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A Review of the Genus *Hypochilus* and a Description of a New Species from Colorado (Araneae, Hypochilidae)

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The key position of the primitive spiders of the family Hypochilidae was noted by me in a revisional study of the world fauna (Gertsch, 1958). The hypochilids still retain features shared during Carboniferous times with primitive forebears and that are now found in no other true spiders. The disjunct distributions of the four known recent genera (with centers in North America, China, Tasmania, and southern Chile) reflect the early wide range and present near extinction of these relict types.

The North American genus *Hypochilus* is reappraised and enlarged to four species in the present paper. In 1958 this genus was known from two principal areas: the southern Appalachian Mountains, with the species *thorelli*, and the central Sierra Nevada Mountains of California, with the species *petrunkevitchi*. The evident need for more adequate collections and fuller distributional information has prompted much recent interest in the group. The surprising discovery of a third species, named *gertschi* by Hoffman (1963), from Virginia and West Virginia was a reward of vigilant collecting in the eastern mountains. Many new collections have been made during recent years in California, and these indicate a much broader range for the far western species than was anticipated. Finally,

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an exciting event has been the discovery of a distinctive new species, *bonneti*, in the deep canyons of southern Colorado.

Hypochilus thorelli was described in 1888 and immediately was recognized by students throughout the world as a relict type linking true spiders with their tarantula forebears. The discovery of three additional species of *Hypochilus* within a period of about 10 years points up the relative inattention of araneologists to these retiring spiders during a long period. Each of the three exotic genera is still known from a single species.

Inasmuch as this paper is supplementary to my revisional study of the family (Gertsch, 1958), only the basic synonymic bibliography is given. Much of the new material listed below is in the American Museum of Natural History and was collected on field trips supported by grants from the National Science Foundation (G-9036 and G-24384).

I am grateful to the following individuals for gifts of specimens, photographs of webs and habitats, and good fellowship during collecting trips for *Hypochilus*: Mr. Robert Ayre, formerly of Denver, Colorado; Mrs. Bea Vogel Durden, Yale University, New Haven, Connecticut; Mr. Jack McCoy, Jr., University of Colorado, Boulder, Colorado; Mr. Patrick Miller, Colorado National Monument, Montrose, Colorado; Mr. Wilton Ivie, the American Museum of Natural History, New York; Mr. Richard Graham, Rutgers University, Newark, New Jersey; Mr. Vincent Roth, Southwestern Research Station, Portal, Arizona; and Dr. Richard L. Hoffman, Radford College, Radford, Virginia.

GENUS *HYPOCHILUS* MARX

Hypochilus: GERTSCH, 1958, p. 6.

DISCUSSION: This genus was rather fully characterized by the present author in 1958. With much new material available, particularly males, it is now possible to offer some notes on variation. The male palpi, and especially the length and proportions of the various segments, are subject to a modest amount of variation. The elongated tibiae, thickened in the basal third to various degrees in all the species, reach their acme in *gertschi* in which the incrassation far exceeds the thickness of the patella. In *thorelli* the patella varies from four to almost five times as long as the greatest width. The palpal elements also are somewhat variable. This variation was noted especially for males of *petrunkevitchi* in which the length and thickness of the conductor and embolus varied considerably, on the basis of the few specimens available. The tibial apophysis lying on the retrolateral side of the male palpus bears a spur consisting of a series of four to six flattened spines intimately pressed together to form essentially a single element.

Dorsal segmentation of the abdomen is clearly evident in the species of *Hypochilus*, as is well shown in figure 8. Although the segments are not sharply delimited by grooves, the color shadings and rows of setae give ready clues to the limits of each.

The relationships of our four species deserve some comment. The two species from the eastern mountains, *thorelli* and *gertschi*, are closely related, as indicated by quite similar eye patterns, coloration, and genitalia. The far western species, *petrunkevitchi*, is of similar type but can be readily differentiated by its distinctive eye formula. The Colorado species is most distinct of all in genitalic features and can be readily recognized by color clues alone. The species can be separated exclusively on the basis of geography, but the following key based on morphology and coloration is offered.

