# INSECT PESTS, THEIR CONTROL AND MANAGEMENT IN AGROECOSYSTEM OF GUJARAT: WITH SPECIAL EMPHASIS ON TERMITES

## (CONCISE SUMMARY)

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India and Sri Lanka and Smeathman (1781), reported about the huge termite mounds of tropical Africa.

The study on termite systematics was done mainly at the Zoological Survey of India, Calcutta, and the Forest Research Institute, Dehradun during the period 1960-69.

Well known Termitologists, Dr. Roonwal and Chhotani have done extensive and effective work on taxonomy, systematics and various aspects of termites. Roonwal and Chhotani (1961, 1967), have dealt with the wood destroying termites of India. Biology of termites from Indian region given by Roonwal (1970) and Sen-Sarma *et al.* (1975) brought the monograph on the Indian wood destroying termites.

Sen-Sarma (2000), reported that several common termite species cause serious damage to crops like Wheat, Millets, Pulses, Cotton, Spices and Vegetables. He also stated that some ecological factors like rainfall pattern, atmospheric temperature and humidity, natural enemies etc. are influencing the distributional pattern of the termites. According to his opinion, vegetation and soil type are perhaps more important factors.

Sen-Sarma (2000) mentioned, Termitidae is the largest family and genus *Odontotermes* as most dominant in India and includes over thirty-eight species.

Hussain (1935), reported 6-25 % of loss in the Wheat crop from India. Patel and Patel (1954) reported that the species *Trinervitermes biformis* causes serious damage to crops like Cotton, Wheat, and Groundnut etc. in Maharashtra.

Chhotani (1980) published a technical monograph on termite pests of agriculture in India and their control, in which he brought together the knowledge available on damage and control of termite pests of agriculture in India.

Roonwal and Chatterjee (1962) advised chemical methods to control the mounds of termites. Rana *et. al.* (2001) in Haryana, conducted an experiment to study the effect of various seed treatment insecticides i.e. Cypermethrin, Imidacloprid, Carbosulfan, Triazophos, Chlorpyriphos and Endosulfan for the management of the *Microtermes obesi.*

Parihar (1985) reported, roots and stems of castor were attacked by *Microtermes mycophagus* in Rajasthan. He concluded that pre-sowing soil application of 5% Aldrin dust at 37.5 kg/ha also gave good results, and commonly used 10% HCH dust was least effective.

Chatterjee and Thakur (1968) and Roonwal (1973) have worked on taxonomy and biology of many termite species from Gujarat. Thakur (1989) did extensive work in Gujarat on termite fauna and also published in 1991 a series on the field ecology, eco-biogeography, and economic importance of termites.

Recently Rathore and Bhattacharya (2004) published a paper on termite (Isoptera) Fauna of Gujarat and Rajasthan.

In the present study four agro ecosystems were selected, Sugarcane (*Saccharum officinarum*), Wheat (*Triticum aestivum*), Cotton (*Gossypium herbaceum*) and Castor (*Ricinus communis*). Each crop field in all four areas had incidence of termites. The study sites, Savali, Padra and Dabhoi was composed of sandy loam soil where as Karjan was composed of deep black soil. These crops were selected for study because of following reasons,

1. Economy of the crops for the farmers and the state of Gujarat.
2. Type of Soil (Three study sites was composed of sandy loam soil while one was composed of deep black soil).
3. Farmers rated these crops more susceptible to termite attack.

To check the presence of termites in the fields, samples of unhealthy looking plants from the crop field were located and sampled because sampling of dead plants might lead to bias as it cannot rule out the possibility of termite attack after death (Pearce, 1997).

All four crops were surveyed at seedling stage and the stage just before maturing; as plants near ripening stage are vulnerable to termite attack .Termites were collected from different parts (stems, roots of standing crops) of unhealthy agricultural crops and labeled with information on their location, host crop, infested part of crop, mode of infestation etc.

For Termite identification soldiers play an important part. So, all efforts were made to collect soldiers from each crop field wherever there was termite attack. Efforts were also made to record all termite species present in the surrounding areas of the field. Pearce, (1997) stated that before starting the experiments, some knowledge of termite species present in study area is essential. So, possible habitats and micro habitats wooden logs, under stone, sanding trees, fencings and hedges of agricultural fields were also surveyed. Termites were collected with the help of brush and preserved in 70% rectified sprit.

Identification of collected specimens was done up to the species level with the help of standard systematic keys and other related literature (Roonwal and Chhotani, 1989; Chhotani, 1997).

**Feeding ecology and Pest status of termites:**

The feeding habits of termite are very complicated. They live in communities and the workers forage for food for which they travel long distances. Termites feed on a wide variety of food items including fresh, dead or decaying woody materials as well as dung and soil rich in organic matter (Waller and La Fage, 1987). The foods of termites are mainly of plant origin, which is woody in nature, with cellulose as a main component.

Termites attack agricultural crops at various stages in various modes. Mill (1992), Akhtar and Shahid (1993), Wightman and Wightman (1994) and Wood (1996) intensively investigated the role of termites in agricultural

systems.

