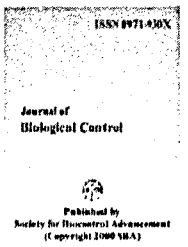

Journal of Biological Control, 25 (2): 124–126, 2011

Research Article

Efficacy of *Acremonium zeylanicum* against sugarcane woolly aphid under laboratory conditions

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ABSTRACT: The fungus, *Acremonium zeylanicum* (Petch) W. Gams and H.C. Evans, was found infectious to sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner and caused differential mortality of different instars at varied concentrations. Studies on the efficacy of the entomopathogenic fungus revealed that the mortality of aphids increased with increase in concentration and time of application. First instar nymphs showed the highest mortality (92.5%) at 1×10^{10} conidia l^{-1} and as the stage of the insect advanced, the mortality rate declined. On the contrary, lower mortality of aphids was recorded at 1×10^{4} conidia l^{-1} after 10 days of application.

KEY WORDS: *Acremonium zeylanicum, Ceratovacuna lanigera*, sugarcane woolly aphid, efficacy

(Article chronicle: Received: 25.01.2011; Sent for revision: 23.03.2011; Accepted: 25.04.2011)

INTRODUCTION

The infestation of sugarcane woolly aphid (SWA), *Ceratovacuna lanigera* Zehntner, in recent years has threatened sugarcane cultivation, particularly in Karnataka. Nymphs and adults of SWA congregate on the lower surface of leaves along the midrib and suck the sap from leaves. Honeydew secretion by the SWA covers the entire upper surface of leaves, leading to growth of sooty mold. Due to continuous sap sucking, the crop becomes stunted and leaves dry up from tip downwards. Continuous infestation leads to reduction in the length, girth and weight of the cane as well as sugar content of the sap (Joshi and Viraktamath, 2004). Though synthetic insecticides are effective against the woolly aphid, they do not find place in sugarcane ecosystem for reasons like difficulty in spraying, operational hazards, improper coverage of crop canopy, high investment for pesticide application and destruction of natural enemies in the sugarcane ecosystem (Lingappa *et al.*, 2004).

The recent report of a new entomopathogenic fungus, *Acremonium zeylanicum* (Petch) W. Gams and H. C. Evans on sugarcane woolly aphid has paved a new avenue for its management. The natural incidence of the fungus was noticed for the first time on sugarcane woolly aphid in Sankeshwar area of Northern Karnataka during July 2005. The fungus produces conidia in large numbers during favourable conditions such as high relative humidity of more than 90 per cent and optimum temperature of 27°C (Tippannavar *et al.*, 2006). This fungus was evaluated against *C. lanigera* under laboratory conditions to work out dosages for the field trial.

MATERIAL AND METHODS

A laboratory experiment was conducted in the Department of Agricultural Entomology, College of Agriculture, Dharwad. Infected woolly aphids along with sugarcane leaves were collected from the field and brought to the laboratory. The pathogen was isolated on specific medium, potato dextrose agar (PDA). A loopful of inoculum from subcultured plates of *A. zeylanicum* was transferred to PDA slants and maintained as pure culture. Sub-culturing was done once in a month and virulence was revived by passing through SWA after 5 to 6 rounds of sub-culturing.

After complete sporulation, conidia from the medium were harvested by washing them thoroughly with sterile distilled water containing Tween-80 (0.2%) for immediate use. A suspension of spores was prepared using distilled water with Tween-80 (0.2%) and filtered through a double layered muslin cloth and spore count was made using a double rolled Neubauers haemocytometer after necessary serial dilution under a phase contrast microscope. From the stock solution, further dilutions were made to obtain

the required concentrations. The pathogenicity tests were conducted by fulfilling Koch's postulates.

To evaluate the pathogenicity of *A. zeylanicum* against *C. lanigera,* four concentrations of the fungus, *viz.*, 1×10^{10}, 1×10^{8}, 1×10^{6} and 1×10^{4} conidia ml^{-1} were prepared by serial dilution from a stock solution of 1×10^{12} conidia ml^{-1}. Sugarcane leaf bits (15cm long) carrying 50 aphids of uniform stage were taken from field collected population and one end of the leaf bit was immersed in a glass vial containing water to maintain its turgidity. Different concentrations of the conidial suspension were sprayed using a hand atomizer so that all aphids were uniformly treated. Four replications were maintained. The relative humidity was maintained at about 90% inside the laboratory using a humidifier to encourage fungal growth. Treated leaves were kept in plastic jars and observations were recorded daily on the mortality of aphids due to fungal infection for up to 10 days. The data were converted to percentage mortality and then transformed into arcsine values for computation of analysis of variance.

