Indian Journal of Entomology 84(3): 614-616 (2022) DoI No.: 10.55446/IJE.2021.97

EFFICACY OF MINERAL AND NON-EDIBLE SEED OILS AGAINST APHIDS AND WHITEFLY IN POTATO

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ABSTRACT

Field experiments were conducted at the ICAR-Central Potato Research Institute-Regional Station, Gwalior, Madhya Pradesh during 2015-16 and 2016-17 to evaluate efficacy of mineral and non-edible seed oils against green-peach aphid *Myzus persicae* and cotton whitefly *Bemisia tabaci* in potato. Three sprays were done at 15 days interval revealed that maximum reduction in their incidence was observed with imidacloprid 17.8SL (0.03%) followed by mineral oil (6 ml/ l); *B. tabaci* incidence reduced by 72.63% and 61.06%, respectively, while it was 87.60% and 62.27% with *M. persicae*. Similar trend was observed with all the three sprays. The non-edible oils were not effective. Incidence of viruses was the least (0.26 and 0.27%, respectively) with imidacloprid 17.8SL (0.03%) and mineral oil (6 ml/ l). Thus, imidacloprid 17.8SL (0.03%) and mineral oil (6 ml/ l) can be recommended to manage vector-virus complex in potato.

Key words: *Myzus persicae, Bemisia tabaci*, potato, Kufri Jyoti, non-edible oil, mineral oil, imidacloprid, sprays, potato virus, vector virus complex, yield

India is the second largest producer of potato in the world (FAOSTAT, 2017), with >85% of being grown in the vast Indo-Gangetic plains of north India (subtropics) during short winter days from October to March (Khurana and Naik 2003). Potato is infested by a number of aphids transmitting more than three dozen viruses, affecting the yield and quality (Salazar, 2006; Bhatnagar et al., 2017). Peach-potato aphid *Myzus persicae* (Sulzer) is the most efficient aphid vector in potato (Bhatnagar et al., 2012). In addition, the cotton whitefly *Bemisia tabaci* (Gennadius) is a major constraint for healthy seed potato production as it transmits the Tomato leaf curl New Delhi *virus* (potato) which results huge yield loss and degeneration of seed stocks (Shah et al., 2019). Currently, the management of vector-virus complex in potato depends on synthetic pesticides, in addition to the cultural practice of growing the crops during low aphid activity period (Pushkarnath, 1959; 1967). However, the management of non-persistent viruses like potato virus Y (PVY) continues to be a challenge. Mineral oils are known as effective means to control insect pests like aphids and to reduce the spread of non-persistent viruses (Shah et al., 2021; Perring et al., 1999). These are widely used in Europe and are increasingly used in the United States and Eastern Canada for seed potato production. Several studies have shown that mineral oils interfere with virus retention in the aphid mouthparts (stylet) and foliar application of mineral oil reduced the transmission of PVY to potatoes (Boiteau et al., 2008; Najar-Rodriguez et al., 2008; Wrobel, 2009). In addition to this, various plant-derived oils have been shown to be effective against the vectors e.g., neem oil (Isman, 2006); pongamia/ karanj oil (Kumar and Singh, 2002). There is little knowledge about the effect of mineral, neem and karanj oils on the sucking pests of potato under north-central Indian conditions, and hence the present study.

MATERIALS AND METHODS

Field experiments were conducted at the ICAR-Central Potato Research Station, Gwalior, during 2015-16 and 2016-17 on potato cv. Kufri Jyoti. The experiments were laid in randomized complete block design, with six treatments and four replications. The treatments included mineral oil (3 ml/ l and 6 ml/ l), pongamia oil (6 ml/ l), neem oil (7.3 ml/ l), imidacloprid 17.8SL (3 ml/ 10l) as standard check along with untreated control. Total of three sprays were given at 15 days interval, starting from 40 days. The crops were raised with recommended agronomic practices, with crop planted on 09/11/2015 and

25/10/2016 during the two seasons. Observations on the number of adult *B. tabaci*, and adults and 3rd and 4th instar nymphs of *M. persicae* were taken from ten randomly selected plants/ plot, one day before, and 7 and 14 days after treatment (DAT). The numbers were counted from three leaves on each plant, one each from upper, middle and lower strata, preferably in the early morning hours. The reduction in incidence was calculated as per Henderson and Tilton (1955). The total tuber yield was recorded on whole plot basis, and % incidence of viruses (severe and mild mosaic, leaf roll) was taken from visual observation on all the plants in each plot. The data on number of insects, % reduction in incidence over control and tuber yield were subjected to ANOVA after appropriate transformation. The treatment means were separated by least significant difference (LSD) test.

RESULT AND DISCUSSION

Observation on *B. tabaci* revealed that the pretreatment counts ranged from 4.04 to 5.19/ 10 plants which increased till mid-December and declined sharply afterwards, again appearing towards February. Therefore, three spray treatments were given; two in November-December and one in February; and maximum reduction in incidence was observed with imidacloprid 17.8 SL (0.03%) followed by that of mineral oil (6 ml/ l). Similar consistent trend was noted for all the three sprays- its incidence reduced by 72.63% and 61.06%, respectively with these treatments. The non-edible oils did not cause an appreciable reduction, while treatments with pongamia oil gave a reduction of 51.20% and neem oil 55.16% reduction (Table 1). These results are in conformity with those

Table 1. Efficacy of mineral and non-edible seed oils against *B. tabaci* and *M. persicae* in potato

