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Bioefficacy of Leaf Extract of Neem (*Azadirachta indica* A. Juss) on Growth Parameters, Wilt and Leafspot Diseases of Brinjal

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ABSTRACT

In present study aqueous Neem (*Azadirachta indica* A. Juss) extract was tested for the growth, yield and disease control of a common vegetable plant Brinjal (*Solanum melongena* L.). The neem extract increased shoot height, number of leaves, number of buds, number of flowers and number of fruits of Brinjal plant over control. Numbers of diseases were calculated as percentage and diseases per plant. The percentage of reduction of disease was calculated after the spray of neem extract. Neem extract was found as most effective agent in controlling leaf spot (82.33%) and wilt (41.34%) in comparison to control under field conditions. The result showed that neem leaf extract acts as potential source for the management of severe diseases in addition to its positive effect on growth parameters.

Key words: Biopesticide, neem extract, brinjal, wilt, leaf spot, growth parameters

INTRODUCTION

The Neem tree (*Azadirachta indica* A. Juss) has been known as the wonder tree for centuries in the Indian subcontinent. It has become important in the global context today because it offers answers to the major concerns that mankind is facing. It has many uses; the most important use of neem products is to fight against crop pests and diseases without any harmful effects on environment. Neem and its products have been widely reported to control insect pests (Ascher, 1993; Schmutterer and Ascher, 1995), plant bacterial diseases (Abbasi *et al.*, 2003), plant parasitic nematodes (Muller and Gooch, 1982; Akhtar and Mahmood, 1995), plant fungal diseases (Vir and Sharma, 1985; Amadioha, 2000; Dubey *et al.*, 2009) as well as a potential agricultural fertilizer (Gajalakshmi and Abbasi, 2004). Moreover, in ayurveda, unani and homeopathic medicine almost every part of this tree including seeds, leaves, roots, bark, trunk and branches have multiple uses (Subapriya and Nagini, 2005). Neem as a bio-control agent is used for centuries in Asia as a potential antifungal agent (Chaturvedi *et al.*, 2003). Several studies have pointed out the potential of neem tree (*A. indica*) to control plant pathogenic fungi that could be listed it as top fungicide and harmless biocontrol agent (Abbasi *et al.*, 2003; Akhtar and Mahmood, 1995; Amadioha, 2000; Dubey *et al.*, 2009). Large number of studies have been undertaken in the laboratory against the causal organism affecting the brinjal plant. However the effectiveness of the neem extracts on individual crops in different agro-climatic zones and cultivars in field condition have not been

investigated much. Hence the objective of the study was to determine to efficacy of aqueous leaf extract of neem for controlling two important diseases wilt and leaf spot as well as its effect on growth and yield of brinjal.

MATERIALS AND METHODS

Preparation of experimental plots and plantation: The grasses and weeds of experimental plots were removed and the land ploughed to a depth of 15-30 cm and several holes with the dimension of 30×30×30 cm were made at every 150 inches interval. In each hole, required amount of cow-dung and organic fertilizer at the rate of 6-12 t ha⁻¹ was applied. Optimum spacing 90×60 cm with one plant per hill was maintained. About 40 days old brinjal seedlings were purchased from the local market and planted in each hole. Planting was done in the afternoon to avoid desiccation of seedlings. The experimental plots were irrigated with tap water when required.

Preparation of aqueous neem extract: Hundred grams from each of the dried, powdered plant sample were weighed and were mixed in a 1000 mL distilled water. Then the solution was boiled, cooled and filtered through the cheese cloths followed by filtration by the Whattman No. 1 filter paper. Then filtrate was kept under normal room temperature and sprayed on brinjal plants on a weekly basis from 15th day onward.

Growth, yield and disease parameters: Morphological measurements of *Solanum melongena* L. were taken 10-120 days with 10 days intervals after transplantation till harvest time. The following parameters were measured as follows: shoot height, number of leaves, number of buds, number of flowers, number of fruits, the percentage of infection (Wilt and Leaf spot) were investigated after 4 weeks of transplantation. Numbers of diseases were calculated as percentage and diseases per plant. The percentage of reduction of diseases were also calculated after the spray of neem extract.

Preparation crude extract: The collected leaves were shade dried under normal environmental condition and then ground into uniform powder using Thomas-Wiley machine. The powdered neem leaves (50 g) were extracted with distilled water by using Soxhlet extraction apparatus for 10-12 h. Then collected solutions were filtered through Whatman No. 1 filter paper. The extracts were evaporated to dryness under reduced pressure at 90°C by Rotary vacuum evaporator to obtain the crude extracts and stored in a freeze condition at -18°C until used for further analysis.

