The prey of *Yllenus arenarius* (Araneae, Salticidae)

Maciej Bartos
Department of Teacher Training in Biology and Biodiversity Studies, University of Łódź, Banacha 1/3, 90-237 Łódź, Poland

Summary

The natural prey of *Yllenus arenarius* Menge, a dune-dwelling salticid, was collected from 1997 to 2002 in 11 inland dunes in central Poland. In the study 83 individuals of insects and arachnids were gathered. The most common prey were Diptera. Other frequently eaten prey were Heteroptera, Homoptera, Orthoptera, Hymenoptera and Araneae. The spiders hunted prey of a wide spectrum of body size, from about a quarter to twice the size of the spider. The mean ratio of prey body size to spider body size was 0.67 (SD=0.38, n=35). The most frequent prey according to size were items about half the size of the spider, and prey with body sizes between 20% and 80% constituted about 83% of the diet. A strong positive correlation was found between the predator and prey sizes (r=0.79, p<0.05, one-tailed test).

Introduction

Since they have a significant influence on insect populations, spiders as insect predators have gained considerable attention (see review in Wise, 1995). Despite usually being generalist predators, not specialising on specific prey (Riechert & Łuczak, 1982; Nentwig & Wissel, 1986; Nentwig, 1987) there have been many studies focusing on both web-building and non-web-building spiders as pest-controlling agents (e.g. Mansour *et al.*, 1983; Riechert & Bishop, 1990; review in Wise, 1995). Studies of spider prey having a limited direct application are much fewer, which is also true for the salticids, a common group well-known for their spectacular courtship and amazing prey-hunting tactics (Jackson, 1982; Jackson & Pollard, 1996). The diet of these spiders is rather difficult to study, compared with web-building spiders, because of the shorter time of prey retention and lower hunting success of hunters (Edgar, 1970; Jackson, 1977). Most salticids are generalist predators (Riechert & Łuczak, 1982; Nentwig & Wissel, 1986; Nentwig, 1987) with diet breadth higher than in web-builders and some other hunters which have been studied in this respect (Nyffeler, 1999). Their prey is similar to that of other cursorial predators, e.g. lycosids (Edgar, 1969). They both catch mainly Diptera, Homoptera, Hymenoptera and Lepidoptera (caterpillars and imagines) (Jackson, 1977; Nentwig, 1987). Some salticid species are specialists (Nentwig, 1987) and they hunt mainly other spiders (Jackson & Blest, 1982) or ants (Edwards *et al.*, 1974; Cutler, 1980). However, the preference for a certain kind of prey depends on its availability in the field and, when the preferred prey is unavailable, spiders can switch to other prey (Nentwig, 1987).

Spiders, like other predators, cannot catch prey which is either too large or too small and prefer prey items of certain dimensions (Nentwig, 1986). Prey which is too small is not perceived, ignored, or left after attack, especially when the costs of handling exceed the energetic food value; too large prey cannot be subdued by the spider and can easily escape. Some prey items can even injure the predator. *Evarcha* sp. is known to prefer prey 20–50% smaller than the spider (Nentwig, 1986), but also accepts prey 80–100% of its own size. Some tropical Salticidae have been reported to subdue prey as much as three times larger than the spider (Robinson & Valerio, 1977).

This paper is part of a wider study (Bartos, 2000) concerning predatory versatility of a salticid spider, *Yllenus arenarius* Menge, 1868. The aim of the following research is a description and analysis of the diet of *Y. arenarius*, which inhabits sandy places of mainly central and eastern Europe (Prószyński, 1990; Żabka, 1997). In comparison with other arachnids living in this habitat, it is a numerically dominant species among day-active hunters. The spider has a relatively long life cycle, lasting three seasons, with two temporarily coexisting cohorts (Bartos, 2000, and in prep.).

Material and methods

The research was carried out from 1997 to 2000 in 11 inland dunes in central Poland. The prey of *Y. arenarius* was collected from the spiders caught every two weeks (from the end of March to the end of September) for life cycle research (Bartos, in prep.). Spider mouthparts, as well as the containers in which spiders were transported to the laboratory, were checked in order to find prey. The prey was measured and preserved in alcohol for further determination. Prey body length was measured from the tip of the head to the end of the abdomen. Other prey items collected accidentally in 2001 and 2002 were also included in the study as qualitative data.

