RHYTHMIC EMERGENCE PATTERNS OF THE MOUNTAIN PINE BEETLE *DENDROCTONUS PONDEROSAE* (COLEOPTERA: SCOLYTIDAE)

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Abstract

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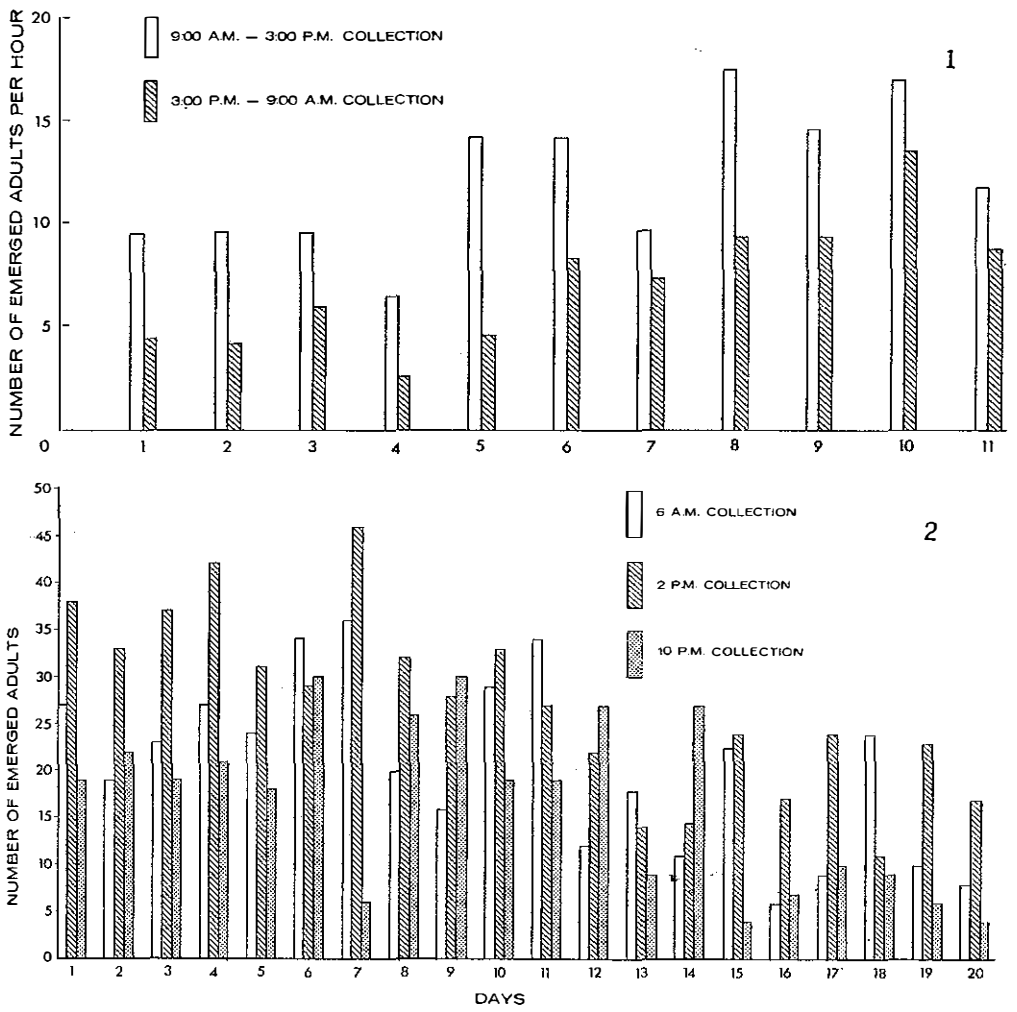
Logs of lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) supporting immature *Dendroctonus ponderosae* Hopkins were maintained under conditions of non-fluctuating temperature and light. The rate of emergence of the adult beetles exhibited a rhythmic, possibly circadian, emergence pattern. When the temperatures fluctuated the emergence rate was always greatest in higher temperature.

