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THE PREY OF THE LYNX SPIDER *OXYOPES GLOBIFER* (ARANEAE, OXYOPIDAE) ASSOCIATED WITH A SEMIDESERT DWARF SHRUB IN AZERBAIJAN

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ABSTRACT. The prey of the lynx spider, *Oxyopes globifer* Simon 1876, occurring on *Salsola nodulosa* (Moq.) plants, was analyzed. In common with other cursorial spiders, the percentage of feeding specimens in the population of *O. globifer* was low (5.5%). Males were observed feeding significantly less frequently than females and immatures of both sexes. After oviposition, however, the records of prey capture in egg-guarding females also declined considerably. *Oxyopes globifer* is a polyphagous predator feeding on a wide range of arthropods: insects of the orders Hymenoptera, Diptera, Lepidoptera and Homoptera, as well as on several spider species. The primary food was worker ants, which accounted for 62.7% of total prey. No other prey taxon was present in any considerable percentage. *O. globifer* captured prey ranging between 22.7 and 243.8% (mean 88.8%) of its own body length. Most frequently taken were medium-sized arthropods varying from 50–110% of spiders' body lengths.

Keywords: diet, myrmecophagy, prey length, semidesert, Azerbaijan

Most lynx spiders (Oxyopidae Thorell 1870) are typical cursorial hunters, which possess relatively keen eyesight and do not use silk for prey capture (Kovoor & Munoz-Cuevas 1997). Instead, they actively pursue their prey and seize it with a short lunge (*Oxyopes* Latreille 1804) or attack it from ambush (*Peucetia* Thorell 1869) (Rovner 1980).

In common with other cursorial spider groups, the literature on prey of Oxyopidae is scarce. Exceptions are the striped lynx spider, *Oxyopes salticus* Hentz 1845 (Lockley & Young 1987; Nyffeler et al. 1987b, 1992; Agnew & Smith 1989; Bardwell & Averill 1997), and the green lynx spider, *Peucetia viridans* (Hentz 1832) (Turner 1979; Randall 1982; Nyffeler et al. 1987a, 1992; Quicke 1988), both being from North America. Less extensive quantitative data are available on the natural prey of *Oxyopes apollo* Brady 1964 from the USA (Agnew & Smith 1989), and *O. licenti* Schenkel 1953 and *O. sertatus* L. Koch 1877 from Japan (Furuta 1977).

The present paper is the first study of the prey of the Mediterranean lynx spider, *Oxyopes globifer* Simon 1876, which occurs in North Africa, Southern Europe, Near East and Central Asia (Levy 1999). In Azerbaijan, individuals of this species are frequently found on dwarf shrubs *Salsola nodulosa* (Moq.), *Artemisia fragrans* (Boiss.), and *Noaea mucronata* (Forssk.). *O. globifer* has an annual life cycle. Adult specimens appear at the end of May and mating lasts throughout June. At the beginning of July males disappear, while females start to produce egg sacs, which they attach to the branches of shrubs. Females attend their cocoons until the young emerge. Breeding season runs until mid September and individual females usually produce several egg sacs during this period (Huseynov unpubl. data).

The investigation was carried out on the Apsheron Peninsula in Azerbaijan. The study site was located near Yeni-Surakhany village (40°42′N, 49°95′E). This was an open area of ephemeral semidesert covered with dwarf shrubs *Salsola nodulosa*, *Alhagi pseudoalhagi* (M.B.) and short grasses, predominantly *Calendula persica* C.A.M., *Senecio vernalis* Willd. & Kar., *Medicago denticulata* Willd., *Carduus arabicus* Jacq., *Erodium cicutarium* (L.), *Pterotheca marschalliana* (Rchb.), *Poa bulbosa* L., *Anisanthea rubens* (L.) and *Aegilops biuncialis* Vis.

O. globifer was abundant only on *Salsola* shrubs, therefore observations were concentrated exclusively on this plant. Sixteen surveys were conducted from 20 May–9 September 1998 and took 27.5 h in total. All observations were made in daylight between 12:00 and 18:00 h. During surveys, *Salsola* shrubs were thoroughly searched for spiders, and each individual *O. globifer* found was captured in a transparent glass vial. In the vial the spider's mouthparts were inspected with a loupe of 4 × magnification to prevent small prey being overlooked. Specimens with prey in their chelicerae were placed in separate vials containing 75% ethyl

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alcohol and brought back to the laboratory for body length measurement and prey identification.

All spiders observed were classified into several groups according to their age, sex and presence or absence of egg sacs near females. When the investigation started, the vast majority of spiders were in the sub-adult stage. Thus, the following four groups were delimited: (1) sub-adult males, which had swelled, but not differentiated pedipalp tips; (2) adult males, with distinctly developed palpal sclerites; (3) pre-reproductive females, including all spiders without swollen pedipalp tips and without egg sacs; (4) females guarding their egg sacs. During each survey the number of spiders with and without prey was counted separately within each of the four groups. Because the study area was large (ca. 500 $\times$ 500 m) and successive surveys were conducted in different parts of this area, it is highly likely that most of the *O. globifer* observed were different specimens. The log-likelihood ratio test (G_1 statistic) was used for comparison of percentage of feeding specimens among different groups of spiders. Voucher specimens of *O. globifer* and their prey items were deposited at the Institute of Zoology, Azerbaijan Academy of Sciences.

