SHORT COMMUNICATIONS

The Antifeedant Effects of Chlordimeform on the Cabbage Armyworm, *Mamestra brassicae* L. (Lepidoptera: Noctuidae)\(^1\)

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Levinson (1975) has noted the possibility of using insecticactics, such as antifeedant chemicals, for the control of pests. Although chlordimeform has been reported to have an antifeeding effect upon some insects (Doano and Dunbar, 1973; Hirata and Sogawa, 1976; Nakamuta and Saito, 1977; Watanabe and Fukami, 1977; Lund et al., 1979; Shimizu et al., 1981, a, b; Antonius and Saito, 1983), the mechanism of action of chlordimeform is yet unknown. To gain insights into this mechanism, we have investigated the free-feeding behavior and mandibular movements of the cabbage armyworm following treatment with chlordimeform.

Insect: Cabbage armyworms, *Mamestra brassicae*, were reared at 24°C on an artificial diet under a 16L:8D photoperiod. Last instar and wandering stage-larvae were used as subjects.

Feeding behavior: The feeding behavior of the subjects was monitored using techniques discussed in a previous paper (Shimizu and Yagi, 1983). The feeding pattern on day 3 and 4 after the final ecysis was monitored electronically. At the beginning on day 4, chlordimeform hydrochloride (a 2 µg sublethal dose) was topically applied on the abdominal tergum of the subjects. The temperature of the room was kept at 25°C. Chlorodimeform hydrochloride solution was prepared at 1,000 ppm with distilled water. Two microliters aliquots were applied on the subjects.

Mandibular movements: An electronic measurement system was used to study the mandibular movements of the wandering-stage larvae (see Shimizu et al., 1980). A clip was attached to the subject’s mandible so that lateral movements of the mandible would activate a thread suspended from the arm of a transducer (TD-112S; Nihon Koden Kogyo Co., Ltd.). With each mandibular movement, the transducer transmitted a pulse to a coupler amplifier (EG-600H and AA-600H; Nihon Koden Kogyo Co., Ltd.), and these pulses were recorded on the chart.

Electromyogram from the mandibular muscles: Electrophysiological investigation was carried out using fixed intact larvae of the wandering stage. The recording method employed in this experiment was essentially the same as that used by Wago and Yamamoto (1978), except that a food plant was not provided.

Aqueous solution (1,000 ppm) of chlordimeform hydrochloride was prepared and 2 µl aliquots were applied on the entrance of esophagus and hypopharynx of the mouthparts. For several minutes following the topical application, an electromyogram taken from the mandibular muscles showed a continuous burst of mandibular movements.

The upper tracing of Fig. 1 shows the typical periodic feeding behavior exhibited by the larva on day 3. The lower tracing of the figure shows the absence of feeding behavior following the application of chlordimeform hydrochloride at the beginning of day 4. This observation is consistent with those of Nakamuta and Saito (1977), who noted that, following treatment with chlordimeform, silkworm larvae (*Bombyx mori*) avoided mulberry leaves and walked toward the margin of the container moving their mouthparts.

Following the topical application of chlordimeform to the mouthparts, uninterrupted mandibular activity occurred, so that a continuous burst of repetitive mandibular movements (CBMM) was recorded (Fig. 2, middle and bottom tracings). This increased mandibular activity seems to occur as the result of a loss of coordination of the abductor and adductor mandibular muscles.

In addition to monitoring the simple activity of the mandibular musculature, we recorded an electromyogram from these muscles. Following the treatment with chlordimeform, the normal phasic pattern (Fig. 3, tracings A and B; cf. Wago and Yamamoto, 1978), were changed into a tonical pattern (Fig. 3, tracings C and D). These changes are consistent with the occurrence of CBMM as illustrated in Fig. 2.

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Fig. 1. Recordings of mandibular activity showing a typical feeding pattern and an antifeeding pattern induced by chloridimeform. The upper tracing shows the normal feeding pattern on day 3 and the lower tracing shows the absence of feeding activity by the same animal on the next day, following the application of chloridimeform (arrow) at the beginning of the day.

Fig. 2. Recordings of mandibular activity showing spontaneous mandibular movements and a continuous repetitive burst of mandibular movements (CBMM). The upper tracing illustrates normal, spontaneous mandibular movements, whereas the middle and lower tracings illustrate chloridimeform-induced CBMM in the same animal.

Fig. 3. Electromyogram recordings from the mandibular muscles. Tracings A and B (B = A × 5) illustrate recordings from normal, spontaneous mandibular movements, whereas tracings C and D (D = C × 5) illustrate recordings from chloridimeform-induced CBMM in the same animal.
These observations suggest that chloridormeform causes a derangement of mandibular muscle coordination, resulting in a burst of mandibular activity which makes feeding impossible for the cabbage armyworm, *Mamestra brassicae*.

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REFERENCES


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Sterilization of the Melon Fly, *Dacus cucurbitae* COQUILLETT (Diptera: Tephritidae), with Gamma-Radiation: Sterility of Flies Irradiated under a Low Temperature Condition

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As the percentage emergence of pupae of the melon fly, *Dacus cucurbitae* COQUILLETT, is deleteriously affected by both high (over 27°C) and low (below 20°C) temperatures during pupal life (Nakamori et al., 1978), temperature in the gamma irradiation facility is kept below 25°C in hot season. Experiments on sterilization of the melon fly with gamma-radiation have been already conducted at 25°C (Teruya et al., 1975; Teruya and Zukeyma, 1979). On the other hand, the minimum temperature in winter in Naha, Japan, is 12.5°C. The present experiment was conducted to determine the lower limits of temperature at which the pupae may be kept before and during irradiation without affecting the degree of sterility.

Flies used for the experiment had been reared artificially for about 65 generations by the method described by Nakamori and Kainohana (1980). Pupae were kept at 25±1°C, except when the pupae were irradiated. Under this temperature the duration of the pupal stage is 10 days for both sexes. A special cooling box maintained at 12°C by a coolant was used for keeping the pupae at a constant temperature during irradiation. A container made of Saran® net containing 1,000 pupae was placed inside the cooling box 1 hr prior to the start of irradiation to keep the pupae at 12°C during the irradiation. The pupae were gamma-irradiated with a dose of 7 kR 2 days before adult emergence in the Melon Fly Sterilization Facility of the Okinawa Prefectural Agricultural Experiment Station, Naha, Japan. After the irradiation, pupae were returned to 25°C within 5 min. As controls, 1,000 pupae irradiated at 25°C with the same dose and the same number of unirradiated pupae were prepared. One day after the emergence, adults of a known number were sexed, confined in 30×30×45 cm aluminum framed Saran® netted cages and reared with method described in Teruya (1982a). To check the fertility of treated flies, 50 treated flies of each sex were crossed with 50 untreated flies of the opposite sex in a similar cage. Fifty pairs of untreated females and males were confined also, as a

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