CHAPTER I

INTRODUCTION
Increasing cereal production at a faster rate is a matter of cardinal importance for the ever increasing human population. It is a sullen irony in our success of the 'green revolution' that pest problems have accentuated with the introduction of high yielding varieties and improved agronomical practices in India. Besides the looming threat by the new pests, termites still continue to occupy a unique niche among damaging pests due to their fairly consistent appearance and inherent potentiality of causing heavy losses to the crops. Hence, termite infestation to wheat and barley crops stands as number one among the limiting factors in obtaining their optimum yields. In Rajasthan the two outrageous species of termites, Odontotermes obsesus (Shambur) and Microtermes obesi Holmgren are widely distributed (Map 1) which are mainly responsible for ravages to wheat and barley crops. Both these species are subterranean in habit with the exception that the former can also build mounds.

According to the estimated data* for 1980-81 season for Rajasthan, wheat was grown in 16.31 lac hectares

* Final forecast issued by the Board of Revenue, Government of Rajasthan, Ajmer for 1980-81.
Map of Rajasthan showing distribution of termites
with a production of 23.89 lac tons and barley covered an area of 4.69 lac hectares with a production of 5.17 lac tons (Map 2 and 3). It is estimated that nearly 14.64 and 26.16 per cent wheat and barley crops, respectively, were grown in unirrigated tract during 1980-81. It is believed that crops subject to water stress are usually more prone to termite infestation than those with ample supply (Peshwani and Katiyar, 1972; Sands, 1977). The irrigated wheat and barley crops are mainly commanded by tube-wells where the frequency of irrigation generally remains less for certain unavoidable circumstances in Rajasthan. The crops thus face water stress due to rapid loss of moisture in lighter soils which made them more vulnerable to termite attack. They cut and eat away the underground parts of the plant resulting in withering, yellowing and finally the death of the plant which can be easily pulled off (Plate 1; Fig. 1).

Normally both these crops suffer maximum damage in the early stage by death of the seedlings or young tillers and during the earing phase as a result of which the ear-heads become chaffy or bear shrivelled grains (Plate 1; Fig. 2).

Information on the losses caused by termites to wheat crop are available from different reports. Hussain (1935) put the loss from 6 to 25 per cent.
MAP 2

Map of Rajasthan showing district-wise area and production of wheat 1980-1981
MAP OF RAJASTHAN SHOWING DISTRICT-WISE AREA AND PRODUCTION OF WHEAT

1980 - 1981

AREA: HECTARE (UNDERLINED)
PRODUCTION: TONS
Map of Rajasthan showing district-wise area and production of barley
1980-1981
PLATE I

Fig. 1  Termite damaged plants

Fig. 2  Grains from healthy and damaged plants
Bindra (1966) and Patel (1962) got higher yields to the extent of 90 and 55.9 per cent, respectively, as a result of termite control. In western Rajasthan, Sharma (1967) put the loss up to 15 per cent. Sood et al. (1970) from Madhya Pradesh mentioned 30 per cent loss in unirrigated light soils. Srivastava and Lal (1973) revealed damage ranging from 0.5 to 34 per cent from Uttar Pradesh. During the survey of various districts of Rajasthan it has been assessed that wheat and barley crops may suffer loss up to 25 per cent under unirrigated and tube-well irrigated conditions in lighter soils (Plate II Fig. 1,2 and Plate III Fig. 1). The intensity of infestation varies from place to place and season to season. Recently, heavy crop losses of wheat and barley were reported for district, Pali, Rajasthan (Batra and Singh, 1979).

Damage by termites is often detected only when the mischief is already done in the crop. Hence, the cultivators are compelled to adopt prophylactic measures to protect their crops. In consequence, indiscriminate applications of high dosages of persistent chlorinated hydrocarbons are often made. In this context Brown (1951) has rightly emphasized that "in crop protection the chemical weapon should be used as a stiletto, not as a scythe". Sands (1960), Katz (1979) and Lewis (1980) also cautioned regarding the general application
PLATE II

Fig. 1  Termite free wheat crop

Fig. 2  Termite infested wheat crop
PLATE III

Fig. 1   Termite infested barley crop
of broad-spectrum insecticides. Limiting the use of general application of pesticides in small scale farming in our country need recognition in view of the economical considerations besides the danger of their persistence in the environment affecting the non-target organisms. Hence, local application should be preferred to wide-spread broadcasting in soil.

