

## Field Trapping of the Mahogany Shoot Borer, *Hypsipyla robusta* (Lepidoptera: Pyralidae), with Synthetic Sex Pheromones in Sabah, Malaysia

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### Abstract

Field trapping with identified sex pheromones of the mahogany shoot borer, *Hypsipyla robusta*, was tested in a mahogany forest in Sabah, Malaysia. Traps with rubber septa impregnated with synthetic (*Z, E*)-9,12-tetradecadiene-1-ol-acetate, (*Z*)-9-tetradecen-1-ol-acetate and a 5:3:2 mixture of (*Z, E*)-9,12-tetradecadiene-1-ol-acetate, (*Z*)-9-tetradecen-1-ol-acetate and (*Z*)-11-hexadecen-1-ol-acetate captured no males, although these compounds have been identified as sex pheromones of *H. robusta*.

**Key words:** (*Z, E*)-9,12-tetradecadiene-1-ol-acetate, (*Z*)-9-tetradecen-1-ol-acetate, (*Z*)-11-hexadecen-1-ol-acetate

## Introduction

The mahogany shoot borer, *Hypsipyla robusta* (Moore), is a serious insect pest of young Meliaceae plantations in tropical Australia, Asia and Africa. The larvae destroy the terminal shoot of young trees, causing forking which deprives the timber of economic value considerably. A number of attempts have been made to control the mahogany shoot borer, but many of these have failed to reduce damage to economically acceptable levels (Newton et al., 1993; Mayhew and Newton, 1998).

To monitor the *H. robusta* population or to control it, tactics utilizing sex pheromones have been suggested. Sex pheromones have proved to be effective against other lepidopterous insects infesting trees, such as the western pine shootborer, *Eucosma sonomana* (Sower and Overhulser, 1986) and the cherrytree borer, *Synanthedon hector* (Matsumoto et al., 2001). Sex pheromones of *H. robusta* have been isolated and identified as a 5:3:2 mixture of (Z,E)-9,12-Tetradecadiene-1-ol-acetate (Z,E-9,12-14:Ac), (Z)-9-Tetradecen-1-ol-acetate (Z-9-14:Ac) and (Z)-11-Hexadecen-1-ol-acetate (Z-11-16:Ac) (Bosson & Gallois, 1982). They also reported that a 7:3 mixture of Z, E-9, 12-14:Ac and Z-9-14:Ac elicited complete behavioral response in the laboratory. However, no testing of field traps baited with these pheromone components has been reported until now. In the present paper, we report the results of field trapping of *H. robusta* by lures baited with synthetic sex pheromone components and behavioral assays in the laboratory with the synthetic pheromone compounds.

## Materials and Methods

### 1) Pheromone

All chemicals (Z, E-9, 12-14:Ac), Z-9-14:Ac and Z-11-16:Ac) were supplied from Shin-Etsu Chemical Co. Ltd. (Tokyo, Japan) and purified by Dr. Hajime Sugie of National Institute for Agro-Environmental Sciences to have a steric purity of >99%.

### 2) Behavioral assays in screen cage

The activity of the synthetic sex pheromones was tested by puffing the vaporized sample (100 mg) from a Pasteur pipette directly to the antennae of male moths

in a screen cage (30x30x30 cm). We counted all males orientated to the direction from which puffing air came, bent their abdomens and opened their claspers. The number of males in each screen cage was three to four.

### 3) Pheromone dispensers

Pheromone dispensers used in field studies were prepared from 8-mm white rubber septa (Aldrich Chemical Company Inc., Milwaukee, Wisconsin, USA) impregnated with 0.1 ml of hexane solution containing one mg of the synthetic sex pheromone components.

### 4) Field trials

Field trials were conducted in mahogany forests (20\_ X\_23 trees, 3 m apart) in Luasong Forestry Centre, about 70 km northwest of Tawau, Sabah, Malaysia. Pherocon 1C sticky traps (Trécé Inc., Salinas, California, USA) baited with one mg of Z-9-14:Ac, Z, E-9, 12-14:Ac or a 5:3:2 mixture of Z-9-14:Ac, Z, E-9, 12-14:Ac and Z-11-16:Ac were hung in a grid pattern 12 m apart at heights of 1.5-1.8 m above ground from a twig of a mahogany tree. Traps were set up on September 19, 1999, and checked daily for twelve days. All treatments were triplicated.

