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EVALUATION OF FURNACE OIL AND NEEM BASED PRODUCTS TO MANAGE *BEMISIA TABACI* AND LEAF CURL VIRUS ON COTTON

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Abstract

Nimbokil applied at 3 % concentration was found most effective in reducing egg hatchability, adult emergence, whitefly population and CLCuV severity on S-14 and NIAB-Krishma, respectively. Furnace oil applied at 2 and 3 % concentration was also effective in controlling *Bemisia tabaci* and CLCuV compared to untreated control. However, Nimbokil at 0.5 and 1 % and furnace oil at 1 and 2 % concentrations were statistically at par in reducing white fly population and CLCuV severity on both the cultivars.

Introduction

Cotton leaf curl caused by a Gemini virus and transmitted through whitefly was first reported in Pakistan near Multan during 1967 (Hussain & Ali, 1975). The inoculum continued to multiply and the disease started appearing in epidemic form in 1988-89. During 1991-1996, several epidemics were reported resulting significant crop and yield losses. Total losses during 1988-94 were estimated to be 2,876 thousand bales worth about Rs. 25-28 billion (Ali *et al.*, 1995).

Cotton crop alone consumes more than 50 % of synthetic insecticides in developing countries like Pakistan. It has led to a number of problems such as insect resistance, high residues in produce, ecological imbalances and health hazards. Unlike synthetic insecticides, the botanical insecticides and oil neither cause environmental pollution nor get included in the food chain and thus have no residue problem. Oils are advantageous in the control of plant diseases in the sense that these possess good spreading and sticking properties on leaf surface, have little toxicity and least health hazards and environmental pollution. In viruliferous sucking insects, while probing a leaf coated with oil, the power of virus transmission is probably affected and insect becomes relatively non-effective.

Neem seeds are a rich source of azadirachtin which vary widely depending upon the seed source. Neem oil as a source of bioactive principle has gained acceptance on a wide scale. The oil has been reported to affect reproduction of insects in several ways. Reduced fertility/fecundity and oviposition deference has been reported in *Bemis tabaci* (Rao & Narayanasamy, 1990). Metamorphosis and growth disruption by neem oil has also been reported in whitefly (Natarajan & Sundramurthy, 1990). The present studies aim at evaluating neem based products and furnace oil (belonging to mineral oil group) for their comparative efficacy against white fly, the vector for leaf curl virus of cotton.

Materials and Methods

Furnace oil (2 and 3 %) and Nimbokil (0.5, 1, 2 and 3 %) concentrations were used as foliar spray in the field on cotton cvs. S-14 and NIAB-Krishma grown in a randomized

complete block design at the Department of Plant Pathology, University of Agriculture, Faisalabad and on similar varieties grown in completely randomized design under controlled conditions. Whitefly populations collected from virus infected plants were released on the plants of same varieties in wooden cages covered with muslin cloth.

The data were recorded on the egg hatchability, adult emergence and adult population of *B. tabaci* one day before spray and then 24, 48 and 72 hrs. after the spray. The observations on these parameters were taken on randomly selected nine plants of each variety from upper, middle and lower parts of the crop canopy. Egg hatchability was recorded in the laboratory after marking eggs and nymphs on 10 leaves collected randomly from each treatment of the two varieties from the field. Cotton leaf curl virus disease severity was recorded at the end of the experiment according to a CLCuV disease rating scale (Anon., 1996).

Results and Discussion

Aphid and white fly are important pests and plant virus vectors. The pest infestation is largely controlled by synthetic insecticides but this measure does not prevent virus transmission as the insect can transmit the virus before being killed (Robertson & Klostermeyer, 1961). Neem (*Azadirachta indica*) has shown immense potential as a pest and vector control agent because of its insecticidal, antifeedent, antiecdysternoidal and antiviral properties (Ketkar, 1976). During these studies minimum egg hatchability was found to be 53.17 % after application of Nimbokil at 3 % concentration, whereas furnace oil did not prove effective as compared to Nimbokil. However, both the materials showed their effectiveness as compared to check (Table 1). Nimbokil applied at 3 % was found to be most effective which gave 51.67 % egg hatchability on NIAB-Krishma, whereas, it was 67.67 % in case of 3 % furnace oil as compared to 92.80 % in check. Results of 0.5 and 1.0 % concentrations of Nimbokil were at par with 2 and 3 % concentrations of furnace oil. Condriet *et al.* (1985) studied the effect of neem seed extract against immature stages of *Bemisia tabaci*. Cotton foliage treated with neem and neem seed extract resulted in a reduction of egg viability and oviposition and prolonged larval periods and larval mortality. Flint & Parks (1990) got 60 % reduction in the number of immature whiteflies on cotton leaves with aqueous sprays containing 160 ppm of azadirachtin (138 mL a.i./ha). The lower concentration including the recommended rate of 20 ppm, however, proved ineffective. Neemark at 0.4 % was found to be as effective as Endosulfan in controlling whitefly (Phadke *et al.*, 1990). Neem oil gave good control against *Bemisia tabaci* but was ineffective against *Helicoverpa armigra* (Rao *et al.*, 1990). Formulations of neem extract were reported to be effective in reducing Aleyrodidae populations after 48 hours (Naqvi *et al.*, 1991).

