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Pardosa vlijmi sp. nov., a new ethospecies sibling *Pardosa proxima* (C.L. Koch, 1848), from France, with description of courtship display (Araneae, Lycosidae)

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ABSTRACT

A new species of the wolfspider genus *Pardosa* C. L. Koch, 1848, *P. vlijmi*, is described from France. The species, which is morphologically almost identical to *P. proxima* (C. L. Koch, 1848), regarding both males and females, differs clearly from the latter in its pattern of courtship behaviour. The courtship patterns of *P. vlijmi* and *P. proxima* are compared on the basis of a detailed analysis.

INTRODUCTION

During a collecting trip in France from 15—24 March 1971 several sub-adult specimens of *P. proxima* were sampled from different populations (Den Hollander et al., 1972). The animals were kept alive in the laboratory where they went through their final moult. The courtship display of the adult males was recorded on film and video tape (for methods see Vlijm & Dijkstra, 1966). From these records it appeared that certain specimens differed strikingly in their courtship display as compared to the "typical" *P. proxima* pattern.

Within the genus *Pardosa*, courtship display is very specific and therefore it is considered to act as an important barrier between the species. This might hold in particular for syntopic populations of different species (Bristowe & Locket, 1926; Alexander, 1967; Claridge & Reynolds, 1973; Den Hollander, 1973). Because of the distinct patterns of courtship display between the

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species and the relatively small variation of these patterns within a species, differences in courtship display might be considered a valid basis for erecting new species. In the present paper a new species is separated from *P. proxima* on such grounds.

Pardosa proxima was originally described from Greece (Koch, 1848). Simon (1937) mentioned this species from "Toute la France, Corse, Espagne, Italie, Grèce, Açores, Madère, Canaries, Ile Alderney (F. Cb.), Ile Giglio". Great-Britain, Central and Southern Europe, the Balkans to Mesopotamia, North Africa, Canary Islands and the Azores are given by Tongiorgi (1966) as the distribution of *P. proxima*.

From the above it is clear that *P. proxima* is wide-spread in the countries around the Mediterranean. We have found *P. "proxima"* widely distributed in France; in two localities only (Pas d'Esculette, near Millau, dept. Lozère and Le Pin, near Auxerre, dept. Yonne) specimens occurred with a deviating courtship behaviour. It therefore seems plausible that the wide-spread *P. "proxima"* refers to *Pardosa proxima* (Koch, 1848) and that the aberrant specimens belong to a new species.

***Pardosa vlijmi* sp. nov., figs. 1, 4, 5; tables I, II.**

Material examined. — Holotype: 1 ♂, Pas d'Esculette, near Millau (Lozère), France, 21 March 1971. Allotype: 1 ♀, Pas d'Esculette, near Millau (Lozère), France, 21 March 1971. Paratypes: 1 ♂ and 4 ♀ ♀, Pas d'Esculette, near Millau (Lozère), France, 21 March 1971; 2 ♀ ♀, Le Pin, in the neighbourhood of Auxerre (Yonne), France, 23 March 1971. — Film records of courtship display of holotype ♂ and allotype ♀. All this material is deposited in the Institute of Taxonomic Zoology (Zoological Museum) of the University of Amsterdam.

Description. — Males and females: Morphologically indistinguishable from *P. proxima* which was sampled from the same localities and in accordance with the descriptions of *P. proxima* given by Koch (1848), Locket & Millidge (1951), and Tongiorgi (1966). Likewise, the genital organs (fig. 1) are virtually congruent with those of *P. proxima*.

Preliminary studies have shown that some very slight differences seem to exist in the shape of the septum of the epigyne and the shape of the basal part of the terminal apophysis of the male palp (fig. 1). Table I, showing some measures on the cephalothorax, the legs and the epigyne of both *P. vlijmi* and *P. proxima*, shows that the values for *P. vlijmi* fall within the range of those for *P. proxima*.

Etymology. — The new species is dedicated to Prof. Dr. L. Vlijm of the Biological Department of the Free University (Amsterdam), in recognition of his encouragement in introducing us to the various aspects of arachnology.

