STUDIES ON THE EFFECTIVENESS OF VARIOUS INSECTICIDES AND DRYING IN CONTROLLING GRANARY WEEVIL (*Sitophilus granarius* L.) IN STORED WHEAT SEED

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ABSTRACT

This study was designed to examine the effects of various insecticidal materials and of repeated seed drying during storage on the population dynamics and survival of Granary Wevil (Sitophilus granarious L.) in wheat. The study was conducted in three parts. The first experiment examined the immediate and longer term effectiveness of the contact insecticide malathion and the fumigant phosphine along with influence of repeated drying to safe moisture contents on granary weevil infestation. Wheat seed was stored for 165 days at 25 C and 80% R.H. Treatments were examined every 30 days to study the development of Sitophilus granarius populations and associated damage to wheat seed and evaluation made of the effects of drying, malathion and phosphine on the established infestation and on seed quality. Granary weevils increased by about a factor of X 10 every 60 days and did extensive damage to chemically untreated seed. Repeated drying reduced the rate of increase but did not eliminate the insect population. Malathion dust added to infested seed severely checked insect development and when combined with drying destroyed the infestation completely. Malathion also displayed considerable residual effect and had no adverse effect on seed viability. Phosphine was found to be totally effective in eradicating an established population of granary weevils from seed without affecting seed quality.

In a second experiment malathion was sprayed onto jute squares at 2.5% and at one half and one quarter of this rate. Treated squares were stored for 90 days at 20 C, ambient RH of 70 - 90% or 30 C, ambient RH of 60 - 80% and the residual toxicity of the deposit was assayed with live insects at intervals after treatment. Malathion was also applied at 2.5% concentration to the outside of grain filled sacks which were then placed individually into large plastic bags into which adult granary weevils were introduced at 7 day intervals. After 56 days storage, counts were made of live and dead insects inside the sacks to assess protective effect of the malathion treatment. On jute squares malathion was completely effective at all concentrations and at both storage temperatures (20 C and 30 C) immediately after application and also after 7 days. Thereafter, it lost its effectiveness slowly over the next 90 days storage. In whole sack treatment malathion was found to provide only immediate protection at both temperatures and was inadequate after only a few days.

In the third experiment wheat seeds, uninfested and infested with Sitophilus granarius, were mixed with ground neem seed of each of two species of neem (Azadirachta indica and Melia azaderach) at 1 g per 20 g wheat and were stored at 25 C and 80% R.H. Seeds were examined for live and dead insects and germination assessed after 90 days storage. Little or no direct mortality of adults was recorded but there was indirect evidence of suppression of egg laying particularly with Azadirachta indica. Neem seed powder did not affect the viability of the wheat seed.

This study has clearly shown the short term residual effectiveness of malathion, the immediate eradicant action of phosphine and the poor performance of the natural insecticidal chemical in neem seed on granary weevil infestation in wheat. The results also show the maintenance of low seed moisture contents in wheat to be a practical method of reducing insect populations. The role of granary weevil in damaging seed was clearly seen by X-ray photography and by the extent of types of abnormal seedlings found in positional germination tests. In the absence of effective control Sitophilus granarius has the potential to devastate wheat seed quality in terms of both purity and germination in as little as 90 days.

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INTRODUCTION

Shortage of food is a major problem in most developing countries. Low crop yields aggravate this problem. Among the factors that increase the yield of agricultural products, the successful production and availability of high quality seed is most important. Even though many countries particularly in the humid tropics and sub-tropics, have developed the necessary technology for the production of high quality seeds they often face great difficulties in maintaining high seed quality in storage, particularly where lengthy storage periods occur between harvest and the next sowing season.

The combination of high humidity and high temperature environments are disastrous in their effects on the viability of stored seeds (Delouche et al., 1973). Some information on how high temperature and humidity affect the seed viability in storage has been provided by Islam (1984). Dehumidified cold storage is the best solution for storing most types of crop seeds. However, financial constraints in most developing countries, such as Bangladesh at present preclude the commercial use of environmentally conditioned seed stores. A common storage practice now being adopted there is to keep the moisture content of stored seed at low levels by repeated drying.

Under high humidity and temperature storage conditions insects can be one of the most important single causes of damage to seeds if infestation is not prevented or controlled (Henderson and Christensen, 1961). Hall (1970) states that at least 10% of harvested food crops are destroyed by pests in storage, and that current losses of 30% are apparently common in large areas of the world especially in some of the tropical and sub-tropical countries where the need for more food is greatest. High temperature and high relative humidity ambient conditions, are most detrimental to seed longevity in storage and at the same time provide very favourable environments for the development of insect populations. This makes safe seed storage in such countries even more difficult. The present study was undertaken to investigate some aspects of chemical control of insects in stored seed.

In Bangladesh wheat and rice seeds are generally stored on a large scale. The storage of wheat seed however, is generally considered to be more difficult. Weevils are the most common insects that infest stored seeds in Bangladesh. The insecticide malathion and

the fumigant phosphine (liberated from Phostoxin tablets) are the chemicals mainly used there to combat insect infestation of seed. However, little research has been done there on the mode of action of these chemicals or on their effects on seed quality and thus practical use depends on the recommendations of manufacturers or suppliers. This study was therefore, undertaken to investigate several aspects of the action of malathion and phosphine when used on wheat seed infested by granary weevil (Sitophilus granarius) under simulated tropical storage conditions.

The increasing cost of some insecticides and also the rapid development of resistance by insects against a particular insecticide necessitates the search for new but relatively cheap insecticides. Recently neem seed has received wide attention as a possible cheap but effective natural pesticide (Ivbijaro, 1983). Neem is readily available in most tropical and subtropical countries including Bangladesh. This study therefore, included an evaluation of the effectiveness of two botanical species of neem seed (Azadirachta indica and Melia Azedarach) as an insecticide against granary weevil.

In summary therefore, the objectives of the present study were to investigate the following aspects of chemical control of granary weevil (Sitophilus granarius L.) in stored wheat seed (Triticum aestivum).

(1) To study the development of granary weevil populations and associated damage done to wheat seed in storage.

(2) To evaluate the effect of seed drying on insect population development and on seed quality.

(3) To evaluate the effectiveness of the contact insecticide, malathion, the fumigant phosphine, and the natural pesticide neem seed, in controlling an established infestation of granary weevil in wheat seed.

(4) To study the effectiveness of malathion applied as a spray to the outside of storage sacks as a preventative measure against infestation.

(5) To investigate the effect of the above chemicals on wheat seed quality.