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Management of chalcid wasp (*Systole albipennis)* (Eurytomidae: Hymenoptera) in coriander: a pest of field and quarantine significance

KRISHNA KANT[1], Y K SHARMA[2], B K MISHRA[3], M K VISHAL[4] and S R MEENA[5]

National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan 305 206

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ABSTRACT

Field experiment on management of chalcid wasp [*Systole albipennis* (Walker)] on coriander crop was conducted during season 2008-09 and 2009-10 using different treatments such as manipulation of date of sowing, application of plant products and synthetic insecticides. The result revealed that late sown crop (15 November) suffered less seed damage while yield was also recorded lower in late sown crops. Among plant products efficacy of neem products was found superior over karanj products for control of the chalcid wasp. Among different neem formulations, application of neem oil 2% gave superior result than other neem products as minimum average of 3.5% seed damage and highest seed yield of 9.70 q/ha was obtained. Among insecticides, spray of thiamethoxam 0.025% and imidacloprid 0.005% provided maximum protection (5.25 and 5.20% seed damage against 16.2% in the control).

Key words: Chalcid wasp, Coriander, Insect pest management, Karanj oil, Neem oil

Among the seed spices, coriander (*Coriandrum sativum* L.) occupies the top place in terms of area, production and export in India. Rajasthan state is major producer of coriander in the country accounting for more than 50 per cent of seed coriander at national level. Coriander is primarily used for flavouring, seasoning and imparting aroma in food, it is also used as intercrop for reduced infestation of pod borer in chickpea and attract predators (Trivedi and Ahuja 2011). Insect pests are one of the major limiting factors in quality seed production and losses of 50 % or more have been reported in coriander (Butani and Mittal 1989). Chalcid wasp, *Systole albipennis* Walker, is specific pest of coriander and fennel and has been reported from Asia, Africa and Europe, whose larvae damage the fruit and survive in them. Infestation occurs at field level and continues during storage of seed (Nagy and Szalay Marzso 1976, Gupta 1962). The female chalcid wasp laid egg on developing seed whose larvae feed and destroys the embryo and/or endosperm consequently. It is found that seed damage by the pest ranged 40% in fennel (*Foeniculum vulgare* Mill.), 35% in carrot (*Daucus carota* L.), 30% in coriander, 27% in dill (*Anethum graveolens* L.), 20% in cumin (*Cuminum cyminum* L.) and 10% in ajwain (*Trachyspermum ammi* Sprague) (Mittal and Butani 1994). The pest significantly reduces the market value of seed coriander and is one of the major constraints for quality seed production. Presence of immature stages of chalcid wasp in seed affects export as it is important quarantine pest (Verma 1991, Bhalla *et al*. 2009). The present investigation was envisaged to find out effective control measures for seed spice chalcid wasp at field level employing monitoring, cultural practices, and use of botanicals and chemical control.

MATERIALS AND METHODS

Two year field experiment on management of chalcid was conducted at field experiment farm of NRC on Seed Spices, Ajmer (Rajasthan), India during *rabi* season of 2008-9 and 2009-10. Coriander variety Ajmer Coriander 1 was selected for the study and the crop was sown on different dates starting from 15 October having plot size of 3 m × 3 m. The experiment was laid out in RBD design with three replications. All recommended practices were followed to raise the good crop. Details of experiment are as under.

The coriander crop was sown at three different dates of sowing at 10 days intervals having plot sixe of 3 m × 3 m. The crop was sown on 25 October, 5 November and 15 November to study the impact of infestation in relation to different dates of sowing. No application of any insecticides/botanical was given till maturity of crop. The average per cent damage of seed at maturity of crop was recorded at harvest.

