CHAPTER 6

PESTS

Cashew, *Anacardium occidentale* L. is known to be infested in India by more than sixty species of insects during different stages of its growth and development. The important records of insect pests affecting cashew were those of Ayyar (1932, 1940 1941 and 1942). The vast literature on cashew pests has been reviewed by Abraham (1958), Beccari and Gerini (1968), Pillai *et al.,* (1976) and Ohler (1977). The pests so far recorded on cashew in the field and processed kernels in storage are given in Appendix 6.1.

When the extent of damage done by the pests is taken into consideration, stem and root borers (*Plocaederus ferrugineus*) tea mosquito *(Helopeltis antonii)*, leaf miner *(Acrocercops syngramma)* and leaf and blossom webber *(Lamida moncusalis)* are considered to be the major pests of cashew in India. From Tanzania, Northwood and Kayumbo (1970) reported that the important pests included sucking bugs *(Helopeltis schoutedeni* and *H. anacardii),* the theraptus bug *(Pseudotheraptus wayi),* the thrips *(Selenothrips rubrocinctus),* the bark borer *(Mecocorynus loripes),* and the defoliating caterpillar *(Nudaurelia bellina).* Brief descriptions of the pests, life histories, their nature and extent of damage, and control measures are discussed here.

Stem and root borers

Plocaederus ferrugineus L. (Coleoptera: Cerambycidae) the stem borer of cashew is capable of killing the tree outright. The symptoms of infestation include presence of small holes in the collar region, gummosis, extrusion of frass through holes, yellowing and shedding of leaves, drying of twigs and final death of the tree (Pillai, 1975; Pillai *et al.,* 1976).

The adult is a medium sized reddish brown longicorn beetle, the head and thorax of which are dark brown or almost black. It lays eggs in the crevices of loose bark in the trunk or exposed portions of roots of cashew trees. The grubs that hatch out bore into the fresh tissues of the bark and feed on the subepidermal and sapwood tissues and make tunnels in irregular directions. As a result of injury to the cells, a resinous materia oozes out, which on exposure to air gets hardened. The tunnels made by the grubs in the sapwood are broad and irregular, deepest in the middle and shallow at the sides, and fully packed with frass and fibrous tissues. When the vascular tissues are damaged, the ascent of plant sap is arrested and the leaves become yellow and are shed. During later stages, the twigs dry up and finally the tree dies. The fully grown grub descends to the root zone through tunnels in the sap wood and bores through the heart wood forms a chamber tightly packed with fibrous tissues and frass providing protection for the calcareous cocoon. Biology of the pest has been studied (Pillai *et al.,* 1976). Incubation period lasted for 4–6 days, grub phase 6–7 months and pupal period 20 days (when cocoon was not formed) and 60 days (inside cocoons) in laboratory cages.

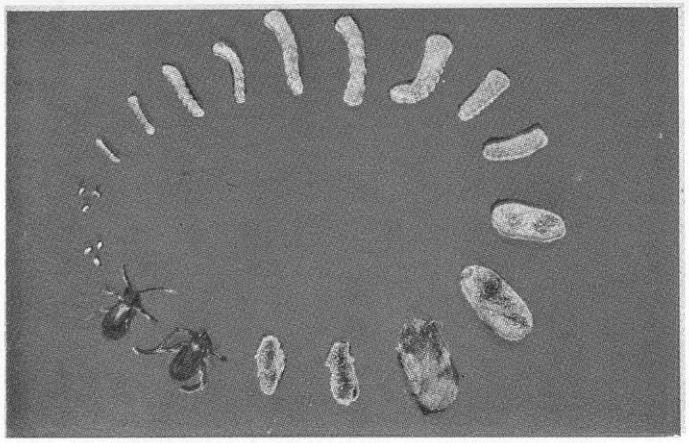
Two other species of longicorn beetles, *P. obesus* Gahan and *Batocera rufomaculata* De G. were also observed infesting cashew trees. *P. obesus* is a chestnut brown beetle with black pubescence. The adult is 40 mm long and the fully grown grub measures 75 mm. The excavations made by the grubs are wider than those of *P. ferrugineus*. *B. rufomaculata* is dark brown with fine greyish vestiture, pronotum with two kidney shaped orange yellow spots, white scutellum, and elytra with numerous black tubercles and yellowish spots of varying number and shape. The fully grown grub is 100 mm long. The larval excavations in early stages are extensive, irregular and deep, and packed with coarse fibres and scrapes of wood and bark. The pupae are bigger than those of *P. ferrugineus* and *P. obesus*.

Besides the longicorn beetles listed above, the grubs of the bark and sapwood borers like *Xylothrips flavipes* Ill. (Bostrychidae). *Lampetis fastuosa* F. and *Belionota prasina* Thumb. (Buprestidae), *Xystrocera globosa* Ol. (Cerambycidae) and *Coptops aedificator* F. (Lamiinae) also are seen associated with stem borer infested trees. Infestation by these insects will aggravate the condition of stem and root borer-infested trees.

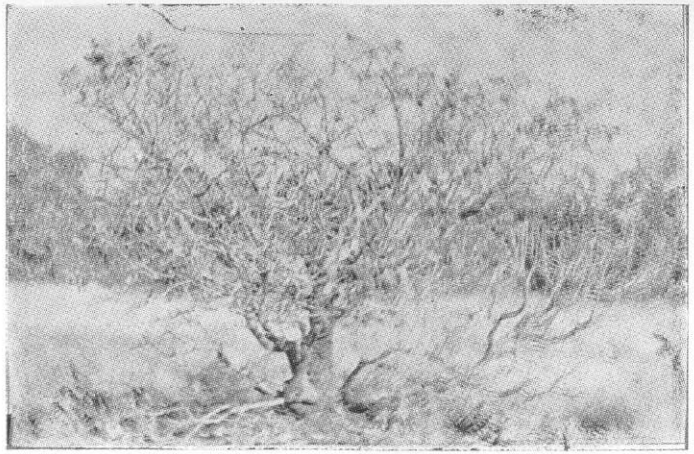
Aspergillus sp. isolated from dead grubs was not found to be pathogenic (Basu Choudhuri, 1969). Basu Choudhuri (1973) reported the green muscardine fungus *Metarhizium anisopliae* Metch. (Sorokin) from *P. ferrugineus* grubs and gave the details of its host-range, symptomatology, epidemiology and pathogenicity. However, the tests carried out at CPCRI, Kasaragod with *M. anisopliae,* isolate from *Oryctes rhinoceros* grubs, showed that this was not very effective, particularly when the inoculum was applied by mixing with cashew bark, the feeding material of grubs. Similar trials with the entomogenous bacteria, *Bacillus thuringiensis* Berl. and *B. popilliae* Dutky also did not give encouraging results. However the nematode-*cum*-bacterium culture, DD–136 *(Neoaplectana carpocapsae* and *Achromobacter nematophilus*), at an inoculum dose of 100 nemas / gram body weight of host grubs, effected 50–60% mortality of grubs within 24 days, when the inoculum was mixed with the feed, the cashew bark, in laboratory. This is yet to be tried under field conditions (Pillai *et al.,* 1976).

