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SHORT NOTE

CROSS ATTRACTIONS OF THE PINE BEETLE PHEROMONE IN TAIWAN[1]

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Y. S. Chow, Y. Chen, R. S. Tsai and Y. W. Meng (1988) Cross attractions of the pine beetle pheromone in Taiwan. *Bull. Inst. Zool., Academia Sinica* 27(1): 67-72. Four different pheromonal formulations: IPS lure, mountain pine beetle pheromone, southern and western pine beetle pheromones combined with the Lindgren 8-funnel traps were tested in two locations in *Pinus taiwaniana* habitat from April 1984 through August 1987. Traps were hung about 5 feet off the ground by nylon cords suspended on pine trees. No target pest was attracted to its corresponding pheromone. The southern pine beetle pheromone, frontalin and α-pinene treatment traps collected a greatest number of large weevil *Hylobitelus* sp.. IPS lure baited traps collected a clerid beetle *Thanasimus* sp. which is a predator of many pine beetles. The next number of pest attracted by the above 4 formulations is *Rhyncolus* sp.. Other pest species collected are identified as *Serica* sp., *Mycetophagus flexuosus*, *Nodina* sp., *Hylurgops longipilis*, *Pityophthorus* sp., *Dyscerus* sp., and *Cis* sp.. The last insect is very interesting, because it not only can be found in the galleries of bark beetles, but also is an important pest of fungus *Ganoderma* sp. an ingredient used in Chinese medicine.

Key words: Cross attraction, Pine beetle pheromone, Lindgren and funnel trap.

Pheromone are substances secreted by an animal to influence the pine behavior of other animals of the same or an other species. Recently, great progress in insect sex pheromone research has been made in the United States of America and Japan, both in population monitoring (survey) and direct insect control (mass trapping and communication disruption) (Kerkut and Gilbert, 1985). In Taiwan, we have also confirmed the use of sex pheromones of many Lepidoptera insects in crop field experiment, such as Tobacco armyworm *Spodoptera litura* and beet armyworm *S. exigua* (Chow and Lin, 1983). Although sex pheromone of many bark beetles, which are very important pests for coniferous forests have been identified, synthesized and merchandised in North America (Goyer *et al.*, 1974; Miller *et al.*, 1987) but no experimental trial was carried out before 1984 here in Taiwan. In the early 1984, Dr. M. C. Miller from USDA Forest Service, Southern Forest Experiment Station, Pineville, LA. USA initiated an international project for pheromone cross attraction studies to determine the response

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of insect natural enemies to commercially available aggregating pheromones of north American bark beetles. We joined the study in 1984 and this paper presents our results.

MATERIALS AND METHODS

Lindgren eight-funnel traps (Phero-Tech, Vancouver, B. C., Canada) were baited with the commercially available aggregating pheromones of southern pine beetle (*Dendroctonus frontalis* Zimmerman) SPB, western pine beetle (*D. breviconis* LeConte) WPB, mountain pine beetle (*D. pseudotsugae* Hopkins) MPB, and IPS (*Ips typographus*) lure (Table 1).

Three replicates of a trap line made up of four pheromone traps were set out in randomized block design at two locations. One location from 1984 to 1986 is approximately 2275 M in elevation 46 km northeast of Tung-Shih city, which is 160 km south of Taipei. The location for the 1987 experiment was near Wu-Ling Farm in central Taiwan at approximately 1600 M in elevation. Traps were hung about 5 feet off the ground by nylon cords suspended on pine trees and collecting jars of the funnel traps were filled with antifreeze (ethylene glycol) liquid to kill and preserve insects. Insects collected were mailed to Dr. Miller for identification by specialists.

