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Natural prey of the spider *Tibellus macellus* (Araneae, Philodromidae)

Elchin Fizuli oglu Huseynov
Institute of Zoology, Azerbaijan Academy of Sciences,
Block 504, passage 1128, Baku 370073, Azerbaijan

Summary

The natural prey of the spider *Tibellus macellus* Simon, 1875 was studied in a meadow in the subtropical zone of Azerbaijan. The percentage of specimens of *T. macellus* found while feeding was unusually high for cursorial spiders (15.6%). There was no statistically significant difference in the percentage of feeding specimens between males and females and immatures. The investigation has shown that *T. macellus* is a polyphagic predator feeding on a wide range of prey, with representatives of six arthropod orders found in its diet. The primary food of *T. macellus* was aphids, which accounted for over half of the total prey (53.1%). The only other considerable prey components were leafhoppers and dipterans (12.5% and 18.7% respectively). The length of prey killed by *T. macellus* ranged between 0.50 and 8.25 mm (mean 2.55 mm) and constituted from 7.1 to 163.6% (mean 39.5%) of the length of their captors. Most frequently taken were small arthropods not exceeding half the length of the spiders, which accounted for 77.8% of the total prey.

Introduction

Spiders of the family Philodromidae Thorell, 1870 are vagrant hunters which do not use silk for prey capture. As is typical of cursorial spiders very little is known about the natural prey of philodromids. Putman (1967) provided 26 prey records for *Philodromus* spp. from peach orchards in Ontario, Canada. Recently, Guseinov (2004) investigated the diet of three epigeic species of the genus *Thanatus* C. L. Koch, 1837 in ephemeral semidesert in Azerbaijan. However, nothing is known about the natural prey of *Tibellus* Simon, 1875, yet another large and worldwide distributed genus of Philodromidae. Therefore when I found a relatively dense population of *Tibellus macellus* Simon, 1875, it was decided to study quantitatively its prey composition to provide some insight into the feeding ecology of *Tibellus*.

Tibellus macellus is a Trans-Palearctic species, distributed from Europe to the Russian Far East (Efimik, 1999). Unlike its congener *Tibellus oblongus* (Walckenaer, 1802), which has been the subject of some ecological and ethological studies (Thomas, 1949; Mikulska, 1970; Rapp, 1984, 1986), I am unaware of any paper dealing with the biology of *T. macellus*, nor has it been mentioned in textbooks on the biology of European spiders (Nielsen, 1932; Savory, 1928; Bristowe, 1958). In common with other *Tibellus* species, *T. macellus* is a medium-sized spider (adult body length 6–9 mm) with an elongate slender body and long legs that are adaptations to its life on dense tall grasses. *Tibellus macellus* uses a "sit-and-move" predatory strategy, similar to that described for lycosids (Samu *et al.*, 2003); for most of their time the spiders sit motionless on stems of grasses, but frequently change their locations, moving to a new stem (Huseynov, unpubl. data).

Material and methods

The investigation was carried out in the territory of Hyrcan National Park situated in the subtropical forest zone, in the south-east of Azerbaijan. The study site was a meadow bordered by Hyrcan relic forest near Khanbulan village (38°40′N, 48°52′E). The vegetation in the meadow consisted of shrubs (*Rubus* spp.) and various grasses, weeds and forbs. *Tibellus macellus* was found primarily on dense and tall herbaceous plants, such as *Calamagrostis* sp., *Elytrigia repens* (L.) Newski and *Poa masenderana* Freyn & Sint. The prey of spiders were collected daily from 24–31 May 2006. All surveys were conducted in daylight hours between 11:00 and 20:00 and took 44 h in total. During surveys, the grassy vegetation was thoroughly searched for spiders, and each individual *T. macellus* found was captured in a transparent glass vial. In the vial the spider mouthparts were inspected with a hand-lens of 4 × magnification to prevent small prey being overlooked. Specimens with prey in their chelicerae were placed in separate vials containing 75% ethyl alcohol and brought back to the laboratory for measurement and prey identification. All spiders observed were classified into two groups according to their sexual status: (1) adult males, which had swollen palpal tips, with distinctly developed copulatory sclerites; and (2) adult females and immatures which included all spiders without modified palpal cymbia. During each survey the numbers of spiders with and without prey were counted separately within each of the two groups. Voucher specimens of *T. macellus* and their prey items were deposited at the Institute of Zoology, Azerbaijan Academy of Sciences.