Field trials on the curative chemical control of stem and root borers revealed that success of the curative treatment depended much on the stage and intensity of infestation. Eventhough most of the insecticides tried were effective in controlling the grubs, the trees in the middle and advanced stages of infestation could not be saved. If the infestation was detected in the early stage itself, even swabbing with BHC 0.1% after removal of the affected tissues with immature stages of the pest, was quite effective. The dead trees and those which are beyond recovery should be removed from the plantation, lest they serve as reservoir for the multiplication of these pests, and the associated bark and sap wood borers. Some sort of an integrated approach including the phytosanitary measures is quite necessary for tackling stem and root borer infestation in cashew.

The bark borer *Indarbela tetraonis* Mo. (Lepidoptera: Arbelidae) is another pest present in almost all plantations irrespective of age of the trees (Pillai *et al.,* 1976) The adult moth lays eggs on the branches and the trunk. The caterpillars make small holes and tunnel through the superficial tissues of the bark on which they feed. They are seen inside the galleries made of silken threads reinforced with scrapes of tissues



1. Stem and root borer *(Plocaederus ferrugineus* L.) —Different stages of development



2. Stem borer infested cashew tree

3. *Helopeltis antonii Sign.* infested tender shoot

4. *Helopeltis antonii* Sign. infested cashew tree

and frass. They cause damage sometimes to the cambial tissues of small branches resulting in their drying. When the trunk and older branches are affected the tree presents a dirty appearance because of the presence of galleries and frass on the branches. Mechanical removal of the larval galleries and swabbing with BHC 0.1% will control the pest.

Analeptes trifasciata Fab.(Coleoptera: Cerambycidae) is widely distributed in Africa but particularly more serious in the western coastal belts. The recorded hosts of this longicorn beetle, besides cashew, include Sterculiaceae, Rubiaceae and Moraceae in Ivory Coast; Bombacaceae, Anonaceae and Verbenaceae in Ghana; *Adansonia digitata* L. and *Ceiba pentandra* Gaertn. in Nigeria and *Eucalyptus* sp. in Kenya and Uganda. The adult beetle lays eggs singly in incisions at the bases of branches immediately above the characteristic rings made by them. The grubs complete their life cycle in tunnels hollowed out inside the dead wood of the ringed branches and fallen ones. The infestation can be serious in young plantations.

Paranaleptes reticulata Thomas (Coleoptera: Cerambycidae) also causes more or less the same type of damage as that of *Analeptes,* though generally the branches attacked are much smaller. This insect too has numerous host plants such as *C. pentandra, Hibiscus* sp., *Plumeria acuminata, Bougainvillea* sp., etc.

Mecocorynus loripes Ches. (Coleoptera: Curculionidae) is the most serious pest in the cashew growing tracts of East Africa. Its incidence is considered to be more in Kenya and Mozambique. The adult is a dark grey weevil which lays eggs in the crevices of the bark. The grub period lasts for 60–75 days. The pupation takes place in burrows hollowed out in the xylem. The insect causes damage to the roots, trunk and branches. Intense attack quite often leads to the death of the tree.

The other Coleopteran borers on cashew include *Apate terebrans* Pall. (Bostrychidae), *Ceratosomus reidii* Kirby and *Marshallus* sp. (Curculionidae) reported from Brazil and *Apata* sp. and *Heterobostrychus* sp. (Bostrychidae), *Coptops aedificator* F. (Cerambycidae) and *Stephanoderes macrolobii* Egg. (Scolytidae) from West Africa (Agnoloni and Giuliani, 1977).

Tea mosquito

The tea mosquito, *Helopeltis antonii* Sign. (Heteroptera: Miridae) causes more economic losses to the crop than any other pests of cashew. The adults and immature stages of this mirid bug suck sap from tender shoots, leaves, floral branches, developing nuts, and apples. The injury made by the suctorial mouth parts of the insect causes the tender shoot to exude the resinous gummy substance. The tissues round the point of entry of stylets become necrotised and brown or black scabs formed, presumably due to the action of the phytotoxin present in the saliva of the insect injected to the plant tissues at the time of feeding. The adjoining lesions coalesce and finally the affected shoot/panicle dries up. Abraham (1958) estimated the average damage to tender shoots to be about 25% and to tender nuts as 15%. When the floral branches are infested it results in inflorescence blight which accounts for about 30% loss (Anon., 1966).

The immature nuts infested by this pest develop characteristic eruptive spots and finally shrivel and fall off.

Sathiamma (1977) observed that a final instar nymph of tea mosquito produces 114 lesions (range 78–235), a female bug 97 lesions (range 16–238) and a male 25 lesions (range 11–59) during 24 hr. Water soaked lesions appear at the feeding sites 10–15 minutes after feeding. These become prominent within 3–6 hr. The water soaked lesions turn pinkish brown in 24 hr and scabby and black in 2–3 days (Nambiar *et al.*, 1973). The initial lesions are about 2.0 mm long and 1.3 mm wide on leaves and 9.2 mm long and 1.9 mm wide on stems. Lesions on fruits appear as brownish or blackish circular spots of 2.6–3.7 mm diameter. It was also estimated that on an average 14.0% shoots were infested (range 5.2–32.8%). The panicle damage may be partial (the secondary rachii only affected) or full (main rachis and secondary rachii infested). On an average 48.5% panicles were found attacked (24.2% partial and 24.3% full). Fully affected panicles dry up. Fruit damage was estimated to be 32.0%. Tea mosquito damages young cashew trees throughout the year as they produce flushes almost continuously (Sathiamma, 1978). However, older trees do not show any damage during June–September when they will be without new flushes (Pillai *et al.*, 1976). Similar observations have been made for *H. anacardii* Miller on cashew in Tanganyika also (Swaine 1959).

Remamony and Abraham (1977) observed *Pachypeltis maesarum* Kirkaldy (Heteroptera: Miridae) in company with *H. antonii.* The percentage of *P. maesarum* in the mixed populations ranged from 22 - 52 as revealed from random samples. Under confinement in cages, the adults and nymphs were found to infest tender stems, young leaves and inflorescences. The affected leaves curl up and show necrotic lesions around the feeding punctures. The infested twigs and inflorescences dry up rapidly.

