Scientific Note

On the life expectancy of a male Chilean rose tarantula, *Grammostola rosea* (Walckenaer, 1837) (Araneae: Theraphosidae) reared in captivity

Sobre la esperanza de vida de un macho de tarántula rosada chilena, *Grammostola rosea* (Walckenaer, 1837) (Araneae: Theraphosidae) mantenido en cautiverio

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Abstract. Here we present the case of a male Chilean rose tarantula *Grammostola rosea* (Walckenaer, 1837) (Araneae: Theraphosidae) reared in captivity, whose life expectancy has been dated at 8.5 years. The specimen spent the last three as an adult. Both records are outside the average range of lifespan expected for an adult male. The specimen was kept under natural conditions in a Mediterranean climate, without photoperiod or temperature control. Diet was composed of *Tenebrio molitor* larvae and *Gryllus* sp./*Acheta* sp. nymphs and adults. The feeding regime was 1-2 prey per week in the early stages and later 1 prey every 20 days since the individual exceeded 15 mm body length approximately, to his death. The specimen spent most of its adult life without eating, actively refusing prey. The maximum time without eating was 22 months. At the time of death, the specimen measured 35 mm in body length and 130 with leg expanded. Previous research reported lower life expectancies in male tarantulas. More research on understudied lifecycle aspects of the Theraphosidae is needed.

Key words: Arachnida; caloric restriction; neotropical mygalomorphs; spiders.

Resumen. Presentamos el caso de un macho de tarántula rosada chilena *Grammostola rosea* (Walckenaer, 1837) (Araneae: Theraphosidae) mantenido en cautiverio y cuya esperanza de vida hemos datado en 8,5 años, de los cuales el ejemplar evaluado pasó los últimos tres como adulto. Este ejemplar se mantuvo en condiciones naturales de clima mediterráneo sin control de fotoperiodo ni de temperatura. La dieta se compuso de larvas de *Tenebrio molitor*, así como ninfas y adultos de *Acheta* sp. y *Gryllus* sp. Se proveyó de 1 a 2 unidades de presa por semana durante los primeros estadios de desarrollo de la araña, y posteriormente 1 unidad cada 20 días cuando que el individuo supero los 15 mm de longitud corporal y hasta el momento de su muerte. El individuo pasó la mayor parte de su vida adulta sin comer, rechazando las presas proporcionadas. El tiempo máximo que el individuo pasó sin comer fue de 22 meses. En el momento de la muerte, el espécimen medía 35 mm de longitud corporal y 130 mm de envergadura con las patas extendidas. Publicaciones previas reportan esperanzas de vida más cortas en machos. Son necesarios más estudios sobre aspectos poco abordados del ciclo de vida de las Theraphosidae.

Palabras clave: Arachnida; arañas; migalomorfas neotropicales; restricción calórica.

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Spiders are one of the most diverse groups on the planet, with more than 50,400 species described to date (World Spider Catalog 2022). However, despite great efforts to generate new knowledge about this group, there is a patent lack of knowledge about many aspects, such as their real diversity —Linnean shortfall—, delineating the species distribution —Wallacean shortfall— ecological or lifecycle aspects (Cardoso *et al*. 2011), especially in the case of species recently described or with complex life cycles. In this way, it is worth highlighting the tarantulas of the family Theraphosidae.

