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Evaluation of pongamia oil soap against leaf hopper, *Amrasca biguttula biguttula* (Ishida) infesting okra

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ABSTRACT: Field studies on evaluation of pongamia and neem oil soap at various concentrations against okra leaf hopper, *Amrasca biguttula biguttula* (Ishida) was carried out during the year 2018-19. Treatments i.e. T_1: Pongamia oil soap 0.6%; T_2: Pongamia oil soap 1%; T_3: Pongamia oil soap 2%; T_4: Neem oil soap 0.6%; T_5: Soap solution 0.5%; T_6: Quinalphos 25 EC @ 0.05%; T_7: Standard check applied once at vegetative stage and twice during reproductive stage. Quinalphos 25 EC @ 0.05 % was effective followed by pongamia oil soap 2 per cent, pongamia oil soap 1 per cent, neem oil soap 0.6 per cent and pongamia oil soap 0.6 per cent. The effectiveness of the soap reduced after seven days of treatment.

KEY WORDS: Pongamia. neem oil soap, leaf hopper

Okra, *Abelmoschus esculentus* (L). Moench also known as lady's finger native to West Africa is a warm season vegetable crop cultivated for its tender and delicious fruits which remains productive even in the long summers of South East. India stands first in okra production with 62 per cent share of world production. With a production of 6094.94 MT during 2017-18, okra is cultivated in 509.02 ha of area with a productivity of 11.97MT/ha (Anon., 2018). One of the major constraints for okra production is heavy infestations of several insect pests which exert both quantitative and qualitative loss. Insect pests caused 48.97 per cent loss to the tune of 77.78 q/ha (Kanwar and Ameta, 2007). Early stages of crop is infested by sucking pests like leafhoppers, aphids and whiteflies that cause huge economic loss due to sucking of the cell sap and making the plant weak. Krishnaiah (1980) reported that leafhoppers alone can cause a yield loss of 54.04 per cent in okra.

Okra being harvested at frequent intervals, application of synthetic insecticides may lead to toxic residues in fruits causing health hazards. Non judicious use of synthetic pesticides over the last four to five decades have resulted in many negative consequences like resurgence and resistance of pests and pesticide residues in farm products (Kabir *et al.,* 1994; Mahapatro, 1999). Hence, to control these pests and to reduce such risks, alternative environmentally safe methods like bio pesticides, botanicals etc., are to be adopted (Khade *et al*., 2014).

Pongamia pinnata (L.) is a multipurpose tree species of pea family Fabaceae which is widely distributed in India, China, Bangladesh and Australia. It is commonly called as Indian Beech Tree or Karanj. Karanj oil is thick yellowish red/brown non edible oil, extracted from seed. It is used for the treatment of rheumatism and skin diseases, in soap

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industry, as a fuel, lubricant and pesticide. The secondary metabolites like flavanoids, chalcones, steroids and terpenoids in pongamia oil serve as natural pest repellents (Pavela, 2009). It has insecticidal (antifeedent) properties similar to neem oil and act against a number of insect pests. Tripathi *et al.* (2012) stated that pongamia oil is safe to humans and other mammals. Hence an experiment was carried out to evaluate the efficacy of botanical product "pongamia oil soap" at various concentrations against leaf hopper infesting okra..

Pongamia oil soap was prepared according to the technology used for the preparation of Ready To Use neem oil garlic soap, the first botanical of KAU, approved by Kerala Agricultural University (Varma, 2018).

A field study was carried out in the Instructional farm, College of Agriculture, Padannakkad during 2018 – 19. Seeds of okra (Variety: Arka Anamika) were sown at a spacing of 60 x 45 cm^2 during October to January under randomized block design (RBD). There were seven treatments (Table 1). Spraying of pongamia oil soap solution was done at 30 days after sowing (DAS) during vegetative phase and during the reproductive stage at 55 and 80 DAS using 16 L Knapsack sprayer. Spraying was carried out during evening hours and precautions were taken to avoid drift. Four plants out of eight were randomly selected and tagged in each plot for recording the observations. Population density of leaf hopper was recorded by counting the number of nymphs and adults from five leaves (one top, two middle and two lower) of selected four plants on one day prior to and 1, 3, 5, 7 and 14 days after spraying of various treatments. Data on the population density of sucking pests were analyzed after square root transformation. The data were analysed using analysis of variance (ANOVA). Web Agri Stat Package (WASP) was used to compare the significance of each treatment.