The tea mosquito has a wide host range including tea, guava, cacao, mahogany, cinchona, red gum, apple, grapes, and neem trees (Rao, 1915; Puttarudriah and Appanna, 1955). Eventhough adequate data on the extent of crop losses caused by this pest are lacking, it was observed that the incidence was very severe in most of the cashew growing tracts on the West Coast. Contrary to the earlier belief that tea mosquito is not a major problem on the East Coast, recent observations revealed its incidence in severe proportions in Tamil Nadu, particularly in Cuddalore, Vridhachalam and Pudukkottai areas.

The adult bug is reddish brown with a black head, red thorax, and black and white abdomen. A knobbed process arises from the dorsal aspect of the thorax. The bug lays eggs singly deep inside the tissues of tender shoots or floral branches. A pair of fine thread-like chorionic processes projecting outside is indicative of the presence of eggs inside the tissues. The eggs are reniform and creamy white. The incubation period lasts 6–7 days and nymphal period comprising five instars is completed in 10 days. The build up of population synchronises with the emergence of new flushes after cessation of monsoon showers. The pest population reaches its peak when the trees are in full blossom.

Damodaran and Nair (1969) assessed the relative efficacy of eleven insecticides in controlling *H. antonii* and found that two sprayings with DDT 0.2% at 15 days interval starting as soon as the pest attack was noticed, gave the best results, followed by Sevin (0.1%), endrin (0.03%) and dieldrin (0.05%). Systemic insecticides were not as effective as contact insecticides in controlling the pest.

Chemical control trials carried out at Kasaragod revealed that endosulfan 0.05%, applied as high volume spray, or 0.1% as low volume spray, at the time of emergence of new flushes, panicles and fruit set, was effective in controlling tea mosquito population and reducing the resultant crop losses. Endosulfan treated plots recorded 10.7% infestation of inflorescences as against 32.5% in the untreated control plots. The average yield of nuts per tree in the treated plots was 2.5 kg as against 1.3 kg in the untreated control (Pillai and Abraham, 1975).

Three rounds of sprayings are recommended taking into consideration the trends in population fluctuation of the pest. Moreover, the third round of spraying given at the time of fruit-set will take care of not only tea mosquito infestation, but also other insects which are responsible for immature fruit drop in cashew. Infestation by tea mosquito, flower thrips and fruit borers accounted for 12.3% fruit drop during the mustard stage, 16.4% during pea nut stage and 1.1% during later stages (Pillai and Pillai, 1975). They also found that immature fruit drop was quite high at the mustard, pea nut and later stages.

The time of spraying is very important for the effective control of a pest like tea mosquito. The spraying has to be done well in advance before the insect has inflicted injury to the crop. As the flowering in cashew is protracted, the insecticide that is used for spraying inflorescences should be one which does not affect the pollinating insects adversely. A study of the insects associated with cashew inflorescences revealed that the honey bees *Apis indica* and *Apis florea,* the dipteran fly *Thoracitis abdominalis,* ceratinid bees, wasps (Vespidae, Scoliidae, and Xylocopidae) and ants (Formicidae) were the major species of insects visiting cashew inflorescences. The exact role played by each species of these insects in the pollination of cashew is yet to be confirmed.

Three species of *Helopeltis* are associated with cashew in different cashew growing tracts of the world (Swaine, 1959, Northwood and Kayumbo, 1970). Of these, *H. schoutedeni* Reuter *(=H.bergrothi* Reuter) is the most wide spread species occurring in Africa, extending from Togo and Nigeria to Tanzania and Mozambique, while *H. anacardii* Miller is essentially confined to the coastal cashew regions of Africa. *H. antonii* Sign.,on the other hand, is distributed in India and neighbouring countries, Brazil etc.

Leaf miner

Infestation by the leaf miner *Acrocercops syngramma* M. (Lepidoptera: Gracillariidae) is commonly observed in the post-harvest and post-monsoon flushes. Young trees are more prone to the attack of this pest. The injury by the caterpillars which mine through tender leaves become visible as tortuous markings first. Later on, the thin epidermal peel of the mined areas swell up as blistered patches. When the infested

tender leaf matures the damage will be manifested as big holes. As many as eight caterpillars have been observed on a single leaf. Abraham (1958) estimated the damage to be 26% in severely infested tracts, whereas Basu Choudhuri (1962) observed that 75–80% leaves were damaged.

The adult is a silvery grey moth which lays eggs in tender leaves. Freshly hatched caterpillars are pale white and the fully grown ones reddish brown. They make their way out of the mined areas and fall to the soil and pupate.

Spraying phosphamidon or fenitrothion 0.05% at the time of emergence of new flushes is effective in controlling the pest. Spraying with endosulfan 0.05% against tea mosquito infesting new flushes will take care of this pest also.

A chalcidid parasite (unidentified) has been recorded from *A. syngramma.*

Leaf and blossom webber

Two species of leaf and shoot webbing caterpillars *Lamida (=Macalla) moncusalis* Walker and *Orthaga exvinacea* Hamps have been recorded as pests on cashew. Of these, the former has attained the status of a major pest in recent years in the East Coast tracts, particularly in the coastal districts of Andhra Pradesh (Ayyanna, Narayana and Rao, 1977). The pest is assuming severe proportions in the cashew plantations of Tamil Nadu and Orissa also. The symptoms of infestation include the presence of silken webs reinforced with pieces of plant parts on the terminal portions of tender shoots and blossom and the drying of webbed shoots.

L. moncusalis male is dark, fuscous and female paler and more olive green. Rao et al., (1973) studied the comparative biology of the insect on cashew and mango and found that the life cycle was completed in 37 days on cashew and 41 days in mango. Murthy *et al.,* (1974) reported that the egg, larval, prepupal, pupal and adult stages lasted for 5–6, 16–21, 1–2, 8–11 and 3–6 days respectively.

Spraying 0.2% BHC or 0.05% fenitrothion or endosulfan at the time of emergence of new flushes immediately after the monsoon was recommended for the control of the pest. Ayyanna, Subbaratnam and Rao (1977) found that Carbaryl 0.15% and malathion 0.15% were most effective against the pest with endosulfan 0.05% and fenitrothion 0.15% being the next best.

Two species of *Apanteles* and an unidentified species of Braconid have been reported as natural parasites of this pest.

Less serious enemies of cashew

The less serious pests are the defoliating caterpillars, shoot tip caterpillars, leaf thrips, leaf beetles and weevils, flower thrips, apple and nut borers, and nut crinkler.

Defoliating caterpillars

Cricula trifenestrata H. (Lepidoptera: Saturnidae) is a sporadic pest which causes extensive damage by defoliation of isolated trees in certain localities. The body

of the caterpillar is beset with urticating hairs and spines. The full grown larva is stout, dark brown and about 50–65 mm long. Pupation takes place inside dark silken cocoon spun amongst the leaves often in masses. The adult is a reddish brown moth with three clear concentric spots on wings.

