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Laboratory evaluation of cashew nut shell liquid against chilli aphid *Aphis gossypii* Glover (Homoptera: Aphididae)

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ABSTRACT: The chilli aphid *Aphis gossypii* G. is one of the major sucking pests of chilli causing crinkling and yellowing of leaves. Laboratory study showed that Cashew nut shell liquid (CNSL) 0.2 % was equally effective as the chemical check, thiamethoxam 0.03 % at 24, 48 and 72 hours after treatment.

KEY WORDS: Cashew nut shell liquid, *Aphis gossypii*, management

Chilli (*Capsicum annuum* Linn.) is one of the major commercial crops and occupies the first position among the spices produced in India. Although, the crop has got great export potential, low productivity limits the full exploitation. The ravages by pests drastically reduces the chilli productivity. The sucking pest complex comprising of chilli thrips (*Scirtothrips dorsalis*), aphids (*Aphis gossypii*) and yellow mites (*Polyphagotarsonemus latus*) desap the plants causing curling, distortion and discoloration of leaves, leading to stunted growth. Both adults and nymphs of *A. gossypii* result in direct damage by sucking sap from plant parts resulting in wrinkled, yellow and stunted leaves. Indirectly it also affects the crop by excreting honeydew that favour the growth of sooty mould that inhibit photosynthesis (Singh *et al.,* 2014). Simons (1955) reported *A. gossypii* and *M. persicae* as vectors of Cucumber Mosaic Virus. Both nymphs and adults of aphids transmit pepper vein mottle virus (Alegbego, 1986). The flower buds became brittle and drop down. Severely infested plants were affected in all their growth parameters (Kumar, 1999).

The failure of insecticide control strategies coupled with the chances of leaving high pesticide residues warrants development of alternate eco-friendly management measures. Plant origin insecticides are emerging as replacements to chemical pesticides particularly in kitchen garden that are comparatively easily degradable, least toxic to natural enemies, pollinators, mammals and safer for the environment. The nut of cashew has a shell of about 1/8 inch thickness with a honey comb structure which has a high concentration of phenolic compounds like anacardic acid, cardol which are used as a defence against insect pests (Venmalar and Nagaveni, 2005). The dark reddish brown viscous liquid exuding from the shells during cashew processing known as the Cashew Nut Shell liquid (CNSL) is a by-product of cashew industry available in quantity at minimal cost.

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The efficacy of CNSL against chilli aphid under laboratory condition is being evaluated in the present investigation.

Laboratory evaluation of the botanical insecticides was done taking aphid (*A. gossypii*) as test insect. The test insects were reared on seedlings of chilli *C. annuum* variety Jwalamukhi obtained from Instructional farm, College of Agriculture, Vellayani which were planted in grow bags. Aphids were collected from the field and released into these plants and protected using cylindrical polyester cages having cloth lined ventilations. The population thus maintained served as source of aphids. The gravid females were collected from the population and transferred to new plants from which 50 numbers of second instar nymphs were collected and transferred carefully to chilli seedlings (three to four leafed stage) planted in a 150 mL cup using a camel hairbrush and used for the experiment. A white paper was kept at the base of the seedlings.

Cashew nut shell liquid (CNSL), was evaluated as emulsions at different concentrations (0.025, 0.05, 0.075, 0.1 and 0.2 %) along with Neem Seed Kernel Extract (NSKE) emulsion 5 %, neem oil emulsion 2 % and commercial botanical pesticide oxuron 5 ml l^{-1}. Thiamethoxam 0.03 % served as chemical check. The plants sprayed with distilled water served as untreated check. These seedlings with aphids were then covered with a transparent cup having pinholes. Three replications were maintained for each treatment. The number of dead aphids was counted at 24, 48 and 72 hours after treatment. The mortality of aphids treated with different botanical pesticides were corrected with mortality in untreated check using Abbot's formula and the cumulative corrected percentage mortality at 24, 48 and 72 hours after treatment (HAT) (Table 1).

Among the various treatments evaluated, the chemical check thiamethoxam 0.03%, CNSL 0.2% and neem oil emulsion 2 % recorded 66.67, 64 and 58% mortality respectively of chilli aphid and were superior to all other treatments at 24 HAT. This was followed by oxuron 5 ml l^{-1}, CNSL 0.1 %, CNSL 0.075%, NSKE 5% and CNSL 0.05% with mortality of 49.33, 47.33, 47.33, 41.33 and 42% respectively which were on par with each other.

