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Further notes on the occurrence of the Wolfspider genus *Pardosa* C. L. Koch, 1848 (Araneae, Lycosidae) in Southern France

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ABSTRACT

New data are added to the known distribution of the genus *Pardosa* in France. Special attention is paid to the *Pardosa pullata* group and to some species of the *Pardosa amentata* group with regard to morphological variation and interbreeding.

Subsequent to earlier collections in 1965 (Vlijm, 1971), lycosid spiders of the genus *Pardosa* were sampled in Southern France from 15—24 March 1971.

In the first place three localities which had been previously investigated in 1965, were revisited to establish any changes in the populations of *Pardosa* species between 1965 and 1971. Secondly, samples were taken from sixteen new localities to add new data to the known distribution of the genus *Pardosa* in Southern France.

The data are mainly qualitative. Some notes on the abundance of the species are added, but these are based only on the rather subjective observations which were made during collecting.

In the nineteen localities which were visited (table I) more than a thousand specimens belonging to fourteen species of the genus *Pardosa* were collected by handsampling. Most specimens were subadult when collected; they were kept in the laboratory for some time to pass the final moult.

The observed species were named mainly according to Tongiorgi (1966 a, b), see table II.

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Locality	Species															
	paludicola	monticola	agrestis	morosa	wagleri	amentata	lugubris	nigriceps	hortensis/proxima	hortensis	cribrata	prativaga scoparia	prativaga pullata	femorialis		
1. Drôme	.	.	.	+	++		
2. Le Pouzin	++	.	++		
3. Crâne-Allex	+	++		
4. Valence	{+}		
5. Dieu le Fit, arable land	.	(+)	++	++		
6. Dieu le Fit, brook	.	(+)	++	++		
7. Rognac-Crâne	.	++	++		
8. Tour du Valat	++	++	++		
9. Le Sambuc-Salin de Giraud	.	+	++	.	++		
10. Salin de G.-Les Sts Maries	++	++		
11. Aigues Mortes-Montpellier	++	++	++		
12. Selon	++	+	++		
13. Palavas-Sète	+	++		
14. Agde	++	++	++		
15. Pas d'Esculette	++	.	++	++	++		
16. Le Pin, arable land	.	++	+	+	++		
17. Le Pin, trans. land	.	+	.	.	.	+	.	++	++	++		
18. Le Pin, pool	++		
19. Etang de Brion	++	(+)		
	pal	agr	mon	wag	mor	ame	lug	nig	h/p	pro	hor	cri	p s	p p	pul	fem

TABLE I. The occurrence of fourteen species of the genus *Pardosa* (Lycosidae) in nineteen localities in France. (+): very small numbers, +: moderate numbers, ++: large numbers.

I. COLLECTIONS FROM LOCALITIES WHICH WERE ALSO VISITED IN 1965

Along the border of the Drôme, *P. morosa*, *P. wagleri* as well as *P. agricola* were sampled in 1965. In 1971 the former two species occurred again in large numbers, especially *P. morosa*. However, no specimens at all of *P.*

TABLE II. List of *Pardosa* species discussed.

<i>P. morosa</i> (L. Koch, 1870)	<i>P. cribrata</i> Simon, 1876
<i>P. wagleri</i> (Hahn, 1822)	<i>P. nigriceps</i> (Thorell, 1856)
<i>P. agricola</i> (Thorell, 1856)	<i>P. monticola</i> (Clerck, 1757)
<i>P. hortensis</i> (Thorell, 1872)	<i>P. amentata</i> (Clerck, 1757)
<i>P. proxima</i> (C. L. Koch, 1848)	<i>P. palustris</i> (Linnaeus, 1758)
<i>P. lugubris</i> (Walkenaer, 1802)	<i>P. luctinosa</i> Simon, 1876
<i>P. femoralis</i> Simon, 1876	<i>P. prativaga scoparia</i> Simon, 1937
<i>P. prativaga</i> (C. L. Koch, 1870)	<i>P. sphagnicola</i> (Dahl, 1908)
<i>P. agrestis</i> (Westring, 1861)	<i>P. riparia</i> (C. L. Koch, 1833)
<i>P. paludicola</i> (Clerck, 1757)	<i>P. fulvipes</i> (Collett, 1875)
<i>P. pullata</i> (Clerck, 1757)	

agricola could be collected. Contrastingly, *P. hortensis* occurred in very large numbers on the rubbish near the borders of the Drôme in 1971.

