Revision of the genus *Phiale* C. L. Koch, 1846 (Araneae, Salticidae). IV. The polymorphic species of the *gratiosa* group

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Summary

Three species, *Phiale guttata* (C. L. Koch), *P. gratiosa* C. L. Koch and *P. roburifoliata* Holmberg are placed in the *gratiosa* group of *Phiale* and the group diagnosed and described. A key to species is given. The study of living specimens of *P. gratiosa* and *P. roburifoliata* demonstrated the existence in both species of a chromatic sex-controlled polymorphism with monomorphic males and polymorphic females.

The following names are newly synonymised: *Phiale rufoguttata* C. L. Koch, *P. berina* C. L. Koch, *Plexippus selectus* C. L. Koch, *Palestrina variegata* Peckham & Peckham, *Menemerus quadrinotatus* Mello-Leitão, *Menemerus ursinus* Mello-Leitão and *Freya haemorrhoa* Mello-Leitão with *Phiale gratiosa; Phiale erythrogaster* Holmberg, *P. aristocratica* Holmberg, *Freya boeroi* Mello-Leitão and *Phiale ferruginea* Mello-Leitão with *P. roburifoliata* Holmberg.

Introduction

The present paper, the fourth in a series on the spider genus *Phiale,* deals with three species belonging to a homogeneous group. The species are *Phiale gratiosa* C. L. Koch, 1846, *Phiale guttata* (C. L. Koch, 1846) and *Phiale roburifoliata* Holmberg, 1874. There is considerable similarity in the genitalia and in the chaetotaxy, but this study has shown that the differences between these species are constant.

Nothing is known about the natural history of *P. guttata.* In a previous paper (Galiano, 1979) the new combination was established based on the study of thirteen males and eleven females. They showed only a small degree of sexual dimorphism (males with white abdominal patches and females with yellow ones).

P. gratiosa and *P. roburifoliata* are the main subjects of the present paper. Many preserved and living specimens have been studied, with the conclusion that both species present a chromatic sex-controlled polymorphism, with monomorphic males and polymorphic females. A similar case was demonstrated in four of the five species of the *Phiale mimica* group (Galiano, 1981).

The discovery of polymorphism in *P. gratiosa* is especially interesting because it is the type-species of the genus. Up to now, only the females were known (Galiano, 1978). Four polymorphic variants have been described as new species and the males have been placed in different genera (*Freya, Plexippus*) by previous authors.

Methods

The standard abbreviations and measurements are those used by Galiano (1963a, 1979). The description of chaetotaxy follows the system used by Platnick & Shadab (1975).

The *gratiosa* group

Diagnosis: The *gratiosa* group is closely related to the *mimica* group. Species belonging to the *gratiosa* group differ from those of the *mimica* group in that (1) the embolus is bent in a right angle; (2) the cymbium has no proximal, blunt process; (3) the epigynum has two large depressions, each with a spiral border.

Description: Carapace: broad (width/length 73-95%); high (height/length 40-50%). Ocular quadrangle wider than long. Ocular quadrangle length occupies 35-44% of length of carapace. Posterior row usually a little wider than anterior row. (In small specimens, can be equal or wider in front than behind). Small eyes of second row closer to ALE. Height of clypeus equal to nearly one-third diameter of AME. White or yellow hairs thickly cover the space between AME and the margin. *Chelicerae:* strong, vertical, parallel; front considerably swollen in females. Promargin with two teeth, retromargin with one. *Legs:* male 1432; female 4312. *Leg spination: Male:* femora I, II d 1-1-1, p 2, r 1-2; III d 1-1-1, p 1-2, r 1-2; IV d 1-1-1, p 1-2, r 1-2. Patellae I, II p 1; III, IV p 1, r 1. Tibiae I p 1-1, v 2-2-2; II p 1-1, r 1-1, v 2-2-2; III, IV d 1, p 1-1-1, r 1-1-1, v 2-2. Metatarsi I v 2-2; II p 1, r 1, v 2-2; III p 1-2, r 1-1-2, v 2-2; IV p 1-1-2, r 1-1-2, v 2-2. Variations:

femora I, II p 1-2, r 1; III r 1-1. Patellae I, II r 1. Tibiae I r 1-1; II v 1-2-2; III, IV p 1-1-1-1, r 1-1-1-1, in two rows, v 1-2. *Female:* femora I d 1-1-1, p 2, r 1; II d 1-1-1, p 2, r 1-2, III d 1-1-1, p 1-2, r 1-2; IV d 1-1-1, p 1, r 1. Patellae II p 1; III, IV p 1, r 1. Tibiae I, II p 1-1, v 2-2-2; III, IV p 1-1-1, r 1-1-1, v 1-2. Metatarsi I, II v 2-2, III p 1-2, r 1-1-2, v 2-2; IV p 1-1-2, r 1-1-2, v 2-2. Variations: femora I r 1-2, r 2; III r 1, r 1-1; IV p 2. Patellae I p 1; II p 0. Tibiae I p 0; II v 1-2-2; III, IV d 1, v 2-2-2. Metatarsi IV v 1-2. *Palp:* femur slightly bent, with patch of white hairs on dorsal distal half; patella larger than tibia; proximal end of cymbium covered by dorsal band of long, white hairs. Tibial retrolateral apophysis a long spur. Bulb swollen, bilobed at base; embolus arises on prolateral side of distal end. Body of embolus bent at right angle; proximal part membranous, cylindrical, stout; distal part chitinous, straight, thin distally. *Epigynum:* posterior margin with central pocket; anterior half with two large depressions each with a spiral border. Spermathecae situated posteriorly; ducts curved.

Key to species of the *gratiosa* group

1. Males 2
– Females 4
2. Cymbium with stout prolateral border. Abdomen red dorsally, with anterior band of black hairs. . . . . *P. gratiosa*
– Cymbium without prolateral process; abdomen otherwise 3
3. Tibial apophysis slightly bent; bulb relatively large. Abdomen with red hairs dorsally . . . . . *P. roburifoliata*
– Tibial apophysis straight; bulb relatively small. Abdomen black with white patches dorsally . . . . . *P. guttata*
4. Epigynal depressions widely separated; spiral border with wide margins . . . . . *P. guttata*
– Epigynal depressions close together; spiral border with narrow margins 5
5. Epigynal depressions large, occupying more than half the epigynum; spiral coil open (Figs. 5, 6); palps dark brown . . . . . *P. gratiosa*
– Epigynal depressions small, occupying less than half the epigynum; spiral coil closed almost as a circle (Figs. 3, 4); palps yellowish white . . . . . *P. roburifoliata*

Phiale gratiosa C. L. Koch, 1846

Phiale gratiosa C. L. Koch, 1846: 193, figs. 1240, 1241 (female holotype and one immature female, paratype, No. 1625 M.N.B., from Brazil; examined); 1851: 58 (*Phyale*). Simon, 1903: 695, 701, 702, 707. Petrunkevitch, 1911: 691; 1928: 196. Mello-Leitão, 1941a: 298. Bonnet, 1958: 3507. Galiano, 1978: 162, figs. 1-4, 8, 9.

