



## Evaluation of seed protectants and the state of wheat pests in storage- A Review

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### Abstract

The economic value of protecting wheat against various insect and pest infestations throughout storing. One of the most extensively used pest control methods, integrated pest management also uses fumigants and a variety of contact and residual insecticides. Today's top issues include residual issues and human health risks, which have made it necessary to restrict or even ban the use of synthetic pyrethroids. Pests have evolved resistance to the majority of the synthetic pesticides and fumigants that are now on the market. This article covers a wide range of topics, such as insect pest storage losses, the negative impacts of using pesticides to protect grains, using plant products instead of synthetic ones, classifying plant-based chemicals, and powder and oil compositions as grain protectants.

**Keywords:** pest infestations, integrated pest management, grain protectants and wheat pests

### Introduction

The most significant cereal crop, wheat (*Triticum aestivum* L.), is a member of the Poaceae (Graminae) family and is a member of the genus *Triticum*. It is said to have originated in South-West Asia and belongs to the oldest cereal crop still being grown today. It has been called the "King of Cereals" because of its great productivity and significant role in the global commerce of food grains. For the entire human population, it contributes around 20% of the total food calories. One billion people worldwide eat wheat as a staple meal in 43 different nations [1]. The words "wheat" come from several different languages, particularly the English, German, and Welsh. All cultures most frequently refer to wheat as "that which is white" due to its physical traits as a light-colored crop. The three primary species of the genus *Triticum* comprise the majority of the cultivars of wheat. These include the hexaploid *T. aestivum* L. (bread wheat), the tetraploid *T. durum* Desf, and the diploid *T. dicoccum* Schrank and *T. monococcum*. The most significant species worldwide, accounting for 90% of the area, is bread wheat (*T. aestivum* L.). The second-most popular wheat is durum, which occupies around 9% of the total surface area, while *T. diccoum* and *T. monococcum* wheat occupy just under 1% of the total surface area [2]. India is the world's second-largest producer and consumer after China. One-fourth of one percent (14.13%) of the world's wheat is produced in India. In the past 68 years, only wheat has witnessed its production increase by more than 16 times (from 6.5 million tonnes in 1950 to 99.87 million tonnes in 2018). About 20% of the food calorie consumption by the entire world's population, or close to 55 percent, come from wheat [3].

Around 70% of the food typically stays only with farmers for seeds and other purposes, with 10% of that quantity being lost in post-harvest processing and storage due to insect, rat, bird, mite, microbe, and moisture attacks. In

addition, losses in terms of quality and quantity occur as a result of the decline in the nutritional value of dietary grains. As a result, every year a million metric tonnes of grain crops costing several thousand crores of rupees either are destroyed or lost due to ignorance about and failure to adapt to scientific methodology of storage. Due to infestations of the insect pests *Trogodarma granarium*, *Rhyzopertha dominica*, and *Tribolium castaneum*, wheat suffers both quantitative and qualitative losses throughout storage. Among the biggest pests of grains and numerous other stored goods among the khapra beetles is *Trogoderma granarium* Everts (Coleoptera: Dermestidae) [4-6]. Its indisputable economic significance is based on its capacity to feed stored grains, which results in significant physical and qualitative losses. The harmless adults have an oblong-oval form and measure 1.6-3.0 mm in length and 0.9-1.7 mm in width. The wing covers of the males are reddish-brown to black with faint brown patterns on them. The head is tiny and typically deflexed in females, who are also slightly bigger and lighter in colour than males. The adults have a limited lifespan, with mated females living for 4-7 days, unfertilised females for 20-30 days, and males for 7-12 days; they are flightless, and they consume very little food [7]. According to estimates, post-harvest losses from storage bugs could reach up to 9% in industrialised nations, but up to 20% in impoverished ones. In India, post-harvest loss for cereals represented 7-10% of the entire production from the field to the consumer. High infestations levels of the Khapra beetle can cause significant harm in the area. With rising productivity, post-harvest damages to seeds are rising each year. Despite numerous advances in seed technology, we haven't been able to decrease the losses caused by insect pest and diseases during storage [8-10]. The best tools for cleaning and safeguarding stored seeds and grains are seed protectants (botanicals and synthetic pesticides). The control of the storage predatory insects

relies heavily on insecticides. One of most efficient and safe method for reducing the danger posed by pesticides is thought to be the use of biopesticides to check insect pests, but we should not completely disregard the speed and efficiency of synthetic pesticides for cleaning and defending stored goods from infestation.

#### **Khapra beetle infestation level, *Trogoderma granarium* Everts**

Bhargava and Choudhary (2007) [11] in the years 2005–2006, a survey was carried out in each district within the state of Rajasthan. They claimed that *T. granarium* was connected to wheat and other grains. Various storage structures, including bags, loose objects, metal containers, kothis, bhukharis, clay pots, stone bins, and pusa bins, were seen at various locations throughout Rajasthan. Grain loss was greatest when it was stored loosely and least in a metal container.

