

PARASITOIDS OF IMMATURE STAGES OF
AGRILUS SEXSIGNATUS (FISHER) (COLEOPTERA: BUPRESTIDAE)
ATTACKING *EUCALYPTUS DEGLUPTA* BLUME IN
SURIGAO DEL SUR¹

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ABSTRACT

The parasitoids of immature stages of the varicose borer, *Agrilus sexsignatus* (Fisher) (Coleoptera: Buprestidae), on bagras, *Eucalyptus deglupta* Blume, in the industrial tree plantations of the Paper Industries Corporation of the Philippines in Surigao del Sur were studied from 1980 to 1986. One species of hymenopterous parasitoid, *Ooencyrtus erionotae* Ferrieri, was prevalent and parasitized 32 to 57%, or an average of 47%, of *A. sexsignatus* eggs. Two species of hymenopterous parasitoids, *Tetrastichus* sp. and *Foenatopus* sp. were recovered from larvae. *Tetrastichus* sp. accounted for 2 to 50%, or an average of 12%, parasitism of the larvae. Larval parasitism by *Foenatopus* sp. was only 0.3%. Based on the degree of parasitism, *O. erionotae* and *Tetrastichus* sp. appeared to have better potential for biological control of *A. sexsignatus* than *Foenatopus* sp.

Key words: Parasitoids, *Agrilus sexsignatus*, *Eucalyptus deglupta*, *Ooencyrtus erionotae*, *Tetrastichus* sp., *Foenatopus* sp., biological control.

INTRODUCTION

The varicose borer, *Agrilus sexsignatus* (Fisher), (Coleoptera: Buprestidae), is a serious bark borer pest of bagras, *Eucalyptus deglupta* Blume in the Philippines. The larvae bore and tunnel under the bark and feed on tissues of outer wood and inner bark of stems, branches, and roots, thereby causing severe damage and mortality of the host.

The species is native to the Philippines. It was first collected in Luzon and Palawan, and described by Fisher in 1921. However, varicose borer has not been an economically important forest insect pest until 1975, when it was first detected causing serious infestation on bagras in the industrial tree plantations of the Paper Industries Corporation of the Philippines (PICOP) in Surigao del Sur (Raros et al., 1975). Since then, several studies (Viado, 1979; Lapis et al., 1979; Garcia and Serrano, 1980; Braza, 1988) basic to the formulation of varicose borer management strategy have been undertaken.

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This paper presents the results of a study conducted to determine the parasitoids associated with immature stages of the varicose borer and to gain insight, based on degree of parasitism, into the relative potential of the parasitoids for biological control of the pest in the bagras industrial plantations of PICOP.

MATERIALS AND METHODS

Collection of egg parasitoid

Monthly samplings were conducted in 10 bagras stands from October to December, 1983 and from July to December, 1986. Eggs were collected from the basal portion, up to 3m height from ground level, of stems of randomly selected trees by cutting 1 cm² sections of bark with eggs. The bark sections were glued, side by side with outer surface up, on 2 x 15 cm strip of kraft paper, then placed in 2.5 cm diameter test tube plugged with cotton, and brought to the laboratory. In the laboratory, the eggs from which the parasitoids had already emerged, as indicated by emergence hole cut by parasitoids on the dorsal side of eggs, prior to collection were counted and removed from the strips. The rest of the egg samples were then reared in their test tube containers for emergence of parasitoids. Parasitized eggs were counted daily until all the parasitoids had emerged.

Collection of Larval parasitoid

Samples of nine to 25 infested bagras stems were collected monthly from January, 1980 to December, 1981 from 22 bagras stands. The stems were debarked in the laboratory and all pupal cells and larvae encountered were collected. The pupal cells were removed from the stems by cutting 5 x 8 x 2 cm wood blocks with pupal cell inside. The larvae were implanted into and cultured in 50 cm long uninfested bagras stem sections with 5 to 10 cm diameter. A bamboo-tube cage, 3 cm long with 3 to 5 cm diameter and covered at one end with muslin cloth, was taped over each pupal cell in wood blocks and of laboratory-reared larvae in bagras sections to collect emerging parasitoids. Parasitized larvae were counted daily until all the parasitoids had emerged.

Seven hundred forty-four parasitoids from 26 parasitized larvae were cultured in petri dishes for survival rate and duration of pupal stage and life span of parasitoid adults in captivity.

Determination of degree of parasitism

The degree of parasitism by each parasitoid was determined in terms of percentage of parasitized samples using the following formula:

Number of eggs parasitized by *O. erionotae* (including eggs from which the parasitoids had already emerged prior to collection), or number of larvae parasitized by *Tetrastichus* sp. or *Foenatopus* sp.

$$\text{Degree of parasitism} = \frac{\text{Number of eggs parasitized by } O. \text{ erionotae (including eggs from which the parasitoids had already emerged prior to collection), or number of larvae parasitized by } Tetrastichus \text{ sp. or } Foenatopus \text{ sp.}}{\text{Total number of egg or larval samples}} \times 100$$

RESULTS AND DISCUSSIONS

Egg parasitoid

Only one species of hymenopterous parasitoid, *Ooencytrus erionotae* Ferrieri³, was observed parasitizing varicose borer eggs. Table 1 shows the

Table 1. Percent parasitism of *A. sexsignatus* eggs by *O. erionotae* on bagras plantations of PICOP in Surigao del Sur.

