

A SYNERGISTIC AGGREGATION PHEROMONE COMPONENT IN THE BANANA WEEVIL *COSMOPOLITES SORDIDUS* GERMAR 1824 (COLEOPTERA: CURCULIONIDAE)

Hugo Cerda¹, Kenji Mori², Toru Nakayama² and Klaus Jaffe³

1. Laboratorio de Control de Plagas, Universidad Simón Rodríguez, Apartado 47925, Caracas 1041A Venezuela, Fax 582-6817436 / 6811374.

2. Department of Chemistry, Science University of Tokyo, 1-3 Kagurazaka, Shinjuku-ku, Tokyo 162, Japan.

3. Departamento de Biología de Organismos, Universidad Simón Bolívar, Apartado 89000, Caracas 1080A, Venezuela, Fax: 58-2-9063624, e-mail: kjaffe@usb.ve

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ABSTRACT: *Cosmopolites sordidus* is an important pest on banana plantations worldwide. The chemistry of the aggregation pheromone of this insect has been recently resolved and here we present the first evidence from field trials that sordidin, a compound from the male released aggregation pheromone, attracts significant number of weevils only if host plant odors are also present. Sordidin attracts few insects when it is presented without the host plant tissue. However, the attractiveness of host plant tissue increases more than tenfold when it is presented simultaneously with sordidin in field traps. We confirm experimentally that sordidin may be used as part of a system for mass trapping and monitoring this insect. **Key words:** *Cosmopolites sordidus*, banana weevil, pheromone, Coleoptera, aggregation, Sordidin.

Un componente sinérgico de la feromona de agregación del picudo del banano *Cosmopolites sordidus* Germar 1824 (Coleoptera: Curculionidae)

RESUMEN: *Cosmopolites sordidus* es una plaga importante de plantaciones de bananos a nivel mundial. La composición química de la feromona de agregación de este insecto ha sido resuelta recientemente y aquí presentamos la primera evidencia de trampas de campo, de que Sordidin, un compuesto de la feromona de agregación secretada por los machos, atrae a números significativos del picudo, sólo si olores de la planta hospedera también están presentes. Sordidin atrae a pocos insectos cuando es presentado sin tejidos de la planta hospedera. Sin embargo, la capacidad atrayente del tejido vegetal de la hospedera se incrementa más de 10 veces cuando es presentado simultáneamente con Sordidin en trampas en el campo. Confirmamos experimentalmente que Sordidin puede ser utilizado como parte de un sistema de trapeo masivo para controlar o monitorear a este insecto. **Palabras clave:** *Cosmopolites sordidus*, picudo del banano, feromona, Coleoptera, agregación, Sordidin.

INTRODUCTION

The banana weevil *Cosmopolites sordidus* Germar (1824) is one of the major pests on banana plantations worldwide (Boscan and Godoy, 1988, Busoli et al. 1989, Waterhouse and Norris 1987). The larvae feed internally on the pseudostem, the rhizome and roots, thereby affecting production. This pest can be monitored in the field using traps baited with host plant tissue (Castrillon 1989, Ndiege et al., 1991, Budenberg et al., 1993b), which suggests that host plant volatiles attract weevils. Budenberg et al. (1993a) have shown that male weevils emit an aggregation pheromone which attracts adults of both sexes, and Beauhaire et al. (1995) identified sordidin (1S*,3R*,5R*,7S*)-1-ethyl-3,5,7-trimethyl-2,8-dioxabicyclo [3,2,1] octane as the major component of the volatiles released by males.

Successful pheromone traps for Coleoptera have been developed for *Anthonomus grandis* (Hardee, 1982), Scolytidae (Borden, 1993) and the palm weevil (Hernández et al., 1992, Oehlschlager et al., 1995). Thus,

mass trapping the banana weevil, by using its aggregation pheromone, seems to be a feasible possibility. Here we demonstrate that sordidin is an active component of the aggregation pheromone and explore the possibility of using sordidin as an attractant to traps in the field.

MATERIALS AND METHODS

Experiments were carried out in a banana plantation at Estación Experimental Río Negro of the Universidad Simón Rodríguez, Dto. Acevedo, Edo. Miranda, that had a mix of "pineo" (genotype: AAA), "plátanos" (AAB), "topochos" (ABB) and "cambur manzano" (AAB) plants. The pitfall traps were placed in the ground with the trap opening leveled with the soil surface. For each experiment, 50 traps consisting of glass flasks, were used. The traps were 10 cm in diameter and 18 cm deep. These were placed randomly in the field, in the shade, respecting a minimum distance of 10 m between traps. On the bottom of each trap, in a smaller flask, we placed the attractant to be tested. The attractants tested were: Plant tissue taken

Table 1. Number of weevils captured in the various traps in different experiments

Experiment	Traps	Season	weevils captured per trap per day	n of traps	p of difference*
1	PT + W	wet	1.3 ± 1.9	46	0.0084
1	PT	wet	0.4 ± 0.7	46	
2	PT	wet	1.0 ± 1.1	6	0.0119
2	W	wet	0.0 ± 0.0	6	
3	PT + S + A	dry	0.567 ± 0.62	90	0.00001
3	S + A	dry	0.056 ± 0.52	90	
3	PT + A	dry	0.044 ± 0.29	90	

PT: Plant tissue, W: weevils, A: alcohol, S: sordidin,
Wet season (08-1994); dry season (01-1996)

*: Kruskal Wallis test

from the base of banana rhizomes (approximately 25 g), 10 adult weevils (a mix of males and females collected in the field), 2.5 ml of sordidin solution in ethanol (0.1 µg/ml), ethanol (2.5 ml), or combinations of these. Each second day the traps were examined and the weevils found in them collected. Preliminary experiments had shown that weevils can not escape from these traps. Traps were tested in the field for 15 days. (±)-Sordidin was 99.6% pure as analyzed by Gas-Chromatography and was synthesized as described in Mori et al. (1996). Release rate of sordidin in the field was approximately 0.025 µg of sordidin per trap per day.

RESULTS AND DISCUSSION

Table I shows the number of weevils captured in the various experiments. Plant tissue always captured some weevils. The number of weevils captured varied between experiments due to the fact that they were performed in different seasons, and the available weevil population was clearly different. During the wet season populations of adult weevils seem to be orders of magnitude larger than during the dry season. It seems thus convenient to use the amount of weevils captured in pitfall traps baited with plant tissue as a reference or control. Data in the table show that the presence of weevils increased the capture in the

traps threefold, whereas a solution of sordidin increased it more than tenfold compared to the controls of that season. Weevils alone did not capture insects, but the sordidin solution alone did capture some, although this effect could be due to the presence of ethanol, a known attractant for many Coleoptera (Cerde et al., 1994).

Our results show that neither weevils nor sordidin alone attract many adult weevils in the field. Plant tissue alone does attract some weevils, but this attraction is multiplied when either weevils or synthetic sordidin are present. The results thus suggest that sordidin is an active component of the male secreted aggregation pheromone of this weevil, synergizing the attraction of plant tissue for the aggregation of adult *Cosmopolites sordidus*. The fact that the aggregation pheromone, in order to attract insects, has to be synergized by host plant odors, seems to be a common feature among Curculionidae and possibly also among other Coleoptera (See also Jaffe et al. 1993). The adaptive advantage of such a communication system is still not completely clear.

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