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NEMATOCIDAL PROPERTIES OF RED SILK COTTON (*Bombax costatum* Pellegr. & Vuil.) FLOWER AGAINST ROOT-KNOT NEMATODE, (*Meloidogyne javanica* (Treub. 1885) CHITWOOD 1949

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ABSTRACT:

A study was conducted in Jalingo Nigeria to determine the nematocidal activity of water extract of flower powder of Bombax costatum against the eggs and J2 juveniles of Meloidogyne javanica in the laboratory. For both egg hatch inhibition and juvenile mortality, 15 Petri-dishes were used for each and were arranged in Complete Randomized Design (CRD). For egg hatch inhibition test, 500 suspended in 10 ml distilled water were dispensed into each of 15 Petri-dishes used. Five treatments used included crude extract (stock solution) of *B. costatum*, 5 ml, 10 ml and 15 ml dilutions and control which were also dispensed into the petri dishes. Hatched nematodes were counted after three days. For juvenile mortality test, 500 J2s suspended in 10 ml distilled water were dispensed into each of 15 Petri-dishes used. The five treatments used included crude extract (stock solution) of *B. costatum*, 5 ml, 10 ml and 15 ml dilutions and control which were also dispensed into the petri dishes. Dead nematodes were counted after every day for three days. Data collected was analyzed. Results showed that the 100% concentration (crude extract) treatment gave the highest egg hatch inhibition and juvenile mortality of 89.33% and 94.33% respectively. This is an indication of the potential of flower powder of *B. costatum* to limit these inoculums of M. javanica and therefore reduce their damage potential. Pot and field trials will be needed before can be recommended for wider use.

Key words: *B. costatum*, extract, Eggs, *M. javanica*, mortality,Juveniles

INTRODUCTION

Root-knot nematodes (RKN) are pests that cause huge devastation to crops worldwide. In fields with high RKN infestation rates, up to 80% yield loss can be recorded and this may be accompanied by increase in soil-borne disease severity (Bourne *et al.* 2004; Kaşkavalcı 2007; Aissani *et al*., 2015; Hussain *et al*., 2016; Khalil and Darwesh, 2018). Inoculation of eggplants with 4.7 and 3.2 *M. javanica* eggs and juveniles/g soil respectively resulted in 50 % yield losses and shoot growth (Moosavi, 2014). Biological agents such as bacteria, fungi, actinomycetes and viruses that decrease the disease-causing activities of pathogens have been used (Symondson et al., 2002) as agents of control. Chemicals such as carbofuran and methyl bromide have been used to control RKN (Fatoki, 2001; Adegbite, 2003; Orisajo and Dongo, 2007; Orisajo *et al*., 2008) but their extreme level of toxicity to man, plants and environmental pollution has precluded them from such use. Attention then turned to the use of plants in the form of powders, extracts and compost to control RKN and they have been found to be effective in reducing the harmful activities of nematodes on crops as well as being non-toxic to man and the environment (Coltro-Roncato *et al.*, 2016; Bajestani *et al.*, 2017; Bakr, 2018; Ogwulumba and Ogwulumba, 2018; Aji *et al.*, 2019; Mamman *et al.*, 2020; Moazezikho *et al.*, 2020; Mamman *et al.*, 2021). This necessitated the use of *B. costatum* to find out if it has the potential to curb damage to crops by *M. javanica*. *Bombax costatum* is a deciduous small tree 3 – 15 m tall with flowers whose petals are red to orange but rarely yellow in colour; it is a common tree of savannas of West Africa and the calyx of the flower are cooked and eaten as vegetable or added to sauces to thicken them (Burkhill, 1985).

MATERIALS AND METHODS

The experiments (egg hatch inhibition and juvenile mortality tests) were carried out in the laboratory of the Department of Agronomy, Taraba State University, Jalingo in 2018.

Analysis of the phytochemical constituents of powder of red silk cotton (*Bombax costatum*) flowers (calyx and corolla) was carried out at the laboratory of Department of Biochemistry, Faculty of Life Sciences, Modibbo Adama University, Yola.