Metanastria hyrtaca Cram. (Lepidoptera: Lasiocampidae) is also a sporadic pest attacking isolated cashew trees. Nair *et al.,* (1974) studied the biology of the pest in Kerala. The moth lays eggs in clusters on the lower surface of leaves. The eggs hatch in nine days. The larval period lasts 33 days for males and 35 days for females. There are five larval instars. The duration of different instars also varied for males and females. The pupal period lasts 12 days. The early instar caterpillars are gregarious feeders on tender foliage and the full grown caterpillars feed voraciously on mature leaves as well. They congregate on the tree trunk during day time and are active during night only.

Rao *et al.,* (1976) studied the biology of the pest in Andhra Pradesh. The pest appeared in June-July with the emergence of new flushes in cashew and continued up to December. Its fecundity ranged from 26 to 128. Incubation period lasted for 8–12 days with an average of 9.8 days, larval period comprising 5–7 instars ranged from 21–47 days and pupal period (including prepupal period of 2–3 days) for 12–18 days with an average of 14.7 days. The total life cycle from egg to adult took 54–76 days with an average of 66 days. An interesting feature noticed was that it took 75–109 days to complete the life cycle in sapota as against 54–76 days in cashew.

Perilampus microgastrii Ferr. (Perilampidae) was reared from parasitised larva collected from the field (Pillai *et al.,* 1976).

Misra and Basu Choudhuri (1974) recorded *Lymantria obfuscata* Walker (Lepidoptera: Lymantriidae) as a new pest of cashew from South India. The caterpillars feed voraciously on foliage during night, but are inactive during day time. They congregate in large numbers, on the ground under dry leaves, near the base of the tree in crevices of bark, or on lower parts of well shaded branches. Its life cycle lasts 45–51 days during April-May. Field and laboratory observations revealed that the pest completed five generations and started a sixth one in an year under South Indian conditions. Some Tachinids have been reported as parasites of this pest (Misra and Basu Choudhuri, 1974).

The slug caterpillar *Latoia (Parasa) lepida* Cram. (Lepidoptera: Eucleidae) and the looper *Oenospila flavifuscata* W. (Lepidoptera: Geometridae) were also reported as sporadic pests of cashew. Recently *Estigmene lactinae* C. (Arctiidae) (Sreeramulu *et al.,* 1975), *Diacrisia obliqua* Walker (Arctiidae) and *Stathmopoda* sp. near *paraealbata* Meyr. (Stathmopodidae) were also recorded as pests infesting cashew foliage (Pillai *et al.,* 1976).

Rao *et al.,* (1977) studied the biology of the leaf eating caterpillar *Thalassodes quadraris* Guen. (Lepidoptera: Geometridae), recorded as a cashew pest in Guntur and Prakasam districts of Andhra Pradesh. The adult is a medium sized moth, apple green in colour with a pale oblique line running across the fore and hind wings. The caterpillar is a semilooper having pale, yellowish pink colour. The life cycle from egg

to adult is completed in 22–35 days (egg period 3–5 days, larval period 13–20 days and pupal period 6–10 days).

Bombotelia jocosatrix Guen. (Lepidoptera: Noctuidae) is another leaf eating caterpillar recorded as a cashew pest from Andhra Pradesh. Early instar caterpillars feed on the leaf margins by making holes all along. Fully grown larvae feed on the entire leaf gregariously leaving behind the midrib only. The total life cycle from egg to adult is completed in 30.6 days (egg period 3.8 days, larval period 14.9 days and pupal period 11.9 days) (Rao *et al.*, 1978). Distinct sexual dimorphism was noticeable in the moths. Males are dark purple brown and females purple brown. Hind wings are white with purple brown margins with a small round spot in the centre in both the sexes. Mango is another host of this pest (Fletcher, 1914; Ayyar, 1940).

Stray cases of incidence of the leaf roller *Sylepta auranticollis* F., a Eucosmid caterpillar *Argyroploce tonsonia* F., and the Tassar silk moth *Antherea paphia* B. have also been noticed on cashew (Abraham, 1958).

Rao (1978) recorded *Spodoptera litura* F. as a pest of cashew foliage. Tobacco is another important host of this pest. When plant protection measures were taken up for the control of *S. litura* in tobacco nurseries, the caterpillars were found to migrate to cashew plantations and to cause considerable damage to cashew foliage in October–November.

Shoot tip caterpillars

The tiny yellowish or greenish brown caterpillars of the moth *Hypatima (Chelaria) haliqramma* M. (Lepidoptera: Gelechiidae) damage the shoot tips. It occasionally bores through the tender shoot tip to a depth of about 20–25 mm causing stunting and drying up of growing shoot tips. Upto 26% damage has been recorded in severe cases of infestation (Abraham, 1959). Remamony (1965) recorded the caterpillars of *Anarsia epotias* Meyr. (Lepidoptera: Gelechiidae) causing considerable damage to tender shoots. As the caterpillar reaches the third or fourth instar, it bores into the terminal shoot tip and tunnels backwards feeding on the internal tissues and filling the tunnels with frass. Usually it bores to a depth of 20–30 mm. Gummosis will also be seen in such shoots. The infested shoot gradually dries up.

As the infestation of shoot tip caterpillars coincides with the emergence of new flushes, sprays done against tea mosquito and other foliage pests at the time of emergence of new shoots will control these pests as well.

Leaf and flower thrips

Of the three species of thrips recorded as foliage pests of cashew in India viz., *Selenothrips rubrocinctus* Giard *Rhipiphorothrips cruentatus* Hood and *Retithrips syriacus* M. (Thysanoptera: Thripidae), the former two cause very severe damage to young plantations particularly during summer months. Fennah (1962) observed that the populations of *S. rubrocinctus* Giard on cashew trees in Trinidad, West Indies also regularly increased during the dry season, from a low level in December and January to a peak in April or May and then rapidly declined during the wet season. S. *rubrocinctus* was found to feed on leaves that were subjected to water stress and to breed only on debilitated trees

(Boboye 1968), the evidence suggested that the adequacy of its supply of nutrients depends on the induction of suitable metabolic conditions within the leaf by water stress. This pest is widely distributed in West Indies, East Africa and India. In Kenya, the infestation takes place at the end of rainy season and culminates in September–November. In India also the pest is most active in the summer months, March to May rather than during the monsoon.

The adults and immature stages of thrips colonise on the lower surface of leaves. As a result of their rasping and sucking activity the leaves become pale brown and slightly crinkled with roughening of upper surface. Infestation by foliage thrips in severe proportions had been observed during the summer months in cashew plantations in Tamil-Nadu. Spraying 0.05% endosulfan or fenitrothion so as to give a thorough coverage to the lower surface of leaves will control the pests.

