Title: Field Attractiveness of the Synthetic Sex Pheromones of the Rice Stem Borer Moth, Chilo suppressalis Walker (Lepidoptera: Pyralidae)

Author(s): TATSUKI, Sadahiro; OHTA, Kyuji; UCHIUMI, Kyoichi; KURIHARA, Masaaki; FUKAMI, Jun-ichi; KISHINO, Kenichi

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Kyoto University

1. ニカメイガの合成性フェロモンの野外における誘引性 田付俊秀, 太田九二, 内海敬一, 藤原政明, 深見順一 (理化学研究所, 埼玉県和光市), 久野貞一 (農林省東北農業試験場) 51. 7. 16

The rice stem borer, Chilo suppressalis W., is one of the most important insect pests of rice culture in the temperate-subtropical region of Asia.

The presence of a sex pheromone in this species was first suggested by the early investigation of Kaburaki et al. using McIndoo's olfactometer. It has since been reported that the sex pheromone acts as both an attractant and a stimulant, the latter initiates the mating dance prior to copulation. Isolation and characterization studies were undertaken, however, attempts to identify the chemical structures were unsuccessful due to limited materials.

Recently, Nesbitt et al. reported that the sex pheromone of this moths collected in the Philippines is a mixture of (Z)-11-hexadecenal (HDAL) and (Z)-13-octadecenal (ODAL). A peak of activity occurred at the 75% mixture as monitored by a laboratory bioassay utilizing the mating dance as the sensing agent. However, attractiveness of the 75% (3:1) mixture could not be demonstrated by attraction tests in a laboratory flight chamber. Therefore, a field test was designed to confirm the attractiveness of the synthetic pheromones to male C. suppressalis.

Synthetic pheromones used for this study were the same as in the previous report. The purity was greater than 98% as determined by GLC.

One- or two-day-old virgin females were obtained from a rearing program utilizing rice seedlings as the larval diet at the Institute of Physical and Chemical Research. Female pupae and emerged adults were held in a wire screen cage (23×23×32cm) at the room temperature under a natural photoperiod.

Field tests were conducted in a paddy field of the Tohoku National Agricultural Experiment Station, Omagari, Akita Prefecture in June, 1976. The sticky traps, Pherocon® IC (Zoecon Corp., U.S.A.**), were placed at 15-20m intervals in two parallel straight lines which were about 200m apart at a height of 30-40cm. A hexane solution of the chemicals was placed on a piece

* Present Address: Niigata Engineering Co. Ltd., Kamatahoncho, Ota-ku, Tokyo.
** They were kindly supplied by Dr. Siddall of Zoecon Corp.
of filter paper that was hung in the middle of a trap and secured with adhesive tape. Two virgin females were confined in a plastic vial (6×3cm) with wire screen ends. The vial was placed directly on the sticky surface of a trap. The traps were baited within about 30min of 19:45hr to 20:40hr during which time the male is in flight searching for females. The number of males captured in traps were counted about 2hr after the baiting.

Preliminary field tests showed that each mixture of HDAL and ODAL in ratios of 3:1 (optimum ratio for the activity obtained from laboratory bioassay), 5:1 (active mixture reported by Nesbitt et al.) and 7:1 (naturally occurring ratio in our previous study) was attractive to males at the total level of 1 or 10μg. Thus, six mixtures in ratios of 20:1, 7:1, 5:1, 3:1, 1:1 and 1:3 using 1μg of mixture per trap were tested simultaneously along with the individual compounds at the 1μg level and two virgin females. The data obtained from six successive nights are summarized in Table 1. It is clearly shown that synthetic HDAL and ODAL were attractive when they were mixed together in ratios of 1:1 to 20:1. On the contrary, 1:3 mixture and each individual compound alone were shown to be quite inactive. Among the active mixtures, 3:1, 5:1 and 7:1 mixtures were equally more attractive than the 1:1 and 20:1. These data confirm the result of Nesbitt et al. and almost coincide with the result of our laboratory bioassay. Moreover, the attractiveness shown by pheromone mixtures of a relatively wide range of ratios is similar to of Heliothis virescens (F.) whose sex pheromone is a mixture of (Z)-11-hexadecenial (same as the major component of the Chilo sex pheromones) and (Z)-9-tetradecenial.

