

A remarkable new genus of wolf spiders from southwestern Spain (Araneae, Lycosidae)

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Summary

A new genus and species of wolf spiders (*Donacosa merlini*) is described from the neighbourhood of the Coto Doñana Nature reserve in southwestern Spain. The genus is diagnosed by the shape of the unbanded female carapace and characters of the genitalia, mainly the scapeless ridged epigyne and the presence of a tegular apophysis and a ridged median apophysis in the male palp. The spider exhibits a remarkable sexual dimorphism. It lives in burrows and the copulation period appears to occur in autumn and/or winter.

Key words : new species, Coto Doñana, phenology, life cycle, habitat, affinities, morphology.

Résumé

Les auteurs décrivent *Donacosa merlini*, genre et espèce de Lycosidae inédits, en provenance des alentours de la réserve naturelle «Coto Doñana» au sud-ouest de l'Espagne. Le genre est défini par le céphalothorax parallèle sans bandes de la femelle et par les caractères des genitalia, en particulier l'épigyne sans septum mais pourvue d'une crête et la présence d'une apophyse tegulaire et une apophyse médiane avec une crête dans le palpe mâle. Le dimorphisme sexuel est spectaculaire pour un Lycoside. L'araignée vit dans un terrier. La copulation est supposée se dérouler en automne et/ou hiver.

Mots-clés : nouvelle espèce, Coto Doñana, phénologie, cycle vital, habitat, affinités, morphologie.

Introduction

The spider fauna of western Europe is doubtlessly the best known in the world. New species are rarely described and if they are, they usually belong to speciose genera (e.g. *Lepthyphantes*, *Meioneta*, *Zodarion*) or to so-called difficult genera with strongly related, similar species (e.g. *Theridion*, *Enoplognatha*, *Pardosa*). We were therefore surprised to find a large, burrowing, wolf spider which could not be placed in a known genus, in southwestern Spain.

A single adult female and some juveniles were collected by one of us (RJ) in April 1988. During a second attempt to collect material in April 1990, several more adult females were found, some of them with an egg sac. No adult males were collected, notwithstanding a serious effort, including the use of tens of pitfall traps in an

area with many burrows. Three juveniles collected during the last campaign proved to be males and moulted to the subadult stage. One finally reached adulthood in early November, eight months later after passing three months in a closed burrow. A second reached adulthood in December in quite different circumstances, described below.

A remarkable character of this spider is its sexual dimorphism: the adult male is pink (fig. 2), spectacularly different from the colour of the female and of the juvenile stages, which are mainly dark grey without a trace of pink (fig. 1). The carapace shape is markedly different in male and female, a rare feature in lycosid spiders.

Format

Abbreviations

AE	: anterior eyes
ALE	: anterior lateral eyes
AME	: anterior median eyes
CL	: carapace length
CW	: carapace width
F	: femur
Ht	: holotype
juv.	: juvenile
MA	: median apophysis
Mt	: metatarsus
P	: patella
PLE	: posterior lateral eyes
PME	: posterior median eyes
sa	: subadult
T	: tibia
t	: tarsus
*	: spines in a row, not in pairs

All measurements are in mm.

All material is deposited in KBIN (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, L. Baert) except a male and a female paratype which are given to the MNHN (Muséum national d'Histoire naturelle de Paris, C. Rollard).



Fig. 1. – *Donacosa merlini*, female with egg sac and juveniles.



Fig. 2. – *Donacosa merlini*, male, habitus.

DONACOSA new genus

Diagnosis

The genus is characterized by the absence of longitudinal carapace bands, the long, almost parallel-sided carapace in the female (fig. 3a), the poorly spinated Mt I, and by the characters of the genitalia. In the female the epigyne lacks a scape and possesses a central longitudinal ridge (fig. 5a). The male has a scopulated cymbium (fig. 4c) and a large, ridged, median apophysis (fig. 4c-e) which conceals the embolus (which is broad due to a membranous appendage) and the membranous tegular apophysis.

