

Laboratory Breeding between European and North American Populations of the Spider *Philodromus rufus* Walckenaer (Araneida: Thomisidae)

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Introduction

The North American population of *Philodromus rufus* Walckenaer was defined as polytypic on a combination of behavioural and anatomical characters (Dondale, 1967; Dondale and Redner, 1968). No behavioural information was available on the Old World population, though the nominate form was originally described from the vicinity of Paris (Walckenaer, 1826). Mating behaviour has now been studied in collections from France (including the type locality) and Switzerland, and crossbreeding has been attempted between lots from Europe and North America.

Subadult spiders were collected from trees or shrubs in autumn, or in early spring, and reared to maturity in individual laboratory cages. Matings were judged successful if the males courted and mounted the female, and inserted their emboli one or more times during the two minutes after first contact between the sexes. Success in breeding was based only on the ability to mate and to produce offspring; a persistent rearing difficulty prevented the study of adult hybrid behaviour.

Results

The results of breeding tests between spiders from the Swiss Jura and Ontario are given in Table 1, where the European form is provisionally identified

as *P. rufus rufus* Walckenaer. No tests involving European males resulted in offspring. Ontario males were partially successful, their European mates laying a maximum of 21% fertile eggs (45% fertile eggs in control lot). A few tests were also made between *rufus* of Europe and *P. exilis* Banks of southern Ontario, in which one of 13 attempted matings was judged successful, with no offspring resulting. In all of the European material the males vibrated their legs in courtship like the *rufus* males of Ontario and the females constructed egg sacs on the walls of the cages. These results show that intercontinental crossbreeding in *P. rufus* is at least theoretically possible.

P. rufus rufus closely resembled *P. rufus quartus* Dondale and Redner of Ontario in size (four measured characters and one ratio, in samples of 16 to 30 individuals) and in external genitalia. The carapace and legs of living specimens of the European form, however, were usually green rather than orange, orange-red, or yellow-brown as in the various North American subspecies. The green pigment disappeared with alcoholic preservation. *P. rufus rufus* also differed in the time interval between successive egg sacs when cultures were maintained at 24°C and 50% R.H. (12.3 ± 2.1 days in contrast to 6.1 ± 1.0 days for *P. rufus quartus* and 5.8 ± 1.2 days for *P. rufus vibrans* Dondale). The mean for *P. rufus rufus* differed from both the others at the 0.001 level of statistical significance.

Another result was the discovery of a *rufus*-like species, provisionally identified as *Philodromus* sp. near *rufus*, in both the Jura and Paris collections. It mated reciprocally with *P. rufus quartus* (12 matings successful in 19 attempts) and with *P. rufus vibrans* (16 matings in 29 attempts) from Ontario, but only three of these, in all of which the male was *P. rufus*

	<i>P. rufus quartus</i> ♀♀ (Ontario)				<i>P. rufus vibrans</i> ♀♀ (Ontario)				<i>P. rufus rufus</i> ♀♀ (Switzerland)			
	Mating attempts	Suc-cesses	Eggs per ♀	Hatch %	Mating attempts	Suc-cesses	Eggs per ♀	Hatch %	Mating attempts	Suc-cesses	Eggs per ♀	Hatch %
<i>P. rufus quartus</i> ♂♂	8	8	67	60	—	—	—	—	2	1	61	21
<i>P. rufus vibrans</i> ♂♂	—	—	—	—	7	7	58	69	6	1	34	0
<i>P. rufus rufus</i> ♂♂	8	2	86	0	6	0	0	—	31	31	60	45

Table 1: Mating, egg production, and hatching in three subspecies of *Philodromus rufus* in the laboratory

vibrans, resulted in fertile eggs, total hatch being 7.5%. The two European species were sexually incompatible in the laboratory. Brief courtship occurred in four of 17 tests. A single, very brief copulation occurred between a male of *Philodromus* sp. near *rufus* and a female of *P. rufus rufus*, but no offspring resulted. Thirty-three within-species matings yielded from 20 to 53 eggs per female of which 20 to 64% hatched. Both species were found together in spruce trees and in deciduous shrubs at Delémont and Orbe, Switzerland, and in pine trees in the Bois de Vincennes, on the outskirts of Paris.

The foregoing raised the question as to the identities of *P. rufus* Walckenaer and of the *rufus*-like species living with it in western Europe. Curators of three major European arachnid collections (D.J. Clark, M. Vachon, O. Kraus *in litt.*) agree that Walckenaer's collections no longer exist and that there is no likelihood of a type specimen of *P. rufus* coming to light. Furthermore, the original description of *P. rufus* is brief and equivocal, offering no clue as to which of the two species should take this name. The International Commission on Zoological Nomenclature provides for the solution of such problems through the selection and description of a neotype.