In total, 947 specimens of *O. globifer* were observed, 52 of which (5.5%) had prey in their chelicerae. Among them 93 sub-adult males (6 with prey ~6.5%), 153 adult males (4 with prey ~2.6%), 431 pre-reproductive females (36 with prey ~8.4%) and 270 females with egg sacs (6 with prey ~2.2%) were recorded. The percentage of feeding specimens in pre-reproductive females was significantly higher than those in adult males ($G_1 = 6.98$, $P < 0.01$) and egg-guarding females ($G_1 = 12.7$, $P < 0.001$). In contrast, there was no statistically significant difference between pre-reproductive females and sub-adult males in this respect ($G_1 = 0.39$, $P > 0.5$).

One spider seen with prey escaped, so 51 prey items were collected for dietary analysis. These prey items were distributed among five orders of arthropods: four from the class Insecta (Hymenoptera 68.6% of total prey, Diptera 11.8%, Lepidoptera 11.8%, Homoptera 2.0%), and one from the class Arachnida (Araneae 5.9%). The dominant food component was worker ants, which accounted for 62.7% of total prey. *Cataglyphis aenescens* Nylander contributed the bulk of ants (28 specimens), followed by two *Cardiocondyla* sp. and two *Plagiolepis* sp. Other hymenopterans included two bees *Coelioxys argentea* Lepeletier (Megachilidae), *Halictus* sp. (Halictidae) and one parasitic wasp (Braconidae). Diptera were represented by five bombyliids (*Villa* sp.) and one dolichopodid fly, and Lepidoptera comprised one unidentified moth and five unidentified caterpillars. Among the spiders captured were one gnaphosid (*Micaria rossica* Thorell 1875), one unidentified salticid and one conspecific. The latter was the male captured by the female; i.e. sexual cannibalism probably took place. The remaining prey was a leafhopper (Cicadellidae).

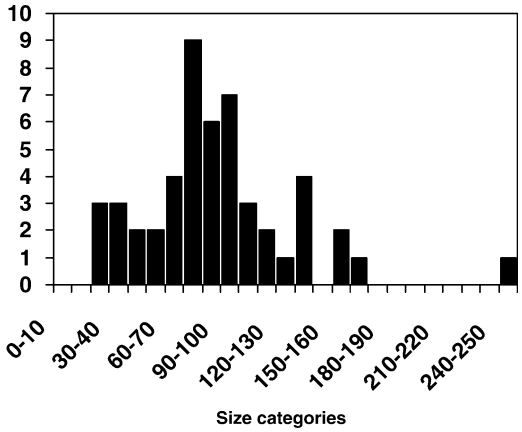

Figure 1.—Distribution of prey in different size categories, which are body lengths of prey expressed as percentage of the body lengths of their captors.

Fifty prey items were measured. Their length varied from 1.5–12.8 mm (mean $\pm$ SD: 4.9 $\pm$ 2.6 mm) and constituted from 22.7–243.8% (88.8 $\pm$ 40.9%) of the length of their captors (Fig. 1), which ranged from 4.7–9.0 mm (6.7 $\pm$ 1.0 mm). According to their body length, all prey of *O. globifer* can be divided into three groups. Small prey, not exceeding 3 mm in length, made up 14.9% of total prey measured. This group included the salticid spider, the dolichopodid fly, the leafhopper, *Cardiocondyla* and *Plagiolepis* ants, none of which exceeded half the size of their captors. The largest part of the diet of *O. globifer* (62.5%) was medium-sized arthropods (3–7 mm), consisting of all specimens of *Cataglyphis aenescens*, the halictid bee, the braconid wasp, two spiders (*Micaria rossica*, *Oxyopes globifer*) and one lepidopteran larva. Relative length of these prey items varied from 50–110%. The third group consisted of arthropods larger than 7 mm, being from 110–250% of their captors' lengths. This prey amounted to 22.9% of the prey as a whole and included a moth, a megachilid bee, bombyliid flies and most caterpillars.

There was no positive relationship between spider length and prey length (Correlation analysis, $r = 0.1588$, $P = 0.271$), and no difference between spider sexes in the prey length taken (ANOVA, $F_{4,45} = 0.3020$, $P = 0.875$).

The percentage of feeding specimens in the population of *O. globifer* studied was low (5.5%), as is usual with cursorial spiders (Nyffeler & Breene 1990) and lynx spiders in particular (Nyffeler et al. 1987a, b, 1992). Moreover, the percentage of feed-

Table 1.—Length of prey of different oxyopid species.

