

Effects of incubation temperature on the embryonic development and the oviposition in the silk spider, *Nephila clavata* L. Koch

Akiō KONDO

Department of Biology, Faculty of Science, Toho University
2-2-1 Miyama, Funabashi, Chiba 274, Japan

The silk spider, *Nephila clavata*, widely distributed all over Japan except Hokkaido, the most northern part of Japan. Since this spider passes the winter at their embryonic stage, it is expected that optimum temperature is different for developmental stages and for geometrical locations where they live. The author reported that the Akayu-eggs of the silk spider deposited in early October in Funabashi reached the stage of appearance of cephalothoracic appendages by December, but many of them died soon (Kondo, 1986). Their death may be caused by low temperature compared with spring when they develop under natural condition.

This report deals with the influence of incubation temperature on embryonic development of the silk spider in laboratory and the second ovipositions found by chance in the course of breeding adult females.

The adult females were collected in Akayu (140°10'E, 38°03'N, 220m alt.), Yamagata Prefecture, in mid September and were bred in Funabashi (140°03'E, 38°41'N, 25m alt.), Chiba Prefecture.

I. Effects on embryonic development

The eggs deposited in late September to early October in Funabashi and kept in natural condition were incubated in five different temperature from the stage of disappearance of the cumulus posterior in late November. The results were as follows:

- (1) 3-5°C: The eggs developed at the stage of formation of ventral plate by mid December and at the stage of appearance of rudiments of cephalothoracic appendages in January. But they did not develop afterwards, then became abnormal embryos by May.
- (2) 7-10°C: The eggs reached at the stage of early embryonic reversion in mid December and hatched out in early January.
- (3) 12-16°C: All eggs died due to infection in high humidity.
- (4) 17-22°C: The eggs hatched out in mid December and moulted in late December.
- (5) 24-27°C: The eggs hatched out and moulted by mid December.

The first moultings took place in several days after hatching out, but all spiderlings died within a week after moulting.

These results suggest that the lowest temperature at which silk spiders can complete their embryonic development is about 5°C, this coincides with the previous observation (Kondo, 1986).

II. Effects on oviposition

In Okinawa, the most southern part of Japan, the second ovipositions of the silk spiders were observed in 3.2 to 17.7% of the wild population at an interval of about two months (Shimojana, 1971). Among thirteen adult females of the silk spider collected in Akayu and kept in Funabashi, twelve females deposited two egg masses severally at an interval of three or four weeks. The first ovipositions were observed during late September and early October, and the second during late October and early November (Table 1). In all cases egg masses laid in the second oviposition were smaller than those in the first, and the egg size showed the same tendency. So it was confirmed that the silk spiders have the ability to deposit egg masses twice in a breeding season also in the mainland of Japan. In Akayu, the second ovipositions may be disturbed in the field due to poor food and/or low temperature.

Table 1. Collecting, feeding and oviposition in Akayu-females. c: collecting, d: died, E: the first oviposition, E': the second oviposition, f: feeding.

	September		October		Nov.
	13	1			1
AKA 201	c	f	E	f . f . f . f	f E'
AKA 202	c	E	f . f . f . f	f	E'
AKA 203	c	d			
AKA 204	c	f	E	f . f . f . f	f E'
AKA 205	c	f	E	f . f . f . f	f E'
AKA 206	c	f	f	Ef . f . f . f	f E'
AKA 207	c	f	E f	f . f . f . f	f E'
AKA 208	c	f	E	f . f . f . f	f E'
AKA 209	c	E	f	f . f . f . f	f E'
AKA 210	c	f	f	E f . f . f . f	f E'
AKA 211	c	f	f	E f . f . f . f	f E'
AKA 212	c	f	f	E f . f . f . f	f E'
AKA 213	c	f	E f	f . f . f . f	f E'

References

- Koñdo, A. (1987) *Proc. Arthropod. Embryol. Soc. Jpn.*, (22), 11-13.
 Shimojana, M. (1971) *Biol. Mag. Okinawa*, 7, 1-18 (in Japanese).