RESULTS AND DISCUSSION

Efficacy of *A. zeylanicum* on 1st instar nymphs of SWA

The fungus showed significantly highest per cent mortality at 1×10^{10}conidia l^{-1} concentration both at 5th and 10th day after spray and at 1×10^{8} registered 53 per cent mortality at 5 DAS. The control treatment recorded 1 per cent mortality. At 10 DAS, significantly highest mortality of SWA (92.5%) was observed due to fungal infection at 1×10^{10}conidia l^{-1} concentration, whereas 1×10^{8} and 1×10^{6} conidia l^{-1} treatments registered 74.0 and 69.0 per cent mortality, respectively. The least mortality was registered in 1×10^{4}conidia l^{-1} concentration (69.0%), while the control treatment recorded 4.0 per cent mortality.

Efficacy of *A. zeylanicum* on 2nd instar nymphs of SWA

At 5 DAS, significantly higher mortality of 59 per cent was observed with 1×10^{10} conidia l^{-1} concentration followed by 47% mortality at 1×10^{8}. The control treatment recorded 1 per cent mortality. At 10 DAS, significantly higher mortality of SWA (88.5%) was observed due to fungal infection at 1×10^{10}conidia l^{-1} concentration, whereas 1×10^{8} and 1×10^{6} conidia l^{-1} treatments registered 80.5 and 69.0 per cent mortality of 2nd instar nymphs, respectively. The least mortality was registered in 1×10^{4} conidia l^{-1} concentration (65.0%), while the control treatment recorded 4.0 per cent mortality.

Efficacy of *A. zeylanicum* on 3rd instar nymphs of SWA

As high as 56 per cent mortality was observed at 1×10^{10}conidia/l concentration at 5 DAS followed by 48.5

Table 1. Effect of *Acremonium zeylanicum* on different instars of sugarcane woolly aphid

Treatment	Per cent mortality of SWA at different instars							
	1st instar		2nd instar		3rd instar		4th instar	
	5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
1×10^{10} conidia l^{-1}	71.0a (57.4)	92.5a (74.1)	59.0a (50.2)	88.5a (70.1)	56.5a (48.7)	84.0a (66.40)	43.5a (41.3)	83.3a (66.0)
1×10^{8} conidia l^{-1}	53.0b (46.7)	83.0b (65.6)	47.5b (43.5)	80.5b (63.8)	48.5b (44.1)	77.5b (61.7)	34.5b (35.9)	69.5b (56.5)
1×10^{6} conidia l^{-1}	47.00b (43.3)	74.0c (59.3)	36.0c (36.9)	69.0c (56.1)	29.0c (32.6)	71.0c (57.4)	24.0c (29.3)	60.0c (50.8)
1×10^{4} conidia l^{-1}	39.0c (38.63)	69.0c (56.1)	26.0d (30.6)	65.0c (53.7)	17.5d (24.7)	56.0d (48.4)	19.0d (25.8)	48.0d (43.8)
Untreated check	1.0d (6.4)	4.0d (11.5)	1.0e (6.4)	4.0d (11.5)	1.0e (6.4)	3.0e (9.9)	1.0e (6.4)	3.0 (9.9)
SEM±	0.86	1.22	0.74	1.07	0.80	0.79	0.80	0.68
CD at 1%	5.62	7.94	4.85	6.96	5.18	5.17	5.22	4.44
CV (%)	4.49	4.57	4.45	4.19	5.10	3.23	5.80	3.01

Means followed by the same letter in a column do not differ significantly; DAS – days after spraying; figures in parentheses are arcsine transformed values

per cent mortality at 1×10^8 of 3rd instar nymphs. The control treatment recorded 1.0 percent mortality. At 10 DAS, maximum mortality of SWA (84.0%) was observed due to fungal infection at 1×10^{10} conidia l^{-1} concentration whereas 1×10^8 and 1×10^6 conidia l^{-1} treatments registered 77.5 and 71.0 per cent mortality of 3rd instar nymphs, respectively. The least mortality was observed in 1×10^4 conidia l^{-1} concentration (56.0%), while the control treatment recorded 3.0 per cent mortality.