Results

In total, 424 specimens of *Tibellus macellus* were observed, 64 of which (15.1%) had prey in their chelicerae. Two females were consuming two prey items simultaneously. Thus the percentage of feeding events was slightly higher (15.6%). Among the spiders observed, 71 males (8 prey records ~ 11.3%) and 353 females and immatures (58 prey records ~ 16.4%) were recorded. There was no statistically significant difference in percentage of feeding specimens between males and immatures and females (χ^2=0.133; df=1; p>0.5).

Two *T. macellus* individuals dropped their prey during the process of spider capture. Thus 64 prey items were collected for dietary analysis. These prey items were distributed among six orders of arthropods (Table 1): five from class Insecta (Homoptera, Diptera, Thysanoptera, Orthoptera, Collembola), and one from class Arachnida (Araneae). The dominant food component was aphids, which accounted for over half of the total prey (53.1%). The most frequently captured were aphids from the family Aphididae (27 prey items), followed by two Chaitophoridae and one Phloeomyzidae. Four aphids were too masticated to be identified to family level. Most of the aphids captured were wingless individuals (91.2%). Other homopteran prey included eight leafhoppers (Cicadellidae). The second most abundant prey order was Diptera, represented by 11 nematocerans

(5 Sciaridae, 3 Cecidomyidae, 1 Ceratopogonidae, 1 unidentified midge, 1 unidentified larva) and one brachyceran fly (Agromyzidae). The remaining insects comprised two larval and one adult thrips (Aelothripidae), two grasshoppers (Tettigonidae) and one springtail (Sminthuridae). Among the spiders captured were one immature oxyopid (*Oxyopes lineatus* Latreille, 1806), one female araneid (*Mangora acalypha* (Walckenaer, 1802)), one male theridiid (*Enoplognatha thoracica* (Hahn, 1833)), and one unidentified juvenile spider.

Sixty-three prey items were measured. Their length varied from 0.50–8.25 mm (mean ± SD: 2.55 ± 1.87 mm) and constituted from 7.1–163.6% (39.5 ± 30.4%) of the length of their captors, which ranged from 3.85–9.00 mm (6.40 ± 1.06 mm). The size distribution of prey in relation to the sizes of their captors is shown in Fig. 1. The most abundant were small arthropods not exceeding half the length of the spiders, which accounted for 77.8% of the total prey measured. To this group belonged most of the aphids, dipterans and spiders, as well as all thrips and the springtail. Medium-sized prey (from 50–100% of spider body length) and large prey (exceeding the length of their captors) were captured significantly less frequently (14.3% and 7.9% respectively). Grasshoppers and leafhoppers contributed the bulk of the prey in these size categories.

Discussion

The populations of cursorial spiders are usually characterised by low (<10%) percentages of specimens found while feeding (Nentwig, 1986; Nyffeler & Breene, 1990), and the data on philodromid spiders of the genus *Thanatus* are consistent with this generalisation (Guseinov, 2004). However, the percentage of individuals of *Tibellus macellus* found while feeding was unusually high, with no comparable value known in other cursorial spiders. It could be suggested that this fact is related to an especially high abundance of potential prey in the habitat of *T. macellus*. However, a study of the prey of another grass-dwelling cursorial spider, *Oxyopes lineatus*, at the same site and during the same period of time, revealed a significantly lower percentage of feeding specimens in this species (4.6%) (Huseynov, 2007). Perhaps, some peculiarities of the predatory strategy of *T. macellus* make this spider particularly successful at capturing prey. This question requires further investigation in the future. Another interesting fact is that males of *T. macellus* captured their prey almost as frequently as did females and immatures. This is in contrast to observations on most other cursorial spiders that I have studied in this respect, in which males fed significantly less frequently than females and immatures (Guseinov, 1999). The reasons for this difference remain unclear.

