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Yasuhiro Fujii

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Hunting Behaviour of the Wolf Spider, *Pardosa insigne* (Boes. et Str.)

Yasuhiro FUJII

Department of Biology, Nippon Dental College, 1-Chome, Fujimi, Chiyoda-ku, Tokyo, Japan

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ウズキコモリグモ Pardosa T-insignita (Boes. et Str.)
の狩猟行動について

国学部 藤井 靖浩

概 要

コモリグモ類 (Lycosidae) は餌の捕獲に際して網を利用して地表を徘徊しながら狩猟するものが大部分である。Pardosa 属は定まった住居や退避場所をもたず、餌を求めて放浪する狩猟者として知られる。しかし実際の野外における日常生活の観察例は少ない。ウズキコモリグモ Pardosa T-insignita は本邦の畑地や裸地にごく普通のきわめて敏捷なコモリグモである。筆者は調査区域を栃木県西部平地の休耕地内に設け、昭和47年、48年の2年間にわたりこのタモについての狩猟行動を調査した。15分間の連続観察56回、2〜3時間の連続観察5回、44匹の標識個体の24日間にわたる追跡、および若干の室内実験がこの間に行なわれた。これらの資料に基づいて、次のようないかの結論を得た。

1. ウズキコモリグモは定着通り定住せず、常に移動している。しかしそれは狩猟のための移動ではない。それらの狩猟は、基本的には待伏型の狩猟である。従って餌探索のための徘徊はせずに触れの多い歩脚を八方に伸ばして餌の到来を待つ。移動はアリ、ハミガキあるいは同種他個体に追われて結果的に生じたものであり積極性を欠く。

2. 成体の雄は配偶個体を求めて積極的に徘徊する。この移動は曲折の多い点、自発的な点で、より直線的、受動的な移動をする幼体や雌のそれとは明らかに異質である。

3. 幼体・成体、雄・雌の差にかかわりなく、顕著な日周性がみられ、昼の活動がさかんである。しかし成体の雄以外のそれは、昼間に摂乱し移動を促すような諸条件が多いことと関係が深いと考えられ、内在的な性質とみなすよりも、見かけ上のものとしてとらえる方が合理的である。
4. ウズキコモリグモは餌の捕獲に際して自種と他種を区別せず、捕えうるものを探り、
より強大なものからは逃げ去る。幼体は、飼育容器の狭い空間では成体から逃がれるこ
とができずに捕食されてしまう。しかし幼体は成体の雌も、危険なとき以外はあまり活
発に移動しないので、実際にそれは互いに遭遇する機会はそれほど多くないと思わ
れる。繁殖期以外には自種を識別する能力がみられないので、狩猟に際しての社会的な
機構の存在は期待できない。
Hunting Behaviour of the Wolf Spider, *Pardosa T-insignita* (Boes. et Str.)

1. INTRODUCTION

Wolf spiders (Lycosidae) are ground-living hunters which generally don't depend on webs to catch their preys. The field studies on their actual daily life or hunting processes are, however, not yet satisfactory. *Pardosa T-insignita* (Boes. et Str.) is one of the common and active wolf spiders in Japan, and lives in sunny grasslands with bare patches. This paper reports some results of field observations and experiments which were carried out in this spider from 1972 to 1973.

2. MOTILITY

Wolf spiders, especially those of genus *Pardosa*, have relatively good sensibility not only to tremors of their substrata but also to rapidly moving shadows, and they always run away from a man who comes up to them unpreparedly. So they may be often regarded as very active hunters searching for their preys unceasingly. But they were not so mobile when I observed them standing or sitting quietly. It was rather easy to follow them without disturbance as long as the care was paid to carry my foot
cautiously.

