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Research Note

Field evaluation of *Mallada desjardinsi* (Navas) (Neuroptera: Chrysopidae) against Asian citrus psyllid, *Diaphorina citri* Kuwayama

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ABSTRACT: Studies on field evaluation of various stages and doses (eggs @ 2, 4 and 6/shoot, early instar larvae @ 2 and 4 /shoot, adults @ 1 and 2 pairs/shoot) of a chrysopid predator, *Mallada desjardinsi* (Navas) (Neuroptera: Chrysopidae) along with foliar application of malathion (0.06%) were conducted in Nagpur mandarin (*Citrus reticulata* Blanco) orchard with Asian citrus psyllid (*Diaphorina citri* Kuwayama) infestation during spring 2010, 11 and 12. Two releases of each treatment were made at an interval of 2-weeks. The observations on *D. citri* nymphal population were recorded at weekly intervals before and after the release of the predator. *D. citri* nymphal population was significantly less in malathion. Among the *M. desjardinsi* release stages and doses, early instar larvae @ 4/shoot, adults @ 2 pairs/shoot followed by eggs@ 6/shoot were found effective in reducing the *D. citri* population.

KEY WORDS: Chrysopid predator, *Mallada desjardinsi*, field evaluation, Asian citrus psyllid

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Green lacewings (Neuroptera: Chrysopidae) are important biological control agents of several insect pests (Canard *et al.,* 1984; Tauber *et al.,* 2000) and constitute an important group of predators due to their amenability to mass production and their use as biocontrol agents in different ecosystems. In citrus ecosystem, *Mallada desjardinsi* (Navas) has been reported as an important predator of Asian citrus psyllid, citrus blackfly, leaf miner (Shivankar *et al.*, 2001; Ingole *et al.,* 2005; Rao *et al.,* 2003), mealybugs (Mani and Krishnamoorthy, 1990) and aphids (Rao and Jagadish Chandra, 1985). The population of *M. desjardinsi* is associated invariably with citrus groves infested with sucking insect pests in central India (Shivankar *et al.,* 2003). The Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) is a serious and regular pest on citrus cultivars grown across India. Feeding potential of *M. desjardinsi* revealed that on an average each larva consumed 115-120 *D. citri* nymphs before it underwent pupation (Shivankar *et al.,* 2003, Shivankar and Rao, 2005). Having been standardised the mass-multiplication technique of such a multifarious predator at National Research Centre for Citrus (NRCC), Nagpur (Shivankar, 2000) studies on field evaluation of *M. desjardinsi* were taken up against *D. citri* during 2010- 12.

Mallada desjardinsi was reared in the laboratory (at 26 ± 2°C and 65 ± 5% RH) using protinex 40 g + fructose 70 g in 250 ml water as adult diet and UV sterilized eggs of *Corcyra cephalonica* (Stainton) as larval diet as described by Shivankar (1997). Laboratory-reared 1-day old eggs, early instar larvae and 7-day old adults of *M. desjardinsi* (Fig. 1,2) were used as test insects for field release studies.

Field evaluation of *M. desjardinsi* against *D. citri* was conducted during *Ambia* (spring) flushing seasons of Nagpur mandarin, *Citrus reticulata* Blanco in 2010, 11 and 2012 at Research farm of NRCC, Nagpur. Field releases were made on same trees during 2010-12. The treatments evaluated were release of *M. dejardinsi* @ 2 eggs /shoot , 4 eggs /shoot, 6 eggs /shoot, 2 larvae / shoot, 4 larvae /shoot, 1 pair of adults/shoot and 2 pairs of adults /shoot in release cages along with chemical control (malathion @ 0.06%). In each treatment, two releases/sprays were made at an interval of 2-weeks. The release cages were designed locally in the laboratory for the release of *M. desjardinsi.* For the construction of release cage, muslin cloth bags (size: 45 cm x 30 cm) stitched on three sides and open from one side were used. *D. citri* infested shoots of 40 cm length were taken into consideration for the release of eggs, larvae and adults of

M. desjardinsi. Adequate care was taken to remove the predators and parasitoids already present on the selected shoots with *D. citri* nymphal infestation. After taking the *D. citri* early instar nymphal population counts, the twigs were labelled and eggs, larvae and adults of *M. desjardinsi* were released on shoots placed in the muslin cloth bag. Adults were confined to the cage for 2 days and were fed with the cotton wad soaked in adult diet (Shivankar, 1997). The open end of each release cage was secured with the help of thread. Eight release cages per tree covering 4 directions 2 each on one side of tree were placed. The trees including selected trees in the experimental orchard were not treated with any of the insecticides one month before and after the release of *M. desjardinsi*. The observations on *D. citri* nymphal population/5 cm twig were recorded at weekly intervals and continued up to 2 weeks after second release/second spraying. The experiment was laid in randomized block design with 4 replications and the data on *D. citri* population were transformed to square root values and subjected to analysis of variance.

The results on field evaluation of *M. desjardinsi* against *D. citri* at different stages and doses revealed that all the treatments recorded significantly low population of *D. citri* as compared to control irrespective of year and week after release. *D. citri* nymphal population recorded was significantly low in malathion treatment than other treatments irrespective of year and week after release (38.77 in 1 Weeks After First Release (WAFR), 31.23 in 2 WAFR, 25.31 in 1Weeks After Second Release (WASR), 19.48 in 2WASR nymphs/5cm twig). Among the different stages and doses, release @ 4 larvae/ shoot recorded significantly low *D. citri* nymphal population (46.20 nymphs/5cm twig in 1WAFR; 38.63 nymphs/5cm twig in 2WAFR; 32.26 nymphs/5cm twig in 1WASR; 27.96 nymphs/5cm twig in 2WASR) than other treatments irrespective of weeks after first/second release in all three years but was at par with *M. desjardinsi* release @ 2 pairs of adults/shoot (46.62 nymphs/5cm twig in 1WAFR; 40.23 nymphs/5cm twig in 2WAFR; 33.73 nymphs/5cm twig in 1WASR; 29.87 nymphs/5cm twig in 2WASR) during 2010,11,12 and with *M. desjardinsi* release @ 6 eggs/shoot (49.66 nymphs/5cm twig in 1WAFR; 34.26 nymphs/5cm twig in 1WASR; 28.36 nymphs/5cm twig in 2WASR) during 2012 (Table 1). The results of field release of different stages/doses of *M. desjardinsi* showed that its release @ 4 larvae/shoot, 2 adult pairs/shoot followed by 6 eggs/shoot reduced the nymphal population considerably (41.39-50.85 per cent reduction at two weeks after second release) as compared to other treatments. As *M. desjardinsi* larvae feed immediately on the ACP nymphal population in their vicinity probably resulted in effectively reducing the ACP nymphal population as compared to other stages.

Perusal of literature showed that field release of *M. desjardinsi* eggs @ 4 and 6 /shoot were effective against citrus blackfly *Aleurocanthus woglumi* Ashby (Ingole *et al.,* 2005). Similar, Bavanthade (1997), Wadhai (2001) and Rao *et al.,* (2003) observed similar trend in respect to population reduction of citrus blackfly and leaf miner, respectively. Further, efficacy of *M. desjardinsi* against red spider mite, *Oligonychus coffeae* infesting tea was reported by Vasanthakumar and Babu (2013). The impact of *M. desjardinsi* feeding on *D. citri* population may not be equally significant as compared to chemical control (66.49 per cent reduction at two weeks after second release), when released in the open field; however, the importance of the role of this predator in regulating the populations of more than one insect pest (*D. citri*) in citrus orchards cannot be undermined.

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