

**TAXONOMIC AND NATURAL HISTORY NOTES ON
PHRUROLITHUS FRATRELLUS GERTSCH
(ARANEAE: CLUBIONIDAE)**

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ABSTRACT

Phrurolithus fratellus Gertsch and *P. britcheri* Petrunkevitch are similar species characterized by peculiar, asymmetrical epigyna. This paper redescribes *P. fratellus*, compares it with *P. britcheri*, and presents data on the natural history of the former. *P. fratellus* differs from *P. britcheri* by its smaller size, flatter carapace, and relatively larger eyes. These species are difficult to separate by epigynal characters. Specimens of both species may have either copulatory tube opening anterior to the other on the mid-ventral line. Pitfall collections indicate *P. fratellus* is a species of field and second growth habitats. Males were collected from 17 April until the week of 17 July; females were collected from 12 June until the week of 25 September. A single male, collected between 23 and 30 October, suggests males overwinter as adults. Fluctuations in weekly collections suggest that this species is more active when the moon is waxing or waning.

INTRODUCTION

There are two species of clubionid spiders in eastern North America characterized by peculiar, asymmetrical epigyna. Perhaps due to their small size these species remain relatively unknown. During a study of spider ecology in central Ohio (Penniman, 1975) a series of one of these was collected and originally identified as *Phrurolithus britcheri* Petrunkevitch, 1910. There is also a very similar form *P. fratellus* Gertsch, 1935, for which the male was described by Barrows and Ivie (1942). I suspected that these were synonymous, but further study revealed that *P. britcheri* and *P. fratellus* are distinct species and that my original collection was of *P. fratellus*. (According to Dondale and Redner [pers. comm.] American species of *Phrurolithus* belong in *Scotinella* Banks, 1911, and *P. britcheri* is a senior synonym of *S. pallida* Banks, 1911, the type species of *Scotinella*. Since I have not seen the type of *S. pallida* or specimens of *P. festivus* C. L. Koch, the type of *Phrurolithus*, I think it would be premature to use the names in combination with *Scotinella* at this time.)

The purpose of this paper is to clarify the identity of these confusing species, to provide a complete description of *P. fratellus*, and to present data on the natural history of this species.

METHODS

Specimens of *P. fratrellus* were collected in Sharon Woods Metropolitan Park just north of Columbus, Franklin Co., Ohio, from 17 April to 6 November 1973. Twenty-one pitfall traps were placed in each of three habitats, a field, a second growth area, and a wood. Each trap consisted of a 16-oz. cottage cheese carton, containing about 30 ml of ethylene glycol, set in the ground with the rim flush with the soil surface. Traps were left in place for periods of one week, then removed, replaced with clean traps, and returned to the lab for sorting. Spiders collected were preserved in 70% alcohol and labeled to indicate week and habitat.

The types of both species were borrowed from the American Museum of Natural History, New York. Six additional specimens of *P. britcheri* and one of *P. fratrellus* were obtained on loan from the Canadian National Collection, Ottawa, Ontario.

Table 1.—Measurements in mm of *P. fratrellus* and *P. britcheri*. Mean \pm one standard deviation; levels of significance between females of the two species are given by: n.s.—not significant, *— $P < .05$, ***— $P < .001$, blank—not calculated (Student's *t*, one-tailed test). Note that measurements of *P. britcheri* are significantly greater than those of *P. fratrellus*, except that the eyes of *P. fratrellus* are larger or there is no difference.