Spider species	*n*	Length of spiders mm range	Length of spiders mm mean	Length of prey mm range	Length of prey mm mean	Length of prey % range	Length of prey % mean	Source
Oxyopes salticus	64	2.6–8.0	—	0.6–5.6	2.61	10.0–110.0	—	Nyffeler et al. 1987b
Oxyopes salticus	63	1.9–8.0	4.24	0.5–5.8	2.41	8.0–129.0	56.0	Nyffeler et al. 1992
Peucetia viridans	25	8.2–12.7	10.96	1.6–16.5	5.90	14.0–130.0	—	Nyffeler et al. 1987a
Peucetia viridans	31	4.5–16.5	10.08	1.3–13.6	7.04	26.0–136.0	68.0	Nyffeler et al. 1992
Oxyopes globifer	50	4.7–9.0	6.70	1.5–12.8	5.90	22.7–243.8	88.8	Present study

ing specimens among adult males was significantly lower than among pre-reproductive females. Laboratory investigations on feeding in other oxyopids have also revealed that males feed less often than females (Lingren et al. 1968; Furuta 1977). A similar tendency has been reported in jumping spiders (Salticidae) by Jackson (1977) and Givens (1978). Both investigators attributed this fact to the specific life style of salticid males, which emphasizes mating and only opportunistically involves feeding. In contrast, females, which need a high intake of food for yolk production, spend much of their time searching or waiting for prey. It seems reasonable to apply this speculation to lynx spiders too. In this context it is worthwhile to note that the percentage of feeding specimens among sub-adult males of *O. globifer* was comparable to that among pre-reproductive females. Apparently the life style of immature males does not differ significantly from that of females and changes drastically only after final molt.

After oviposition, lynx spider females normally attend their cocoons (e.g., Cutler et al. 1977). Such behavior facilitates protection of eggs and increases survival of the offspring (Fink 1986), but it is disadvantageous for parent spiders themselves, since this restricts their hunting activity. Although egg-guarding oxyopid females have been observed eating prey (e.g., Willey & Adler 1989), this is probably not frequently the case, because spiders have no opportunity to choose optimal foraging sites when they brood their egg sacs. One would therefore expect a substantial reduction in feeding frequency in *O. globifer* females during the egg-guarding period. In fact, the percentage of feeding specimens among egg-guarding females was significantly lower than among solitary ones. In wolf spiders the feeding frequency of maternal females is also significantly lower than that of non-maternal females (Nyffeler 2000).

This investigation has shown that *O. globifer* is a polyphagic predator feeding on a wide range of arthropods. Lynx spiders are generally known to have broad diets (see Nyffeler 1999). The heavy prevalence of worker ants in the diet of *O. globifer* may be unusual, since these insects, possessing effective defensive equipment, are not palatable to most cursorial spiders (Nentwig 1986). However, myrmecophagy is apparently a common phenomenon within the family Oxyopidae. Worker ants were found among the prey of all lynx spiders, where data on natural prey is available: *O. salticus* (Nyffeler et al. 1987b), *O. apollo* (Agnew & Smith 1989), *O. scalaris* (McIver 1989), *O. licenti* and *O. sertatus* (Furuta 1977), *P. viridans* (Nyffeler et al. 1992). Does *O. globifer* prefer ants to other prey or is their predominance in its diet due to the abundance of these insects on *Salsola nodulosa*? Experimental laboratory investigations are required to answer this question. However, extensive field observations on the prey of *O. salticus* in cotton agroecosystems in the USA have shown the proportion of ants in the diet of this species to be highly variable. While worker ants were the dominant food component of spiders occurring in Houston County, Texas (Nyffeler et al. 1987b), their percentage was quite insignificant in the diet of *O. salticus* inhabiting cotton fields in Burleson County, Texas (Nyffeler et al. 1992), and they were entirely missing among prey of spiders observed in Sunflower County, Mississippi (Lockley & Young 1987). These data suggest that the proportion of ants in the diets of *Oxyopes* species may depend significantly on their abundance in the spider's habitat.

The range and mean value of relative length of prey of *O. globifer* were greater than those of other lynx spiders studied (Table 1). However, this difference is not pronounced. There was a marginally significant positive relationship between spider length and prey length across species (Correlation analysis, $r = 0.853$, $P = 0.066$). Larger species (*P. viridans*) tended to catch larger prey, while smaller species (*O. salticus*) tended to catch smaller prey than did *O. globifer*.

Laboratory tests on prey-size preference of spiders have shown that most cursorial spiders do not capture prey larger than 150% of their body length, with a most preferred range of 50–80% (Nentwig & Wissel 1986). *Oxyopes globifer* caught several

prey items exceeding 150% of its length. However, the proportion of such prey in its diet was low. Moreover, only one prey item was more than two-fold larger than its captor (243.8%). This is probably the largest prey recorded for oxyopid spiders (in terms of prey/predator size ratio). All other prey have not exceeded 170% in relative length, and medium-sized arthropods prevailed among them. Thus, one can conclude that the prey-size spectrum of *O. globifer* is, in general, comparable to the common pattern found among cursorial spiders, although it is somewhat biased to large prey.

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