

RESEARCH NOTE

Potential of Chitin Inhibitors and Botanical Insecticides for the Control of Cabbage Caterpillars

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Cabbage caterpillars, diamond back moth, *Plutella xylostella* (L.), cabbage looper, *Plusia eriosoma* (F.), *Crociodolomia binotalis* Zell., *Prodenia litura* (F.) and *Hellula undalis* (F.) are the main insect pests of cabbage and other crucifers in Sri Lanka. Several insecticides such as methamidophos, quinalphos, monocrotophos and profenofos have been recommended for their control. But many of these insecticides are highly hazardous and categorized under "restricted pesticides". Some of these insecticides are incapable of giving economic control due to the build up of resistance in the pests. This compels farmers to use higher dosages of insecticides at frequent intervals further aggravating the problem. Thus, alternative insecticides with favourable properties are urgently needed. For this purpose, 3 chitin inhibitors (triflumuron, diflubenzuron, chlorfluazuron), 1 biological insecticide (*Bacillus thuringiensis*) and 2 botanical insecticides (seed kernel oil of *Azadirachta indica* commonly known as neem oil and methanol extract of the root of *Hortonia angustifolia*) were tested against leaf-eating caterpillars of cabbage.

A non-replicated experiment was carried out in the laboratory of Central Agricultural Research Institute, Gannoruwa, to study the ovicidal activity, and larval/pupal mortalities. To study the ovicidal activity, 5 ml of these insecticides were sprayed to cabbage plants containing known number of diamond back moth (DBM) eggs. The egg hatchability was observed 3 days after the treatment. To investigate the larval/pupal mortality, one month old cabbage seedlings were sprayed with the same insecticides and half an hour after spraying, 10 second instar larvae of DBM were introduced to each treated seedling. Number of pupae and adults which emerged in each treatment were counted 2 weeks after the treatment.

A field experiment was conducted at the Open Prison Camp (OPC) at Pallockelle during yala 1989. Cabbage cv. SD cross was used. All insecticides with the exception of neem oil and the extract of *H. angustifolia* were applied at fortnightly intervals from the time of transplanting, while these two botanicals were sprayed at 10-day intervals. Observations on the number of live larvae/pupa (irrespective of the species) in 12 randomly selected plants from each plot were recorded before the insecticide application and 7 days after spraying. Before the harvest, visual examination of caterpillar damage to the surface leaves of the head, based on 0-4 scale, was made. At harvesting the whole heads and thereafter the marketable heads (after removing the damaged leaves) were weighed.

In the laboratory experiments, the highest ovicidal activity was observed in plants treated with methamidophos. Chlorfluazuron and neem oil also effectively reduced the egg hatchability. Triflumuron and diflubenzuron showed comparatively poor ovicidal activity. Pupation of DBM larvae was not observed in cabbage seedlings treated with *B. thuringiensis* and methamidophos. Although, 40% of the larvae on chlorfluazuron treated plants pupated, there was no adult emergence. Only a few larvae on neem oil treated plants, developed up to the adult stage (Table 1).

In the field, DBM and cabbage looper were the predominant leaf eating caterpillars. In the field experiment, the highest reduction of the number of leaf eating caterpillars was reported in neem oil and chlorfluazuron treated plots (Table 2). Triflumuron, *H. angustifolia* extract and diflubenzuron also reduced the caterpillar incidence significantly, compared to the control, *B. thuringiensis* and the methamidophos treatments. The lowest leaf damage by the caterpillars was also observed in neem oil and chlorfluazuron treated plots. Triflumuron treatment also significantly reduced the leaf damage compared to the control. Significantly low percentage of unmarketable yield due to caterpillar damage was observed only in the neem oil treated plots. Based on these results, methamidophos and *B. thuringiensis* were not effective under field conditions. At the OPC field, methamidophos has been used continuously for caterpillar control and as a result caterpillars would have developed resistance to it. Failure of *B. thuringiensis* to control the caterpillars may be attributed to its instability under the hot and sunny conditions prevailing at OPC field, Pallockelle.

From these results, neem oil, chlorfluazuron and triflumuron can be recommended as promising insecticides for the control of cabbage caterpillars when DBM and cabbage loopers are predominant.

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Table 1. Effect of different insecticides on egg hatchability and larval mortality of diamond back moth, *Plutella xylostella*

Treatment	Dosage	Egg hatchability (%)	Pupation (%)	Adult emergence (%)
Diflubenzuron 25 EC	200 ppm a.i.	52.7	70	40
Chlorfluazuron 5 EC	100 ppm a.i.	18.9	40	00
Triflumuron 480 SC	200 ppm a.i.	69.7	60	10
Methamidophos 60 LC	672 ppm a.i.	00.0	00	00
Neem oil emulsion	2% (oil)	24.1	40	10
<i>Hortonia angustifolia</i> extract	0.4%	--	10	00
<i>Bacillus thuringiensis</i>	0.2%	--	00	00
Control	--	96.4	70	60

a.i. = active ingredient

Table 2. The efficacy of different insecticides against cabbage caterpillars

Insecticide	Rate/ha	No. of larvae/ 12 plants	Leaf damage*	% unmarketable yield
Triflumuron 480 SC	200- 400 g a.i.	4.22 a	1.33 bc	25.6 ab
<i>Bacillus thuringiensis</i> HP	500-1000 g	5.44 ab	2.00 d	24.6 ab
Diflubenzuron 25 WP	75- 100 g a.i.	6.22 ab	1.66 cd	28.4 ab
Chlorfluazuron 5 EC	50- 100 g a.i.	2.89 a	1.00 ab	21.4 ab
Neem oil	11- 16 l	2.11 a	0.66 a	18.4 a
<i>Hortonia angustifolia</i> extract	2200-4400 g	4.78 a	1.66 cd	28.4 ab
Methamidophos 60 EC	420- 500 g a.i.	5.55 ab	2.66 de	28.1 ab
Control	-	8.89 b	3.00 e	28.2 ab
CV (%)		26.0	19.2	13.6

Means in the same column, followed by the same letter are not significantly different according to DMRT

* scale : 0-25% leaf damage = 1, 26-50% leaf damage = 2, 51-75% leaf damage = 3, 76-100% leaf damage = 4