CHAPTER- VIII
TERMITE DAMAGES TO VARIOUS PLANT AND
AGRICULTURAL CROPS

8.1. Introduction

In addition to structural wood, the termite also infested woody plants, such as trees, shrubs, and herbs reported by Harris (1971, Roonwal (1979). These plants are generally attacked by termite, when they are not in a vigorous state of growth. Their vitality is low either due to internal growth factor or environmental stress such as drought or poor soil. Several species of trees have been reported to injured and even killed by termite (Haris, 1961 Roonwal, 1979). The damages being more serious in young plants of about one or two year of age.

Damages caused by *O. wallonensis* to plants may occur through the natural cracks, or abrasion or other wounds on the stem region, they construct of narrow runway on the stem and plastering with broad earthen sheet. In addition to this damages also caused to under ground portion of the plant. In latter case the termite attack usually begins on the root and then spreads to the upper parts of the plant. In older plants the bark and the underlying tissue is eaten up, which gradually exposes the pith and hollows out the stem, resulting the ultimate death of the plant. Thus the fact that, what may appear to be a superficial initial injury should not be neglected.

Termite damages to living trees falls under two categories mainly, the damage by monophagous termites which have restricted among distribution and colonies are confined to single trees where as the damage by polyphagous termite which forage over a wide range of distance in search of food. *Eucalyptus* species are attacked whenever and wherever they are planted. Among indigenous species the young *Tectona grandis* was severely damaged besides the seedling species of trees such as *Acacia arabica, Casurina equisetifolera, Coccus nucifera*, etc. have been damaged by termite.

However very little and scattered information is available on the termite damaging various trees grown in and around Bidar area. Therefore the present study was under taken to investigate the species of termites infesting different trees, other plants growth, their pattern of damage and seasonality in their damage, in relation to the seasonal variation of various climatic factors such as rainfall temperature and relative humidity.
8.2. Material and Methods

Survey and Sampling

Along with survey of structural wood destroying by termites and survey on termite damages to various species of plants grown in and around Bidar area was also conducted during period December, 2008 to November, 2009. The plants were closely and carefully inspected for signs of termite activity, damages such as earthen sheet covering runways and galleries on trees trunks, earthen sheet covering and runways formation by termite belonging to termitidae. Trees were selected for observation of damages by termite at different places in and around Bidar area. The attack of termites belonging to termitidae covering the above ground part of the plant with earthen sheet and runway was recorded. Based on size of the earthen sheet (in relation of size of the concerned plant) the slightly modified scale Esenther and Beal (1974) and Beal et al., (1979) is adopted.

O = No damage

+ = plastering of earthen sheet of about 5% of stem of the trees.

++ = plastering of earthen sheet of about 25% stem of the tree

++++ = plastering of earthen sheet of about 35% stem of the trees.

+++++ = plastering of earthen sheet of about 65% of the stem.

+++++++ = 90% portion of trees covered with earthen sheet.

8.3. Results and observations

8.3.1 Nature of Damage

The nature of damage by species of termites are different in the different trees (table.16). The damages of Odontotermes wallonensis was recorded in the form of nibbling on dead as well as live bark of both stem and root underneath the cover of earthen sheet and runways. The attack of Odontotermes spp. occurred usually at the basal part of the trunk. The damage although not severe it was localized resulting in the
formation irregular cavities or grooves of various size on the surface of the trunk which may reached up to about 2 to3 meters height. The infestation generally originated and spread internally in the plant through the termite move from the soil into the roots. The damages were more or less similar in *Azadarachta indica*, *Coccus nucifera*, *Mangifera Indica*, *Eucalyptus* species. It extended runway from the ground up to two meters on the barks of the tree trunk. In some tree such as *Cocos nucifera*, *Mangifera indica* it constructed runways in and around underneath bark. Mostly these runways were extended towards the dead portion of the living trees. It damage was observed on the dried portion of the living plant. In Eucalyptus trees it eat up dead wood as well as adjacent to the stem, thus hollowed the stem. However tree remains live condition. As other part of the tree were not damaged. However in some cases where the attack was moderate the tree were in live condition.

