

TAKING CARE ABOUT FUTURE: EVIDENCE OF MATE GUARDING BEHAVIOUR IN *SYNEMA GLOBOSUM* (ARANEAE: THOMISIDAE)

Marco Colombo¹ & Piergiorgio Di Pompeo²

¹ Busto Arsizio (VA), Italy. calosoma88@gmail.com

² Bologna (BO), Italy. piergiorgio.dipompeo@alice.it

Abstract: In this work we present for the first time 12 observations of mate guarding behaviour in the spider *Synema globosum* (Araneae: Thomisidae) and a ritualized fight between two adult males.

Key words: Crab spider, reproductive strategy, mate guarding, etology, sexual selection

Cuidando el futuro: evidencia del comportamiento de mate guarding en *Synema globosum* (Araneae: Thomisidae)

Resumen: En este trabajo se presentan por primera vez 12 observaciones del comportamiento de mate guarding en la araña *Synema globosum* (Araneae: Thomisidae) y una lucha ritualizada entre dos machos adultos.

Palabras clave: Araña cangrejo, estrategia reproductiva, escolta de pareja, etología, competencia intrasexual

Prendersi cura del futuro: evidenza del comportamento di mate guarding in *Synema globosum* (Araneae: Thomisidae)

Riassunto: In questo lavoro vengono presentate per la prima volta 12 osservazioni del comportamento di mate guarding nel ragno *Synema globosum* (Araneae: Thomisidae) e un caso di combattimento rituale tra maschi adulti.

Parole chiave: Ragno granchio, strategia riproduttiva, mate guarding, etologia, selezione sessuale

Introduction

The behaviour of mate guarding, in which adult males stay near or in the burrows of females, is a strategy aimed at driving away any rival males and therefore preventing the female from mating several males, avoiding the sperm competition that would follow; forms of mate guarding and cohabitation have been known and documented for decades in several arthropods, including crustaceans, insects and arachnids such as mites and spiders (Birkhead & Clarkson, 1980; Holdsworth & Morse 2000; González Pisani & López Greco, 2020; Jormalainen & Merilaita, 1993; Oku, 2009).

Mate guarding in Araneae was first studied by Robert R. Jackson, who mainly addressed the cohabitation behaviour of the family Salticidae and Araneidae (Jackson, 1986). A bibliographic review on the topic has been recently published by Elias *et al.* (2011). Most of the reports and studies on this behavior in spiders concern precopulatory mate guarding, in which adult males guard immature or receptive females, attacking and trying to drive away other male suitors; adult males often coexist in the same web or silk sac of the subadult female and mate shortly after the female has moulted. This behaviour has been documented in Araneidae, Salticidae and Thomisidae (Elgar & Bathgate, 1996; Del Matto *et al.*, 2021; Jackson, 1986; Chan *et al.*, 2008).

Reports of postcopulatory mate guarding, in which adult males guard or coexist in the same silk sac or cobweb with the females they have already mated with, in order to avoid subsequent mating of the female with other males, have also been reported in Pholcidae (Calbacho-Rosa *et al.*, 2010; Elias *et al.*, 2011) and Araneidae (Herberstein *et al.*, 2005; Kuntner *et al.*, 2009; Del Matto *et al.*, 2021).

Precopulatory mate guarding seems to be more widespread in spiders than postcopulatory mate guarding due to the greater sperm success of the first male that manages to fertilize a female. This is confirmed for many Entelegynae spiders (Elias *et al.*, 2011), although sperm hierarchies have been scarcely studied, with the exception of few well-studied species in recent works (Matzke *et al.*, 2022). Nevertheless, postcopulatory mate guarding behaviors, plugs, mutilations of

the female epigyne after mating, are recorded in several families (Schneider & Fromhage, 2010; Mouginot *et al.*, 2015).