KEY TO SPECIES OF *Hypochilus*

- 1. Males 2
- Females 5
- 2. Eyes large and close together: anterior median eyes at least three-fourths of size of and separated from anterior lateral eyes by radius of former; eastern United States 3
- Eyes smaller, more widely separated: anterior median eyes about one-half of size of anterior lateral eyes and separated from them by at least full diameter of former; western United States 4
- 3. Anterior median eyes equal to anterior lateral eyes; eyes of median quadrangle subequal; tibia of palpus slightly incrassated at base, about four or five times as long as broad *thorelli* Marx
- Anterior median eyes smaller than both anterior lateral eyes and posterior median eyes in ratio about 3/4; tibia of palpus greatly incrassated at base, about three times as long as broad *gertschi* Hoffman
- 4. Tibia of palpus less than four times as long as broad, considerably thickened at base; legs with contrasting dark spots or rings; California *petrunkevitchi* Gertsch
- Tibia of palpus at least five times as long as broad; legs at most inconspicuously annulated; Colorado *bonneti*, new species
- 5. Eyes of median quadrangle subequal *thorelli* Marx
- Anterior median eyes clearly smaller than posterior median eyes 6
- 6. Anterior median eyes separated from anterior lateral eyes by full diameter of former; western United States 7
- Anterior median eyes separated from anterior lateral eyes by about two-thirds of diameter of former *gertschi* Hoffman
- 7. Body and legs yellowish brown, with faint dusky spots and annuli on legs; Colorado *bonneti*, new species
- Body and legs white to yellow, with distinct black spots and annuli on legs; California *petrunkevitchi* Gertsch

Hypochilus thorelli Marx

Figure 1

Hypochilus thorelli MARX, 1888, p. 161. HOFFMAN, 1963, p. 6, figs. 6–8. GERTSCH, 1958, p. 7.

DISTRIBUTION: Mountains of North Carolina, Tennessee, and adjacent areas of Kentucky, Alabama, Georgia, and South Carolina (see map, fig. 1).

NEW RECORDS: *North Carolina:* Smokemont, Swain County, October 3, 1960; Crabtree to Betsey's Gap, 3956 feet, October 3, 1960; 5 miles east

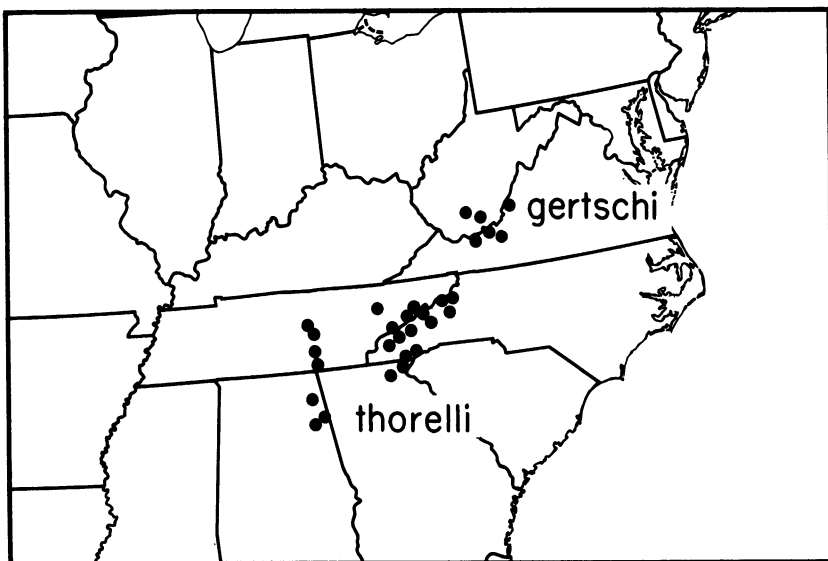


FIG. 1. Distribution of *Hypochilus thorelli* and of *H. gertschi*.

and 4 miles north of Bryson City, Graham County, October 1, 2, 1960; 1 mile north of Spruce Pine, Mitchell County, October 4, 1960; Grandfather Mountain, Avery County, October 4, 1960; 10 miles west of Maggie, Cherokee Indian Reservation, Jackson County, October 3, 1960 (all W. J. Gertsch and W. Ivie), many males, females. Dry Galls, Cullasaja River, Highlands, June, 1948 (J. M. Valentine). *Tennessee:* Carson's Springs, Newport, fall of 1959 (Robert Sellers), males, females. Greenbrier Cove, 8 miles north of Gatlinburg, Sevier County, October 2, 1960 (W. J. Gertsch), males, females. *Georgia:* Tray Mountain, 3000 feet, White County, September 15, 1935 (J. M. Valentine), male. *Alabama:* DeSoto

State Park, DeKalb County, August 10, 1948 (A. F. Archer), male, females.