Along a brooklet in a bush near Le Pouzin (Ardèche), *P. proxima*, *P. lugubris*, *P. hortensis*, and *P. femoralis*, the latter distinguished by Vlijm (1971) among *P. prativaga* sensu lato, were collected in 1965. In 1971 these species occurred again in this locality, except *P. proxima*. *P. femoralis* occurred in relatively small numbers.

Along a ditch in arable land, between Crâne and Allex (Drôme), in the neighbourhood of Valence, *P. femoralis*, *P. agrestis*, *P. lugubris*, and *P. proxima* occurred in 1965. Of these species only *P. femoralis* could be collected in 1971. Besides, in this year, relatively large numbers of *P. hortensis* as well as small numbers of *P. paludicola* occurred in this locality.

Conclusions

These results show that, on the population level, remarkable changes in abundance can be found after a period of six years. In some localities the populations of particular species had completely disappeared whereas other species had established themselves in large numbers within the same period. On the other hand, in all localities observed, at least one species persisted from 1965 till 1971.

II. OTHER LOCALITIES VISITED IN 1971

A. In the neighbourhood of Valence (Drôme) three other localities were visited (the localities described in chapter I are also situated around Valence).

Along a similar ditch as described under I (between Crâne and Allex), *P. femoralis* could be collected in large numbers. Other species of the genus *Pardosa* scarcely occurred in this locality.

P. proxima and *P. hortensis* occurred together in large numbers near Dieu le Fit (Drôme), both were seen along the border of a brook as well as over the adjacent slopes of arable land. In these two habitats *P. femoralis* as well as *P. agrestis* occurred in small numbers. *P. morosa* could be collected along the border of the brook only.

Rather high on the slope of a hill between Rognac and Crâne (Drôme), large numbers of *P. agrestis* could be collected on arable land grown with lupin. Some specimens of *P. hortensis* also occurred in this locality.

B. Three samples were taken at different parts of the Camargue (Bouches du Rhône). In all samples the predominant species were *P. proxima* and *P. cribrata*.

The sample taken near Tour du Valat contained in addition large numbers of *P. prativaga* as well as some specimens of *P. femoralis*. The latter two species were found especially on the higher areas grown with rather high grasses. *P. proxima* as well as *P. cribrata* occurred mainly on the wetter, slimy parts of the habitat grown with *Salicornia* spec..

The third sample, taken between Salin de Giraud and Les Sts Maries, only contained *P. proxima* and *P. cribrata*.

C. Between Aigues Mortes (Gard) and Agde (Hérault), along the coast of the Golfe du Lion, four samples were taken. Generally, *P. prativaga* and *P. cribrata* were the predominant species.

In the first locality, next to the road from Aigues Mortes (Gard) to Montpellier (Hérault), densely grown with high grasses, only the two above mentioned species of the genus *Pardosa* could be collected.

The second locality, situated near Selon (Hérault), contained in addition specimens of *P. femoralis* and *P. proxima*. The habitat was a transitional area between wet, slimy soil grown with *Salicornia* spec., and the drier grounds densely grown with high grasses.

In the third locality, densely grown with high grasses, rather dry, and situated along the road from Palavas to Sète (Hérault), the same species occurred as in the former locality except *P. cribrata*, which could not be found at all.

P. cribrata, however, was the only species of the genus *Pardosa* which occurred in relatively large numbers in the fourth sample, which was taken along the road from Sète to Agde (Hérault). The habitat of this locality consisted of a true Salicornietum.

D. Four species of the genus *Pardosa* could be collected in relatively large numbers on a meadow along the Pas d'Esculette near Millau (Lozère): *P. femoralis*, *P. nigriceps*, *P. proxima*, and *P. hortensis*.

E. In the neighbourhood of Auxerre (Yonne), between Dijon and Paris, two localities were sampled.

The first one, near Le Pin, consisted of the transitional area from arable land, shrubs and trees (*Rubus*, *Betula*) to a marshy pool. Throughout this area up till nine species of the genus *Pardosa* could be collected. *P. agrestis* occurred mainly all over the arable land, *P. pullata* was most numerous in the transitional area from arable land to shrubs and trees. *P. paludicola* as well as *P. prativaga* dominated near to the marshy pool. Besides these species, especially in the transitional area some specimens of *P. nigriceps*, *P. proxima*, *P. hortensis*, *P. monticola*, and *P. femoralis* could be collected.

At the second locality (Etang de Brion), *P. prativaga*, *P. pullata*, *P. femoralis*, and *P. amentata* were found in a reed swamp along the border of a pool. Especially of *P. prativaga* and *P. amentata* large numbers could be collected.