SAMPLING PERIOD	Varicose borer eggs, No.		% Parasitism
	Total	Parasitized	
1983			
October	60	19	31.67
November	43	22	51.16
December	42	16	38.09
1986			
July	1,405	574	40.85
August	840	327	38.92
September	799	393	49.19
October	1,544	876	56.74
November	356	150	42.13
December	870	463	53.22

³ Identified by Dr. Eliseo P. Cadapan, Department of Entomology, College of Agriculture, University of the Philippines at Los Baños, College, Laguna.

degree of parasitism of varicose borer eggs by *O. erionotae*. The parasitoid was not only prevalent but also appeared to be an important and effective natural enemy of varicose borer. Occurring in all sampling stands. *O. erionotae* was responsible for a considerably high percentage of egg mortality which ranged from 32 to 57%, with an average of 47%. Apparently, *O. erionotae* is a gregarious parasitoid. One to three parasitoid adults emerged from a parasitoid egg. Based on 1,508 egg samples, the proportions of eggs with one, two, and three parasitoids were 58, 40 and 2%, respectively.

The parasitized eggs turn greyish and slightly expanded laterally. About one week before they emerged, the parasitoids could be discerned through the convex and semi-transparent dorsal side of eggs.

Larval parasitoid

Two species of hymenopterous parasitoids, *Tetrastichus* sp. and *Foenatopus* sp.,⁴ attacked varicose borer larvae. *Tetrastichus* sp. was more commonly encountered in all sampling stands throughout the sampling period and, thus, appeared to be more effective parasitoid than *Foenatopus* sp. From January, 1980 to December, 1981, the monthly degree of parasitism by *Tetrastichus* sp. ranged from 2 to 50%, with an average of 12% (Table 2). Five to 100% of the larvae in individual stems were parasitized by *Tetrastichus* sp.

Like *O. erionotae*, *Tetrastichus* sp. is a gregarious species. The number of *Tetrastichus* sp. adults emerging from a single larva ranged from 15 to 76 ($n = 137$) with an average of 33. *Tetrastichus* sp. emerged mostly from pupal cells, indicating the parasitoid ultimately killed the larvae after they have constructed pupal cell or when they were already about to pupate. Rarely did a parasitized larva died in its feeding tunnel. Based on 529 cultures, the pupal stage of *Tetrastichus* sp. lasted for 10 to 12, or an average of 11 days, with a survival rate of 38 to 100%, or an average of 74%. Under room temperature (28–30°C) and in captivity, adults lived for 1 to 9, or an average of 3 days.

The other larval parasitoid, *Foenatopus* sp., was reared only from 6 out of 1,915 larval samples, and was collected in only three sampling stands. The species is a solitary parasitoid. Like *Tetrastichus* sp., it also killed the larvae when they were already inside their pupal cell.

The results show that at least three parasitoid species attack *A. sexsignatus* in PICOP plantations in Surigao del Sur, and based on the degree of parasitism, *O. erionotae* and *Tetrastichus* sp. appeared to have better potential for biological control of *A. sexsignatus* than *Foenatopus* sp.

⁴ Identified by Dr. Clare R. Baltazar, Department of Entomology, College of Agriculture, University of the Philippines at Los Banos, College, 4031 Laguna.

Table 2. Percent parasitism of *A. sexsignatus* larvae by *Tetrastichus* sp. in bagras plantations of PICOP in Surigao del Sur.

SAMPLING PERIOD	NO. OF VARICOSE BORER LARVAE					
	Total		Parasitized		% Parasitism	
	1980	1981	1980	1981	1980	1981
January	103	129	29	5	28.15	3.88
February	79	99	13	3	16.46	3.03
March	38	55	10	1	26.32	1.82
April	55	56	16	14	29.09	25.00
May	80	46	40	4	50.00	8.69
June	50	57	9	14	18.00	24.56
July	78	63	2	3	2.56	4.76
August	102	60	31	2	30.39	3.33
September	82	110	6	2	7.32	1.82
October	101	40	2	1	1.98	2.50
November	120	72	5	3	4.17	4.17
December	109	131	8	14	7.34	10.69

REFERENCE CITED

- Braza, R.D. 1988. Biology of the varicose borer, *Agrilus sexsignatus* (Fisher), on bagras, *Eucalyptus deglupta* Blume, in the Philippines. Philipp. Entomol. 7 (4): 351-358
- Fisher, W.S. 1921. New Coleoptera from the Philippine Islands. Phil. J.Sci. 18 (4): 349-447.
- Garcia, M.L. and R.C. Serrano. 1980. Extent of infestation by varicose borer in young native bagras plantations. Terminal Report. Forest Research Department (FRD), Paper Industries Corporation of the Philippines (PICOP), Tabon, Bislig, Surigao del Sur. (Unpublished).
- Lapis, E.B., H.O. San Valentin, and G.B. Viado. 1979. Studies on the varicose borer, *Agrilus sexsignatus* (Fisher) (Coleoptera: Buprestidae), infesting *Eucalyptus deglupta*. FORI-PICOP Cooperative Research Project Report. Forest Research Institute, College, Laguna (Unpublished)
- Raros, R.S., E. de Guzman, and R.E. de la Cruz. 1975. Report of the survey on the industrial forest plantations of PICOP. Department of Forest Biological Sciences, U.P. at Los Baños, College of Forestry, College, Laguna. June 26. (Unpublished).
- Viado, G.B. 1979. The varicose borer, *Agrilus* sp. (Coleoptera: Buprestidae), of bagras (*Eucalyptus deglupta*). Sylvatrop, Phil. For Res. J. 4(1): 45-47.