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Efficacy of insecticides, oils and antibiotics on management of Brinjal little leaf disease

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Abstract
Brinjal or eggplant (*Solanum melongena* L.) belongs to the family *Solanaceae* which contains 75 genera and over 2000 species. Phytoplasmal little leaf disease is economical important capable of causing yield losses up to 40 per cent. The commonly encountered disease symptoms were leaf curling or cupping, reduced leaf size, reduced the petiole length, proliferation of auxiliary shoots, flowers malformed into leaf like structures (phyllody), yellowing and stunted plants growth and death of little leaf infected brinjal plants. Present investigation carried out in *Kharif,* 2018 for management of brinjal little leaf disease under field condition. For the management of brinjal little leaf disease insecticides, oils and antibiotics were used among this all antibiotic were recorded as effective for management of brinjal little leaf followed by insecticides and oils. The effect of integrated management on brinjal little leaf disease can be controlled by treatment with spraying of insecticide i.e. Dimethoate followed by spraying of Neem oil 1000 ppm and Tetracycline @ 500 ppm. The highest disease incidence was recorded in spraying of Garlic oil 1000 ppm.

Keywords: Brinjal little leaf, management, insecticides, oils and antibiotics

Introduction
Brinjal is a self-pollinated, annual herbaceous plant (2n=24 chromosoms). Brinjal is the most popular and widely grown vegetable crop of both tropics and sub-tropics of the world. It is being grown extensively in India, Bangladesh, Pakistan, China, Philippines, France, Italy and United States. India is the centre of origin. It is highly productive and find its place as the poor man's vegetable (Som and Maity, 2002) [12]. In India, immature fruits of brinjal are consumed as a cooked vegetable in various ways (Rai *et al.,* 1995) [10] and fruits are rich source of minerals like Ca, Mg, P and fatty acids. Besides, it is used as fresh vegetable and known to have some medicinal properties in curing diabetic patients, asthma, cholera, bronchitis, diarrhoea and other complaints (Tomar and Kalda, 1998) [13]. Eggplant is very low in calories and fats but rich in soluble fibers. 100 g provides just 24 calories but contributes about 9% of RDA (Recommended Daily Allowance) of fiber. It contains good amounts of many essential B-complex vitamins such as pantothenic acid (Vitamin B_5), pyridoxine (Vitamin B_6), thiamin (Vitamin B_1) and niacin (Vitamin B_3), total water soluble sugars, free reducing sugars and amide proteins (Gopalan *et al.,* 2007) [3].
Brinjal little leaf disease incidence was up to 45% with the yield per plant reduced by 90% (Kelly *et al.,* 2009) [4]. Phytoplasmas are important phloem-limited, insect transmitted pathogenic agents, causing about 1000 diseases, many of which are lethal, in hundreds of plant species. They are non-cultivable, gram positive prokaryotes in the class- Mollicutes (Weintraub, 2007) [14].
Brinjal crop cultivation is increasing day by day in India especially, in Maharashtra State. Brinjal little leaf phytoplasmal disease has been emerging as a threat to brinjal cultivation in Marathwada region of the state of Maharashtra. It is serious problem in all varieties considering economic importance of disease and very few information available on management of disease therefore the present investigation carried out for management of brinjal little leaf disease.

Material and Methodology
The experiment was conducted during *Kharif* -2018 on the experimental farm of the Department of Plant Pathology, College of Agriculture, Latur. The field experiment was laid out by applying randomized block design (RBD) with ten treatments and three replications. The Brinjal variety Gaurav, susceptible to brinjal little leaf disease was used during present

experiment. Recommended doses of fertilizers were applied with light irrigation for better seedling growth. Intercultural operations were performed as and when required. Three spraying of insecticides, oils and antibiotic were given. First spraying will be done after first appearance of disease and subsequently two at 20 days interval. Observations on little leaf were done from its first appearance at an interval of 10 days and continued till final picking of the fruits and also one day before each spraying.