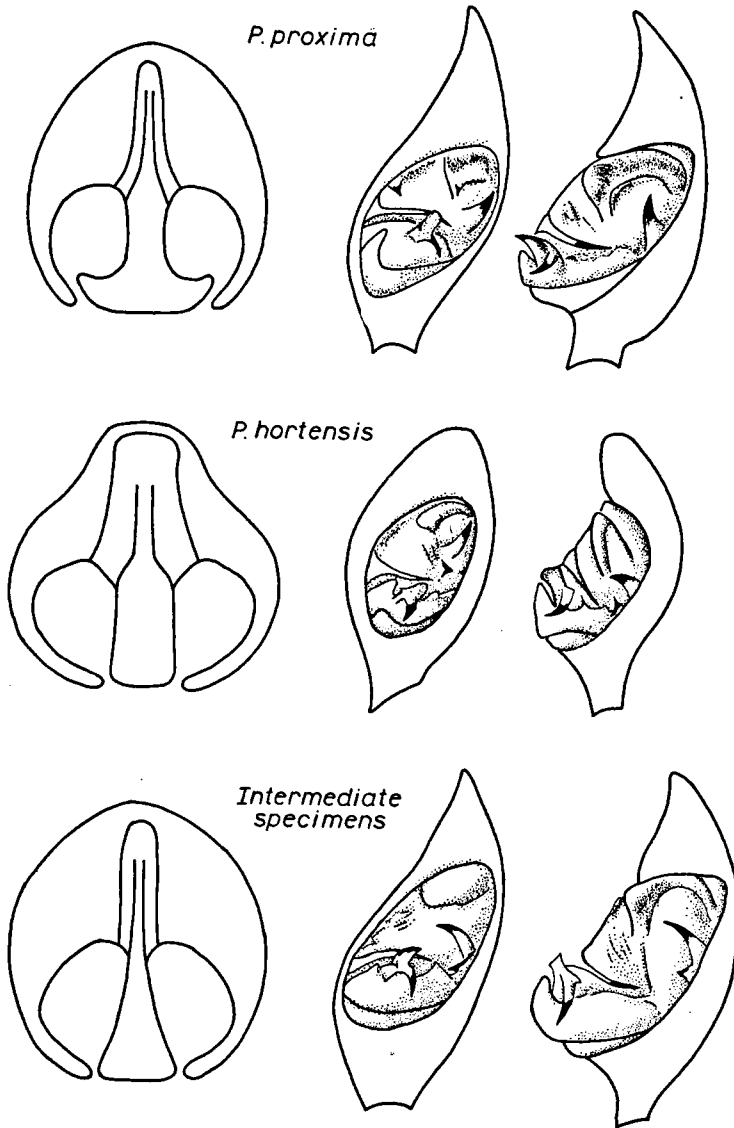


FIG. 1. Schematic drawings of the epigyneal and palpal structures of *P. proxima*, *P. hortensis*, and intermediate specimens. G. W. H. van den Berg fecit.

Conclusions

The results of the present study show similarities as well as differences as compared with those of Vlijm (1971).

Concerning the species *P. lugubris*, *P. palustris*, *P. paludicola*, *P. morosa*, *P. wagleri*, *P. luctinosa*, and *P. agrestis* the present conclusions confirm those of Vlijm (1971).

In contrast to the earlier results *P. agricola* did not occur in the present collections, though habitats in which this species could be expected („sandy or stony banks of lakes and watercourses”, Wiebes, 1959; Locket & Millidge, 1951; Tongiorgi, 1966a) have been visited, e.g., along the borders of the Drôme.

Vlijm (1971) mentioned that he was not able to collect *P. nigriceps* at all. Indeed, we too did not find this species in the lower regions of Southern France; however, we did at higher altitudes in the Cevennes near Millau. It seems likely that with regard to this species the same can be stated as with regard to *P. palustris*: occurring wide-spread in the Northern areas, in the Southern areas being restricted to the mountain regions. The same may hold for *P. amentata* which species could not be traced by us in Southern France; it was met with only more towards the North (Etang de Brion). Of this species Vlijm (1971) states that it is as wide-spread in France as it is e.g. in the Netherlands. However, the present observations suggest that in Southern France *P. amentata* is replaced by *P. proxima*, just as it is in Corse and Spain, and occasionally by *P. hortensis*. *P. monticola* too was not represented in the samples taken in Southern France, although some specimens of this species were taken more towards the North (Le Pin).

Although Vlijm (1971) did not mention *P. luctinosa* in Southern France, this species could be expected to be wide-spread there, especially in the Camargue, on the basis of its habitat (saline marshes, e.g. a *Salicornietum*, c.f. Tongiorgi, 1966a). However, we did not find this species at all. In most areas in which this species was expected to occur, another species occurred in the samples viz. *P. cribrata*. Indeed, the habitat of this species has also been stated to be saline marshes (Tongiorgi, 1966a).