Spiders from three age groups were used in the research: juveniles in first year of life (juv-I), juveniles in second year of life (juv-II) and adults (ad.) in second and third years of life. Spiders were assigned to the age groups on the basis of their size and maturity. The method was developed after a four-year study of the spider life cycle. The characteristics of individuals of different ages proved to differ significantly, allowing easy age determination in the field (Bartos, in prep.). Since the spiders were released back in the dunes, the measurements were taken alive. To immobilise the spiders during the measurements they were covered with transparent kitchen foil and delicately pressed against a piece of sponge. Spider abdomen length was measured and the total body length was calculated on the basis of a proportion between body length and abdomen length derived from some anaesthetised specimens. In the years 1999 and 2000 invertebrates living in the dunes were collected by sweep-netting dune grass. These prey items were used in laboratory experiments concerning the hunting strategy of *Y. arenarius* (Bartos, 2002). Although no detailed study on potential prey was carried out, regular prey collecting for laboratory experiments and some field observations provided an impression of the spiders' potential prey, and their size and frequency in the field.

Results

Prey characteristics: In the field during the study period 83 individuals of insects and arachnids caught by the spiders were found (Fig. 1, Table 1). Some prey types, e.g. Diptera, Homoptera and Heteroptera, were typically found among spider food throughout the year and at the same time they were also present in sweepnet samples from dune grass. Some other prey items, e.g. Orthoptera, were preyed upon for several weeks only. Juvenile Acrididae grew up very quickly and although they were very common on the sand in spring and early summer, they were found among the spider diet only until the end of May. Out of four salticids found in the diet three individuals were cannibalised *Y. arenarius*, and one was *Heliophanus dubius* C. L. Koch. Two ants out of four caught by the spiders were winged. Only one of them, however, was *Formica rufibarbis*—the most numerous day-active invertebrate in the dunes. This ant was commonly observed in the field to be intentionally avoided by *Y. arenarius*.

Prey size: The spiders hunted prey of a wide spectrum of body size (Fig. 2), from about a quarter of spider size up to twice as large as the spider. The average body length of females of *Y. arenarius* was 6.02 mm (SD=0.34 mm, n=10), and of males 5.26 mm (SD=0.17 mm, n=10). The mean ratio of prey body size to spider body size was 0.67 (SD=0.38, n=35). In the spider diet the most common prey items were about half the size of the spider, and prey with body sizes between 20% and 80% of the spider size constituted about 83% of the diet. The smallest prey items were some Araneae, Diptera, Heteroptera and Thysanoptera. The largest prey items were larvae of Lepidoptera, some Hymenoptera and Heteroptera. There was a strong positive correlation (Fig. 3) between the predator and prey sizes (r=0.79, p<0.05, one-tailed test).

Prey type	N	%
Diptera	25	30.1
Brachycera	25	30.1
Heteroptera	13	15.7
Aradidae	3	3.6
other Heteroptera	10	12.0
Homoptera	12	14.5
Cicadinea	9	10.8
Aphidinea	3	3.6
Orthoptera	10	12.0
Acrididae	10	12.0
Hymenoptera	10	12.0
Formicidae	4	4.8
Andrenidae	2	2.4
other Hymenoptera	4	4.8
Araneae	8	9.6
Salticidae	4	4.8
Linyphiidae	2	2.4
Theridiidae	2	2.4
Lepidoptera (larvae)	2	2.4
Thysanoptera	1	1.2
Psocoptera	1	1.2
Coleoptera	1	1.2
Total	83	100

Table 1: Prey of *Yllenus arenarius*.

Discussion

Yllenus arenarius is an epigeic spider which hunts prey on the sand surface. Most of the potential prey is either blown onto the sand from the surrounding vegetation or actively moves around on the dunes. Although dunes are habitats which differ in many respects from those where salticid diets have previously been studied (Jackson, 1977; Nentwig, 1986), the proportions of different prey taxa are similar to those given by other authors for polyphagous salticids (Jackson, 1977; Nentwig, 1986). This effect is probably the result of similar representation or activity in the field of the main invertebrate groups rather than spider prey preferences. The latter, however, cannot be excluded at least for some prey types, e.g. Diptera, Homoptera and Orthoptera, which in laboratory experiments triggered the spiders' hunting behaviour more often than others (Bartos, unpubl.). In the case of Orthoptera the relatively high number of individuals caught by the spiders in the field during a limited time may suggest they are more readily eaten, but no preference tests were done.