A male of the form herein discussed as *P. rufus rufus* Walckenaer, labelled "*Philodromus rufus* Walckenaer. Bois de Vincennes, Paris, 14-X-1969. Mature in lab 11-X1-1969. C. Dondale" is hereby designated as neotype. It is deposited in the Muséum National d'Histoire Naturelle in Paris, and is described as follows: Carapace 1.70 mm long and 1.68 mm wide; femur II 2.76 mm long; total length 4.1 mm. Carapace green in life, orange in alcohol. Legs green basally in life, orange-yellow in alcohol. Dorsum of abdomen with chevron pattern. Retrolateral apophysis of palpal tibia terminating in curved tooth that is set at angle to long axis of apophysis (Fig. 1). Tegulum broad, bulged prolaterally, with embolus long and arising probasally (Fig. 2). As thus defined *P. rufus* differs from *Philodromus* sp. near *rufus* in the set of the tooth on the retrolateral apophysis (compare Figs. 1 and 4), the breadth of the tegulum, and the length of the embolus (compare Figs. 2 and 3). *P. rufus* is further distinguished, in the female, by having an elongate, rather than curled, spermathecal organ (compare Figs. 6 and 8).

The task of naming *Philodromus* sp. near *rufus*

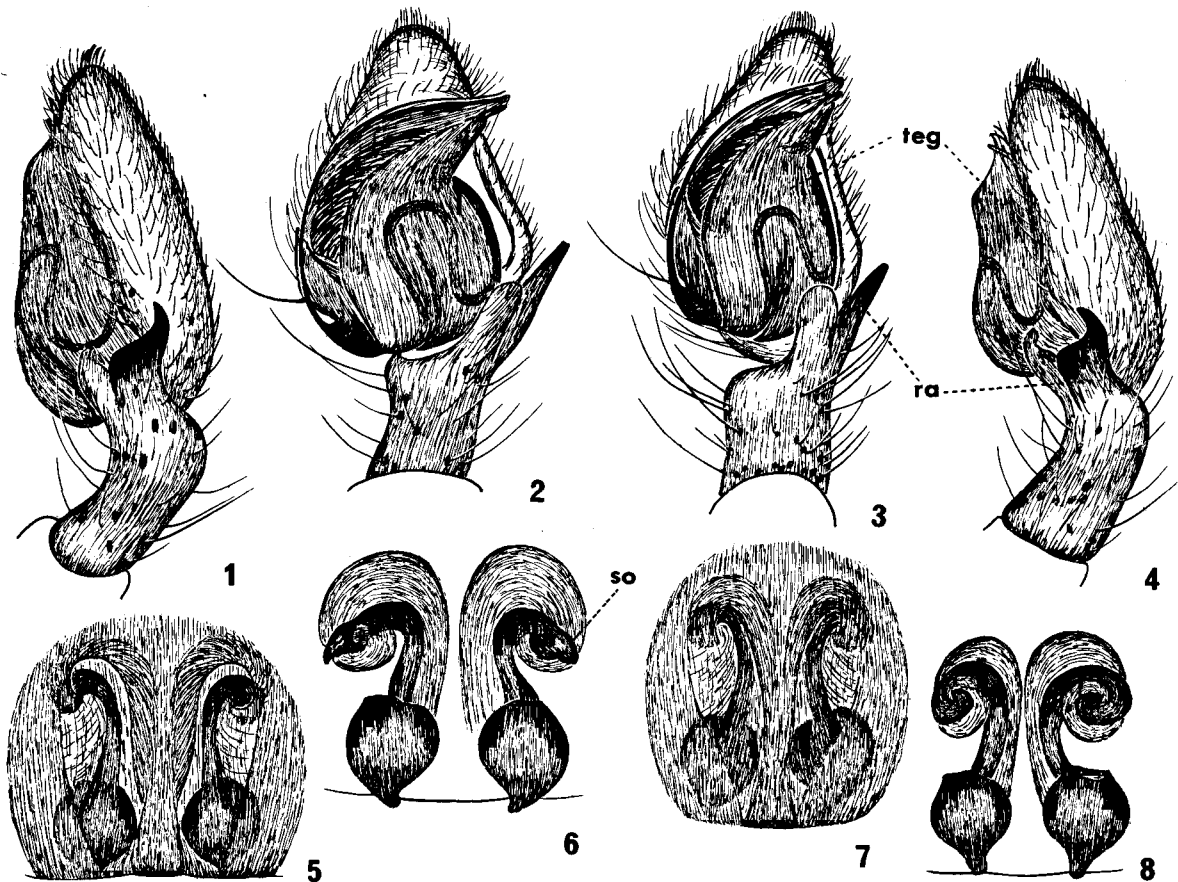
remains. The names examined were those listed as synonyms of *P. rufus* by Bonnet (1945-61): *P. clarki* Blackwall, 1850; *P. pallax* Herman, 1879; *P. clarae* Bertkau, 1880; and *P. rufus virescens* Simon, 1932.