Measurement	<i>P. fratrellus</i> ♀♀		<i>P. britcheri</i> ♀♀		sign.	<i>P. fratrellus</i> ♂♂
	holotype	OH.and Ont. n=19	holotype	Ont. n=6		Ohio n=20
carapace l.	.75	.83 \pm .018	.93	.97 \pm .038	***	.80 \pm .021
carapace w.	.61	.69 \pm .017	.85	.81 \pm .033	***	.66 \pm .021
carapace ht.	.24	.27 \pm .037	.42	.35 \pm .053	***	.26 \pm .029
front height	.05	.07 \pm .006	.09	.08 \pm .000		.08 \pm .002
chelicera l.	.26	.28 \pm .017	.37	.37 \pm .024	***	.27 \pm .013
AME diam.	.05	.05 \pm .007	.04	.05 \pm .008	n.s.	.05 \pm .005
ALE diam.	.05	.06 \pm .008	.04	.05 \pm .005	*	.07 \pm .007
PME diam.	.06	.07 \pm .007	.05	.05 \pm .009	***	.08 \pm .006
PLE diam.	.05	.06 \pm .007	.04	.04 \pm .005	***	.06 \pm .009
sternum l.	.48	.52 \pm .018	.62	.56 \pm .023	***	.48 \pm .015
sternum w.	.47	.52 \pm .011	.61	.59 \pm .018	***	.48 \pm .016
labium l.	.09	.09 \pm .005	.12	.12 \pm .012		.10 \pm .009
labium w.	.11	.14 \pm .007	.19	.17 \pm .007		.13 \pm .003
endite l.	.21	.24 \pm .013	.30	.29 \pm .010		.24 \pm .009
femur I	.61	.69 \pm .018	.90	.87 \pm .038	***	.65 \pm .025
pat + tib. I	.87	.89 \pm .022	1.21	1.13 \pm .054	***	.83 \pm .032
m'tarsus I	.57	.58 \pm .017	.83	.75 \pm .036		.55 \pm .022
tarsus I	.38	.40 \pm .011	.50	.46 \pm .014		.36 \pm .017
femur II	.55	.60 \pm .020	.87	.79 \pm .036	***	.56 \pm .022
pat + tib. II	.65	.71 \pm .022	1.02	.93 \pm .039	***	.65 \pm .025
m'tarsus II	.43	.49 \pm .018	.71	.65 \pm .016		.46 \pm .016
tarsus II	.35	.38 \pm .012	.48	.46 \pm .028		.35 \pm .019
femur III	.46	.50 \pm .024		.68 \pm .032		.47 \pm .021
pat + tib. III	.55	.59 \pm .023		.78 \pm .027		.56 \pm .024
m'tarsus III	.40	.44 \pm .025		.62 \pm .027		.43 \pm .020
tarsus III	.34	.38 \pm .022		.47 \pm .026		.34 \pm .021
femur IV	.68	.72 \pm .025	.93	.90 \pm .028	***	.68 \pm .029
pat + tib. IV	.84	.89 \pm .031	1.10	1.07 \pm .044	***	.82 \pm .030
m'tarsus IV	.67	.69 \pm .028	.84	.83 \pm .038		.65 \pm .028
tarsus IV	.47	.51 \pm .018	.60	.58 \pm .022		.47 \pm .025

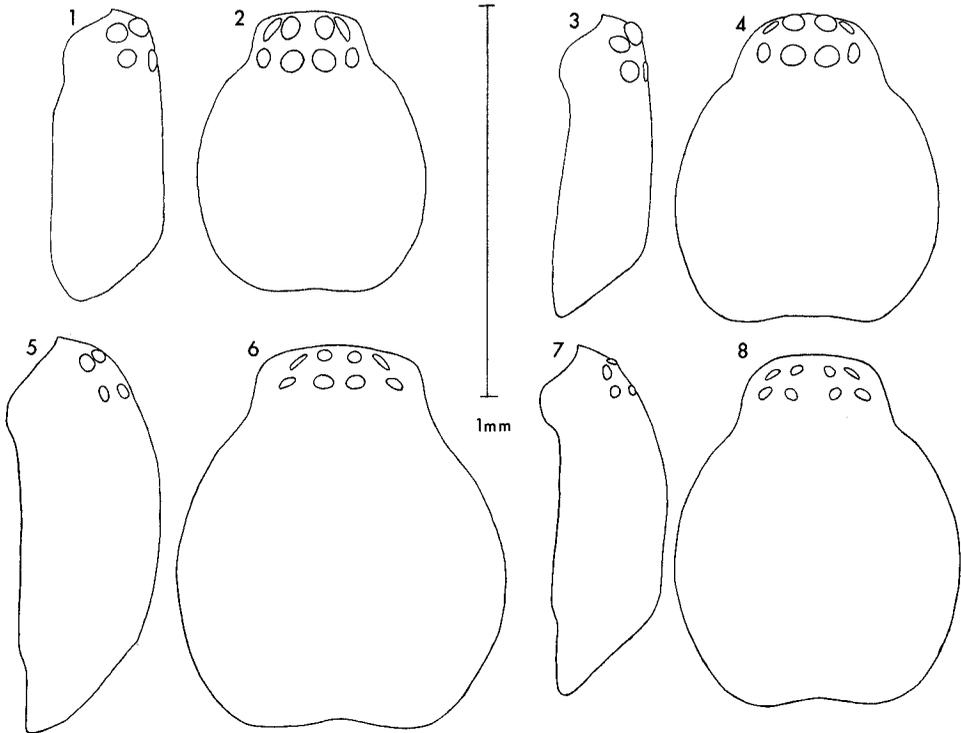
All measurements and drawings of carapaces and epigyna were made at 90X with an American Optical stereo-dissecting microscope fitted with an ocular micrometer or drawing reticule as appropriate. SEM photomicrographs were made with the Hitachi SEM in the College of Biological Sciences, The Ohio State University.

