ATTACK ON SALTICIDAE: NEW RECORDS OF MANTISPIDS (NEUROPTERA: MANTISPIDAe) IN NEOTROPICAL JUMPING SPIDERS (ARANEAE: SALTICIDAE)

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ABSTRACT

Jumping spiders present natural enemies like insects of the subfamily Mantispinae. We report for the first time for Uruguay the salticids *Neonella minuta*, *Tullgrenella serrana* and the presence of Mantispinae larvae in this species and in *Sarinda* sp. In *T. serrana* we record the development of the parasitoid *Dicromantispa gracilis*.

Key words: Araneomorphae, larvae, parasitoidism, spider egg sacs.

Salticidae Blackwall, 1841 is currently the most diverse family within the order Araneae, with 646 genera and 6229 species (World Spider Catalog, 2020). This family is distributed worldwide (except in Antarctica), and is characterized by having larger middle eyes than the rest with a highly developed vision, with which they stalk and hunt their prey by jumping during the day (Jocqué & Dippenaar, 2006). In the Salticidae family, several natural enemies like insects of the family Mantispidae Leach, 1815 (Neuroptera) (Redborg & MacLeod, 1985; Hoffman & Brushwein, 1989, Rice & Peck, 1991; Monserrat, 2014). This family is composed of four subfamilies: Calomantispinae Lambkin, 1986, Drepanicinaceae Lambkin, 1986, Mantispinae Leach, 1815 and Symphrasinae Lambkin, 1986, with 44 genera and 420 species (Monserrat, 2014), being Mantispinae the richest in species and most studied subfamily. The Mantispinae larvae are obligatory parasitoids of spiders since they need them to complete their development (Redborg, 1998). The larvae of Mantispinae species present three different instars where the morphology changes abruptly, the first one is campodeiform and the second and third ones are scarabaeiform (Redborg, 1998). Females lay large egg masses on posts, fences, and bushes, where spiders often roam (LaSalle, 1986; Rice, 1986). Once the larva emerges from the egg, they can perform two strategies to locate a spider egg sac: it moves until it finds an egg sac and penetrates it or is transported by the spider and gets into the egg sac when the spider builds it. Some mantispinae species facultatively can use either of these two mentioned strategies (Redborg & MacLeod, 1985; Redborg, 1998). In addition to feeding on the eggs, there are records where mantispid larva can also feed on spider hemolymph (Redborg & MacLeod, 1984; Hoffman & Brushwein 1989; Hoffman & Brushwein, 1989; Rice & Peck, 1991). When the spider female makes the egg sac, the larvae gets inside and feeds on the eggs, and once it is fed enough it begins to pupate, and then emerges as an adult (Redborg, 1998). This parasitoidism is registered for 30 spider families: Agelenidae, Anyphaenidae, Araneidae, Cheiracanthiidae, Clubionidae, Corinnidae, Ctenidae, Ctenizidae, Dictynidae, Dysderidae, Filiostrephonidae, Gnaphosidae, Lycosidae, Nipponopidae, Oecobiidae, Oxyopidae, Philodromidae, Pholcidae, Pisauridae, Salticidae, Scytodidae, Sicariidae, Sparassidae, Tetragnathidae, Theraphosidae, Theridiidae, Thomisidae, Trechaleidae, Uloboridae and Zoropsidae (Capocasale, 1971, Hoffman & Brushwein, 1989; Rice & Peck 1991; Brushwein et al. 1992; Redborg, 1998; Nunn, 2011; Monserrat, 2014; Trillo et al. 2015). Salticidae Blackwall, 1841 is currently the most diverse family within the order Araneae, with 646 genera and 6229 species (World Spider Catalog, 2020). This family is distributed worldwide (except in Antarctica), and is characterized by having larger middle eyes than the rest with a highly developed vision, with which they stalk and hunt their prey by jumping during the day (Jocqué & Dippenaar, 2006). In the Salticidae
family the presence of mantispid larvae is registered for 18 genera: *Bagheera* Peckham & Peckham, 1896, *Eris* C. L. Koch, 1846, *Habronattus* F. O. Pickard-Cambridge, 1901, *Hentzia* Marx, 1883, *Lyssomanes* Hentz, 1845, *Metacyrba* F. O. Pickard-Cambridge, 1901, *Maevia* C. L. Koch, 1846, *Menemerus* Simon, 1868, *Metaphidippus* F. O. Pickard-Cambridge, 1901, *Mopsus* Karsch, 1878, *Peckhamia* Simon, 1900, *Phidippus* C. L. Koch, 1846, *Platycryptus* Hill, 1979, *Plexippus* C. L. Koch, 1846, *Psecas* C. L. Koch, 1850 *Salticus* Latreille, 1804, *Servaea* Simon, 1888, *Synageles* Simon, 1876 (Redborg & MacLeod, 1983; Austin, 1985; Downes, 1985; Hoffman & Brushwein, 1989; Rice & Peck, 1991; Brushwein et al. 1992; Rienks, 2000; Vieira & Romero, 2008; Hill, 2011; Snyman et al. 2020).