Hypochilus gertschi Hoffman

Figure 1

Hypochilus gertschi HOFFMAN, 1963, pp. 2-8, figs. 1-5, 8.

DISTRIBUTION: Southern West Virginia and adjacent Virginia (see map, fig. 1).

Hypochilus petrunkevitchi Gertsch

Figure 2

Hypochilus petrunkevitchi GERTSCH, 1958, p. 11. HOFFMAN, 1963, p. 2.

DISTRIBUTION: Mountains of California from extreme western part of

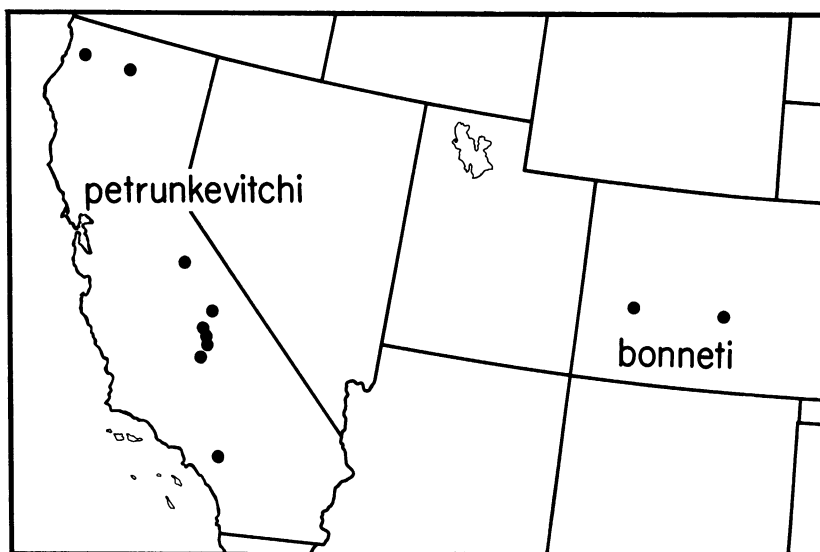


FIG. 2. Distribution of *Hypochilus petrunkevitchi* and of *H. bonneti*.

San Bernardino County northward through Sierra Nevada Mountains into Humboldt County (see map, fig. 2).

NEW RECORDS: *California*: Mountain Home Creek, San Bernardino County, August 13-18, 1959 (W. J. Gertsch, V. Roth, R. X. Schick), male, immature. Belnap Spring and McIntire Creek, near Nelson Camp, Tulare County, July 11, 1958 (W. J. Gertsch; V. Roth), females, immature; one male matured August 8, 1958. Near Ash Mountain Entrance, Se-

quoia National Park, July 9, 1958 (W. J. Gertsch, V. Roth), female, immature. Yosemite Falls, Yosemite National Park, Mariposa County, September 22, 1961 (W. J. Gertsch; W. Ivie), female, numerous webs on large rocks near base of falls. Ney Springs, 5 miles west of Mt. Shasta, Siskiyou County, September 2, 1959 (W. J. Gertsch; V. Roth), female. Five miles southwest of Orleans, Humboldt County (near Del Monte County line), August 22, 1959 (W. J. Gertsch; V. Roth), females, egg sacs.