Description

Large spiders (15 - 20 mm); carapace uniform without pale median or lateral bands; carapace with parallel margins and strongly raised cephalic area in the female; male carapace narrowed in front and with much less raised cephalic area. Cephalon in frontal view with relatively steeply sloping sides (although not as steep as in *Pardosa*). Cephalic area in frontal view wider than eye field. Eye arrangement: anterior row slightly procurved; AME slightly larger than ALE; AE less than their diameter apart and; distance AME-AME slightly larger than distance AME-ALE; PME large, less than their diameter apart; PLE large, slightly smaller than PME. Ocular quadrangle almost square, hardly diverging backwards. Chelicerae in the female with a protruding base, not swollen in male. Legs relatively short and strong in the female, more slender in the male. FI and FII with two prolateral spines each. TI with one pair and two single ventral spines. MTI with few spines. Male palp with strongly scopulated cymbium and broad, relatively short embolus entirely situated in the distal part of the bulbus. Epigyne without scape but with central ridge; vulval structure simple.

Affinities

The systematic position of the genus described is unclear because the present state of the systematics of the Lycosidae is confusing. Two recent views of lycosid classification (DONDALE 1986, ZYUZIN 1985) are contradictory and have been subject to recent change (ZYUZIN, 1990). In both systems, *Donacosa* would be placed in the Lycosinae. However, the delimitation of this subfamily is very broad and varies considerably with the author. DONDALE'S (1986) Lycosinae, based on male palpal characteristics, includes such diverse genera as, for instance, *Arctosa*, *Alopecosa*, *Hippasa*, *Ocyale* and *Trochosa*. In ZYUZIN'S (1985) view, based on genital but also on somatic characters, the Lycosinae include the former Pardosinae, a statement which was altered more recently

(ZYUZIN, 1990). The Trochosini, proposed in the latter as part of the Lycosinae, is clearly a paraphyletic grouping, as it is based on the absence of characters found in burrowing lycosids, to which *Donacosa* doubtlessly belongs. It may seriously be questioned whether the characters of burrowing wolf spiders, united in Lycosini by ZYUZIN (1990), can be considered synapomorphies since it is very likely that burrowing behaviour has evolved several times in this group and that the similarity between the different taxa is homoplastic.

It is difficult to evaluate the generic position of *Donacosa* at this moment, due to the poor definition of taxa and of taxonomic instability within the Lycosidae. A clear definition of subfamilies, tribes and genera, will be needed before real affinities between these taxa can be established. This is hampered by relatively recent diversification and speciation phenomena (e.g. in *Pardosa*, ALDERWEIRELDT & JOCQUE, in press) and by the use of highly variable characters in the taxonomy of Lycosidae by previous authors (ROEWER, 1959, 1960; GUY, 1966; comments in ALDERWEIRELDT, 1991; ZYUZIN, 1985).

Comparison of *Donacosa* with other genera suggests affinities with *Arctosa* C.L. Koch and *Tricca* Simon (if *Tricca* is to be considered a separate genus, see discussion in BRAUN, 1963; DONDALE & REDNER, 1983; WUNDERLICH, 1984). Similarities are the unbanded carapace and the very simple vulval structure with widely separated entrance openings and short copulatory ducts running forward to widely separated, small spermathecae. The male palp is characterized by the short embolus, entirely situated in the distal part of the bulbus. In most other Lycosidae it runs towards the middle of the bulbus where it meets the median apophysis. However, the genital structures of *Donacosa* are clearly distinct, especially the short and broad embolus, the large, blunt, median apophysis and the membranous tegular apophysis in the male palp and the scapeless epigyne with a central ridge (compare with LUGETTI and TONGIORGI, 1965, 1967). The presence of 2 prolateral spines on F I also distinguishes *Donacosa* from *Tricca* and *Arctosa* which have only one. Moreover, the striking parallel-sided, unbanded, female carapace of *Donacosa* appears to be unique, at least among Holarctic and Afrotropical wolfspiders.

Burrowing representatives of the genus *Lycosa* are also clearly different from *Donacosa*. They possess broad pale bands on the carapace and have an epigyne with a T-shaped median septum.