Phiale mimica (part) Roewer, 1954: 1061.

Philia gratiosa Bertkau, 1880: 40. Goeldi, 1892: 212.

Pardessus gratiosus Peckham & Peckham, 1896: 36. Cambridge, F. O. P.-, 1901: 221, pl. 18, fig. 11-11a.

Phiale rufoguttata C. L. Koch, 1846: 197, fig. 1245 (female holotype No. 1627 M.N.B., from Brazil, Minas Gerais; examined); 1851: 59 (*Phyale*). Simon, 1903: 702. Petrunkevitch, 1911: 693. Roewer, 1954: 1063. Bonnet, 1958: 3509. Galiano, 1978: 165, figs. 7, 10, 11. NEW SYNONYMY.

Palestrina variegata Peckham & Peckham, 1901: 304, pl. 26, fig. 4, 4a-c (two females, from Brazil, Chapada, Smith coll., one female (M.P.M.) possible syntype, examined). NEW SYNONYMY.

Phiale variegata Simon, 1903: 702, 707. Petrunkevitch, 1911: 693. Bonnet, 1958: 3510. Roewer, 1954: 1063.

Phiale berina C. L. Koch, 1846: 198, fig. 1246 (male immature, holotype No. 1624 M.N.B., from Brazil; examined); 1851: 59 (*Phyale*). Petrunkevitch, 1911: 689. Roewer, 1954: 1057. Bonnet, 1958: 3505. NEW SYNONYMY.

Menemerus 4-notatus Mello-Leitão, 1939: 88, fig. 79 (female immature, holotype No. 1206a M.H.N.B., from Paraguay, Ternetz coll.; examined); 1946: 48. Roewer, 1954: 1268 (*M. quadriguttatus lapsus*). Bonnet, 1957: 2772 (*M. quadrinotatus*). Galiano, 1963b: 2, 4. NEW SYNONYMY.

Menemerus ursinus Mello-Leitão, 1945: 288, fig. 78 (female holotype, No. 19.800 M.L.P., from R. Argentina, Misiones: Puerto Victoria, Zenzes coll.; examined). Roewer, 1954: 1268. Galiano, 1963b: 4. NEW SYNONYMY.

Plexippus selectus C. L. Koch, 1846: 100, fig. 1163 (male holotype No. 1750 M.N.B., from Brazil, Langsdorf coll.; examined); 1851: 52. Petrunkevitch, 1911: 695. Roewer, 1954: 1089. Galiano, 1979: 345. NEW SYNONYMY.

Freya haemorrhoa Mello-Leitão, 1945: 282 (male holotype No. 16.765 M.L.P., from R. Argentina, Misiones: San Ignacio, Birabén coll.; examined) NEW SYNONYMY.

Type locality: Brazil.

Distribution (Fig. 2): Brazil: São Paulo, Minas Gerais, Mato Grosso, Mazonas. R. Argentina: Misiones prov. Paraguay: San Pedro Dep., Concepción Dep.

Females: The female holotype was described in a previous paper (Galiano, 1978). Among the many females studied, the following polymorphic variants were observed (Fig. 1). (All the morphs have dark brown palps):

1. Abdomen B-1, carapace 1
2. Abdomen B-2, carapace 2
3. Abdomen B-3, carapace 3
4. Abdomen B-2, carapace 4
5. Abdomen C, carapace 8
6. Abdomen D, carapace 5
7. Abdomen E, carapace 8
8. Abdomen F-1, carapace 9
9. Abdomen G, carapace 8
10. Abdomen H, carapace 8
11. Abdomen I, carapace 6
12. Abdomen F-1, carapace 6
13. Abdomen F-2, carapace 5
14. Abdomen F-3, carapace 5
15. Abdomen J, carapace 5
16. Abdomen K, carapace 8
17. Abdomen K, carapace 9
18. Abdomen L, carapace 8
19. Abdomen M, carapace 5
20. Abdomen N, carapace 8
21. Abdomen O, carapace 5

From the observed patterns, three main variants can be delimited: (a) abdomen covered with black hairs, mixed with yellow, white and orange hairs (Fig. 1 B 1-3); (b) abdomen covered with black hairs, with two pairs of lateral patches of yellow, orange or red hairs (Fig. 1 F 1-3); (c) abdomen covered with black hairs, with a marginal band of yellow, orange or red hairs (Fig. 1 K-0). The percentage of each variant is given in Table 1.

Male No. 7208 MACN: Total length 9.98. Carapace 4.13 long, 3.26 wide, 1.73 high. Clypeus 0.30 high. Ocular quadrangle 1.57 long, first row 2.23 wide, third row 2.20 wide. Small eyes of second row closer to ALE than to PLE. Diameter of AME 0.70. Chelicerae, relative length of legs and leg spination as for the species group. Palp: Figs. 10-12.

Colour "in vivo": Monomorphic males: To the legend of Fig. 1 A the following can be added: the two white bands on the sides of the carapace form a wide band on the clypeus. The central narrow band with white hairs on the abdomen runs from the anterior end either full length or only one-third of the total length of the abdomen. The lateral bands with white hairs (Fig. 1 A-1) may be replaced by patches (Fig. 1 A-2). Legs black, with many white hairs on femora III and IV and on tibiae and metatarsi I and II. Palp black, with dorsal distal end of femur and proximal half of cymbium covered with long, white hairs. Distal half of cymbium brown.

Colour of immatures: Body, legs and palps black. The subadult females show the bands and patches they will have as adults. The penultimate instar males have the abdomen red, with an anterior white band that runs along both sides and is widened in the middle of the lateral part, forming a round, white spot. There is another pair of white spots at the posterior end of the abdomen.