The results revealed that a day after the first application, the plot treated with quinalphos 25 EC at 0.05 per cent (standard check) recorded the least count of 1.75 leaf hoppers/5 leaves, followed by pongamia oil soap 2 per cent (2.81 leaf hoppers/5 leaves) and pongamia oil soap 1 per cent (3.75 leaf hoppers/5 leaves) which were on par with the standard check. All the treatments stood significantly superior over the control (5.38 leaf hoppers/5 leaves) whereas soap solution 0.5 per cent (5.19 leaf hoppers/5 leaves) was on par with control. It was further observed that after three days of application, among the botanicals, pongamia oil soap 2 per cent showed lowest population of 1.19 leaf hoppers/5 leaves which was at par with standard check (1.00 leaf hoppers/5 leaves). It was followed by pongamia oil soap 1 per cent, neem oil soap 0.6 per cent and pongamia oil soap 0.6 per cent (2.81, 3.00 and 3.69 leaf hoppers/ 5 leaves) respectively which was at par with each other. Soap solution 0.5 per cent and control showed highest population count of 5.31 and 5.56 leaf hoppers/5 leaves which was at par with each other. Five days after first application lowest hopper population was observed in standard check (0.31 leaf hoppers/ 5 leaves) which was immediately followed by pongamia oil soap 2 per cent (0.81 leaf hoppers/5 leaves). A gradual decrease in the population was observed in all the treatments except control and soap solution 0.5 per cent on the seventh day after first application with minimum population recorded in standard check (0.13 leaf hoppers/ 5 leaves) which was on par with pongamia oil soap 2 per cent (0.44 leaf hoppers/ 5 leaves). Pongamia oil soap 1 per cent was at par with neem oil soap 0.6 per cent with a population count of 1.00 and 1.25 leaf hoppers/5 leaves respectively. A gradual increase in leaf hopper population in all the treatments on fourteenth day after first application and among the botanicals pongamia oil soap 2 per cent recorded the lowest leaf hopper population of 0.75 leaf hoppers/5 leaves which was at par with standard check 0.31 leaf hoppers/5 leaves. Soap solution 0.5 per cent and control showed the highest population count of 7.44 and 7.50 leaf hoppers/5 leaves which was at par with each other (Table 1).

Precount of leaf hopper population prior to second application was at a range of 5.37 - 8 leaf hoppers/ 5 leaves /plant. A day after the second application, a reduction in the leaf hopper population was observed in all the treatments except in soap solution 0.5 per cent (8.06 leaf hoppers/ 5 leaves) and control (8.1 leaf hoppers/ 5 leaves) which were on

par with each other. Quinalphos 0.05 per cent (standard check) recorded the least count of 3.13 leaf hoppers/ 5 leaves, followed by pongamia oil soap 2 per cent (4.63 leaf hoppers/5 leaves). Pongamia oil soap 1 per cent (5.81 leaf hoppers/ 5 leaves), neem oil soap 0.6 per cent (6.06 leaf hoppers/ 5 leaves) and pongamia oil soap 0.6 per cent (6.19 leaf hoppers/ 5 leaves) were found on par with each other.

A similar trend was observed at three days after second application with lowest population recorded in standard check (1.00 leaf hoppers/ 5 leaves) followed by pongamia oil soap 2 per cent (2.50 leaf hoppers/ 5 leaves). Pongamia oil soap 1 per cent, neem oil soap 0.6 per cent and pongamia oil soap 0.6 per cent (3.88, 4.25 and 4.50 leaf hoppers/ 5 leaves) respectively were found on par with each other. Standard check showed the lowest hopper population of 0.19 leaf hoppers/5 leaves followed by pongamia oil soap 2 per cent (0.94 leaf hoppers/ 5 leaves) at five days after second application while Soap solution 0.5 per cent and control showed the maximum leaf hopper population with 9.00 and 9.31 leaf hoppers/5 leaves. Observations at seventh day after second application during rabi season revealed standard check as the best treatment with 0.00 leaf hopper population as significantly superior treatment followed by pongamia oil soap 2 per cent (0.56 leaf hoppers/ 5 leaves) and pongamia oil soap 1 per cent (1.69 leaf hoppers/ 5 leaves). However all the treatments were significantly superior to control and soap solution 0.5 per cent. A gradual increase in leaf hopper population was observed in all the treatments at 14 days after application with standard check showing the lowest population count of 0.56 leaf hoppers/ 5 leaves, while among the botanicals pongamia oil soap 2 per cent recorded the lowest leaf hopper population of 1.06 leaf hoppers/5 leaves. Neem oil soap 0.6 per cent (3.94 leaf hoppers/5 leaves) and pongamia oil soap 0.6 per cent (4.06 leaf hoppers/5 leaves) were on par with each other.