Etymology

The name is a contraction of Doñana, referring to the name of the famous National Park «Coto Doñana» in southern Spain, the area where the specimens were found, and *Lycosa*.

*Type species**Donacosa merlini* new species.***Donacosa merlini* new species**
(fig. 1 - 6)*Type material*

Male holotype : Spain, Andalucia, Almonte, 5 km SW, direction El Rocío, open area in *Pinus pinea* woodland on coarse sand; collected on 15.IV.1990 as juv., raised to adulthood (2.XI.1990) in Belgium, R. & M. Jocqué (KBIN).

Paratypes : 1 ♂ : data as for Ht, but final moult in December; 5 ♀ : together with Ht, adult at time of collecting; 2 juv. : as Ht; 1 ♀, 2sa ♀, 1 juv. : 10.IV.1988, further data as for Ht; 1 juv. : Torre de la Higuera, dunes, 13.IV.1990, M. & R. Jocqué; 1 juv. : dunes 5 km N of Torre de La Higuera, 13.IV.1990, M. & R. Jocqué (1 ♂, 1 ♀ in MNHN, others in KBIN).

Diagnosis

As for the generic diagnosis.

Description

Male (holotype, ♂ paratype in brackets) : Measurements. Total length 17.24 (16.66); carapace 7.91 (8.08) long, 5.50 (5.66) wide.

Colour (living animal, fig. 2) : carapace with dark brown to black tegument densely covered with pink hairs; with a striking patch of white hairs promesal of each PLE; mixed black and white hairs between AE and PME and on clypeus. Sternum yellowish brown, with a few hairs. Dorsal side of femora with dense cover of pink hairs; ventral side of femora bluish grey; remainder of legs covered with pale hairs, slightly yellowish on tarsi. Abdomen dark grey with paler patches on dorsum, pale yellowish brown on venter. Cymbium of palp with dark extremity and striking, pale grey proximal part.

In the preserved specimen (ethanol) the basic pattern has remained but striking colours have disappeared.

Carapace rather flat, without steep slope from cephalic to thoracic area. Chelicerae rather weak not swollen at base. Chilum poorly delimited, composed of two weakly sclerotized transverse triangles provided with some hairs. Eyes : AME : 0.38; ALE : 0.16; PME : 0.77; PLE : 0.67; AME-AME : 0.20; AME-ALE : 0.14; PME-PME : 0.63; PLE-PLE : 1.51. Anterior eye row procurved along both tangents.

Leg measurements

	F	P	T	Mt	t	Tot
I	6.91	3.25	7.16	8.33	3.58	29.23
II	6.00	2.92	5.33	6.91	3.75	24.91
III	5.83	2.75	4.66	6.66	3.33	23.23
IV	6.83	3.00	6.41	9.66	4.33	30.23

Leg spination

	F	P	T	Mt
I	pl2d2*rl2*	rl1	pl3*d1rl2v1-1-2	pl3*
II	pl2*d3*rl3*	pl1rl1	pl2*d1rl2*v2-2-2	pl2-1-1rl3*v2-2-1
III	pl2*d3*rl2*	pl1rl1	pl2d2rl2v2-2-2	pl1-1-2rl1-2v1-2-1-1-1
IV	pl2*d3*rl1	rl1	pl2d2rl2v2-2-2	pl1-1-2d1-1

Tarsi and metatarsi with dense scopula. Unpaired claw small.

Palp (fig. 4) : tibia long (2/3 length of cymbium) with lateral bunch of long hairs. Cymbium slender in distal part, ventral surface densely covered with medium size dark hairs, thus forming a scopula. Subtegulum relatively small. Tegulum large with spermduct only visible over short distance. Tegular apophysis large, membranous, with slightly serrated distal margin. Median apophysis large, without pointed part, but with central ridge. Embolus short and broad; proximal margin sclerotized, distally membranous.

Female : Measurements (all female paratypes) : length 13.16 - 16.00; carapace 6.50 - 7.50 long, 4.16 - 5.00 wide.