Natural History

P. gratiosa has an annual life cycle, with adults in spring (October, November). The species is found in tropical and subtropical forest but, within these areas, it prefers open and sunny places like road verges where a thick growth of grasses develops. Among the Gramineae, *Setaria poiretiana* (Schult.) Kunth is

Variants		N	%	Group total %
a	Black and yellow mixed hairs	111	44.0	
	Black and white mixed hairs	22	8.7	53.9
	Black and orange mixed hairs	3	1.2	
b	Black with two pairs of yellow patches	39	15.4	27.7
	Black with two pairs of red patches	31	12.3	
c	Black with a marginal band with yellow, red or orange hairs	46	18.2	18.2
	Total	252	99.8	99.8

Table 1: Distribution of polymorphic variants of *P. gratiosa* females according to abdomen patterns. (N: number of specimens; a, b and c: main variants, see text).

Fig. 1: Polymorphic variants of *Phiale gratiosa* C. L. Koch, 1846.

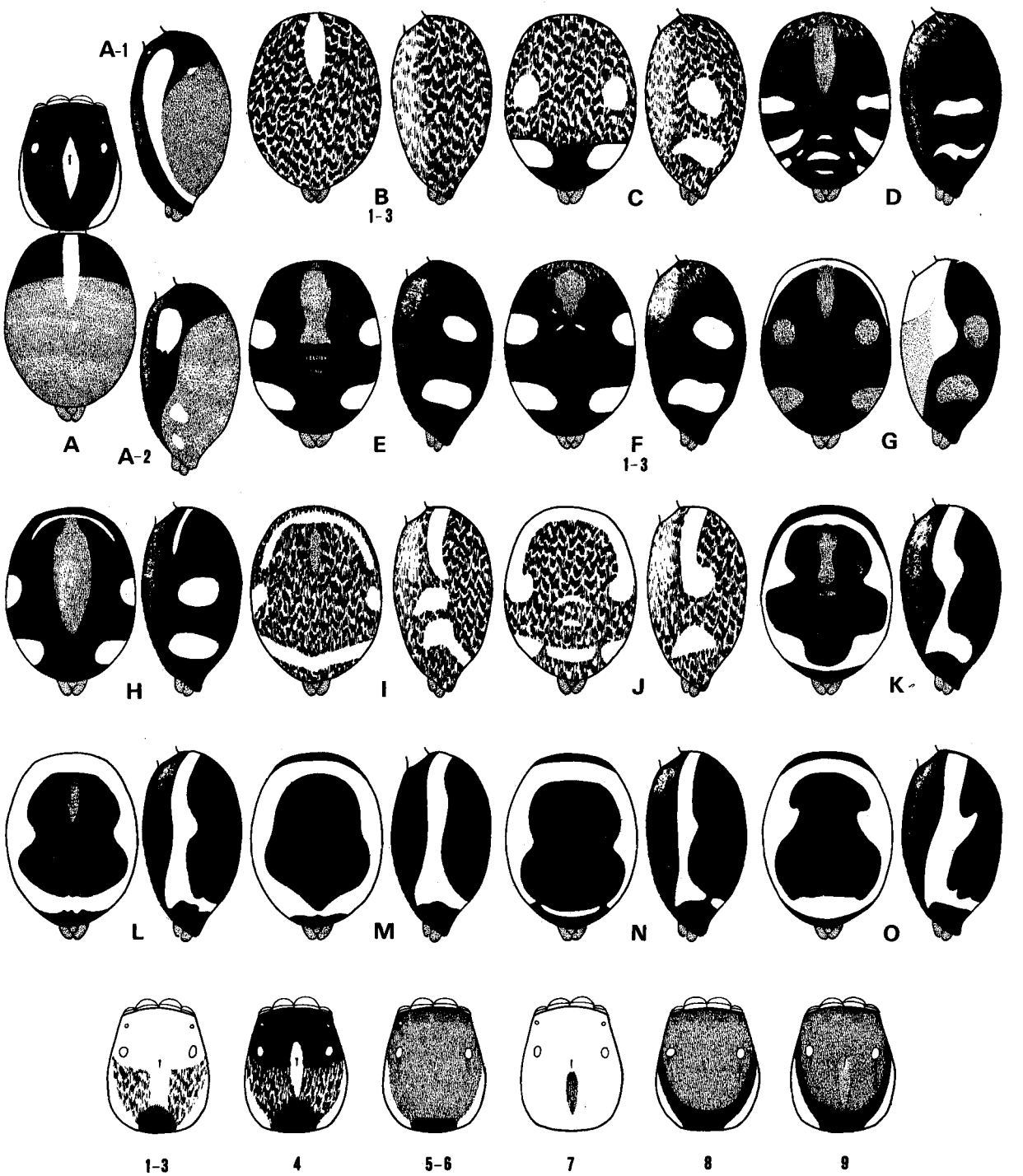
A, A-1, A-2. Male, dorsal and lateral patterns. Carapace black with black hairs; central and lateral bands with white hairs. Abdomen with black integument covered with red hairs (dotted) except anterior band with black hairs. Central band with white hairs. Lateral bands **(A-1)** or lateral patches **(A-2)** with white hairs.

B-0. Female abdomen, dorsal and lateral patterns.

B-1. Black integument with black and white mixed hairs; central band with white hairs.
B-2. As **B-1**, but with black and yellow mixed hairs.
B-3. As **B-1**, but with black and orange mixed hairs.
C. Black integument with black and orange mixed hairs. Patches with yellow integument and orange hairs.
D. Black integument with black hairs; anterior spots with yellow hairs. Central band (dotted) with red hairs. Other bands and patches with yellow integument and yellow hairs.
E. Black integument with black hairs. Central band and patches (dotted) with red hairs. Lateral patches with yellow integument and orange hairs.
F-1. Black integument with black hairs; anterior spots with yellow hairs. Central band (dotted) with red hairs. Patches with yellow integument and yellow hairs.
F-2. As **F-1**, but lateral patches and anterior spots with orange hairs.
F-3. As **F-1**, but lateral patches with red hairs.
G. Black integument with black hairs; anterior band with yellowish white hairs. Central band and lateral patches (dotted) with red hairs.
H. Black integument with black hairs; anterior band with yellow hairs. Central band (dotted) with red hairs. Lateral patches with yellow integument and yellowish white hairs.
I. Black integument with black and orange mixed hairs. Central band (dotted) with orange hairs. Other bands and patches with yellow integument and red hairs.
J. Black integument with black and yellow mixed hairs. Bands and patches with yellow integument and orange hairs.
K. Black integument with black hairs; central band (dotted) with red hairs. Marginal band with yellow integument and orange hairs.
L. Black integument with black hairs; central band (dotted) with yellowish white hairs. Marginal band with yellow integument and reddish orange hairs.
M. Black integument with black hairs; marginal band with yellow integument and orange hairs.
N. Black integument with black hairs; marginal band with yellow integument and golden yellow hairs.
O. Black integument with black hairs; marginal band with yellow integument and reddish orange hairs.