The aim of this study is to report for the first time parasitoidism in three species of neotropical jumping spiders by Mantispinae species.

A female of *Neonella minuta* Galiano, 1965 (Salticidae: Salticinae: Euophryini) was found in dry grasses and one female of the genus *Sarinda* Peckham & Peckham, 1892 walking on an external wall of a rural house, both collected in Melilla, Montevideo, Uruguay (34°43’53”S, 53°51’37”W) in a hill, under a rock. The presence of mantispid larvae on the spiders was verified in the field and later confirmed by examining the specimens under binocular magnifying glasses. *Tullgrenella serrana* and *Sarinda* sp. were kept under laboratory conditions in plastic petri dishes with a piece of cotton moistened in water and fed with *Drosophila melanogaster* Meigen, 1830 (Diptera: Drosophilidae) ad libitum. *Neonella minuta* was fed with springtails (Hexapoda: Collembola) and whiteflies (Homoptera: Aleyrodidae) ad libitum, due to its small size. The day of oviposition of the female of *T. serrana* and the day of hatching of the mantispid were recorded. We follow Machado & Rafael (2010) descriptions for the determination of the mantispid. Spiders and mantispids were preserved in 75% ethanol and were deposited in the Entomological Collection of the Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay. Photographs of the live specimens were taken with an Olympus Tough TG-4 camera and the photographs of preserved specimens in ethanol with a Nikon D3500 adapted to a stereo microscope.

The presence of *T. serrana* and *N. minuta* is registered for the first time for Uruguay. In turn, the association of *Dicromantispa gracilis* (Erichson, 1839) (Neuroptera: Mantispidae: Mantispinae) with *T. serrana*
is recorded for the first time. The position of the mantispid larvae on *N. minuta, Sarinda* sp. and *T. serrana* was similar, being found attached to one side of the prosoma and with their mouthparts towards the pedicel region (Fig. 1A-E). Female of *T. serrana* made an egg sac and after 28 days (September 20, 2019 – October 18, 2019) a *D. gracilis* pupa emerged (Fig. 1F), leaving the egg sac completely empty.

This is the first record of parasitoidism of mantispsids in three species of the Salticidae family, *N. minuta*, *Sarinda* sp. and *T. serrana*. We register that *T. serrana* is host of *D. gracilis* and previous studies in Uruguay indicate the occurrence of this species parasitizing egg sacs of Trechaleidae family, with records for the departments of Lavalleja, Paysandú and Treinta y Tres (Trillo et al., 2015), with the new records, we extended the range of distribution of the mantispid to the department of Cerro Largo. *Neonella minuta* and *Sarinda* sp. died before making the ootheca, so it was not possible to visualize the complete development to determine the mantispid species associated with them. It is known that larvae of parasitoids have a minimum requirement of nutrients in order to complete their development (Rice, 1985), this establishes a limit size of host to guarantee these necessary nutrients. It is possible, therefore, that small species such as *N. minuta* and *Sarinda* sp. are not viable hosts for the mantispid larva and this explains the premature death of the observed specimens. Confirming these assumptions would require other studies, such as knowing the species of mantispid that parasitizes these jumping spiders and the nutritional requirements that the larva require. Redborg (1998) mentions that mantispid larvae are generally located on or closely to the pedicel, since this region is inaccessible to the host spider. This Mantispinae larvae behavior was observed in the three spider species of this study.

Collection of live spiders in the field, their rearing and maintenance in the laboratory is crucial to understanding the life cycles of their parasitoids and how they develop. Future studies will be focused on the breeding and maintenance of different jumping spider species in order to detect associated parasitoids and to establish their developmental time.

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REFERENCES

Austin A.D. 1985. The function of spider egg sacs in relation to parasitoids and predators, with special reference to the Australian fauna. Journal of Natural History, 19: 359-376.

Brushwein J.R., Hoffman K.M. & J.D. Culin. 1992. Spider (Araneae) taxa associated with *Mantispa viridis* (Neuroptera: Mantispidae). Journal of Arachnology, 20: 153-156.

