

NOTAS CIENTÍFICAS

BIOLOGICAL CONTROL OF THE BOLL WEEVIL¹

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ABSTRACT - Behavioral and biological aspects of some boll weevil (*Anthonomus grandis* Boheman) parasitoids were studied under laboratory experiments. Parasitoidism indexes of *Catolaccus grandis*, *Bracon* spp., *Catolaccus hunteri* and a specie of Ichneumonidae family were 72%, 11%, 3% e 57% respectively. A specie of the Eupelmidae family was recently included in this study. These parasitoids have showed different responses to parasitize immature stages of boll weevil. High searching ability of these parasitoids for larvae inside of squares and "Parafilm M" cells was also observed.

CONTROLE BIOLÓGICO DO BICUDO-DO-ALGODOEIRO

RESUMO - Aspectos comportamentais e biológicos de alguns parasitóides do bicudo-do-algodoeiro, (*Anthonomus grandis* Boheman) foram estudados, preliminarmente em condições de laboratório. Os índices de parasitoidismo do *Catolaccus grandis*, *Bracon* spp, *Catolaccus hunteri* e uma espécie da família Ichneumonidae foram 72%, 11%, 3% e 57%, respectivamente. Uma espécie da família Eupelmidae está sendo estudada. Ao nível de campo houve a predominância de *Bracon* spp. Estes parasitóides mostraram comportamentos diferentes com relação à preferência para oviposição em estádios imaturos do bicudo. Verificou-se, ainda, que os parasitóides apresentaram alta habilidade de procura às larvas de bicudo, tanto nas películas de parafina como em botões florais.

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INTRODUCTION

Natural control of the boll weevil *Anthonomus grandis* Boheman, 1843 (Coleoptera: Curculionidae), in addition to bioclimatological factors, is a work of parasitoid insects and, to a lesser extent, that of mites. These arthropods act as endoparasitoids and ectoparasitoids by feeding internally and externally on the immature stages of the boll weevil, respectively.

According to Cross & Chesnut (1971) there are forty-two species of arthropods that parasitize the boll weevil. Out of that total, thirty-three are Hymenoptera, six Diptera, one Coleoptera and two are Acarina. Parasitoids of the boll weevil have been more specially studied in the United States than in any other cotton growing areas where this pest exists. The earliest studies were conducted by Townsend (1895), Rangel (1901), Ashmead (1902) and Pierce (1908).

In the United States, *Bracon mellitor* Say, 1836 (Hymenoptera: Braconidae) is the most common boll weevil parasitoid. It has been accounted with about 80% of the parasitoidism on boll weevil larvae (Bottrell 1976, 1983). On the other hand, Cross & Mitchell (1969) observed that *Catolaccus grandis* Burks 1954 (Hymenoptera: Pteromalidae) is the most important natural agent to control the boll weevil in the Pacific Coast, Mexico and Central America. In Brazil, Gravena (1983) found *B. mellitor* in cotton fields in São Paulo. In the Northeast of Brazil, Bleicher & Broglio-Micheletti (1988) found boll weevil larvae parasitized by *Bracon* spp. and *C. grandis*.

Pesticides usage in cotton in Brazil is very low when compared to the cotton producing areas of North and Central America. This unique situation favors the implementation of a biological control based on the use of imported and indigenous boll weevil parasitoids. The boll weevil has tropical origin and it is generally agreed that the southern Mexico or central America is its center of origin. In this area there are over twenty species of host plants on which it is known to develop (Cross et al. 1975). While these plants occur in a diversity of habitats, all occur in frost-free areas and undergo an annual dry season that lasts for four to five months. Essentially, these same conditions occur in Brazil. The probability of establishing parasitoids from tropical regions into different regions of Brazil appears to hold promise. In fact, these areas appear to be the optimum situation, in the entire range of the boll weevil, for the use of parasitoids to suppress it. Therefore, the purposes of the present study were to explore the habits and biology of some indigenous parasitoids which occur in the Northeast of Brazil. The parasitoids *Bracon* spp., *C. grandis*, *Catolaccus hunteri* Crawford 1908 (Hymenoptera: Pteromalidae), *Eupelmus* sp. (Hymenoptera: Eupelmidae) and one unidentified specie of the

family Ichneumonidae were collected in fields located in the states of Paraíba and Pernambuco, Brazil.

