http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (4): 400-401, 2001

Chemical Control of *Anthrenus oceanicus* Attacking Stored Cocoons of the Silkworm with Commercial Formulations Containing Permethrin, Tetramethrin, Phenothrin and Allethrin

O. A. Akinkunmi and J. A. Odebiyi
Department of Crop Protection and Environmental Biology University of Ibadan, Ibadan Nigeria

Abstract: Adult samples of a species destroying the cocoons of the mulberry silkworm in store were identified as *Anthrenus oceanicus* Fauvel 1903 (Coleoptera: Dermestidae). The beetles were treated with a commercial dust formulation containing 0.60% permethrin and an aerosol containing tetramethrin (0.20%), Phenothrin (0.12%) and allethrin (0.25%). The commercial dust formulation was applied at 0mg, 20mg, 100mg and 200mg while the aerosol was sprayed for 0, 1, 2, 3 and 4 seconds. These two formulations were effective in killing the beetles even at the lowest concentrations applied.

Key words: *Anthrenus oceanicus*, cocoons, *Bombyx mori*, stored product pest

Introduction

Africa's enormous potentials in rawsilk production (Hardingham, 1996: ICIPE, 1997) are faced with some constraints, which are likely to pose problem to local cocoon producers in the near future. Apart from the lack of infrastructure, sufficient inputs and technical expertise, sericulture industry in Africa faces a major threat from pests and diseases at various levels of the sericultural activities. Pests and diseases attack the mulberry plant on the field (Akinkunmi, 1995; Akinkunmi *et al.*, 1999; Sengupta *et al.*, 1991). The silkworms also have various pests and diseases limiting its productivity (Lim *et al.*, 1990; Hazama, 1995). Finally, the cocoon while in the store, are attacked both by invertebrate and vertebrate pests (Vijay Veer *et al.*, 1996).

Notable among these invertebrates are insects in the order: Coleoptera, family: Dermestidae. In the family Dermestidae, members of the genus Anthrenus have been reported in many regions of the world, including America (Hoebeke *et al.*, 1985; Mertins 1985), Europe (Hummel and Kleeberg, 1997; Watson *et al.*, 1997), Africa (Ali, 1997), Asia (Vijay Veer *et al.*, 1996, Ansari and Basalingappa, 1986) and Australia (Hianes, 1991). Vijay Veer *et al.* (1991) reported *Anthrenus oceanicus* among other dermestid beetles as pests of woolen fabrics in India, but this species was not reported as a pest of silkworm cocoons in India. Other species in this family found as pest of silkworm cocoons in India include *Dermestes undulatus, D. frischii, D. ater, D. leechi, D. lardarius, Attagenus fasciatus, A. birmanicus, A brunneus, A. pellio, A. unicolor, Togoderma halsteadi, T. sternale, T. varium, T. versicolor, Orphrinus fulvipes, Anthrenus flavipes, A. pimpinellae, A. verbasci* and *Trinodes rufescens* (Vijay Veer *et al.*, 1996). *D. maculatus* was however reported as vector of the pebrine disease of the silkworm in Italy (Vijay Veer *et al.*, 1996).

Anthrenus oceanicus was recently found attacking dried cocoons of the mulberry silkworm in store at Ibadan. This pest had been exported from Nigeria to United Kingdom, with animal products in 1960s. It is therefore very important to explore available control measures in order to avert imminent cocoon loss to these beetles. This study was conducted to determine the effectiveness of some available commercial formulations containing permethrin, tetramethrin, phenothrin and allethrin in the laboratory.

Materials and Methods

Pest Identification: Beetles were collected from stored dry cocoons of the mulberry silkworm *Bombyx mori* L. These were killed in an airtight Kilner jar containing ethyl ether soaked cotton wool. The samples were collected, mounted and preserved (Youdeowei, 1977; Mc Ewen, 1997). The insect was identified to the family level in the Insect Reference Collection and Identification Centre in the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan and to the species level at the Central Research Laboratory, United Kingdom.

Insect Cultures: A culture of *Anthrenus oceanicus* was raised on dry cocoons of the Nistari race of the mulberry silkworm at a temperature range of 25 – 30°C and relative humidity of 70 – 85 % in the laboratory. The insect culture was made inside a medium-sized Kilner jar provided with wire mesh lid during the wet season from April to October.