The termite damages to the *C. nucifera* and *Eucalyptus* species are the stem of *C. nucifera* entering either through the roots or wound on the stem. It fed up to middle portion. The damages caused by *O. wallonensis* in *A. arabica* trees and *Tamarindus indica* it extended the runways of the stem above the bark up to the branches about at 6m height, cause damages and it was recorded at the basal portion of the trunk, it extending a few cm below and above the ground with earthen sheet covering on the trunk which extended up to the branches (Plate 22). Heavy damages also recorded on *C. nucifera*, *Eucalyptus spp.*. And *M. indica* where earthen sheet being plastered up to 5-6 m on the stem and branches (Plate 23). In some cases these runways was constructed on the stem and they were extended up to the branches on the bark of stem. The damaged stems and branches with earthen sheet and underneath the earthen sheet filled with mud in the excavated portion. In partially hollowed out the trunk from the base of *T. grandis* filled the excavated portion with mud the cavity extended upto 2 meter from the surface of the ground in the stem.

### 8.3.2 Seasonality of Damage

Seasonality of damage in the form of plastering of earthen sheet on various trees shows that, damages was about 35% of the stem of *A. Indica* and *Eucalyptus* species during winter. In summer the earthen sheet plastering reduced to 25% of the stem of
Eucalyptus trees which further reduce to 5% of A. Indica. In rainy season it was sporadic on these trees mostly occurring during the post monsoon period.

Seasonal plastering of earthen sheet caused by O. wallonensis on various trees is presented in table14. During winter the earthen sheet plastering was maximum about 65% of the stem of C. nucifera, C. equisetifolia, Eucalyptus sp.. In summer it reduced to about 5% of the stem of C. nucifero, C. equisetifolio, Eucalyptus. During pre-monsoon and rainy season it damaged about 35% of stem of Eucalyptus sp. and 25% of C. nucifera 35% stem. Seasonal fluctuation in the form of plastering of earthen sheet by O. wallonensis on various trees showed that, the damage was about 90% of the stem of Eucalyptus during winter season and it reduced to about 65% during summer and 25% during rainy season.

Seasonal in the form of earthen sheet plastering by O. wallonensis in various plants grown in and around Bidar area as shown in table 14. The damage was occurred on the major portion of the stem of A. indica and C. nucifera. During winter which reduced to minimum in both the plants. During summer the damages of similar intensity continued. During rainy season however no such damage was recorded on the stem of A. indica and it was rare on the stem of Eucalyptus species, during summer interestingly ,when the effectiveness of temperature was nullified. The rain fall in presence of relative humidity showed a significant co-relationship with the damage caused.

The effect of abiotic factors on the termite damages in the form of earthen sheet covering of the trees grown in and around the Bidar area shows that, temperature in presence of relative humidity and rainfall showed a significant relationship with damage species of plants.
Table -13: Pattern of damages caused by *O. wallonensis* to various species of trees in and around Bidar area during December 2008 to January 2010.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Species of plant damages</th>
<th>Intensities of damages</th>
<th>Plant part damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Azadirachta indica</em></td>
<td>++</td>
<td>Stem &amp; branch</td>
</tr>
<tr>
<td>2</td>
<td><em>Casuarina equisetifolia</em></td>
<td>+++</td>
<td>Stem &amp; branch</td>
</tr>
<tr>
<td>3</td>
<td><em>Eucalyptus species</em></td>
<td>++</td>
<td>Stem &amp; branch</td>
</tr>
<tr>
<td>4</td>
<td><em>Mangifera indica</em></td>
<td>++++++</td>
<td>Stem</td>
</tr>
<tr>
<td>5</td>
<td><em>Coccus nucifera</em></td>
<td>++++++</td>
<td>Stem</td>
</tr>
<tr>
<td>6</td>
<td><em>Accaica arabica</em></td>
<td>++</td>
<td>Stem</td>
</tr>
<tr>
<td>7</td>
<td><em>Tamarinds indica</em></td>
<td>++</td>
<td>Stem</td>
</tr>
</tbody>
</table>
Table – 14: Seasonal damages caused by *O. wallonensis* on different species of plants in and around the Bidar during December 2008 to January 2010

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Plant Species</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dec</td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td>1</td>
<td><em>Azadirachta indica</em></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>2</td>
<td><em>Casuarina equisetifolia</em></td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>3</td>
<td><em>Eucalyptus species</em></td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>4</td>
<td><em>Mangifera indica</em></td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td><em>Coccus nucifera</em></td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
</tbody>
</table>
8.4. Discussion

