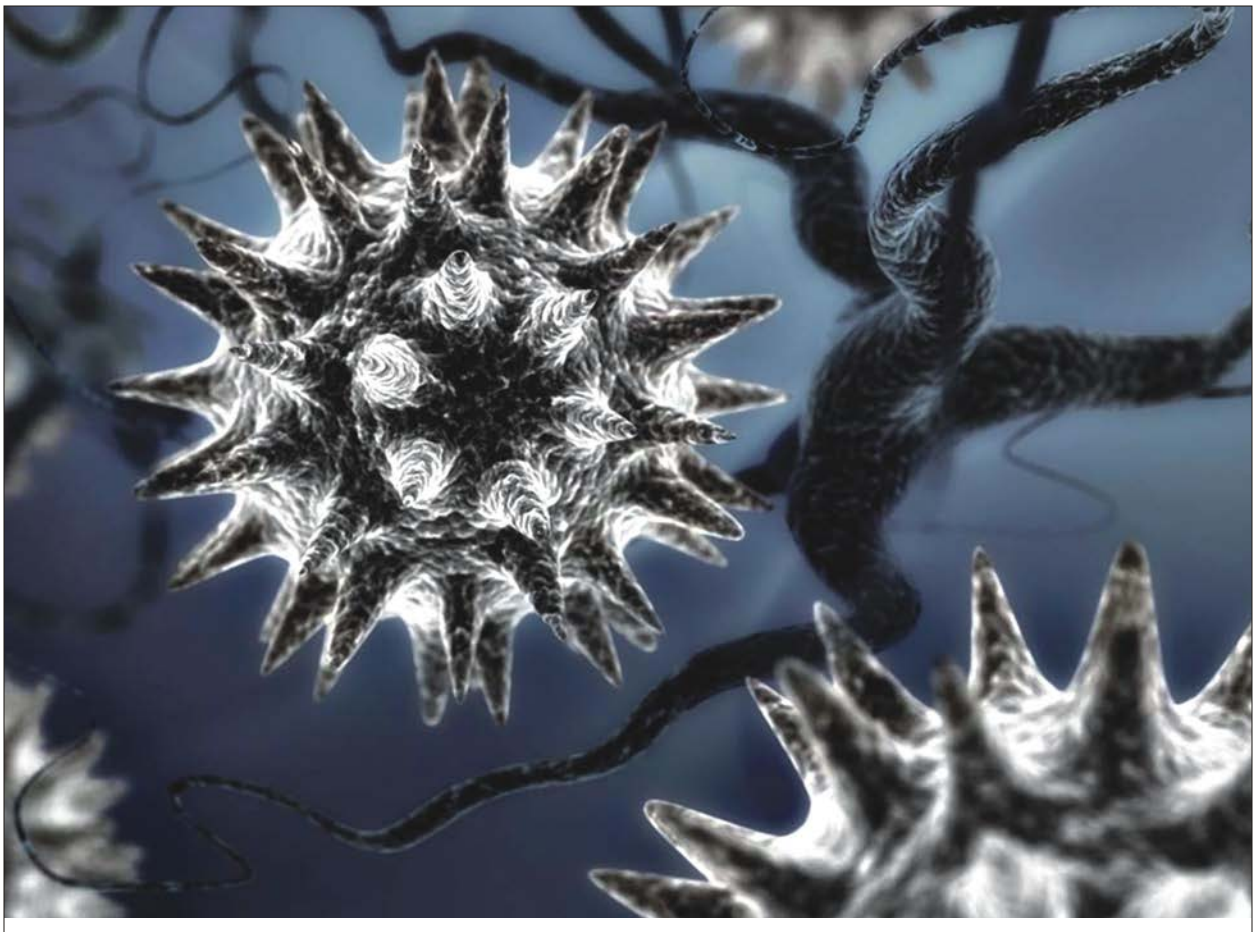

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Management of Leaf Curl Disease of Chilli (*Capsicum annuum* L.)