RESULTS AND DISCUSSION

Among those insects collected, 10 species were identified and counted. No target species has been attracted to its corresponding pheromone. The results were summarized in Table 2. In 1984, we collected a very limited number of insect species (Table 2.), because we were not using the antifreeze liquid to trap the attracted insects. These results were not reliable. In 1985 we changed our method and better results obtained. In the two-year experiments, the southern pine beetle pheromone, frontalin and α-pinene treatment traps as shown in Table 2., collected the greatest number of the large weevil *Hylobitelus* sp. (Fig. 1. a). The next in great number attracted by the above 4 formulations was small weevil *Rhyncolus* sp. (Fig. 1. b). Other pest species collected are identified as *Serica* sp., *Mycetophagus flexuosus*, *Nodina* sp., *Hylurgops longipilis*, *Pityophthorus* sp., which is a very serious pine pest in Taiwan, *Dyscerus* sp. and *Cis* sp.. The last insect is of interest, because it can be found in the galleries of bark beetles, and it is an important pest of fungus *Ganoderma* sp. an ingredient used in in Chinese medicine. Since we had not attracted any general predator such as clerid beetle *Thanasimus undatulus* Say or like the specific beetle *Rhigophagus grandis* Gyllenhal (Payne *et al.*, 1984; Thatcher *et al.*, 1982), we moved our experiment field to Wu-Ling Farm. Surprisingly, the traps with IPS lure

TABLE 1
Technical description of bark beetle lures

Lure	Components	Relative proportions	Release rate	Duration
MPB	Myrcene	Individual	20 mg/d	120 d
	trans-verbenol	release vials	1 mg/d	
	exo-brevicomin		0.5 mg/d	
SB and SPB	Frontalin	0.67		
	α-pinene	0.33 g/release vial	10 mg/d	
WPB	Frontalin	15	12 mg/d	100 d
	Myrcene exo-brevicomin	2.5 g/release vial	0.5 mg/d	
I. typographus (IPS)	2-methyl-3-butene-2-ol	15	10 mg/d	?60 d
	cis-verbenol	0.70 in one release	1 mg/d	
	Ipsdienol	0.15 device	0.17 mg/d	