Rhynchothrips raoensis G. and another unidentified species of thrips have been reported by Abraham (1958) attacking cashew inflorescences. The rasping and feeding injury made by thrips results in scabs on floral branches, apples and nuts. Infestation on developing nuts results in the formation of corky layers on the affected parts; malformation of nuts and even immature fruit-drop. The third round of spray against tea mosquito at the time of fruit set will control flower thrips as well.

Leaf beetles and weevils

Monolepta longitarsus Jac. (Coleoptera: Chrysomelidae) appears in large numbers during the South West monsoon period (June-August) and causes damage to the tender leaves and portions of stem. Young plantations and nursery seedlings are more severely affected by this pest. *Hyperaxis albostriata Mots., Hoplosoma abdominalis* Jac., *Basilepta falvicorne* Jac., and *Pagria constatipennis* Jac. (Chrysomelidae), *Arodepus marginatus* Pasc. (Attelabidae) and *Oxycetonia versicolor* Fab. (Cetonidae) have been observed to congregate on new shoots and feed on them.

The leaf twisting weevil *Apoderus tranquebaricus* F. (Coleoptera: Curculionidae) which is a pest on mango, was observed on cashew also at the time of emergence of new flushes (Abraham, 1958). The weevil folds the leaves along the midrib, deposits its oval orange coloured eggs on leaf tips and twists the leaf into a compact roll. The grub after hatching feeds on the rolled up leaf tissues.

Three other species of weevils observed feeding on tender foliage of cashew are *Myllocerus discolor* B., *M. viridanus* F., and *Amblyrhinus poricollis* B. Of these *M. discolor* was observed to cause heavy damage to tender leaves, particularly in nursery seedlings and young plantations.

Spotted locust and bag worms

The spotted locusts, *Aularches miliaris* Linn. (Orthoptera: Acrididae) have been observed to cause severe damage by feeding on the foliage of cashew trees (Pillai *et al.*, 1976). This is a polyphagous insect infesting teak, coconut, arecanut, coffee and erythrina. Its incidence in an epidemic scale in June 1975 in the Malappuram district of Kerala State caused severe damage to cashew, coconut, arecanut and other crops. An

unidentified species of bag worm (Lepidoptera: Psychidae) was observed feeding on cashew foliage in the cashew plantations of the Forest Department, Goa (Pillai *et al.*, 1976).

Mealy bugs and scales

Incidence of mealy bug *Planococcus lilacinus* (Ckll.) and wax scale *Ceroplastes floridensis* C. on tender shoots, mild incidence of the scale *Diaspis* sp. on leaves and stray incidence of the giant scale *Monophlebus sp.* on tender shoots were reported by Abraham (1958) and Basheer and Jayaraj (1964). *Pseudaonidia trilobitiformis* Green is distributed in the regions of East Africa (Kenya and Tanzania) and the Seychelles Islands (Ohler, 1977). The sucking action of insects leads to foliar yellowing and defoliation.

Wide spread infestation of white flies *Aleurodicus cocois* Curtis (Aleyrodidae) has been reported from cashew plantations of North East Brazil (Ohler, 1977). As a result of the attack sooty mould may develop on the ventral side of leaves. In cases of severe infestation there is a sharp drop-off in production, and defoliation of the plant with consequent general withering and eventual death (Agnoloni and Giuliani, 1977).

Mites

Bano and Chandra (1973) recorded *Oligonychus mangiferus* Rahman and Sapra (Acarina: Tetranychidae) from cashew. The young and adult mites were found congregating along the midrib and veins sucking the sap causing depressions. When the attack is severe, the leaves get desapped and turn brown. Infestations by mites have been observed in severe proportions in some cashew plantations in Karnataka, Andhra Pradesh and Orissa.

Oligonychus coffeae Neitner (Acarina: Tetranychidae) is a pest of cashew in Africa, (Rodrigues, 1967). This is a dark red mite that colonises on the upper surface of the leaves though it infests inflorescences as well. As a result of infestation the interveinal tissues appear bright red and later show large number of silvery blotches.

Pests on inflorescence

In addition to blossom webber and thrips, inflorescences are attacked by the hairy caterpillar *Euproctis scintillans* W. (Lepidoptera: Lymantriidae), the chafer beetle *Popillia complanata* Newm. (Coleoptera: Rutelidae), the caterpillar *Pingasa ruginaria* Gn. (Lepidoptera: Geometridae) (Sreeramulu *et al.*, 1975) the mealy bug *Ferrisia virgata* (Ckll.), the aphid *Toxoptera odinae* Vdg., and the flatids, *Flata* sp. and *Ketumala* sp. (Pillai *et al.*, 1976).

Apple and nut borers

Thylocoptila panrosema M. (Lepidoptera: Pyralidae) is a pinkish dark actively moving caterpillar which bores into tender apples and nuts. In years of severe infestation nearly 10% of the apples and nuts are affected. The apple borer *Nephopteryx* sp. also is responsible for heavy crop losses (Dharmaraju *et al.*, 1974). Dharmaraju *et al.*, (1976)

reported that damage by this pest amounts to 20–60% in certain cashew plantations in Bapatla and Chirala Taluks of Andhra Pradesh. The caterpillars attack the fruits at all stages and cause the shrivelling and premature fall of nuts. Only a single caterpillar is generally seen either in the apple or nut, but there are reports of up to five caterpillars occurring in apples and three in nuts. There are five larval instars lasting 15–33 days. The full grown larvae drop to the ground and pupate in earthern cocoons. The pupal period lasts 8–10 days. Ayyanna *et al.,* (1977) found that 0.15% carbaryl and malathion were the most effective insecticides against *M. moncusalis* and *Nephopteryx* sp., with endosulfan 0.05% and fenitrothion 0.15% being the next best.

Basu Choudhuri and Misra (1973) reported *Hyalospila leuconeurella* Ragonot (Lepidoptera: Pyralidae) and *Anarsia epotias* Meyrick (Lepidoptera: Gelechiidae) also as pests of cashew apples and nuts in South India. The control measures include identification of trees which bear apples and nuts during the off-season and control of the pests by mechanical destruction or spraying of infested inflorescences apples and nuts with a suitable insecticide. Phytosanitary measures during Pre-flowering season and foliar application of suitable insecticides during July-October will arrest the population build up of the pests.

Nut crinkler

Nair and Remamony (1964) reported the Coreid bug *Paradasynus* sp. *(rostratus* Dist?) (Heteroptera: Coreidae) sucking sap from tender nuts causing them to shrivel, and dry up. The adult bug lays eggs on leaf surface in groups of upto 52, equally spaced and arranged in regular rows of five or six. The incubation period was 8–11 days and the nymphal period comprising five instars was completed in 21–36 days with an average of 27 days. The eggs are parasitised in the field by *Hadrophanurus* sp. (Scelionidae) and *Anastatus* sp. (Eupelmidae). The third round of spraying done against tea mosquito at the time of fruit setting will control this pest also. The same Coreid bug has been recorded as a new nut crinkler pest of coconut also in Kerala.