1-9. Female carapace.

1. Cephalic region, central and lateral bands with white hairs. Thoracic region with black and white mixed hairs.
2. As **1**, but with yellow hairs instead of white.
3. As **1**, but with orange hairs instead of white.
4. Cephalic region with black hairs; central and lateral bands with white hairs. Thoracic region with black hairs interspersed with some white hairs.
5. Cephalic region with red hairs; lateral bands with yellowish white hairs.
6. Cephalic region with red hairs; lateral bands with orange hairs.
7. Cephalic and thoracic regions with white hairs; central band (dotted) with yellowish orange hairs.
8. Cephalic region with red hairs; lateral bands with white hairs. Thoracic region with black hairs.
9. Cephalic region with red hairs; central band (dotted) with bright red hairs. Lateral bands with yellowish white hairs. Thoracic region with black hairs.


A-1
B
1-3
C
D
A
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5-6
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9

commonly chosen for building the nests. Dozens of specimens are found within a few metres and then, not a single one for kilometres. This seems to be some kind of aggregation.

Individuals of *P. gratiosa* wander along the upper side of leaves, especially in the late afternoon. Among their prey we saw Lepidoptera, Odonata, Diptera, Homoptera Cicadellidae, and other spiders such as Thomisidae. Specimens of *P. gratiosa* are not timorous, they remain at their place, watching approaching danger, rotating the carapace and waving palps and legs. The males sometimes show threat display. At the last moment they run under the leaf or jump away.

The retreat or nest is a white silk tube about 3-5 cm long, wider in the central part, open at both ends. The entrances are narrow slits, closed with silk during moulting, oviposition and while the pair are inside. The spider folds longitudinally the distal end of a leaf and constructs the nest inside the resulting cone, or builds the retreat in the angle of a bent leaf. In the laboratory they often built nests at the angles formed by walls and roof, many times with three entrances. The nests of inseminated females are particularly large and dense and frequently the silk is yellow.

In the National Park Iguazú at the beginning of October, most of the males are adult and the females subadult. The subadult female constructs a nest and the male builds a second chamber on the female nest, closing the entrances. This double nest with two separate chambers has been described for *Phidippus johnsoni* (Peckham & Peckham) (Jackson, 1977). It is likely that copulation occurs inside the nest after the moulting of the female, but I never saw it. In the laboratory copulation took place on the walls of the bottle, outside the nest. Both females and males may mate several times, with the same or with other partners. The female remains with the egg sac until emergence. The spiderlings emerge from the egg sac, stay inside the retreat, moult once and then go out. For several days, mother and offspring can be seen walking in and out of the nest until the final dispersion. There is a clear tendency on the part of the first stages to build their retreats in aggregations. The mother constructs another nest in which she may oviposit again.

Polymorphism

Material and methods: Two hundred and fifty-two females and sixty males came from the National Park Iguazú, R. Argentina. Many of them were collected as immatures and reared in the laboratory to adult. The majority of the males were collected as adults, and most of the females as subadults. Thirty-six pairs were found enclosed in retreats with two chambers. When a cohabiting pair were found, the nest was opened and each member enclosed in a separate plastic tube. In the laboratory they were reunited in the same bottle and generally they rebuilt a double nest. Single specimens were maintained in 500 ml glass bottles, with a piece of paper as support and voile material as floor. *Drosophila melanogaster* and *Musca domestica* were provided three times a week. A piece of cotton wool provided moisture. Virgin females mated with males introduced into their bottles.

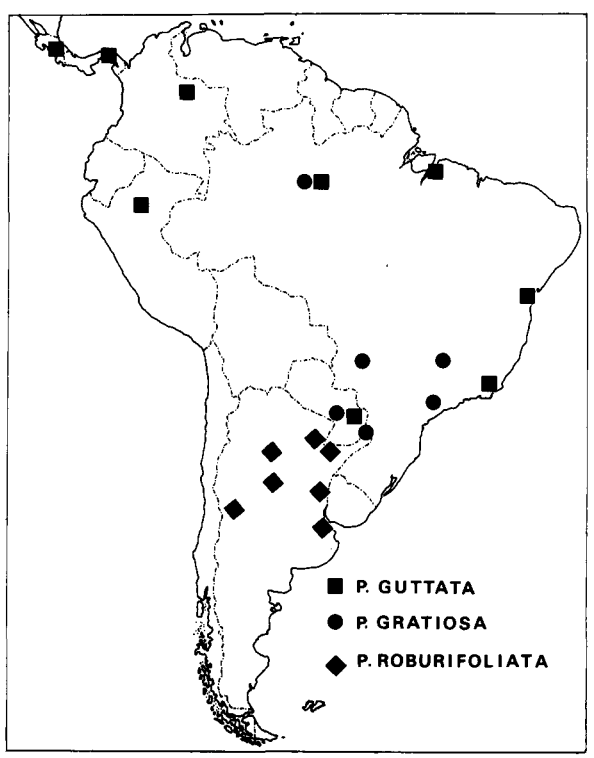


Fig. 2: South America, showing distribution of the *gratiosa* group species.

