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PHYTOTOXICITY EFFECT OF PONGAMIA OIL ON CHILLI

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ABSTRACT

This study evaluated the phytotoxicity potential of pongamia oil on chilli plants. The pongamia oil at 0.5, 1.0, 2.5, 5.0 and 10% concentrations were evaluated under field conditions. The dose @ 0.5, 1.0 and 2.5% were observed to be safe with no phytotoxicity symptoms. Pongamia oil @ 5.0 and 10% caused the moderate and high phytotoxicity interfering with photosynthesis and plant growth.

Key words: *Capsicum annuum*, sucking pests, pongamia oil, essential oil, karanjin, phytotoxicity, photosynthesis, plant growth, yield, benefit cost ratio

India is the world's largest producer, consumer and exporter of chilli (*Capsicum annuum* L.) . It is an essential ingredient of Indian curry. Major losses in the chilli yield have been recorded due to thrips (*Scirtothrips dorsalis* Hood), mites (*Polyphagotarsonemus latus* Banks) and aphids (*Myzus persicae* Sulzer, *Aphis gossypii* Glover). Repeated application of insecticides for their management leads to several ill effects. To avoid the harmful effects of synthetic insecticides considerable effort has been devoted to using ecofriendly products from natural sources. Botanicals are now emerging as the prime means to protect crops (Kovarikova and Pavela, 2019). Essential oils from aromatic plants serve as source of biopesticides (Abd-ElGawad et al., 2021). Pongamia oil, rich in karanjin has excellent biological activity, and is a good synergist and has antifeedant, oviposition deterrent, ovicidal and insecticidal properties (Kumar et al., 2006). A combination of pongamia oil + neem oil + cotton seed oil + citronella oil (50:25:15:10 ratio) @ 2.0% concentration has been found effective against sucking pests in the chilli ecosystem (Gadge et al., 2021). Though pongamia oil offers good insecticidal potential along with several advantages over conventional pesticides, it is observed to have phytotoxicity effects. This study evaluates the phytotoxicity of pongamia oil on chilli under field conditions.

MATERIALS AND METHODS

Field experiment was laid out at the College of Horticulture, Bagalkote, Karnataka (16° 9' 52" N, 75° 36' 51" E, 542 masl) during kharif 2019-20. Randomized block design (RBD) with seven treatments and three replications, with a plot size of 2.4 x 2.1 m leaving a gangway of one meter around the plots was followed. Thirty days old chilli seedlings of the variety Sitara Gold (Monsanto) were transplanted at a spacing of 60 x 30 cm, and the crop raised following recommended package of practices of UHS, Bagalkote (Anonymous, 2018). The treatments were imposed using a knapsack hydraulic sprayer at a spray volume of 500 l/ ha. The first spray was given ten days after transplanting (DAT) and subsequent ones at an interval of ten days. Pongamia oil was procured from the market, and used at five concentrations of 0.5, 1.0, 2.5, 5.0 and 10% mixed with a 0.3% spreader concentration. Phytotoxicity effect with observations from ten randomly tagged plants leaving the border rows, were recorded a day before, 3, 7 and 10 days after each spray. Symptoms like leaf margin necrosis (browning) or chlorosis (yellowing), brown or yellow leaf spots or patches, leaf cupping or twisting and plant stunting or plant death were scored in a 0 - 10 scale (Ambarish et al., 2017). Subsequently, green chillies were harvested separately at each picking and yield was recorded as kg/ plot and computed on ha basis. The B: C ratio was worked out, and the data were subjected to ANOVA with treatment means compared by Duncan's Multiple Range Test (DMRT, p=0.05).

