

# **Physiological analysis of the circatidal rhythm in the mangrove cricket,**

## ***Apteronemobius asahinai***

Kazuki Sakura

### **Introduction**

The circatidal rhythm has been examined in many intertidal organisms since the 1950s. Many authors have attempted to clarify the Zeitgeber for the rhythm and the mechanism of an endogenous clock producing it by behavioral analyses. In the circatidal rhythm, however, there are some topics on which the knowledge is insufficient in contrast to the circadian rhythm. For example, only a few authors examined whether the expression of a circatidal rhythm required tidal experiences. Another example is that the statistical methods for detecting a phase of activity rhythm on an actogram were devised based only on behavioral results in the circadian rhythm. When these methods were applied to activity data other than a circadian rhythm, therefore, the calculated statistic values were not guaranteed as proper.

The mangrove cricket, *Apteronemobius asahinai*, inhabits the floor of mangrove forests. Adult crickets of this species collected from the field spontaneously showed both circatidal and circadian rhythms in their locomotor activities. Although a previous study showed that the circatidal rhythm of *A. asahinai* was entrained to inundation, it is still unclear whether contact with water or exogenous disturbance causing body locomotion functions as a Zeitgeber.

In the present study, I searched the Zeitgeber for the circatidal rhythm, devised a statistical method for detecting a phase of circatidal rhythms, and described activity rhythm patterns in adults which were reared in the laboratory without any tidal experience.

### **Materials and methods**

To identify the Zeitgeber for the circatidal rhythm, I fixed the cricket's body by insect pins, inundated the body, and observed whether the circatidal rhythm was entrained to the inundation or not.

To devise a statistical method for detecting a phase of circatidal rhythms, I devised a cycle-by-cycle adaptation of the Hierarchical Factor Segmentation method. I measured the detection accuracy of the cycle-by-cycle adaptation and compared it with that of the naive adaptation.

To describe the activity rhythm patterns of laboratory-reared adults, I measured their locomotor activities under constant red dim light, constant bright light and light-dark cycles.

## **Results and Discussion**

The circatidal rhythm was entrained to inundation even though the cricket's body was fixed, indicating that the contact with water itself functions as a Zeitgeber.

I clarified that the detection accuracy of the cycle-by-cycle adaptation was higher than that of the naive adaptation. This result indicates that the cycle-by-cycle adaptation is effectively applied to behavioral results in the circatidal rhythm.

I measured the activity rhythm patterns of laboratory-reared adults. Although approximately half of them showed a circatidal rhythm, most of the remaining showed a unimodal daily rhythm. This result indicates that the tidal experiences were required in order for all crickets to express a circatidal rhythm. The unimodal daily rhythm did not disappear under constant light in which a circadian rhythm of this species disappears. It was individually different whether the unimodal daily rhythm was entrained to light-dark cycles. Therefore, I neither verify nor deny the hypothesis that the unimodal daily rhythm derived from the circadian rhythm.

## **Conclusion**

*A. asahinai* receives some tidal cues during postembryonic development and expresses a circatidal rhythm. The circatidal rhythm is entrained to a tidal regime by contact with water.