[1]Susheel Kumar Pandey, [2]A.C. Mathur and [3]Manisha Srivastava
[1]Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, B.H.U., Varanasi-221005, India
[2]Department of Plant Pathology, S.K.N. College of Agriculture, Jobner-303329, India
[3]Department of Botany, Harish Chandra P.G. College Varanasi-221001, India

Abstract: In present study management of chilli leaf curl disease has been studied. The management of leaf curl disease, by plant products showed that Neem Seed kernal extract (5%) found most effective than Karanj and Tumba seed extract. Management by insecticides, imidacloprid 17.8 SL (0.003%) was most effective than spinosad 48 EC (0.02%), malathion 50 EC (0.05%), acephate 75 SP (0.1%) and methyl-demeton 25EC (0.025%). Management of chilli leaf curl was done by seed extract of plants and insecticides at different concentrations.

Key words: Whiteflies, transmission, vector, disease incidence and herbal pesticides

INTRODUCTION

Chilli crop is attacked by a large number of pathogens but heavy losses are caused due to viruses. Several viral diseases attack this crop and induce mild to severe mosaic, yellow mosaic, mosaic mottle, leaf curl, leaf roll, bushy stunt and necrosis symptoms. The leaf curl disease of chilli caused by chilli leaf curl virus is transmitted by viruliferous whitefly (*Bemisia tabaci* Genn.). In India, Senanayake *et al.* (2006) have reported first time chilli leaf curl virus on chilli crop. Duleep Kumar Samuel (1990) observed that the flower extract of 20 plant species when mixed with the infective sap obtained from chilli mosaic virus infected plants were inhibitory. Rajasri *et al.* (1991) evaluated six synthetic insecticide, four neem preparations and one chitin inhibitor as foliar spray against chilli pests complex including mite, *P. latus* under field conditions in Andhra Pradesh during 1989 and found chitin inhibitors, dulhar least effective against *P. latus.* Triazophos proved the best among the synthetics, whereas neem preparations gave poor results as compared to synthetic insecticides. Rustamani *et al.* (1994) conducted field experiments to see the effectiveness of different insecticides against *B. tabaci* on chillies. Recommended concentration of Thiodon 35 EC (endosulfan), Azodrin 40 EC (manocrotophos), Anthio 25 EC (formothion) and Curocron 50 EC (profenifos) were spread thrice at two-weekly intervals. Formothion found significantly more toxic against *B. tabaci.* The disease incidence was also dependent on the effectiveness of insecticides against *B. tabaci.* The incidence of leaf curl virus observed higher in untreated check plots. Venkatesh *et al.* (1998) reported that chilli leaf curl complex was caused by leaf curl geminivirus (CLCV) transmitted by chilli mite (*Polyphagotarsonemus latus*), whitefly (*Bemisia tabaci*) and thrips (*Scirtothrips dorsalis*). Unah *et al.* (1999) used

Corresponding Author: Susheel Kumar Pandey, Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, B.H.U., Varanasi-221005, India

cypermethrin, decomethrin, carbofuron and formothion for control of *B. tabaci* on irrigated capsicum in the Nigeria. Dhawan *et al.* (2002) tested four genotypes of capsicum viz., AVRDC-183, Hisar Vijay, Hisar Shakti and Pusa Jwala grown during 1996 to 1999. Observations on whitefly populations and disease incidence were recorded at ten days intervals. Disease management studies were performed by treating three nursery beds separately by spraying with malathion, neem based insect repellent and water (as control) prior to transplanting to the field. Misra (2003) observed that efficacy of five insecticides i.e., Naclfmoa 1.9 EC (fermentation metabolite) at 15, 20 and 25 mL ha^{-1}, abamectin (Vertimec) 1.9 EC at 20 mL ha^{-1}, dimethoate (Rogar) 30% at 300 mL ha^{-1}, dicofol (Hilfol) 18.5% EC at 500 mL ha^{-1} and ethion (Phosmite) 50% EC at 250 mL ha^{-1} were evaluated in a field at Bhubaneshwar. Ethion proved superior in controlling the leaf curl disease of chilli. Noor (2004) conducted a trail in Jodhpur, Rajasthan for two years to control early season pests of chilli av. RCH-1 (*Scirtothrips dorsalis* and *Polyphagotarsonemus latus*) using different insecticides, applied through various methods. The methods included seed bed (soil) treatment, seedbed + seedling root tip and seedling spray. The insecticides used were phorate, monorotophos, carbofuron, acephate and methyl demeton applied individually or in combination and found phorate 10 G @ 3 g m^{-2} applied as seed treatment followed by monocrotophos (0.05%) root dip before transplanting was highly effective in controlling the pests and leaf curl disease. However, the treatment with carbofuron 3 G (10 g m^{-2}) soil treatment acephate (0.05%) as seedling root dip showed similar efficacy. Khan *et al.* (2006) observed that natural incidence of mosaic and leaf curl disease on various cultivars of chilli at Banthra Research Station of NBRI, Lucknow. The virus isolates causing mosaic and leaf curl diseases in chilli cultivars were transmitted by aphids and whiteflies, respectively.