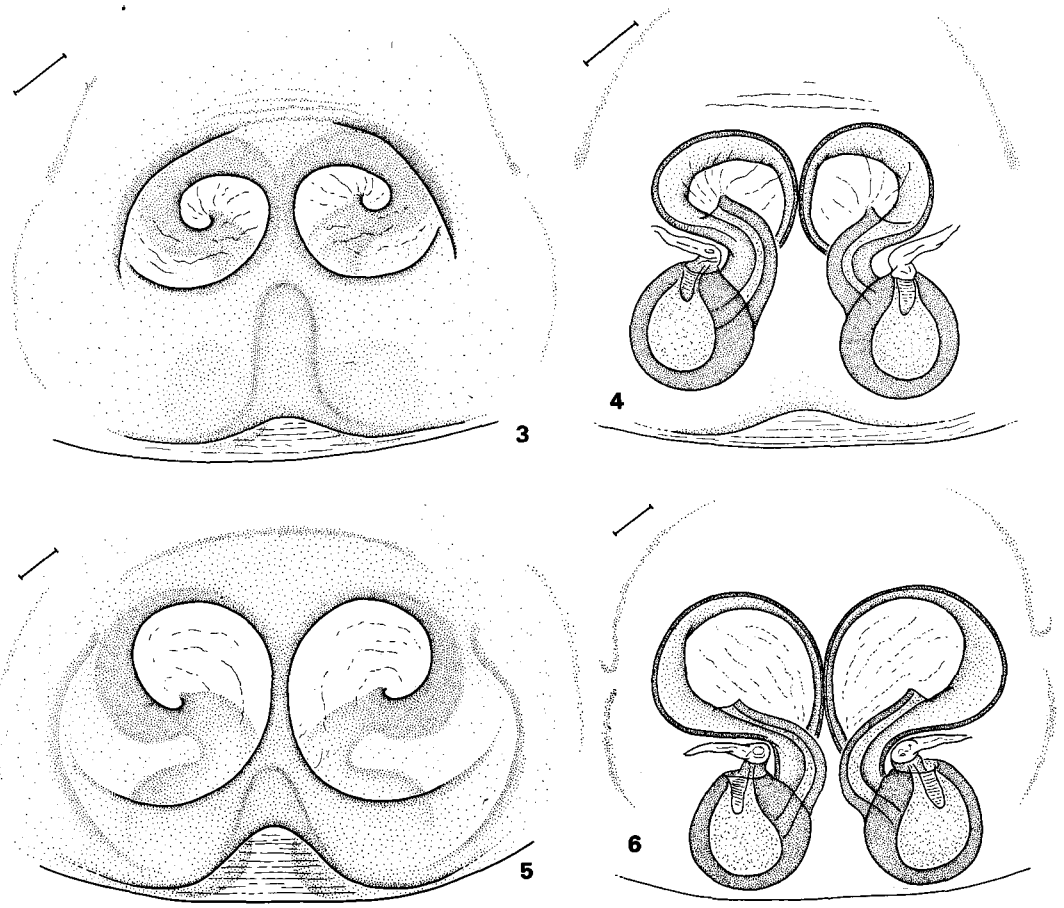
One hundred and four egg sacs were oviposited in the laboratory, both by females that were already inseminated when collected and by females inseminated in the laboratory. Ninety-five egg sacs produced spiderlings, which were given a number and reared according to techniques developed during previous research with *Phiale tristis* Mello-Leitão (Galiano, 1981). In spite of the fact that *P. tristis* and *P. gratiosa* seem closely related on the basis of morphological and biological characters, it is evident that their needs are different because the controlled rearing of *P. tristis* was successful while that of *P. gratiosa* produced only six adults out of hundreds of spiderlings.

Results:

(1) Mother No. 721: black integument with black and yellow mixed hairs (Fig. 1 B-2).
Offspring: one adult male (Fig. 1 A).

(2) Mother No. 667: black integument with black hairs; central band with red hairs and four patches with yellow integument and yellow hairs (Fig. 1 F-1).
Offspring: three adult males (Fig. 1 A).

(3) Mother No. 685: black integument with black and yellow mixed hairs (Fig. 1 B-2).
Offspring: one adult female with the same colour pattern.



Figs. 3-4: *Phiale roburifoliata* Holmberg, epigynum. **3** ventral view; **4** dorsal view.

Figs. 5-6: *Phiale gratiosa* C. L. Koch, epigynum. **5** ventral view. **6** dorsal view.
Scale lines = 0.1 mm.

(4) Mother No. 972: black integument with black hairs; marginal band with yellow integument and orange hairs (Fig. 1 M).
Offspring: one adult male (Fig. 1 A).

Discussion: The results of the controlled rearing are very poor but, together with the study of hundreds of living specimens in the field and in the laboratory, allow us to state the following conclusions:
(1) Three females with different colour patterns produced the same kind of adult male as a descendant.
(2) In the field, adult males of *P. gratiosa* have been found on 36 occasions in a retreat with two chambers enclosed with a subadult female with a different colour pattern.
(3) In the laboratory, males of *P. gratiosa* can mate several times with the same or other females with different colour patterns.
(4) Females inseminated in the laboratory or caught already mated, constructed 104 egg sacs from 95 of which spiderlings emerged. The fact that the great majority of them died before attaining maturity should be ascribed to deficient experimental techniques and not to genetic incompatibility because the mortality occurred among the offspring of both types of females.
(5) The different polymorphic variants live in the field in the same site forming aggregations.
(6) There are no structural differences in morphology among the polymorphic variants.

Phiale roburifoliata Holmberg, 1874

Phiale roburifoliata Holmberg, 1874: 293, pl. 6, fig. 4 (two females, from R. Argentina, Buenos Aires, in Holmberg's private collection, destroyed, not examined); 1876: 24 (*Phyale*). Petrunkevitch, 1911: 693. Mello-Leitão, 1933: 60; 1944: 320, 321. Roewer, 1954: 1063. Bonnet, 1958: 3509.

Phiale erythrogaster Holmberg, 1876: 24 (*Phyale* ?) (males from R. Argentina, in Holmberg's private collection, destroyed, not examined). Mello-Leitão, 1933: 60. Roewer, 1954: 1059. Bonnet, 1958: 3506. NEW SYNONYMY.

Phiale aristochratica Holmberg, 1876: 24 (*Phyale*) (female from R. Argentina, in Holmberg's private collection, destroyed, not examined). Mello-Leitão, 1933: 60. Roewer, 1954: 1057. Bonnet, 1958: 3504 (*aristocratica*). NEW SYNONYMY.

Plexippus luteostriatus (non *P. luteostriatus* (Keyserling, 1877)): Mello-Leitão, 1941b: 185 (=*P. roburifoliata*).

Phiale gratiosa (non *P. gratiosa* C. L. Koch, 1846): Mello-Leitão, 1944: 321 (=*P. aristochratica;* =*P. erythrogaster*).

Phiale ferruginea Mello-Leitão, 1944: 386 (female holotype No. 16.280 M.L.P., from R. Argentina, Buenos Aires, Tigre; Prosen coll., examined). Roewer, 1954: 1059. NEW SYNONYMY.