Diagnosis. — Males of *Pardosa vlijmi* can be distinguished from males of *Pardosa proxima* by their courtship display.

TABLE I. Some measures on *Pardosa vijimi* and *P. proxima* from two localities in France. +: clearly annulated, (+): vaguely annulated, —: not annulated, a, b, c, and d: see fig. 1.

Locality	Specimens	cephalothorax		retrolateral spines		annulation			epigyne (see fig. 1)				
		length (mm)	width (mm)	tibia-meta-tarsus	tibia I	a	b	c	d				
Pas d'Esculette	1 <i>P. vijimi</i> ♂ (holotype)	2.8	2.0	2-1	(+): 1 X								
Pas d'Esculette	1 <i>P. vijimi</i> ♂ (paratype)	2.8	2.0	0-1	(+): 1 X								
Pas d'Esculette	3 <i>P. proxima</i> ♂ ♂	2.5-2.8	1.9-2.0	2-1 (2X) 1-0	—: 3 X								
Le Pin	1 <i>P. proxima</i> ♂	2.8	2.0	2-1	—: 1 X								
Pas d'Esculette	1 <i>P. vijimi</i> ♀ (allotype)	3.0	2.4	0-1	+ : 1 X	0.41	0.41	0.08	0.41	0.08	0.21		
Pas d'Esculette	4 <i>P. vijimi</i> ♀ ♀ (paratypes)	2.8-3.0	2.1-2.3	0-0 (2X) 1-0 (1X) 1-1 (1X)	—: 1 X (+): 1 X + : 2 X	0.38-0.44	0.44	0.06-0.08	0.14-0.19				
Le Pin	2 <i>P. vijimi</i> ♀ ♀ (paratypes)	3.0	2.3	1-1 (2X)	(+): 1 X + : 1 X	0.44-0.45	0.41-0.44	0.08-0.10	0.13-0.19				
Pas d'Esculette	7 <i>P. proxima</i> ♀ ♀	2.8-3.1	2.0-2.4	0-0 (2X) 1-0 (2X) 1-1 (3X)	(+): 5 X + : 2 X	0.38-0.45	0.38-0.44	0.06-0.10	0.15-0.25				
Le Pin	6 <i>P. proxima</i> ♀ ♀	3.1-3.4	2.4-2.6	0-0 (3X) 1-0 (1X) 1-1 (2X)	—: 2 X (+): 1 X + : 3 X	0.40-0.44	0.38-0.44	0.06-0.10	0.19-0.25				

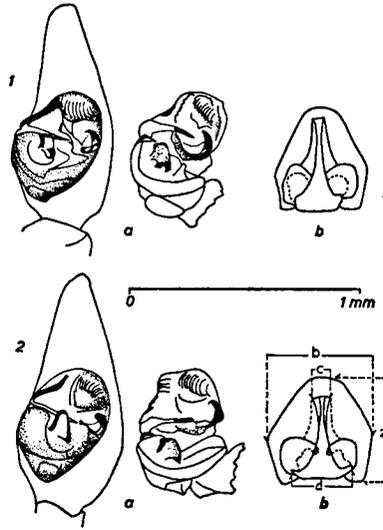


FIG. 1. The genital organs of *Pardosa vlijmi* (1) and *P. proxima* (2); a: male, b: female.

