WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Assessment of Grain Yield Losses by Different Stored Grain Insect Pests Infesting Pearl Millet (Pennisetum Glaucum)

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ABSTRACT-

India produces more than 163 commodities including cereals, pulses, spices, oil seeds, tubers etc. and herbals besides 900 processed foods. Cereals, pulses and oilseeds are the most important food and commodity from seed storage purpose as well as for stored product from it like flour, suji, maida and grains. Advancement of technologies in agriculture has led to increased food production every year. In many countries, major portion of the food grains produced, were storing for contingency and regular supply. These stored grains were infested by insects directly or indirectly and causing severe damages, apart from other storage losses. Most of the storage part is mainly concentrating on grain storage either in domestic or commercial scale. In India, pests such as *Rhyzopertha dominica* (Lesser grain borer), *Sitophylus oryzae* (Rice weevil), *Sitophilus zeamais* (Maize weevil), *Trogoderma granarium* (Khapra beetle), *Callosobruchus maculatus* (Pulse beetle) *Ephestia cautella, Sitotroga cerealella* (Angomoise grain moth), Plodia *interpunctella* (Indian meal moth), *Tribolium castaneum* (Rust red flour beetle) and *Oryzaephilus surinamensis* (Saw toothed beetle) are responsible to a greater extent in the damage of stored food grains. The adult insects of *Tribolium castaneum, Tribolium confusum* and *Oryzaephilus surinamensis* were collected in the monthly samples of the year 2021 and 2022. The population of *Tribolium castaneum* and *Tribolium confusum* infesting Pearl millet products (bajra flour) is maximum in August and minimum in February whereas that of *Oryzaephilus surinamensis* is maximum in September and minimum in January-February during the years 2021-2022.

Keywords- *Tribolium castaneum, Tribolium confusum, Oryzaephilus surinamensis,* Bajra flour, maximum, miminum.

INTRODUCTION

The COVID-19 pandemic has led to widespread food insecurity around the world and threatens to trigger long-term malnutrition and negative health consequences. Food systems are complex entities that affect food, human health, and a variety of other outcomes, including economic growth, natural resources and environmental resilience, and socio-cultural factors. Cereal Grains make up the majority of commodities maintained in storage and represent an important component of the world food supply. Loss of cereal grains and their products via insect infestations pose a serious problem especially in developing countries. Before processing, the harvested grains are stored for some time. The profitability of such storage depends only upon maintaining grain quality. In developing temperate countries the % of damage is 5-10% whereas it vary to 20-30% in tropical zones. (Dubey et al,2008; Rajashekhar and Shivanandappa,2010; Ileke and Oni, 2011; Akinneye and Ogungbite, 2013). Pearl millet flour stored for longer duration increases the risk of insect infestations. Variety of insects infests stored grains and their products. The most common species of insects inhabiting Pearl millet grains are *Tribolium castaneum, Tribolium confusum, Rhyzopertha dominica, Trogoderma granarium and Oryzaephilus surinamensis.*

MATERIALS AND METHODS

There are several flour mill mandis in and around the Jodhpur city- Mandore, Basni, Siwanchi Gate & Ghantagar etc. In the year 2021 and 2022, three samples of infested Pearl millet grains weighing 250gms were collected in different bags in the first week of every month from different mills of Jodhpur. The peak period of each adult insect infesting Pearl millet grains was recorded.

The maximum and minimum values of the abiotic factors during the study period were taken from the Annual Report of Central Arid Zone Research Institute (CAZRI) of Jodhpur.

RESULTS AND DISCUSSION

The adult insects of *Tribolium castaneum, Tribolium confusum* and *Oryzaephilus surinamensis* were observed in samples of both the years 2021 and 2022. (Table 1). The peak period of *Tribolium castaneum* and *Tribolium confusum* was found to be in August (Average Max. Temp.= 33.9 Min. Temp.= 26.15 and Relative humidity= 70%) and that of *Oryzaephilus surinamensis* in September (Average Max. Temp.= 34.9 Min. Temp.= 22.55 and Relative humidity= 64.5%) during both the years of study. *Tribolium castaneum* was found to be highest in population followed by *Tribolium confusum,* whereas *Oryzaephilus surinamensis* ranked lowest in all samples. (Figure 1 & 2).The difference in the peak periods of the adult insects is due to the difference in stored varieties, storage management and differences in temperature and humidity conditions that favour some insects over the other. KHARE AND AGARWAL (1962) studied the population of stored pest ***Sitophilus oryzae*** and ***Rhyzopertha dominica*** abundant during July, August and September and it was maximum during August in Kanpur district (India). SINGH *et al* (1977) calculated approximately damage caused by insect pests to wheat grains during storage near Varanasi. ***Sitophilus oryzae***, (Lo), ***Trogoderma granarium*** (Events), ***Tribolium castaneum*** (Herbst) and ***Rhyzopertha dominica*** (Fab.) species were found to be reported. PRAKASH *et al*., (1981) recorded the population fluctuation of insect pests in stored paddy under natural and controlled conditions and concluded that ***Sitotroga cerealella*** appeared first, then ***Rhyzopertha dominica, Sitophilus oryzae*** and ***Tribolium castaneum***.

