their cooperation in the survey for parasitism in different states. The assistance by staff of pulse entomology unit at ICRISAT in many of the observations is thankfully acknowledged.

REFERENCES

Ahmad, T. 1940. On the biology of *Euderus lividus* (Ashm.), a parasite of *Agromyza obtusa* Mall. *Indian J Entomol*, 2, 59-63.

Bindra, O. S. and Singh, H. 1972. Tur podfly, *Melanagromyza obtusa* Malloch. (Diptera : Agromyzidae). *Pesticides*, 6, 11-12 & 22.

Fellowes, R. W. and Amarasena, T. 1982. Natural parasites of some grain legume pests in the dry zone. *Trop. Agric.*, 133, 83-89.

Gangrade, G. A. 1960. Description of a new species of the genus *Euderus* Haliday, 1884 (Eulophidae : Chalcidoidea). *Indian J Entomol*, 22, 80-82.

Gangrade, G. A. 1962. The biology and morphology of immature stages of *Euderus agromyzae* (Eulophidae : Hymenoptera). *Indian J. Entomol.*, 24, 265-273.

Khan, M. A. 1985. Eulophid parasites (Hymenoptera : Eulophidae) of Agromyzidae in India. *Bombay Nat. Hist. Soc.*, 82, 149-159.

Lateef, S. S. and Reed, W. 1983. Review of crop losses caused by insect pests in pigeonpea internationally and in India. *Indian J. Entomol. Spl. Issue*, 2, 284-293.

Singh, S. 1982. Ecology of the Agromyzidae (Diptera) associated with leguminous crops in India. *Memoirs of the School of Entomology, No. 8.* St. John's College, Agra, India, 126 pp.

Sithanantham, S., Rameshwar Rao, V., and Reed, W. 1983. Survey of pigeonpea podfly parasites in India. *Internatl. Pigeonpea Newsl.* 2, 66-68.

Thakur, B. S. and Odak, S. C. 1982. New record of parasites of *Melanagromyza obtusa*. *Sci. & Cult.*, 48, 80.

J. Biol. Control, 1 (1), 16—19, 1987

Relative Contact Toxicity of Four Common Insecticides to *Apanteles* sp. (*vitripennis* sp group) and its Host *Spodoptera litura* (F.).

A. G. SHEIKH* and K. S. KUSHWAHA
Department of Entomology, Rajasthan College of Agriculture, Sukhadia University, Udaipur - 313 001

ABSTRACT

Four insecticides each in three concentrations i. e., carbaryl and malathion (0.05, 0.07 and 0.10%) and endosulfan and phosalone (0.02, 0.04 and 0.05%) were evaluated in the laboratory for their efficacy against the tobacco caterpillar, *Spodoptera litura* (F.) simultaneous to safety considerations to the associated parasite, *Apanteles* sp. (*vitripennis* sp. group). All the insecticides proved significantly toxic to the parasite as well as to its host at all concentrations. Considering the relative safety in terms of percentage mortality inflicted to the parasite, phosalone proved to be distinctly safer of the four insecticides. Considering the maximum safety to the parasite and control of the pest, it was concluded that phosalone (0. 05%) was the best.

Key words : Safety, contact Pesticides Carbaryl, Malathion, Endosulfan, Phosalone Parasite *Apanteles* sp. Toxicity *Spodoptera litura*.

* Present address :
Head, Department of Entomology, Sher-e- Kashmir University of Agricultural Sciences and Technology, Wadoora Sopore Campus.

Though tobacco caterpillar, *Spodoptera litura* is suppressed by a large natural-enemy complex, *Apanteles* sp. (*vitripennis* sp. group) is one of the key biocontrol agents. Using broad spectrum and persistent insecticides against the insect pest could be catastrophic to the biotic balance. The decision to use insecticides must be based on the range and degree of selectivity for fighting a particular group of pests, carefully sparing the non-target organisms like the natural enemies of insect pests (Kushwaha and Bhardwaj, 1977). Studies were, therefore, made to screen some common insecticides for their safety to *Apanteles* sp. (*vitripennis* sp group).