Freya boeroi Mello-Leitão, 1945: 281 (male holotype No. 16.775 M.L.P., from R. Argentina, Entre Ríos: Rosario Tala, Boero coll., examined). Roewer, 1954: 1080. NEW SYNONYMY.

Type locality: R. Argentina, Buenos Aires province.

Distribution (Fig. 2): R. Argentina, Buenos Aires city, Buenos Aires province; Entre Ríos, Santa Fe, Corrientes, Chaco, Santiago del Estero, Formosa, Córdoba, Mendoza.

Female No. 7210 MACN: Total length 9.44. Carapace 3.87 long, 3.13 wide, 1.80 high. Clypeus 0.20 high. Ocular quadrangle 1.60 long, first row 2.16 wide, third row 2.33 wide. Small eyes of second row closer to ALE than to PLE. Diameter of AME 0.66. Chelicerae, relative length of legs and chaetotaxy as for the species group. Epigynum: Figs. 3, 4.

Colour: All the morphs have yellowish white palps. The following polymorphic variants were observed (Fig. 13):

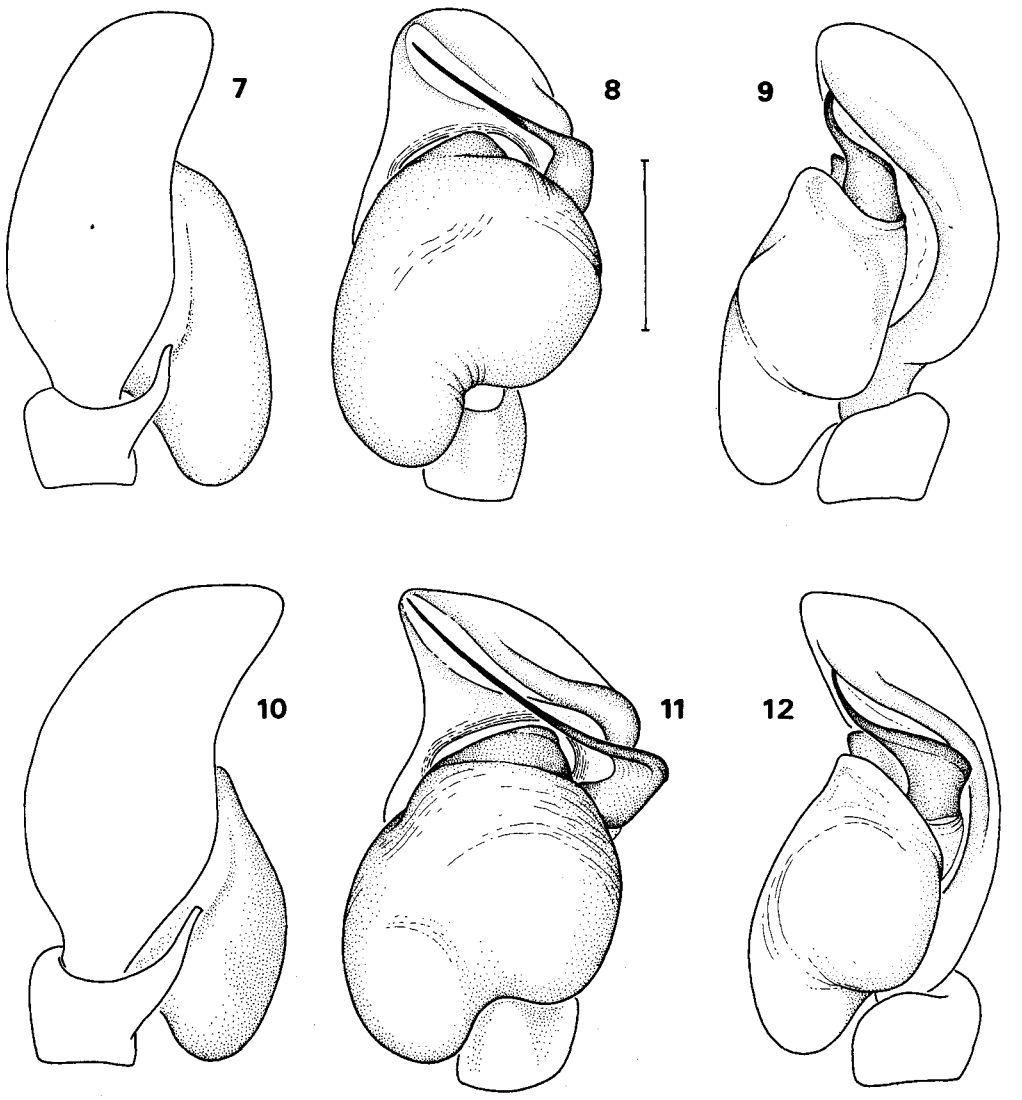
1. Abdomen B-1, carapace 1
2. Abdomen B-2 with lateral spots of yellow hairs, carapace 1
3. Abdomen C, carapace 1
4. Abdomen D, carapace 1, sometimes with a few red hairs on cephalic region
5. Abdomen D, carapace 2
6. Abdomen E, carapace 2
7. Abdomen F, carapace 1
8. Abdomen F, carapace 2
9. Abdomen G, carapace 2
10. Abdomen H, carapace 2
11. Abdomen I, carapace 2
12. Abdomen J, carapace 2

Three main variants can be delimited: (a) abdomen covered with black and yellow or orange mixed hairs

(Fig. 13 B, C); (b) abdomen with two pairs of more or less extended lateral patches with yellow or orange hairs (Fig. 13 D, E, F, J); (c) abdomen with a marginal band with yellowish white, yellow, orange or red hairs (Fig. 13 G-I).

Male No. 7209 MACN: Total length 6.33. Carapace 3.40 long, 2.80 wide, 1.66 high. Clypeus 0.20 high. Ocular quadrangle 1.40 long, first row 1.96 wide, third row 1.98 wide. Small eyes of second row closer to ALE than to PLE. Diameter of AME 0.66. Chelicerae, relative length of legs and chaetotaxy as for the species group. Palp: Figs. 7-9.

Colour "in vivo": Monomorphic males: To the legend of Fig. 13 A, the following can be added: the two white bands on the sides of the carapace form a white band on the clypeus. The central and



Figs. 7-9: *Phiale roburifoliata* Holmberg, male palp. **7** retrolateral view; **8** ventral view; **9** prolateral view.