SINCLAIR (1982) conducted three surveys on the stored products in the farms of the Darling Downs, Queensland and recorded the population of ***Sitophilus oryzae, Rhyzopertha dominica, Cryptolestes species*** and ***Tribolium castaneum***. The insect population peaked in late autumn and reached a minimum in early summer. LAL AND SRIVASTAVA (1985) studied the population of stored wheat pests in Madhya Pradesh, India. ***Sitophilus oryzae*** was the most dominant insect pest followed by ***Rhyzopertha dominica, Trogoderma granarium*** and ***Tribolium castaneum*** respectively in descending order. Ahmed et al (1990) studied the population densities of ***Rhyzopertha dominica, Trogoderma granarium, Tribolium castaneum*** and ***Sitophilus oryzae*** and loss caused by them at monthly intervals in wheat stored in ware houses in Karachi, Pakistan. LOHRA AND SINGHVI (1997) observed the population of certain stored grain pests of jowar of Jodhpur region during the year 1994. The major insects found were, ***Rhyzopertha dominica, Tribolium confusum, Tribolium castaneum, Oryzaephilus surinamensis, Sitophilus oryzae*** and ***Sitotroga cerealella.*** OKORONKWO *et al.* (2000) studied the distribution and population of insect species associated with cowpea *Vigna unguiculata*. The insect species were estimated by weekly sampling of cowpea

plants from seedling emergence until harvesting. RENTERIA-GUTIERREZ-TR (2000) studied the population growth of *Rhyzopertha dominca* and *Tribolium castaneum* in different wheat varieties and groups commercially produced in Sonora, Mexico. RAGHVANI *et al.* (2001) concluded that two pairs of *Callosobruchus analis* in green gram are sufficient enough in causing severe damage to seed and bringing down the seeds viability below minimum seed certification of 75%.PANWAR, *et al.* (2005) found different varieties of insect pest infesting wheat in different season. Insects found in wheat are *Trogoderma granarium, Rhyzopertha dominica, Sitophilus oryzae, Tribolium castaneum, Tribolium confusum, Oryzaephilus surinamensis* and *Sitotroga cerealella.* Population of insect species alters as temperature and humidity varies.

Table(1) : MEAN POPULATION OF INSECTS INFESTING PEARL MILEET GRAINS DURING THE YEAR 2021(A) AND 2022 (B) AT JODHPUR REGION

Month of Observation	**Name of Insects**					
	Tribolium Castaneum		***Tribolium confusum***		***Oryzaephilus Surinamensis***	
	A	*B*	*A*	*B*	*A*	B
January	4.00	3.67	1.67	2.67	0.67	1.33
February	1.67	2.67	1.00	1.33	1.00	0.67
March	3.67	4.00	1.67	1.67	1.67	2.00
April	4.33	4.67	2.67	2.33	2.33	2.33
May	7.67	7.33	4.33	4.67	4.33	4.00
June	8.00	8.33	5.00	5.33	5.00	4.67
July	13.33	14.00	8.67	8.00	5.67	6.00
August	**16.67**	**17.00**	**14.00**	**12.33**	7.00	7.33
September	13.67	14.00	10.67	10.67	**8.00**	**8.33**
October	11.67	11.00	8.00	8.00	2.67	4.00
November	7.00	7.67	3.67	3.00	1.00	1.67
December	4.00	4.00	1.33	1.00	0.33	0.67

