beetle (Lasioderma serricorne) and Red flour beetle (Tribolium castaneum) of insect were observed on turmeric and cardamom but no insect was observed on black pepper stored samples during the storage time.

Insect count

The jars were monthly examined for the presence of insect pests. The number of adults for each insect species per jar were counted and recorded to calculate the mean number of insects per month.

From the stored seed samples of 500 g for the four replicate of turmeric the insects observed per month per replicate were ranges from 34 to 45 and for cardamom the insects observed per month per replicate were from 9 to 18. On black pepper there were no insects observed.

Estimating the weight loss of seeds

The percentage weight loss in seeds of Black pepper, Cardamom and Turmeric was calculated by the "count-and-weight" method described by Harris and Lindblad. The grains were separated into undamaged and damaged categories. Grains in each category were counted and weighed. No black pepper weight loss is occurred due to insect pest but the two spices were loss their weight due to insect infestation. Their loss ranges from 6.53-24.26 for turmeric and 22.2-32.2 for cardamom. The cardamom weight loss was high due to complete insect infestation on the seed. With thirteen (13) birr one kilogram market value of dried turmeric from hundred kg about 220.74 birr will be lost and with two hundred (200) birr market value of cardamom five thousand three hundred fourteen (5314) birr will be lost [6].

CONCLUSION

Storage is the most important and critical post-harvest operation. From the above table all the crops were reduced their weight due to moisture loss. Black pepper weight loss due to moisture ranges from 2.2-5.8, Cardamom weight loss ranges from 4.4-7.6 and Turmeric weight loss ranges from 11.84-12.6. This shows that turmeric

weight loss is high and contains more moisture than the other spice which needs more attention on drying for storage. The minimum weight loss and no insects were observed on Black pepper. This indicates that Black pepper with proper storage practices can stay without any insect damage for many years. The insect observed in the storage places which damage the two crops (Cardamom and Turmeric) is two species: Cigarette beetle (Lasioderma serricorne) and Red flour beetle (Tribolium castaneum) that cause 16.98 % post-harvest weight loss for turmeric and 26.57 % for cardamom. The number of damaged seeds range from 92.31 to 97.51 for turmeric and 92.86% to 95.18 for cardamom. This indicates that in number wise turmeric is more infected than cardamom but in weight loss cardamom is the highest that was damaged by this storage insect pest. From the above results we conclude that black pepper was not easily attacked by storage pests and the two crops i.e. turmeric and cardamom were easily attacked by post-harvest storage pests and must be either kept at proper places, sold to market early or managed by chemical pesticide treatments. Drying the crops at the required moisture content and storing at proper places can reduce insect pest infestations. In the future trials must be done on how to manage these insect pests with appropriate repellant, fumigant or chemical pesticides to decrease the burden on farmers.

ACKNOWLEDGMENT

The Author thanks Teppi Agricultural Research Center and Spice Program for providing all the necessary facilities and support. My sincere thanks go to the laboratory staff of Teppi Agricultural Research Center and Wondimu Gebresillase for their assistance during data collection.

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