Research Application Summary

Effects of botanical insecticides on the egg parasitoid *Trichogramma cacoeciae* Marchal (Hym. Trichogrammatidae)

Abdelgader, H.
Agricultural Research Corporation, Crop Protection Research Centre, Wadmedani,
P. O. Box 126, Sudan
Corresponding author: abdelgaderh@yahoo.com

Abstract

This study was carried out to test the effect of the botanicals azadrichtine and Quassin on the parasitoid *Trichogramma cacoeciae.* For each of these, 2 formulatons were used i.e., Neemazal T/s Blank and Celaflor for azadrichtine and Alcohlic and Water extracts for Quassin. In the study, adults (susceptible life stage) of Trichogramma were exposed to glass plates sprayed by the respective formulations or to host eggs sprayed with the botanical formulations immediately after drying or after 6 days. The effect of time of egg spraying after parasitising was also studied. Residues of Neemazal formulations on glass plates harmful (Neemazal-Blank) or moderately harmful (Celaflor) to *T. cacoeciae* adults. The two Quassin formulations tested were harmless. When treated host eggs were offered to adults *T. cacoeciae,* all the chemicals were almost harmless. All tested insecticides significantly reduced pupation, with the effect being maximum when host eggs where sprayed two days after parasitism. It is therefore concluded that both Azadirachtine and Quassin are relatively safe towards *T. cacoeciae* and could therefore be used in combination with *Trichogramma* releases in the management of lepidopteran pests.

Key words: Botanical insecticides, Neemazal, Quassin, side effects, *Trichogramma*

Résumé

Cette étude a été réalisée pour tester l'effet de l'azadrichtine des plantes et la quassine sur le parasitoïde *Trichogrammacacoeciae*. Pour chacune d'entre-elles, 2 formulations ont été utilisées. Il s'agit de NeemAzal T/s Blank et Celaflor pour azadrichtine et des extraits d'alcool et de l'eau pour quassine. Dans l'étude, les adultes (stade de la vie sensible) de *Trichogramma* ont été exposés à des plaques de verre traitées par les formulations respectives ou aux œufs de hotes pulvérisés avec des formulations botaniques immédiatement après le séchage ou après 6 jours. L'effet du temps de l'œuf après la pulvérisation parasitant a également été étudié. Les

résidus de formulations NeemAzal sur les plaques de verre étaient nuisibles (NeemAzal-Blank) ou modérément nocifs (Celaflor) pour les adultes de *T. cacoeciae*. Les deux formulations testées de Quassine étaient inoffensives. Lorsque les œufs traités des hotes ont été offerts aux adultes de *T. cacoeciae*, tous les produits chimiques étaient presque inoffensifs. Tous les insecticides testés ont réduit considérablement la nymphose, l'effet étant maximal lorsque les œufs des hôtes étaient pulvérisés deux jours après le parasitisme. On conclut donc qu'ensemble l'azadirachtine et la Quassine sont relativement sûres vers *T. cacoeciae* et pourraient ainsi être utilisées en combinaison avec les versions de trichogrammes dans la gestion des lépidoptères ravageurs.

Mots clés: insecticides botaniques, Neemazal, Quassine, effets secondaires, *Trichogramma*

Background

Parasitoids of the genus *Trichogramma* occur naturally worldwide and play an important role as natural enemies of lepidopterous pests on a wide range of agricultural crops. Results of augmentative releases of *Trichogramma* can be affected by the use of broad-spectrum insecticides in or near release plots (Stinners *et al.* 1974, Ables *et al.* 1979, King *et al.* 1984). The search for selective insecticides to be used with Trichogramma releases is of great importance. The recent laboratory studies were carried out to investigate the side effects on *Trichogramma cacoeciae* of two formulated products of each of two botanical insecticides: Azadirachtine (Neemazal T/S Blank and Celaflor®) and Quassin (alcoholic or water extracts) to study their possible use with Trichogramma releases, since these are plant origin insecticides and therefore believed to have less negative impact on the environment..

Materials and Methods

Two formulations of the botanical active ingredient, azadrichtine (Neemazal T/s Blank and Celaflor) as well as two extracts of Quassin (Alcohlic and Water extracts) were included in the study. The field recommended concentrations of these formulations were used. The study included exposing adults (susceptible life stage) of Trichogramma to sprayed glass plates using the method described by Hassan *et al*. (2000). In other experiments adults *of Trichogramma* were xxposed to sprayed host eggs. The treated host eggs were either offered directly after drying of the spray or the eggs were held at 15 °C and offered to adults after 6 days. Less susceptible life stage (parasites within their hosts) were also exposed to test treatments

following the method described by Hassan and Abdelgader (2001). The study included spraying of parasitised host eggs at different interval after parasitisation ranging from 1 – 8 days. The percentage of adult emergence and the reduction in emergence relative to the control were then determined and the pesticides were categorised accordingly.

Research Application

Effects on adults. Results of tested botanicals on adults are presented in Table 1. Results showed that residues of Neemazal formulations on glass plates (the standard test method) were either harmful (Neemazal-Blank) or moderately harmful (Celaflor) to *T. cacoeciae* adults to The two Quassin formulations tested were harmless.

Table 1. Effects of exposing adult *Trichogramma cacoeciae* to various treatments.