Numerous investigations on prey sizes preferred by spiders suggest that they are on average 25% up to 75% of spider size (see review in Nentwig, 1987). The results

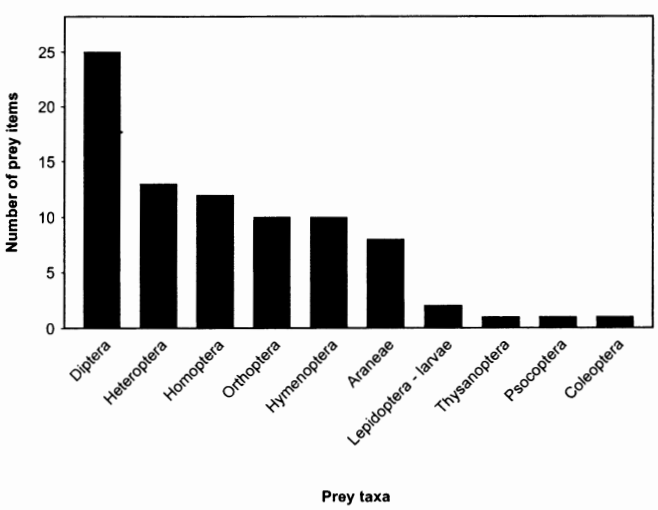

Fig. 1: Prey of *Yllenus arenarius*.

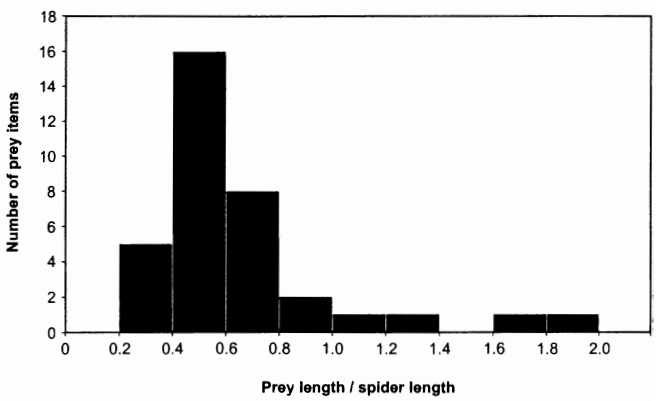

Fig. 2: Number of prey in different size groups, presented as ratio of prey length/spider length.

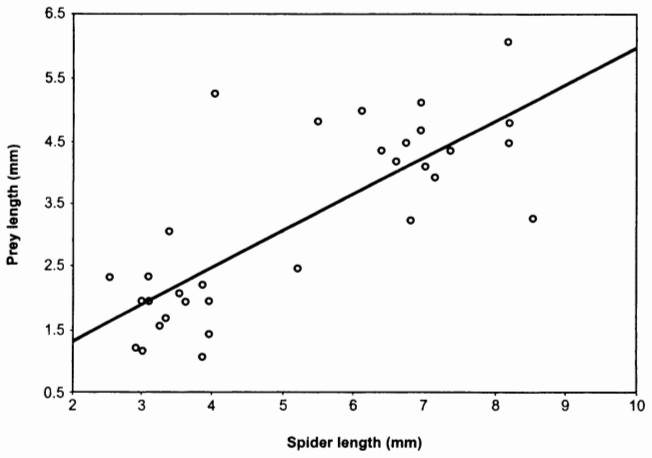

Fig. 3: Correlation between spider length and prey length ($r=0.79$, $p<0.05$, one-tailed test).

for the prey size of *Y. arenarius* support earlier findings concerning prey size preferences of spiders (Nentwig & Wissel, 1986; Nentwig, 1987). All the studies show that spiders can hunt prey smaller and much larger than themselves, but the correlation, however, suggests that larger spiders prefer relatively larger prey and smaller predators prefer smaller prey. Such size preferences can signify a qualitative change in diet over the spider's life and can reduce food competition between two temporarily coexisting cohorts. The laboratory observations support this assumption. Spiders ignored prey which was either significantly smaller or larger than themselves. In the laboratory adult spiders ignored Thysanoptera and Homoptera whose body length was about 40% or less of the spider body length (Bartos, unpubl.). Juveniles in the first and second year of life constantly ignored prey more than twice their own length. First, however, the prey perception posture was observed, but for some very small prey, adults and juveniles did not exhibit the characteristic posture signifying prey perception, which could mean that it remained unnoticed. Large Orthoptera could easily push small spiders off their bodies and jump away. The exceptions were caterpillars, which were stabbed and not held but released after venom injection. Some larvae, even three times larger than the spider, were attacked and eaten. The rather low number of caterpillars in the spider diet could result not only from their low representation in the dune, but they could also have been overlooked while collecting the spiders, since *Y. arenarius* keeps at a distance from the stabbed but still moving prey. Several times the spiders escaped from a wriggling caterpillar after being bitten or after contact with liquid discharged from the caterpillar's mouth.

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