Details of male-to-male fights have been described, mostly in Salticidae (Hoefler, 2007; Chan *et al.*, 2008; Elias *et al.*, 2014). Among Thomisidae, details of fights have been described for *Misumenoides formosipes* (Walckenaer, 1837) (Dodson & Beck, 1993; Dodson & Schwaab, 2001; Dodson *et al.*, 2015). Adult males wait, standing on the same stems a few centimeters from sub-adult females (close to mature age) and often fight very fiercely for supremacy. Encounters can lead to the immediate retreat of one of the contenders, without an actual fight. Escalation can occur between specimens of similar size. In this case, the fight ends with the escape of the loser (which may also lose a leg for autotomy), or with the killing and cannibalization by the victorious male.

In *Misumena vatia* (Clerck, 1757), precopulatory mate guarding was rarer compared to *M. formosipes* and fighting episodes were not common. In cases of actual combat, no males suffered amputations or other injuries (Holdsworth & Morse, 2000). Age of adult males in mate guarding influences their aggressiveness towards other males, with higher rates of attack and aggressivity by older specimens. The most plausible explanation for this phenomenon is the fact that very old specimens have less ability to move and encounter other females (Anderson & Morse, 2001; Hu & Morse, 2004; Morse, 2007).

Therefore, many reports both for weaver and wandering species have been described, but there have been very few observations of this behaviour in the Thomisidae family; in this work, we record it for the first time in *Synema globosum* (Araneae: Thomisidae).

Spiders were looked for inspecting bushes and vegetation during daytime in two different localities across Italy. Observation in Oasi Le Bine/Parco Oglia Sud (CR) has been made during a “Bioblitz”, an annual event open to the public, organized by protected areas, in order to involve the public in research topics and biodiversity importance.

Material examined:

Synema globosum, 10.VI.2020, Pescara (PE), Abruzzo: *Teucrium fruticans* hedge, 2 different pairs 50 cm apart, in each one an adult male guarding a subadult female, one of the latter moulting; 22.V.2022, Oasi Le Bine/Parco Oglio Sud (CR), Lombardy: open grassland in reforestation area with mixed plant species, 1 pair on *Melilotus officinalis*, male fighting with another incoming male; 28.V.2023, Pescara (PE), Abruzzo: *Teucrium fruticans* hedge and *Euryops pectinatus* inflorescences, 4 different pairs, in each one adult males guarding subadult females; 29.V.2023, Pescara (PE), Abruzzo: *Euryops pectinatus* inflorescences, 5 different pairs, in each one adult males guarding subadult females.

Results and discussion

Mate guarding was observed in *Synema globosum* (Araneae: Thomisidae) in four instances from two localities in Italy. In one case, the subadult female was moulting (Fig. 1).

In another case an adult male was fighting with another to defend its position (Fig. 2): this male was guarding for a female hidden in a silk sac, was approached by another specimen of the same sex. After the first touch with the forelegs, both specimens begun swinging back and forth, opening chelicerae and trying to bypassing each other. No chelicerae contact has been observed, but the fight was very fast and soon the contender left the scene. These observations seem to indicate that *S. globosum* engaged in precopulatory mate guarding (as already observed with other species in the same family, see references in the Introduction), because at least one case the female was fulfilling the last moult, and could not have been mating before.

What has been observed seems to outline a strong male-male competition over mating first and the high value of subadult virgin females: this is in agreement with the morphological structure of the ducts and spermatheca in the Entelegynae in which the precedence for the fertilization of the eggs is to the advantage of the first spermatozoa introduced (Austad, 1984; Elgar, 1995).

Although observations of mate guarding in spiders have already been documented in the literature, this behaviour has so far been little reported in Thomisidae. From our observations, precopulatory mate guarding behavior appears to be very common in *S. globosum* during the reproductive period: in the Pescara area, all the subadult females observed had one or more adult males next to them.

Mate guarding (and possibly male fighting) seems to be more widespread in spiders than previously thought.

Interestingly, one observation has been made during an annual event open to the public (Bioblitz), confirming the importance of citizen science.



Fig. 1. Mate guarding in *Synema globosum*, Pescara: please note the subadult female moulting to adult age (photograph by P. Di Pompeo)

Fig. 2. Male-to-male fighting in *Synema globosum*, Oasi Le Bine: the female is hidden in a silk sac under the leaf and only legs are visible (photograph by F. Russo)

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