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Investigation on the Decline of *Balanites aegyptiaca* (Heglig) tree Associated with the Cerambycid Beetle, Macrotoma palmata, in the Blue Nile area – Middle Region of Sudan

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ABSTRACT: This study was done to assess the impact of the longhorn beetle, Macrotoma palmata,on Balanites aegyptiaca in the Sudan. The research was to investigate the phenomenon of the decline of the wood of the tree by the wood boring beetle. A total of 14 plots were randomly selected from Khour Abuseif forest, regenerated by B. aegyptiaca wood tree species. Each selected plot had a square shape, with an area of ¼ hectare. In each selected plot, trees were counted and grouped into 2 different categories: sound trees and infested ones. For further recognition of the infested trees, dissection of the suspected branches was done to ensure the presence of one or all developmental stages of the pest. Mean frequency of infestation in the trees was determined in each selected plot by counting the infested ones in each chosen plot. Approximately, the overall mean frequency of infestation was 24% from the whole computed trees. In each selected plot, different growth parameters were measured in sound trees and compared with those of infested ones. High significant reductions, in the parameters of the infested trees, were recorded. The mean reductions in diameter at breast height (dbh), height (h), volume (v) and mean annual increment (m.a.i) of the infested trees in reference to sound ones was15.62%, 17.90%, 41.53% and 40.6% respectively.

KEYWORD: Tree Growth Parameters – Wood Boring Insects – *Balanites aegyptiaca* – *Macrotoma palmata*

INTRODUCTION

This study was done in the Blue Nile area in Khour Abuseif Forest**.** It is a natural "Dahara" forest which extend about 12 kilometers southeast from Wadelnail town and 5 kilometers northeast from Gulgani town. It is mostly a pure stand dominated by *Balanites aegyptiaca* (heglig) trees, with few *Acacia nubica* (laawot) scattered between the main stock. soil in this area is alluvial sandy with a low rocky elevations, intersected by valleys and seasonal streams. Trees of *B. aegyptiaca* in this area which have an age ranging between 19 and 32 year are much affected by the yearly, continuous lopping of branches by the owners of livestock, especially in dry seasons. Trees are also affected by the dry wood and mound termites, buprestid and longhorn beetles mainly *Chrysobothris* and *Macrotoma* species (Ahmed S. M., 2007).

Balanites aegyptiaca is widely distributed in Sudan. Its range stretches from Egyptian frontiers and Red Sea coast to the southern part of the Sudan, being

absent only from the wettest parts of the country. It is characteristic of dark cracking clay under a rainfall of 500 mm and above, where it is commonly associated with *Acacia seyal*. On the sandy soils of Kordofan and Darfur it occurs as a scattered tree where rainfall exceeds 250 mm. It is also found on hard surfaced soil at the foot slopes of rocky hills (Elfeel, 2004).

The tree has been rated as one among the most valued species for its medicinal, food, environmental and industrial properties. All parts of the tree are utilized for different purposes. In Sudan it is used for a forestation purposes particularly in village and town perimeters for shade and amenity. It provided considerable products to rural people; the timber is locally used for furniture and household applications and it is good for fuel wood and charcoal (Mahgoub, 1996).

According to a detailed study by Parameswaran and Conrad (1982), the wood is light brown in color or golden yellow distinctly brighter marked with whitish yellow pores in the early wood. No distinguishable heartwood. Stem form with a tendency for exocentric and fluted growth with ingrown bark area. The wood is fine, grained, easily worked, take a good polish, insect resistant and saws and planes well which makes it widely used for toll handles, bowls, posts, mortars and many household and agricultural implements. The high calorific value of 4600 kcal/kg made it excellent for fuel wood and charcoal (Von Maydell, 1986) .

The tree has a deep root system and thick bark. It is a drought resistant species and can not be damaged by grass fires. It is not found in nature in areas regularly flooded by rivers, but mature trees withstand one or two months flooding a year. In Upper Nile it withstands flooding by rainwater more than *Acacia seyal* (Badi et al., 1989). It suffers from repeated attacks of locusts and beetles. In Burkina Faso 50% of the tree population had leaf galls, bugs or scales (ICRAF Data Base, 1998). Two fungi, *Phorma balanitis* and *Septora balanitis,* are reported to infest this species (ICRAF Data Base, 1998).