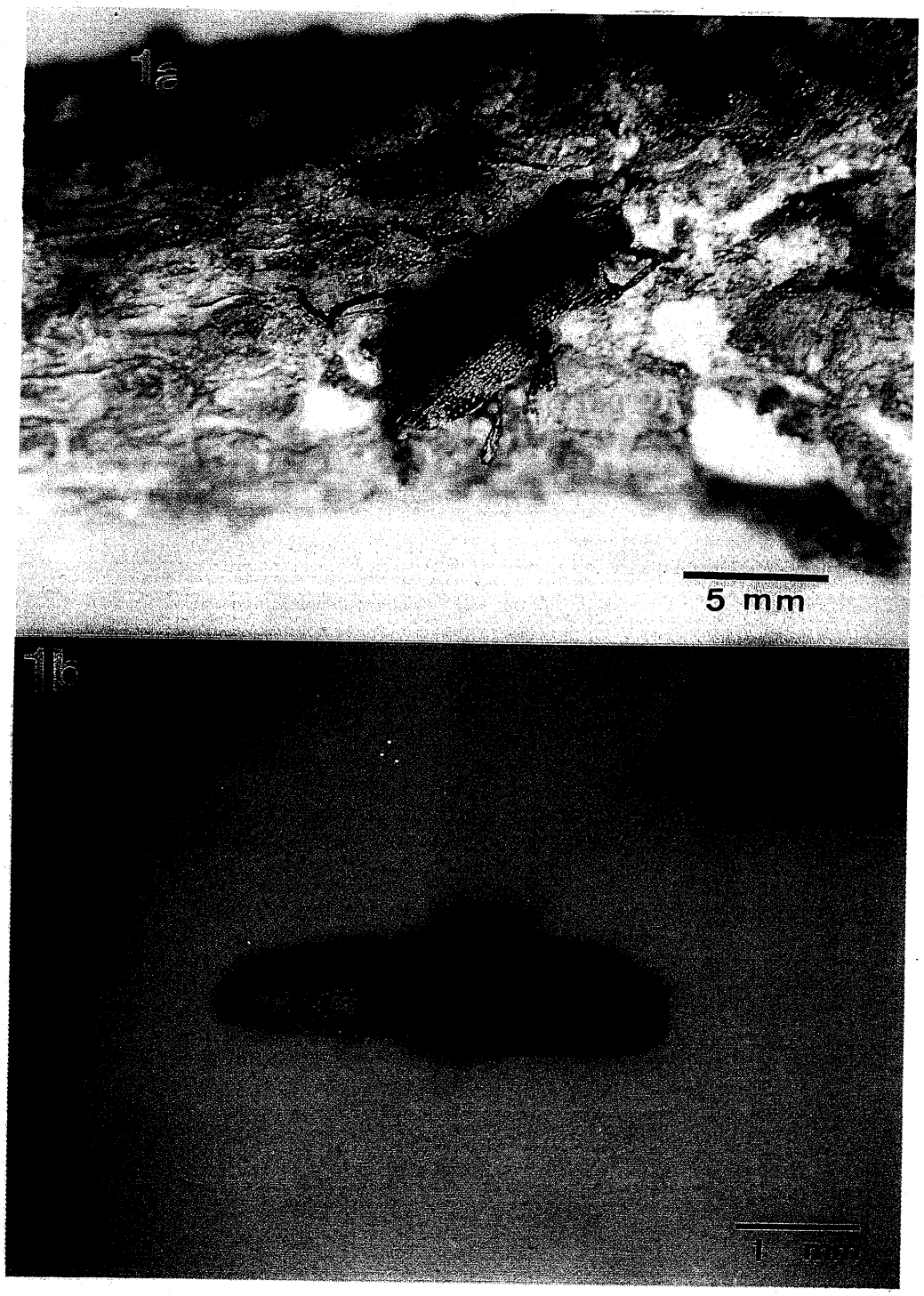

Fig. 1. Photomicrographs of the large pine weevil *Hylobitelus* sp. (a) and small pine weevil *Rhyncolus* sp. (b).