Treatments	Mean no. of from 10 plants (3 leaves/ plant)									% reduction over control
	1st Spray			2nd Spray			3rd Spray			
	Pre-count	7 DAT	14 DAT	Pre-count	7 DAT	14 DAT	Pre-count	7 DAT	14 DAT	
B. tabaci										
Control	4.19	8.98	10.30	10.30	6.10	3.80	3.80	3.25	5.33	
	(2.27)	(3.15)	(3.35)	(3.35)	(3.35)	(2.18)	(2.18)	(1.98)	(2.51)	-
Imidacloprid 17.8SL	4.04	3.00	1.75	1.75	0.00	0.38	0.38	0.13	0.17	
@ 0.03%	(2.24)	(1.89)	(1.61)	(1.61)	(1.00)	(1.14)	(1.14)	(1.05)	(1.07)	72.63
Mineral oil @ 3 ml/ l	4.57	7.75	4.25	4.25	1.75	0.50	0.50	0.25	0.42	
	(2.35)	(2.95)	(2.21)	(2.21)	(1.65)	(1.20)	(1.20)	(1.10)	(1.17)	42.97
Mineral oil @ 6 ml/ l	4.64	5.25	1.88	1.88	0.54	0.17	0.17	0.00	0.17	
	(2.37)	(2.45)	(1.61)	(1.61)	(1.23)	(1.07)	(1.07)	(1.00)	(1.07)	61.06
Pongamia oil @	4.94	5.88	5.50	5.50	2.25	0.50	0.50	0.00	0.50	
6.8 ml/ l	(2.43)	(2.59)	(2.52)	(2.52)	(1.77)	(1.20)	(1.20)	(1.00)	(1.20)	51.20
Neem oil @ 7.3 ml/ l	5.19	6.88	4.13	4.13	1.25	0.50	0.50	0.25	0.25	
	(2.48)	(2.78)	(2.24)	(2.24)	(1.49)	(1.20)	(1.20)	(1.10)	(1.10)	55.16
SEm	0.002	0.23	0.22	0.22	0.10	0.11	0.11	0.13	0.09	
CD (p = 0.05)	NS	0.71	0.68	0.68	0.30	0.35	0.35	0.42	0.27	
M. persicae										
Control	1.75	5.13	10.50	10.50	12.68	14.38	14.38	15.00	12.75	
	(1.65)	(2.47)	(3.38)	(3.38)	(3.69)	(3.69)	(3.69)	(3.99)	(3.68)	-
Imidacloprid 17.8SL	2.16	2.43	1.00	1.00	0.25	0.25	0.25	0.00	0.00	
@ 0.03%	(1.77)	(1.84)	(1.36)	(1.36)	(1.10)	(1.10)	(1.10)	(1.00)	(1.00)	87.60
Mineral oil @ 3 ml/ l	1.90	4.13	5.50	5.50	3.13	4.63	4.63	3.25	1.75	
	(1.70)	(2.26)	(2.54)	(2.54)	(2.00)	(2.00)	(2.00)	(2.05)	(1.65)	44.19
Mineral oil @ 6 ml/ l	2.28	3.25	4.13	4.13	1.75	2.38	2.38	1.50	0.25	
	(1.81)	(2.05)	(2.26)	(2.26)	(1.65)	(1.65)	(1.65)	(1.57)	(1.10)	62.27
Pongamia oil @	1.98	2.13	6.75	6.75	4.75	3.75	3.75	1.75	2.00	
6.8 ml/ l	(1.72)	(1.60)	(2.76)	(2.76)	(2.39)	(2.39)	(2.39)	(1.64)	(1.73)	49.66
Neem oil @ 7.3 ml/ l	2.09	4.50	4.38	4.38	3.00	2.75	2.75	1.75	0.50	
	(1.75)	(2.23)	(2.64)	(2.64)	(1.99)	(1.99)	(1.99)	(1.65)	(1.20)	51.58
SEm	0.038	0.23	0.13	0.13	0.10	0.10	0.10	0.08	0.13	
CD (p = 0.05)	NS	NS	0.40	0.40	0.30	0.30	0.30	0.24	0.40	

Values pooled data of two seasons; Precount- Pretreatment count; DAT – Days after treatment; values in parentheses square root transformed as √x+0.5; NS = not significant

of Bhatnagar et al. (2016). Imidacloprid 17.8SL (150 ml/ ha) at 15 days interval was the most effective (Nag et al., 2018). About the *M. persicae*, it appeared after mid-December, therefore, three sprays were made from December to February, which increased from 1.75/ 10 plants in the third week of December to 15.00/ 10 plants towards mid-February and declined afterwards. The data on the incidence pooled over two seasons revealed that maximum reduction was obtained with imidacloprid 17.8SL followed by that of mineral oil (6 ml/ l), with results being similar with all the three sprays, with incidence reducing by 87.60% and 62.27%, respectively. The non-edible oils did not show such reduction (Table 1). These results are in confirmation with those of Khan (2011), Basavaraju et al.(2015) and Nag et al. (2018). Azadirachtin results in >60% suppression of aphids (Ghosh, 2015). Neem oil (1%), NSKE (5%), pongamia (1-2%) and karanj oil (1 and 2%) are reported as effective (Kumar and Singh, 2002; Pavela, 2007). Although the incidence of viruses was low during both the seasons, significant reduction in the incidence being with treated plots, the least incidence being with imidacloprid17.8 SL (0.03%) and mineral oil (6 ml/ l). Total tuber yield (ranging 29.22 to 31.44 mt/ ha) was non significant among the treatments.

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(Manuscript Received: March, 2021; Revised: August, 2021;
Accepted: September, 2021; Online Published: November, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e21083