The larvae of the *Cerambycidae* bore for the most part into the wood of trees, but a few are confined to the roots or pith of herbaceous plants. Most species affect dead or decaying trees, some selecting moist and others dry wood. Certain species bore into the bark or into the sap or heard wood of living trees and a few, such as *Saperda,* live in stems. On account of their concealed mode of life, the larvae are soft and fleshy and of a whitish or yellowish color and are often finely pubescent. The form of the larvae is largely correlated with their habits, the bark-boring species being more or less flattened while those living in wood or stems tend to become cylindrical. The head, invigilated into the prothorax, is usually small and transverse, but in the family Lamiinae it is longer than broad. The prothorax is large and is broader than the remaining trunk-segments. The seventh abdominal segment is often longer than those preceding and somewhat vesicular in the *Aseminae* it bears a pair of spines. Thoracic legs are generally present, but are usually so much reduced as to be nonfunctional: in most of the Lamiinae they are wanting. Locomotion takes place by the aid of dorsal and ventral segmentally arranged abdominal swelling which, in some genera, bear cuticular asperities. In

many larvae a variable number of the anterior abdominal segments bear small aster form structures known as pleural discs which are the points of attachment of chorodotonal organs

(Richards and Davies, 1976).

Larvae of the beetle *Macrotoma palmata* are found in the branches of their host, *Balanites aegyptiaca*, boring the wood. They are almost a ffect dead, decaying branches, dry wood and that wood of least moisture content. The larva is soft fleshy and of a color ranging between yellow to dark brown. It is characterized by an expansion of the prothorax, with reference to the abdomen, somewhat less than that expansion found in the individuals of the family Buprestidae (Plate No. 1 and 2) .The body which consist of 13 segments is almost cylindrical and the head is small, with black color and entirely withdrawn into the prothorax .The length of the full-grown larva is ranging between 58 to 72 millimeters with an average width of the prothorax of about 12 millimeters (Ahmed, 2007).

MATERIALS and METHODS

A total of 14 study plots were randomly selected from Khour Abuseif Forest. In each selected plot, which is equivalent to an area of ¼ hectare, sound and infested trees were counted. The diameter at breast height (DBH) in centimeters and height (H) in meters were measured by caliper and blume-leiss altimeter, respectively for each selected tree. Average tree volume (M^3) and mean annual increment (MAI m^3/year) were then calculated for the sound and affected trees. The MAI was also calculated using the formula: MAI = volume % age m^3 / years .

Statistical analysis was then carried out by computer using ANOVA, LSD and T-test to test differences between DBH, height, volume and MAI of sound and infested trees in the different selected plots.

RESULTS and DISCUSSION

In this experiment, in each selected plot the total number of *Balanites aegyptiaca* trees, was computed and the trees were grouped into 2 classes: healthy and infested ones. Comparison of diameter at breast height, tree height, volume and mean annual increment showed significant differences between the two classes (Tables1-4). The measured parameters in infested trees showed considerable reductions and the difference between them were significant as shown in the tables.

Table 1: Comparison of tree diameter at breast height in sound and infested *B. aegyptiaca* trees

Tree Status	Mean DBH (Cm)	T. grouping	F. value	Pr>F	C.V.	L.S.D
Sound	38.2922	A	43.29	0.0001	5.989	1.7799
Infested	32.3125	B				

Table 2: Comparison of tree height in sound and infested *B. aegyptiaca* trees

Tree Status	Mean H(m)	T. grouping	F. value	Pr>F	C.V.	L.S.D
Sound	9.6779	A	66.12	0.0001	5.782	0.4292
Infested	7.9452	B				

Table 3: Comparison of tree volume in sound and infested *B.aegyptiaca* trees

Tree Status	Mean V (m^3)	T. grouping	F. value	Pr>F	C.V.	L.S.D
Sound	0.56913	A	54.45	0.0001	16.182	0.0618
Infested	0.33278	B				

Table 4: Comparison of tree mean annual increment in sound and infested *B.aegyptiaca* trees

Tree Status	Mean MAI (m^3/yrs)	T. grouping	F. value	Pr>F	C.V.	L.S.D
Sound	0.021764	A	38.94	0.0001	19.679	0.0029
Infested	0.012915	B				