Northwood and Kayumbo (1970) reported the theraptus bug *Pseudotheraptus wayi* Brown (Heteroptera: Coreidae) from Tanzania, as feeding on developing nuts and producing black sunken spots on the kernels. Usually there will not be any sign of damage on the shells. The percentage of affected kernels in some consignments may be as much as 8–10. This pest also infests coconut and cacao. Biological control of the pest using the predacious ant *Oecophylla longinoda* on coconut has been reported from Tanzania.

In view of the heavy economic losses caused by different insect pests it is imperative to adopt timely plant protection measures in cashew. Chemical control of various pests has been reported to be successful. However, it is rather impracticable to adopt control measures against individual pests except in cases of isolated outbreaks. Adoption of suitable plant protection measures to cover different pests at a particular time would be quite desirable and more economical. Researches on biological control of different pests are to be intensified and suitable measures to be taken for conservation of natural enemies of different pests. The future of pest control research in cashew lies in working out a strategy for integrated pest management covering all the major and minor pests.

APPENDIX 6.1.

Pests of Cashew

Name of pest	*Reference*
INSECTS	
Achaea catocaloides Gn.	Beccari and Gerini (1968)
Achaea ezea Cram.	Beccari and Gerini (1968)
Achaea faber Holl.	Beccari and Gerini (1968)
Achaea lienardi Bod.	Beccari and Gerini (1968)
Acrocercops syngramma Meyrick	Ayyar (1932, 1940, 1941 and 1942), Abraham (1958), Basu Choudhuri (1962), Browne (1968), Agnoloni and Giuliani (1977)
Aethalion reticulatum	Parente and Ribeiro (1970)
Aethemenes (Nezara) *chloris* Westw.	Beccari and Gerini (1968)
Ahasverus advena Watl.	Pinheiro (1968)
Aleurodicus cocos Curtis	Arruda (1970), Parente and Ribeiro (1970), Dunham and Andrade (1971), Agnoloni and Giuliani (1977), Ohler (1977)
Aleurotrichus flocosus	Parente and Ribeiro (1970)
Alphitobius diaperinus Panz	Pinheiro (1968)
Alphitobius laevigatus F.	Pinheiro (1968)
Amblyrhinus poricollis. Schoenherr	Browne (1968)
Analeptes trifasciata Fab.	Jones (1961), Tuley and Iwenjora (1963), Browne (1968), Agnoloni and Giuliani (1977)
Anarsia epotias Meyrick	Remamony (1965), Browne (1968) Basu Choudhuri and Misra (1973)
Anastrepha mombinpraeoptans Ein.	Beccari and Gerini (1968)
Anastrepha sp.	Araque (1968)
Anoplocnemis curvipes F.	Lefebvre *et. al.*, (1973)
Antheraea paphia L.	Abraham (1958), Browne (1968)
Antistarcha binocularis Meyrick	Peixoto (1960), Calzavara (1970), Parente and Ribeiro (1970), Agnoloni and Giuliani (1977).
Aoniella orientalis Newstead (= *Aspidiotus cocotiphagus* Marlatt)	Browne (1968)
Apate congener Gerst.	Pinheiro (1968)
Apate sp.	Beccari and Gerini (1968),Agnoloni and Giuliani (1977)
Apate terebrans Pallas	Peixoto (1960), Browne (1968), Pinheiro (1968), Agnoloni and Giuliani (1977)
Apion amplum F.	Ayyar (1932, 1940, 1941 and 1942), Anon. (1957), Abraham (1958), Anon. (1959), Wheatly (1961), Beccari and Gerini (1968), Pinheiro (1968)

Apoderus tranquebaricus Fabricius	Abraham (1958), Browne (1968)
Apologlostatus acaciae Schedl.	Beccari and Gerini (1968)
Apterygida albipennis Charp.	Pinheiro (1968)
Argyroploce tonsonia M.	Abraham (1958)
Arodepus marginatus Pasc.	Pillai *et al.* (1976)
Aspidiotus destructor Signoret	Peixoto (1960), Beccari and Gerini (1968)
Aulacaspis cinnamomi Newstead (= *Aulacaspis tubercularis* Newstead)	Beccari and Gerini (1968)
Aularches miliaris Linn.	Pillai *et al.* (1976)
Bag worm	Pillai *et al.* (1976)
Basilepta flavicorne Jac.	Pillai *et al.* (1976)
Batocera rufomaculata De G.	Pillai *et al.* (1976)
Belionota prasina Thumb.	Pillai *et. al.* (1976)
Bombotelia jocosatrix Guen.	Arjuna Rao *et al.* (1978)
Bostrychoplites sp.	Beccari and Gerini (1968)
Cadra cautella Wlk.	Pinheiro (1968)
Camponotus sp. Mayr.	Abraham (1958)
Carpophilus dimidiatus (F).	Pinheiro (1958)
Carpophilus sp.	Pinheiro (1968)
Catacanthus sp.	Davis (1949)
Ceroplastes floridensis Comstock	Ayyar (1932, 1940, 1941 and 1942), Abraham (1958 and 1959), Basheer and Jayaraj (1964), Browne (1968)
Ceryx imaon Cramer	Sathiamma (1978)
Charaxes numenes Hew.	Beccari and Gerini (1968)
Chrysobothris curta Kerr.	Pinheiro (1968)
Chrysomphalus ficus Ashmead (= *Aspidiotis ficus* = *Chrysomphalus aonidium* L.)	Browne (1968)
Coccus hesperidum L,	Wheatly (1961)
Coptops aedificator F.	Beccari and Gerini (1968), Pillai *et al.*, (1976)
Cricula trifenestrata Helfer	Ayyar (1932, 1940, 1941 and 1942), Abraham (1958), Morton (1961), Browne (1968)
Crimissa sp. Stal.	Parente and Ribeiro (1970), Johnson (1973)
Cryptolestes ferrugineus Steph.	Pinheiro (1968)
Cryptolestes pusillus Schonh.	Pinheiro (1968)
Ctenomeristis ebriola Meyrick	Thatchenko (1949), (1954–61), Browne (1968)
Diacrisia obliqua Walker	Pillai *et al.* (1976)
Diaspis sp.	Abraham (1958), Basheer and Jayaraj (1964)
Disphinctus humeralis Walker (= *Pachypeltis humerale* Walker)	Beccari and Gerini (1968), Browne (1968)
Disphinctus politus Walker	Beccari and Gerini (1968)
Dysdercus superstitiosus	Lefebvre (1973)
Eccoptopterus spinosus Oliv.	Beccari and Gerini (1968)