There are several ways in which the termites attack on plants. Nair and Verma (1981) discussed the different aspects of primary and secondary termite attack to *Eucalyptus* species, the termite made tunneled to the surface of the trees and built earthen runways on the surface indicating that the tree had been infested by termite. However under such case the tree appeared normal and healthy condition, as most of the tree living parts are not damaged when other *Odontotermes* species have fed directly on the plant root and killed the plant, Harries (1971). The plants attacked by the termite were wilted before dying this may be due to root damage by the termite hence the proper intake of water and minerals, nutrients became difficult for the plant. During the present investigation in some cases *Odontotermes* species infested maximum part of the plant particularly with shrub and small plants. The attack of termites belonging to termitidae particularly of *Odontotermes* species. usually occurred in the form of earthen sheet and runways on the bark the termite worker and soldiers continued their activity under the earthen covered the dead barks of almost all the trees were attacked Roonwal (1979). The worker at thin surface layer of the bark, however the damage so caused was negligible but this damage occasionally can become serious. In some cases the termite formed nest among branches of tree or tree trunk the attack in most cases began from root level and spreads to upper part. In older stem the bark under lying tissue was eaten up gradually reaching the pith howloing out of stem occured resulting ultimate death of plant.

During the present study the damage caused by *O. wallonensis* was more or less similar in both living and dead tree filled with mud. The runways was extended up to 3 to 4m height on *A. indica. , M. indica*. The nature of damage of *O. wallonensis* was in the form of earthen sheet plastered on stem branches however, Roonwal (1979) recorded wide spread damage by *O. wallonensis*. In deciduous forest its attack was also recorded in *casuarina spp.* although a little information given on the nature of damage *Microtermes* can feed on any roots they made excavation that is the hole in roots and move into the stem.
Nair and Varma (1981) did not find any correlation between the seasonal distribution of rainfall and incidence of termite attack or any relationship between annual rainfall and annual loss due to termite. They even had no support to the general belief that termite attacks are more common during dry periods. They further reported that most of the damage occurred before the onset of the dry season. The intensities of damage of *O. wallonensis* on *Eucalyptus sp.* and *A. indica* reached maximum during winter season with decreased in temperature there was no significant correlation between its damage and seasonal variation in temperature. During the present study seasonality in infesting various trees viz. *C. equisetifolia*, *C. nucifera*, *M. indica* the seasonal variation in temperature rain fall and relative humidity significantly play the role. In absence of relative humidity the temperature could not influence the intensity of damage by *O. wallonensis*

8.5. Damage to Agricultural Crops

8.5.1 Introduction

Termite attacks on annual and perennial crops cause significant yield losses. Termites can attack plants at any stage of development from the seed to the mature plant. Termite attack usually begins on the roots and then spread to upper part of the plants In older plants the bark and underlying tissue is eaten up which gradually exposed resulting ultimate death of the plant.Apart from crops they also attack the crop left over (root stubble) fallen leaves twigs bark etc. so far there are no reports available on the losses caused, except a report of Raj Gopal and Veeresh (1983). Termite damage has been recorded on the majority of crops grown in and around Bidar area. Plant may be partially or severely attacked at the base such as maize, soya bean, ground nut, sugar cane, maize foliage, finger millet mango trees. With regard to termite, credible information on the economic losses is difficult to obtain. Termite damage to crops in generally expresses as plant attacked or plant mortality reported in some species. Damages was observed at basal part of the trunk extended up to the branches During the process of food collection the workers generally attack plant and made week due to some internal growth factors, Nearly 200 species of termite are known in India among these 40 species of termite have been recognized as a pest of agriculture. Chhotani (1977) reported
that, the termite attack on plant at any stage of development from the seeds to the mature plant. Therefore the present study is undertaken to investigate the species of termite damage crop in and around the Bidar area.

**8.5.2 Material and Methods**

A survey was conducted and study was undertaken crops were evaluated for termite damage at several place in and around Bidar area. Plants fully or partly damaged by termite infestation are observed, in plants out of healthy plant survey is conducted during December-2008 to November-2009. Plants were closely and carefully inspected for signs of termite activity and damage such as earthen sheet covering run way and galleries on trunk and root are carefully observed.

**8.5.3 Damage to seedling species**

Termites builds large mounds containing many thousands of individual. The termite construct shallow subterranean foraging galleries radiating from nest for distance up to 50 meter. The Main galleries give rise to network of small galleries from which termite forage directly on under ground plant material seeding are either cut just below or above the soil surface.

**8.5.4 Damage to maturing and mature plants**

Damage to mature plants are largely caused by the species of *O. wallonensis*. Its nest consisting of diffuse network of galleries and chamber termite enter and consume the root system and directly or indirectly killed the plant. Decreased translocation of water and nutrient attack to the root system can also leads to increase susceptibility to pathogen. When the grain in lodge plant touches the ground soil fungi such as *Aspergillus* may invade it.