TAXONOMY

Phrurolithus fratrellus Gertsch 1935:6 (Holotype female from Texas, Bell Co., Belton, in AMNH, examined). Barrows and Ivie 1942:20-21 (Male from Ohio, Franklin Co., Columbus, in University of Utah Collection housed at AMNH, missing).

Female.—The description of *P. fratrellus* by Gertsch is good, but, since it was based on a single specimen, does not consider variation; in fact, the type is the smallest female I have seen (Table 1).

Carapace—Somewhat flattened in lateral view (Figs. 1, 3). Ground color amber, margins a darker brownish-gray; central light area irregularly shaped with a trapezoidal dark blotch within. Ocular area black. Surface sparsely covered with fine setae. Anterior eye row slightly procurved, medians dark, laterals may appear dark or pearly white. Posterior row also slightly procurved, the eyes white or pearly white.



Figs. 1-8.—Carapaces of *Phrurolithus* spp. females. 1-2, *P. fratrellus* holotype: 1, lateral view; 2, dorsal view. 3-4, *P. fratrellus*, Ohio, Franklin Co., 4-11 Sept. 1973 in field: 3, lateral view; 4, dorsal view. 5-6, *P. britcheri* holotype, New York, Onondaga Co.: 5, lateral view; 6, dorsal view. 7-8; *P. britcheri*, Ontario, Carleton Co., 12 May 1974: 7, lateral view; 8, dorsal view.

Chelicerae—Amber, concolorous with lighter parts of carapace. One macroseta on antero-medial margin about one third the proximal to distal length of paturon. Two rows of fine setae above each fang and an oblique row of fine setae on posterior surface. No promarginal teeth, retromargin with two minute teeth.

Sternum—Amber, darker around edges due to thicker sclerotization. Extends posteriorly between coxae IV where it is rounded. Surface sparsely covered with fine setae.

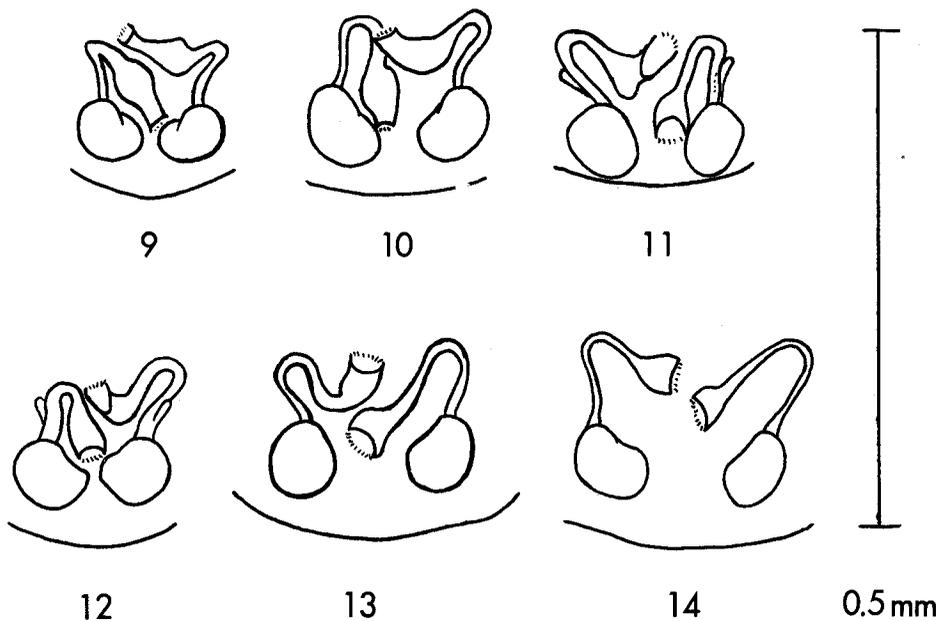
Labium—Center amber, darker at posterior margin and corners; anterior margin white with two tufts of setae.