In these field tests, all the 1μg mixtures were less attractive than two live females. It is believed that this level of activity is a result of method in which these chemicals were dispensed, although some other factors related to the attractiveness remain to be evaluated.

The effective period of the active mixtures at 1μg level treated on filter papers was about 2hr. This was probably due to rapid evaporation or/and degradation of the compounds. To prolong the effectiveness of the compounds for a longer period in field investigations, use of pheromone dispensers such as rubber septa, polyethylene wicks, etc. should be examined. Furthermore, considering that many aldehydes are readily oxidized by atmospheric oxygen molecules, an appropriate antioxidant mixed with the pheromones would probably prolong activity.

The lack of attractiveness of the synthetic mixture in the laboratory can not be fully interpreted, however, a time lag between the sexually active time of the males released and the effective period of the chemicals baited might be a factor.

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Studies on the Toxic Action of Insecticides against Insects. III. Quantitative Expression of Toxicities of Several Insecticides against Larvae of the Silkworm, Bombyx mori L. (Lepidoptera: Bombycidae) and of the Fall Webworm, Hyphantria cunea Drury (Lepidoptera: Arctiidae). Kimihiko Sato and Masana Suwana. (Faculty of Agriculture, Tokyo University of Agriculture and Technology, Fuchu, Tokyo, Japan) Received July 22, 1976. Botyu-Kagaku, 42, 3, 1977. (with English Summary 9)

2. 殺虫剤の昆虫に対する致死作用に関する研究（第 3 報）数種殺虫剤のカイゴガ幼虫およびアメリカシロホトリ幼虫に対する殺虫剤効力の定量的表現法 佐藤内正（東京農工大学農学部，東京都府中市幸町 3-5）51. 7. 22 受理

令の異なるカイゴガ幼虫およびアメリカシロホトリ幼虫に対する 5 種類の殺虫剤（DDVP, マラソン, パラチオン, γ-BHC および NAC）の施用濃度と致死時間の関係を調べた。体壊が一定の虫の個体群については、限界死致用葉数を Ws、限界死致時間を Ts とすれば、施用葉数 W と致死時間 T の関係は (W − Ws) (T − Ts) = K で示される。K は定数である。K と体壊Mとの関係は K = aM + B となる。a および B の値は供試虫と殺虫剤の組合せにより異なる定数であり、これらの定数の大小により当該昆虫に対する供試された範囲内の殺虫剤の効力を推定できることが判った。

令の異なるカイゴガ幼虫に対する殺虫剤の効力について、スプレーの吹き出し速度についての Campbell12, ピレトリンの LC90 値についての吉田6 および DDT、スミチオンの LD90 値についての波部・高野6 の報告があり、それらはいずれも幼虫の部位が変化するため各殺虫剤の効力が著しく減少するとしているが、体壊との関係を定量的に示している報告はない。一方、アメリカシロホトリ幼虫に対する殺虫剤の効力については、石井4 が BHC、ホリードール（パラチオン）などを用いて調べ、体壊と殺虫剤効力に関係すると報告している。

殺虫剤による昆虫の致死葉数については、課程内4 および Suwana11 が先にアズキソウム成虫を対象に数種殺虫剤の施用葉数−致死時間の関係を表わす実験式として

\[ (W − W_s) (T − T_s) = K \]  

を提示した。これに、W：施用葉数、Ws：限界死致施用葉数、T：致死時間、Ts：限界致死時間、K：定数であること。

第 1 報4 では令の異なるヨトウガ幼虫に対する殺虫剤の効力を、第 2 報4 では令の異なるハチモンショトウ幼虫およびハチミツガ幼虫に対する数種殺虫剤の効力を調べ、施用葉数と致死時間との関係は、いずれの場合にも(1)式で示され、K は定数となり、しかも K の値が虫の体重 (M) と一次の関係

\[ K = aM + B \]  

で表わし得ることを報告した。

本報告では、普通飼育のカイゴガ幼虫およびアメリカシロホトリ幼虫に DDVP、マラソン、パラチオン、γ-BHC および NAC をそれぞれ施用した場合、上記と同様のことが成立立つかどうかを確かめるために行なった結果をまとめたものである。

本文に入るに先立ち、本大学講師斎藤栄明一郎君には供試虫の飼育等援助を受けた。ここに謝意を表す。