Result and Discussion

The results (Table 1) revealed that those insecticides, oils and antibiotic tested were effective in reducing disease incidence over untreated control. Little leaf per cent disease incidence recorded at 60 DAT was comparatively minimum, but later it increased slowly upto 180 DAT in the treatments attempted. Among the treatments, average incidence of the disease ranged from 3.47 to 17.01 per cent. However, it was least with the treatment T_3: spraying of Dimethoate 30% EC @ 20ml/ 10 lit water (3.47%), followed by T_7: Neem oil 1000 ppm @ 5 ml/ lit water (4.40%), T_4: spraying of Tetracycline @ 500 ppm (5.42%), T_1: spraying of Imidacloprid 17.8% SL @ 2ml/ 10 lit water (5.53%) and T_5: spraying of Tetracycline @ 1000 (5.74%). Rest of treatments recorded average disease incidence in the range of 6.54 to 11.88 per cent as against comparatively maximum average incidence (17.01%) in unsprayed control.

Table 1: Effect of sprayings of insecticides, oils and antibiotic on incidence of brinjal little leaf disease at various intervals

Tr. No.	Treatments	Dosages	Disease incidence (%) days after transplanting													*Av. Incid. (%)
			60	70	80	90	100	110	120	130	140	150	160	170	180	
T_1	Spraying of Imidacloprid 17.8% SL	FS @ 2 ml/10 ltr	2.64 (9.35)	4.00 (11.53)	4.00 (11.53)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.53
T_2	Spraying of Thiomethoxam 25% WG	FS @ 5 gm/10 ltr	5.32 (13.33)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.54
T_3	Spraying of Dimethoate 30% EC	FS @ 20ml/10 ltr	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	2.64 (9.35)	2.64 (9.35)	2.64 (9.35)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	5.32 (13.33)	3.47
T_4	Spraying of Tetracycline	FS @ 500 ppm	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	2.64 (9.35)	5.32 (13.33)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	5.42
T_5	Spraying of Tetracycline	FS @ 1000 ppm	2.64 (9.35)	4.00 (11.53)	4.00 (11.53)	4.00 (11.53)	4.00 (11.53)	5.32 (13.33)	5.32 (13.33)	6.64 (14.93)	6.64 (14.93)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	5.74
T_6	Spraying of Tetracycline	FS @ 1500 ppm	1.32 (6.59)	4.00 (11.53)	4.00 (11.53)	4.00 (11.53)	4.00 (11.53)	6.64 (14.93)	6.64 (14.93)	10.64 (19.03)	10.64 (19.03)	13.32 (21.40)	13.32 (21.40)	13.32 (21.40)	13.32 (21.40)	8.01
T_7	Spraying of Neem oil 1000 ppm	FS @ 50 ml/ 10ltr	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	4.00 (11.53)	4.00 (11.53)	5.32 (13.33)	5.32 (13.33)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	8.00 (16.42)	4.40
T_8	Spraying of Karanj oil 1000 ppm	FS @ 50 ml/ 10ltr	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	5.32 (13.33)	8.00 (16.42)	10.64 (19.03)	10.64 (19.03)	14.64 (22.49)	14.64 (22.49)	20.00 (26.56)	20.00 (26.56)	20.00 (26.56)	20.00 (26.56)	11.37
T_9	Spraying of Garlic oil 1000 ppm	FS @ 50 ml/ 10ltr	1.32 (6.59)	4.00 (11.53)	5.32 (13.33)	6.64 (14.93)	12.00 (20.26)	12.00 (20.26)	12.00 (20.26)	13.32 (21.40)	13.32 (21.40)	18.64 (25.57)	18.64 (25.57)	18.64 (25.57)	18.64 (25.57)	11.88
T_{10}	Control (unsprayed)		10.64 (19.03)	10.64 (19.03)	13.32 (21.40)	13.32 (21.40)	16.00 (23.57)	17.32 (24.59)	17.32 (24.59)	18.64 (25.57)	18.64 (25.57)	21.32 (27.49)	21.32 (27.49)	21.32 (27.49)	21.32 (27.49)	17.01
	S.E. ±	-	0.33	0.47	0.53	0.58	0.73	0.77	0.77	1.09	1.09	1.42	1.42	1.42	1.42	-
	C.D. (P= 0.05)	-	1.00	1.40	1.59	1.74	2.19	2.29	2.29	3.25	3.25	4.26	4.26	4.26	4.26	-