Precount of leaf hopper population prior to third application was at a range of 7.93 – 11.25 leaf hoppers/5 leaves /plant. A day after the third application pongamia oil soap 2 per cent showed least population of 5.50 leaf hoppers/5 leaves among the botanicals which was on par with standard check (11.94 leaf hoppers/5 leaves). Pongamia oil soap 1 per cent (7.00 leaf hoppers/5 leaves) was the next best treatment followed by neem oil soap 0.6 per cent (7.75 leaf hoppers/5 leaves) which was on par with pongamia oil soap 0.6 per cent (8.31 leaf hoppers/5 leaves). Soap solution 0.5 per cent (11.19 leaf hoppers/5 leaves) was at par with control. Third day count of leaf hopper population recorded the lowest population of 2.00 leaf hoppers/ 5 leaves in standard check followed by pongamia oil soap 2 per cent, pongamia oil soap 1 per cent, neem oil soap 0.6 per cent and pongamia oil soap 0.6 per cent with 3.38, 4.44, 5.00 and 5.44 leaf hoppers/ 5 leaves respectively. A similar trend was observed at five days and seven days after third application were standard check showed the lowest hopper population of 1.19 and 0.81 leaf hoppers/ 5 leaves followed by pongamia oil soap 2 per cent (2.38 and 2.13 leaf hoppers/ 5 leaves). While the population was 12.50 and 13.00 leaf hoppers/5 leaves at seven days after third application in soap solution 0.5 per cent and control respectively which were on par with each other. A gradual increase in leaf hopper population in all the treatments at 14 days after application was observed while among the botanicals pongamia oil soap 2 per cent recorded the lowest leaf hopper population of 2.81 leaf hoppers/ 5 leaves after the standard check 1.25 leaf hoppers/ 5 leaves which was followed by pongamia oil soap 1 per cent, neem oil soap 0.6 per cent which was on par with pongamia oil soap 0.6 per cent with 4.19, 4.75 and 5.06 leaf hoppers/ 5 leaves respectively. Soap solution 0.5 per cent and control showed the highest count of 13.19 and 14.06 leaf hoppers/ 5 leaves respectively (Table 1).

From the data observed during the rabi season it is evident that all the treatments except soap solution 0.5 per cent was effective in reducing the leaf hopper population significantly as compared to that of control. In general the efficacy of pongamia oil soap at 0.6, 1 and 2 per cent and neem oil soap 0.6 per cent were significantly superior over control, however the standard check (Quinalphos 25 EC @ 0.05 per cent) was superior to pongamia and

Table 1. Average population density of leaf hoppers during rabi season from October 2018 to January 2019