In the colder months of 2002–2003, Mansoor *et al.* (2004) [12] performed assessments in five storage facilities of the Leiah region of Punjab (Pakistan) to determine the overwintering populations of storage pest species, grain loss, and percentage grain weight loss. In comparison to typical grain damage of 0.50 percent, the total weight loss approximated 0.15 percent. The average amount of overwintering insects per kilogramme, including *R. dominica*, *T. castaneum*, and *T. granarium*, was 0.59.

Rice damage caused by *R. dominica* was evaluated by Hsieh *et al.* (1978) [13] in relation to grain water content and storage time. According to the results, the grain's capacity to absorb water rose with humidity levels during a specific period of time before equilibrating. After 2.5 months, high RHs had higher pest infestation rates; the percentage of grain weight lost as a result of pest infestation was 5.8, 4.9, 3.8, and 2.7% at 93 + 1, 85 + 1, 75 + 1, and 64 + 1% RH, respectively.

180 samples of wheat were obtained by Bhardwaj *et al.* (1977) [14] from 12 districts in Punjab. *Sitophilus oryzae* (L.), *Rhyzopertha dominica* (Fab.), *Sitotroga cerealella* (Ol.), *Tribolium castaneum* (Herbst), *T. granarium* Everts, and *Oryzaephilus surinamensis* have been the stored grain insects most frequently discovered in the samples. The grain's water content reached 11%, germination was 82.5%, weevil infested was 5.1%, the germ was consumed 2.6%, and losing weight was 2.5% after approximately 10 months of storage on the farm, according to laboratory findings.

#### **Tests of seed protection methods against the Pests**

According to Khan and Thakare (1997) [15] exposure of larvae of *Corcyra cephalonica* to grain treated with karanj, neem, and castor oils (0.5 and 0.1%) dramatically inhibited adult emergence. When larvae were fed grains coated with neem seed powder (1.0%), neem oil (0.5%), and karanj oil (0.5%), the larval period was similarly greatly lengthened. Neem seed kernel powder at 4% and neem leaf powder at 5% were found to protect maize over five months against *S. oryzae*, *S. cerealella*, *R. dominica*, and *T. granarium*, according to Sharma (1999) [16]. Neem oil (Nimbecidine, 2%) significantly decreased the appearance of all pests' F1 and F2 offspring and totally shielded maize for up to nine months.

When neem dust was combined with wheat seeds at a ratio of 0.015 parts per 100 parts (w/w), Singh *et al.* (1999) [17]

found that it entirely stopped the development and growth of first larval instars. However, to inhibit third instar larvae in wheat seeds, a greater concentration of 0.125 parts/100 parts was required. Additionally, they observed that preemptive application of neem dust to wheat seed as well as other commodities may be a potent substitute for synthetic insecticides in the fight against such a pest.

Against *Rhyzopertha dominica* in wheat grain, Khan and Marwat (2003) [18] evaluated the powdered leaves, seed, and barks of neem (*Azadirachta indica*) and the leaves, bark, and flowering of kanair (*Nerium oleander*). The administration of neem seed plus leaf powder had the best possible results, having 96.0% insect deterrence/repellency for each case. Neem bark, kanair bark, and kanair leaf powders following, with 92.5, 90.8, and 90.5% deterrence/repellency of test bug, respectively. The least productive plant was Flowers of Kanair, which had an insect deterrence/repellency of 73.5%. With the exception of the kanair flower treatments, none of the treatments notably differed from one another.

According to a 2014 report by Anonymous [19], Indoxacarb, deltamethrin, and Emamectin benzoate proven to be more effective than botanicals in controlling the number of *S. cerealella*. But every pesticide was also designed to keep pest infestations to a minimum while in preservation and to sustain germination levels above IMSCS after three or six months of storing.

#### **Biological control of stored grain pests**

Pests can be managed by biological control, which makes use of some predatory insects or bacteria. Hymenopterous parasites, which are helpful insects, attack and eliminate a variety of pests found in stored grains, including weevils, rusty grain beetles, maize weevils, confused flour beetles, lesser grain borer, Angoumois grain beetles, sawtooth grain beetles, and grain moths. Although parasites are eliminating a lot of grain pests, the grains themselves have suffered severe damage, so they are not completely protected. Numerous stored grain pests are also fed upon and raised by tiny, black, wasp-like insects called *Seenopinus fenestral*, which aids in reducing pest infestation. A white, thread-like worm known as a window-pane fly larva feeds voraciously on various grain pest larvae despite not harming grains [20, 21].

#### **Conclusion**

The key benefits of natural insecticides are that they are non-toxic to organisms other than the target species, easily biodegradable, and may be made from locally accessible raw materials. Numerous plant-based insecticides have been investigated in laboratories. In addition to their effectiveness, research should concentrate on the compound's stability, mammalian toxicity, mechanism of action in insects, seedling growth, impact on nutritional quality, and method of action in pests. The insecticides with plant origins could be used to create new compounds with very specific targets for long-term insect pest control in stored grains.

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