Pre-sowing soil application of insecticides, seed treatment with insecticides, drenching the soils with insecticide during irrigation in standing crop and extermination of termite colonies by treating the mounds are some of the pertinent approaches employed for termite control.

Seed treatment as one of the cheapest methods of pest control is quite convenient and demands only small quantities of toxicant. Insecticidal seed treatment has been tested against several cereal pests in Britain, Canada, U.S.A. and Australia. On several occasions, these experiments appeared somewhat disappointing. The probable reasons for the failure of some compounds to protect the planted seed or crop were either their ineffectiveness against the pest or injury to the germinating seed due to lack of sufficient knowledge of the insecticide and seed relationship. An initial attempt in Rajasthan to study the effect of insecticidal
seed treatment by the author during 1964-65 (Anonymous, 1970) revealed adverse effects of chlordane and heptachlor powders when applied either as dry or with mineral or vegetable oils as sticking agents. Therefore, for choosing an ideal pesticide for seed treatment certain biological requisites as mentioned below are essentially to be looked into:

- pesticides should have a large safety margin between the dosage that destroys the pest and the dosage that harms the germination of seed.

- the seed must be covered uniformly with the chemical.

- the chemical must adhere firmly to the seed to avoid dislodging of powder formulations during handling following the treatment.

- be compatible with other compounds used on the seed.

- should not produce harmful residues in the soil or the plant.

The efficacy of pesticides against termites is largely governed by their application rates. The adherence of powder pesticides is known to be regulated by its specific formulation or by the use of stickers. Whereas pesticides applied through sprays can be easily loaded on the seed at the desired dose. So far, little
is known regarding the amount of actual pesticide retained on the seed when applied in powder form. This fact is necessary to know in order to fix the dosages of powdered formulations for seed treatment as the pesticidal application should be harmless to the germination and growth of the plant. The advent of new compounds in powder and emulsifiable formulations necessitates their evaluation for the control of termites through seed treatment keeping in view their practical application with regard to germination and growth. Practically no information on these aspects was available in the literature for barley crop, and only fragmented and outline knowledge available for wheat crop can not be directly utilised for the conditions prevailing in Rajasthan. It was, therefore, considered pertinent to undertake seed treatment studies in detail with a view to elucidate the efficacy to certain pesticidal applications on the control of termites in wheat and barley crops after meticulously scanning their effects on germination and plant growth in order to evolve feasible control measures.

Post-sowing control of termites with the application of pesticides through irrigation water has widely been recommended. The conventional recommended dosages are very high, however, some recent studies indicated
effectiveness of lower dosages (Verma et al., 1974; Sandhu and Sohi, 1977). It was, therefore, considered indispensable to work out the minimum effective dosages of some promising compounds to reduce the cost of control operation and to maintain their biocentration in the environment at a low ebb.

The efficiency of a chemical for mound poisoning depends on a number of factors especially the insect species involved and thus needs an assessment prior to its adoption in a new area. Further, this method has usually been appraised only on the basis of its role in destroying the treated termitaria and not attempted to discover its impact in reducing the level of termite infestation in crops raised subsequently. It was, therefore, envisaged to test the feasibility of this method in the semi-arid region of Rajasthan.

Against the background of all these reasons the present investigations were contemplated along the following lines.

1. Relative adherence of pesticidal powders to wheat and barley seeds with and without stickers at different dosages.

2. Green-house tests of wheat and barley seed treated with pesticidal powders and emulsifiable concentrates
at various dosages to study their effects on germination, emergence period and plant growth parameters.

3. Microplot field tests of wheat and barley seed treated with pesticidal powders and emulsifiable concentrates at various dosages to study their effects on germination and tillering.

4. Field trials to compare the efficacy of various pesticides through seed treatment against termites in wheat and barley crops.

5. Evaluation of different insecticides and dosages applied through irrigation water in growing wheat crop for the control of termite infestation.

6. Determination of the relative efficacy of certain chemicals for the destruction of mound inhabiting colonies of termites.