Tropentag, October 6-8, 2009, Hamburg
"Biophysical and Socio-economic Frame Conditions for the Sustainable Management of Natural Resources"

A Survey of the Longhorned Beetles Species (Cerambycidae) on Acacia Trees in the Gum Arabic Belt of Sudan

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Introduction

Acacia trees occur in a wide area of semi-arid land across sub-Saharan Africa. The *Acacias* in Sudan are of high economic, environmental and social importance. Common direct and indirect benefits of *Acacia* trees include supply of fuel wood, charcoal, timber, pharmaceuticals, honey, fruit, pesticides, and forage. Moreover, *Acacias* are used for erosion control, soil improvement and particularly in agroforestry as shade dispensers, ornamental and intercropping trees (AFT, 2008, El houri 1989, Vogt, 1995). The major producers of marketable gum are *Acacia senegal* (*Hashab* gum) and *A. seyal* (talh gum) (Jamal and Huntsinger 1993). Many factors interfere with the health of *Acacia* trees. Among the most important are pest insects. Thus, *A. senegal* is attacked by numerous insects e.g. termites, longhorned beetles, locusts and grasshoppers. Larval stages of Coleoptera (bruchids), Lepidoptera, and Hymenoptera damage the seed. As stated by Younis (2006) over 40 species of insects are reported to be associated with *A. seyal*. *A. mellifera* was subject to heavy browsing by stock and game (AFT, 2008).The ecological knowledge of insect pest species of *Acacia* trees is still scarce. Thus, the study aimed at the identification and characterization of a pest insect group of worldwide importance: the longhorned beetles.

Study Area and Methodology

The study was conducted in North Kordofan State, located in the dry semi-arid region between latitudes 11,15°-16,45°N and longitudes 27,5°-32,15°E. As a result of a presurvey the study sites El Himaira, El Demokya and Nawa (for *A. senegal*), El Ein reserve forest and Simaih Agricultural project (for *A. mellifera*) and Um Fakrain forest and Simaih Agricultural project (for *A. seyal*), were chosen for investigations on longhorned beetles. The field work had been conducted between May and August 2007. On each site five sample plots have been sampled based on randomized experimental design. Spectrum and relative abundance of pest species were determined by catch results of flight interception traps. To characterize the study sites and for causal analysis a variety of variables were measured including microclimatic conditions (e.g. trunk surface temperature below dbh level by data loggers) and tree parameters (e.g. crown size, crown diameter, tree age, tree height and diameter in breast height by direct measurements).

Results

The spectrum of longhorned beetle species on the study sites comprised: *Anthracocentrus arabicus* (Thomson, 1877); *Coelodon servum* White, 1853; *Crossotus albicollis* (Guérin, 1844); *C. strigifrons* (Fairmaire, 1886)**;** *C. subocellatus* (Fairmaire, 1886); *Doesus telephoroides* Pascoe, 1862; *Gasponia gaurani* (Fairmaire, 1892); *Titoceres jaspideus* (Audinet Serville, 1835) ; *Tithoes sp.*. All *Acacia* species (*A. senegal*, *A. mellifera*, *A. seyal*) exhibited holes of infestation by the longhorned beetles. But tree species differed with respect to the distribution of the holes. Results obtained showed that *A. mellifera* had the maximum number of holes in the trunks, while branches were less affected (Fig.1). Opposite results were obtained for *A. senegal* with most holes in the branches and least in the tree trunks. *A. seyal* showed no presence of holes in the branches.

Considering the distribution of holes in the directions of wind an unbalanced infestation pattern was obvious, too. With respect to *A. senegal* infestation holes existed in all directions of wind with a maximum on the west and a minimum on the south side of trunks. *A. seyal* and *A. mellifera* missed infestation holes on the north side of tree trunks at all. With *A. mellifera* maximum infestation was obvious on the south side and with *A. seyal* on the east side of the tree trunks (Fig. 2).

Regarding *A. senegal*, on plots with an average tree age of 13 years results indicated an infestation percentage of 6.81%; on plots with an average tree age of 43 years it was 68.42%. Thus, infested trees of *A. senegal* had a mean age of 27.07 years (SD±16.49), non infested trees a mean age of 12.67 years (SD±6.88). On plots covered with *A. mellifera* 14.77% of the trees were infested. The mean tree age of infested trees was 12.23 years (SD±3.60), and the mean age of non infested trees 8.17 years (SD±3.87). The results for *A. seyal* showed an infestation percentage of 6.47%. Age of infested trees was on average 19.33 years (SD±4.09), age of non infested trees 13.17 years (SD±7.59). Thus, in all *Acacia* species infestation corresponded with the tree age.

Discussion

The investigation demonstrates that longhorned beetles are serious pests of *Acacia* trees on the study sites. The tree species-specific distribution pattern of infestation could most probably be explained by microclimatic conditions in connection with tree morphology and the respective requirements of the pest species (Eisa et. al, 2009). Except *A. senegal* with infestation holes also on the north side of trunks most infestations of longhorned beetles occurred on trunk sides exposed to the sun, implying the need of the pest species for heat. DAJOZ (1992) stated that temperature under bark is a function of the exposure of the tree to sunlight, and the structure of the bark. At sunny sites daily variation in temperature is much bigger than those recorded at sheltered trees. Under bark sheltered from sunlight fluctuations of temperature are slighter than those of the ambient air. The same applies to the temperature inside the trunk. Thus, temperature plays an important part in the localization of insects that live in tree trunks. As an example, the life cycle of the Cerambycid *Monochamus scutellatus* lasts one year in trunks exposed to sunlight, and three years in shaded trunks,
(http://jcringenbach.free.fr/website/beetles/cerambycidae/Crossotus_subocellatus.htm.).
Although, there is little knowledge of the longhorned beetle species found on our study sites, the duration of life cycle could have influenced the infestation pattern, too.