***Hypocheilus bonneti*, new species**

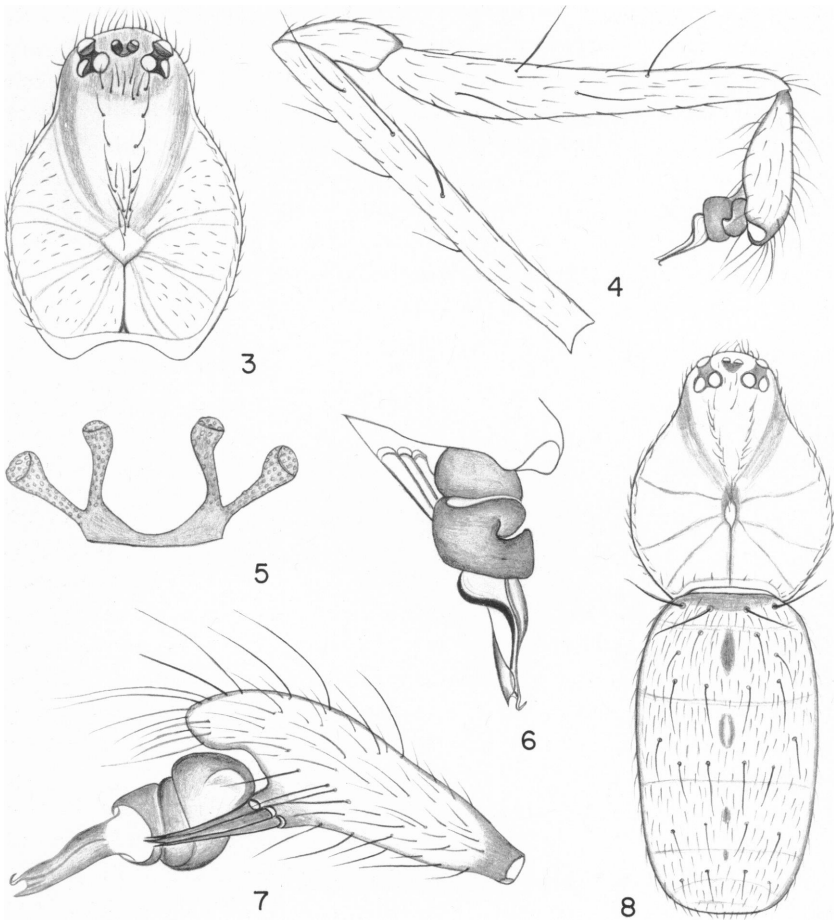
Figures 2-11

This distinctive species is dedicated to Prof. Pierre Bonnet of the University of Toulouse, Toulouse, France, good friend and araneologist extraordinary, whose energy and devotion have produced the "Bibliographia Araneorum," a monumental work for which students will remain everlastingly grateful.

DESCRIPTION: Coloration similar in both sexes. Dorsal aspect of cephalothorax and abdomen as shown in figures 3 and 8. Base color of carapace and appendages of alcoholic specimens dull to bright orange-brown. Carapace quite uniform in color, somewhat darker in eye region and with faint dusky lines radiating from median groove. Eye tubercles black; anterior median eyes dark, all others pearly white. Chelicerae, maxillae, and labium orange-brown. Sternum and coxae of legs dull yellow. Legs quite uniform bright orange-brown, with faintly indicated dusky purple spots or partial rings as follows: femora with four or five ventral spots representing obsolete rings, in some specimens faintly represented on sides and dorsa; tibiae with similar number of very faint rings. Abdomen dull white to yellowish brown, paler down middle of length; dorsum with lateral series of six or seven pairs of indistinct, dusky purplish patches from base to apex, each pair separated by faint transverse indications of dorsal segmentation; sides mottled with dusky spots; venter dull yellow, unmarked. Abdomen of male dull white, without distinct pattern.

HOLOTYPE, FEMALE FROM FLY CAVE: Total length, 12.4 mm.; carapace, 4.8 mm. long, 3.5 mm. wide; abdomen, 8 mm. long, 4.7 mm. wide; pars cephalica, 2 mm. wide at second eye row.

Eye rows equal in width. Ratio of eyes: A.L.E.:A.M.E.:P.L.E.:P.M.E. = 35:19:37:39. Anterior row moderately procurved, as viewed from in front (moderately recurved as seen from above); median eyes separated by about their diameter, nearly two diameters from much larger lateral eyes. Posterior row moderately recurved; oval median eyes separated one and one-half long diameters (39/53), narrowly separated from oval lateral



FIGS. 3-8. *Hypochilus bonneti*, new species. 3. Carapace of female. 4. Left male palpus, prolateral view. 5. Epigynum, dorsal view. 6. Bulb of male palpus, prolateral view. 7. Tarsus and bulb of left male palpus, retrolateral view. 8. Carapace and abdomen of male, dorsal view.

eyes by one-fourth of a diameter. Median ocular quadrangle twice as long as broad (125/65), narrowed in front (125/55), front eyes much smaller. Lateral and posterior median eyes on moderately elevated, connate tubercles; anterior median eyes on discrete conical tubercles. Clypeus subvertical, equal in height to about short diameter of anterior lateral eye.

