Preliminary Report on the Mating Behaviour of the Primitive Spider *Heptathela kimurai* (Kishida) (Araneae, Liphistiomorphae)

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The mating behaviour of a spider belonging to the Liphistiomorphae (Mesothelae) is described. Mating is introduced by palpal signals of the male. The copulation takes place just in front of the opened trap-door of the female's burrow. The male inserts only one palpal organ. After the copulation the couple separates quickly but peacefully.

A spider male has to be very careful when approaching a female for copulation in order not to be mistaken as a prey. Specific behavioural patterns are used as recognition signals, as has been found out by numerous observations on the mating behaviour of various spiders throughout the system of Araneae [1, 2]. Even evolutionary lines have been drawn from the different positions used for mating [3]. Nevertheless, the mating behaviour of the most primitive spiders, the Liphistiomorphae, seems to be still unknown, or at least undescribed. Only Yoshikura [4], when describing the development of *Heptathela kimurai*, made a short note that both palpal organs of the male are inserted into the female's genital opening.

Now, new observations have been made on *Heptathela kimurai*, which is widely distributed on the Ryu-kyu-Islands [5]. The specimens have been collected on the Ryu-kyus during spring, and were kept in our laboratory.

While young males may be recognized already by their thickened pedipalps [6, 7], the adult male (Fig. 1) has a fully developed and quite complicated palpal organ, which will be described in detail, elsewhere. Immature specimens as well as adult females live in a burrow with a trap-door at which the prey is being caught. The adult male gives up this characteristic way of living. After the last moult, it leaves the burrow in October, in order never to return. Consequently, it does not catch prey anymore, and it has to live on its reserves for several weeks or even months to come.

Outside, it first spins a sand coated shelter, and it seems to be possible that here the first filling of its palpal organs with sperm takes place, but this process has not been observed, yet. During daytime and later at night the male hides somewhere in a moist cavity, but in the evening it becomes active. Strolling about it may find different trap-doors, those belonging to spiders of the family Ctenizidae (Gen. Latouchia) as well as those of its own species.

Passing a door of a young *Heptathela kimurai*, the male stops and then may settle on or at the door, putting at least the tarsus of one leg on the trap-door or its margin. In these cases no courtship behaviour has been observed. If the young spider lifts the trap-door for split seconds, the male will run away. When passing the trap-door of an adult female, the male makes a halt immediately, and starts a characteristic behaviour. Sitting at the door or 1.0 – 1.5 cm in front of it, the male holds up its palps high above the eyes and then slowly moves them parallel and alternatively to each other in longitudinal direction to the body (ca. 1.5 Hz). Apparently, the palps neither touch each other, nor the ground. No reaction is observed, if the female sits on the bottom of its burrow, but once it is waiting just behind the trap-door, it opens the door immediately and raises on its last two pairs of legs. The male approaches very quickly. With its first two pairs of legs it catches hold of the female (Fig. 2), and then inserts one palpal organ perpendicularly into the female's genital opening. The other palp is also placed at the first lung plate, under which the genital opening is situated, but it is held in a bent position. The mating process lasts for only 3 – 5 sec, during which the female rests immobile with attracted legs. Then the male quickly retracts the palpal organ and runs away. Immediately, the female regains its motility, 'slams the door' and returns into the depth of its burrow. In the case observed, the second palpal organ has not been inserted. Apparently, a female accepts only one copulation once a year, but the male continues to look for other females.

When arriving at the door of a female coupled already, the male will start the same courtship behaviour. The courted female sitting behind of its door will open and close the door very rapidly either once, or more often (three to five times). The quick movement of the trap-door causes the male to flee. So far, no casualties have been observed during courting or after mating, in contrast to the fatal cases by which the males of orb-web spiders are overtaken quite often.

The mating behaviour of *Heptathela kimurai* shows much similarity to that in Mygalomorphae [2, 8], but in this group repeated copulations by the same couple have been observed, during which also both palpal organs may be inserted, one after the other.