Preparation of Plant Extracts: The flowers (calyx and corolla) of red silk cotton plant (*B. costatum*) were collected from the trees within and around the university campus in Jalingo and dried in the shade on sacks. They were ground to powder using mortar and pestle. The powders were stored in plastic containers. Extracts were prepared as described by Umar (2009). Fifty grams of the powder of *B. costatum* flower was turned into a 5 litre plastic container and 500 ml distilled water was added and left to stand for 48 hours. It was then filtered through Whatman No.1

filter paper. The filtrate obtained (stock) was labelled crude extract (100 % filtrate). The stock or crude extract (20 ml) was diluted with 5 ml, 10 ml and 15 ml distilled water to obtain 5 treatments including crude extract (stock solution), 5 ml dilution, 10 ml dilution and 15 ml dilution and 100% distilled water was used as control (CT).

Inoculum Source/Nematode Eggs and Juveniles Extraction

Second stage juveniles of *M. javanica* were isolated from tomato roots through the modified Baermann method (Whitehead and Hemming, 1965). Sieves lined with tissue paper were placed on shallow plastic trays with macerated okra roots placed on the sieve and water was poured into the tray by the side. The set up was allowed to stand for 24 hours and nematode juveniles were collected by decanting into a beaker. Nematode in 10 ml aliquots of the suspension were counted under a stereoscopic microscope using a grid counting dish and an average of 500 nematode juveniles were used for juvenile mortality.

Nematode eggs were extracted from okra roots by agitating the root segments of 1 – 2 cm in 0.05% sodium hypochlorite (NaOCl) for 2 – 3 minutes as described by Hussey and Barker (1973). These eggs were then collected and rinsed with tap water on nested 150- and 25-µm pore sieves (Dong *et al*., 2007). They were used to prepare a suspension of nematode eggs at a concentration of 100 eggs/ml.

Egg Hatch Inhibition Test: Eggs of *M. javanica* were dispensed into petri-dishes at the rate of 500 eggs/10 ml suspension. Into this was added 10 ml concentration of treatment and this was carried out for each of the five treatments which included the crude extract, 5 ml, 10 ml and 15 ml dilutions and control designated as CT. The set up was replicated three times. There were 15 petri-dishes in all and they were arranged in complete randomized design (CRD). This set up was allowed to stand for three days after which hatched nematodes were counted under a stereoscopic microscope.

Juvenile Mortality Test: Second stage juveniles (J2) of *M. javanica* at 500/10 ml of nematode suspension were dispensed into a petri-dish to which was added 10 ml concentration of treatment. Each of the five treatments (T1 - crude extract, T2 - 5 ml, T3 - 10 ml and T4 - 15 ml dilution and control designated as T0) received the same suspension. The set up was replicated three times and arranged in complete randomized design (CRD). A total of 15 petri-dishes were used. Observation and counting of dead nematodes was done every 24 hours for 72 hours (three days).

All data collected was subjected to analysis of variance (ANOVA) using SAS version 9.4 and means separated by New Duncan's Multiple Range Test (NDMRT) at 5 % level of probability.

RESULTS AND DISCUSSIONS

Phytochemical analysis of ethanol extract of powder of *B. costatum* flowers showed the presence of saponins, tannins, flavonoids and alkaloids.

Results of the egg hatch inhibition test revealed that the extract of *B. costatum* has the potential to inhibit the hatching of *M. javanica* eggs. The crude extract (stock solution) recorded significantly ($p \geq .05$) higher egg hatch inhibition than the three dilutions and control with 90.33 %. This was followed by the 5 ml dilution with 83.33 %, 10 ml dilution with 59.33 % and 15 ml dilution with 40.33 %. The least was control (100 % distilled water) with 15 % egg hatch inhibition (Figure 1). Laboratory analysis showed that the extract contained phytochemicals which may have been responsible for the egg hatch inhibition observed. Similarly, Izuogu and Oyedunmade (2008) reported that mortality of juveniles, egg hatch inhibition and development of infective second stage juveniles of *Meloidogyne incognita* was caused by the presence of saponins and flavonoids in *Phyllanthus amarus*, *Morinda lucida*, *Cymbopogon citratus*.