Bioassay: Round holes measuring 2.5 cm (diameter) were made on the lids of plastic disposable petri dishes and fine nets (mesh size – 1mm) were cut and glued to cover the holes on the lids. Clean filter papers (90 mm) were placed inside the disposable petri dishes. Ten adult beetles were randomly selected from the insect culture and placed in each of the petri dishes. Two commercial formulations were tested in this study. The first is the dust formulation containing 0.60% permethrin and the other an aerosol containing a combination of tetramethrin (0.20%), Phenothrin (0.12%) and allethrin (0.25%).

The dust formulation of permethrin was weighed out into separate petri dishes at 20mg, 100mg and 200mg using an AND digital balance (200g; 0.01mg). Each measured permethrin dust formulation was taken as a treatment. Each treatment and a control (0mg of the formulation) were replicated four times and these were laid out in completely randomized design on a laboratory table at temperature range of 25 – 30°C and relative humidity of 70 – 85 %. This set up was monitored for 48 hours.

Also, the aerosol formulation of tetramethrin (0.20%), Phenothrin (0.12%) and allethrin (0.25%) were applied to another set of adult beetles placed in groups of ten on filter paper in petri dishes. The aerosol was sprayed through the holes prepared on the lid of the dishes after the introduction of the beetles into the petri dishes. The spray durations used were 1, 2, 3, and 4 seconds and each of these represents a treatment. The treatments and a control (which was not sprayed at all) were replicated four times. These were arranged in completely randomized design on a laboratory table.

Results

The beetle was identified as a member of the order Coleoptera and family Dermestidae at the Insect Reference Collection and Identification Centre in the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan. The beetle was later identified as *Anthrenus oceanicus* at the Central Research Laboratory, United Kingdom.

Within the first 20 minutes of introduction to permethrin dust, the beetles were observed running haphazardly in the petri dishes, making attempts at flight in a bid to escape, whereas this kind of agitation was not observed in the control which contained no permethrin. This agitation was observed in all the three treatments containing permethrin. Within the first 60 minutes of permethrin treatment, all the treated beetles were knocked down and most of them were seen lying on their backs. The knocked down beetles were still able to move their appendages slightly when touched. When turned to keep an upright posture, the beetle showed high level of immobility and they often fell again on their backs.

Similar agitation was observed in all the groups of beetles treated with the aerosol within the first 20 minutes of application of the spray. All the beetles were knocked down and killed thereafter. It is however interesting to know that the two commercial formulations tested on the beetles were effective in killing the beetles even at the lowest concentration of 20mg and 1second of spray.

Although the damaging stage of this species is the larval stage, controlling the adults is equally important so as to prevent them from breeding and producing another generation of the damaging larval stage. This is also a convenient point of getting rid of the pest without allowing further damage to the cocoons and also preventing the establishment of the pest on our valued cocoons. Further work will investigate the effect of these chemicals on the larval stages of the beetle.

The use of the dust formulation as against the aerosol is preferred due to the liquid nature of the aerosol, which may have some side effects on the biochemical and physical nature of the cocoons. The cocoons are made up of two proteins called fibroin and sericin and these are likely to be affected if sprayed with aerosol. On the other hand the dust formulation can be spread on the base of the storage container and still be effective without much contact with the cocoons. The behavior of this pest is such that both the adults and the larvae show high preference for dark and unexposed places. They are rarely found on the upper regions of the storage container.

Metcalf and Metcalf (1993) categorized the control of *Anthrenus* spp. in the household into two distinct phases. One phase involves measures aimed at preventing the beetles from becoming established and the other phase involves the eradication of the beetles after damage has begun. These authors however recommended fumigation (where practicable) or the use of chemicals such as diazinon, malathion, chloropyrifos, resemethrin, or other pyrethroids in the control of these beetles.

Watson *et al.* (1997) studied the behavioral response of *A. verbasci* to permethrin 25% (ec) and an insect repellent, N, N-diethyl-m-toluamide (DEET) using a computerized tracking system. The larvae however did not respond to DEET but were seen moving away from the areas treated with permethrin (ec). The use of the dust formulation of permethrin in the storage of silkworm (*B. mori)* cocoons is recommended for producers and buyers of the cocoons in Africa due to its effectiveness and easy availability.

