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Termites Control in Small - Scale Nurseries of *Acacia senegal* (L.) Willd by Using Some Powders from the Neem Tree

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Abstract:
This experiment was conducted for two successive seasons 2014 and 2015 under small-scale nursery conditions at Um Dekaka village, North Kordofan State, Sudan. The objective of the experiment was to study the effect of neem leaves and kernel powder for control of termites on *Acacia senegal* nurseries. The experimental design was a randomized complete block design (RCBD) with four replications. Data was collected for dead seedlings. The results showed significant differences among all tested rates of neem powders for the two seasons of the experiment. In the first season (2014), all tested rates of neem kernel and leaves powders significantly decreased the death rate of *A. senegal* seedlings in the nursery. After four months of treatment, no seedlings death was recorded by the highest rate of neem kernel powder (400 g/m^2) followed by neem leaves powder at 800 g/m^2 which gave 2.5 % death percentage. For the second season (2015) same trend was noticed. The combined analysis for the two years revealed that neem kernel powder at 400 g/m^2 showed the lowest death rate of the seedlings followed by neem leaves powder at 800 g/m^2. The results suggested that neem kernel at 400 g/m^2 and leaves powders at 800 g/m^2 are effective and safe options for the control of termites in small – scale nurseries of *A. senegal*.

Keywords: Neem, powder, termites, *Acacia senegal*, nurseries.

Introduction:

In Sudan, *Acacia senegal* (L.) Willd occur naturally in a belt commonly known as the gum Arabic belt, located between Latitudes 100 and 140 N. this broad ecological zone represents a complex and diverse environment with regard to climate, soil, vegetation, animals and human activities (Ballal, 1991). The belt is considered an important area because it accommodates around one fifth of the total population of Sudan and two third of the livestock population (Gaffar, 2005). The belt acts as a natural barrier, protecting more than 40% of Sudan from desert encroachment. Generally within this diverse ecological zone, *A. senegal* tree species occurs under rainfall of 280-450 mm in sandy soils, in Kordofan, Darfur and western of White Nile and under an average rainfall of 500 mm in the central clay plain (Ahmed, 1986; Badi *et al*. 1989; Hussein and Sulieman, 1999).

According to environmental and economical importance of gum arabic trees, many attempts were made in

recent years to restocking the gum belt in north kordofan (NFC, 2015). The National Forestry Corporation adopted the decentralization production of *A. senegal* seedlings in small – scale nurseries to restocking gum belt (Abdelnour, 2008). Vogt (1995) reported that termites are considered the main pest responsible of *A. senegal* seedling death in the nurseries with loss ranged between 30 to 60%. Abdelnour (2008) stated that healthy seedlings in the nursery were made through the use of suitable soil mixture well mixed with a termiticide.

The over-reliance on synthetic pesticides as the sole measure for pest control has created several problems (e.g., resistance, residues, pollution, etc). Plant extracts proved to be effective as natural pesticides. They are cheap, safe, ecologically sound, and IPM compatible. In this respect, more than 2000 species of higher plants possess insecticidal properties against various insect pests and vectors of plant diseases (Stoll, 2000). Among such plants, the neem tree (*Azadirachta indica* A. Juss) is becoming a potential source of natural insecticides. Neem extracts prepared from seed kernels and leaves contain numerous active ingredients, and exert different biological activities (toxic, repellent, antifeedant and growth regulatory effects) on insects. The results of several field experiments showed that, neem different formulations are comparable to many conventional synthetic insecticides in controlling different economical pests worldwide (Schmutterer 1988, 1990 & 1995). In Sudan, several researchers studied the insecticidal effect of neem extract (e.g., Siddig, 1991; Satti, 1997 and Elsiddig, 1998). The results of their studies showed that, neem formulations from seed kernel, seed cakes and leaves were effective against several insects including Bemisia tabaci, Aphis gossypii, Jacobisca lybica and Macrotermes thoracalis infesting melom, potato and groundnut.

Based on the economic importance of *A. seengal* and hence the economic importance of the termites the current study was initiated to evaluate the potentiality of some neem powders as a home-made insecticide for the control of termites in small – scale nurseries of *A. senegal*.

Materials and Methods:

This experiment was conducted for two years 2014-2015 in small-scale nursery at Um Dekaka village (Lat: 13 30 N, long: 30 13 E alt 547 m) North Kordofan State, Sudan.

Preparation of neem powders: i) Neem leaves powder: Fresh leaves of neem tree were collected from Um Dekaka village, dried under shade and powdered with electric mill to very fine powder and kept at room temperature in a plastic container until to be use.

ii) Neem-seed kernel powder: Mature neem berries were collected from previous site and dried under shade. The dried berries were moistened in water, depulped, dried again and decorticated for getting the kernels. The previous procedure was followed for preparing the kernel powder.

