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Adult Emergence of *Coccinella septempunctata bruckii* MULSANT (Coleoptera: Coccinellidae) in Winter in Central Japan[1]

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The first generation adults of *Coccinella septempunctata bruckii* MULSANT emerge usually in spring and aestivate at the base of weeds such as *Miscanthus sinensis* (SAKURAI et al., 1981) and *M. sacchariflorus* (SAKURATANI and KUBO, 1985) in central Japan. The second generation adults emerge in autumn and overwinter in the weeds without obligatory diapause (SAKURAI et al., 1981). However, it is suggested that the overwintering stage of *C. septempunctata bruckii* is not always fixed, because we often observed not only active adults but also larvae and pupae of this species in winter fields. This paper reports the adult emergence of *C. septempunctata bruckii* in winter in central Japan.

On 7th December 1983, 5 prepupae and 7 pupae were found on a dumped wood stake, $7 \times 8 \times 110$ cm, lying on a sunny and grassy bank (34.9°N, 135.7°E, 10 m above sea level) of the Yodo River in the Osaka Plain. Including some mature larvae which crawled from the surrounding grasses, the total number of pupae attached to the stake amounted to 31. The developmental process of each pupa or prepupa was observed at intervals of 3–5 days till 31st January 1984. We confirmed the emergence of adults by checking the pupal exuvia remaining on the stake.

Figure 1 shows the processes of pupation and adult emergence of *C. septempunctata bruckii* on the stake. Six (Nos. 26–31) of 31 pupae disappeared from the stake by unknown factors, 3 pupae (Nos. 23–25) did not emerge as adults till 31st January and others (22 pupae) became adults. Two (Nos. 17 and 18) individuals were observed in the course of molting to pupae on 7th December 1983. The emergence of adults reached a peak late in January 1984. The period of pupal stage calculated for 13 individuals for which both pupation and adult emergence could be observed, ranged from 25 to 48 days with a mean of about 33 days.

The cold of that winter was a record among the last several years. The prepupae and pupae were covered with snow several times and probably were exposed to intense cold in the morning (31 days during the observation period were below 0°C in minimum air temperature at the Kyoto Local Meteorological Observatory, 15 km distant from our investigation site (The Japan Meteorological Agency, 1984)). Nevertheless, most pupae were able to become adults (Fig. 1). Some new adults, with pale colored elytra, were observed around the stake and were not malformed but normal. The developmental zero and thermal constant for pupae of *C. septempunctata bruckii* is respectively 12.2°C and 50.4 day-degrees for a Kyoto population (SAKURATANI et al., 1985). The total effective temperature calculated based on maximum air temperature recorded at the Kyoto Local Meteorological Observatory (The Japan Meteorological Agency, 1984) was only 6 day-degrees during the observations. This value was too low for the pupae to develop to adults.

Figure 2 shows the hourly changes of the temperature recorded by a resistance thermometer at the stake on 14th–15th December 1983. In the

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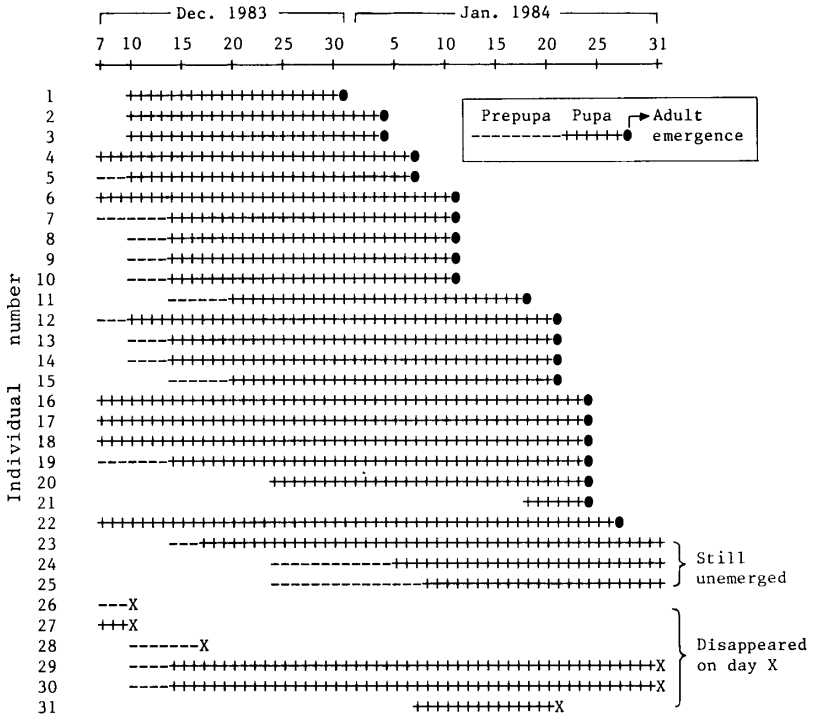

Fig. 1. Developmental processes of 31 individuals of *C. septempunctata bruckii* on the wood stake in winter.