Egropa malayensis Dist.	Beccari and Gerini (1968)
Estigmene lactinea C.	Sreeramulu *et al.*, (1975)
Euproctis scintillans Walker (=*Porthesia scintillans*)	Abraham (1958), Browne (1968),
Euthalia garuda Moore	Browne (1968)
Ferrisia virgata Cockerell	Abraham (1958 and 1959), Morton (1961), Beccari and Gerini (1968), Browne (1968), Bohlen (1973), Pillai *et al.*, (1976)
Flata sp.	Pillai *et al.*, (1976)
Gnathocerus maxillosus F	Pinheiro (1969)
Helopeltis anacardii Miller	Morton (1961), Wheatly (1961), Beccari and Gerini (1968), Evaristo and Pais (1970), Northwood and Kayumbo (1970), Bohlen (1973), Nambiar *et al.*, (1973), Hill (1975), Agnoloni and Giuliani (1977).
Helopeltis antonii Signoret	Rao (1915), Ayyar (1932, 1940, 1941 and 1942), Puttarudriah and Appanna (1955), Abraham (1958), Morton (1961), Browne (1968), Damodaran and Nair (1969), Nambiar *et al.*, (1973), Nambiar (1974), Pillai and Abraham (1974), Pillai (1975), Pillai and Abraham (1975), Pillai *et al.*, (1976), Agnoloni and Giuliani (1977), Sathiamma (1977)
Helopeltis schoutedeni Reuter (=*Helopeltis bergrothi* Reuter)	Anon. (1957), Mutter and Bigger (1962), Beccari and Gerini (1968), Evaristo and Pais (1970), Northwood and Kayumbo (1970), Bohlen (1973), Nambiar *et al.*, (1973) Agnoloni and Giuliani (1977)
Helopeltis spp.	Agnoloni and Giuliani (1977), Ohler (1977)
Heterobostrychus brunneus Murr.	Pinheiro (1968)
Hilda patruelis Stal.	Wheatly (1961), Beccari and Gerini (1968), Bohlen (1973)
Hoplosoma abdominalis Jac.	Pillai *et, al.* (1976)
Hyalospila leuconeurella Ragonot	Browne (1968),
	Basu Choudhuri and Misra (1973)
Hypatima haligramma Meyrick (=*Chelaria haligramma*)	Abraham (1958 and 1959), Basheer and Jayaraj (1964), Browne (1968)
Hyperaxis albostriata Mots.	Pillai *et al.*, (1976)
Idarbela tetraonis Moore	Abraham (1958), Browne (1968), Pillai *et al.*, (1976)
Kissophagus confusus Egg.	Beccari and Gerini (1968)
Lamida moncusalis Walker (=*Macalla moncusalis*)	Abraham (1958), Basheer and Jayaraj (1964), Browne (1968), Ganeswara Rao *et al.*, (1973), Krishna Murthy *et al.*, (1974), Ayyanna *et al.*, (1977)

Lampetis fastuosa F.	Pillai *et al.*, (1976)
Lasioderma serricorne F.	Pinheiro (1968)
Latoia (*Parasa*) *lepida* Cram.	Abraham (1958), Basheer and Jayaraj (1964), Pillai *et al.*, (1976)
Lecanium latioperculatum Green	Ayyar (1932, 1940, 1941 and 1942), Browne (1968)
Lepidosaphes sp.	Wheatly (1961)
Leptocentrus sp.	Sathiamma (1978)
Liposcelis sp.	Pinheiro (1968)
Lygus palus Auct.	Beccari and Gerini (1968)
Lymantria obfuscata Walker	Misra and Basu Choudhuri (1974)
Lypesthes sp.	Sathiamma (1978)
Macrodactylus pumillo Burm.	Abrahao and Orlando (1956), Mariconi (1963), Parente and Ribeiro (1970)
Marshallus sp.	Agnoloni and Giuliani (1977)
Mecocorynus loripes Ches.	Mutter and Bigger (1962), Pinheiro (1958) Northwood and Kayumbo(1970), Hill (1975), Agnoloni and Guiliani (1977), Ohler (1977)
Megalopyge lanata	Parente and Ribeiro (1970)
Metanastria hyrtaca Cram.	Abraham (1958), Browne (1968), Nair *et al.*, (1974), Arjuna Rao *et al.*(1976)
Mimips bidentatus Schedl.	Beccari and Gerini (1968)
Monolepta longitarsus Jacoby	Abraham (1958 and 1959,) Basheer and Jayaraj (1964), Browne (1968)
Monophlebus sp.	Abraham (1958), Basheer and Jayaraj (1964)
Myllocerus discolor Boheman	Abraham (1958), Basheer and Jayaraj (1964), Browne (1968)
Myllocerus viridanus Fabricius	Abraham (1958), Basheer and Jayaraj (1964), Browne (1968)
Necrobia rufipes (DeG.)	Abraham (1958), Pillai (1959), Pinheiro (1968)
Nephopteryx sp.	Abraham (1958), Dharmaraju *et al.*, (1974 and 1976), Ayyanna *et al.*, (1977)
Nezara viridula L.	Le Pelley (1959), Browne (1968)
Nudaurelia dione Fabricius	Browne (1968), Northwood and Kayumbo (1970)
Oecophylla smaragdina Fabricius	Basheer and Jayaraj (1964), Browne (1968)
Oenospila flavifuscata Walker	Abraham (1958), Browne (1968)
Oereodes sparsus Bah.	Sathiamma (1978)
Olethreutes tonsoria Meyrick *(=Agyroploca tonsoria)*	Browne (1968)
Orthaga exvinacea Hamps.	Ayyanna *et. al.*, (1977)
Oryzaephilus mercator (Fauv.)	Tuley and Iwenjora (1963), Pinheiro (1968)
Oryzaephilus surinamensis (L.)	Abraham (1958), Pillai (1959), Pinheiro (1968)

