Bioefficacy of neem insecticidal soap (NIS) on the disease incidence of bhendi, *Abelmoschus esculentus* (L.) Moench under field conditions

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ABSTRACT

Menace of Bhendi Yellow Vein Mosaic Virus (BYVMV) disease drastically reduces the yield and quality of the bhendi, *Abelmoschus esculentus* L Moench. To alleviate this problem, Neem Insecticidal Soap (NIS @ 2%) a laboratory formulation was prepared and its efficacy was evaluated along with Neem Azal 0.6 % (Parry India Ltd), Neem gold 0.6% (Spic, India), Achook 0.6% (Godrej Agrovet Ltd, India), Rogar 0.05% (30 Ec Dimethoate) under field conditions. Disease incidence noticed in control plot was 46% while the Neem Azal, Rogar, Neem gold, Achook and NIS applied plots were 21, 20, 19, 18 and 17%, respectively. The maximum percentage of fruit yield was obtained from the field treated with NIS (59.26 q/ha), whereas, the minimum yield was recorded in control (53 .25 q/ha) as well as in neem gold treated fields (53.31 q/ha). Thus, the use of NIS has been considered as cheap, ecofriendly and effective for controlling Bhendi yellow vein mosaic virus (BYVMV) consequently optimize their yield.

Key words: Bioefficacy, bhendi, Crop pest, BYVMV, NIS, bio-pesticide and disease incidence.

INTRODUCTION

Bhendi (*Abelmoschus esculentus* (L.) Moench.) commonly known as lady's finger is an important vegetable crop of Uttar Pradesh for its tendril fruit to be consumed as fresh and as canned food. The total estimated loss of vegetable by Bhendi Yellow Vein Mosaic Virus (BYVMV) menace was around 20-30% if it is uncontrolled by any means then the loss may goes up to 90% (Hamer and Tthompson, 1957). The causal agent of yellow vein mosaic disease of bhendi was diagnosed as a geminiviruses (18X 30 nm), which has showed a close relationship to Indian cassava mosaic bigeminivirus in ELISA tests (Henda and Gupta, 1993). Whitefly *Bemisia tabaci* Genn. (Hemiptera : Homoptera : Aleyrodidae), the vector of BYVMV also causes considerable damage by sucking sap and emission of honeydew, on which fungi develop. The production of wax impede the normal physiological functions and makes chemical control difficult. (Viggiani, 1993). Infection of BYVMV disease upon cultivar drastically reduces its yield, quality of the produce and the extent of damage declines with delay in infection (Fajinmi and Fajinmi, 2010). Plants infected 50 and 65 days after germination suffer a loss of 84 and 49% respectively (Sastry and Singh, 1974). The aim of the present work is to evaluate the impact of Neem Insecticidal Soap (NIS @ 2%) a laboratory formulation was prepared and its efficacy was evaluated along with Neem Azal 0.6 % (Parry India Ltd), Neem gold 0.6% (Spic, India), Achook 0.6% (Godrej Agrovet Ltd, India), Rogar 0.05% (30 Ec Dimethoate) under field conditions.

MATERIALS AND METHODS

This experiment was started on early August in the cultivated field at vegetable and pulse research station, Kanpur. The field was ploughed thrice and applied with farmyard manure was divided in to 24 plots, having 3.0m x 4.5 m (13.5 m²). The plots are laid out in randomized block design having 6 different treatments and 4 replicates for each treatment. Seeds of bhendi (var. Pusa Sawani, highly susceptible to BYVMV) were sowed with 30 x 15 cm spacing. Urea and potash was given once after 25 DAS as manure prescribed by local farmers.

Preparation of NIS

Both neem oil (*Azadirachta indica* A.Juss.) and til oil (*Sesamum indicum*) were filtered through a double layered muslin cloth. 20 gm of vegetable oil soap (Swasti bar) was chopped by knife and soaked for 2-3 hrs in 500 ml beaker containing 80 ml of oil mixture (Neem and Til oil in 1:1 ratio v/v. by R. Choudhury 1993). The soap oil mixture was heated gently until the appearance of brown effervescence, over a burner and mixed with glass rod to get a homogenized mixture. The semisolid neem oil soap mixture was poured in aluminum tray lined with polyethylene sheet was evenly spread and cooled for making oil cakes.