This study has shown that *T. macellus* is a polyphagic predator feeding on a wide range of prey. All these prey were soft-bodied, safe arthropods. Ants were common at the study site and they constituted about 20% of the prey of coexisting *O. lineatus* (Huseynov, 2007). Their absence from the diet of *T. macellus* suggests that this spider avoids attacking these dangerous prey. Similar results were obtained in laboratory experiments on the prey preference of *T. oblongus*, which readily accepted soft-bodied flies, midges, leafhoppers, mirid bugs and small spiders, but consistently rejected such well defended prey as wasps, worker ants and beetles (Nentwig, 1986). The most remarkable aspect of the diet of *T. macellus* is the strong prevalence of aphids. Aphids frequently constitute the major part of the prey of web-building spiders from various families (e.g. Nentwig, 1983; Nyffeler *et al.*, 1988, 1989; Alderweireldt, 1994;

Prey taxa	N	%
Insecta		
Homoptera	[42]	[65.6]
Aphidinea		
Aphididae	27	42.2
Chaitophoridae	2	3.1
Phloeomyzidae	1	1.6
Unidentified	4	6.2
Cicadinea		
Cicadellidae	8	12.5
Diptera	[12]	[18.7]
Nematocera		
Sciaridae	5	7.8
Cecidomyidae	3	4.7
Ceratopogonidae	1	1.6
Unidentified	2	3.1
Brachycera		
Agromyzidae	1	1.6
Thysanoptera	[3]	[4.7]
Aelothripidae	3	4.7
Orthoptera	[2]	[3.1]
Tettigonidae	2	3.1
Collembola	[1]	[1.6]
Sminthuridae	1	1.6
Arachnida		
Araneae	[4]	[6.2]
Araneidae	1	1.6
Oxyopidae	1	1.6
Theridiidae	1	1.6
Unidentified	1	1.6
Total	64	100.0

Table 1: Prey composition of *Tibellus macellus*.

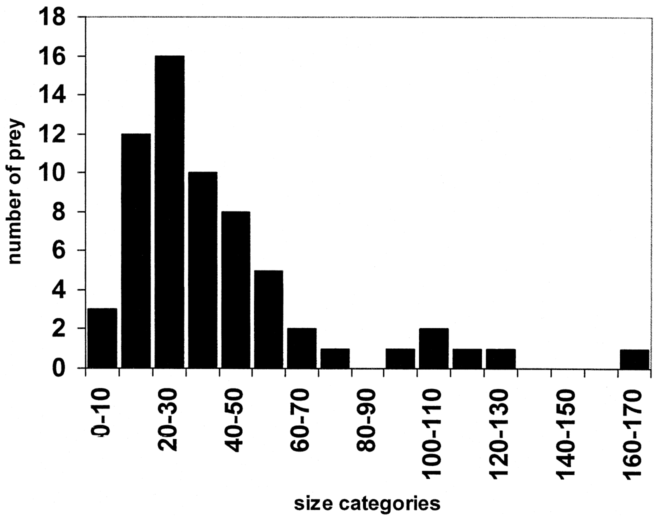

Fig. 1: Distribution of prey of *Tibellus macellus* in different size categories (body lengths of prey expressed as percentages of the body lengths of their captors).

Herberstein, 1997; Pekar, 2000), but are relatively rarely captured by cursorial spiders. The only study where aphids were found to be an important food component of cursorial spiders was that by Nyffeler & Benz (1988) on the prey of *Pardosa* spp. in a winter wheat field. Yet, even in this case the proportion of aphids was considerably lower (27%) compared with that in the present study (53%). It is worth mentioning that in the diet of the coexisting spider *O. lineatus* the percentage of aphids was insignificant (11.5%) (Huseynov, 2007). Further research is required to clarify the predator–prey relationship between *Tibellus* and aphids. However, the present study suggests that *T. macellus* might be considered as a potentially efficient biological control agent against harmful aphids.

Laboratory experiments have shown that *T. oblongus* exhibited a preference for smaller prey compared with other spiders from different families (Nentwig & Wissel, 1986). My field observations are in agreement with these results. Among 20 species of cursorial spiders that I have studied in the field, *T. macellus* has the lowest value of mean relative prey length (cf. Guseinov, 1999). It is remarkable that the coexisting spider *O. lineatus*, on average captured significantly larger prey (in terms of predator prey size ratio) than *T. macellus* (61.4 ± 35.3 vs. 39.5 ± 30.4%). Perhaps, spiders of the genus *Tibellus* specialise in capturing smaller prey in comparison with other cursorial spiders. Investigation of various species of *Tibellus* is needed to evaluate this hypothesis.

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