Moreover, site conditions play an important role for infestation levels. Site condition, in combination with weather, determines the rate of growth and general vigor of the host trees. Many forest insects exploit trees that are physiologically weakened as a result of stress created by nutrient deficiencies, drought, flooding, overcrowding, and other variables (Coulson and Witter 1984). Accordingly, the documented differences in the infestation level of different *Acacia* species may be due to different soil conditions, as in our study area *A. senegal* growed on sandy soils, A. *mellifera* on mixed soil (mostly gardud type).

Fierke et al. (2007) mentioned that increased success of red oak borer *Enaphalodes rufulus* (Cerambycidae) could be caused by declining tree resistance. Resistance of trees to various diseases and insects varies in a complex manner with tree age. Old trees on sites experiencing stressful conditions may not be able to defend themselves against pest attack. This may justify our results of increasing infestation rate with tree age.

References

AFTD (2008): AgroForestry Tree database. A Tree species reference and selection guide. ICRAF corporate with PROSEA network. http: // www.worldagroforestry.org. Accessed 2006.

Coulson, R. N. and Witter, J. A. (1984): Forest Entomology, Ecology & Management. John Wiley & Sons, Inc. Pp 669.

Dajoz, R. 1992. Insects and Forests. The Role and Diversity of Insects in the Forest Environment. Pp 668.

Eisa, M. A., Roth, M., and Brunk, I. (2009)**:** Infestations of *Acacia senegal,* L. (Wild) with longhorned beetles (Coleoptera: Cerambycidae) in the gum Arabic belt of Northern Kordofan State (Sudan). Mitt. Dtsch. Ges. Allg. Angew. Ent. (17) in press.

El houri, A. A. 1989. Land restoration and revegetation. In: role of forestry in combacting desertification. FAO Conserv. Guide 21.Rome, 253-255.

Fierke, M. K., Kelley, M. B. and Stephen, F. M. (2007): Site and stand variables influencing red oak borer, (Coleoptera: Cerambycidae), population densities and tree mortality. *Forest Ecology and Management* 247: 227–236.

Jamal, A., and Huntsinger, L. (1993): Deterioration of a sustainable agro-silvo-pastoral system in the Sudan: the gum gardens of Kordofan. Agroforestry Systems Volume 23, Issue 1: 23-38.

Vogt, K. (1995): A field guide to the identification, propagation and uses of common trees and shrubs of dry region of Sudan SOS Sahel International (UK), pp 61.

Younis, E. A. M. 2006. Msc Thesis. Yield potential of *Acacia seyal* (*variety seyal* Del.) in relation to growth parameters, methods and position of tapping.

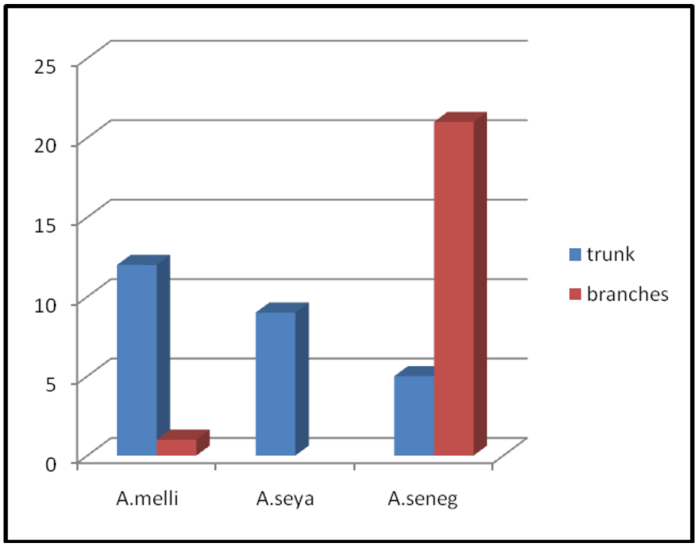

Fig.1 Location of holes of infestations of the longhorned beetles on Acacia species

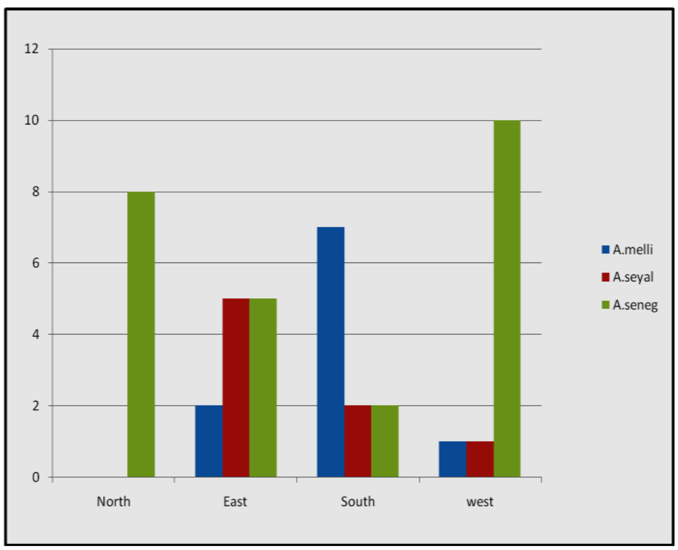

Fig.2 Direction of holes of infestation by the longhorned beetles on tree trunks of Acacia species