Pedipalps—Endites concolorous with sternum except at proximal medial corners and distal margins where they are more thickly sclerotized; distal medial corners white and scopulate; ventral surfaces with a few setae. Distal segments yellowish-brown and more densely clothed with setae; femur with a dorsal macroseta; patella and tibia with one macroseta each on prolateral faces; tibia with a dorsal macroseta; tarsus with a claw.

Legs—All segments amber. Macrosetae as follows: femur I with two prolateral macrosetae in distal half; tibia I with five pairs of ventral macrosetae; tibia II with nine ventral macrosetae; metatarsi I and II with seven macrosetae each. Trichobothria present on tibiae, metatarsi, and tarsi of all legs.

Abdomen—Dorsum light gray with two white chevrons and traces of two more; a white spot dorsal to anus. Venter white. Six spinnerets pale yellow to white.

Epigynum—Surface pale yellow. Two spermathecae anterior to epigastric furrow. Two openings in mid-ventral line, each connected to a spermatheca by a curved copulatory tube. Either opening may be connected to either spermatheca (Figs. 9-12).



Figs. 9-14.—Epigyna of *Phrurolithus* spp., ventral views. 9-12, *P. fratrellus*: 9, holotype, “left-tubed”; 10, Ohio, Franklin Co., 19-26 June 1973, “left-tubed”; 11, same loc. 4-11 Sept. 1973, “right-tubed”; 12, same loc. 11-18 Sept. 1973, “left-tubed.” 13-14, *P. britcheri*: 13, holotype, “right-tubed”; 14, Ontario, Carleton Co., 12 May 1974, “right-tubed.”

Male.—The description of this sex by Barrows and Ivie (1942) is extremely scanty. I have not seen their specimen, but their drawings of the palp suggest that they did have this species despite a discrepancy between their figures and mine in the shape of the embolus (Fig. 16).

Carapace—Amber, similar to female but with less dark pattern. Eyes as in female.

Chelicerae—As in female.

Sternum—As in female.

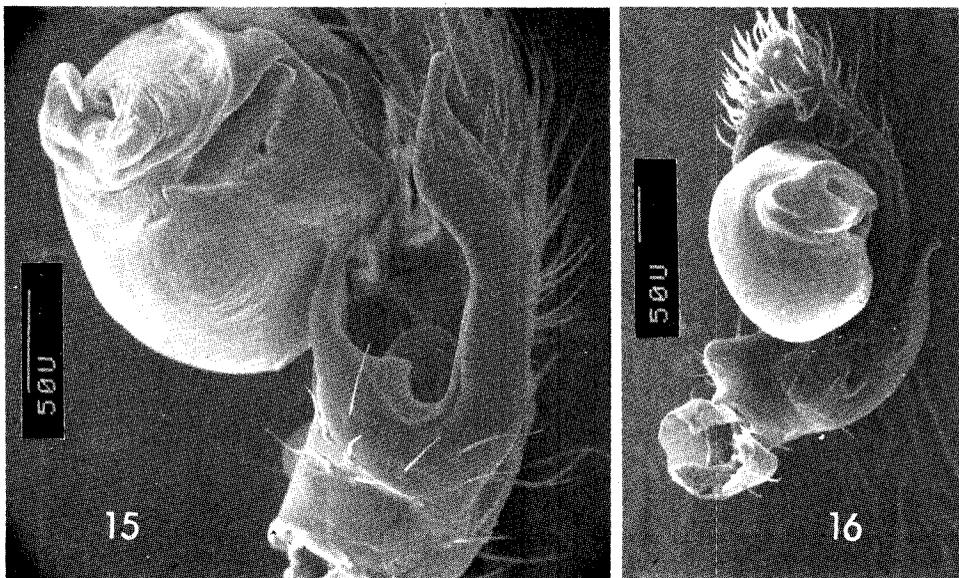
Labium—As in female.