[1] Senior Scientist (e mail: kknrcss@gmail.com), [2]Principal Scientist (e mail: yksharma.nrcss@yahoo.co.in), [3]Senior Scientist (e mail: bkmmicro@gmail.com), [4]Scientist (e mail: mukeshvishal.rns@gmail.com), [5]Technical officer (e mail: meenasr36@gmail.com)

Two applications of botanicals based on neem and karanj formulation and synthetic insecticides were applied at 10 day intervals during flowering stage of the crop sown on 25 October having plot size of 3 m × 3 m. Among botanicals the products selected for the study were neem seed kernal extract (NSKE)-2%, NSKE-5%, neem oil-1%, neem oil-2%, karanj oil-1%, karanj oil-2%, karanj seed powder extract (KSPE) - 2% and KSPE -5%. Neem and karanj oil, based on cold press extraction, were obtained from local market. Liquid soap (Labolene-Ran Chem, Mumbai, India) at a dose of 5 ml/l was added to spray tank as a wetting and emulsifying agent. For preparations of NSKE and KSPE, seed kernel of neem and karanj were obtained from the neem and karanj trees grown in the Institute campus. Respective quantity of the seed kernel was powdered in mixer-cum-grinder and soaked in one litre of water for 12 hours. The suspension was thoroughly mixed, squeezed and filtered through muslin cloth. Additional water was added to achieve required concentration for spray. Eight insecticides, viz. trizophos-0.03%, chlorpyriphos-0.03%, deltamethrin-0.0015%, endosulfan-0.03%, thiamethoxam-0.025%, imidacloprid-0.005%, quinolphos-0.05% and dimethoate-0.03%, were sprayed on the crop by Knapsack sprayer. The data on seed infestation by seed wasp was recorded at maturity of the crop. Total 1 000 seeds from 10 randomly selected plants in each treatment were examined and thus per cent damage was worked out. Seed yield in each treatment was also recorded after harvest and calculated per hectare basis. All Statistical analysis was done through SAS 9.2 software for different treatments of seed damage and yield of the crop.

RESULTS AND DISCUSSION

The observation recorded on infestation of wasp in coriander sown at different date of sowing and yield of seed at harvest found that crop suffer from damage and yield loss at all sowing dates (Table 1). The late sown crop suffers less from the seed damage as only 10.45% damage was recorded in crop sown on 5 November. Whereas, in crop sown on 25 October, damage of 15.45 % was observed. The yield was recorded maximum (5.8 q/ha) at early sown crop (15 October) in comparison to 4.4 q was obtained in crop sown on 5 November. Singh (2007) reported that seed spices grown in December-January had more infestation of pests compared to October sown crops. Patel *et al.* (1986) found lowest damage of *S. albipennis* in fennel in January (5.4%) and highest in March (20.70%). Singh and Basawana (1984) reported the infestation of *S. albipennis* to fruits on number and weight basis which varied from 1.5 to 28.3 and 1.8 to 17.7 per cent, respectively in different varieties of coriander under test.

Application of all plant products on coriander crop against seed wasp showed significant reduction in seed damage at harvest, consequently an increase in the seed yield (Table 2). Neem products were found superior over karanj products both in term of seed infestation and seed yield at harvest. Among different neem formulations, application of neem oil 2% gave superior result than other neem products as minimum average of 3.5% seed damage and highest yield of 9.70 q/ha of seed coriander was obtained for both years. NSKE 5% and neem oil 1% application were also showed good efficacy against the pest and were found statistically at par with neem oil 2.0 %. NSKE -5% spray gave average seed yield of 9.4 q/ha and was next only to neem oil 2.0 % (9.7 q/ha). Among karanj products spraying of KSPE -5% was found superior over other formulations of the karanj in which only 4.5 % seed damage and yield of 7.85 q/ha was recorded at harvest. Patil *et al*. (2009) reported that single application of neem oil-2% was moderately effective and NSKE -5% was less effective for control of wasp under field condition. All the insecticides applied on the crop prevent the damage of seed wasp on coriander and gave higher yields. However, application of thiamethoxam-0.025% and imidachlorprid-0.005% gave maximum protection and were statistically at par where only 5.25 and 5.20% seed damage was recorded respectively (Table 3). Other effective treatments were dimethoate-0.03%, endosulfan-0.03% and deltamethrin-0.0015% showed at par. Seed yield was obtained highest in thiamethoxam-0.025% application (13.2 q/ha) followed by

Table 1 Effect of different date of sowing on seed damage and yield of coriander

Date of sowing	2008-09		2009-10		Mean	
	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)
15-Oct	12.5^{a}	4.8^{b}	18.4^{c}	6.8^{b}	15.45^{c}	5.8^{c}
25-Oct	14.0^{b}	4.0^{a}	13.0^{b}	6.1^{b}	13.5^{b}	5.05^{b}
5-Nov	11.7^{a}	3.6^{a}	9.2^{a}	5.2^{a}	10.45^{a}	4.4^{a}

