African Journal of Agricultural Research Vol. 6 (33), pp. 6755-6758, 30 December, 2011
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJARX11.019
ISSN 1991-637X ©2011 Academic Journals

Review

Problems and management of insect pests in social forestry in Nigeria

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Accepted 7 December, 2011

Social forestry involves the participation of the local people in the management and protection of forests and afforestation with the purpose of fostering environmental, social and rural development. The species commonly planted belong to the genera *Acacia*, *Albizia*, *Artocorpus*, *Azadirachta*, *Casuarina, Celtis*, *Eucalyptus*, *Moringa*, *Mangifera*, *and Prosopis*. This paper studied the current status of forest pests, by reviewing the main problems faced by these tree species commonly planted and appropriate measures to manage these pests. For instance seed pests such as *Dichocrosis punctiferalis* and *Sitophilus spp* bore fruits in the standing trees and nursery pests that cause serious damages to roots are *Holotrochia consanguinea* and *Apogonia uniformis*. Pests problem in plantations are mainly defoliators, sap suckers and xylophagous pests. Management practices to prevent these pests include behavioural and genetical methods of control, plant varietal resistance, cultural methods or ecological management, and biological control. However, access to improved breed of tree species would have a long way to reducing the incidence of pests attack in social forestry.

Key words: Social forestry, insect pests problems management.

INTRODUCTION

Social forestry programmes have been initiated with a view to meeting the forest product requirements of local population and to reverse the process of ecological and climatic degradation through proper soil and water conservation and to improve the socio-economic conditions of the rural people. The term social forestry first came to prominence in the 1976 report of the National Commission of Agriculture (NCA) in India, in which it was used for a programme of activities to encourage those who depended on fuel wood and other forest products to produce their own supplies-in order to "lighten the burden of production forestry" (NCA, 1976). Social forestry was a country-wide concept by the Indian Government with the aim of taking the pressure off currently existing forests by planting trees on all unused and fallow land (Anon, n.d). World Bank (2006) estimated that some 275 million rural poor in India depend on forest for part of their livelihood. The principal aim of social forestry which is hinged primarily on community or local people participation in forestry activities is to provide among others fuel wood, fodder, fruit and small timbers primarily to meet the need of the inhabitants of villages scattered throughout India (Khosho, 1986). Social forestry programmes have the following objectives: To meet the needs for fuel wood, small timber, bamboo, fodders and other minor forest products on a sustained basis:

1. To provide employment opportunities to the rural population;
2. To develop cottage industries in rural areas;
3. To utilize the land available for the best advantage according to its production capacity;

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4. To provide efficient soil and water conservation; and
5. To improve aesthetic values of the area and to meet the recreational needs of the population.

Success of social forestry programme depends on the active involvement and cooperation of the community. Social forestry programme is designed to be implemented in village common lands, wastelands, homestead, along banks of ponds, canals, etc, in the selection of tree species the emphasis is given on the multipurpose trees (MPT) which yields fuel wood, fodder, fruits, edible or non-edible oil etc, and nitrogen fixing trees (NFT). The commonly planted tree species belong to the genera *Acacia, Albizia, Artocarpus Azadirachta, Casuarina, celtis, Eucalyptus, Mangifera, Moringa, Prosopis*, *Tamarindus* and the others. These species are primarily grown as monoculture under intensive management in order to achieve the highest productivity by reducing competing vegetation and maintaining an optimum stand density. However, these species are not naturally gregarious, thus introducing an element of artificiality in the monoculture where the insect pest populations build up rather rapidly on account of easy availability of food supply, the absence of natural energy complexes and a short life cycle of tropical insects (Sen - Sarmma, 1972).

Native and exotic tree legumes species are grown as multipurpose trees in agrofestry systems throughout the tropics. Species in both categories habour insects that defoliate, produce galls or leaf mines, eat seeds, suck sap or bore in stems, roots or branches. Some insects, mainly sap suckers, also transmit pathogens. The debilitating impact of insect on the forage quality and seed quantity may be so great that remedial activity is desirable (Sen - Sarmma 1986).

Introduced plants usually “accumulate” a range of associated herbivorous insect species; some invade from elsewhere, whereas other insects may have been pre-adapted to the introduced plants, perhaps through their adaptation to a close relative. Other insects may be present in low numbers and use the tree as alternative host when their usual host is unsuitable or unavailable. The list of insects that attack an introduced plant species in most cases increases rapidly initially and then gradually increase with time (Strong et al., 1984), presumably as the distribution of the plant increases and as the rate of encounter of insect species pre-adapted to the host are slowed down.