Pedipalps—Endites as in female. Distal segments amber and more densely clothed with small setae, no macrosetae. Femur $0.23 \pm .01$ mm long with a ventral, retrolaterally pointing, hooked apophysis as in other members of the genus. Tibia (Fig. 15) $0.16 \pm .02$ mm long with two brown retrolateral apophyses; the ventral one $0.11 \pm .02$ mm long and paddle-shaped; the dorsal one $0.23 \pm .01$ mm long and complexly curved and twisted. A small toothlike point present in the bight between the two apophyses. Bulb sub-spherical, tegulum amber, the apical portion darker. An internal sperm duct visible through the tegulum in some specimens. Embolus amber and hook shaped. Cymbium $0.38 \pm .01$ mm long with a cluster of stout setae at the distal margin of the alveolus against which the embolus rests in the unexpanded palp (Fig. 16).

Legs—As in female.

Abdomen—Dorsal scutum covers anterior three-fourths; grayish amber in scutal area with two or three amber chevrons and a posterior white spot. Sides gray, venter whitish. An amber scutum anterior to epigastric furrow. Spinnerets grayish-amber.

Diagnosis.—*P. fratrellus* is very similar to *P. britcheri*. It can be separated from the latter by its smaller size, flatter carapace, and relatively larger eyes (Table 1, Figs. 1-8). The few *P. britcheri* I have seen all lack dark pigments and the legs tend to be relatively longer. The only epigynal character that will separate these species is the presence of



Figs. 15-16.—*P. fratrellus* males. 15, palpal tibia and tegulum, retrolateral view, Ohio, Franklin Co., 1-8 May 1973 in second growth. 16, palpal tibia and cymbium, ventral view, same loc., 8-15 May 1973 in field. Scale lines are 50 microns.

pouches arising from the spermathecal ends of the copulatory tubes (Figs. 11, 12), which are difficult to see even in cleared specimens. Three *P. britcheri* from Ontario, Carleton Co., Fitzroy Twp. have simpler copulatory tubes than other females I have seen (Fig. 14).

Since the male of *P. britcheri* remains unknown, I can make no comment on its separation from male *P. fratrellus*. I would expect the males to differ in the same features that distinguish females.

DESCRIPTION OF THE STUDY AREA

In 1973 the field had been out of agriculture about 8-10 years. Goldenrod (*Solidago* sp.) and grasses (Gramineae) were the dominant plants and their dead stems and leaves made up most of the litter. Thistles (*Cirsium* spp.), yarrow (*Achillea* sp.), and raspberry (*Rubus* sp.) were also common. The mustard, *Barbarea* sp., was conspicuous in the spring, but by mid-summer only dead stems remained. There were numerous seedlings and saplings of maples (*Acer* spp.), hawthorne (*Crataegus* spp.), apple (*Malus* sp.), and grape (*Vitis* sp.).

The second growth area had relatively less goldenrod and more grasses and poison ivy (*Rhus radicans*) than the field. However, the most conspicuous plants were seedlings and saplings of elm (*Ulmus* sp.) and ash (*Fraxinus* sp.) up to 6 m and 7 m tall respectively. Less important saplings included maples, dogwood (*Cornus* sp.), hawthorne, and pin cherry (*Prunus* sp.). Moss covered most of the ground at two collecting stations; other