MATERIALS AND METHODS

This experiment was conducted at S.K.N. College of Agriculture, Jobner during January 2007 to May 2007. The experimental field was prepared by ploughing thrice with cultivator followed by planking for making a good soil texture fine tilt and smooth soil surface. Recommended doses of FYM (1 t ha^{-1}) were mixed thoroughly in soil before 30 day transplanting of seedlings and nitrogen (100 kg ha^{-1}), phosphorous (50 kg ha^{-1}) and potash (50 kg ha^{-1}) were drilled and mixed thoroughly in soil by light harrowing before transplanting. Thirty-five days old healthy seedlings of local variety that of chilli raised in nursery under insect proof conditions were planted in each plot in 3-4 cm. Six irrigations were given weeding was done regularly to keep the plots weed free. Different plant seeds extracts viz., Neem (*Azadirachta indica*) seed kernel extract, Tumba (*Citrullus colecynthis*) seed extract and Karanj (*Pongamia pinnata*) seeds were broken and their cotyledons collected. Collected cotyledons ground separately. Sterilized distilled water and cotyledons were mixed in 1:1 ratio (v/w). These grounded seed cotyledons were squeezed through two folds of muslin cloth and it centrifuged at 3500 rpm for 30 min. The experiments were conducted with three treatments of seed extract viz., Neem (*Azadirachta indica*) seed kernel extract, Tumba (*Citrullus colecynthis*) seed extract and Karanj (*Pongamia pinnata*) seed extract and one treatment of untreated check without spray. The concentrations of different seed extracts were used. Each treatment was replicated four times in Randomized Block Design (RBD). For disease management (controlling vector) by insecticides the experiment was conducted with five treatments of insecticides viz., methyl-demeton 25 EC, imidacloprid 17.8 SL, malathion 50 EC, spinosad 48 EC and acephate 75 SP including untreated check. Each treatment was

replicated three times in Randomized Block Design (RBD). The concentrations of different insecticides were used. The first foliar spray of vector management substances was done just after the appearance of the vector in the experimental area. The second and third sprays were done at fortnightly intervals after first spray. In control plots sprays was not given. One square meter scale was used for observing the disease incidence in each plot by counting total number of plants as well as diseased plants. Percent disease incidence was calculated by following formula suggested by Nene (1972):

$$\text{Percent disease incidence} = \frac{\text{No. of diseased units}}{\text{Total assessed units}} \times 100$$

Reduction in disease incidence: Percent disease reduction was calculated by following formula:

$$\text{Percent disease reduction} = \frac{\text{C-T}}{\text{C}} \times 100$$

where, C is percent disease incidence in untreated plants, T is percent disease incidence in treated plants.

RESULTS

In disease management (controlling vector) by plant seed extracts, observation taken on percent disease incidence in foliar sprays of different plant extracts showed that percent disease incidence of chilli leaf curl was lower in all the seed extracts treatments in comparison to untreated check (Table 1). Result also indicated that the disease incidence was lowest in the treatment of Neem seed kernel extract showing 27.78% followed by Tumba seed extract (33.33%) and Karanj seed extract (36.11%) and in disease management (controlling vector) by insecticides, observations taken on disease management by controlling vector (Whiteflies) revealed that percent disease of chilli leaf curl was lower in all the insecticidal treatments than untreated check (Table 2). Minimum disease incidence was observed 14.81% with the use of imidacloprid at 0.003% followed by acephate at 0.1% (25.92%), methyl demeton at 0.025% (25.92%), malathion at 0.05% (29.62%) and spinosad at 0.02% (33.33%).