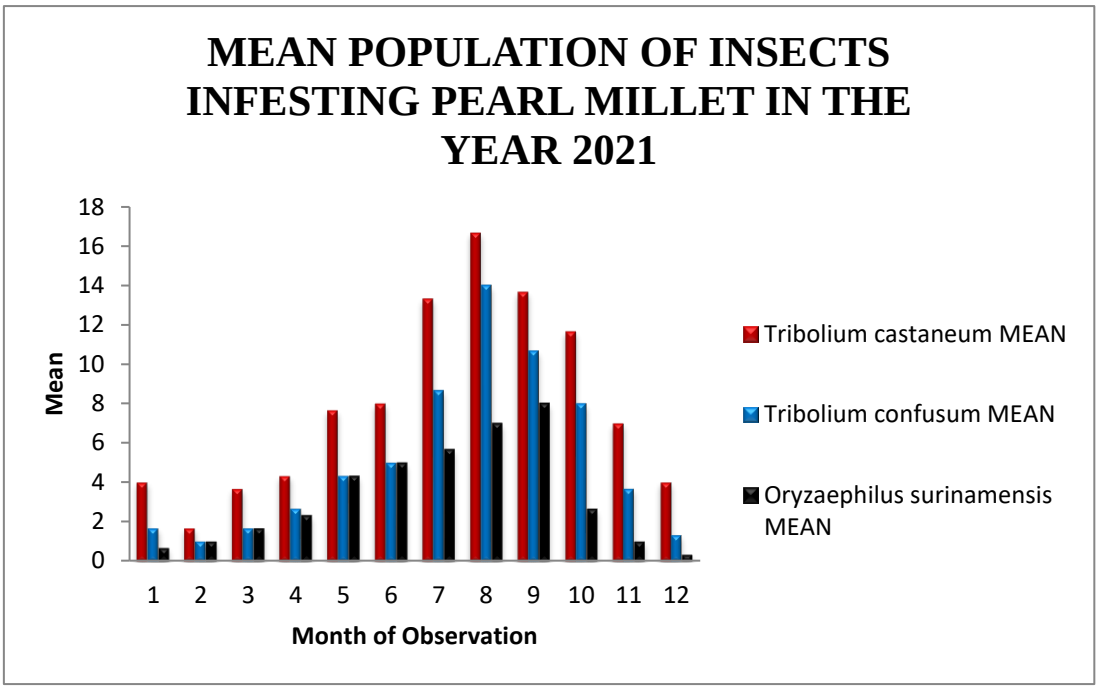

FIGURE-1: MEAN POPULATION OF INSECTS INFESTING PEARL MILLET IN THE YEAR 2021

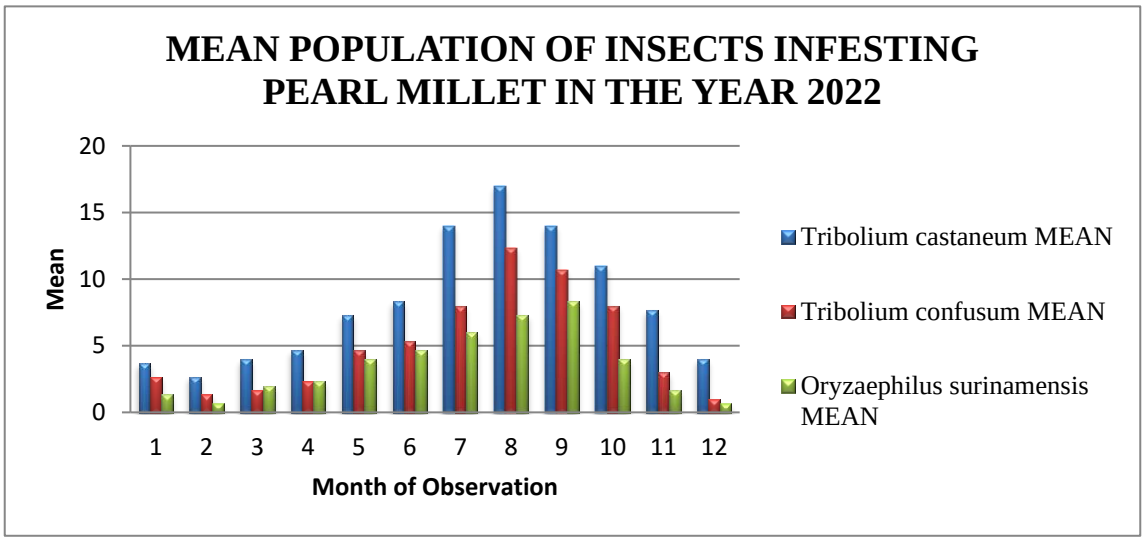

FIGURE-2: MEAN POPULATION OF INSECTS INFESTING PEARL MILLET IN THE YEAR 2022

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