

## Considerations on the possibility of overwintering of Japanese encephalitis virus in *Culex tritaeniorhynchus* females

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**Abstract :** Based on reported data, a consideration was made on the possibility of overwintering of Japanese encephalitis virus in *Culex tritaeniorhynchus* females. The gonotrophic dissociation (phenomenon of blood feeding without development of mature eggs) occurs commonly in this mosquito under experimental conditions of short day-length, but in nature this phenomenon is observed only at a low rate, even under short day-length in autumn. Furthermore, the females feeding on animals in autumn are very small in number. Therefore, only a very few females will overwinter after showing the gonotrophic dissociation. Also, parous females just having emerged from hibernation are seldom collected in early spring. From these facts, it can be said that only an extremely small number of females in the overwintering population has the experience of blood-feeding in autumn. Accordingly, it is not likely for Japanese encephalitis virus to overwinter in this mosquito.

In Japan, it is well known that *Culex tritaeniorhynchus* plays an important role as the vector of Japanese encephalitis during epidemic season. One of important problems on the life cycle of the pathogenic virus is whether or not during the winter this mosquito reserves the virus in the body. To clarify this, investigations on overwintering physiology of this mosquito have been made in our laboratory. Based on these results, together with data reported in Japan, the possibility of the virus to overwintering in the body of *Cx. tritaeniorhynchus* will be considered in this paper.

Oda and Wada (1973) reported that the females which had been bred under the experimental conditions with day-lengths shorter than 13.5 hours and temperatures from 21 to 25°C had small-sized follicles and showed a low feeding rate, and the gonotrophic dissociation in the fed females was indicated at a high rate of ca. 50-100%. The similar result was reported by Ito et al. (1968). They indicated that when the females reared as adults under

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a short photoperiod at 25°C were allowed to take the blood-meal, only a few females took the blood-meal and most of them showed the gonotrophic dissociation. From these result it may be said that the females which emerged under the short day-length in the laboratory represent a low feeding rate and many of the fed females show the gonotrophic dissociation.

Harada et al. (1968, 1970) found that the gonotrophic dissociation rates were ca. 70-100% in the females which had emerged after early September under outdoor conditions. Kawai (1969) also observed that the feeding activity was very low in females which had been reared to adults after middle September with day-length of 13.5 hours under outdoor conditions, and the gonotrophic dissociation was high in rate. Ito et al. (1968) showed that in the females which emerged after late September the feeding activity was lower and the gonotrophic dissociation occurred at higher rates (50-70%). From these results, it can be said that the females which emerged at outdoor under short day-length in autumn show a low activity of the blood-feeding and many of the fed females show the gonotrophic dissociation.

In the fed females which were caught at cowsheds and pigsties in the Nagasaki area and then kept for 10 days under outdoor conditions, the gonotrophic dissociation was very low in rate in spring to summer and became a little higher (ca. 30%) in September and October (Kawai, 1969 ; Oda and Wada, 1973). However, the females attracted to animals in autumn, were very small in number (Wada et al., 1975), therefore in the field the females showing the gonotrophic dissociation are considered to be extremely small in number.

On the other hand, the parous females were seldom caught in late March and early April (Oda et al., 1978 ; Wada et al., 1975). This strongly suggests that most females overwinter in the nulliparous state.

Based on these results, consideration was made on the possibility of overwintering of Japanese encephalitis virus in *Cx. tritaeniorhynchus*. As given in Table 1, the overwintering population of this mosquito can be divided into 3 groups based on the blood-feeding and oviposition in autumn. The females belonging to Group 1 have the experience of blood-feeding and oviposition in autumn. Therefore, they overwinter in a parous state. The females of Group 2 take the blood-meal but do not oviposit in autumn, showing the gonotrophic dissociation. Therefore, the overwintering state is nulliparous. The last group is for the females without the experience of blood-feeding in autumn. Of course, they overwinter as nulliparous females.

Table 1. Structure of overwintering population of *Culex tritaeniorhynchus*

Group	Experience in autumn	Parity (as examined in early spring)
1	with blood-feeding and oviposition	parous
2	with blood-feeding but without oviposition (gonotrophic dissociation)	nulliparous
3	without blood-feeding	nulliparous

Important for the overwintering of the virus are the females with the experience of blood-feeding in autumn, that is, Groups 1 and 2. However, most females are considered to overwinter not in the parous state but in the nulliparous state, because no parous females were caught in early spring as mentioned earlier.

The number of females having shown the gonotrophic dissociation in autumn is thought to be extremely small, also as demonstrated earlier. Therefore, the females of Groups 1 and 2, that is, the females with the experience of blood-feeding in autumn is considered to be extremely small in number. In other words, the overwintering population is composed of the females without blood-feeding, that is, the 3rd group females. Accordingly, it is not likely that Japanese encephalitis virus overwinters in this mosquito.

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日本脳炎ウイルスのコガタアカイエカ体内での越冬の可能性についての考察

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短日の実験条件下で羽化したコガタアカイエカの雌が吸血すると、栄養生殖分離を高率に起す。しかし自然界においては本現象は秋の短日下でも低率にしか起らない。秋に吸血に来る雌の数は非常に少なく、したがって、栄養生殖分離を起して越冬に入る雌の数は極めて少ないと思われる。早春には経産雌はほとんどとれない。それ故、越冬個体群に含まれる、秋に吸血を経験した雌は極めて少ないといえる。したがって、日本脳炎ウイルスが本種蚊体内で越冬する可能性はほとんどない。

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