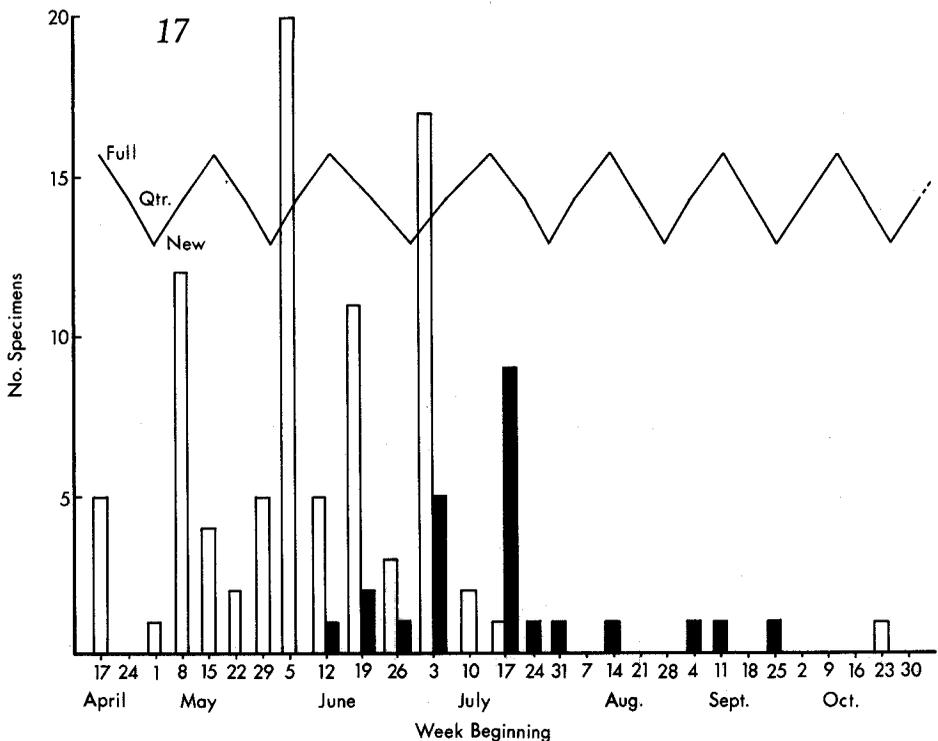


Fig. 17.—Seasonal distribution of pitfall captures of *P. fratrellus* adults. Open bars—males; black bars—females. Zigzag line represents phases of the moon.

plants contributing to the litter were cinquefoil (*Potentilla* sp.), raspberry, yarrow, and basal rosettes of a composite (probably *Heiracium* sp.).

The wood was dominated by very large trees, mostly beech (*Fagus grandifolia*), but including black walnut (*Juglans nigra*), ash, and box elder (*Acer negundo*). A few sycamores (*Platanus occidentalis*) and oaks (*Quercus* sp.) were located at the wood's edge. Smaller trees were hornbeam and hop hornbeam (*Carpinus caroliniana* and *Ostrya virginiana* respectively), buckeye (*Aesculus glabra*), and spicebush (*Lindera benzoin*). Most of the litter layer was beech leaves with a few leaves from other trees. The herbaceous plants, most conspicuous in the spring, included bedstraw (*Galium* sp.), dutchman's breeches (*Dicentra* sp.), wild ginger (*Asarum canadense*), violets (*Viola* spp.), nettles (*Urtica* sp.), Virginia creeper (*Parthenocissus* sp.), and bloodroot (*Sanguinaria canadensis*).

NATURAL HISTORY

P. fratrellus and *P. britcheri* are unusual among spiders in having asymmetrical epigyna. Some specimens have the right copulatory tube leading to the anterior opening ("right-tubed") and others have the left tube leading to the anterior opening ("left-tubed"). This mirror image situation could be a mechanism of genetic isolation, if males were able to mate only with "left-tubed" or "right-tubed" females. It seems that this is not the case, however. Males are equipped with two palps which are mirror images of each other. Even if a male is unable to use both palps in mating due to the asymmetry of the female, he could use one or the other regardless of whether the female is left or right "tubed." There is no *a priori* reason to think that males are not completely ambidextrous. Of the 24 female *P. fratrellus* collected during this study 15 are "right-tubed" and nine are "left-tubed" (not significantly different from 1:1, $P > .10$, χ^2). Of the seven *P. britcheri* seen, four are "right-tubed," three "left-tubed."

