Asian Resonance

Eco-friendly management of tomato leaf curl disease using oil sprays

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Abstract

Experiments were conducted to study the effect of different oil sprays on tomato leaf curl disease. For this purpose mineral oils viz. Sunspray^{R} and Volck^{R} , vegetable oils viz. Cottonseed oil, Soybean oil and Neem oil and essential oils viz. Oscimum oil and Lemongrass oil were used. Results showed that oil spray treatments significantly decrease PDI as compared to control. Studies also showed that Neem oil spray had lowest PDI, was most effective against tomato leaf curl disease followed by Oscimum oil and Sunspray^{R} spray. These findings supports that oil sprays can be used as an eco-friendly method for management of tomato leaf curl disease.

Keywords: *Tomato leaf curl virus* (TLCV), Mineral oil, Vegetable oil, Essential oil, PDI(Percent Disease Incidence) etc.

Introduction

Tomato (*Lycopersicon esculentum,*Mill.), family solanaceae is one of the important vegetable crop grown throughout the world. China, the largest producer, accounted for about one quarter of the global output, followed by the United States, Turkey & India. In India tomato, is grown on an area of 4.58 million hectares with a production of 74.62 million tones. UP is one of the major tomato growing states of India. Among the different diseases of tomato, the leaf curl is most widespread and destructive disease, as sometimes it leads to cent percent crop loss (Butter and Rataul , 1981 ,Saikia and Muniyappa,1989,Ansari and Tewari,2004). In Uttar Pradesh this disease is widely prevalent and estimated to cause 27-40% loss (Ansari et al, 2005). The predominant symptoms of the disease are vein clearing, vein banding, reduction in leaf size, stunting, marginal and severe curling of leaves. Puckering of leaf is also common. The *tomato leaf curl virus* (TLCV) is transmitted by whitefly *(Bemisia tabaci* , Genn.) (Vasudeva and Samaraj, 1948).

Various oils have been used for centuries to control insect and various other pests. Oil sprays when applied to leaf surfaces have been known for long time to interfere with an insects ability to acquire and transfer virus particles to susceptible plants. Oils have different effects on pest insects. The most important is that they block the air holes (spiracles) through which insects breathe, causing them to die from asphyxiation. In some cases, oils also may act as poisons, interacting with the fatty acids of the insect and interfering with normal metabolism. Oils also may disrupt how an insect feeds, a feature that is particularly important in the transmission of some plant viruses by insects. Recent investigations indicate that some chemical constituents of these oils interfere with the octopaminergic nervous system in insects. As this target site is not shared with mammals, most essential oil chemicals are relatively non-toxic to mammals and fish in toxicological tests, and meet the criteria for “reduced risk” pesticides.

Essentially all commercially available horticultural oils (e.g., Sunspray^{R}, Scalecide^{R}, Volck^{R}) are refined petroleum products also known as mineral oils (W.S.Cranshaw) . Impurities in the oil that are associated with plant injury, such as aromatic compounds and compounds containing sulfur, nitrogen or oxygen, are removed. Filtration, distillation and dewaxing complete the production of the finished base oil. Final formulations of horticultural oils are normally combined with an emulsifying agent that allows the oil to mix with water. Vegetable oils also can be used as insecticides, although the type of oil can greatly affect its activity. Cottonseed oil is generally considered the most insecticidal of the vegetable oils. Soybean oil, the most commonly available vegetable oil used in cooking, has often provided fair to good control of some insects and mites. Oils used to inhibit virus transmission are sometimes called "stylet oils," a reference to the piercing and sucking mouthparts (stylets) of

insects that transmit these viruses. Essential oils are defined as any volatile oil(s) that have strong aromatic components and that give distinctive odour, flavour or scent to a plant. These are the by-products of plant metabolism and are commonly referred to as volatile plant secondary metabolites. Essential oils are found in glandular hairs or secretory cavities of plant-cell wall and are present as droplets of fluid in the leaves, stems, bark, flowers, roots and/or fruits in different plants. Typically these oils are liquid at room temperature and get easily transformed from a liquid to a gaseous state at room or slightly higher temperature without undergoing decomposition. In certain plants, one main essential oil constituent may predominate while in others it is a cocktail of various terpenes. Most essential oils comprise of monoterpenes -compounds that contain 10 carbon atoms often arranged in a ring or in acyclic form, as well as sesquiterpenes which are hydrocarbons comprising of 15 carbon atoms (O.Koul, S.Walia and G.S.Dhaliwal,2008).