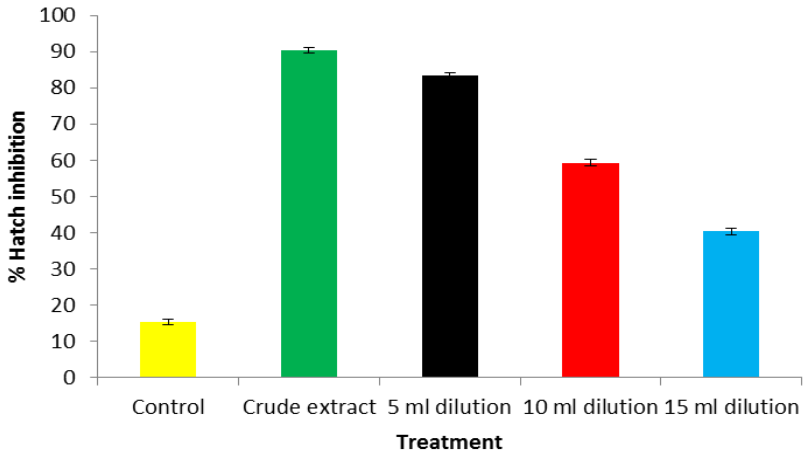

Figure 1: Effects of Extracts of *B. costatum* on Hatching of *M. javanica* Eggs

Result of the juvenile mortality test showed that the crude extract of *B. costatum* flower powder and its dilutions recorded significantly ($p \geq .05$) higher mortality of *M. javanica* juveniles than control (Figure 2). The crude extract (T1) recorded the highest mortality rate 24 hour after treatment with 81 % of the nematodes dead. This percentage mortality increased every 24 hours to 89 % mortality after 48 hours up to 94 % after 72 hours of juvenile exposure to the crude extract. The 5 ml dilution (T2) showed similar trend with a mortality of 56.33 % after 24 hours, 63.33 % after 48 hours and 76.33 % after 72 hours. Control was least with 1 % mortality after 24 hours, 8.33 % mortality after 48 hours and 12.33 % after 72 hours juvenile mortality. The finding of this research showed the crude or 100 % extract caused the highest mortality of *M. javanica* juveniles and this is supported by Das *et al.* (2021) who similarly reported that the 100 % concentration of cabbage extract achieved 100 % mortality of *M. javanica* juveniles and the lower concentrations showed around 80 % mortality. El-Nubi *el al.* (2020) found that the stock solution or 100 % extract of recorded total mortality of nematode juveniles and Haroon *et al.* (2018), observed that mortality increased with increasing concentrations of extract. Also, the extracts of garlic and neem have been reported to be better at suppressing root-knot nematodes under both in vitro and field conditions (Abo-Elyousr *et al.*, 2010).

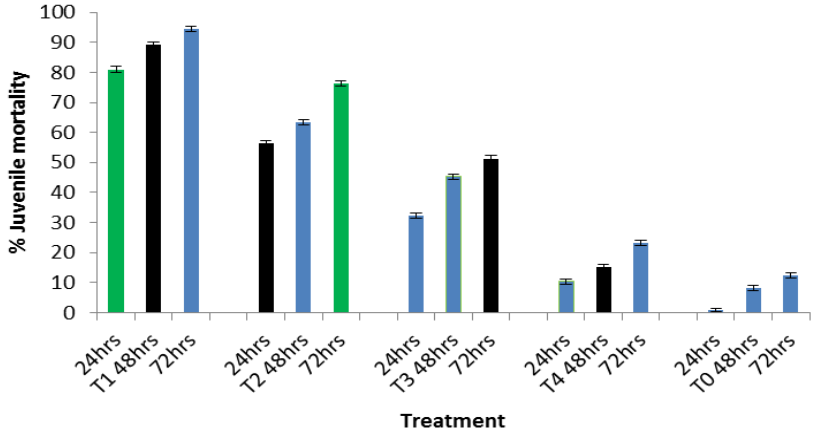

Figure 2: Effects of Extracts of *B. costatum* on the Mortality of *M. javanica* Juveniles
Key: T1 - Crude extract (100% extract), T2 - 5 ml dilution (75 %), T3 - 10 ml dilution (60 %), T4 - 15 ml dilution (50 %), T0 - Control (100 % distilled water)

CONCLUSION

The results revealed that the crude extract of flowers of red silk cotton (*Bombax costatum*) greatly reduced *Meloidogyne javanica* egg hatch and caused high mortality of the nematode juveniles (J2s). further studies should be carried out in pot and field experiments to determine the effect of *B. costatum* flower crude extract on *Meloidogyne javanica* under these conditions.

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