Mean separation within column by Duncan's multiple range test (P<0.05) using SAS 9.2software

Table 2 Effect of different botanicals on seed damage and yield of coriander

Treatment	2008-09		2009-10		Mean	
	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)
NSKE-2%	3.00^{c}	7.00^{cb}	6.60^{bc}	8.20^{cb}	4.80^{b}	7.6a^{bc}
NSKE-5%	2.20^{a}	9.00^{a}	5.30^{a}	9.80^{a}	3.75^{a}	9.40^{a}
Neem oil-1%	2.50^{ab}	7.80^{b}	5.00^{a}	8.80^{b}	3.75^{a}	8.30^{b}
Neem oil-2%	2.30^{ab}	9.40^{a}	4.70^{a}	10.0^{a}	3.50^{a}	9.70^{a}
Karanj oil-1%	6.00^{e}	6.20^{dc}	7.10^{c}	7.50^{dc}	6.55^{c}	6.85^{d}
Karanj oil-2 %	3.10^{c}	7.20^{b}	6.80^{bc}	8.00^{cb}	4.95^{b}	7.6^{abc}
KSPE-2%	4.40^{d}	7.00^{cb}	8.20^{d}	7.00^{d}	6.30^{c}	7.0^{cd}
KSPE-5%	2.70^{bc}	7.50^{b}	6.30^{b}	8.20^{cb}	4.50^{b}	7.85^{bc}
Control	9.60^{f}	5.90^{d}	18.80^{f}	5.00^{f}	14.20^{d}	5.45^{e}

Mean separation within column by Duncan's multiple range test (P<0.05) using SAS 9.2 software

Table 3 Effect of different Insecticides on seed damage and yield of coriander

Treatment	2008-09		2009-10		Mean	
	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)	Damage (%)	Yield (q/ha)
Chlorpyriphos-0.03%	7.4^{d}	7.8^{g}	10.5^{c}	8.2^{g}	8.95^{c}	8.00^{d}
Trizophos-0.03%	8.4^{e}	11.3^{c}	9.9^{c}	12.4^{c}	9.15^{c}	11.85^{b}
Thiamethoxam-0.025%	2.7^{a}	12.7^{a}	7.8^{b}	13.7^{a}	5.25^{a}	13.20^{a}
Imidaclorprid-0.005%	3.1^{a}	10.9^{c}	7.3^{ab}	13.4^{ab}	5.20^{a}	12.15^{a}
Deltamethrin-0.0015%	4.3^{b}	9.5^{d}	9.8^{c}	12.5^{abc}	7.05^{b}	11.00^{bc}
Dimethoate-0.03%	6.2^{c}	11.9^{ab}	7^{ab}	12.1^{bc}	6.60^{b}	12.00^{ab}
Quinolphos-0.05%	12.5^{g}	8.2^{fg}	10.3^{c}	9.6^{d}	11.40^{d}	8.90^{d}
Endosulfan-0.03%	6.6^{c}	9.2^{de}	6.7^{a}	12^{c}	6.65^{b}	10.60^{c}
Control	11.4^{f}	6.6^{h}	21^{d}	6.7^{f}	16.20^{e}	6.65^{e}

Mean separation within column by Duncan's multiple range test at <0.05 using SAS 9.2 software

imidachlorprid-0.005% and dimethoate-0.03% in which seed yield of 12.15 and 12.0 q/ha was obtained. Uses of endosulfan (0.07%), parathion methyl 0.025% and cartap hydrochloride 0.06% were found effective at flowering stages application on fennel crop to minimize the infestation of pest at field level (Mittal and Butani 1994, Singh 2007). Verma (1991) reported that quarantine fumigation with carbon disulphide @ 1230 mg/l or methyl bromide @ 64 mg/l or hydrogen cyanide gas @ 47.1 mg/l for 2 hr at reduced pressure equivalent to 200 mm of mercury and at 27° ± 0.5°C, proved effective for control of *Systole albipennis* infesting seeds of *Coriandrum sativum* and *Foeniculum vulgare*.

Thus present study indicated that infestation of chalcid wasp can be significantly lowered at field level in coriander crop by employing timely sowing of crop, application of neem oil-2% and/or thiamethoxam-0.025%.

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