*= Average of three replications; FS= Foliar spray; DAT= Days after transplanting
Figures in parentheses are arcsine transformed values

Similarly, the results (Table 2, Fig. 1) revealed that the initial little leaf incidence at 60 DAT was increased with slow rate upto third spraying of the treatments, but the rate of increase was comparatively maximum in unsprayed control. However, based on terminal disease incidence after third spraying and average disease incidence, the most effective treatment found was T_3: spraying of Dimethoate 30% EC @ 20ml/ 10 lit water with significantly least disease incidence (2.64%) after third spraying and minimum average disease incidence (1.65%). This was followed by the treatments Neem oil 1000 ppm @ 5 ml/ lit water (4.00% and 1.99%), spraying of Tetracycline @ 1000 ppm (5.32% and 3.99%) and spraying of Imidacloprid 17.8% SL @ 2ml/ 10 lit water (5.32% and 4.32%), respectively of the disease incidence after third spraying and mean disease incidence. Rests of the treatments were also effective except unsprayed control, with comparatively maximum disease incidence (17.32%) after third spraying as well as maximum mean disease incidence (12.98%)

The results (Table 2) revealed that all the treatments significantly reduced little leaf disease incidence, over unsprayed control. However, comparatively highest reduction in disease incidence was recorded with the treatment T_3: spraying of Dimethoate 30% EC @ 20ml/ 10 lit water (87.28%), followed by the treatments T_7: Neem oil 1000 ppm @ 5 ml/ lit water (84.66%), T_4: spraying of Tetracycline @ 500 ppm (77.04%), T_5 and T_6: Tetracycline @ 1000 and 1500 ppm, respectively (each 69.26%). Rest of the treatments recorded disease reduction in the range of 51.38 to 66.71 per cent.

Similar results regarding effectiveness of insecticides in controlling the vector leaf hoppers and thereby resulting in reduced incidence of the phytoplasmal phyllody/ little leaf diseases were reported earlier by several workers (Pathak *et al.,* 2013; Singh *et al.,* 2014; Kumari *et al.,* 2017; Khandelwal, 2018) [9, 11, 7, 5]. Similarly, Neem oil and other essential oils were also reported as effective in controlling the vector leaf hoppers and thereby reducing the incidence of phytoplasmal diseases (Kumar *et al.,* 2012c; Ahirwar *et al.,* 2009) [6, 1]. Also, the antibiotic Tetracycline at various concentrations was reported as effective in controlling various phytoplasmal diseases (Kumhar and Meena, 2016 and Akhtar *et al.,* 2009a) [8, 2].

Table 2: Effect of sprayings of insecticides, oils and antibiotic on incidence of brinjal little leaf disease