Most of the serious damages to trees are caused when the insect reach high densities, although some species causes considerable damages even when relatively few are present. Few stem borers, and sometimes just one, may be sufficient to kill a tree (Conway, 1978). Such aspects of an insect’s life history may determine appropriate methods of control. Some species that cause serious damage only at high densities may be reduced to acceptably low levels by biological control or the breeding of resistant cultivars, while others may need to be dealt with in other ways (Conway, 1978). The objective of this paper is to review the problems of insect pests in social forestry and their associated management practices.

STATUS OF FOREST INSECT PESTS

With the accelerated pace of afforestation, forest area increases year by year, coupled with the occurrence of various types of forest pest damage. The forest plantation offers a large number of host plants, and coupled with a fragile ecological environment in many areas, the forest is often prone to pest attack. According to Yujian (2007), forest plants habouring pests cause huge economic losses each year, severely limited forestry production and stable ecological environment, hence prevention and control of forest pests becomes an extremely critical problem. Some of these forest insect pests are thus discussed.

Seed pests

Seeds are damaged on the mother trees by insects during their formative stages or those fallen on the ground, during transit and /or storage period (Lvsen, 2009). *Dichocrosis punctiferalis* feeds on flowers and fruits of *Mangifera indica, Alcides spp* and *Sitophilus spp* bore fruits on the standing trees. The principal pests of stored seeds belong to the genera *Bruchidus, Bruchus, Caryodon (bruchidae*). The seeds of leguminous plants are highly prone to the infestation by these *bruchidae*.

Nursery pests

For social forestry plantation, seedlings are required in millions. The seedlings are raised in temporary nurseries located near the plantation sites. There is a considerable loss of nursery stocks due to pests and diseases which often disrupts the scheduled plantation programmes (Sen- Sarmma, 1986). Besides, above ground pests such as defoliators, sap-suckers, gall formers, and the underground pests such as cutworm, white grubs and termites can cause the most serious damage, particularly in nurseries where plantation materials are raised from cutting. Species such as *Holotrochia consanginea, Holotrochia serrata, Melolontha furcicauda, Autoserica nathani, Apogonia uniformis*, seriously damage the root growths of seedlings and transplants. Adult beetles defoliate *Acacia nilotica* and *Azadirachta indica* are especially attractive to chafer beetles.

Greasy cutworm (*Agrotis ipsilon*) is a polyphagous pest and it can cause heavy mortality in nursery stocks of several species. Subterranean termites are equally harmful. They either partially or completely remove the

bark at the root or hollow out the taproot. The severity of damage is not restricted only to nursery stocks and transplants, cuttings are equally vulnerable. Termites cause a very severe damage to *Eucalyptus* transplants up to 3 years which often results in nearly destruction (Sen-sarmma, 1986).

Termites commonly encountered causing damage are *Anacanthotermes macrocephalus, Microcerotormes minor, Odontotermes distans, Odontotermes indicus, Odontotermes microdentetus, Odontotermes abesus, Odontotermes Wailonensis and Microtermes obesi* (Sen-Sarmma et al., 2010). Fuel wood and leaf fodder tree species recorded to have been damaged by termites included *Acacia spp, Albizia lebbel, Azadirachta indica, Casuarina equisetitolia, Eucalyptus spp, Moringa oleifera, Prosopis cineraria,* various clones and cultivars of populus (Roonwal, 1979).

Pest problems in plantations

Defoliator

Social forestry plantations are often very seriously plagued by foliation problems. *Acacia spp* and *Azadirachta indica* are defoliated by adults of chafer beetles and become quite serious. The number of lepidopterous defoliators is quite staggering. Most of these are polyphagous and damage can often be quite serious. The large scale defoliation of fodder tree species greatly reduces the availability of leaf fodder for cattles. However, the plant during vigorous growth period can recover quickly from the adverse effects of the defoliation particularly if it happens during the growing season (Beeson, 2007).

Ber, *Zizyphus mauratara* an important fodder and fruit species is prone to defoliation by a number of species of ber butterfly (African Pierrot or Pointed Pierrot), *Tarucus theophrastus* (Butani, 1979). Both adults and larvae of *Diohabda lusca* (*Chrysomelidae*) feed on the foliage of *Celtis australis* in North West India. Some adult weevils also cause an occasional severe defoliation. Some important species of *Chrysomelidae* are *Ambhyrrhinus poricollis, Dereodus pollinosus, Myllocerus* discolor, *Xanthochelus spp*.