## Results and Discussion

No males were captured with the traps baited with 1 mg of Z,E-9,12-14:Ac, Z-9-14:Ac or a 5:3:2 mixture of Z9, E12-14:Ac, Z-9-14: Ac and Z-11-16:Ac during two weeks of trapping.

These results would occur i) if there were no males in the field where we had placed the pheromone traps, ii) if the Sabahan *H. robusta* did not use sex pheromones for communication between sexes, or iii) if *H. robusta* from Sabah utilized different sex pheromone components or the same components in a different ratio from that reported by Bosson & Gallois (1982).

The absence of males in the field was not very probable, since we captured a male and a female with a light trap at 7:30 p.m., when we placed the light trap from 6:30 to 8:30 p.m in the same forest as we placed the pheromone traps. Morgan and Suratmo (1976) reported that adult moths of *H. robusta* were active throughout the year in West Java, Indonesia, although there was seasonal variation in the number of the

Table 1. Number of male *Hypsipyla robusta* responding to three vaporized synthetic pheromones in laboratory screen cages

Compound	No. of males responding / cage	Total no. of males / cage
Z, E-9, 12-14:Ac	0	13
Z-9-14:Ac	0	13
5:3:2 mixture of Z, E-9, 12-14:Ac, Z-9-14:Ac and Z-11-16:Ac	0	13

moths. Infestation of mahogany by the shoot borer was found in Sabah all year despite a clear dry season (Matsumoto and Kotulai, 2002). These two reports also suggest that the presence of adult moths in the field was probable.

In a screen cage we observed that females bent the abdomen dorsally, up between the wings, and that they protruded and retracted the ovipositor alternately from 9:00 p.m. to 1:00 a.m. (unpublished data). While females started calling, males fluttered their wings, suggesting that the Sabahan *H. robusta* may use sex pheromones for sexual communication.

The responses of males to synthetic pheromones were also tested in a screen cage and no male showed any response to these compounds (Table 1). Sex pheromones have been identified from *H. robusta* originating from West Africa (Bosson & Gallois, 1982). It is, therefore, conceivable that the Sabahan *H. robusta* has pheromone components different from West African *H. robusta*.

Similar phenomena as the present results were reported in the citrus leafminer, *Phyllocnistis citrella* (Yjiye, 2000). A sex attractant, (Z,Z)-7,11-hexadecadienal, showed high activity for male moths of this species in Japan, but was ineffective in other countries such as China, Egypt, Reunion Island, Spain, Taiwan, Thailand, Turkey and Uruguay, suggesting differentiation of biotypes in *P. citrella*.

For a more definitive interpretation of the present results, identification of sex pheromones of the

Sabahan *H. robusta* is needed.

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## 合成性フェロモンによるマホガニーマダラメイガ *Hypsipyla robusta* の 野外における誘引

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### 摘 要

すでにマホガニーマダラメイガ *Hypsipyla robusta* の性フェロモンとして同定されている化合物 [合成(*Z,E*)-9,12-tetradecadiene-1-ol-acetate, (*Z*)-9-tetradecen-1-ol-acetate, および(*Z,E*)-9,12-tetradecadiene-1-ol-acetate, (*Z*)-9-tetradecen-1-ol-acetate, (*Z*)-11-hexadecen-1-ol-acetate の5:3:2 混合] を誘引源に用いたトラップにより、

マホガニーマダラメイガの誘殺をマレーシアサバ州のマホガニー林にて試みた。用いた化合物は、西アフリカ産のマホガニーマダラメイガ雌抽出物から同定されているが、今回の誘引実験では1匹の雄も誘殺されなかった。

キーワード；マホガニーマダラメイガ、*Hypsipyla robusta*、合成フェロモン、フェロモントラップ