In order to evaluate the motility of the spider, *P. T-insignita*, the time length spent in locomotion and the straight line distance through the locomotion were measured simultaneously in a 15-minutes observation period. This investigation consisted of 56 times observations (7, 16, 15 and 18 times for juveniles, males, females without cocoons and females with cocoons respectively), and was carried out from May to August, 1973, in an old field which located in the suburbs of Tokyo and had thin vegetation of grasses (*Panicum Crus-galli, Arthrazon hispidus*), mugworts (*Erigeron canadensis*), and horsetails (*Equisetum arvense*), which are all typical species in old fields and roadsides. The measurements were performed on days with relatively calm weather, aided by a simple electric torch with a 1-watt bulb in the nighttime.

<2-a: Time length of locomotion>

Table 1 shows the motility expressed by the percentage values of locomotion time to each 15-minutes observation period. There was seen obvious diel periodicity, that is, the spiders were active in their motility during the daylight hours, particularly in the noon. Except for males wandering to seek for females to mate, however, all animals spented their time rather movelessly. The distributions of the values in the daytime were in the

<table>
<thead>
<tr>
<th>Sampling groups</th>
<th>Juveniles</th>
<th>Females without cocoons</th>
<th>Females with cocoons</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime</td>
<td>1.3 ± 2.2</td>
<td>6.3 ± 4.6</td>
<td>7.7 ± 7.1</td>
<td>31.5 ±13.5</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(8)</td>
<td>(9)</td>
<td>(9)</td>
</tr>
<tr>
<td>Nighttime</td>
<td>0.4 ± 0.7</td>
<td>1.8 ± 1.4</td>
<td>2.8 ± 3.3</td>
<td>1.0 ± 0.7</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td>(7)</td>
<td>(9)</td>
<td>(7)</td>
</tr>
</tbody>
</table>
range of 1.4–13.3% in females without cocoons, 0–20.6% in females with cocoons and 0–4.6% in juveniles, in contrast with that of 13.7–55.8% in males.

It is noteworthy that juveniles and females, which must take foods most actively to grow or to ripen their eggs, were more sedentary. This fact indicates that the locomotion may be necessary for this spider to mate with, but be not so necessary to catch their preys. This phenomenon seems to also apply to the other relatives of this spider. Hallander (1967) and Richter et al. (1971) investigated the relationship between time and distances covered by adult Pardosaee spiders. From these, it is unknown how long time the spiders spend in locomotion, but was revealed that the straight line distances covered by females for a given period of time are not longer than those of males in every species. And besides, the spiders with males traveling longer distances than females, namely P. chelata or P. prativaga, prefer the closely similar environments to the case of P. T-insignita. So, the difference of the locomotive activity between males and the others has probably some relations to their habitat. It is not easy, but may be very interesting to clarify this problem in the context of evolution of locomotive behaviour.

Table 2. The mean straight line distances (cm) covered in each 15-minutes observation period. The sample numbers are shown in ( ).

<table>
<thead>
<tr>
<th>Sampling groups</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Juveniles</td>
<td>Females without cocoons</td>
<td>Females with cocoons</td>
<td>Males</td>
</tr>
<tr>
<td>Daytime</td>
<td>15.5 ± 23.8 (4)</td>
<td>119 ± 83.2 (8)</td>
<td>104 ± 85 (9)</td>
<td>361 ± 172 (9)</td>
</tr>
<tr>
<td>Nighttime</td>
<td>1.3 ± 2.3 (3)</td>
<td>31.0 ± 45.8 (7)</td>
<td>34.9 ± 66.4 (9)</td>
<td>14.0 ± 15.3 (7)</td>
</tr>
</tbody>
</table>
<2-b: Straight line distances>

The mean straight line distances covered in each 15-minutes observation period are shown in Table 2. These results have the same trend mentioned above section, 2-a.

3. VAGRANCY

It has been said from fairly long ago that the *Pardosae* are true vagrants and do not use any retreat (Gertsh, 1949 etc.). Recently these descriptions were confirmed in several spiders by mark-and-recapture method (Vlijm, 1966 and Hallander op. cit.), and again here, were supported by my work of 15-minutes observation and a marking test in *P. T-insignita*.

