ORB-WEBS AS EXTENDED-PHENOTYPES: WEB DESIGN AND SIZE ASSESSMENT IN CONTESTS BETWEEN NEPHILENGYS CRUENTATA FEMALES (ARANEAE, TETRAGNATHIDAE)

by

CYNTHIA SCHUCK-PAIM\textsuperscript{1,2)}

(Department of Ecology, University of Sao Paulo, Brazil)

(Acc. 27-V-2000)

Summary

In this study I investigate a mechanism underlying size assessment during contests between females of the orb-weaving spider \textit{Nephilengys cruentata}. Among orb-weaving spiders, some structural parameters of webs have been shown to vary with the size of the web builder, making it theoretically possible for an intruder to gather information about the web's resident when initiating a fight. Here I examined whether \textit{N. cruentata} females are able to assess the size of the web owner during contests by using information from web design. The fighting behaviour of intruders was analysed in two situations: (1) web design indicated the presence of a small resident but actual resident size was large (treatment) and (2) web design cued the presence of a large resident, and actual resident size was also large (control). This was achieved by removing original web builders from their webs and letting newly introduced spiders establish ownership before inducing conflicts. Results were consistent with the hypothesis that web design is used as a cue for web resident size. Strategies adopted by intruders were influenced at an initial stage of the fight mainly by the size of the web builders instead of the size of the newly established residents. The implications of the results for the understanding of fighting behaviour in this species are discussed.

\textsuperscript{1)} Current address: Department of Zoology, University of Oxford, South Parks Road OX1 3PS, Oxford, UK; e-mail address: cynthia.schuck@zoo.ox.ac.uk
\textsuperscript{2)} I am very grateful to C. Ades, W.J. Alonso, J. Chappell, P.S. Santos-Filho, W. Vahl, J. Vasconcellos-Neto, the editor and the anonymous referees for helpful comments on earlier versions of the manuscript. Financial support to this work was provided by CAPES — Coordenacao de Aprimoramento de Pessoal de Nivel Superior.
Introduction

Intraspecific conflicts over resources are generally asymmetric: the opponents may differ in competitive ability (‘resource holding power asymmetry — RHP’: Parker, 1974), in the relative value of the disputed resource (‘pay-off asymmetry’), or even in some arbitrary convention which is not correlated with either competitive ability or pay-off (‘uncorrelated asymmetry’). There is a great body of evidence showing that most conflicts are settled on the basis of some kind of asymmetry. In general, asymmetry in competitive ability (usually related to body size) is a good predictor of contest outcome (reviewed in Hutington & Turner, 1987). However, asymmetries can only be used to settle contests if contestants are informed about them (Maynard-Smith & Parker, 1976). Game theory models predict, in this sense, that fighting strategies function to allow contestants to assess the probability that the opponent will win a fight (Parker, 1974; Parker & Rubenstein, 1981; Enquist & Leimar, 1983; Leimar & Enquist, 1984), so that they can decide whether to give up or to escalate the combat.

Studies of aggressive interactions among spiders are widespread in the agonistic conflict literature, and can be classified in two main categories: conflicts between females over web sites and conflicts between males over mates. In both categories, relative body size is a good predictor of contest outcome and, thus, of competitive ability: the greater the difference in size, the higher the probability that the larger spider will win the contest (e.g. Buskirk, 1975; Riechert, 1978; Wells, 1988; Dodson & Beck, 1993; Faber & Baylis, 1993; Hodge & Uetz, 1995). Among web-building spiders empirical evidence indicates that fighting ability is indeed assessed during conflicts (Riechert, 1978; Leimar et al., 1991; Hack et al., 1997). In spite of the extremely poor vision typical of web builders (Homman, 1971), transmission of vibrations on the web may provide a reliable cue for weight assessment of individuals engaging in movements and displays (Witt, 1975; Riechert, 1984). Yet, little attention has been paid to the role of the web in cueing contest behaviour. This is a potential source of information about the web builder size in the case of orb weaving spiders, since web parameters have been shown to change with the spider body size, even when a fixed web area is considered (e.g. Witt et al., 1972; Opell, 1987; Vollrath, 1987; Eberhard, 1988; Miyashita, 1997). Although other factors might account for variations (Sandoval, 1994; Vollrath et al., 1997), webs with larger sticky spiral spacing