Of 114 *P. fratrellus* collected 74 (65%) were taken in the field, 38 (33%) were trapped in the second growth, and a male and a female were taken in the woods. Thus this is a species of early to mid-successional habitats.

Males occurred in the traps from 17 April until the week of 17 July (Fig. 17). Females first appeared the week of 12 June and persisted until the week of 25 September. A single male trapped between 23 and 30 October and the fact that males were mature when trapping began suggests that males, at least, overwinter as adults. Maturation of males before females was a common pattern among other species collected at the same time (Penniman 1975:62).

Numbers trapped fluctuated sharply from week to week; the fluctuations seemed to follow the lunar cycle, more spiders being trapped while the moon was waxing or waning than when it was new or full (Fig. 17). Because pitfall catches are dependent on activity, this suggests a particular activity pattern for this species. The significance of such a wax-wane pattern is unclear.

Barrows and Ivie (1942) remarked that their *P. fratrellus* male was collected in an ant nest, and Kaston (1948:392) reported a female *P. britcheri* collected with "red" ants. Three female *P. britcheri* from Ontario, Carleton Co., Fitzroy Twp., were collected under a rock with "yellow ants" on 12 May 1974. Unfortunately, ants from my pitfalls were not saved, so I have no evidence regarding such an association. Since ants and *Phrurolithus* spp. may be cryptozoic, the relationship between them may be coincidental

rather than symbiotic. Investigations of an association with ants, of activity patterns related to the lunar cycle, or of mating behavior of *P. fratrellus* in light of its asymmetrical epigynum could prove rewarding.

ACKNOWLEDGMENTS

I am deeply indebted to Charles Dondale and Mr. James Redner for their suggestions which kept me on the right track at a crucial stage of this work, and for specimens of *P. britcheri* which they were kind enough to loan. I am indebted also to Dr. Norman Platnick, American Museum of Natural History, for the loan of the types of *P. britcheri* and *P. fratrellus* and for his review of the manuscript. Dr. B. J. Kaston carefully reviewed the manuscript and Drs. Dondale and George Uetz read a rough draft. Dr. Barry Valentine provided valuable advice and assistance including helping me to gain access to the scanning electron microscope. Mr. Edward Hutchins and his staff of the Columbus and Franklin County Metropolitan Parks were helpful in providing the study site where *P. fratrellus* was collected.

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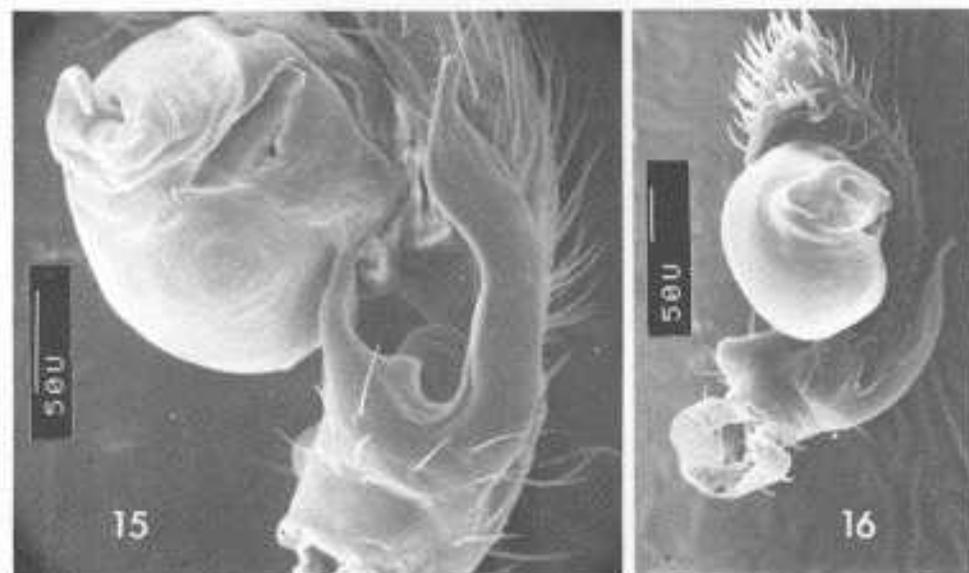
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