Carapace (fig. 3) much longer than broad; pars cephalica moderately

elevated, convex, at second eye row little more than half of width of carapace; pars thoracica flattened, narrowly rebordered on sides and behind, marked with shallow radial grooves from rounded median groove and demarked from pars cephalica by shallow side furrows. Clothing of carapace fine erect black hairs and weak black setae forming Y-shaped series from eyes to median groove. Sternum, 3 mm. long, 2.25 mm. wide, covered sparsely with erect black hairs and weak setae. Labium, 1.2 mm. wide, 0.45 mm. long; maxillae, 1.5 mm. long, 0.8 mm. wide. Chelicera stout; brown fang stout, half as long as basal segment; upper margin of furrow with five teeth, all stout but fourth from base of fang; lower margin with four small teeth opposite fifth tooth of upper series.

Leg formula, 1243; second and fourth pairs subequal. Legs long, very thin, thickly covered with fine suberect hairs and few thin spines. First femur, 0.8 mm. wide at base, 0.5 mm. wide at center. Legs becoming thinner toward apex. Tarsi thin, pliable, curved, marked with numerous false sutures. Calamistrum biseriate, occupying basal one-third of fourth metatarsus and consisting of two rows of fine setae, with about 25 in each series. First leg 8.5 times as long as carapace. Femora with few dorsal and lateral spines; metatarsi with few, weak, lateral and ventral spines.

	I (mm.)	II (mm.)	III (mm.)	IV (mm.)	Palpus (mm.)
Femur	12.5	10.3	8.0	9.7	3.5
Patella	2.3	2.0	1.8	1.8	1.1
Tibia	12.3	9.9	7.2	9.2	2.8
Metatarsus	9.4	8.0	6.5	8.3	—
Tarsus	4.5	4.0	3.2	4.3	2.5
Total	41.0	34.2	26.7	33.3	9.9

Abdomen suboval, about as high as broad, clothed sparsely with suberect black hairs and weak setae. Posterior lung opening somewhat nearer spinnerets than genital groove.

Epigynum as shown in figure 5.

MALE FROM FLY CAVE: Total length, 8 mm.; carapace, 3.7 mm. long, 3 mm. wide; pars cephalica, 1.5 mm. at second eye row; abdomen, 4.3 mm. long, 2.5 mm. wide.

Structure (fig. 8) like that of female, except for smaller size, proportionately longer legs, and slight variations as follows: Pars cephalica narrower, its width at second eye row half of that of carapace. Eye relations essentially like those of female but eyes more closely grouped; posterior median eyes separated by one and one-third diameters. Clypeus equal in width to radius of anterior lateral eye. Abdomen set with transverse series of thin setae outlining transverse segmentation.

Leg formula, 1243; second and fourth pairs subequal. First leg 12 times as long as carapace. First femur thicker in basal half, armed there on dorsal and prolateral surfaces with series of about 30 thin spines.

	I	II	III	IV	Palpus
	(mm.)	(mm.)	(mm.)	(mm.)	(mm.)
Femur	12.8	11.0	8.8	10.2	3.2
Patella	1.9	1.5	1.5	1.5	1.0
Tibia	13.5	10.7	0.8	9.7	2.8
Metatarsus	11.7	9.2	7.7	9.2	—
Tarsus	5.0	4.0	3.5	4.5	1.1
Total	44.9	36.4	22.3	35.1	8.1

Left palpus as shown in figures 3, 5, and 6.

FEMALE FROM BLACK CANYON NATIONAL MONUMENT: Total length, 12.5 mm.; carapace, 5 mm. long, 4 mm. wide; pars cephalica, 2.2 mm. wide at second eye row; abdomen, 8 mm. long, 5 mm. wide. First leg 8.4 times as long as carapace.

	I	II	III	IV	Palpus
	(mm.)	(mm.)	(mm.)	(mm.)	(mm.)
Femur	12.5	10.7	9.2	9.5	4.0
Patella	2.2	2.1	1.8	2.0	1.3
Tibia	12.5	10.3	8.0	9.0	3.3
Metatarsus	10.0	8.6	7.2	9.2	—
Tarsus	4.8	4.0	3.5	4.4	2.7
Total	42.0	35.7	29.7	34.1	11.3

MALE FROM BLACK CANYON NATIONAL MONUMENT: Total length, 8.8 mm.; carapace, 4 mm. long, 3 mm. wide; pars cephalica, 1.5 mm. at second eye row; abdomen, 4.7 mm. long, 2.5 mm. wide; first leg 11.1 times as long as carapace.