Figs. 10-12: *Phiale gratiosa* C. L. Koch, male palp. **10** retrolateral view; **11** ventral view; **12** prolateral view. Scale line = 0.5 mm.

lateral white bands on the abdomen may join anteriorly and posteriorly. Legs black, with light brown metatarsi and tarsi. Palp black, with distal half of cymbium brown; white hairs dorsally on distal half of femur and proximal half of cymbium.

Colour of immatures: Body and legs black; palps yellowish white.

Natural History

Specimens of *P. roburifoliata* are relatively common in Buenos Aires city and its surroundings. They can be found on Cactaceae, plants which they seem to prefer for constructing their nests. The retreats and behaviour of the males are very similar to those of *P. gratiosa,* but the nests are smaller and always white.

Twenty-eight females and eleven males were collected at different times, mainly in Buenos Aires and Entre Ríos. They were kept alive in the laboratory. Mating and oviposition were observed, but all the offspring which emerged from the egg sacs died before reaching maturity. Only individuals that were collected as immatures or subadults lived until the adult stage.

Conclusions

The study of the type specimen of *P. gratiosa,* its comparison with samples from several collections, controlled rearing in the laboratory and the study of many specimens in the field demonstrate the existence of a chromatic sex-controlled polymorphism, with monomorphic males and polymorphic females. Some of the morphs have been described as new species by other authors. *Phiale rufoguttata* and *Menemerus quadrinotatus* belong to the variant with two pairs of abdominal patches (Fig. 1 F). *Palestrina variegata* and *Menemerus ursinus* belong to the morph with black and yellow mixed hairs (Fig. 1 B). *Palestrina variegata* was described from Brazil, Chapada, based on two females. In the collection of the Milwaukee Public Museum I found one female from Chapada (with no other label) which I believe to be one of the types.

The type specimen of *Phiale berina* is a subadult

Fig. 13: Polymorphic variants of *Phiale roburifoliata* Holmberg, 1874.

A. Male, dorsal and lateral patterns. Carapace black with black hairs; central and lateral bands with white hairs. Abdomen with black integument covered with red hairs (dotted). Anterior, central and lateral bands with white hairs.

B-J. Female abdomen, dorsal and lateral patterns.

B-1. Black integument with black and orange mixed hairs. Band and patches with orange hairs.
B-2. Black integument with black and yellow hairs. Band and patches with yellow hairs.
C. Black integument with black and yellow mixed hairs. Bands and patches with yellow integument and yellowish white hairs. Some orange hairs interspersed all over the dorsum.
D. Black integument with black hairs. Anterior band with yellow integument and orange hairs. Central band with whitish yellow hairs. Lateral patches (dotted) with yellow integument and reddish orange hairs.
E. Black integument with black hairs. Anterior and central bands with whitish yellow hairs. Dorsal and lateral patches (dotted) with yellow integument and orange hairs.
F-1. Black integument with black hairs. Anterior and central bands with yellow integument and yellowish white hairs. Lateral patches (dotted) with yellow integument and golden yellow hairs.
F-2. As **F-1**, but with whitish yellow lateral patches.
G. Black integument with black, yellow and some orange hairs, all mixed. Marginal band with yellow integument and orange hairs.
H. Black integument with black hairs. Central band with yellowish white hairs. Marginal band (dotted) with yellow integument and red hairs. Venter with yellowish white hairs.
I. Black integument with black and yellow mixed hairs. Central band with white hairs. Anterior and posterior bands (dotted) with yellow integument and red hairs. Anterior end and venter with yellowish hairs.
J. Black integument with black hairs. Anterior and central bands, and central patches with yellow integument and yellowish white hairs. Lateral patches (dotted) with yellow integument and orange hairs.

1-2. Female carapace.

1. Black with black hairs. Central and lateral bands with white hairs.

male and that of *Plexippus selectus* has no palps, but both show the same abdominal pattern characteristic of subadult males of *P. gratiosa.*

The type specimen of *Freya haemorrhoa* is similar to the males obtained by controlled rearing.

The study of living specimens of *P. roburifoliata* in the field and in the laboratory and of those preserved in collections leads to the conclusion that this species also shows a sex-controlled polymorphism, with monomorphic males and polymorphic females. The males have been described as *Phiale erythrogaster* and as *Freya boeroi. Phiale aristocratica* and *P. ferruginea,* being polymorphic variants, are also synonyms.

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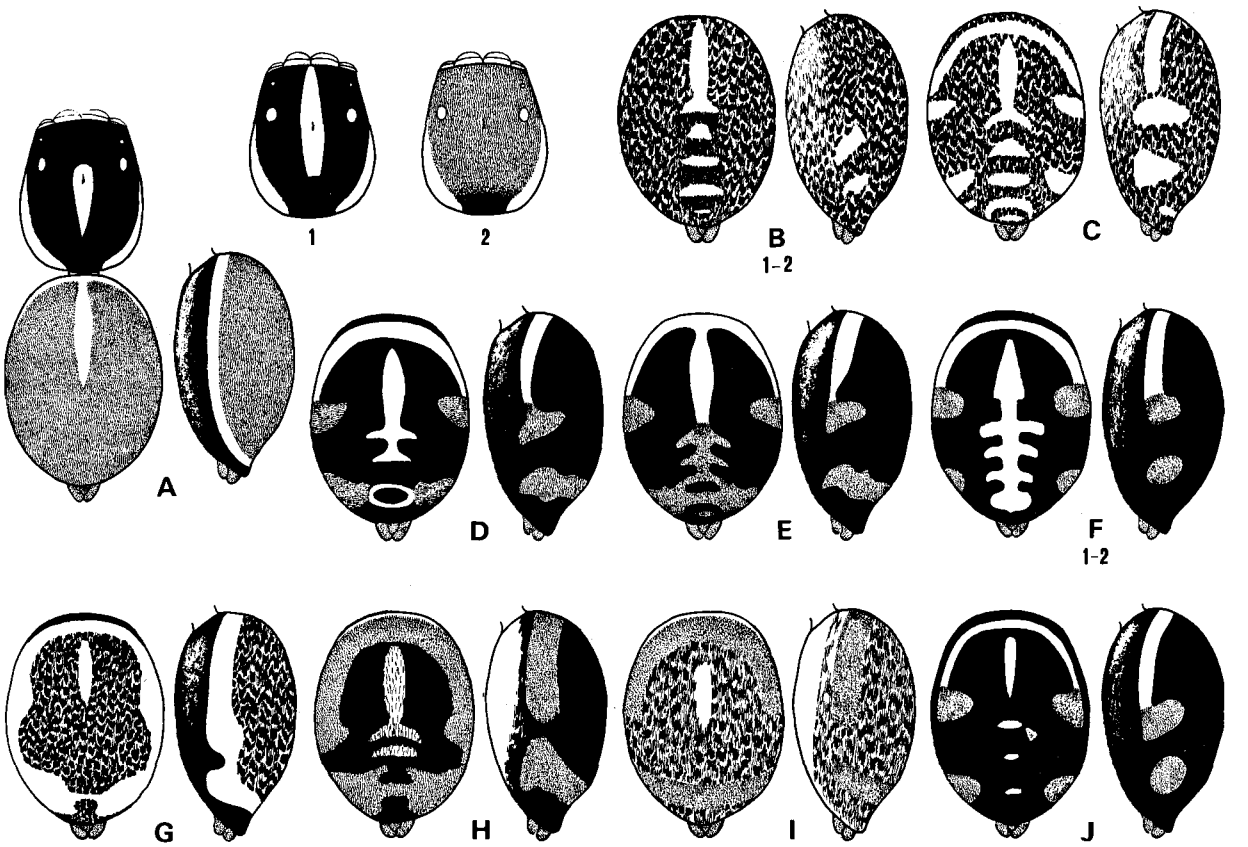
References