Colour (living animal, fig. 1) : carapace with dark brown to black tegument covered with pale hairs, denser along margin, and some long dark ones in eye region; pale hair cover less dense in older specimens. Sternum yellowish brown, with a few hairs. Legs yellow, with dark hairs; femora with broad dorsal black and brown stripes and some lateral and ventral dark patches; tibiae with short mesal and lateral dark stripe. Abdomen dark grey to dark brownish with paler transverse bars in posterior half; sides and venter pale grey.

Carapace strongly raised in cephalic area, sharply falling from cephalic towards thoracic area. Chelicerae strong, swollen at base. Chilum composed of two weakly sclerotized transverse sclerites, without hairs.

Leg measurements (female carapace length 6.50, width 4.16)

	F	P	T	Mt	t	Tot
I	4.83	2.08	3.91	4.00	2.25	17.07
II	4.25	1.92	3.33	3.58	1.92	14.99
III	3.75	2.00	2.92	3.83	2.33	14.83
IV	5.00	2.50	4.33	6.25	2.75	20.83

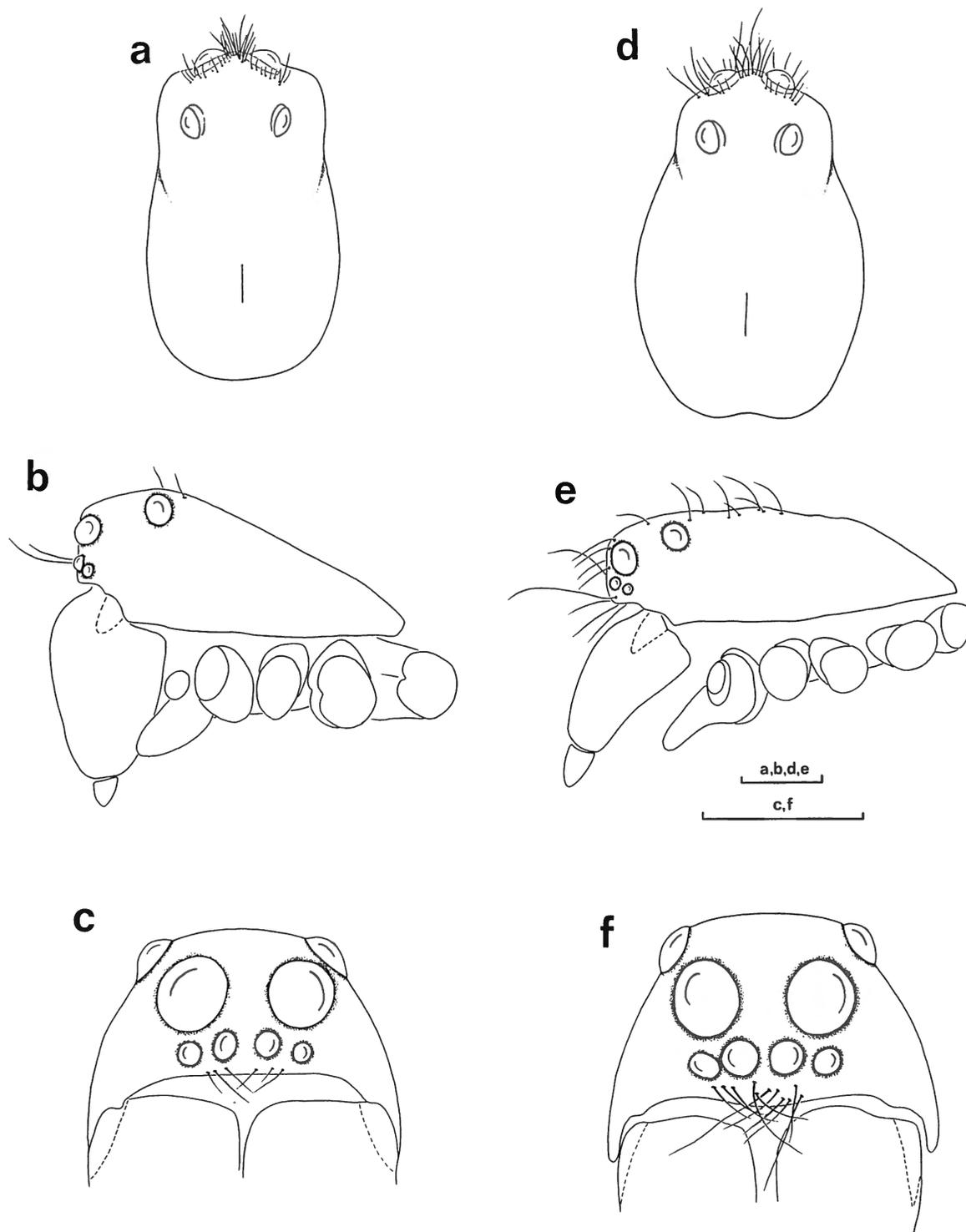


Fig. 3. – *Donacosa merlini*, a-c. female carapace : a. dorsal view, b. lateral view, c. frontal view; d-f. male carapace, d. dorsal view, e. lateral view, f. frontal view. (scale bars = 2 mm)

Leg spination

	F	P	T	Mt
I	pl2d3*	pl1r1l	pl3*v2-1-1	v2-1-1
II	pl2*d3*	pl1r1l	pl2*v1-2-2	pl1-1-2v2-2-1
III	pl2*d3*r12*	r1l	pl2*r12*v2-2-2	pl1-1-2r1l-1-2v2-2-2
IV	pl2*d3*	r1l	pl2*r12*v2-2-2	pl1-1-2r1l-1-2v2-2-1-1-1

Egg cocoon pale greenish blue, globular, ± 10 mm in diameter.

Etymology

The species is named after RJ's son, Merlijn, who helped a great deal with the field work.