P. clarki was based on a male spider taken at Southgate, England, in June 1849 and deposited "in the cabinet of Mr. Walker" (Blackwall, 1850). The specimen later could not be found for illustration in "A History of the Spiders of Great Britain and Ireland", and Picard-Cambridge (1899) stated definitely that it had been destroyed. Renewed searches at Oxford and the British Museum (Natural History) by G.H. Locket and D.J. Clark in recent years failed to raise the specimen in question. The original description of *P. clarki* undoubtedly was of *P. rufus* in the broad sense but not specifically of either *P. rufus rufus* or *Philodromus* sp. near *rufus*. Picard-Cambridge (1895) described and illustrated a male that matched *P. rufus rufus*, and A.R. Jackson collected a male (deposited in British Museum (Natural History)) that appeared to be *Philodromus* sp. near *rufus*, both specimens being from the New Forest. This suggests that both species occur in Britain. Confirmation from living material is desirable, after which the identity of *P. clarki* may be decided.

P. pallax was described from a female spider collected at Orsova (Herman, 1879). The type has not been found, and the original description and illustrations apply equally well to *P. rufus rufus* or *Philodromus* sp. near *rufus*.

P. clarae was based on a male and female from Bonn, Germany (Bertkau, 1880), and deposited in the Muséum National d'Histoire Naturelle, Paris (Bocal No. 1559, Simon collection No. 3895). Simon's unpublished cahier-manuscrit comments as follows: "3895. *rufus* W. Bonn. Bertkau (*sub P. clarae*)". These specimens were examined and found to match the form described here as *P. rufus rufus*; *P. clarae* Bertkau is therefore confirmed as a junior synonym of *P. rufus*.

P. rufus virescens was based on a female spider from Banyuls-sur-Mer, France, and proposed as a colour variety of *P. rufus* (Simon, 1932). Article 45 (e) of the Code of Zoological Nomenclature states that a name given as a variety, before 1961, "is not to be interpreted as an express statement of either subspecific or infraspecific rank." The cataloguers



FIGS. 1 - 8. *Philodromus*. Male palpus of (1, 2) *P. rufus rufus* Walckenaer; (3, 4) *Philodromus* sp. near *rufus*. Epigynum of (5, 6) *P. rufus rufus* Walckenaer; (7, 8) *Philodromus* sp. near *rufus*. *teg*: tegulum. *ra*: retrolateral apophysis. *so*: spermathecal organ.

Bonnet (1945-61) and Roewer (1942-54), however, regard Simon's "variété" as a subspecies in the modern sense. Although the name *virescens* is preoccupied by *P. virescens* Thorell, 1877, it seemed desirable to stabilize *P. rufus virescens* Simon through typology. A search for the type in the Simon collection at the Muséum National d'Histoire Naturelle revealed specimens labelled only as to country and none with the name of the type locality. A female labelled "*Philodromus rufus virescens* Simon. Banyuls-sur-Mer, 6.VI.1969. C. Dondale, R. Legendre" is therefore designated as neotype and deposited in Bocal 1559 in that museum. The

neotype is described as follows: Carapace 1.63 mm long and 1.58 mm wide; femur II 1.83 long; total length 4.3 mm. Carapace and legs greenish in life, pale yellow-orange in alcohol, finely speckled with red-brown to black. Dorsum of abdomen with indistinct heart mark and series of chevrons. Epigynum perforate (Fig. 7), with spermathecal organ elongate (Fig. 8). As thus defined, *P. rufus virescens* matches *P. rufus rufus* as defined herein, and the former is confirmed as a junior synonym of the latter. *P. rufus virescens* differs from *Philodromus* sp. near *rufus* in having an elongate, rather than curled, spermathecal organ (compare Figs. 6 and 8).

Summary

Laboratory breeding between European and North American lots of *Philodromus rufus* Walckenaer is demonstrated. On this basis, *P. rufus* of western Europe is designated *P. rufus rufus*, which differs from the North American subspecies in colour and in the time interval between successive egg sacs in ovipositing females. The name *P. rufus rufus* is stabilized by designation of a neotype. Sympatric with *P. rufus rufus* is a second species, the name of which depends, in the first instance, on the identity of *P. clarki* Blackwall, 1850 and, in the second, on that of *P. pellax* Herman, 1879. *P. clarae* Bertkau, 1880 and *P. rufus virescens* Simon, 1932 are confirmed as junior synonyms of *P. rufus rufus*. A neotype is also designated for *P. rufus virescens*.

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