Much information about theraphosids, can be found both in classical (*e.g.,* Simon 1864; Comstock 1980; Breene *et al*. 1996 among others) and in recent literature (Foelix 2011; Pérez-Miles 2020) of which, however, there are few published scientific works focused on life expectancy. It is demonstrated that tarantula species are very long-lived, with females that can live for 30 years or more (Costa & Pérez-Miles 2002; Criscuolo *et al.* 2010; Montes de Oca *et al*. 2016), always 3-4 years more than males that usually live until mating (Foelix 2011; Padilla *et al*. 2018). Males present a shorter lifespan compared to females (Pérez-Miles & Perafán 2020). Usually, by performing queries in the usual Internet search engines, abundant information on this topic can be found, concretely coming from hobbyists, who kept an immense variety of species. Tarantula keeper communities usually state male tarantulas kept in captivity live around five-six years –from a few months to a maximum of two-three years as adults, *e.g.*, web forums such as Arachnoboards.com or pet-tarantulas.com–. However, most data provided is informal, unprecise, speculatory, and not published in any scientific journal. Concerning tarantula keeping, on the other hand, Schultz & Schultz (2009) estimated that the maximum lifespan of a newly emerged adult ranges from a few months to a year and a half, pointing out specifically for the species *Grammostola rosea* (Walckenaer, 1837) (Theraphosidae: Theraphosinae) that the life expectancy for both sexes is not properly studied.

In this way, it seems there is hardly any verified, recent data published at a specific level concerning the Theraphosidae lifespan of the more than 1,000 species that make up the clade Theraphosidae. The very longevity of the species is a handicap since it requires very large monitoring. Recently, two new studies have provided new data on this aspect. The first, which was carried out on the species *Brachypelma albopilosum* Valerio, 1980, found that a higher feeding power led to a faster development rate. The second, which was carried out on the Argentinian *Grammostola vachoni* Schiapelli & Gerschman, 1961 and focused on a demographic study, observed that male specimens, even under controlled laboratory conditions, reached adulthood in an average of 7.03 years, and rarely exceeded 12 months of life after reaching this stage.

In December 2014, our research group acquired a spiderling from the species *Grammostola rosea* from a supplier located in Jerez de la Frontera (Andalusia, Spain) – unavailable since 2018 due to business closure– initially needed for a behavioral study on the species non-related to the information presented in this note. The specimen originally had a 15 mm body length. No data was provided on its birth or number of previous molts. Due to the known prolonged development of members of this genus, it can be estimated with high certainty that the individual could be one year old attending to body size. Since the exact number of molts carried out so far was not known, hereafter the subsequent molts were not counted, but rather the total number of years lived before and after the last molt. The specimen was fed with larvae from the species *Tenebrio molitor* L., 1758 —its main food source— and crickets from the genus *Acheta* L., 1758 and *Gryllus* L., 1758 (see Montes de Oca & Mendoza 2020). The specimen was also offered cockroaches (*Blaptica dubia* Serville, 1839) during its lifetime, but always refused them.

The specimen was always fed less frequently than recommended (Schultz & Schultz 2009; see also Montes de Oca & Mendoza 2020). In its early stages of development, the average fed was 1-2 times a week. If prey was considerably small compared to the tarantula,

more prey was provided in a timely manner. Later, when body length hovered around 20-25 mm, food intake was reduced to one prey every 20 days. This diet was maintained until adulthood. Within these frequencies, prey items were provided randomly so as not to have a fixed feeding pattern, to reproduce the random arrangement of prey natural to a wild environment being the feeding period slightly longer or shorter. The only exception to this feeding regimen occurred each autumn period: a high quantity of prey was provided punctually for a short period of time so that the individual could retain reserves during the winter torpor.

The specimen carried out its last recorded molt on August 17, 2019, reaching the adult stage. The previous molt – the preadult stage– occurred on August 1, 2018. As of 2019, the specimen reduced its food intake and spent time exploring the experimental enclosure to find a mate. This behavior, initially not very apparent, increased as went on, being more pronounced in his last year of life. In its adult state, the specimen actively refused offered food and reacted very nervously to any stimulus. Although the food was released freely in the enclosure, the prey was removed dead without having been ingested. It can be assumed the studied specimen did not eat any food during this time, except on two recorded occasions that are detailed later.