The adult emergence was 55.17 and 48.07 % on S-14 and NIAB-Karishma when Nimbokil was applied @ 3 % concentration. The present findings are in accordance with those of Nimbalkar *et al.* (1993) who reported considerable reduction in whitefly nymphal population. After the last spray on S-14 with Nimbokil at 2 and 3 % concentration was effective in minimizing the whitefly population as 3.44 and 3.01 whitefly/leaf. In case of NIAB-Karishma, Nimbokil at 2 and 3 % also proved effective as it gave 1.48 and 0.99 whitefly per leaf compared to 8 whitefly per leaf in untreated control, respectively. Significant reduction in whitefly population by using botanical insecticides especially neem based products, like Neemark, Neem guard and Neem oil has also been reported by several research workers (Nandihalli *et al.*, 1990; Phadke *et al.*, 1990; Rao *et al.*, 1990; Naqvi *et al.*, 1991).

Table 1. Mean white fly population before and after spray of chemicals and CLCuV incidence.

Treatments		Chemical sprays on S-14								CLCuV severity	
		1st		2nd		3rd		4th			
		Before	After	Before	After	Before	After	Before	After	Before	After
Furnace oil	(2 %)	6.00 a	6.90 a	8.06 a	7.69 a	7.48 ab	9.46 ab	8.81 b	7.05 b	4.5 a	4.0 b
	(3 %)	6.82 a	7.12 a	4.30 b	4.19 b	6.65 bc	6.31 cd	5.74 b	5.68 b	4.2 a	3.2 b
Nimbokil	(0.5 %)	6.50 a	6.91 a	4.33 b	3.99 b	6.93 bc	6.02 cd	7.53 b	6.29 b	4.0 a	2.9 b
	(1 %)	6.82 a	5.68 a	3.48 b	3.57 b	7.33 abc	7.80 bc	6.39 b	6.21 b	3.9 a	2.7 b
	(2 %)	5.90 a	3.50 b	3.25 b	2.06 b	5.55 bc	4.50 de	5.50 b	3.01 b	3.7 a	2.0 b
	(3 %)	6.10 a	3.52 b	2.34 b	1.24 b	5.03 c	3.41 e	5.33 b	3.43 b	3.8 a	1.8 b
Control		6.32 a	7.48 a	9.21 a	8.79 a	9.33 a	11.92 a	19.84 a	14.02 a	4.0 a	4.5 a
		Chemical sprays on NIAB Krishma								CLCuV severity	
		1st		2nd		3rd		4th			
Furnace oil	(2 %)	4.20	4.53 a	5.38	5.39 a	5.00	4.80 ab	2.70 b	2.72 b	1.0 a	0.9 b
	(3 %)	3.98	3.53 abc	3.68	3.32 ab	5.16	4.65 ab	2.78 b	2.20 b	1.0 a	0.9 b
Nimbokil	(0.5 %)	3.87	4.05 ab	3.83	3.87 ab	4.57	5.20 ab	2.42 b	2.44 b	1.0 a	0.7 b
	(1 %)	3.78	3.68 abc	3.95	3.69 ab	4.65	4.16 ab	1.70 b	1.55 b	1.0 a	0.5 b
	(2 %)	3.67	2.80 bc	2.10	1.99 b	2.45	2.10 b	1.73 b	1.47 b	1.0 a	0.6 b
	(3 %)	3.56	2.34 c	2.16	1.62 b	2.24	1.78 b	1.65 b	0.99 b	1.0 a	0.3 b
Control		3.98	4.35 a	5.96	6.42 a	5.70	6.74 a	8.44 a	7.97 a	1.0 a	1.0 a

*Figures sharing similar letters in a column do not differ significantly at 5 % level of probability.

The minimum leaf curl virus disease incidence was recorded as 1.8 on S-14 and 0.3 on NIAB-Krishna when Nimbokil was used at 3 % concentration. Dohroo & Gupta (1995) reported that Azadirachtin and other limonoids were quite effective in controlling plant diseases of diverse nature. Neem extract and oil were the most potent in reducing the virus incidence.

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