Circadian Basis of Assembly Pheromone Response in *Argas (Persicargas) persicus*

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ABSTRACT


A very close negative correlation has been demonstrated between the assembly pheromone response and locomotor activity in *Argas (Persicargas) persicus* (Oken). The daily rhythm of the activity of ticks in constant darkness showed alternation of diurnal assembly and nocturnal locomotor activity in regular circadian oscillations, but the intensity of the locomotor activity gradually decreased. The tendency for the period of the circadian oscillation to be longer and for the active phase of the rhythm to shift to the daytime hours occurred in ticks of the Azerbaijan population and unengorged ticks of the Czechoslovak laboratory population. This was not so in the engorged males from Czechoslovak population. The periodicity in the alternation of active and passive phases and the number of active ticks grew progressively in relation to increasing temperature. The presence of females increased the locomotor activity of males.

INTRODUCTION

The species *Argas (Persicargas) persicus* (Oken, 1818) is one of the nest-dwelling argasids with nocturnal host-seeking activity rhythm. As Howell (1976) showed in the case of *A. cooleyi* Kohls and Hoogstraal, 1960, the daily rhythm in the behaviour of that species is regulated by photoperiod. The water balance, changes in the temperature, or CO₂ concentration did not affect the activity rhythm in his experiments. As noted by Belozerov (1983), these results did not exclude the possibility of the existence of an endogenous circadian process in the control of tick activity rhythms, as proposed by Babenko (1974). Under consideration is an endogenous regulator, operating as an ‘interval timer’ which could be ‘switched on’ by the change from photophase to scotophase. A similar mechanism probably governs the daily drop-off rhythm of feeding larvae, familiar also in *A. persicus* (Hadani and Rechav, 1969). This daily rhythm
of engorged ticks probably also has an endogenous circadian basis, which is mainly entrained by such exogenous signals as photoperiod, daily rhythms in the physiology and locomotor activity of hosts, etc. An interaction of exogenous and endogenous components therefore takes place in this circadian system (George, 1964, 1971; Balashov, 1967; Doube, 1975; Rechav, 1978; Belozerov, 1982).

The hormonal control concept of morphogenetic diapause in A. (P.) arbo-reus Kaiser, Hoogstraal and Kohls, 1964 was proposed by Khalil and Shanbaky (1976). Although the diapause does have an endogenous basis, it can be also influenced by exogenous signals. The leading exogenous stimuli appear to be photoperiod (Khalil, 1976) and temperature (Khalil and Shanbaky, 1976). Termination of diapause in this species can be affected by juvenile hormone analog (Bassal and Roshy, 1974).

The existence of daily rhythm of host-seeking activity and of winter morphogenetic diapause in A. (P.) persicus is well known (Lounsbury, 1906; Hooker et al., 1912; Galuzo, 1957; Dusbábek, 1985b). Equally well known is the strongly positive reaction of engorged ticks of this species to the assembly pheromone (Leahy et al., 1973; Dusbábek, 1985c). However, we lack more accurate data on the interaction of these biological phenomena and on manifestations of it in laboratory experiments. This article therefore seeks to supply the gap by some laboratory studies on the interaction of assembly pheromone response with daily rhythm of activity and morphogenetic diapause.

MATERIAL AND METHODS

For the experiment we used A. (P.) persicus ticks bred in the laboratory of the Institute of Parasitology of the Czechoslovak Academy of Sciences, but originating from henhouses at Ipelský Sokolec, Levice district, Czechoslovakia, collected on 28 July, 1972 and May 4th, 1982 (Cz population), and from Arad and Shlelyan, Yevlakh district, Azerbaijan SSR, collected on 16 and 22 October 1979 (Az population). The ticks were kept in darkness at 27 ± 1°C and 75 ± 5% r.h. maintained by saturated NaCl solution. The régime of permanent darkness (DD) was only interrupted by short-term illumination (15–30 min) twice weekly when the state of the ticks was checked during the working day and during feeding on the host in the course of ontogenesis. The material was supplemented by a group of ticks from a population caught in the field at the Ipelský Sokolec locality on 12 June 1985, which were kept until the beginning of the research, i.e. for 10 weeks, in the same standard conditions.

The ticks' assembly-pheromone response was studied using the multiple-choice methods in Petri dishes proposed by Leahy et al. (1973). On each of five occasions 10 non-mated males were tested on 8 filter-paper discs in closed rough-bottomed Petri dishes (150 mm) for an uninterrupted 96 h. The experiment was conducted in darkness at temperatures of 20°C, 27°C and 34°C, at