Capocasale R. 1971. Hallazgo de *Mantispa decorata* Erichson parasitando la ooteca de *Lycosa poliostoma* (Koch) (Neuroptera, Mantispidae; Araneae, Lycosidae). Revista Brasileira de Biologia, 31: 367-370.

Downes M.F. 1985. Emergence of *Austromantispa imbecilla* (Gerstaecker) (Neuroptera: Mantispidae) from the retreat web of *Mopsis penicillatus* (Karsch) (Araneae: Salticidae). Australian Entomological Magazine, 12: 54.

Hill D.E. 2011. Notes on *Hentzia mirata* (Hentz 1846) (Araneae: Salticidae: Dendryphantinae). Peckhamia, 91 (1): 1-15.

Hoffman K.M. & J.R. Brushwein. 1989. Species of spiders (Araneae) associated with the immature stages of *Mantispa pulchella* (Neuroptera: Mantispidae). Journal of Arachnology, 17: 7-14.

Jocqué R. & A.S. Dippenaar-Schoeman. 2006. Spider Families of the World. Musée Royal de l’Afrique Centrale, Tervuren. 336pp.

LaSalle M.W. 1986. Note on the mantispid *Climaciella brunnea* (Neuroptera: Mantispidae) in a coastal marsh habitat. Entomological News, 97: 7-10.

Machado R.J.P. & J.A. Rafael. 2010. Taxonomy of the Brazilian species previously placed in *Mantispa* illiger, 1798 (Neuroptera: Mantispidae), with the description of three new species. Zootaxa, 2454: 1-61.

Monserrat V.J. 2014. Los Mantíspidos de la Península Ibérica y Baleares (Insecta, Neuropterida, Neuroptera, Mantispidae). Graellsia, 70 (2): e012.

Nunn S.C. 2011. Observations on the predatory behaviour of the mantispid *Campion tenuistrigus* (Neuroptera: Mantispidae) parasitising a tarantula egg sac (Araneae: Theraphosidae). Australasian Arachnology, 81: 4-7.

Redborg K.E. & E.G. MacLeod 1983. *Climaciella brunnea* (Neuroptera: Mantispidae): a mantispid that obligately boards spiders. Journal of Natural History, 17: 63-73.

Redborg K.E. & E.G. MacLeod. 1984. Maintenance feeding of first instar mantispid larvae (Neuroptera, Mantispidae) on spider (Arachnida, Araneae) hemolymph. Journal of Arachnology, 11: 337-41.

Redborg K.E. & E.G. MacLeod.1985. The developmental ecology of *Mantispa uhleri* Banks (Neuroptera: Mantispidae). Illinois Biological Monographs, 53. 130 pp.

Redborg K.E. 1998. Biology of the Mantispidae. Annual Review of Entomology, 43: 175-194.

Rice M.E. 1985. Spiderling survival in a *Mantispa* (Neuroptera, Mantispidae) infested egg sac. Journal of Arachnology, 13: 139-140.

Rice M.E. 1986. Communal oviposition by *Mantispa iuscicornis* (Say) (Neuroptera: Mantispidae) and subsequent larval parasitism on spiders (Arachnida: Araneida) in south Texas. Journal
Rice M.E. & W.B. Peck. 1991. *Mantispa sayi* (Neuroptera: Mantispidae) parasitism on spiders (Araneae) in Texas, with observations on oviposition and larval survivorship. Annals of the Entomological Society of America, 84: 52-57.

Rienks J.H. 2000. Extended nest residence and cannibalism in a jumping spider (Araneae: Salticidae). Journal of Arachnology, 28(1): 123-127.

Snyman L.P., Ohl M., Pirk C.W.W. & C.L. Sole. 2020 A review of the biology and biogeography of Mantispidae (Neuroptera). Insects systematics & evolution, 51: 1-42.

Trillo M.C., Ardila-Camacho A. & M.J. Albo. 2015. Ocurrencia de mantíspidos (Neuroptera, Mantispidae) eclosionados de tres especies de araña (Araneae: Trechaleidae) de Uruguay. Boletín de la Sociedad Zoológica del Uruguay, 24(2): 198-205.

Vieira C. & G.Q. Romero. 2008. Maternal care in a neotropical jumping spider (Salticidae). Journal of Zoology, 276(3): 237-241.

World Spider Catalog. 2020. World Spider Catalog. Version 21.0 Natural History Museum, Bern. Online at http://wsc.nmbe.ch, accessed on 02 november of 2020.