Consequently, the spider remained without eating for two long periods of time. The first of them lasted approximately one year, between the summer of 2019 and the summer of 2020, The second, of almost two years —22 months and 3 weeks— lasted from this last date until a week before his death, which occurred on June 30, 2022. On this occasion, the specimen had made an extensive and dense web on the ground similar to a sperm web, where a *Tenebrio molitor* larva was captured passively, and attached to the web. In its last days of life, the Chilean tarantula was frantically foraging in search of a mate. Subsequently, its activity sharply reduced, and it died of exhaustion and weakness on June 30, 2022. Thus, life expectancy has been dated at 8.5 years. This figure may have been even higher, given that in certain cases the development times in the genus can be very slow. At the time of death, the specimen measured 35 mm in body length (Fig. 1) and 130 mm with legs expanded. It also presented very well-developed tibial spurs and palpal bulbs, morphologically normal for an adult male. The specimen's adult lifespan was 3 years and 13 days. The specimen was taxonomically determined in its adult stage following the most up-to-date works related to the taxonomic identity of *G. rosea*: Aguilera *et al*. (2022) and previous references listed in this work.

Throughout its lifetime, the specimen was always kept in natural conditions of light and temperature, and always within the parameters considered adequate by Schultz & Schultz (2009). It was stored in an experimental enclosure in facilities located in cities with a Mediterranean climate. This type of climate, typical of the Mediterranean region, also develops in some regions of Chile (Peel *et al.* 2007) where the species naturally occurs (Aguilera *et al.* 2019, 2022). From 2014 to the end of 2019, the specimen was in facilities located in Cádiz (southern Andalusia, purely Mediterranean climate). Due to logistical changes, at the end of 2019, the specimen was moved to Madrid (central peninsular, continental Mediterranean climate) until the date of its death. The specimen was always maintained between maximums of 35 °C and minimums of 14 °C. In heat waves, the specimen was stored in dim conditions during the day. The substrate used in the experimental terrarium consisted of coconut fiber, or coconut fiber mixed with silica sand for aquariums, with logs, rocks, and hiding places to naturalize the environment. When the substrate was dry, water was poured on it and water was sprayed on the surrounding air, and a small dish was also filled. The specimen was moved four times throughout its life to adapt the enclosure to the specimen's needs. The last enclosure, where it spent its adult life, had dimensions of 30x30x20 cm (width x length x height).