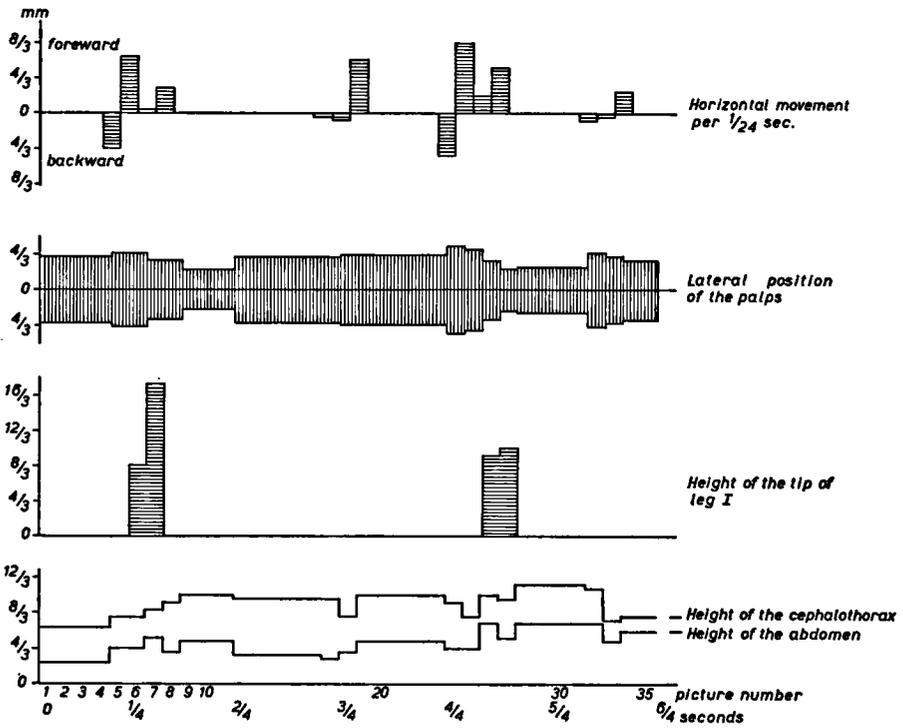


FIG. 2. Graphic representation of the courtship display of *Pardosa proxima*.

COURTSHIP DISPLAY

The courtship display of *P. proxima* (figs. 2, 3) is characterized by obvious jerky horizontal movements of the body. The interval between two jerks varies between a half and one second. Simultaneously there are movements of the front legs and the palps. The front legs are raised, either both the first and second pairs or the first pair only. The palps are moved laterally. In between these primary jerks, a secondary jerk occurs which is not accompanied by movements of the legs and sometimes not by movements of the palps. Oscillatory movements of both the cephalothorax and abdomen do occur but they do not seem to be related to the jerks.

In contradistinction to *P. proxima*, courtship display of *P. vlijmi* (figs. 4, 5, table II) is defined by large amplitude vertical movements ("hop") of the body. One "hop" consists of a sudden up and down movement of both the cephalothorax and the abdomen, but especially the cephalothorax, while the