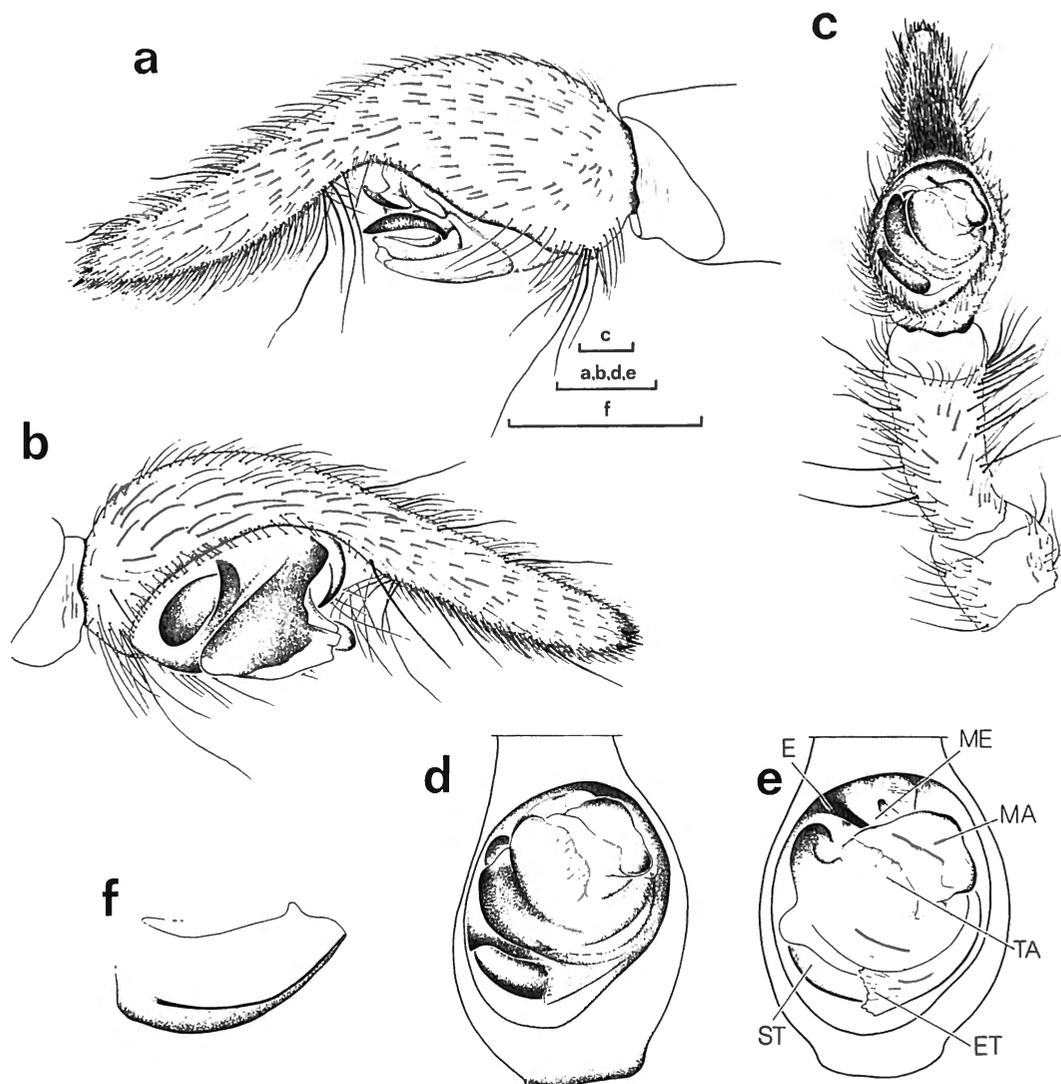


Fig. 4. – *Donacosa merlini*, left male palp : a. lateral view; b. mesal view, hairs obscuring bulbus interrupted or partly omitted; c. ventral view; d. ventral view, detail of bulbus, hairs omitted; e. mesoventral view, detail of bulbus; hairs omitted; f. detail of embolus. (scale bars = 0.5 mm) (E : embolus, ET : edge of tegulum, MA : median apophysis, ME : membranous part of embolus, ST : subtegulum, TA : tegular apophysis)

Natural History

The type locality of *Donacosa merlini* is characterized by the presence of *Pinus pinea* woodlands. The spiders apparently live on coarse, slightly compacted, sandy soils. Their burrows were found on the verges of roads and paths but only once on the path itself. They were also found in the neighbourhood of dunes but never in loose sandy patches. Sand with numerous pebbles of over 5 mm in diameter, was never inhabited. The two main populations at Almonte were separated by a slight dip in the relief about 150 m wide, in which the sand was mixed with pebbles of 5 mm or more in diameter. The habitat is further characterized by the almost complete absence of litter and they were never found in the litter layer of the *Pinus* woodland. All localities were characterized by recent human interference, such as clearfelling, pruning or other activities resulting in the

removal of the herb and litter layer. It is probable that clearfelled areas with suitable soil structure are rapidly colonized by *Donacosa*. This would explain the presence of a dense population of juveniles in a former *Eucalyptus* plantation, clearfelled the year before.

Burrows (fig. 6) are, on average, 19 cm deep. They are between 8 and 12 mm in diameter at the entrance, which is almost always provided with a small turret about 1 cm high. This is a loose construction of silk, sand and some plant debris, most often broken needles of *Pinus pinea*. At certain periods the entrance is closed but it is not clear why, and some burrows were closed when most others remained open. The burrow width remains similar over about two thirds of its depth and is then widened to about 3 cm and slightly tilted (Fig. 6). Apart from the hole and the turret, there are no signs of digging activity (such as thrown out sand) nor remains of prey. Although it is possible that the burrow is constructed