Treatments	Number of leaf hoppers/5 leaves																	
	First application						Second application						Third application					
	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	14 DAA	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	14 DAA	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	14 DAA
Pongamia oil soap 0.6%	4.94 (2.21)	4.31 (2.07)^{ab}	3.69 (2.02)^{ab}	2.50 (1.56)^{b}	2.38 (1.68)^{b}	3.31 (1.94)^{b}	7.75 (2.87)^{a}	6.19 (2.48)^{b}	4.50 (2.23)^{b}	3.06 (1.88)^{b}	3.38 (1.96)^{b}	4.06 (2.01)^{b}	10.37 (3.21)^{ab}	8.31 (2.88)^{b}	5.44 (2.33)^{b}	4.94 (2.22)^{b}	4.44 (2.10)^{b}	5.06 (2.24)^{b}
Pongamia oil soap 1%	4.44 (2.07)	3.75 (1.90)^{abc}	2.81 (1.81)^{b}	1.63 (1.27)^{c}	1.00 (1.22)^{c}	1.56 (1.42)^{c}	7.06 (2.73)^{ab}	5.81 (2.40)^{b}	3.88 (2.08)^{b}	1.88 (1.53)^{c}	1.69 (1.46)^{c}	2.06 (1.43)^{c}	10 (3.16)^{b}	7.00 (2.63)^{b}	4.44 (2.09)^{bc}	3.63 (1.90)^{c}	3.19 (1.78)^{c}	4.19 (2.04)^{c}
Pongamia oil soap 2%	5.06 (2.22)	2.81 (1.58)^{bc}	1.19 (1.25)^{c}	0.81 (0.89)^{d}	0.44 (0.96)^{d}	0.75 (1.11)^{d}	6.31 (2.60)^{bc}	4.63 (2.15)^{c}	2.50 (1.72)^{c}	0.94 (1.18)^{d}	0.56 (1.02)^{d}	1.06 (1.02)^{d}	8.75 (2.95)^{c}	5.50 (2.34)^{c}	3.38 (1.82)^{c}	2.38 (1.52)^{d}	2.13 (1.45)^{d}	2.81 (1.67)^{d}
Neem oil soap 0.6%	4.13 (2.01)	4.06 (2.00)^{ab}	3.00 (1.86)^{b}	2.06 (1.43)^{bc}	1.25 (1.31)^{c}	1.69 (1.46)^{c}	7.18 (2.77)^{ab}	6.06 (2.45)^{b}	4.25 (2.17)^{b}	2.94 (1.85)^{b}	2.81 (1.81)^{b}	3.94 (1.97)^{b}	10.25 (3.20)^{ab}	7.75 (2.78)^{b}	5.0 (2.23)^{b}	4.44 (2.10)^{bc}	4.00 (1.99)^{b}	4.75 (2.17)^{b}
Soap solution 0.5%	4.25 (1.97)	5.19 (2.25)^{a}	5.31 (2.40)^{a}	6.00 (2.43)^{a}	6.63 (2.65)^{a}	7.44 (2.81)^{a}	7.87 (2.89)^{a}	8.06 (2.83)^{a}	8.44 (2.98)^{a}	9.00 (3.08)^{a}	9.63 (3.18)^{a}	10.25 (3.19)^{a}	11 (3.31)^{a}	11.19 (3.34)^{a}	11.63 (3.40)^{a}	12.06 (3.47)^{a}	12.50 (3.53)^{a}	13.19 (3.63)^{a}
Quinalphos 25 EC 0.05%	4.00 (1.97)	1.75 (1.27)^{c}	1.00 (1.17)^{c}	0.31 (0.55)^{e}	0.13 (0.78)^{d}	0.31 (0.88)^{d}	5.37 (2.41)^{c}	3.13 (1.76)^{d}	1.00 (1.19)^{d}	0.19 (0.82)^{e}	0.0 (0.70)^{e}	0.56 (0.72)^{e}	7.93 (2.81)^{c}	4.69 (2.14)^{c}	2.0 (1.38)^{d}	1.19 (1.08)^{e}	0.81 (0.89)^{e}	1.25 (1.11)^{e}
Control	4.69 (2.10)	5.38 (2.25)^{a}	5.56 (2.41)^{a}	6.25 (2.49)^{a}	6.81 (2.70)^{a}	7.50 (2.82)^{a}	8 (2.91)^{a}	8.1 (2.92)^{a}	8.38 (2.97)^{a}	9.31 (3.13)^{a}	10.0 (3.23)^{a}	11.0 (3.31)^{a}	11.25 (3.35)^{a}	11.94 (3.45)^{a}	12.19 (3.48)^{a}	12.75 (3.56)^{a}	13.0 (3.60)^{a}	14.06 (3.74)^{a}
C.D (0.05)	NS	0.62	0.49	0.28	0.25	0.25	0.24	0.17	0.24	0.19	0.23	0.22	0.15	0.25	0.29	0.20	0.14	0.13

Figure in parenthesis denotes square root transformed value. Means followed by similar letters are not significantly different; DBA- Day before application; DAA- Days after application: NS- Non significant.

neem oil soap. Similar findings were reported by Kumar (2013), where he stated that imidacloprid followed by triazophos, quinalphos and neem based insecticides were effective in reducing jassid population as compared to that of control.

After three sprays, pongamia oil soap 2 per cent was effective in reducing the leaf hopper population followed by pongamia oil soap 1 per cent, neem oil soap 0.6 per cent and pongamia oil soap 0.6 per cent. Efficacy of pongamia oil soap was reduced with the reduction in concentration. Even though ponamia oil soap 0.6 per cent and neem oil soap 0.6 per cent showed similar results, better efficacy was showed by neem oil soap 0.6 per cent in reducing leaf hopper population. Similar results were observed by Anitha (2007) who reported that among the botanicals and myco pathogens, neem oil 2 per cent recorded least leafhopper population (2.90 leafhoppers/3 leaves) followed by pongamia oil 2 per cent (3.44 leafhoppers/3 leaves) on okra. Superiority of neem based insecticides have been reported by Mandal *et al.* (2006) and Sinha and Sharma (2007). Higher efficacy of pongamia oil soap 2 per cent against leaf hopper as observed in this study is in line with Sardana and Krishnakumar (1989), who stated that maximum reduction in hopper population to the extent of 17.51 leafhoppers per plant was recorded in case of karanj oil (2 per cent) as compared to neem oil (0.5 per cent) and garlic oil (0.5 to 1%).

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