Quantitative phytochemical estimation of the crude extract: Phytochemical analysis of aqueous leaf extract of *Azadirachta indica* A. Juss was carried out using standard quantitative methods as described by Hagerman *et al.* (2000), Kumaran and Karunakaran (2006) and Obadoni and Ochuko (2002). The components analyzed for phytochemicals were phenol, flavonoids, tannins, alkaloids and saponins.

RESULTS AND DISCUSSION

The experiment was conducted on growth and yield of brinjal cultivars as influenced by neem extracts and the results on effectiveness of various treatments including an untreated control for the management of brinjal plants have been described and discussed as follows.

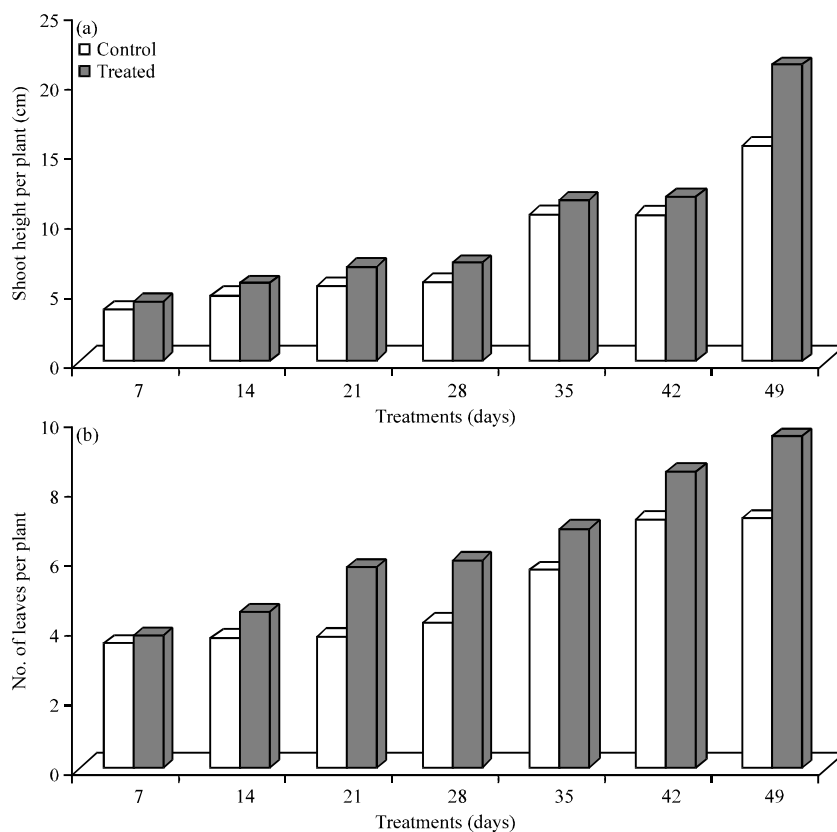


Fig. 1(a-b): Effect of *Azadirachta indica* aqueous extract on (a) Plant hight and (b) No. of leaves of *Solanum melongena* L.

There was significant increase in the plant height and leaf number at all growth stages from 7-49 days in neem extract treatments in comparison to controls (Fig. 1a-b). Number of buds from 30-60 days, number of flowers from 45-75 days and number of fruits from 75-105 days were recorded. All measured parameters gave significant differences from their respective controls (Fig. 2a-c).

Growth stimulating effect of ten medicinal plant extracts (*P. pinatta*, *A. marmelos*, *A. indica*, *B. campestris*, *P. nigrum*, *E. tirucalli*, *V. negundu*, *A. conyzoides*, *T. patula* and *Z. jujube*) on *Lycopersicum esculentum* have been observed (Pattnaik *et al.*, 2012). Similar experiment was carried out by Okunlola and Ofuya (2013) who showed the effect of *Azadirachta indica* and *Piper guineense* on the growth and yield of jute under sole and mixed cropping. All growth parameters increased in comparison to control this may be due to reduction in insect pests or the percentage infestation by the pests or both. In another experiment ethanolic extracts of *Melia azedarch*, *Eucalyptus robusta*, *Sapium sebiferum* had no significant influence on growth and development of Soybean seedlings (Wan *et al.*, 2012). Effect of tea seed extracts on growth of beet, mustard, oat and barley were studied. Different concentrations of these extracts increased the growth, yield and biomass of the crops. The growth stimulating effect is not exclusively by its adverse effect on pathogen or by an increase in nutrient uptake. However substances with hormone like properties can stimulate of effect biomass allocation in plants.