Treatment	Glass plate test		Fresh insecticide residue sprayed on host eggs		6 day insecticide residue sprayed on host eggs	
	Parasitism rate (eggs/female)	Class	Parasitism rate (eggs/female)	Class	Parasitism rate(eggs/female)	Class
Control	18.9 abc*		28.8 bc		36.0 b	
Quassin-Alcohol	21.2 bc	1	23.1 ab	1	31.6 ab	1
Quassin-Water	22.0 c	1	33.0 c	1	33.9 b	1
Neemazal-Blank	0.0 a	4	24.0 ab	1	24.0 a	2
Celaflor	1.0 ab	3	20.3 a	1-2	23.2 a	2

** Figures followed by the same letter are not significantly different (Multiple Range Test, 5%). Class = IOBC classification.

In another set of experiments, where treated host eggs were offered to adults *T. cacoeciae*, all tested chemicals were almost harmless. Celaflor was slightly toxic to adults, both when freshly or 6-day old sprayed host eggs were offered to adults of. Neemazal-Blank formulation was only slightly toxic when 6 day old sprayed host eggs were offered to the adults.

Effects on immature stages. Spraying parasitised host eggs one day after parasitism resulted in a significantly lower number of black eggs (i.e. lower pupation). All tested insecticides significantly reduced pupation, when host eggs where sprayed two days after parasitism, indicating that *Trichogramma* was very sensitive during this stage. This might have coincided with the hatching of the vulnerable neonate larvae of *Trichogramma* from laid eggs. The pupation rate was not reduced as a result of treatment, when host eggs were sprayed on the third and subsequent days after parasitism (Table 2). This trend can also

Table 2. Developing black eggs after treating parasitised eggs at various days after parasitism.

Treatment	Days of treatment after parasitizing eggs					
	1	2	3	5	7	8
Control	427.3 c	329.0 a	388.3 ab	465.2 ab	440.2 b	355.5 ab
Quassin-Alcohol	400.8 c	189.8 b	441.7 bc	464.2 a	420.7 b	388.5 bc
Quassin-Water	401.7 c	247.8 b	448.8 c	506.3 b	412.0 b	421.3 c
Neemazal-Blank	219.0 a	219.8 b	357.5 a	437.5 a	340.3 b	325.3 a
Celaflor	334.3 b	197.0 b	466.5 c	430.2 a	420.0 b	323.2 a
SE	17.5	20.9	19.3	26.0	19.5	20.8

** = Within columns, figures followed by the same letter are not significantly different (Multiple Range Test , 5%); SE = Standard Error.

Table 3. Developing Black eggs after treating parasitsed eggs at various days after parasitism (IOBC – Classification).

Treatment	1 day		2 days		3 days		5 days		7 days		8 days	
	% RC	Class	% RC	Class	% RC	Class	% RC	Class	% RC	Class	% RC	Class
Quassin-Alcohol	6.2	1	42.3	2	-13.7	1	0.2	1	4.4	1	-9.3	1
Quassin-Water	6.0	1	24.8	1	-15.6	1	-8.9	1	6.4	1	-18.5	1
Neemazal-Blank	48.8	2	33.2	2	7.9	1	6.0	1	22.7	1	8.5	1
Celaflor	21.8	1	40.1	2	-20.1	1	7.5	1	4.6	1	9.1	1

% RC = Percentage Reduction relative to the control. Class = IOBC classification.

be seen clearly when the percentage reduction relative to the control and the categorisation according to the IOBC classification was determined (Table 3).

The results showed, in general, that both Azadirachtine and Quassin were relatively safe to the tested parasitoid and could therefore be used in combination with *Trichogramma* releases.

Acknowledgement

The author thank the Agricultural Research Corporation of Sudan for the support in carrying on the research.

References

Ables, J.R., Johnes, R.K., Morrison, V.S., House, D.L., Bull, L.F., Bouse and Carlton, J.B. 1979. New developments in the use of *Trichogramma* to control lepidopteran pests of cotton, pp. 125-127. In: Proceedings, Beltwide Cotton Production Research Conference. National Cotton Council, Memphis, TN.

Hassan, S.A., Halsall, N., Gray, A.P., Kuehner, C., Moll, M., Bakker, F.M., Roembke, J., Yousef, A., Nasr, F. and Abdelgader, H. 2000. A laboratory method to evaluate the side effects of plant protection products on *Trichogramma cacocciae* Marchal (Hym., Trichogrammtidae). pp. 107 - 119. In: Candolfi, M.P., Blümel, S., Forster, R., Bakker, F.M., Grimm, C., Hassan, S.A., Heimbach, U., Mead-Briggs, M.A., Reber, B., Schmuck, R. and Vogt, H. (Eds.) 2000. Guidelines to evaluate side-effects of plant protection products to non-target arthropods. IOBC/ WRPS, Gent.

Hassan, S. and Abdelgader, H. 2001. A sequential testing program to assess the effects of pesticides on *Trichogramma cacoeciae* Marchal (Hym., Tricho-grammatidae). Pesticides and beneficial Organisms. *IOBC/ WRPS Bulletin* 24(4):71-81.

King, E.G., Bouse, L.F., Bull, D.L., Dickerson, W.A., Lewis, W.J., Liapis, P., Lopez, J.D., Morrison, R.K. and Phillips, J.R. 1984. Potential of management of *Heliothis* spp. pp. 232-236. In: cotton by augmentative releases of *Trichogramma pretiosum*. Proceedings, Beltwide Cotton Production Research Conference. National Cotton Council, Memphis, TN.

Stinners, R.E., Ridgway, R.L., Coppedge, J.R., Morrison, R.K. and Dickerson, Jr. W.A. 1974. Parasitism of *Heliothis* eggs after field releases of *Trichogramma pretiosum* in cotton. *Environ. Entmol.,* 3:497-500.