Acknowledgement

Some of the equipment and materials provided in the International Foundation for Science Research grant B/2729-1 were used in this study.

References

Akinkunmi, O. A., 1995. A survey of insect pests on the exotic mulberry varieties (*Morus* sp. L.) in Ibadan, Oyo state as an aspect of population dynamics. M. Sc. Thesis, University of Ibadan, Nigeria, pp: 93.

Akinkunmi, O. A., E.O. Osisanya and M.O. Ashiru, 1999. Checklist of indigenous insect species on exotic mulberry (*Morus* sp.) varieties in Ibadan, Nigeria. Annex of Proc. XVIIIth I. S. C. Congress, Cairo-Egypt, 12th –16th Oct. 1999. pp: 38-50.

Ali, M.F., 1997. Development and heat tolerance of *Anthrenus coloratus* Reitter (Coleoptera: Dermestidae) reared on a laboratory diet. J. stored Prod. Res. , 33: 2451-255.

Ansari, M. F. and S. Basalingappa, 1986. Infestation of stuffed birds and mammals by the larvae of *Anthrenus coloratus* Reitter (Dermestidae: Coleoptera) J. Stored Prod. Res., 22: 131- 134.

Hardingham, M., 1996. The potentials for silk in Africa. *Spore* No. 61 1996 pp: 5

Hazama K., 1995. Sericulture in the Tropics. AICAF, Japan, pp: 150.

Hianes, C. P., 1991. Insects and Arachnids of Tropical Stored Products: Their Biology and Identification. Natural Resources Institute, U.K. pp: 246.

Hoebeke, E. R., A. G. Wheeler Jr. and R. S. Beal Jr., 1985. *Anthrenus pimpinellae* F., a Palearchive dermestid established in East North America (Coleoptera: Dermestidae. Journal of the New York Entomology Society, 93: 1216-1222.

Hummel, E. and H. Kleeberg, 1997. New results from the practical application of Neem Azal-formulations. Proceeding of the General and Applied Entomology, Bayreuth, Germany, 18-22 March, 1997.

ICIPE., 1997: Spinning a yarn from the wild. *Spore* No. 71 pp: 6.

Lim, S. H., Y.T Kim and S. P. Lee, 1990. Sericulture Training Manual 80. FAO, Rome pp: 111.

Mc Ewen, P., 1997. Sampling, handling and rearing insects. In: Methods in Ecological and Agricultural Entomology. D. R. Dent, M. P. Walton (Ed.) CABI, U.K. 5-26.

Metcalf, R. L and R.A. Metcalf, 1993. Destructive and Useful Insects. McGraw Hill Inc. New York.

Metins, J. W., 1985. *Laelius utilis* (Hymenoptera: Bethylidae), a parasitoid of *Anthrenus fuscus* (Coleoptera: Dermestidae) in Iowa. Entomophaga, 30: 65-68.

Sengupta, K., Govindaiah and P. Kumar, 1991. Diseases and Pests of Mulberry and their Control. Central Sericultural Research and Training Institute, Mysore, India, pp: 45.

Vijay Veer, Rameshwar Prasad and K. M. Rao, 1991. Taxonomic and biological notes on Attagenus and Anthrenus spp. (Coleoptera: Dermestidae) found damaging stored woolen fabrics in India. J. stored Prod. Res., 27: 185-198.

Vijay Veer, B. K. Nagi and K. M. Rao, 1996. Dermestid Beetles and some other insect pests associated with stored silkworm cocoons in India. J. stored Prod. Res., 32: 69-89.

Watson, E., G. Barson, D. B. Pinniger, G. Roberts and A. R. Ludlow, 1997. Evaluation of the laboratory resources of *Anthrenus verbasci* adults and larvae to permethrin (ec) using a computerized tracking system. J. stored Prod. Res., 33: 335-346.

Youdeowei, A., 1977. A Laboratory Manual of Entomology. Oxford University Press, Ibadan, Nigeria.