Tr. No.	Treatments	Dosages	Disease incidence (%) *					
			Before Ist Spray	After Ist Spray	After IInd Spray	After IIIrd Spray	Mean	Reduction (%) over control
T_1	Spraying of Imidacloprid 17.8 SL	FS @ 2 ml/10 ltr	2.64 (9.35)	4.00 (11.53)	5.32 (13.33)	5.32 (13.33)	4.32 (14.54)	66.71
T_2	Spraying of Thiomethoxam 25 WG	FS @ 5 gm/10 ltr	5.32 (13.33)	6.64 (14.93)	6.64 (14.93)	6.64 (14.93)	6.31 (7.38)	51.38
T_3	Spraying of Dimethoate 30 EC	FS @ 20ml/10 ltr	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	2.64 (9.35)	1.65 (9.94)	87.28
T_4	Spraying of Tetracycline	FS @ 500 ppm	1.32 (6.59)	1.32 (6.59)	2.64 (9.35)	6.64 (14.93)	2.98 (11.52)	77.04
T_5	Spraying of Tetracycline	FS @ 1000 ppm	2.64 (9.35)	4.00 (11.53)	4.00 (11.53)	5.32 (13.33)	3.99 (11.52)	69.26
T_6	Spraying of Tetracycline	FS @ 1500 ppm	1.32 (6.59)	4.00 (11.53)	4.00 (11.53)	6.64 (14.93)	3.99 (11.52)	69.26
T_7	Spraying of Neem oil 1000 ppm	FS @ 50 ml/ 10 ltr	1.32 (6.59)	1.32 (6.59)	1.32 (6.59)	4.00 (11.53)	1.99 (8.10)	84.66
T_8	Spraying of Karanj oil 1000 ppm	FS @ 50 ml/ 10 ltr	1.32 (6.59)	1.32 (6.59)	5.32 (13.33)	10.64 (19.03)	4.65 (12.45)	64.17
T_9	Spraying of Garlic oil 1000 ppm	FS @ 50 ml/ 10 ltr	1.32 (6.59)	4.00 (11.53)	6.64 (14.93)	12.00 (20.26)	5.99 (14.16)	53.85
T_{10}	Control (unsprayed)	-	10.64 (19.03)	10.64 (19.03)	13.32 (21.40)	17.32 (24.59)	12.98 (21.11)	-
	S.E. ±	-	0.33	0.47	0.58	0.77	-	-
	C.D. (P= 0.05)	-	1.00	1.40	1.74	2.29	-	-

*= Average of three replications; FS= Foliar spray.
Figures in parentheses are arcsine transformed values.

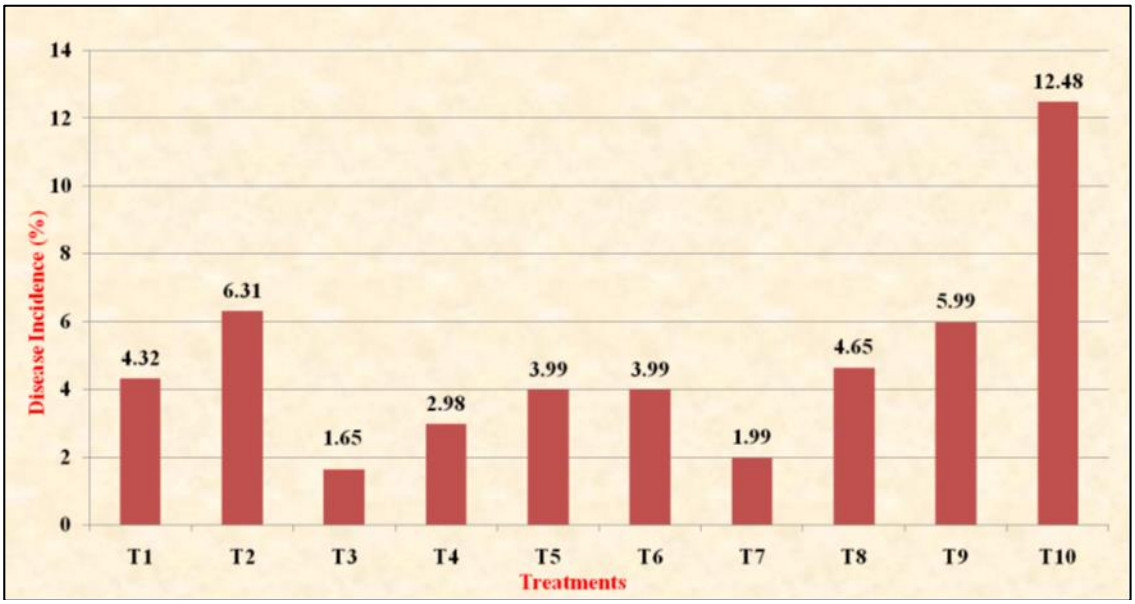

Fig 1: Brinjal little leaf disease incidence (%) as influenced by sprayings of insecticides, oils and antibiotic

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