	I	II	III	IV	Palpus
	(mm.)	(mm.)	(mm.)	(mm.)	(mm.)
Femur	12.7	10.7	9.2	10.2	3.7
Patella	1.8	1.5	1.5	1.5	1.0
Tibia	13.5	10.7	8.3	9.7	3.2
Metatarsus	11.5	9.0	7.7	9.5	—
Tarsus	5.0	3.9	3.3	4.5	1.3
Total	44.5	35.8	30.0	35.4	9.2

TYPE DATA: Female holotype from Fly Cave, about 5800 feet, in Oil Creek, 13 miles north of Canon City, Fremont County, Colorado, February 26, 1961 (R. W. Ayre), in the American Museum of Natural History.

DISTRIBUTION: Known only from Fly Cave and the Black Canyon of

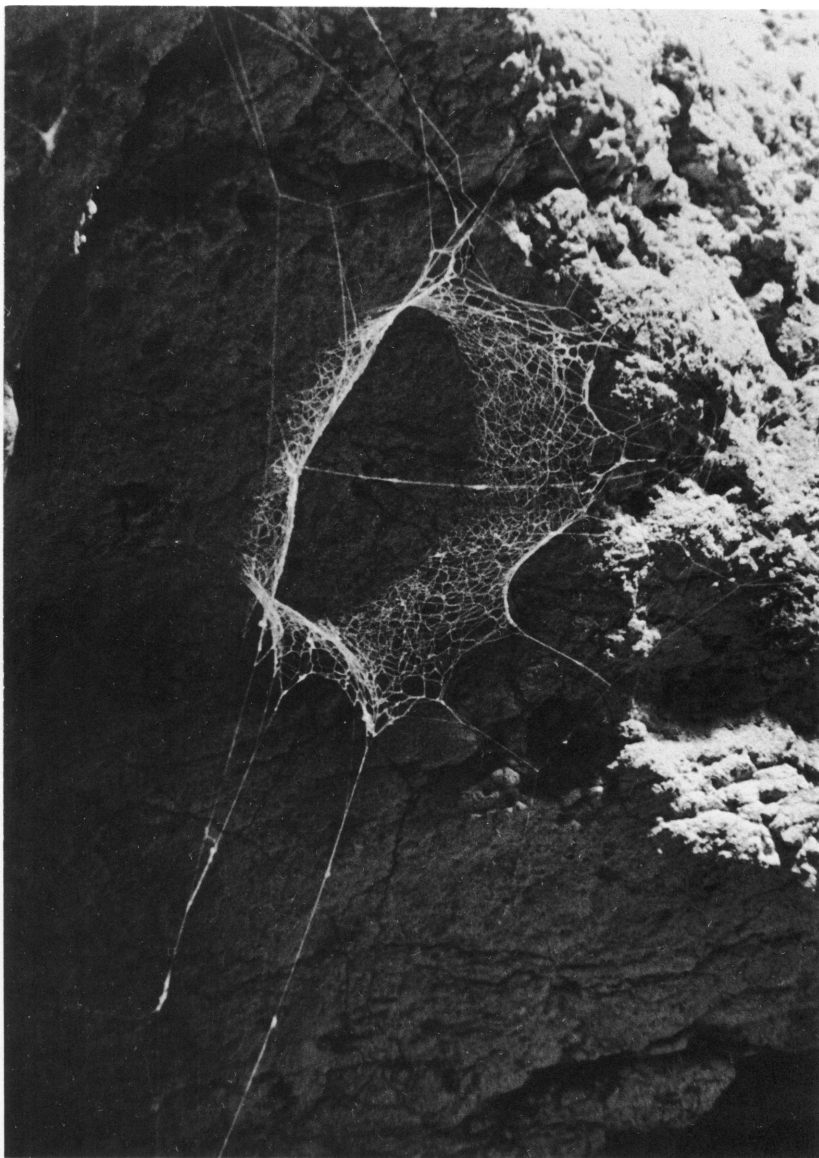


FIG. 9. Web of *Hypochilus bonneti* in Fly Cave. Photograph by R. W. Ayre.

the Gunnison River but probably widely distributed in canyon habitats of south central Colorado. (See map, fig. 2.)