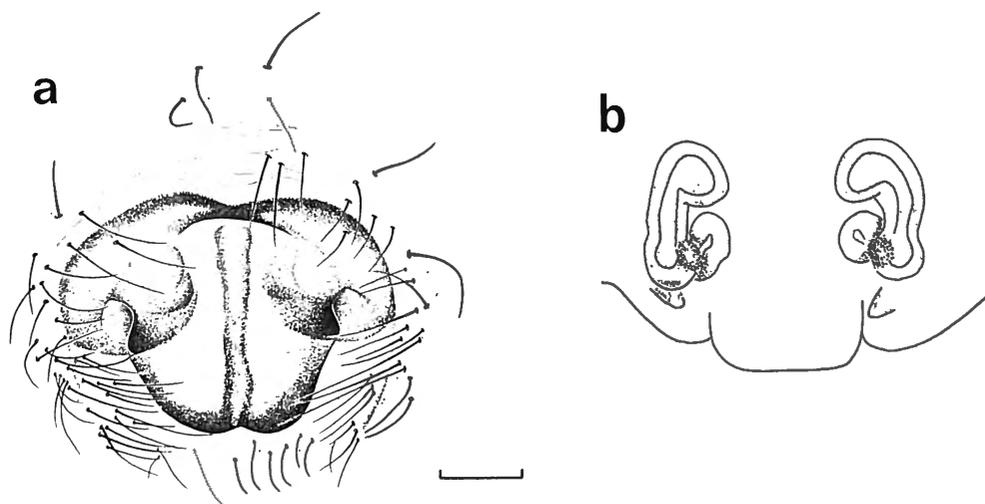


Fig. 5. – *Donacosa merlini*, a. epigyne; b. vulva, cleared, dorsal view. (scale bar = 0.2 mm)

by compaction of the sand rather than by removing it, this is contradicted by the behaviour of spiderlings which remove the sand from the burrow.

The strong sexual dimorphism is doubtlessly an adaptation to burrowing. The strongly bulging chelicerae, the raised cephalic area and the short legs are all characters found in juveniles and females but lacking in males, which apparently do not burrow once they have reached adulthood.

Prey remains were rarely found at the bottom of the burrow. On one occasion it contained remains of ants, in another case the exoskeleton of a millipede.

In the field no differences in depth were observed in burrows of large juveniles or adults. *Donacosa* is night active and sometimes seen at the burrow entrance at sunset, but never outside its burrow. However, one of the pitfalls at ca. 40 cm of a burrow contained a large juvenile, which might indicate that the spiders will wander to a certain distance from their burrows. In captivity, we often observed juveniles wandering at some distance from their burrow. When disturbed while walking, they did not try to retire to their burrow except when very near the entrance.

Some observations :

- ★ depth of burrow : $19.46 (\pm 2.25, \text{range } 15-25, n=30)$
- ★ contents of 34 burrows excavated (6-14 April) :
 - 24 juveniles (one with remains of a millipede)
 - 5 females with egg sac
 - 1 female without egg sac
 - 1 with *Scarites* sp. (Carabidae) with remains of *Donacosa* !
 - 1 with another large lycosid (*Arctosa villica* (Lucas))
 - 1 empty with remains of ants
 - 1 empty
- ★ highest density recorded : $0.36/\text{m}^2$ (9/25 m^2)

In comparison with other large lycosids *Donacosa merlini* is a very peaceful and unaggressive wolf spider. If handled with some care it never tried to bite. The attack speed is also relatively slow and reactions to the presence of possible prey cautious. However, the reaction to conspecific spiders is very rapid and placing two of these spiders together resulted in a deadly bite for one of them within a few seconds.

Phenology

Notwithstanding considerable effort, no adult males were found in the field in March or April. One subadult male was collected in March 1988. It is supposed that the adult male activity period occurs during autumn and winter. This is corroborated by the fact that two males, caught in April 1990, moulted to the subadult stage at the end of August, having passed almost three months in a closed burrow in a greenhouse where the day temperature sometimes reached 40°C , comparable with the temperatures of its natural habitat. This period is possibly a diapause but no physiological data are available to confirm this. One male finally reached adulthood early in November and the second one died on the same day. A third male, collected with the others, reached adulthood in December, apparently without having passed a diapause stage. It was kept in room conditions and was active throughout the entire period.