<3-a: The relationship between locomotion time and locomotion distance>

The two kinds of measurement, already mentioned in 2-a and 2-b, were combined each other in order to examine the relationship between the locomotion time (not the observation time) and the locomotion straight line distance. As shown in Fig. 1, the simple linear relationship was obtained in every group. This result means that the spiders are wandering about with time, and have no adherency to any particular places. However, the values of the regression coefficient varied from the minimum of 6.9 in the males and to the maximum of 18.0 in the females without cocoons, in other words, the females without cocoons walk in fairly straight line, and the males do in tortuous manner. Therefore, if the females were always more active, they could travel a longer distance with less energy or less time than the males. A tortuous walking may be probably necessary to seek for something positively.

<3-b: Observation with marking method>

For the observation of all hunting processes, it may be the best way to
shadow each individual in their natural field. But I could not continue to follow all day long without missing or disturbing them. The marking method was applied to a more long-term examination of their vagrancy.

The study area for the marking test were selected in the old field described previously and had been enclosed by a low bank with dense weeds. The stable extent of the area in which the spiders lived were about 360 square meters, since pools or damp grounds were formed after a rainfall
(Fig. 3). 44 individuals of *P. T-insignita* (15 females with cocoons, 11 females without cocoons, 7 males and 11 juveniles) were collected from the study area in the noon of July 23rd, 1973. They were brought back immediately to the laboratory, anaesthetized with carbon dioxide, marked individually on the abdomen and the carapace with a cellulose paint in yellow, and released in the evening into the center of the same field.

Edgar (1971) has proved in *P. lugubris* that carbon dioxide has no inimical effects. My 5 marked specimens (3 females and 2 males) began to be kept in the laboratory on the same day when the 44 spiders were collected and released, to examine whether the marking procedure has ill-effects or not. Every female normally oviposited three times, carried cocoons and youngs, and is still alive now (Dec. 18th, 1973). The youngs could not cling to the painted parts of their mother’s abdomen, however, the ill-effects of marking on the physiology or behaviour of adult or juvenile were negligible. There may be some possibility of selective predation on marked spiders in the field.

Half of the marked spiders released in the field disappeared during the first night of 13 hours (0.54 days) and had never come back. Out of 12 individuals found in the next morning, 10 individuals (5 females with cocoons, 1 female without cocoons, 2 males and 2 juveniles) stayed within 5 meters from the releasing point. 4.5 days after the releasing, the members of remainders differed partially from those of the previous time, and were scattered over the whole study area. 2 of females with cocoons had lost their cocoons and the same number of females without cocoons had got cocoons. The marked juveniles hadn't been discovered there, on and after this time. Through the all 5 times investigations covering 24 days by August 16th, 2, 1, 9, 11 individuals were repeatedly found 4, 3, 2, 1 times respectively, and none of them attended regularly. Assuming that the indi-
individuals which once disappeared and appeared again afterwards also had been staying continuously, the successive changes in percentage of remainders to the total 44 experimental specimens are illustrated in Fig. 2, where the females with and without cocoons are not classified. The animals which had past the first night calmly, thence disappeared relatively slow at the rate of 0.88 individuals per day. The cause of the disappearance in the first night are not clear, but it seems to be largely concerned with emigrations since the main predators dwelling in this region, namely birds and lizards, take their foods in other places or vegetations during these seasons.

![Graph showing percentage of remainders over time](image)

**Fig. 2.** The successive changes in percentage of remainders to the total 44 marked specimens that were released in the study area, and the changes in relative density of unmarked natural population in this area.
Although a small carnivorous beetle, *Cicindela specularis*, occurred and chased to the spiders in the study area, they could not catch especially adult spiders that can run away more rapidly. This was confirmed through the observation in the field and laboratory.