Bioassay and data analysis

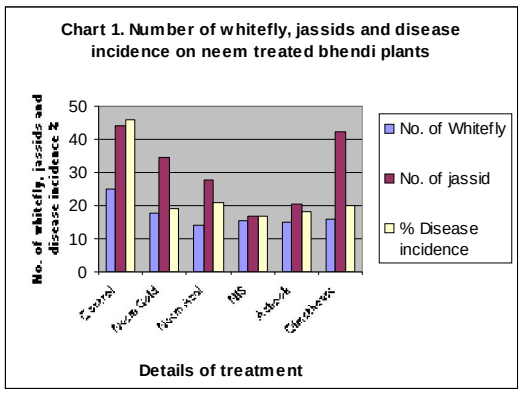
The treatments applied were neem Azal 0.6 %, neem gold 0.6% Achook 0.6%, Neem Insecticide Soap 2% (laboratory prepared) Rogar 0.05% (30 EC Dimethoate) and tap water as control. Totally 3 foliar sprays were given by using pedal sprayer throughout cultivation at 22, 35 and 55 DAS (days after seed sowing). A total volume of 4000 ml of solution mixture was used in one-treatment for 4 replicates or per 400 bhendi plants. Vectors, *Bemisia tabaci* Genn. and green jassids, *Amrasca biguttula biguttula* population, plant height and disease incidence were monitored from randomly selected 10 plants/plot with weekly interval. The yield assessment was achieved qualitative and quantitatively from 14 different phases of fruit picking and the number and weight of healthy and infected fruits (by fruit borer *Earias vitella* Fab.) were counted separately the data was analyzed statistically (Duncan Multiple Range Test).

RESULTS AND DISCUSSION

The whitefly started appearing 12 DAS and maximum population obtained from control plots with 25 adults / 10 plants while all the treated plots ranged about 14-18 in numbers (chart 1& Table 2). Green jassids (*Amrasca biguttula biguttula*.) appeared was 443 and 421 / 10 plants in control and Rogar (Dimethoate) plots, while Neem Gold, Neem Azal, Achook and NIS treated plots observed with 344, 277, 206 and 167 respectively(table-II). Both nymph and adult jassids suck the sap from bhendi leaf, the affected leaves were curl upwards margins and tip regions were noticed with necrotic development which expended to entire leaf Average of 4 replications (each plot considered as a replicate) and resulting in drying up of whole leaf. Damage by the fruit borer *E,vittella* in NIS and N.Gold was reduced by 20% over control and dimethoate treated plots. More fruit damage noticed in control and dimethoate treatments with 5.44 and 5.01 q/ha and the damage caused by the top borer *Earias vittella* Fab. which makes hole on fruits and leave them unmarketable and also bores tender shoots, pedicel and the petiole of host plant. Disease symptoms noticed at 18-20 DAS and which kept on increasing unto 40 DAS then after no markable change (Table 1) and percentage incidence in control, neem Azal, Rogar, neem gold, Achook and NIS plots were 46%, 21, 20, 19, 18 and17% at harvesting (Table 2).

Table 1. Effect of neem products on the occurrence of disease incidence percentage

Treatments	Days after sowing (DAS)		
	20	35	45
Control	10	21	43
Neem Gold	10	14.5	18.8
Neem Azal	11	12.8	21
NIS.	10,5	12.5	16.8
Achook	11	11.5	17.5
Dimethoate	10.7	16	19.5



Neem Azal achieved with maximum plant growth (85.7 cm) while the minimum recorded in neem gold treated plant (73.1 cm).The plant height recorded at the time of harvest were 83.6cm, 83.5, 81.6 and 81.5 cm in Achook, Rogar (30 Ec Dimethoate), control and NIS plots respectively. The maximum yield obtained from NIS treated plot with 59.26 q/ha while the minimum yield recorded from control plots with 53.25 q/ha. The fruit harvested from the, Rogar, Achook, neem Azal and neem gold was 58.93, 57.87, 55.1, and 53.31 q /ha respectively (Table 2).