The studies of life history of these native parasitoids of the boll weevil were made primarily in laboratory, though some observations were taken in field. A laboratory colony for the studies were obtained by collecting adults as well as squares infested with boll weevil from field in different cotton growing areas of the states of Paraíba and Pernambuco. These insects were placed in 31,0 cm x 31,0 cm x 40 cm rearing boxes and fed on a 20% honey solution. Boll weevil larvae taken from infested squares were placed into individualized "Parafilm M" cells in order to be parasitized by these parasitoids in rearing boxes at $25 \pm 2^{\circ}\text{C}$ temperature and $70 \pm 10\%$ relative humidity.

Bracon spp. was easily reared under laboratory conditions. It was observed that the females always paralyze the boll weevil by stinging, which consists of piercing the cuticle and injecting the venom. This was done on larvae inside of squares as well as in "Parafilm M" cells. After the boll weevil larvae had been paralyzed, the female parasitoid deposits its egg on the larva or within its cell which develops as an ectoparasitoid. The life cycle averaged twelve days. These laboratory studies showed that *Bracon* spp. outcompeted populations of other species by increasing its searching ability and reproductive capability. These results agree with Adams et al. (1969) 28 and O'Neil & Cate (1985).

Indexes of parasitoidism found under laboratory experiments in rearing boxes was 11% in "Parafilm M" cells and 51% in squares (Fig. 1). Under field conditions *Bracon* spp. is the predominant specie. Up to eleven eggs on a single boll weevil larva were observed.

The ectoparasitoid *C. grandis* has the boll weevil larva as its exclusive host. Since it is difficult to catch the adult in the field, infested squares were collected and placed into emergence boxes. The females preferred to oviposit on third-instar boll weevil larvae. These species do not paralyze the boll weevil larvae before egg laying. Cannibalism was observed when more than one larva was developed on a single boll weevil larva. This insect was observed parasitizing boll weevil pupae. Life cycle averaged thirteen days. The index of parasitoidism observed in rearing boxes was 72% from "Parafilm M" cells and 63% from squares (Fig. 1).

The parasitoid *C. hunteri* was found in squares and bolls collected from fields. Like other parasitoids the females probed into squares, "Parafilm M" cells and bolls. After localizing its host the female lays an egg on first-instar boll weevil larva. The percent of parasitoidism in rearing boxes from "Parafilm M" cells was very low (Fig. 1).

Individuals of Ichneumonidae family were emerged from bolls collected in field. This insect also paralyzes boll weevil larvae by

injecting venom which is followed by ovipositing, on the average two eggs each time.

This insect was observed parasitizing boll weevil pupae and also paralyzing larvae without parasitoidism. This parasitoid showed high degree of searching capacity even when the host was in "Parafilm M" cells, high level of activity and aggressiveness. Its live cycle ranged from thirteen to fifteen days. Parasitoidism rate in "Parafilm M" cells was 57 percent (Fig. 1). In several locations *Bracon* spp. was the most common parasitoid.