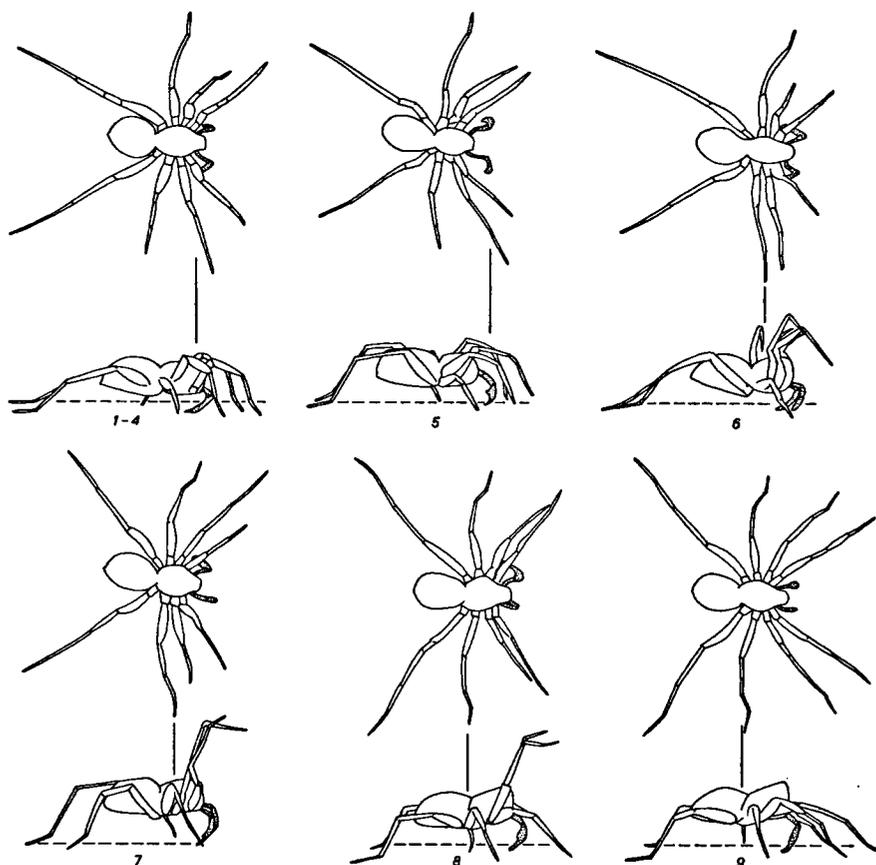


FIG. 3. Schematic drawings of the courtship display of *Pardosa proxima*. 1—9: picture numbers.

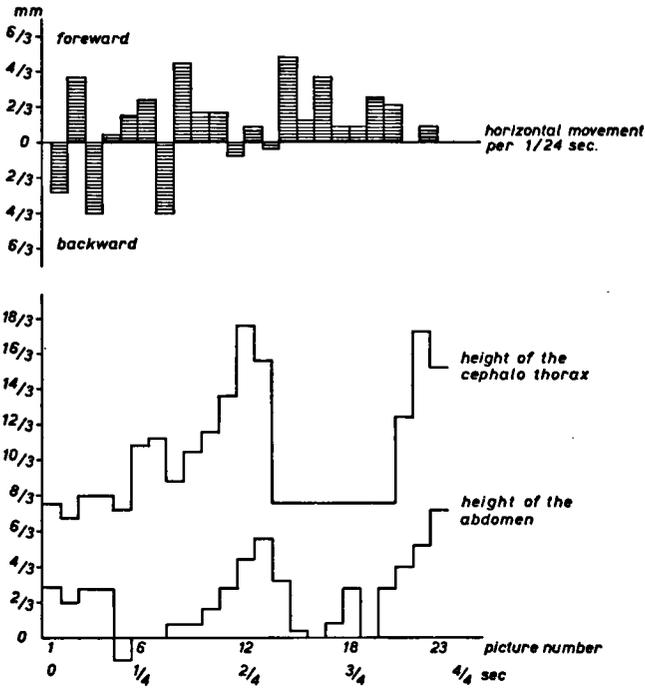


FIG. 4. Graphic representation of the courtship display of *Pardosa vlijmi*.

movements of the abdomen are somewhat retarded as compared to those of the cephalothorax (fig. 4). No particular movements of legs and palps are involved, although the palps seem to diverge when the cephalothorax is in its highest position (fig. 5 B).

Series of "hops" alternate with resting periods. The number of "hops" per series as well as the length of the series is variable (table II).

A "hop" series is initiated and terminated by distinct movements. The initial phase is characterized by vigorous forward-backward movements with some vertical components (fig. 5 A). In the terminal phase only movements of the palps are involved ("hoeing") (fig. 5 C).

Comparing the two species, clearcut differences exist in courtship display between *P. proxima* and *P. vlijmi*:

1. In *P. proxima* the horizontal movements of the body are most conspicuous; in *P. vlijmi*, to the contrary, the vertical movements.
2. In *P. proxima* legs and palps are involved in courtship display, which is not the case or to a small extent only, in *P. vlijmi*.
3. In *P. vlijmi* courtship display clearly shows initial and terminal phases whereas in *P. proxima* the courtship pattern is uniform.