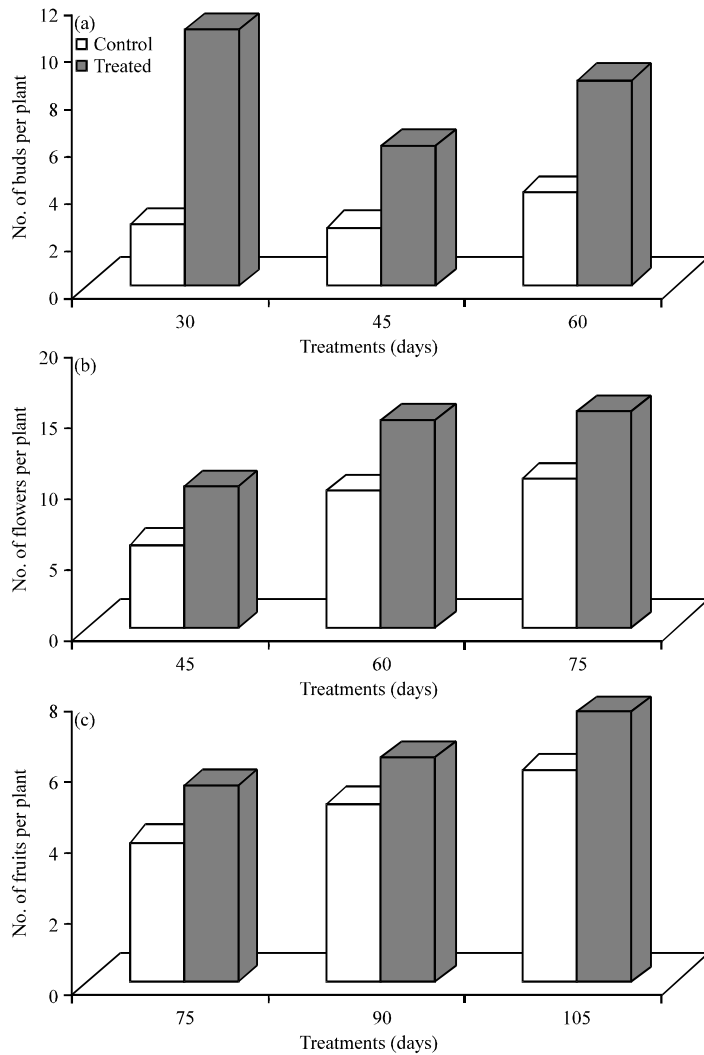


Fig. 2(a-c): Effect of *Azadirachta indica* aqueous extract on (a) No. of buds, (b) No. of flowers and (c) No. of fruits of *Solanum melongena* L.

In addition to hormones, medicinal plant extracts contain saponins and polyphenols which could be the active compounds causing the effect on growth and yield of the plant (Andresen and Cedergreen, 2010).

Neem based formulations in all the treatments were found to be superior over control not only on shoot height, number of leaves, number of buds, number of flowers, number of fruits but in respect of disease control also. The results revealed that *Azadirachta indica* was moderately efficient in controlling wilt and but highly efficient in controlling leaf spot diseases in *Solanum melongena* L. Experiment on aqueous leaf extracts of *Azadirachta indica* to control leaf spot of brinjal indicated that there was a significant reduction (82.33%) and showed a strong bio-controlling effect in reducing bacterial leaf spot disease severity (Fig. 3, 4). In particular, extracts of *Azadirachta indica* substantially reduced the number of infected leaves and number of lesions on foliage and curtailed disease development, which in turn, protected flowers and capsules from infection (Enikuomehin, 2005). Reduction of leaf spot diseases up to 40% *A. indica*



Fig. 3: Leaf spot disease in brinjal plant

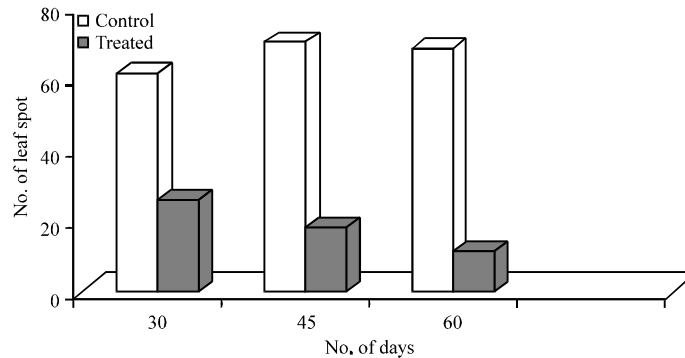


Fig. 4: Effect of *Azadirachia indica* aqueous leaf extract on leaf spot of brinjal plant

extract has been reported in *Lycopersicum esculentum* (Pattnaik *et al.*, 2012). It proves that the plant extracts can serve as alternatives to the synthetic pesticides for controlling of bacterial leaf spot disease of *Solanum* without any adverse effect on crop yield and yield parameters.