Materials and Methods-

Tomato plants were planted under green house conditions taking into consideration all the environmental requirements conditions of irrigation, fertilization and weed control. Four week old seedlings were transplanted in eight experimental plots of 3x4m. each. Six seedlings were planted in four rows making total 24 plants per plot. Oil spray treatments started after one week of transplantation. Spray treatments were given at regular interval of one week. To know the effect of treatments data were taken at 15, 30 and 45 days interval after first spray treatment. Percent disease incidence(PDI) were calculated by counting total number of plants and number of diseased plant in each plot.

$$PDI = \frac{P_1 \times 100}{P_2}$$

Where, P_1 = Number of infected plants.

P_2 = Total number of plants.

For this experiment mineral oils viz. Sunspray^R and Volck^R , vegetable oils viz. Cottonseed oil, Soybean oil and Neem oil and essential oils viz. Oscimum oil and Lemongrass oil sprays were sprayed in plot 1 to 7 ,where as plot 8 remained untreated and served as control. Data regarding this experiments were shown in table-1.

Table-1

Effect of different oil sprays on tomato leaf curl disease:

S.No.	Oil	Treatments	Percent disease incidence(PDI)		
			After15 days	After 30 days	After 45days
1	Mineral oil	SunsprayR oil	16.66	41.66	58.33
2		VolckR oil	20.83	45.83	66.66
3	Vegetable oil	Cottonseed oil	25.00	45.83	70.83
4		Soybean oil	29.16	50.00	75.00
5		Neem oil	12.50	33.33	54.16
6	Essential oil	Oscimum oil	16.66	41.66	58.33
7		Lemongrass oil	20.83	37.50	62.50
8	control	Untreated	37.50	70.83	87.50

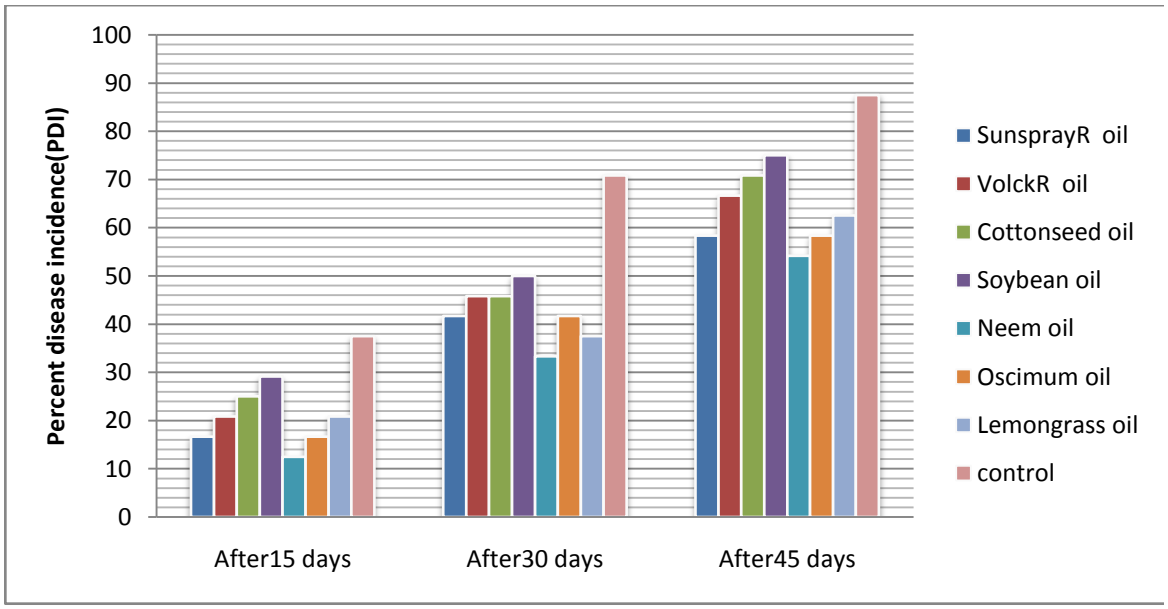

Fig: Effect of oil sprays on incidence of tomato leaf curl disease

Results and discussion-

The results indicate that experimental plots treated with oil sprays showed significant decrease in PDI as compared to control which had almost 87.50 percent disease incidence. Among different oil used , neem oil spray had lowest PDI and highest protection against tomato leaf curl disease followed by oscimum and sunspray^{R} oil sprays.