The species *P. prativaga*, *P. pullata*, and *P. femoralis* (*P. pullata* group) as well as the species *P. proxima* and *P. hortensis* (*P. amentata* group, c.f. Wiebes, 1959) are of special interest. Both groups of species show considerable morphological variation (Tongiorgi, 1966a), and interbreeding between the species within the groups has been assumed (Den Hollander, 1970; Vlijm, 1971).

P. pullata was not seen in Southern France, neither in the neighbourhood of Valence, nor in the Camargue, nor along the coast of the Golfe du Lion (total of fourteen localities visited). Only in Central France (neighbourhood of Auxerre) this species could be collected. Contrastingly, Vlijm (1971) did find *P. pullata* in the surroundings of Valence in 1965.

P. prativaga also could not be sampled in 1971 in the latter area. Although Vlijm (1971) mentioned *P. prativaga* from these localities, his *P. prativaga* sensu lato refers to *P. femoralis*. We found *P. prativaga* throughout the Camargue, along the Golfe du Lion as well as in Central France, in the latter area in mixed populations together with *P. pullata*. However, all males sampled in Southern France showed white hairs on both the tibia and patella of the palps, whereas the males sampled in Central France showed black hairs on those places. According to Holm & Kronstedt (1970), this character distinguishes between *P. prativaga prativaga* and *P. prativaga scoparia*.

Indeed, both subspecies showed completely similar reproductive behaviour and interbred reciprocally without any difficulties (c.f. Den Hollander, Dijkstra, Alleman & Vlijm, 1972).

P. femoralis has been recorded only from France, occurring on alpine meadows in the Alps and Pyrenees (Holm & Kronestedt, 1970). On the other hand we were able to collect this species in most of the localities visited. *P. femoralis* occurred in largest numbers along ditches in arable land and on moist grassy lands. As compared to the other species of the *P. pullata* group, *P. femoralis* is a very large species, the males showing a characteristic darkened patella and tibia of the first leg. The reproductive behaviour of males of this species is comparable to that of *P. sphagnicola*.

The remaining species of the *P. pullata* group (*P. sphagnicola*, *P. riparia* and *P. fulvipes*) did not occur in the samples taken at any locality visited.

Vlijm (1971) refers to *P. proxima* as one of the most common species in Southern areas. Indeed, we did collect this species in most of the localities visited. Vlijm (1971) mentions *P. hortensis* as lacking in Southern France. The present data show that this species is also wide-spread in Southern France. However, *P. hortensis* did not occur at all in the localities in which *P. cribrata* was found (Camargue, Golfe du Lion). Generally, *P. proxima* occurs in mixed populations together with either *P. hortensis* or *P. cribrata*.

Like Vlijm (1971) we noted considerable variation in the epigyneal structures of both *P. proxima* and *P. hortensis*, which were corroborated by Ledoux (pers. comm.). Moreover, we were able to observe another very interesting point, concerning courtship behaviour. The courtship behaviour of *P. hortensis* resembles that of *P. amentata* (Vlijm & Dijkstra, 1966), consisting mostly of palpal movements. *P. proxima* males on the other hand show mainly "hopping", i.e., a special way of approaching the female (c.f. Den Hollander, Dijkstra, Alleman & Vlijm, 1972). In this type of "hopping" all parts of the body, i.e., the cephalic and abdominal regions are involved to the same extent. Now, specimens collected in two localities (Pas d'Esculette, Le Pin) which had been determined first as *P. proxima*, showed a different type of hopping. In this type of hopping especially the cephalic region of the spider males is strongly elevated by the stretching of the front legs. The abdomen is heightened only at about half the level of the cephalic region.

Closer examination of the morphology of these specimens resulted in the following observations. In habit they most resembled *P. proxima*; however, their size was intermediate between that of *P. proxima* and that of *P. hortensis*. The external genital structures (palp, epigyne) also showed intermediate features between both species, although these structures were comparable to those of *P. hortensis* rather than to those of *P. proxima* (fig. 1).

In the localities concerned, both *P. proxima* and *P. hortensis* occurred together with these aberrant specimens. Up till now we did not confront males and females of the species *P. proxima* and *P. hortensis* with the specimens described above, so that, as yet, it is not possible to answer the question whether these populations show either hybrid specimens between *P. proxima* and *P. hortensis*, or local variants of one or both species, or a particular ethospecies.

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