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THE EFFECT OF INSECT ASSOCIATION ON THE PRODUCTIVITY OF SOME FOREST TREES IN SUDAN

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Abstract

The effect of insect association on productivity of selected forest tree species in Sudan was investigated. The selected trees were *Acacia senegal* subsp. *senegal* (Hashab), *Butyresperaum paradoxum* (Shea tree), *Faidherbia albida* (Haraz), *Moringa aleifera* (Moringa), *Prosopis chilensis* (Mesquites) and *Salvadora persica* (Arak, Tooth brush tree).

The biology, distribution in Sudan and the economic importance of these selected tree species were reviewed. The insect species associated with the tree and their seeds were identified and their effects were summarized. Beneficial effects were reported for *A. senegal* trees and specially on gum production. Other insects associated with other trees showed deleterious effect on the trees and their organs (leaves, seeds, and wood ... ete). The insects involved were: *Agrilus nubeculosus* (Fairm) in *A.senegal* , *Cirina butyrospermi, Anacridiam moestum var.melanorhodon, Ceratitis silvestrii, Pachmerus longus, Sinoxylon senegalense,* caterpillars and locusts for *Faidherbia albida, Eupterate mallifera for Moringa*

oleifera, Rhipibruchus allults and *Crematogaster* sp. For *Prosopis chilensis* and *Lepidoptera Colotis* ephiae and *Eriophyes* for *Salvadora persica.* The effect of each insect on the tree and its organs is summarized.

Introduction

In many countries timber products are almost always seen as the only contribution of forestry to national economy. However, in dry areas, non-wood products are also very important and often, most significant to local economies and to the wellbeing of rural people. In dry area especially, these products make woody vegetation economically and socially relevant to rural people. There are many examples in Africa, Asia and Lain America of non-timber forest products being more important in economic and monetary terms than timber itself. Forestry had evolved in the last five decades and the importance of these products and related technology are highlighted to rural development and particularly to food security. The international organizations (e.g. FAO Council and the Committee on World Food Security) in 1985 had discussed the role of forestry in food security. They recognized that natural foods from forest were much more important in the food supplies of many countries than is generally realized; particular concern was expressed “at the loss of species resulting from destruction and deterioration of the tropical forest resources and attention was drawn to the fact that these forests constituted the world’s largest resource of genetic diversity, including the wild relatives of important staple food plants. There is similar concern at the degradation and loss of savanna vegetation, which contains a multitude of forest species that contribute significantly to the diet of dry zone people, throughout the tropical world and particularly in Africa.

This paper had two main objectives. The first one was to collect and summarize information on production of a few major non-wood products which are significant at the country level, and in particular to provide: 1) brief description of forest tree species, ii) assessment of production per tree, iii) and indication of the economic importance of the products. The second objective was to identify the insect pests associated with some selected forest species and their effect on tree productivity.

Materials and Methods

The information included in this study were collected from published data and from personal experience. The selected forest trees included in this study were: *Acacia senegal subsp. senegal, Butyrospermum paradoxum, Faidherbia albida, Moringa oleifera, Prosopis chilensis* and *Salvadora persica* (Table 1).

Results and discussion

Table 2 summarizes the uses and environmental requirements of the tree species reviewed in the text. In addition the distribution of the trees in Sudan was also included.

Table 1. The selected forest tree species used.

Scientific name	Common name	Family	Habit	Part used.
Acacia senegal subsp. senegal	Hashab	Fabaceae	Tree	Gum
Butyrospermum paradoxum	Shea tree	Sapotaceae	Tree	Seeds
Faidherbia albida	Haraz	Fabaceae	Tree	Leaves, Fruits
Moringa oleifera	Moringa	Moringaceae	Tree	Leaves, Fruit, Seeds
Prosopis chilensis	Mesquite	Fabaceae	Tree	Leaves, Fruits
Salvadora persica	Arak	Salvadoraceae	Tree	Leaves, stem, Fruits

Table 2. Summary for the uses and environmental requirements of the tree species reviewed

Species	Rainfall (mm)	Habitat	Soils	Uses	Distribution in Sudan (El-Amin, 1990)
Acacia senegal subsp. senegal	100-800	Open savanna	Sandy Preferred	- Agroforestry - Browse - Soil - conservation - Eaten by man - Fuel - Gum/Latex - Bee food - N-fixation	On sandy and clay plains in short grass savanna forming a continuous belt from east to west in central Sudan. More common on the western sand plaines of kordofan and Darfur as pure stands.

				- Drnamental. - Shade and shelter	
Butyrospermum paradoxum	400-1500	Savanna	Various (not suitable for heavy clays)	- Browse - Soil conservation - Eaten by man - Fuel - Bee food - Oil - Medicinal - Toxins and poisons - Shade and shelter - Wood	On deep loamy soils in high rainfall savanna in Darfur (Hofrat El Nahas, and Kafia kingi).