In Lucknow region of U.P in North India the incidence of *Bemisia tabaci* fluctuated throughout the year with peak occurrence in March -April, June and September- October (Roychoudhary and Jain, 1993). The present study reveals that both vector and virus were started appearing after 13 and 16 DAS (days after sowing) and the vector population remain almost constant up to 25 days after seed sowing. Significant relationship noticed between adult whiteflies population density and the incidence of BYVMV as suggested earlier by Borad et al., 1993. Reduction of adult population (*Bemisia tabaci.*) was attained around 40% in NIS treated plots over control. Vector mortality was 20-80% and alcohol extracts were superior to aqueous ones against bhendi (Okra) yellow vein mosaic bigeminivirus (Chowdhury et al., 1992). Neem aqueous extracts 4-5%, cake 1. 5 %, seed oil (1-1.5%) and insecticidal soap showed a clear reduction in numbers of pupae (Serra and Schumutterer, 1993) and nymphs (Price and Schuster, 1991).

Both NIS and Achook(2%, 0.6%) were efficiently controlled the whitefly and jassids population up to 40-

Table 2. Efficacy of neem products on yield of bhendi (*Abelmoschus esculentus* L. Moench.) in field experiments.

Treatment	Average height in cm $	No of insects		% Disease incidence	Yield obtained (Q / ha) $		
		B tabaci	*A.biguttula*		Healthy	Infected	Total
Control	81.6	25	443 a	46a (46.87)	47.81	5.44	53.25
Neem Gold	73.1	17.7	343.7 a	19 b (25.84)	49.25	4.06	53.31
NeemAzal	85.7	14	277 a	21 b (27.27)	50.69	4.82	55.1
NIS	81.5	15.5	166.9 b	17 b (24.35)	55.34	3.92	59.26
Achook	83.6	15	206.2 b	18 b (25.10)	53.01	4.56	57.87
Dimethoate	83.5	16	422.2 a	20 b (26.57)	53.92	5.01	58.93

Note.$ - Not statistically significant (Average taken from four replicates.)Within columns, means followed by same letter do not differ significantly at the 5% probability level by DMRT.Numbers in the parenthesis are arcsine transformed values.

65%, reduced *E.Vittella* damages by 40% and subsequently increases 10% yield (6q/ha).Similarly NSK (5%), NO (0.3%) spray effectively control the whitefly population in okra by 80% and 78% (Kathirvel,1988 and Mohan, 1989). Sardana and Krishna Kumar (1987) observed NO (2%) to be effective against *Earias* sps but less effective against jassid (*A. biguttula biguttulIa*). Nimbecidine was more effective than NO against Earias sps (Udaiyan and Ramarathinan, 1994). Three sprays of Repelin (1%) reduced jassid population and E. vittella, respectively and lead to 28% higher yield (Patel and Sojitra, 1993). Repelin was least effective, spraying of neem products like Neemark, Repelin and NO 4-6 times did not give the adequate control of okra pests. Achook (azadirachtin enrich formulation, Raman *et al.*,1993) and Neemax 25 kg/ha (Nimbalkar *et al.*, 1994) observed to be most effective against jassid, whitefly and top borer.

The Whitefly, jassid and fruit borer are very serious pests on bhendi (okra) and the damage may varies with weather, pest population and the availability of alternate hosts. The weather parameter and nature of host plant also appears to influence the effectiveness of neem products and the transmission ability of the vector *Bemisia tabaci* Genn. Though controlling virus disease by neem products is rather difficult than preventing, a systematic integrated approach with neem products against pests and diseases of bhendi can apparently possible. Spray of Neem Insecticidal Soap @ 2% at 15 days interval, starting 2-3 weeks after germination is advised to reduce the spread of BYVMV by checking its vector *Bemisia tabaci* Genn. as the flies highly sensitive to neem insecticidal soap.

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