MATERIALS AND METHODS

An experiment was carried out in a completely randomized design in the laboratory to evaluate four commonly used insecticides, each in three concentrations, i.e., carbaryl and malathion (0.05, 0.07 and 0.10%) and endosulfan and phosalone (0 02, 0.04 and 0.05%) for their efficacy against *S. litura* and safety to the associated parasite *Apanteles* sp. (*vitripennis* sp group). Twelve hour old parasite adults were exposed to treated cauliflower leaves placed in glass jars (15 x 10 cm). Inner surfaces of jars also were treated with respective insecticides of desired concentrations and dried before use. Simultaneously, III instar larvae of the host were released in these jars. The leaves were previously sprayed with graded concentrations with hand compression sprayer and dried for one hour before parasite adults and host caterpillars were exposed to them. The mouths of the jars were covered with muslin cloth. In all, there were 13 treatments including control (water spray) each replicated thrice. Ten parasite adults and 20 host caterpillars were exposed in each replication. The parasite adults were provided 30% honey in cotton swabs.

Mortality counts of the parasite adults as well as of host caterpillars were recorded separately every 24 h upto 72 h after these were exposed to treated leaves/jars. Percentage mortality was worked out separately in each case. The data were analysed statistically after angular transformation.

RESULTS AND DISCUSSION

All the insecticides proved significantly toxic to the parasite as well as to its host, at all concentrations and all durations, as compared to the control. Considering the relative safety in terms of percentage kill of the parasite, phosalone proved to be distinctly superior of the four insecticides tried. Phosalone was equitoxic at all the three concentrations 24 h after treatment. The mortality ranged from 56.68 to 70.33%. However, 48 h after the parasite adults were exposed to the treated cauliflower leaves / jars, the mortality percent recorded was 63 42, 80.69 and 83.65 at 0.02, 0.04 and 0.05%, respectively. After 72 h, the lowest concentration (0.02%) alone was significantly superior to the rest and knocked down 76.82% of parasite adults; whereas, it was 93.30 and 95.47% at 0.04 and 0.05% concentrations of the insecticides respectively.

Endosulfan proved next in preference to phosalone. Its two lower concentrations were in parity to the two higher concentrations of phosalone when mortality at 24 h after exposure was considered. Correspondingly, the mortality was 73.49 and 74.82%. Similar efficacy was recorded following 48 h. However, after 72 h, only lowest concenration of endosulfan was comparable to two higher concentrations of phosalone. The mortality recorded in this case was 83.65 and 86.98% after 48 h and 98.85 and 100.00% after 72 h. The remaining insecticides and the respective concentrations were less safer as compared to phosalone and endosulfan (Table 1).

Considering the mortality inflicted to the pest *S. litura* following 24 h of applications, carbaryl 0.10%, endosulfan 0.05%, phosalone 0.05% and malathion 0.10% showed comparable bioefficacy, with mortality ranging from 33.32 to 38.32%. After 48 h of exposure, carbaryl 0.10%, endosulfan 0.05% and phosalone 0.05% uniformly inflicted 53.33% mortality. Similarly, the efficacy of phosalone 0.05%, carbaryl 0.10% and endosulfan 0.05% after 72 h depicted a mortality range of 66.68 to 70.00%. The other insecticide concentrations provided significantly lower mortality as is evident from Table 1.

Considering the maximum safety to the parasite and mortality of the pest, it may be concluded that phosalone at 0.05% concentration was the best. Further, the next lower concentration 0.04% may be next choice in view of the safety considerations. The present findings are in conformity with the findings of Kushwaha (1982) who also reported phosalone safer to *Apanteles* sp. These findings are also in concurrence with those of Hamilton and Attia (1976) who reported carbaryl, malathion and endosulfan highly toxic to *Apanteles glomeratus*.