Faidherbia albida	100-2050	Wide butmainly riverine	Not clays	- Agrofrestry - Browse - Soil conservation - Eaten by man - Bee food - Medicinal - Nitrogen fixation - Shade and shelter - Tannins - Miscellaneous - Wood	The tree grows in various habitats. Widespread along rivers, streams, and water depressions from south to north and east to west but successful along the seasonal water courses of W.Sudan in Darfur.
Moringa aleifera	300-2250	Open savanna	Not stiff clay	- Browse	This is an exotic

				- Eaten by man - Fuel - Gum - Oil - Fibre - Hedge - Medicinal Ornamental - Toxins and poisons - Water purification - Shade and Shelter	species and grown in many parts of Sudan

				- Tannins	
Prosopis chilensis	400-1200	Savanna	Various	- Browse - Eaten by man - Fuel - Bee food - Medicinal - N-fixation - Toxins and poisons - Tannins - wood	Introduced by Forestry combact desertification. Now naturalized and a widespread weed in most areas of W. and central Sudan
Salvadora persica	50-1000	Desert, savanna	Clays preferred, salt	- Browse - Soil conservation	In the arid areas of the flood plalns along valleys and

			tolerant	- Eaten by man - Fuel - Bee food - Oil - Medicinal - Shade and shelter - Micellaneous - Wood.	khors in N. and E. Sudan Red Sea Hills (Sinkat), Kassala (Gedaref an Dinder), White Nile (Dueim , and Getaina), Khartoum and Kordofan.

Acacia senegal (l.) Willd subsp. senegal:

As shown in Table 2 the main product of *A. senegal* is gum Arabic. The insect pests associated with the tree are the Buffalo tree hopper (*Stictocephala bubalus)* which destroy 16.7 – 82.5% of seeds. Spiders (*Cyclops* sp.) may smother young growing apex (Cheema and Quadir, 1973; Duke, 1981). Also, the larval stage of *Coleoptera* (bruchids) cause great damage.

Locusts (*Acridium melanorhodon*) can defoliate vast areas over night (Awouda, 1974).

Recently, Kalil and El-Tigani (2020) have reported that the beetle *Agrilus nubeculosus* (Fairm.) lives in *A senegal* (Hashab) environment and spend most of its time between trees during the tapping season. The presence of this insect during the tapping time can be used as an indication for high gum production. Also, they showed that three micro-organisms were isolated from *A. nubeclosus,* namely *Ceadosporium oxysporum , Aspergillus* spp. and a nitrogen fixing bacterium.

Butyrospermum paradoxum (Gaertner f.) Hepper. Subsp. niloticum (Syn. *Vitellaria paradoxa* Gaertner f

The nuts of this tree form the main source of shea bulter. Caterpillars of *Cirina butyrospermii* (saturniid) and *Anacridiam moestum* var. *melanorhodon* cause defoliation. *Ceratities silvestrii attack* the ripe fruits (Godin and Spensley, 1971 ; Maydell, 1983) and *Mussida nigrivenella* lives on the nuts. Locust attacks can

prevent fruit production over a large area (Anon, 1912). It can be concluded that these insects affect adversely shea butter production.

Faidherbia albida (Del.) A. Chev. (Syn. *Acacia albida*).

The haraz tree is useful in agroforestry, soil conservation and in nitrogen fixation. The leaves and ripe fruit provide good fodder for domestic animals the fruits are also eaten by man. The seeds and trees are attacked by some insects. Seed borers *Pachymerus longus* and *P.(Caryedon) pallidus, Bruchidus sp.* Ear *rufulus* and *B. silaceous* can damage 51% of seeds; wood borer *Sinoxylon senegelernse* can damage wood; termites may damage roots. Leaves susceptible to various insects, caterpillars and locusts (Wickens, 1969). As a result of the insect investation the forage produced is severally affected.

Moringa oleifera

Moringa tree provides good fodder, food and oil. The leaves, fruit, seeds form the most useful organs of the plant. The hairy caterpillar, *Eupterote mollifera* causes defoliation but can be controlled by insecticides as reported in India (Council of Scientific of Industrial Research, 1962). Other pests of *Moringa* include an aphid *Aphis caraccivera*; caterpillars *Tetragonia siva, Metanastia hyrtaca* and *Heliothis armigera;* a scale insect, *Ceroplastodes cajani;* a borer *Diaxenopsis apomecynoides* and a fruit fly, *Glitonia (* Ramachandran *et al*., 1980). All these insects affect the productivity of Moringa trees.

Prosopis chilensis

Prosopis chilensis provides good fuel. It is a wide spread fast growing tree. The leaves and pods form a good fodder. Also, the sweet fruits are eaten by man. Beetls are reported to attack the stem of the trees and feed on the phloem sap. These insect damage the wood and causes great losses.

Salvadora persica L.

The Arak tree is characterized by medicinally important metabolites (glucosinolates, low calorie sweeteners ... etc) in their leaves and fruits. The tree is attacked by defoliating larvae of several beetles (Council of Scientific of Industrial Research, 1972) and leaves often attacked by caterpillars of the Lepidoptera *Colotis* ephiae (Brumer, 1983). The mite *Erioplyes* causes leaf galls (Kant and Arya, 1971).

Conclusion

It is clear from the above that insect association to forest tree species can be beneficial as in the case of *A.nubeculosus* with *Acacia senegal* trees in high production of gum. Other insects (e.g. locust) can cause great damage to foliage leaves which results in a serious reduction of fodder as in the case of *F. albida* and *P.chilensis*. The nature of interactions do occur between plants and insects is still obscure, but few studies suggested hormonal interactions are possible at many levels and depend on the ability of physiologically active chemicals to interact between the different types of the living organisms. More research is needed to explain the interactions between plants and insects.

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