The ensuing more gradual decrease after the abrupt disappearance at the first night was parallel to the decrease observed in natural unmarked animals in the study area (Fig. 2). The adult of *P. T-insignita* occurs here through almost all seasons except a few months of midwinter, and a large number of subadults were also seen at the beginning of the investigation, thus, the gradual disappearance should be explained not by the death resulting from the longevity or from the predation but mainly by the dispersion, that is, the vagrancy. The steeper decrease in marked juveniles may be due to more or less the moults in addition to the emigration. It is probable

![Diagram](image)

Fig. 3. The loci drawn by each marked spider in the study area.
that the disturbance by the observations and the changes in the community by long drought resulted in high emigration surpassing immigration.

The discovery points of each remainder had been moved unceasingly throughout the investigation period, and the loci of each spider intersected one another (Fig. 3). This fact suggests that this spiders are roaming about fitfully without any exclusive retreats or perhaps without own territories.

4. PASSIVITY

As already described in 2-a, *P. T-insignita* does not walk so actively to catch their preys. They spend their time rather movelessly ambushing for foods. On the other hand the distances covered by their locomotion are considerably long (2-b, 3-a, 3-b). In order to reveal what events motivate them to travel, I shadowed them over 2-3 hours continuously, and recorded the relationship between the total locomotion distances covered by each animal (the length of actual course of locomotion) and various events happened in each locomotion process, in August and September, 1972. The total distances were obtained by use of cotton thread, which was put on the ground where the spiders had passed through and measured afterwards. The straight line distances were also measured.

Fig. 4 shows well that the spiders' locomotion itself is lacking in spontaneity or positiveness. Occasionally, the spiders found the preys passing through and sprinted or rushed on them. But usually, they could not notice the existence of foods untiill they were touched on their bodies, and they waited for the chance movelessly stretching the long legs with sensitive hairs. Generally they were made to move by the force of ants, cicindelids, wind and so on. So, the agility of the spiders seems to play the important role not in chasing their preys but in running away from the enemies.
Fig. 4. The relationships between the locomotion distances covered in 2 or 3 hours and the various events happened in each process.

They can take foods even in the nighttime, therefore, the diel periodicity in females and juveniles shown in 2-a, 2-b, may be a reflect of some other properties of their own to a certain extent, i.e., it may be attributed more or less to the fact that there are more events to disturb them in the daytime.

5. CANNIBALISM

As long as spiders utilize webs, it is not so probable for them to encounter with or to touch on one another without any notice in their usual daily life. *Pardosa*, however, don’t use any webs to catch prey. Hallander (1970) reported that considerably hard cannibalism had been found to occur in *P. chelata* and *P. pullata*, both in the field and under laboratory conditions.
Here, in the spiders of *P. T-insignita*, whether they have the ability to distinguish the individuals of their own species from others was examined by a simple experiment from May to August, 1972. Adult females of *P. T-insignita* were confined individually in $3 \times 12$ cm vials with cotton plugs. Then two small juveniles both were same in size, one was *P. laura* whose habitat overlaps partially in space and time to that of *P. T-insignita* and another was *P. T-insignita*, were put simultaneously into each vial, and it was recorded which juveniles as preys were selected by adults as predators.

Table 3 shows these results. The adult females of *P. T-insignita* predate both species indiscriminately. However, the chances of the encounter happen not so frequently under the natural conditions until the population density becomes much higher, and all encounters do not introduce the cannibalism because, in the case of that between the individuals with same size, they sprint back from at once each other. The passivity observed in their hunting behaviours may be very significant to avoid these cannibalism.

Table 3. The number of juveniles of each species (*P. T-insignita* and *P. laura*) predated by adult *P. T-insignita* of 11 individuals (A-K).

<table>
<thead>
<tr>
<th>Species of juvenile as a prey</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. T-insignita</em></td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td><em>P. laura</em></td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

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REFERENCES