**8.5.5 Results and Observations**

1. **Maize**

   It is one of the major staple cereal crop grown throughout the region. The termite *O. wallonensis* was observed in the field. Damage was recorded to the seeds and seedlings. However it is attacked the stem of the maize plant at the ground level covering with earthen sheet up to 10 cm height from the base. When the earthen sheet was
removed to examine the damage, a hole was found at the base which was completely eaten a few cm upwards and downward and filled with soil. However the outer covering of the stem remained intact. Some of plants were found covered with earthen sheet, these are severely damaged plants were lodged on the ground even by slight wind. *O. wallonensis* caused severe damage to young maize crops. It doesn’t attack the root until plant reach maturity plant may either remains standing or lodge (fall over) attack by termite resulting total destruction of cobs (Plate-25A). In India it is observed that *Microtermes* spp. attacks the maize plants is maximum as compare to other termites. During the present study however they did not record any damage to seed and seedling in the beginning of the crops. Harvesting of lodged plants in commercial agriculture where the crop is mechanically harvested lead to high loss of yield. Where as, harvesting is undertaken by hand losses are considerable lower in other parts of southern region. Pre-harvesting loss in maize is due to termite.. Agrawal. S.B.D 1955 reported that, gradual increased in the intensity of attack by termite from November when rains were ceased (Plate 25 B).

2. Ground nut

*O. wallenensis* attacks to groundnut is observed in around Bidar area. The plants covering the stem with earthen sheet up to 5 cm height from the surface of the ground. It bored into the main stem just close to the ground level. Then tunneled down into the tap root and up to the stem. It damages pegs as well as mature pods occasionally penetrating into their shells, the damage to pegs lead to their breaking during harvesting, thus leaving the pods in the ground (Plate 27 A). Chhotani (1980) reported that, species of termite damaging ground nut. In India the loss of plant due to the damage of *O. wallonensis* was recorded. It has been reported to cause heavy plant mortality and observed that, more plant were attacked in the area of fields with soil moisture content. Though there was no direct information on the relationship of soil moisture content of the field and the termite damage to the groundnut plants. A significant relationship has been recorded between rainfall and *Microtermes* spp. Infestation to the ground nut  Johnson *et. al.*, (1981)

Termite are serious ground nut pests and invade actively growing ground nut plant through root and stem near ground level, hollowing out and causing plant to wilt
and die with consequent reduction in crop stand. The outer layer of the pods is sacrificed by termite. Termite can kill the plant directly by destroying tap root. Termite removes the soft non fibrous layer of the shell leaving the veins exposed causing scarification of the pods. Such pod may become mould at the time of harvesting generally damage and losses are expressed in the form plant mortality. Plant with earthen sheeting pod scarification and pod filled by soil. Termite damage was found serious in low rainfall area. The pods scarified were weaker and liable to crack. During harvesting time termite act as potential vector of pathogenic soil fungi in ground nut. The termite incidence in ground nut was estimated by counting the number of plant died due to termite damages, number of plants covered by earthen sheeting. The foliage of ground nut was attacked by *O. wallonensis* resulting loss in the yield damage varied from year to year. The termite attacks all the stage of the ground nut in the field as well as seed storage and also causing loss to the root and kernels of ground nuts resulting a severe damage.

3. Sugarcane

The survey conducted in the field of sugarcane with respect to damages caused by *O. wallonensis*. After plantation stage the attack by *O. wallonensis* prevent germination resulting in a poor stand. Termite attack the crop as it begins to mature. Secondary attack also occur when termite gain access to soft pith through site damaged by rodent and stem borers. The efforts have been made to investigate early shoot bore. The crop during the early part of cane growth before internodes formation. It also attacks the cane stalks in the year of scanty rainfall. Cane is grown from short length of cane (settes). The most common damage to the crops when these settes are first planted in the field attack, at this stage prevents germination resulting in a poor stand. Termite also attack crops as it begins to mature as well as secondary attack also occur when termite gain access to soft pith.

Termite enter the cane laterally through one or more holes in the stalks (shoot), and bores downward as well as upward killing the growing points. Thus it cuts upward of the central leaf cause heavy yield losses as it affects the plant area which will be poor in juice with less cane weight. Damages the crops soon after the cane laterally through one or more holes in the stalks (shoot) and bores downward as well as upward killing
the growing point. Thus it cuts upward of the central leaf cause heavy yield losses as it effects the plants area which will be poor in juice with less cane weight. Damages the crops soon after internodes formation and its activity continue till harvest. Most damages of sugarcane is destruction of settis (planting material) shown Plate 25 B

4. Soyabean

It has been observed in the field that, the *O. wallonensis* damages maximum number of soyabeam plants. It damages below ground level and remove the internal tissue causing weakened plant. Attack took place in crop with losses increasingly. In addition to this termite also attack, soyabean roots were damaged maximum. Maximum losses are noticed to root stubble on Soyabean has been observed (Plate 28 A). Workers left without damaging soyabean roots stubble. Lost in weight as compare to other crops.