* Means with same letter are not significantly different

The data revealed that infestation of *Balanites aegyptiaca* was widely spread in the selected area and about 25% of the trees were infested with the longhorn beetle (*Macrotoma palmate)*. The beetles inflected significant reductions in all the parameters measured. The mean percentage reductions in tree diameter at breast height, tree height, volume and in mean annual increment were 15.6%, 17.9%, 41.5% and 40.7%, respectively. Forest decline and reduction in stand and growth of trees are world-wide phenomena (Ciesla and Donaubaur, 1994). And were attributed to complex diseases (Sinclair, 1965 and Manion, 1992) and are considered an integral part of the dynamics of forest communities (Mueller and Dombois, 1992). In either case, decline is the result of a series of interacting causal factors. Sinclair (1965) suggested that several declines of trees may develop from the interaction of three or more sets of factors. The first of these are long-term, slowly changing factors such as soil, site and climate. These predisposing factors alter the trees ability to withstand or respond to injury including agents. A second group of factors are referred to as inciting factors. Their action is usually of short duration. They may be physiological or biological in nature. These generally produce dieback of small branches. Examples of

inciting factors are defoliation by insects, salt spray, drought and unseasonable forests. A third group of factors, referred to as contributing factors, includes environmental factors and biotic agents such as canker and decay, fungi or barks and wood boring insects. These are often the most conspicuous factors associated with the decline and are often mistaken as the primary causal factors.

Within the framework of events descryibed and the field observations made during this study, many factors seem to have led to the occurrence of the observed widespread decline in the tree species under study. The complex of cambium and wood boring beetles which are invading the affected trees are considered to be contributing factors. Insects of the families Cerambycidae and Buprestidae typically attack trees which have been recently affected or killed, however some species attack living trees which have been severely weakened by drought or site related factors. The larvae of the wood boring insects, specifically the beetle under study work at first in their early stages in the phloem of the invaded trees for some time after hatching and then penetrated deeper, in their late stages, into the wood. The work of larvae in the meristematic tissues led to the killing of the terminal shoots and hence reduction of foliage quantity and consequently reduction in the photosynthetic area and concomitantly lessening of the photosynthat. Also the beetles destroy the meristematic tissues and led to the rupture of the phloem and xylem and thus interrupt of water flow and translocation of assimilates. Reduction in the photosynthate amount, transpiration, water flow and food translocation may be the main factors which led to losses in the different measured growth parameters inthe selected tree species.

Plate No 1: A full grown larva of the longhorn beetle, *Macrotoma palmata,* found inside a branch of *Balanites aegyptiaca* (heglig) tree

Plate No 2: Mature adult of a longhorn beetle, *Macrotoma palmata*, found trying to found its way, through the exit hole, outside a branch of *Balanites aegyptiaca* (heglig) tree

REFERNCES

1. Ahmed, S. M. (1997). Investigation on the Dieback of *Acacia nilotica* in the Blue Nile Area Associated with the Bark Beetle *Chrysobothris dorsata*. M.Sc. thesis. Faculty of Forestry. University of Khartoum.
2. Badi, K. H., El. Houri, A. A. and Bayoumi, A. M. (1989). The Forests of the Sudan. Volume 1 of the book of Agriculture in the Sudan. Agricultural Research Council, Khartoum, Sudan 11-152.
3. Ciesla, W.M. and Donaubaur, E. (1994). Decline and Mortality of *Acacia nilotica* in Riverine Forests of the Blue Nile. Food and Agriculture Organization of the United Nations. Rome- Italy.
4. Elfeel, A.A. (2004). Genec- ology and Conservation Status of *Balanites aegyptiaca* (L.) Del (Heglig Tree) in Sudan. A Thesis subm-itted in fulfillment of the degree of Doctor of Philosophy in Forest Genetic Resources Cons-ervation. Khartoum University-Sudan.
5. ICRAF, Data Base, (1998). *Balanites aegyptiaca*. Agro forestry Data Base.
6. Mahgoub, S. (1996). Seed handling and silvicultural operations National Tree Seed Centre. Soba-Khartoum.
7. Miller, P. R. and Dombois, D. (1992). The natural dieback theory, cohort senescence as an alternative to decline disease theory in forest decline concepts. APS press, St. Paul Minnesota.
8. Parameswaran, N. and Conrad, H. (1982). Wood and bark anatomy of *Balanites aegyptiaca* in relation to ecology and taxonomy. IAWA Bulletin 3(2) 75- 89.
9. Richards, O.W. and Davies, R.G. (1976). Imm's Gereral Textbook of Entomology. Tenth edition.

Volume 2: Classification and Biology. Chapman and Hall Ltd. London $ECP_{4\ 4}EE$.

10. Sinclair, W.A. (1965). Decline of hardwoods: Possible causes. Proceedings International shade tree Conference 42:17-32.
11. Von, Maydell Hj. (1986). Trees and shrubs of the Sahel, their characteristics and uses. Eschborn. Eschborn, GTZ, Germany.