DISCUSSION

Within the genus *Pardosa*, generally four groups of species are distinguish-

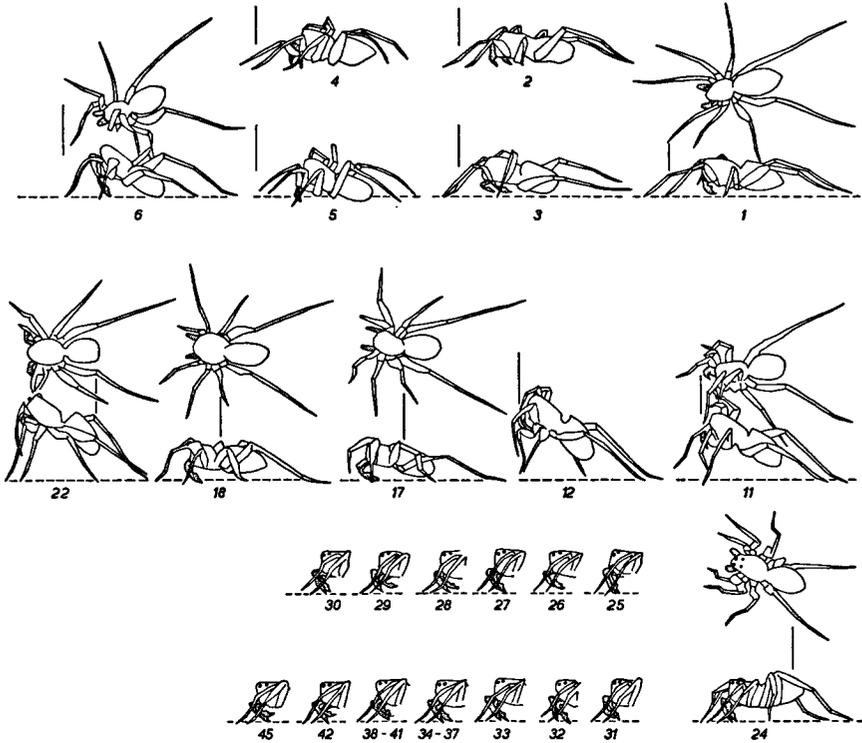


TABLE II. Durations of courtship elements in *Pardosa vlijmi* (in sec.).
 picture 1—6; B: hop phase, picture 11—22; C: terminal phase, picture 24—25.

TABLE II. Durations of courtship elements in *Pardosa vlijmi* (in sec.).

Element	range	mean	number
resting period	8.72—22.14	15.234	9
“hop” series	1.10— 7.30	4.028	9
inter-“hop” interval	0.12— 0.86	0.368	94
number of “hops”/series	4 —21	11.4	9
mean inter-“hop” interval/series	0.30— 0.46	0.382	9
upward phase of a “hop”	0.16— 0.20	0.180	9
downward phase of a “hop”	0.08— 0.10	0.088	9
resting phase of a “hop”	0.06— 0.24	0.014	9

ed: the *amentata*, the *pullata*, the *monticola* and the *paludicola* group (Wiebes, 1959). Within these groups, morphological differences between species are quite small, especially in females. Considerable overlap exists between various species with respect to the frequency distributions of several morphological characters. In addition, intraspecific or even intra-population variation has

been demonstrated to be considerable in various species (Tongiorgi, 1966; Den Hollander, 1970; Vlijm, 1971). Finally, the possibility of interbreeding between sympatric species has been demonstrated. The occurrence of variant specimens, with intermediate structures or deviating combinations of characters, has been assumed to be the result of interbreeding in the field (Locket & Millidge, 1951; Den Hollander et al., 1973). Thus, within the species groups the species show large variations and are indistinct as to morphological characters. On the other hand they are very distinct as to courtship display. The species discussed in the present paper very clearly show this general phenomenon for the genus *Pardosa* (see also Tongiorgi, 1966, and Vlijm, 1971).

These data suggest that evolution in the species groups within the genus *Pardosa* is still in full progress. The species have just gone or are still going through that phase in which species barriers are being established. In this process especially courtship behaviour is involved, because of its slight variability and clear distinctness. As yet, morphological differences between the species have not been stabilized, but this may occur when the species barriers have been completed.

So, at this moment, courtship display provides better features to characterize the species than morphological ones do.

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