Sap sucker

Sap sucking insects belong to the orders Hemiptera and Homoptera. The mouth-parts of these insects are adapted to pierce plant-tissue to suck sap of succulent stems, leaves, flowers or fruits of both healthy and unhealthy plants, the former being preferred (Beeson, 2007). Some insects are also vectors of disease pathogen (Sen-Sarmma, 2008). *Alcurocnathus mangiferae* sucks the sap of tender leaves and succulent twigs of *M. indica. Aspidiotus orientalis* is a serious pest of several trees of importance to social forestry such *as Cordial dichotoma, Dalbegia sissoo*, *A. indica, Tamarindus indica*. Severe infestation can result in retarded growth, leaf shedding and stem die-bark.

Xylophagous pests

The number of xylophagous insects boring shoots, stems and roots is quite large. However, they primarily infest trees which have lost normal vigourity due to water stress. Clones or cultivars of *poplars* that are resistant to water stress can withstand the pests attack considerably. Due to the damage inside, the infested trees are prone to wind damage and forking.

Calosterna scabrator is *Acacia* root and stem borer. However, to late *Eucalyptus spp* and *Prosopsis cineraria* have also fallen prey to this borer. Infestation is manifested by the frass produced by the boring larvae during feeding which is ejected through a hole on the stem. The borer not only retards the growth but it sometimes kills the tree outrightly as well. *Inderbela quadiotata* is a bark-eating caterpillar and attacks a wide range of plants such as Acacia *albizia*, *Cassia fisstula*, *M. oleifera, C. equisetifolia, Terminalia ivorensis* (Lvsen, 2009).

MANAGEMENT PRACTICES

Some of these management practices are discussed below. Social forestry programmes involve the creation of man-made plantation. Complexity and stability of the biocoenose of these plantations depends on the kind of crop planted, cultural practices adopted, general land use pattern and the vegetation complex of the area and weather (Singal and Toki, 1990).

Behavioural and genetic methods of control

Many insect species, particularly those that mate predominantly at night communicate sexually with volatile chemicals called pheromones. For many pests, pheromones have been analyzed and synthesized. As bait in appropriately designed traps, pheromones are effective in luring conspecific insects of the sex that responds to the pheromones, even when densities are so low that the insects are undetectable.

Plant varietal resistance

Breeding programmes can produce free varieties that are resistant to a particular pest species that cause severe damage. This has been done with *Leucaena* and some

bred cultivars are being developed which are quite effective against the *Leucaena psyllid*. Unfortunately, resistance in this species is associated with high tannin content, which decreases the forage value of the plant. However, the resistance mechanism in *Leucaena* is not understood, and this retards progress in selecting for resistance as breeders, with no way of assaying their progress on the basis of chemical analysis rather than on observed resistance to the pests. Transgenic potato and cotton plants, with the gene for producing *Bacillus thuringiensis* toxin intruded into their genome, are now being investigated for possible cultivation. This may be a possibility for defoliating pests (usually caterpillars) of tree legumes that are killed by the toxin.

Cultural methods or ecological management

Cultural control methods are diverse and rely on a good understanding of the pest species ecology in relation to the production system. Not all would be appropriate for pest management in forage free system because the environment is not manipulated to the extent it is in cropping systems. However, combinations of plants in mixed systems can be selected to ensure that pest populations are not inadvertently enhanced by the provision of a good alternative host for a particular pest species. Also stored seed may be protected by manipulating the storage environment and practicing good sanitation.

Biological control

Effective biological control has many advantages, especially if it is self-sustaining. Unfortunately the success rate of biocontrol is, in general, quite low. A substantial effort in locating species-specific parasitoids or predators is necessary, as shown by the exploration for *L. psyllid* natural enemies (Waage, 1990). Furthermore, an appropriate research based on the species status of the natural enemies and host-would substantially reduce the possibility of costly mistakes (Peterson, 1991). It is noteworthy that the *L. psyllid* is thought to have host race (Waage, 1990), which is a good hint that host-specific sibling species are often present.

CONCLUSION

Alternatives to chemical control are available for dealing with insect pests of tree legumes. Biological and varietal control are probably best suited to the requirements of forage production and to the mean and available resources of the grower. Chemical can be quite effective even if little is known about the pest species, and the same chemical can be used to kill insects of several insect pest species. The appropriate research on the host-relationship of parasitoids in nature and the specificity of predator-prey relationships in nature must also be conducted for each species involved.

Finally, the breeding of resistant varieties may be aided considerably by an understanding of the chemical or other basis of resistance and of the way in which the target insects are affected.

RECOMMENDATION

Access to improved breed of tree species would go a long way in minimizing the incidence of pests occurrence in social forestry.

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