5. Coconut Trees

The studies were carried out on the termite attack to coconut plants in and around Bidar area. The *O. wallonensis* seems to cause serious damage to seedling in nurseries and transplanted seedling particularly in the earlier stages. More serious loss is caused when they nibble at the tender growing point. It also damages to coconut plants in nursery mud galleries, an trunk wilting of central shoot, stunted growth and presence mud galleries was also seen on the trunk. The tender shoots of coconut seedling have been observed to be cut off by termites. It is found to cause damages to roots and shoots of seedling as well as young coconut trees (Plate 26 B). The attacked plants dried gradually and finally wilted.

6. Wheat

During the survey in the field of wheat, it was observed that, the attack of *O. wallonensis* at all stages of its growth. *O. wallonensis* have been reported to be most important termite species damaging wheat (Hussain 1935). The average annual losses of wheat in India at different places were estimated to vary from 6 to 40 percent. Wheat crops grown under protective irrigated condition during rabbi season it was found to be damaged by this termite. Among care al wheat is one of the most susceptible cultivated crops to termite attack at all stage of its growth.
7. Assessment of root stubble loss due to *O. wallonensis*.

Apart from crops they also attack on crop left over (Root stubble) fallen leaves, twigs, barks etc. The infestation of termite on the root stubble on sunflower, maize, finger millet was studied. Sunflower maize and finger millet stubbles were up rooted and grouped into un-attacked, partially attacked and completely eaten. The infestation of termite on stubble of crops varied considerably. The stubble loss was maximum in sunflower, moderate in maize and least in finger millet. In finger millet the intensity of attack was maximum from November to February. Maize root stubble noted that, stubble damage and weight loss is due to termite attack partially and completely eaten by termite. Soyabean root at maturity stage damage was maximum number before harvesting. The loss of nutrient such as nitrogen, potash, phosphorus was due to termite attack in the stubble of these crops.

8. Maize Foliage

It was found to feed on the collar region of the maize plants. Infested plants are found to break at the site of attack and lodged on the ground. The mortality varied different stage of the crops. During crop maturity its activities was more on the partially dried leaves and stem. Further fallen plants along with cobs were found to be damaged by this termite after harvesting. The root stubble provided excellent food for these species until the next kharif season. (Plate 24 B).

9. Finger millet

Foraging activity was first noticed on the lower dried leaves after sowing. Further it was constructed earthen sheeting on the shoots causing mortality of the plant. Its foraging is observed on the harvested straw and ear heads which were kept for drying at least for a week under field condition and also continued their activity on root stubble till next kharif season. (Plate 26 A).

10. *Mangifera indica*

During the survey on various trees of mango observed that, *O. wallonensis* well established on mango trees were found. Susceptible to this species as feeding under earthen sheeting on the bark was noticed. The incidences were more and severely damaged by this termite (Plate 23 A).
11. *Eucalyptus*

A survey was conducted throughout the Bidar area. Even 6-7 year old trees were damaged by *O. wallonensis* during 2008-09, 15 trees were finally selected for observation. Earthen sheeting constructed by *O. wallonensis* on the trunk of the *Eucalyptus* tree. Observations on the construction of earthen sheeting was observed further number of trees damaged and heights of sheeting on the trees were also observed.
A. Earthen sheet covering on the tree trunk of *Acacia arabica* by *O. wallonensis*

B. Earthen sheet on the tree trunk of *Tectona grandis* by *O. wallonensis*
A. Earthen sheet covering on the tree trunk of *Mangifera indica* by *O. wallonensis*

B. Earthen sheeth covering the tree trunk of *Casuarinas equisetifolia* by *O. wallonensis*
A. Earthen sheet covering on the tree trunk of *Tamarindus indica* by *O. wallonensis*

B. Maize shoots damaged by *O. wallonensis*
Plate 25

A. Fallen maize leaves and cobs damaged by *O. wallonensis*

B. Sugar cane shoot damaged by *O. wallonensis*
Plate 26

A. Finger millet root stubbles damaged by *O. wallonensis*

B. *C. nucifera* tree damaged by *O. wallonensis*
A. Ground nut root and shoot damaged by *O. wallonensis*

B. Ground nut pods filled with soil by *O. wallonensis*
A. Soyabean root stubble damaged by *O. wallonensis*

B. Maize root stubble damaged by *O. wallonensis*