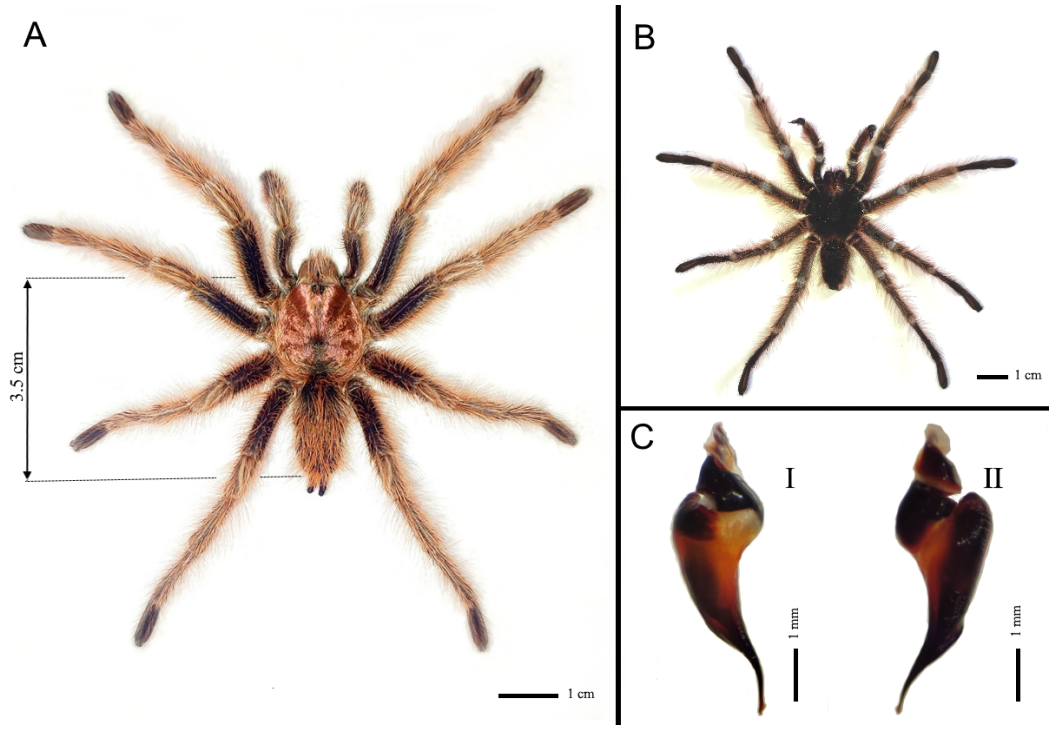

Figure 1. Male specimen of *Grammostola rosea*. **A.** Dorsal view. Opisthosoma and prosoma lengths are indicated. **B.** Ventral view. **C.** Male pedipalp bulb in retrolateral (I) and prolateral views (II). / Espécimen macho de *Grammostola rosea*. **A.** Vista dorsal. Longitudes de opistosoma y prosoma indicadas. **B.** Vista ventral. **C.** Bulbo del pedipalpo del macho en vistas retrolateral (I) y prolateral (II).

Regarding behavior, the specimen entered a state of inactivation almost all winter seasons of its life inside a hiding place that it adapted and closed with a substrate mixed with silk. This behavior was not carried out continuously in its adult stage, where it was erratic in this aspect, limiting itself on some occasions to inactivating in the open until the arrival of spring. On the other hand, this animal showed a calm demeanor, which became restless, and reactionary as entered deeper into his adult stage.

Male *Grammostola rosea* recorded in this note developed a longer lifespan than other *Grammostola* specimens or related genera from previous research (Criscuolo *et al.* 2010; Schweldt *et al.* 2021). Although Ibler *et al.* (2013) documented diverse longevity data of many genera related to *Grammostola*, these are not divided by sex so they cannot be used for comparative purposes. In the case of Schweldt *et al.* (2021), authors stated they hypothetically expected their captive *G. vachoni* to live longer than they did during their experiment: males usually not reached more than one year old in the adult stage. This result matches similar studies carried out to date. Criscuolo *et al.* (2010) conclude wild male tarantulas do not have a longevity greater than 2 years in the adult stage. However, in the case of the specimen we report, longevity probably has been abnormally long. Conclusive results cannot be obtained with only one specimen tested in our case. Also, we didn't test if experiment conditions affected the specimen in another way, *e.g.*, negative effects on fertility.

There are not many studies related to the longevity of spiders and the modulatory effect of external and internal factors. It could only be hypothesized that there may be great intraspecific variability in terms of longevity, but also, in addition to genetic factors —among them, captive breeding stock and not wild captured origin— environmental variables,

including the availability of prey could have a decisive effect on spider life expectancy. Although there is evidence that power feeding affects the speed of development, there is little data on the effect of the rate of feed intake on longevity, and the possible effects that power feeding or low power feeding could have on it. Studies carried out until now show a positive correlation between life expectancy and the reduction in caloric intake without reaching malnutrition in diverse animal groups, such as mice or dogs (Speakman & Mitchell 2011). However, this correlation is not always positive on arthropods, not even within the same order, as occurs in the case of Diptera, where the correlation is positive for the fly *Drosophila* Fallén, 1823 but not for the house fly Speakman & Mitchell (2011). For spiders, it is worth noting the study carried out by Austad (1989) on the linyphiid spider *Frontinella pyramitela* (Walckenaer, 1841). Also, Kleinteich *et al.* (2015) found food limitation extended the lifespan in *Larinioides sclopetarius* (Clerck, 1757). However, food limitation in juveniles decreased the adult lifespan.

We consider the data collected of interest since there are not many reports on the life expectancy of tarantulas and on *G. rosea* in particular. There are still many gaps in its biology and ecology. Basic aspects of lifecycle have not been described until recently (*e.g*., see Aguilera *et al*. 2022 and Montenegro *et al*. 2022). Also, in-depth studies are necessary to know the natural longevity of the theraphosid spiders and determine the factors that may influence it.

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