Crude oil emulsion, kerosene emulsion and paraffin emulsion were oldest known insecticides and used as poison or repellants against soft bodied insects such as aphids,whiteflies and mealy bugs etc. (Sudell, 1946; Gopalswamienger, 1950). Much intrest has been generated in use of oils particularly mineral oils for control of virus vectors and virus diseases (Khune,1980 ; Simons and Zitter, 1980). Mineral oil sprays are also effective in preventing the disease and increasing the yield of tomatoes. Three mineral oils viz. EWOS, BSOE and E-9267, each at concentration of 2% were tested and proved effective in preventing the disease (Butter and Rataul, 1973; Singh et al. 1973,1975). Krishi oil sprays are also effective in control of whitefly population and reducing the disease incidence. The results found in the present experiments confirms the findings of earlier workers. So the findings suggest that oil sprays can be used as an eco-friendly method to control tomato leaf curl disease .

References

1. Ansari N.A. and Tewari J.P.(2004). Observation on the epidemiology of tomato leaf curl disease on tomato in eastern Uttar Pradesh. *Vegetos* , 17(1 & 2) : 43-50.
2. Ansari N.A. ,Pandey A. and Tewari J.P.(2005). Relationship of *tomato leaf curl virus* (TLCV) with its vector, the whitefly (*Bemisia tabaci* Genn.).*J. Liv. World,*12(2) :1-8.
3. Butter,N.S. and Rataul, H.S. (1973). Control of tomato leaf curl virus (TLCV) in tomatoes by controlling the vector whitefly *Bemisia tabaci* Genn. By mineral oil sprays. *Curr. Sci. ,* 42: 864-865.
4. Butter N.S. and Rataul H.S.(1981). Nature and extent of losses in tomatoes due *to tomato leaf curl virus* (TLCV) transmission by whitefly, *Bemisia tabaci* Genn. (Aleyrodidae: Hemiptera). *Indian J. Ecol.* 8 : 299-300.
5. Cransshaw W.S. , Colorado State University Extension entomologist and professor, bioagricultural sciences and pest management ; and Baxendale B. , Teikyo L'oretto Heights University professor, botany, Denver. 2/99. Reviewed 2/05.
6. Gopalaswamienger,K.S. (1950). *Complete gardening in India*. The Hoshi Press, Bangalore.
7. Górski, R. (2004) Effectiveness of natural essential oils in the monitoring of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood). *Folia Hort*., 16, 183–187.
8. Isman, M.B. (2000) Plant essential oils for pest and disease management. *Crop Prot.,* 19, 603–608.
9. Kegler H.(1994). Incidence, properties and control of *tomato yellow leaf curl virus* – a review*. Arch. Phytopath. Pl. Prot.* 29(2) : 119-132
10. Khune, N.N. (1980). Control of plant viruses by oil sprays. *MACCO Agricultural Digest Research Bulletin,* 5(6): 10-13.
11. Koul O., Walia S. and Dhaliwal G.S.(2008). Oils as Green Pesticides: Potential and Constraints. *Biopestic. Int.* 4(1): 63–84.
12. Loebenstein, C, Miriam Alper, and S. Levy.(1970). Field tests with oil sprays for the prevention of aphid-spread viruses in peppers. *Phytopathology* 60:212-215.
13. Saikia A.K. and Muniyappa V.(1989). Epidemiology and control of *tomato leaf curl virus* in Southern India. *Trop. Agric* 66(4) : 350-354.
14. Simons, J.N. and Zitter, T.A. (1980). Use of oil to control aphid borne viruses. *Plant Diseases*, 64: 542-546.
15. Singh, S.J. Sastry, K.S. M. and Sastry, K.S. (1973). Effect of oil spray on the control of tomato leaf curl virus in field. *Indian J. Agric. Sci* : 43:669–672.
16. Singh, S.J. Sastry, K.S.M. and Sastry, K.S. (1975). Effect of alternate spraying of insecticides and oil on the incidence of tomato leaf curl virus. *Pesticides,* 9:45-56.
17. Sudell, R. (1946). Editor *New Illustrated Gardening Encyclopedia*. Odhams Press Ltd. , Long Acre, London.
18. Vasudeva R.S.and Somaraj J.(1948). A leaf curl disease of tomato. *Phytopathology* , 38:364-369.
19. Vrushali, T., Tare, V. and Shushil, K. (2001) Bioactivity of some medicinal plants against chosen insect pests/vectors. *In* K. Sushil, S.A. Hasan, D. Samresh, A.K. Kukreja, S. Ashok, A.K. Sharma, S. Srikant and T. Rakesh (eds.), *Proceedings of the National Seminar on the Frontiers of Research and Development in Medicinal Plants*, CIMAP, Lucknow, pp.
20. Zitter, T.A. and Ozaki, H.Y. (1978). Aphid-born vegetable virus controlled with oil sprays.