Experiment layout and cultural practices: *Acacia senegal* seeds were brought from Regional Tree Seed Centre at ElObeid Research Station. The seeds were sown in polyethylene bags 20X10 cm size filled with a 2:1 mixture of sand clay, in March for both years (2014 and 2015). The experimental design adopted was a randomized complete block design (RCBD) with four replications. The experimental unit consisted of 10

seedlings. The seeds were watered twice a day during the first period and once a day after one month from sowning.

Application of neem powders: The fine powder of neem seed kernel was weighted at rates of: 200, 300 and 400 grams/m^2. Half quantity of each rate was distributed equally on the soil before placing the polyethylene bags, and then the spaces between bags were filled by the rest of the same powder. For the neem leaves powder, the rates used were 400, 600 and 800 grams/m^2. The same above procedure was used for application.

Data collection and statistical analysis: The dead seedlings according to termite infestation were recorded every 15cdays. At the end of the experiment (after four months), the percentage of dead seedling was recorded for each treatment and it was taken as an index to measure the performance of the tested botanical. Data analysis for dead seedlings was done for each season beside the combined data for both seasons. Duncan's Multiple Range Test was used for means separation using Mstat-C statistical package.

Results and Discussion:

In the first season (2014), all tested rates of neem leaves and kernel powders significantly ($P<0.001$) decreased the death rate of *A. senegal* seedlings in the nursery. No seedling death was recorded when applied the highest rate of neem kernel powder followed by neem leaves powder at 800 g/m^2 which gave 2.5 % death percentage (Table 1). For the second season (2015) same trend was noticed (Table 2).

Table 1: Application of neem leaves and kernel powders to control termites on *Acacia senegal* seedlings under small - scale nursery conditions (2014)

Treatment	Rate (g/m^2)	Death rate (%)
Neem kernel powder	200	27.5 (5.2) bc
Neem kernel powder	300	22.5 (4.7) c
Neem kernel powder	400	0.0 (0.7) e
Neem leaves powder	400	32.5 (5.6) b
Neem leaves powder	600	25.0 (4.9) c
Neem leaves powder	800	2.5 (3.2) d
Untreated control	-	65.0 (8.1) a
C.V (%)	-	10.1
SE±	-	0.18

-Means with the same letter in the same column are not significantly different ($P< 0.05$) according to Duncan's Multiple Range Test

-Means in parenthesis are transformed to $\sqrt{x+0.5}$.

Table 2: Application of neem leaves and kernel powders to control termites on *Acacia senegal* seedlings under small - scale nursery conditions (2015)

Treatment	Rate (g/m^2)	Death rate (%)
Neem kernel powder	200	25.0 (4.9) c
Neem kernel powder	300	27.5 (5.0) bc
Neem kernel powder	400	0.0 (0.7) e
Neem leaves powder	400	35.5 (5.8) b
Neem leaves powder	600	32.0 (5.5) bc
Neem leaves powder	800	2.5 (3.2) d
Untreated control	-	67.5 (7.9) a
C.V (%)	-	12.1
SE±	-	0.21

-Means with the same letter in the same column are not significantly different ($P< 0.05$) according to Duncan's Multiple Range Test

-Means in parenthesis are transformed to $\sqrt{x+0.5}$.

Across the two seasons of the study, neem kernel powder at 400 g/m^2 treatment was free of infestation. The lowest death rate of the seedlings was obtained by neem leaves powder at 800 g/m^2 (Figure 1). The above mentioned results showed that neem leaves and kernel powders had potential for the control of termites on *A. senegal* small scale nurseries. The low death of *A. senegal* seedlings at highest rates of both kernel and leaves powders could be due to high repellency and antifeedant effects on termites. Literature revealed different formulations from different parts of neem tree that are safe, affordable and effective natural plant products with some degrees of insecticidal properties against many insect pests (eg., Schmutterer, 1990; Schmutterer, 1995; YashRoy and Gupta, 2005; Isman, 2006 and Morgan, 2009). Regarding the application of neem powders in the sandy soil, Ahmed *et al*., (2014) reported that treatment of groundnut with neem leaves and seed powders at 100 kg/fed and 50 kg/fed respectively protected the groundnut plants for 80 days of sowing.