Introduction

During the routine collection of adults of the mountain pine beetle (*Dendroctonus ponderosae* Hopkins) from logs of lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) placed in an insulated, light-tight rearing room, a rhythmic pattern of emergence was observed. Saunders and Knoke (1968) have ascribed a circadian rhythm operative in the tropical scolytid *Xyleborus ferrugineus* (F.), and cyclic patterns of emergence have been observed for other species of bark beetles in the field (Reid 1962) and in the laboratory (Cameron and Borden 1967). In the latter instances, however, both light and temperature fluctuated freely and emergence was probably affected by one or both factors. This paper describes



FIGS. 1, 2. Daily emergence of *D. ponderosae* reared from larvae to adults under laboratory conditions of continued darkness and temperatures of 21° to 24°C (Fig. 1) and of continued darkness at a constant temperature of 31°C (Fig. 2).

a rhythmic, possibly circadian, pattern of emergence of *D. ponderosae* under controlled laboratory conditions.

Materials and Methods

Lodgepole pine logs, 4 ft long and 8–10 in. in diameter, were cut from trees infested with immature *D. ponderosae* in the East Kootenay region of British Columbia and placed in an insulated, darkened rearing room free of daily variation in temperature and relative humidity.

Emerging beetles were collected in a light trap constructed from an 8×7 in. fiber drum and a shielded 15-w incandescent bulb. The entire outer surface of the drum was coated with a flat black paint so that the only visible light in the rearing room was emitted from the opening cut at the base of the drum. The light intensity at the trap entrance was .032 c.p. The drum was placed on the rearing room floor with the brood logs positioned in a circle about it. Rearing room

temperatures above ambient were maintained with a thermostatically controlled heater.

Newly emerged beetles were continuously collected from four sets of logs maintained as follows: Sets 1 and 2, each containing twelve logs supporting *D. ponderosae* in the larval stages, were placed in the rearing room. The temperature rose gradually from 21° to 24°C with no observable daily temperature fluctuation during the 10-week period that the logs were in the room. Adults found in the light trap were collected twice daily, at 9:00 A.M. and 3:00 P.M. Twelve logs in set 3, each supporting larvae, were placed in the rearing room and maintained at a constant 31°C. Daily collections were made at 6:00 A.M., 2:00 P.M., and 10:00 P.M. Set 4 was composed of three logs cut from one tree that contained teneral adults. The temperature in the rearing room was raised to 31°C at 7:00 A.M. and at 3:00 P.M. was allowed to cool to 24°C daily. Adults were collected each day at 7:00 A.M. and 3:00 P.M.

The relative humidity in the rearing room rose to approximately 80% after fresh logs were introduced and then dropped gradually to approximately 65% within 6 weeks, at which time the adults were emerging. There was no daily fluctuation in relative humidity.

Results

A total of 2200 adult beetles was collected from set 1 during an 11-day period. The emergence rate was constantly higher from 9:00 A.M. to 3:00 P.M. than from 3:00 P.M. to 9:00 A.M. (Fig. 1). A total of 3353 adults emerged from set 2 over a 6-day period and again the pattern of emergence was similar to that illustrated in Fig. 1. From the third log set, 1284 adults emerged during a 20-day period; 542 (42%) emerged from 6:00 A.M. to 2:00 P.M., 332 (26%) emerged from 2:00 P.M. to 10:00 P.M., and 410 (32%) emerged from 10:00 P.M. to 6:00 A.M. (Fig. 2).

The rates of emergence from logs maintained in the fluctuating temperature regime (set 4) were always greatest, on an hourly basis, during the period of higher temperature and thus the pattern of emergence was similar to that in Fig. 1.

Conclusions

Results from this study suggest that broods of *D. ponderosae*, in an environment free of light and temperature fluctuation, exhibit a circadian rhythm in their pattern of emergence. The pattern is coincident with the pattern of emergence that occurs in the field, i.e., the majority of emergence occurs between 9:00 A.M. to 3:00 P.M.

Acknowledgments

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References

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