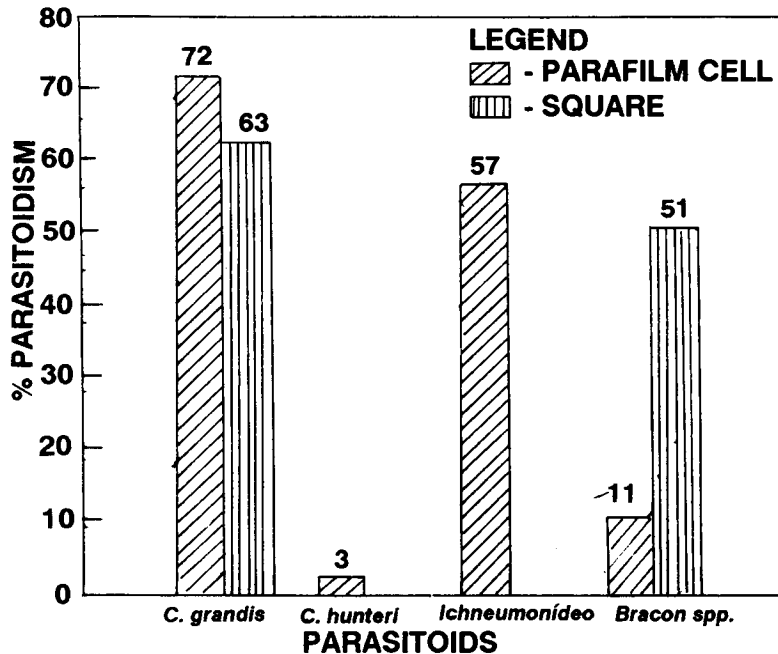


FIG. 1. Parasitoidism of boll weevil larvae by four types of parasitoids on parafilm cells and squares. Campina Grande, PB. 1990.

REFERENCES

- ADAMS, C.H.; CROSS, W.H.; MITCHELL, H.C. Biology of *Bracon mellitor*, a parasite of the boll weevil. *Journal of Economic Entomology*, v.62, n.4, p.889-896, 1969.
- ASHMEAD, W.H.A. New *Bruchophagus* from México. *Boletín de Comunicación Parasitológico*, v.1, p.404, 1902.
- BLEICHER, E.; BROGLIO-MICHELETTI, S.M.F. Parasitos e predadores do bicudo-do-algodoeiro no Nordeste do Brasil. *Relatório Técnico Anual do Centro Nacional de Pesquisa do Algodão - 1985/1986*, Campina Grande, 1988. p.130.
- BOTTRELL, D.G. Biological control agents of the boll weevil. In: CONFERENCE ON BOLL WEEVIL SUPPRESSION, MANAGE-

- MENT, AND ELIMINATION TECHNOLOGY, MEMPHIS, E.U.A., 1974. **Proceedings**. [S.l.]: USDA, 1976. p.22-25 (USDA, ARS, 71).
- BOTTRELL, D.G. The ecological basis of the boll weevil *Anthonomus grandis* Boheman management. **Agriculture Ecosystems Environmental**, v.10, p.274, 1983.
- CROSS, W.H.; CHESNUT, T.L. Arthropod parasites of the boll weevil. **Annals of the Entomologist Society of America**, v.62, n.2, p.516, 1971.
- CROSS, W.H.; MITCHELL, H.C. Distribution and importance of *Heterolaccus grandis* as parasite of the boll weevil. **Annals of the Entomologist Society of America**, v.62, n.1, p.235-236, 1969.
- CROSS, W.H.; LUKEFAHR, M.J.; FRYXELL, P.A.; BURKE, H.R. Host plants of the boll weevil. **Environmental Entomology**, v.4, n.19, p.26, 1975.
- GRAVENA, S. Problema do bicudo-do-algodoeiro. **Jornal do Engenheiro Agrônomo**, n.5, p.5, maio 1983.
- O'NEIL, R.J.; CATE, J.R. Competition between *Bracon mellitor* (Hym.: Braconidae) and *Catolaccus grandis* (Hym.: Pteromalidae) for their host *Anthonomus grandis* (Col.: Curculionidae). **Entomophaga**, v.30, p.4, p.375-384, 1985.
- PIERCE, W.D. Studies of parasites of the cotton boll weevil. **USDA. Bureau Entomology Bulletin**, v.73, p.631-636, 1908.
- RANGEL, A.F. Tercer informe acerca del picudo del algodón (*Anthonomus grandis*). **Boletín de Comunicacion Parasitologica**, v.1, p.197-206, 1901.
- TOWNSEND, C.H.T. Reports on the Mexican cotton boll weevil in Texas (*Anthonomus grandis* Boheman). **Insect Life**, v.2, p.348-350, 1895.