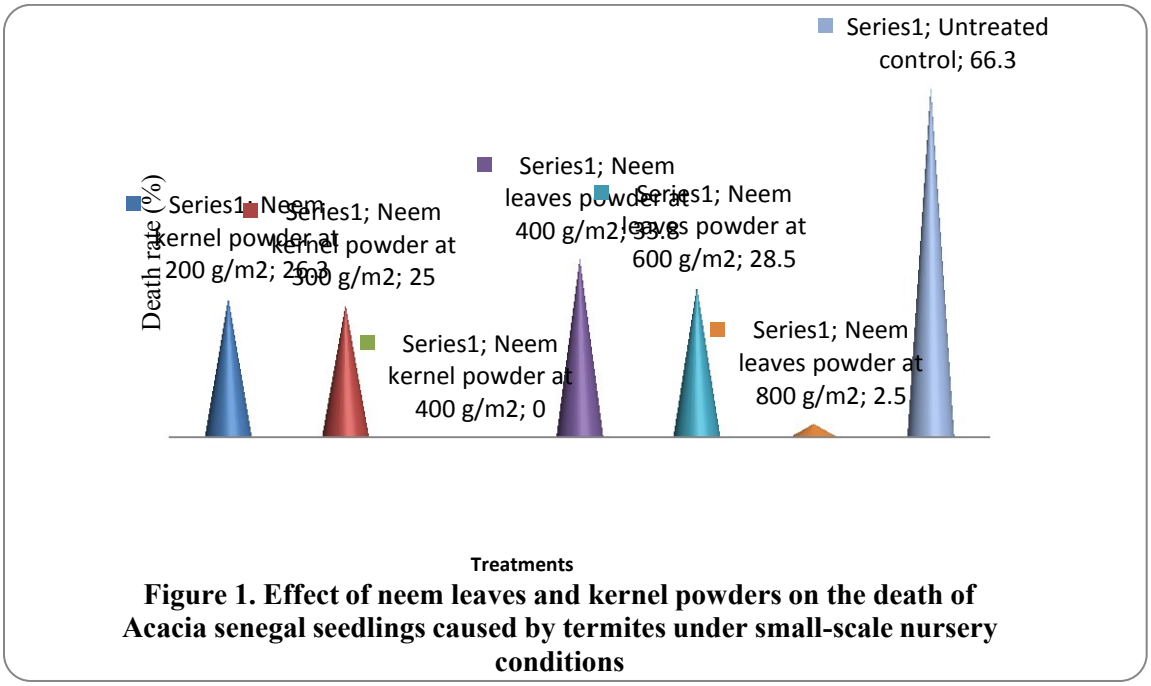

Figure 1. Effect of neem leaves and kernel powders on the death of Acacia senegal seedlings caused by termites under small-scale nursery conditions

In conclusion, the high infestation by termites in the two seasons of the study had been lowered significantly by neem powders treament. Consequently, enhancement in survival of *A. senegal* seedlings was obtained. Therefore, the use of neem kernel powder at 400g/ m^2 or neem leaves powder at 800g/ m^2 is advised for the control of termites on *A. senegal* small-scale nurseries apply in the soil before sowning.

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مكافحة حشرة الأرضة فى مشاتل أشجار الهشاب بإستخدام بعض المساحيق من شجرة النيم

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المستخلص

أُجريت هذه التجربة حقلية لموسميين متتاليين (2014 و 015) تحت ظروف المشتل فى قرية أم دكيكة ، ولاية شمال كردفان ، السودان. كان هدف هذه التجربة دراسة أثر مسحوقى ثمار و واوراق شجرة النيم لمكافحة حشرة الأرضة فى مشاتل شجرة الهشاب. تم إستخدام تصميم القطنعات العشوائية الكاملة باربع مكررات. تم جمع البيانات لموت البادرات. أظهرت النتائج فروقات معنوية بين كل المعدلات المختبرة من مسحوقى النيم لموسمى التجربة. فى الموسم الأول (014) كل المعدلات المختبرة من مسحوقى ثمار و واوراق شجرة النيم قللت معنوياً من موت بادرات الهشاب فى المشتل. بعد أربعة أشهر من المعاملة، لم يُسجل موت لأيٍ من البادرات فى أ لى معدل لمسحوق ثمار النيم (400 جرام/متر) تلاه مسحوق أوراق النيم بمعدل 800 جرام/ متر^2 و الذى أعطى 5. % موت. لوحِظ نفس إتجاه النتائج للموسم الثاني (015). أفضى التحليل التجميعى لسنتى الدراسة أن مسحوق ثمار النيم بمعدل (400 جرام/متر) أظهر أقل معدل موت للبادرات تلاه مسحوق أوراق النيم بمعدل 800 جرام/ متر . أقترحت هذه النتائج مسحوق ثمار النيم بمعدل (400 جرام/متر) و مسحوق أوراق النيم بمعدل 800 جرام/ متر^2 كخياران فعّالان و آمِنان لمكافحة حشرة الأرضة فى مشاتل أشجار الهشاب.