Othreis divitiosa Walker	Beccari and Gerini (1968)
Othreis fullonia Clerck	Beccari and Gerini (1968), Browne (1968)
Othreis materna	Beccari and Gerini (1968)
Oxycetonia versicolor Fab.	Pillai *et al.*, (1976)
Pachypeltis mesarum Kirkaldy	Remamony and Abraham (1977)
Pachypeltis sp.	Sathiamma (1978)
Pagria constatipennis Jac.	Pillai *et al.*, (1976)
Palorus subdepressus (Doll.)	Tuley and Iwenjora (1963), Pinheiro (1968)
Paradasynus sp. *(rostratus* Dist.?)	Nair and Remamony (1964)
Paranaleptes reticulata Thomson	Gardener (1957), Jones (1961), Wheatly (1961), Tuley and Iwenjora (1963), Browne (1968), Hill (1975) Agnoloni and Giuliani (1977).
Parasa lepida Cramer	Abraham (1958), Browne (1968), Basheer and Jayaraj (1964), Pillai *et al.* (1976)
Phlaeothrips anacardii Newm.	Morton (1961)
Phycita leuconeurella Rag.	Thatchenko (1949), Beccari and Gerini (1968)
Phyllodromia bivittata Serv.	Pinheiro (1968)
Piezothetus flavipes Reut.	Pinheiro (1968)
Pingasa ruginaria Gn.	Sreeramulu *et al.*, (1975), Pillai *et al.*, (1976).
Planococcus citri Risso	Beccari and Gerini (1968), Browne (1968)
(= Pseudococcus citri Risso)	
Planococcus lilacinus Cockerell	Abraham (1958), Basheer and Jayaraj (1964),
(= Pseudococcus lilacinus)	Browne (1968)
Planococcoides njalensis Laing	Browne (1968)
(= Pseudococcus njalensis Laing)	
Plocaederus consocius Pascoe	Abraham (1958), Basheer and Jayaraj (1964), Browne (1968)
Plocaederus ferrugineus L.	Ayyar (1932, 1940, 1941 and 1942), Abraham (1958), Basheer and Jayaraj (1964), Beccari and Gerini (1968), Browne (1968), Basu Choudhuri (1973), Pillai *et al.*, (1976).
Plocaederus obesus Gahan	Pillai *et al.*, (1976)
Plodia interpunctella (Hb.)	Abraham (1958)
Popillia complanata Newm.	Sreeramulu *et al.*, (1975), Pillai *et al.*, (1976).
Polygraphus natalensis Egg.	Beccari and Gerini (1968)
Prionoma atratum Gmelim	Basheer and Jayaraj (1964), Beccari and Gerini (1968), Browne (1968)
Pseudaonidia trilobitiformis Green	Peixoto (1960), Wheatly (1961),
(= Aspidiotus trilobitiformis)	Browne (1968), Bohlen (1973), Agnoloni and Giuliani (1977), Ohler (1977).

Pseudotheraptus wayi Brown	Davies (1960), Wheatly (1961), Beccari and Gerini (1968), Northwood and Kayumbo (1970), Bohlen (1973), Agnoloni and Giuliani (1977)
Pulvinaria sp.	Beccari and Gerini (1968)
Retithrips aegiptiacus Marc. *(= Rethithrips syriacus)*	Peixoto (1960)
Rhaphidopsis melalanca Gerst.	Pinheiro (1968)
Rhipiphorothrips cruentatus Hood.	Abraham (1958), Browne (1968)
Rhynchothrips raoensis Ramakrishna	Ayyar (1932, 1940, 1941 and 1942)
Saisettia nigra Nietner *(= Lecanium nigrum)*	Abraham (1958), Browne (1968)
Salberghella spp.	Browne (1968)
Sciothrips sp.	Lefebvre *et. al.,* (1973)
Selenothrips rubrocinctus Gr.	Wheatly (1961)
	Ayyar (1932, 1940, 1941 and 1942), Abraham (1958 and 1959), Bigger (1960), Wheatly (1961), Fennah (1962), Mutter and Bigger (1962), Araque (1968), Browne (1968), Northwood and Kayumbo (1970), Lefebvre (1973), Agnoloni and Guiliani (1977)
Sitophilus Zea-mays Motsch	Pinheiro (1968)
Solenopsis sp.	Pinheiro (1968)
Spodoptera litura F.	Arjuna Rao (1978)
Stathmopoda sp. near *praealbata* Meyr.	Pillai *et al.,* (1976)
Stephanoderes macrolobii Egg.	Beccari and Gerini (1968), Agnoloni and Giuliani (1977)
Sylepta balteata Fabricius *(= Sylepta auranticalis)*	Abraham (1958), Browne (1968)
Tachardia artocarpi Auct.	Beccari and Gerini (1968)
Termites	Bohlen (1973)
Tenebroides mauritanicus L.	Abraham (1958), Pinheiro (1968)
Thalassodes quadraris Guen.	Beccari and Gerini (1968), Arjuna Rao *et al.,* (1977).
Thylocoptila panrosema Meyrick	Basheer and Jayaraj (1964), Browne (1968), Pillai *et al.,* (1976)
Toxoptera odinae Van der Goot *(= Aphis odinae)*	Abraham (1958), Basheer and Jayaraj (1964)
Trachyostus aterrimus Schaufuss	Browne (1968), Pillai *et al.,* (1976)
Tribolium castaneum (Hbst.)	Beccari and Gerini (1968)
Tupalis fasciatus	Abraham (1958), Pillai (1959), Pinheiro (1968)
Xylopsocus sellatus Fah.	Davies (1950), Wheatly (1961)
Xyleborus andrewesi Bland.	Beccari and Gerini (1968)
Xyleborus maneus Blandf.	Beccari and Gerini (1968)
	Beccari and Gerini (1968)

Xyleborus perforans Woll.	Beccari and Gerini (1968)
Xylothrips flavipes Ill.	Pillai *et al.*, (1976)
Xystrocera globosa Ol.	Pillai *et al.*, (1976)

MITES

Aceria sp.	Araque (1968)
Aleuroglyphus ovatus Trop.	Pillai (1959), Pinheiro (1968)
Brevipalpus californicus (Banks)	
Brevipalpus phoenicis (Geijskes)	Rodrigues (1970)
Calacarus citrifolii (Keifer)	Rodrigues (1970)
Caloglyphus sp.	Pillai (1959), Pinheiro (1968)
Cheyletus sp.	Pillai (1959), Pinheiro (1968)
Eotetranychus falcatus Meyer and Rodrigues	Rodrigues (1967), Northwood and Kayumbc (1970)
Lasioseius sp.	Pinheiro (1968)
Leiodinychus sp.	Pinheiro (1968)
Melichares sp.	Pinheiro (1968)
Melichares tarsalis	Pinheiro (1968)
Oligonychus coffeae (Nietner)	Wheatly (1961), Rodrigues (1970), Agnolon and Guiliani (1977)
Oligonychus mangiferus Rahman and Sapra	Bano and Nagesh Chandra (1973)
Pronematus sp.	Rodrigues (1970)
Suidasia nesbitti Hughes	Pinheiro (1968)
Suidasia sp.	Pinheiro (1968)
Tetranychus sp.	Rodrigues (1970)
Tetranychus sp.	Rodrigues (1970)
Tydeus munsteri Meyer Ryke	Rodrigues (1970)
Tydeus sp.	Rodrigues (1970)
Tydeus spatthus	Rodrigues (1970)
Tyrophagus castellanii	Pillai (1959), Pinheiro (1968)
Tyrophagus putrescentiae Sch.	Pinheiro (1968)
Tyrophagus sp.	Pinheiro (1968)