On the basis of the collection data the following life cycle is deduced : the cocoon is produced in early spring and spiderlings are born in April-May. Males as well as females reach adulthood in autumn, after about 18 months. Mating takes place in autumn and winter, whereafter males die. Females are active throughout the winter and produce a cocoon in spring. A remarkable

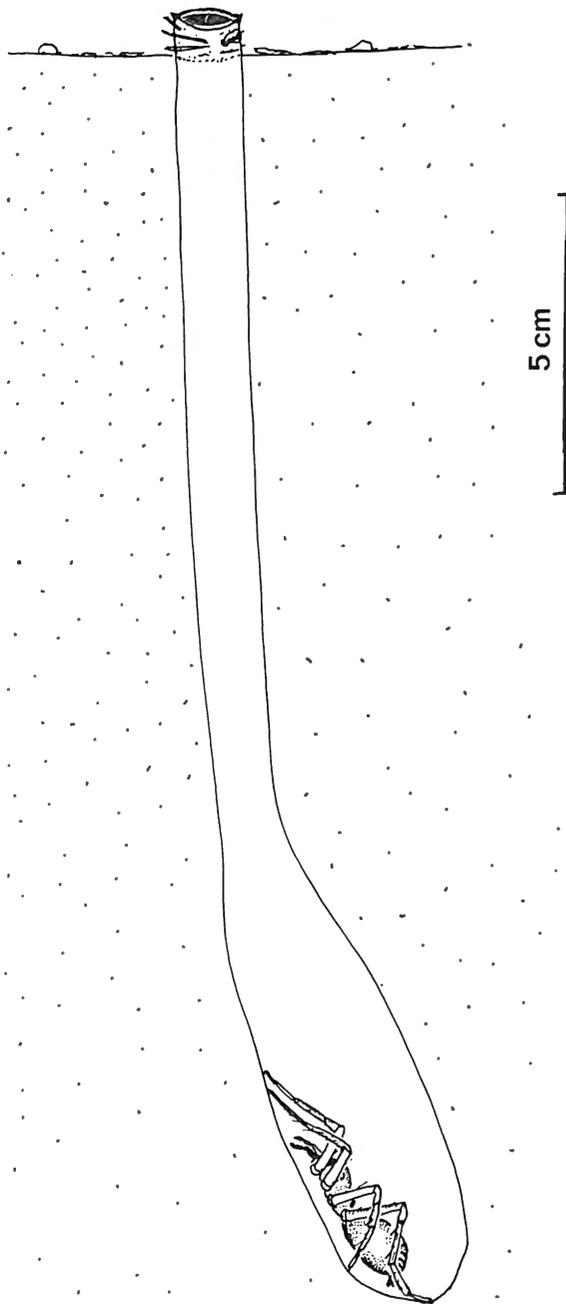


Fig. 6. – *Donacosa merlini*, transect of burrow.

character of the cycle is the inactive period in summer, during which the burrow is closed. This interruption of activity probably does not occur in captivity when humidity is kept high and temperatures near 22°C.

The fact that the males are much larger than the females might be an artefact due to the rearing conditions. However, the differences are so large and inverse as what could be expected as a result of insufficient rearing

conditions, that we consider this to be a clear case of sexual size dimorphism. Whereas female spiders tend to be larger than conspecific males, the reverse may be true in some cases. JOCQUE (1983) explained the phenomenon as a result of average adverse conditions during the copulation period which he supposed would favour larger males. The present case corroborates the hypothesis.

The egg cocoons of two females hatched in captivity. The spiderlings are relatively large compared to those of other lycosids. Even more striking is their relative independence from the mother. In contrast to what happens in other lycosids, they do not limit their activity radius to the abdomen, but crawl over her carapace, legs and even chelicerae; they walk around in the close vicinity of the mother. This seemingly strange behaviour is easily understood when it is remembered that this normally happens in the confinement of a burrow. After a few days the spiderlings, which are extremely tolerant towards one another, leave the mother and make a small burrow. Several times two juveniles were observed together in one burrow. This behaviour may have been induced by a lack of suitable space for burrow construction in captivity.

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