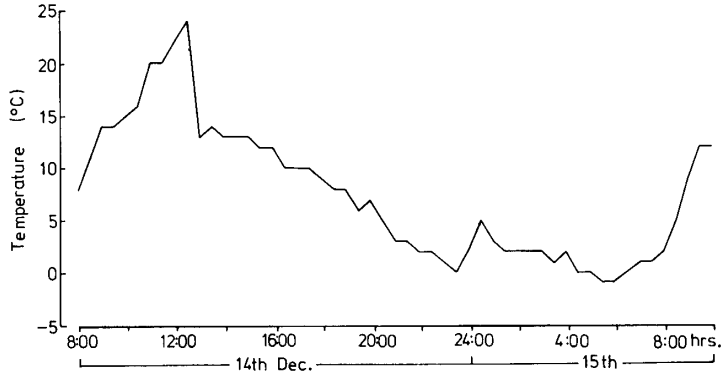

Fig. 2. Hourly changes of temperature on the wood stake on 14th-15th December 1983.

morning the temperature of the stake was almost 0°C but at noon rose more than 20°C. The rapid decline of the temperature in the afternoon on the 14th was due to cloudy weather. It seemed that the pupae of *C. septempunctata bruckii* received radiant heat from the stake which probably became warmer than other objects such as grasses, and thus were able to become adults even on cold days. The differences of the pupal period among individuals (some twice as long as others) (Fig. 1) might be ascribed to the degree of exposure to the sun at the pupation site on the stake. The density of aphids was high even in winter at the observation area, especially on *Rumex* grasses so that the adults of *C. septempunctata bruckii* must feed on them on fine days. Sakurai et al. (1981) showed that the second generation adults of *C. septempunctata bruckii* overwintered without obligatory diapause and suspected that some adults might lay eggs in early winter. The prepupae and pupae found in winter in our observation seemed to derive from such eggs. But, as the oviposition period of *C. septempunctata bruckii*

is more than 60 days at 25°C (KAWAUCHI, 1985) and the period may be prolonged at low temperature in autumn in the field, it is possible that some pupae derived not from second generation adults but from aestivating (first generation) ones. In any case, even in cold winter, the adults of *C. septempunctata bruckii* were able to emerge in central Japan on objects such as the wood stake.

OKUDA and HODEK (1983) stated that the life cycle of *C. septempunctata bruckii* belongs to type Dc of MASAKI's (1980) classification. However, it is considered from our results that some populations of *C. septempunctata bruckii* in warm regions in Japan with abundant sunshine in winter (e.g., the Osaka Plain) may belong to another type in this classification (probably Ec (SAKURATANI et al., 1985)), because of having an active phase in winter.

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Biological Activity of the Chiral Sex Pheromone of the Peach Leafminer Moth, *Lyonetia clerkella* LINNÉ (Lepidoptera: Lyonetiidae)[1]

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The sex pheromone of the peach leafminer moth was reported to be 14-methyl-1-octadecene (SUGIE et al., 1984). Subsequently, SATO et al. (1985) reported that the (*S*)-isomer showed strong biological activity and the (*R*)-isomer had weak activity. This suggested that the (*S*)-isomer up to 1% of which may be contained in the (*R*)-isomer contributed to the activity of the (*R*)-isomer. Since 14-methyl-1-octadecene is unique as the sex pheromone of lepidopterous species, the determination of its absolute configuration is of interest in connection with the correlation of structure-activity. The present paper deals with a further investigation of the activity of the two enantiomers using 100% optically pure synthetic compounds.

MATERIALS AND METHODS

Compounds. The enantiomers of 14-methyl-1-octadecene, the sex pheromone of the peach leafminer moth were synthesized from (*R*)-(+)-citronellic acid as reported previously (MORI and KATO, 1985).

Field tests. A hexane solution of synthetics was immersed in plastic capsules (8×17.8 mm, Yasumotokasei, YK-1) which contained 0.1 mg to 3 mg of each isomer and 0.1 mg to 1 mg of the mixture of the two isomers at the ratio of 9: 1, 5: 5, and 1: 9. Two entrance types of traps with a sticky plate (25×30 cm) were used and the capsules were placed on the plate. Tests were carried out in a peach orchard in Date-machi, Fukushima Prefecture. Traps were set 1.5 m above the ground and 10 m apart and the locations were exchanged when the number of caught males was checked.

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