Wilt is an important disease of brinjal plant causing significant reduction in yield. In present study the *in vitro* bio-efficacy of plant extracts of *Azardiachta indica* was tested to control wilt pathogen. Result of wilt diseases of brinjal indicated that there was a significant reduction (41.34%) in treated plants with neem extract (Fig. 5, 6). Similar finding were obtained against fusarium wilt of Carnation (Chandel and Tomar, 2008). Thirteen plant extracts were testes for antifungal assay showing 58-99% mycelia growth inhibition (Minz *et al.*, 2012). The bio-efficacy of neem extract over pathogens can be attributed to the fact that neem has active compounds such as azadirachtin, nimbin, nimbidin, nimbinene and azadirone which are antifungal, antibacterial and anti-insecticidal in nature (Bohra *et al.*, 2006).

Quantitative estimation of phytochemical compounds of neem leaves showed the presence of phenols, flavonoids, tannins, alkaloids and saponins (Fig. 7). This class of compounds independently or in combination may be responsible for the broad range of medicinal properties of neem which exhibit an extra ordinary array of pharmacological activities. *Azadirachta indica*



Fig. 5: Wilt disease in brinjal plant

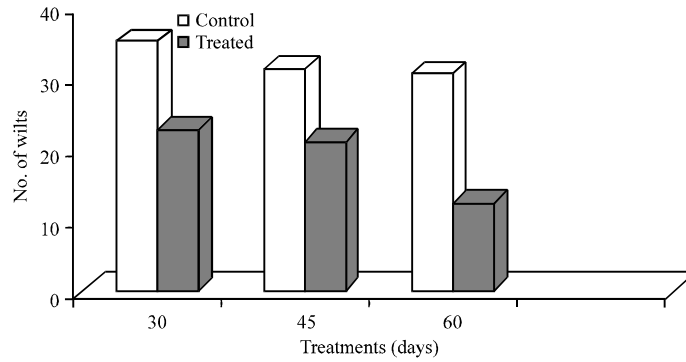


Fig. 6: Effect of *Azadirachta indica* aqueous leaf extract on wilt disease of brinjal plant

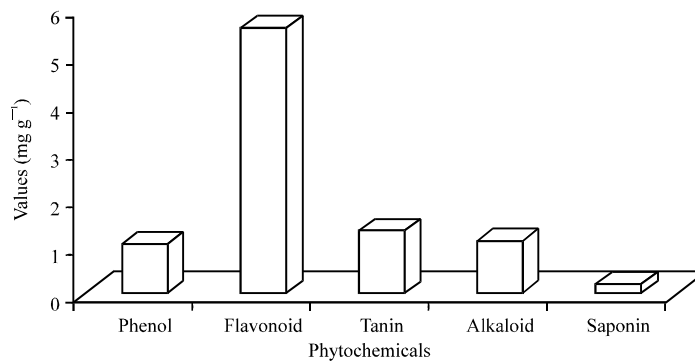


Fig. 7: Quantitative phytochemical estimation of *Azadirachta indica* leaves

(Indian Neem tree), contains at least 35 biologically active principals of which triterpenoides, nimbin, azadirachtin present predominantly in the seeds, leaves and other parts of the neem tree (Mondall *et al.*, 2009; Nahak and Sahu, 2010) are the most active insecticidal ingredients for effective control of wilt and leaf spot diseases of brinjal (Brahmachari, 2004; Gajalakshmi and Abbasi, 2004).

CONCLUSION

The results of the present study showed that neem based formulations in all the treatments were found to be superior over control not only on shoot height, number of leaves, number of buds, number of flowers, number of fruits but in respect of diseases control also such as wilt and leaf spot which suggest that use of neem extracts are good alternative to synthetic pesticides because they are easily available, safe to environment, cost effective, non hazardous, natural enemies, have low to moderate mammalian toxicity. Though neem based products from *Azadirachta indica* have been successfully used for pest control in agriculture since long, the registered neem products for control of pathogens or disease vectors affecting human, still need to be explored. In line with the above findings it is suggested that the further researches on neem should be directed towards identification and quantification of active principles responsible for standardization and formulation of the neem extract would make it easier to use and, therefore, more acceptable to farmers.

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