Table1. Corrected * cumulative per cent mortality of *Aphis gossypii*treated with different botanical pesticides

Treatments	Per cent mortality**		
	24 HAT	48 HAT	72 HAT
T1 (CNSL 0.025 %)	24.67 (29.60)^{d}	80.67 (64.17)^{bc}	98.00 (83.34)
T2 (CNSL 0.05 %)	42.00 (40.39)^{c}	80.33 (64.18)^{bc}	98.67 (85.96)
T3 (CNSL 0.075 %)	47.33 (43.46)^{c}	88.67 (70.94)^{ab}	99.33 (87.09)
T4 (CNSL 0.1 %)	47.33 (43.46)^{bc}	86.00(68.44)^{abc}	100.00 (89.71)
T5 (CNSL 0.2 %)	64.00 (53.15)^{a}	92.67 (74.40)^{a}	100.00 (89.71)
T6 (NSKE 5 %)	41.33 (39.97)^{c}	76.00 (60.70)^{cd}	97.33 (82.46)
T7 (Neem oil emulsion 2 %)	58.00 (49.83)^{ab}	79.33 (63.24)^{bc}	98.00 (83.34)
T8 (Oxuron 5 ml l^{-1})	49.33 (44.61)^{bc}	85.33 (67.67)^{abc}	100.00 (89.71)
T9 (Thiamethoxam 0.03 %)	66.67 (54.73)^{a}	86.67 (69.44)^{abc}	100.00 (89.71)
CD(0.05)	8.440	9.296	NS

*Corrected with Abbot's formula over control

**Mean of 3 replications comprising 50 aphids each

(Values in the parentheses are angular transformed values); HAT: Hours After Treatment

CNSL 0.025% recorded least mortality (24.67%) after 24 hours. At 48 HAT, CNSL 0.2%, CNSL 0.075%, thiamethoxam 0.03%, CNSL 0.1% and Oxuron showed superiority over other treatments with mortality of 92.67, 88.67, 86.67, 86 and 85.33% respectively while at 72 HAT, thiamethoxam, oxuron, CNSL 0.2% and CNSL 0.1% showed 100 per cent mortality which did not vary significantly from the other treatments *viz.,* CNSL 0.075%, CNSL 0.05%, CNSL 0.025%, neem oil 2% and NSKE 5% with 99.33, 98.67, 98, 98 and 97.33% mortality respectively.

The study indicated the suitability of CNSL, mortality increased with increase in concentration and was found to be as effective as the chemical check, thiamethoxam. These were followed by the botanical pesticides, oxuron and neem oil emulsion.The pesticidal property of CNSL is attributed due to the presence of the phenolic compounds cardanol and cardol (Venmalar and Nagaveni, 2005). The toxicity of CNSL was also documented against coconut root grub (John *et al*., 2008), *Helicoverpa armigera* and *Spilarctia obliqua* (Mahapatro, 2011) at concentrations ranging from 1- 25%. In the present study, CNSL was found to have pesticidal effect against *A. gossypii* at a much lower concentrations of 0.075 to 0.2%. Olotuah and Ofuya (2010) evaluated CNSL at concentrations ranging from 0.01 to 1% against *A. craccivora* and identified that the 1% formulation was most effective. Eventhough mortality of aphids at 24 HAT was higher in CNSL 0.2%, this was found to be on par with neem oil 2% and thiamethoxam 0.03%. The mortality of aphids in the treatment with neem oil can be attributed to the presence of azadirachtin, the tetranortriterpenoid plant limonoid having insecticidal properties (Pavela, 2007). The toxicity of neem oil on the adults and nymphs of *A. gossypii* was reported earlier by Souza *et al*. (2015). Thiamethoxam which was reported as an effective insecticide against sucking pests in cotton (Nagger and Zidan, 2013), okra (Ghosh *et al.*, 2016) and green gram (Sujatha and Bharpoda, 2017) remained highly effective against *A. gossypii* also. The oxuron, a commercial botanical product comprising of neem oil and karanja oil was found to be equally effective as CNSL against *A. gossypii* at 48 HAT which was in line with the work of Arya (2015). The toxicity of neem and pungam oil was proved by several workers (Devakumar *et al.,* 1986).

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