Damage occurs from seedling to maturity in annual and perennial crops (UNEP/FAO, 2000). Damage to crops depends mainly on the population density of a particular pest.

Pradhan (1964) opined that insect becomes a serious pest once its population reaches a critical level. Termites, being social insects, live in colonies. Although each colony is regulated as single unit but with the number of individuals in a colony being enormous, it may be said that the population of termites is generally at critical level.

Since there no comprehensive work dealing with the identification, biology and control measures against termites in agro ecosystem in Gujarat. Hence the present study was undertaken with the following objectives.

**Objectives of the Study:**

1. To survey the termite fauna in study area and different agro-ecosystem of selected crops.
2. To find out termite pest species at seedling and maturing stage of crops.
3. To prepare running keys for their identification
4. To study crop wise distribution of termite pest species at seedling and maturing stage.

5. To study in detail the economic importance of termite pest species at seedling and maturing stage of crops.
6. To suggest management systems for termite pests in agro ecosystem.

**Results:**

In these four Agro ecosystems, taxonomical distribution, pest status, nature of damage and ecological studies on termite species is given. In addition, taxonomical key of reported species is also prepared.

**Taxonomical and pest status of termites:**

During study, 15 species from 7 genera and 2 families were recorded from the study area.

Maximum no of 13 species of 6 genera and 2 families are present in Karjan area followed by Dabhoi with 9 species of 5 genera and 2 families, Padra 8 species with 5 genera and 2 families.

Minimum number of seven species belonging to 5 genera and 2 families was recorded at Savli.

Among the four crops selected, Sugarcane recorded maximum of five termite pest species (*Coptotermes heimi, Odontotermes obesus, Odontotermes redemanni, Microtermes mycophagus* and *Microtermes obesi*) while Castor recorded least two (*Odontotermes obesus* and *Microtermes*

*mycophagus*) termite pest species. Wheat crop was found infested with four (*Coptotermes heimi, Odontotermes obesus, Odontotermes redemanni* and *Microtermes obesi*) while Cotton was found attacked by three (*Odontotermes obesus, Microtermes mycophagus* and *Microtermes obesi*) species.

**Environmental factors promoting termite activity:**

Environmental factors like food availability and moisture was found responsible to promote the termite activity. Shelter places, soil type and plant cover provides right moisture to the termites. The species which was found as pest was recorded from all sites of study area and had wide range of habitat occupancy.

At some places termites were noted as secondary pests. It was also noted that crops that were already attacked by pests like Aphids, White grubs, Hoppers and many others are more vulnerable to attack by termites.

It was also observed that infestation was more in the crop fields which had sandy loam soil as compared to the crop fields with deep black soil.

**Percent presence of pest species:**

Percent presence of pest species is shown in Table 1. It was found that, *Coptotermes heimi* and *Odontotermes redemanni* was found attacking the Sugarcane and Wheat crops. *Odontotermes. obesus* was found as pest in all the four crops. *Microtermes mycophagus* was found pest of Sugarcane,

Cotton and Castor and *Microtermes obesi* was found attacking Sugarcane, Cotton and Wheat crops.

**Table-I Percent presence of pest species in various crops**

| Pest species | Sugarcane | Wheat | Cotton | Castor |
|---|---|---|---|---|
| *Coptotermes heimi* | 75.86 | 24.14 | 0.00 | 0.00 |
| *Odontotermes obesus* | 42.88 | 19.51 | 27.42 | 10.19 |
| *Odontotermes redemanni* | 26.80 | 73.20 | 0.00 | 0.00 |
| *Microtermes mycophagus* | 18.01 | 0.00 | 29.09 | 52.91 |
| *Microtermes obesi* | 57.76 | 36.64 | 5.61 | 0.00 |

**Management and control of termites in agro ecosystem:**

Since species found as pests of crops in study area was subterranean, their management and control can be done by following ways.

1. **By preventing termites access to the crops.**

   It can be done by placing the insecticidal barrier of persistent insecticides around the roots of plant

2. **By reducing the termite numbers in the vicinity of the crops.**

   Termite numbers can be reduced by clean cultivation, herbal insecticides and biological control.

**3. By increasing vigor of the crops**

Use of inorganic fertilizers enchases the plant vigor. Application of nitrogen, phosphorous and potassium also improves the plant vigor..

**4. Increasing the biodiversity of predators of the termites**

Growing of large trees in the surrounding areas of the agricultural fields will encourage birds as well as reptiles. Birds like Drongo, Swallow, Bee eater, Crow, etc are normally feeding on termites, Reptiles like *Mabuya carianata*, *Sitana ponticerena* etc., and Amphibians like common toads (e.g. *Bufo stomasticus and Bufo melenostictus*) normally feed on termite alates. Transplanting of ant nests or enhancing ant predation can control termites.

Delving further into the causes and factors that encourage termite infestation might open new vistas in the field of management and control of termite

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