BERTKAU, P. 1880: Verzeichniss der von Prof. Ed. van Beneden auf seinen im Auftrage der Belgischen Regierung unternommenen Wissenschaftlichen Reise nach Brasilien und La Plata im Jahren 1872-73 gesammelten Arachniden. *Mém.cour.Acad.r.Sci.Belg.* 43: 1-120.

BONNET, P. 1957-1958: *Bibliographia araneorum* 2(3-4): 1927-4230. Toulouse.

CAMBRIDGE, F. O. P.- 1898-1903: *Biologia Cent.-Am.* (Arach.) 2: 1-610.



GALIANO, M. E. 1963a: Las especies americanas de arañas de la familia Salticidae descriptas por Eugène Simon. Redescripciones basadas en los ejemplares típicos. *Physis B.Aires* **23**(66): 273-470.

GALIANO, M. E. 1963b: Nota sobre arañas del grupo Marpisseae (Araneae, Salticidae). *Revta Soc.ent.argent.* **24**: 1-8.

GALIANO, M. E. 1978: Revisión del género *Phiale* Koch, C. L., 1846 (Araneae, Salticidae). I. Redescripción de *Phiale gratiosa, P. mimica* y *P. rufoguttata. Physis B.Aires* (C) **37**(93): 161-167.

GALIANO, M. E. 1979: Revision of the genus *Phiale* C. L. Koch, 1846 (Araneae, Salticidae). II. *Phiale guttata* (C. L. Koch, 1846) new combination. *Bull.Br.arachnol. Soc.* **4**(8): 345-348.

GALIANO, M. E. 1981: Revisión del género *Phiale* C. L. Koch, 1846 (Araneae, Salticidae). III. Las especies polimórficas del grupo *mimica. J.Arachnol.* **9**(1): 61-85.

GÖELDI, E. A. 1892: Zur Orientierung in der Spinnenfauna Brasiliens. *Mitt.Osterlande* (N.F.) **5**: 200-248.

HOLMBERG, E. L. 1874: Descriptions et notices d'arachnides de la République Argentine. *Periodico zool.* **1**(3): 283-302.

HOLMBERG, E. L. 1876: Arácnidos argentinos. *An.Agric. argent.* **4**: 1-30.

JACKSON, R. R. 1977: The evolution of courtship and mating tactics in a jumping spider, *Phidippus johnsoni* (Araneae, Salticidae). *Diss.Abstr.* **37**(9): 1-275.

KOCH, C. L. 1846: *Die Arachniden* **13**: 1-234. Nürnberg.

KOCH, C. L. 1851: *Uebersicht des Arachnidensystems* **5**: 1-104. Nürnberg.

MELLO-LEITÃO, C. 1933: Catalogo das aranhas argentinas. *Archos Esc.sup.Agric.Med.vet.Nictheroy* **10**(1): 3-63.

MELLO-LEITÃO, C. 1939: Araignées américaines du Musée d'histoire naturelle de Bâle. *Revue suisse Zool.* **46**(2): 43-93.

MELLO-LEITÃO, C. 1941a: Catalogo das aranhas da Colombia. *Anais Acad.bras.Cienc.* **13**(4): 233-300.

MELLO-LEITÃO, C. 1941b: Arañas de Córdoba, La Rioja, Catamarca, Tucumán, Salta y Jujuy. *Revta Mus.La Plata* (N.S.) (Zool.) **2**(12): 99-198.

MELLO-LEITÃO, C. 1944: Arañas de la provincia de Buenos Aires. *Revta Mus.La Plata* (N.S.) (Zool.) **3**(24): 311-393.

MELLO-LEITÃO, C. 1945: Arañas de Misiones, Corrientes y Entre Ríos. *Revta Mus.La Plata* (N.S.) (Zool.) **4**(29): 213-402.

MELLO-LEITÃO, C. 1946: Arañas del Paraguay. *Notas Mus. La Plata* (Zool.) **11**(91): 17-50.

PECKHAM, E. W. & PECKHAM, E. G. 1896: Spiders of the family Attidae from Central America and Mexico. *Occ.Pap.Wis.nat.Hist.Soc.* **3**: 1-101.

PECKHAM, E. W. & PECKHAM, E. G. 1901: Spiders of the *Phidippus* group of the family Attidae. *Trans.Wis. Acad.Sci.Arts Lett.* **13**(1): 282-358.

PETRUNKEVITCH, A. 1911: A synonymic index-catalogue of spiders of North, Central and South America with all adjacent islands, Greenland, West Indies, Terra del Fuego, Galapagos, etc. *Bull.Am.Mus.nat.Hist.* **29**: 1-790.

PETRUNKEVITCH, A. 1928: Systema aranearum. *Trans. Conn.Acad.Arts Sci.* **29**: 1-270.

PLATNICK, N. I. & SHADAB, M. V. 1975: A revision of the spider genus *Gnaphosa* (Araneae, Gnaphosidae) in America. *Bull.Am.Mus.nat.Hist.* **155**(1): 1-66.

ROEWER, C. F. 1954: *Katalog der Araneae* **2b**: 927-1751.

SIMON, E. 1897-1903: *Histoire naturelle des araignées* **2**: 1-1080.