Efficacy of *A. zeylanicum* on 4th instar nymphs of SWA

At 5 DAS, significantly higher SWA mortality (43.5%) was observed with 1×10^{10} conidia l^{-1} concentration. At 1×10^8, 34.5 per cent mortality of 4th instar nymphs was recorded as compared to 1.0 per cent mortality recorded in control. At 10 DAS, a similar trend was observed with the highest mortality (83.3%) recorded at 1×10^{10} conidia l^{-1} concentration whereas 1×10^8 and 1×10^6 conidia l^{-1} treatments registered 69.5 and 60.0 per cent mortality of 4th instar nymphs, respectively. The least mortality was registered in 1×10^4 conidia l^{-1} concentration (48.0%), while the control treatment recorded 3.0 per cent mortality.

The present findings are in close conformity with Puttannavar (2004) who observed that irrespective of the concentration, higher mortality of SWA was recorded at 1×10^8 conidia l^{-1} in case of different entomopathogenic fungi, *viz., Metarhizium anisopliae, Verticillium lecanii, Beauveria bassiana* and *Nomuraea rileyi*. Nirmala (2003) reported that field trials conducted with oil in water emulsion of *B. bassiana* and *M. anisopliae* caused 19.84 and 42.26 per cent mycosis, respectively. Kulkarni *et al.* (2003) sprayed *M. anisopliae, V. lecanii* and *B. bassiana* @ 2 g l^{-1} on SWA and *M. anisopliae* was found to be the most effective after 10 days. The observations made by Kadam *et al.* (2002) indicated that different concentrations of *V. lecanii* spray gave more than 90 per cent bio-suppression of *C. lanigera* at 5 days after application under laboratory conditions.

In sugarcane, despite 15 per cent estimated loss due to insect pests, hardly less than 3 per cent of the total pesticides produced in India are applied and hence sugarcane ecosystem remains least disturbed and most ideal for the operation of bioagents. Hence, the utilisation of entomopathogenic fungus like *A. zeylanicum* could be a better option to minimize the woolly aphid menace in sugarcane.

REFERENCES

Joshi, S. and Viraktamath, C. A. 2004. The sugarcane woolly aphid, *Ceratovacuna lanigera* Z. (Hemiptera: Aphididae): its biology, pest status and control. *Current Science*, **87**: 307–316.

Kadam, J. R., Mote U. N. and Baviskar, M. B. 2002. Bioefficacy of *Verticillium lecanii* (Zimm.) against *Ceratovacuna lanigera* under laboratory conditions. Research Report, pp. 25–26.

Kulkarni, K. A., Tippannavar, P. S. and Lingappa, S. 2003. Management of sugarcane woolly aphid, *Ceratovocuna lanigera* Z. (Homoptera: Aphididae), In: *XVI Annual Conference of National Environmental Science Academy* Emerging Pollutants: Impact on Health, Agriculture and Environment, p. A–3.

Lingappa, S., Patil, R. K., Tippannavar, P. S., Balikai, R. A. and Prasadkumar. 2004. Development of strategy for the management of woolly aphid, *Ceratovacuna lanigera* Z. (Homoptera: Aphididae) on sugarcane. Report submitted to the Department of Agriculture, Government of Karnataka.

Nirmala, R. 2003. Evaluation of entomopathogenic fungi against sugarcane woolly aphid, *Ceratovacuna lanigera* Z. (Homoptera: Aphididae) and other aphid species. Report of 'Hands on Training' submitted to the PDBC, Bangalore.

Puttannavar, M. 2004. Bio-ecology and management of woolly aphid, *Ceratovacuna lanigera* Z. (Homoptera: Aphididae). M.Sc. thesis, University of Agricultural Sciences, Dharwad, Karnataka, India.

Tippannavar, P. S., Mallapur, C. P., Kulkarni, K. A., Kulkarni, S., Patil, S. B. and Yalmali. 2006. Record of a new entomo-pathogenic fungus on sugarcane woolly aphid. *Current Science*, **91**: 858.