RESULTS AND DISCUSSION

A day before spraying all the plots were observed with

Table 1. Evaluation of pongamia oil for its phytotoxicity effect on chilli

Tr. No.	Treatment	Dosage	Phytotoxicity symptoms (0-10 scale)																				Green chilli yield (t/ ha)	BCR
			Chlorosis/ yellowing					Leaf cupping/ twisting					Leaf dropping					Leaf necrosis						
			1 DAS	3 DAS	7 DAS	10 DAS	Mean	1 DAS	3 DAS	7 DAS	10 DAS	Mean	1 DAS	3 DAS	7 DAS	10 DAS	Mean	1 DAS	3 DAS	7 DAS	10 DAS	Mean		
T_1:	Pongamia oil	0.5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.50 (3.00)^{ab}	1.53
T_2:	Pongamia oil	1.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.63 (3.01)^{ab}	1.57
T_3:	Pongamia oil	2.5%	0	1	1	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.17 (3.11)^{a}	1.63
T_4:	Pongamia oil	5.0%	1	3	3	4	2.75	1	3	3	4	2.75	2	2	3	4	2.75	0	1	2	2	1.25	6.05 (2.56)^{bc}	1.05
T_5:	Pongamia oil	10%	1	3	5	7	4	6	8	9	10	8.25	4	8	9	10	7.75	8	9	10	10	9.25	5.36 (2.42)^{c}	0.88
T_6:	NSPE	5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.02 (3.21)^{a}	1.82
T_7:	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.14 (2.76)^{abc}	1.29
SEm±			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-
CD at 5%			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.47	-
CV(%)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.30	-

(Mean of all 5 sprays); Phytotoxicity visual ratings based on a grade of 0-10, in which 0 is no phytotoxicity (Ambarish et al., 2017); Each value mean of 3 replications. NSPE-Neem Seed Powder Extract; DAS-Days After Spraying; BCR- Benefit Cost Ratio

normal plants showing no phytotoxicity symptoms, and with post treatment too pongamia oil @ 0.5 and 1.0% did not exhibit phytotoxicity symptoms. Plants treated with 2.5% pongamia oil showed low yellowing or chlorosis after 3 and 7 days of the first spray (DAS) (phytotoxicity score 1), which recovered to normal after 10 DAS; pongamia oil @ 5% recorded a phytotoxicity score of 2.75 with chlorosis or yellowing, leaf cupping or twisting, and leaf dropping; at 10%, score was 4 for chlorosis or yellowing, 8.25 for leaf cupping or twisting, 7.75 for leaf dropping and 9.25 for leaf necrosis. Thus, pongamia oil @ 5 and 10% is highly phytotoxic, and at <2.5%, it is safe. These results agree with those of Rolli et al. (2014) who revealed that higher contents of monoterpene alcohols, aldehydes and phenylpropanoids in an essential oil may be an indicator of phytotoxicity. Poonpaiboonpipat et al. (2013) observed decrease in chlorophyll a, b and carotenoid contents indicating that essential oil interfered with photosynthesis. Kumar et al. (2019) observed that recommended doses of castor, pongamia, sesame and neem oil and its formulated products did not cause any problem on tender cotton leaves. Galhiane et al. (2012) showed that castor oil is non-phytotoxic at concentrations that are effective against mites and aphids. When the temperature is high throughout the day, the oil disappears more rapidly and phytotoxic symptoms are reduced in plants. Loss of oil from treated plant surfaces is more rapid in tropical and subtropical than in temperate regions (Beattie, 2005). The phytotoxic potential of essential oil depends not only on the dose, but also on the plant species (Synowiec et al., 2016).

A significant difference in the yield of green chillies was observed with pongamia oil treatment; maximum yield of 10.02 t/ ha was obtained from NSPE treated plot which was statistically on par with pongamia oil @ 2.5% with 9.17 t/ ha, along with no phytotoxicity @ 2.5% concentration. These results corroborate with those of Gadge et al. (2021) that pongamia oil + neem oil + cotton seed oil + citronella oil (50:25:15:10 ratio) and pongamia oil + neem oil (50:50 ratio) @ 2.0% yielded significantly higher yield of chilli. The yield was however low from the plots treated with pongamia oil @ 5.0 and 10%, which is due to their phytotoxicity. Meena and Tayade (2017) obtained maximum yield and BC ratio with pongamia oil @ 4.0%. Zeeshan and Kudada (2019) obtained more chilli yield with neem oil @ 0.03 and karanj oil @ 0.15%. Thus, pongamia oil @ 0.5, 1.0 and 2.5% is safe for chilli plants.

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