Table 1. Effect of insecticides on adult parasite, *Apanteles* sp. *(vitripennis* sp. group) and its host *S. litura* under laboratory conditions

Treatment/ Concentration (%)		Serial cumulative mortality (%) at different duration (h after treatment)					
		24		48		72	
		Parasite	Host	Parasite	Host	Parasite	Host
Carbaryl	0.10	93.30bc	38.32a	98.85ab	53.33a	100.00a	68.36a
Carbaryl	0.07	86.98cd	26.63bc	98.85ab	36.65c	100.00a	41.67cd
Carbaryl	0.05	83.65cde	21.63d	95.47bc	26.63e	100.00a	31.64f
Endosulfan	0.05	83.65cde	38.32a	95.47bc	53.33a	100.00a	66.68ab
Endosulfan	0.04	76.82def	28.30b	86.98cd	39.97bc	100.00a	44.98c
Endosulfan	0.02	73.49def	23.28cd	83.65d	31.64d	98.85ab	38.28de
Malathion	0.10	100.00a	33.32ab	100.00a	41.63b	100.00a	61.68b
Malathion	0.07	100.00a	26.63bc	100.00a	31.64d	100.00a	38.32de
Malathion	0.05	98.85ab	18.26e	100.00a	31.64d	100.00a	36.65def
Phosalone	0.05	70.33efg	38.32a	83.65d	53.33a	95.47c	70.00a
Phosalone	0.04	63.42fg	38.30b	80.66de	41.67b	93.30c	46.67c
Phosalone	0.02	56.68g	23.28cd	63.42e	28.30d	76.82d	33.32ef

In a vertical column, means followed by same letters are not different statistically (P = 0.05) by L. S. D.

REFERENCES

Hamilton, J. T. and Attia, F. I. 1976. Susceptibility of parasite, *Apanteles glomeratus* L. (Hymenoptera : Braconidae) to insecticides. *J. Entomol. Soc. Australia,* (N. S. W.) 9, 24-25.

Kushwaha, K. S. and Bhardwaj S.C. 1977. Insecticidal control. In *Forage and pasture Insect Pests of Rajasthan,* ICAR publication, New Delhi, 186.

Kushwaha, K. S. 1982. Ecobiological studies under laboratory and field conditions to depict differential influence of key biotic factors. Progress Report, July-December, 1982. National Project (ICAR) on Insect Pest Management Based on Life Table Concept. PP. 23-26.

J. Biol. Control, 1(1), 19 - 22, 1987

Development and Feeding Potential of Coccinellid Predator, *Cryptolaemus montrouzieri* Muls. on the grape mealybug, *Maconellicoccus hirsutus* (Green)

M. MANI AND T. S. THONTADARYA
Division of Entomology and Nematology
Indian Institute of Horticultural Research, Bangalore 560089

ABSTRACT

Development and feeding potential of the coccinellid predator, *Cryptolaemus montrouzieri* Muls. was studied on the eggs, nymphs and adult females of the grape mealybug, *Maconellicoccus hirsutus* (Green). The life cycle of the predator was prolonged when it was reared on eggs of mealybugs. Incubation period ranged 4 to 5 days. The grub took 22.80, 13.85 and 13.45 days when reared on eggs, nymphs and adult f male mealybugs, respectively. The prepupal and pupal periods averaged 2.15 and 8.50 days, respectively. Adult longevity averaged 55.90 days for males and 61.40 days for females. The mean fecundity of a mated female was 210.52. The coccinellid grub consumed a total of 881.30 eggs or 259.00 nymphs or 27.55 adult females of *M. hirsutus* under laboratory conditions.

Key words : *Cryptolaemus montrouzieri, Maconellicoccus hirsutus,* development, feeding potential.

The predator, *Cryptolaemus montrouzieri* Muls. is native to Australia. Following the successful control of mealybugs in California, the beetle was introduced into India in 1898 by New Port (Puttarudriah *et al.,* 1952). Its biology has been studied earlier by several workers on many species of mealybugs (Tirumala Rao and David, 1958; Fisher, 1963; Liotta and Mineo, 1965; Bhat *et al.,* 1981; Satyanarayanamurthy, 1982). Recently a lot of interest has been shown on the use of *C. montrouzieri* for the suppression of grape mealybug, *Maconellicoccus hirsutus* Green. The present study was carried out to

Contribution No. 83/87 of I.I.H.R.