Occurrence of 2, 3-Octanediol and 2-Hydroxy-3-octanone, Possible Male Sex Pheromone in Xylotrechus chinensis CHEVROLAT (Coleoptera: Cerambycidae) 1

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In a series of investigation of the sex pheromone in Xylotrechus genus, we have reported the existence in the male grape borer Xylotrechus pyrrophorus BATES using the mating behavior analysis (IWABUCHI, 1982). The major male sex pheromone components were isolated and characterized as 2S, 3S-octanediol (S, S-diol) and 2S-hydroxy-3-octanone (S-ketol) (SAKAI et al., 1984), and the females were attracted most strongly to a mixture of S, S-diol and S-ketol (80:20 ratio) (IWABUCHI et al., 1986).

Herein, we are reporting results from the field observation of the mating behavior and chemical analysis of the secretions from both sexes of Xylotrechus chinensis CHEVROLAT. This species belongs to the same genus as the grape borer and is one of the important pests of mulberry in Japan. Field observations were carried out in a mulberry field in Yamanashi Prefecture from late June to late July, 1984. The secretion from the sexes was collected by the container washing method (SAKAI et al., 1984). Six males or 20 females collected from the field were individually confined in a 100 ml conical flask. A filter paper (5.5 cm in diameter) was placed in each flask to provide traction for walking and to obtain a greater amount of secretion. These flasks were placed at 30°C and at a luminosity of about 4,000 lux with fluorescent lamps for a day. After the insects were removed, the flasks and filter papers were washed twice with hexane. The extracts were combined together separately for each sex and were concentrated by rotary evaporation at 30°C and finally under a stream of nitrogen gas. Another experiment was done to clarify the daily temporal pattern in the content of the male secretion. Eight males which were collected and reared 1 to 2 days before the experiment in the laboratory under a photoperiod of 14 hr light–10 hr dark at 25°C were individually placed in a flask at 8:00, 2 hr after the light-on. The males were transferred to new flasks every hour. The used flasks and filter papers were immediately washed with hexane to obtain the secretion during this period. Gas chromatographic analysis of the components in the secretion was carried out with a Shimadzu GC-7A equipped with a flame ionization detector, using an OV-17 glass capillary column (0.25 mm i.d. x 50 m). The flow rate of the carrier gas (nitrogen) was 0.6 ml/min. Injection temperature was 250°C and the oven temperature was 130°C. The identification of the components was achieved by GC/MS using a CP wax 51 glass WCOT column, 0.24 mm i.d. x 50 m, 150°C (SAKAI et al., 1984).

Under a natural condition, X. chinensis was active from 9:00 to 17:00. Mating behavior during a field observation ending in a successful copulation was recorded in two cases, at 11:01 and 13:20, respectively. The mating behavior started with the in-flight approach of the female towards the male resting on a mulberry tree. The flying female will pass within 1 to 2 m of the male and change her flight pattern by dropping speed, circling and initiating a hovering-style flight near her target. This pattern has been determined to be the typical mate-searching flight in the grape borer (IWABUCHI, 1982). After that, the female alights on a leaf about 20 to 50 cm away from the male and starts walking toward the stem. When the female has approached to within 2 to 3 cm of the male, he immediately locates her, mounts and copulates with her. The copulation lasted more than 5 min. From these observations the mating behavior of X. chinensis was very similar to that recorded for the grape borer (IWABUCHI, 1982, 1986) in which the female-approaching was mediated by a male sex pheromone, 2, 3-diol and 2-ketol (IWABUCHI, 1982; SAKAI et al., 1984). This leads to the supposition that X. chinensis also has the same compounds or its analogues as a male sex pheromone.

GC/MS analyses of the extracts from both sexes of X. chinensis indicated the presence of two sex-specific compounds only in the male extract. The

mass spectra of the compounds were closely similar to those of published data for 2S, 3S-octanediol and 2S-hydroxy-3-octanone (Sakai et al., 1984; Fig. 1). This fact suggested the male specific compounds of X. chinensis were three-2, 3-octanediol (2S, 3S- or 2R, 3R) and 2-hydroxy-3-octanone (2S or 2R). However, their absolute configurations remained obscure, since not enough compounds were isolated to their optical rotations. The ratio of these two compounds was about 15:85, while the ratio for the grape borer pheromone has been estimated to be 80: 20 to 95: 5 (Sakai et al., 1984; Iwabuchi et al., 1986). The maximum contents of 2, 3-octanediol and 2-hydroxy-3-octanone were 1.3 µg and 6.5 µg per male, respectively, and occurred between 14:00 and 16:00, i.e., 8 to 10 hr after the light-on (Fig. 2). The time corresponded to that when the mating behavior was observed under a natural condition, i.e., 7 to 9 hr after sunrise.

It is suggested that 2, 3-octanediol and 2-hydroxy-3-octanone are male sex pheromone components of X. chinensis. Closely related species generally have the same compounds as pheromone components (Cardé and Baker, 1984). This suggests that 2, 3-octanediol and 2-hydroxy-3-octanone may be distributed over the genus Xylotrechus.

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REFERENCES