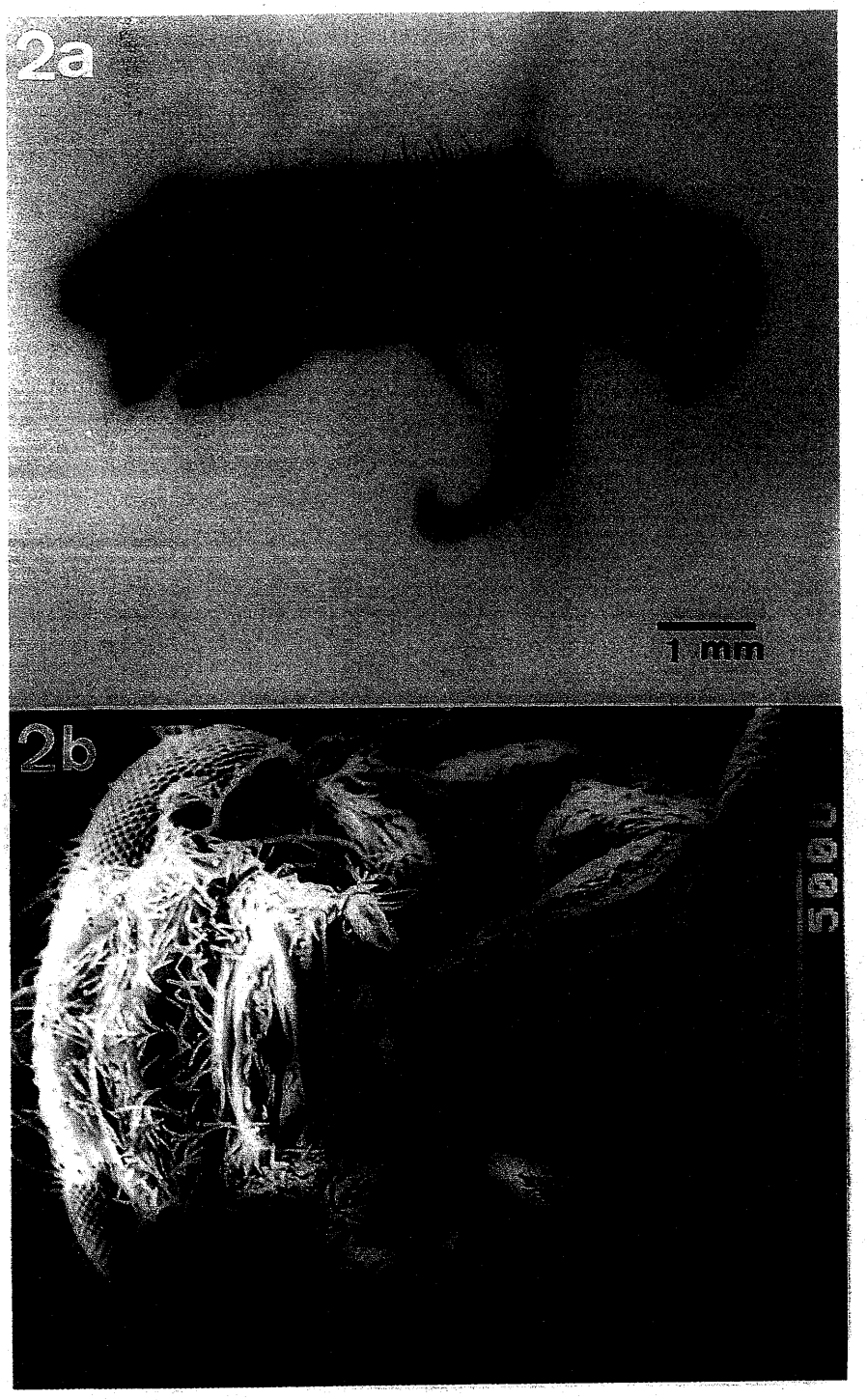

Fig. 2. Photomicrograph of the clerid beetle *Thanasimus* sp. (a) and its scanning electron micrograph showing the head and mandible. (b)

TABLE 2
Insects caught by pheromone-baited Lindgren traps on the central mountain area, Taiwan from 1984 to 1987

Trt	Year	Species										Sum
		a	b	c	d	e	f	g	h	i	j	
A	1984	2	1	2	5	6	0	0	0	0	0	16
	1985	3	1	0	4	3	0	0	0	0	0	11
	1986	0	0	0	2	4	10	8	4	0	0	28
	1987	0	0	0	1	1	1	0	0	0	76	79
B	1984	1	1	1	2	1	0	0	0	0	0	6
	1985	1	0	0	3	5	5	0	0	0	0	14
	1986	0	0	0	0	4	18	19	104	4	0	149
	1987	0	0	0	0	0	7	0	3	0	0	10
C	1984	1	0	1	1	0	0	0	0	0	0	3
	1985	1	0	0	4	6	8	0	0	0	0	19
	1986	0	0	0	0	0	25	1	0	0	0	26
	1987	0	0	0	2	0	4	0	0	0	1	7
D	1984	1	2	5	5	5	0	0	0	0	0	18
	1985	0	3	1	7	3	17	0	0	0	0	31
	1986	0	0	0	1	1	13	5	0	0	0	20
	1987	0	0	0	1	0	1	0	0	0	2	4
	Sum	10	8	10	38	39	109	33	111	4	79	441

A. IPS lure. B. Southern pine beetle pheromone. C. Western pine beetle pheromone. D. Mountain pine beetle pheromone. a. *Serica* sp. b. *Mycetophagus flexuosus*. c. *Nodina* sp. d. *Hylurgops longipilis*. e. *Pityophthorus* sp. f. *Rhyncolus* sp. g. *Dyscerus* sp. h. *Hylobitelus* sp. i. *Cis* sp. j. *Thanasimus* sp.

collected a clerid beetle *Thanasimus* sp. (Table 2. and Fig. 2.). There are no data on the impact of this predator and the bark beetle population, we can not make any suggestion now. If we can mass produce this insect in laboratory, it may serve as one more biological control agents to fight against pests of coniferous forests in the future.

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合成松樹甲蟲費洛蒙在臺灣的效益評估

周延鑫 陳 玥 蔡如秀 孟一文

四種不同合成的費洛蒙，分別是IPS、山松樹甲蟲、南松樹甲蟲及西松樹甲蟲費洛蒙商品，配合林氏(Lindgren) 八層漏斗式誘蟲盒，自一九八四年四月至一九八七年八月在兩處臺灣松 (*Pinus taiwaniana*) 林區做誘蟲試驗。誘蟲盒以繩子繫掛在松樹上，離地約五呎高處。結果並未誘到上述費洛蒙的甲蟲。南松樹甲蟲費洛蒙即 α-pinene 和 frontalin 處理之誘餌誘得最多量的大型象鼻蟲 *Hylobitelus* sp.。IPS 費洛蒙則誘到以多種松樹甲蟲爲食物的捕食性甲蟲 *Thanasimus* sp.。此四種配方其次可誘得 *Rhyncolus* sp.。其他逢機誘得的蟲尙有 *Serica* sp., *Mycetophagus flexuosus*, *Nodina* sp., *Hylurgops longipilis*, *Pityophthorus* sp., *Dyscerus* sp. 及 *Cis* sp.。最後一種害蟲不僅發生在松樹上，且可爲害我國之重要中藥靈芝 (*Ganoderma* sp.)。

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