The management of plant viruses has two aspects (1) protection of host with disease inhibiting materials, so that either virus multiplication in them decrease or stops or insect vector fails to acquire viruses from infected hosts and (2) use of disease inhibiting materials for the control of vectors.

Table 1: Effect of plant seed extracts on the incidence of chilli leaf curl disease

		Percent mean	
Name of plant seed extracts	Conc. (%)	Disease incidence	Reduction in disease incidence in comparison to untreated check*
Neem seed kernel extract	5	27.78 (31.81)	60.00 (50.77)
Tumba seed extract	5	33.33 (35.26)	52.00 (46.15)
Karanj seed extract	5	36.11 (36.94)	48.00 (43.85)
Untreated check	--	69.44 (56.44)	0.00 (0.00)
SEm±		1.18	0.91
CD at 5%		3.76	2.91

*Average of four replications. Values in parentheses are angular transformed values

Table 2: Effect of plant seed extracts on the incidence of chilli leaf curl disease

		Percent mean	
Name of insecticides	Conc. (%)	Disease incidence	Reduction in disease incidence in comparison to untreated check*
Methyl-demeton	0.025	25.92 (30.60)	63.16 (52.63)
Imidacloprid	0.003	14.81 (22.63)	78.95 (62.69)
Malathion	0.05	29.62 (32.97)	57.90 (49.55)
Spinosad	0.02	33.33 (35.26)	52.64 (46.51)
Acephate	0.1	25.92 (30.60)	63.16 (52.63)
Untreated check	Without spray	70.37 (52.02)	0.00 (0.00)
SEm±		1.45	1.59
CD at 5%		4.56	5.00

Average of three replications. Values in parentheses are angular transformed values

DISCUSSION

Among the three seed extracts tested, Neem seed kernal extract (NSKE) was most effective showing 27.78% disease incidence and the reduction in disease incidence in comparison to control was 60%, whereas, reduction in disease incidence in comparison to control were 52 and 48% in Tumba and Karanj seed extracts, respectively (Table 1). During present investigations NSKE has been found highly effective in reducing the transmission of chilli leaf curl virus by checking the vector population. The efficacy of NSKE has been reported by several workers against white fly (Singh *et al*., 1988; Ragupathi and Veeraragavathatham, 2002). However, these results also indicating that NSKE is having both virucidal as well as insecticidal properties. Mariappan *et al*. (1995) also observed similar results of mosaic of chilli. During the study Tumba and Karanj seed extract also gave good results. Chilli pepper seedlings were sprayed with neem seed extract (NeemAzal T/S, 1% of azadiractin) at concentrations of 0.05, 0.10, 0.15 and 0.20 g a.i. L^{-1}, with abamectin 1.8% (Vertimec 18 CE) and with water. Adult females of *P. latus* were transferred to each treated plant and after 6 days, the instantaneous rate of increase (ri) was calculated (Venzon *et al*., 2008).

In disease management by the use of insecticides, The data recorded during present investigation revealed that imidacloprid at 0.003% concentration level was found to be best treatment for checking the vector of leaf curl disease of chilli resulting minimum disease incidence (14.81%) and reduced maximum percent disease than the other treatments (Table 2). Since, imidacloprid is a new molecule hence no literature is available for supporting to data. The next effective treatment was acephate (0.1%) and methyl-demeton (0.025%) followed by malathion (0.05%) and spinosad (0.02%). Rao *et al*. (1984) evaluated 18 insecticides for the control of pest complex of chilli, acephate was recommended as the most effective compounds against the chilli pest complex as a whole. Similar results observed by Ganesha-Naik and Muniyappa (2004), in case of leaf curl disease of tomato. Noor (2004), in control of early season pests of chilli. The efficacy of the following insecticides for their control of this pest on Scotch Bonnet pepper on St. Vincent: spinosad, imidacloprid, chlorfenapyr, novaluron, abamectin, spiromesifen, cyfluthrin, methiocarb and azadirachtin were evaluated. Irrespective of the number of applications and use of surfactant, chlorfenapyr was the most effective in reducing the densities of *S. dorsalis* adults and larvae followed by spinosad and imidacloprid. The performance of other insecticides in controlling *S. dorsalis* populations was inconsistent. Nevertheless, all of the above insecticides if applied repeatedly were effective in suppressing of *S. dorsalis* populations (Seal *et al*., 2006).

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