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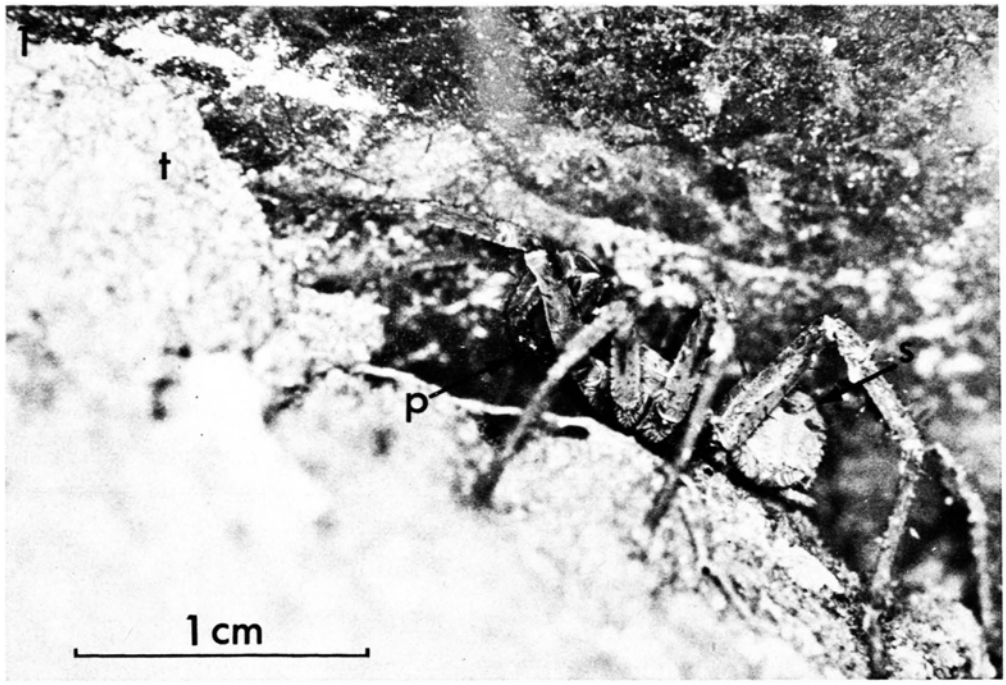

Fig. 1. The male touching the trap-door of a female's burrow with its first legs.

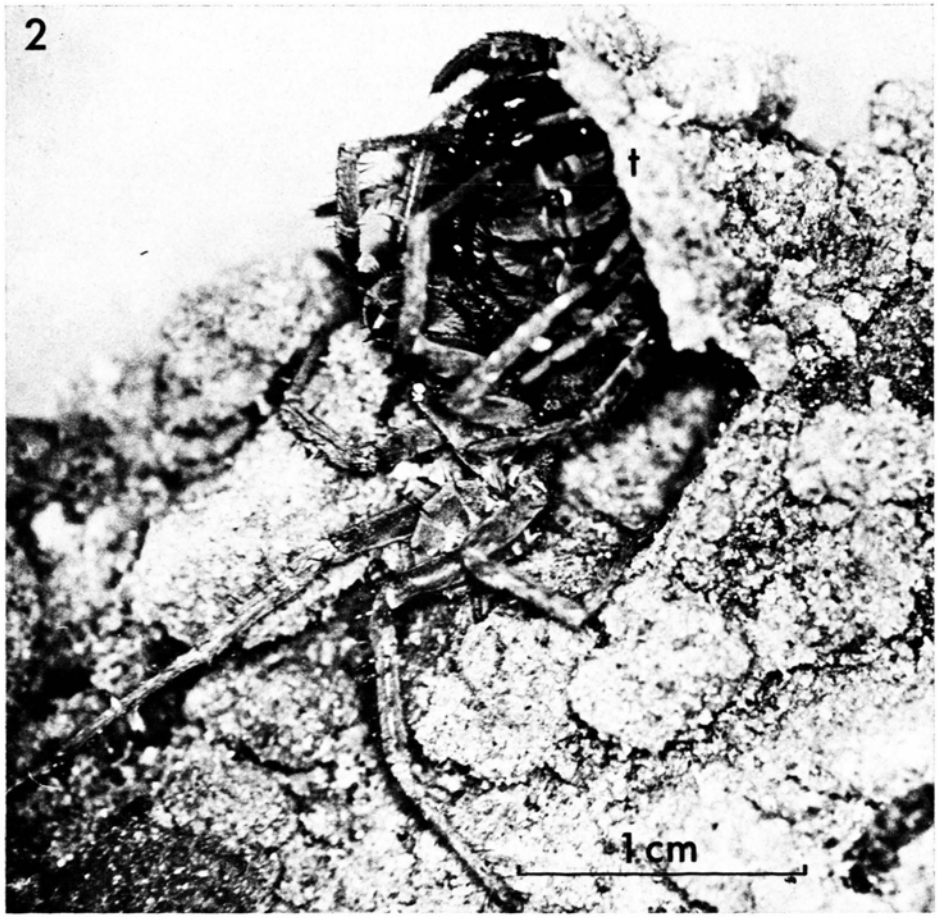

Fig. 2. A couple during copulation. p, palpal organ; s, segmental tergites of the opisthosoma; t, trap-door.

During copulation, the position of the couple is also very similar, although in *Heptathela kimurai* the body of the male forms nearly a right angle (Fig. 2). The palpal movement during the courtship ceremony reminds us the druming of the female's trap door by Ctenizidae males, and the druming of the female's sternum by the male of *Avicularia avicularia*[2]. In some species of Avicullariidae stridulation organs are present between the basal segments of the palps and the first pair of legs. This fact will have to be kept in mind during further studies to be undertaken, as the communicative interaction between male and female is not yet well understood in *Heptathela kimurai*.

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