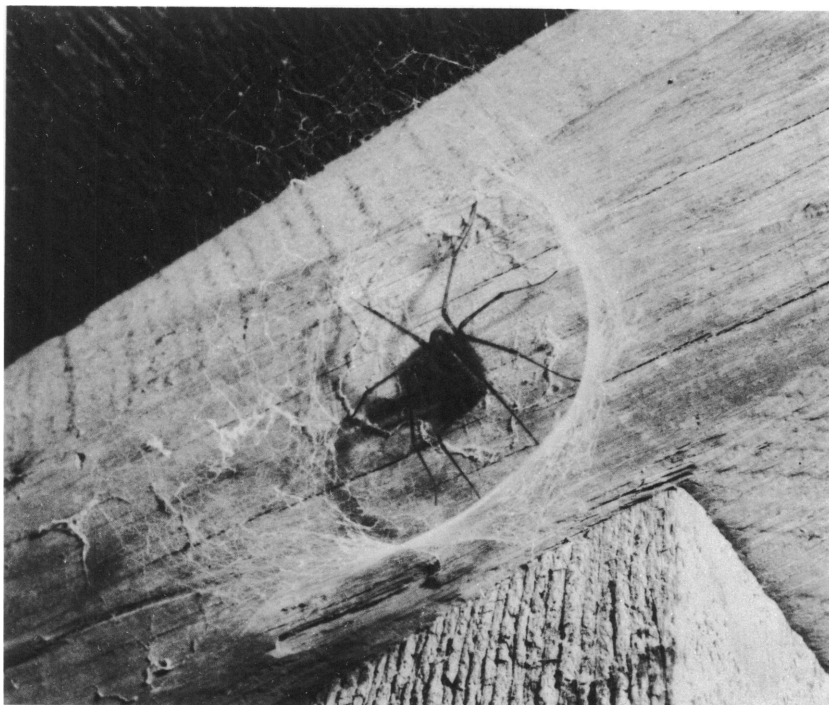


FIG. 10. *Hypochilus bonneti* in web. Photograph by R. Graham.

OTHER RECORDS: *Colorado*: Fly Cave, August 28, 1961 (B. Vogel, W. J. Gertsch, W. Ivie), females, immature; April 28, 1961 (T. P. Maslin, C. J. McCoy, Jr., B. Vogel), male. East Portal, Black Canyon National Monument, 6547 feet, Gunnison County, June 28, 1962 (C. J. McCoy, Jr., P. Miller), females; July 26, 1962 (B. Vogel, W. J. Gertsch, R. Graham), males, females.

BIOLOGY: The webs of *Hypochilus bonneti* resemble those of other species of the genus in size and general appearance. A typical web of a large female from Fly Cave, placed in nearly vertical position on the wall well above the cave floor in the twilight zone, is shown in figure 9. The central area, overlain with a fine sheet of silk where the spider hangs, measures about 3 inches in diameter. The heavy mesh of sticky, hackled-band threads forming part of the lampshade-shaped snare entangles the flies and other insect prey for the spider, which ordinarily remains within the snare retreat. The resting position of the spider, with body appressed to the substratum and legs extended all around to touch the circular mesh,



FIG. 11. Egg sacs of *Hypochilus bonneti*. Photograph by R. Graham.

is well shown in the photograph (fig. 10) of a female hanging in horizontal position from the ceiling of the meat house in Black Canyon. Insect food available in this situation consisted mostly of cave crickets and crane flies.

All species of *Hypochilus* spin several egg sacs. Those of *Hypochilus bonneti* are small suboval pouches covered with detritus and are suspended in unkempt masses on silk threads. They were seen in numbers in the meat house (fig. 11) and in adjacent buildings in Black Canyon.

DISCUSSION: The presence of the Colorado *Hypochilus* in Fly Cave, a relatively small cave with its mouth high on a cliff in Oil Creek at an altitude of about 5800 feet, was first mentioned by a Colorado speleologist, Glen Pollard (1954), who described the cave and its fauna. The large number of flies in the upper parts of the cave near the entrance prompted the name Fly Cave. Several spiders were observed in the same area on the walls in the twilight zone, and examples of them and the flies were sent to the University of Colorado Museum for identification.

Nearly 10 years later, in February, 1961, Robert Ayre, then of Denver,

Colorado, sent me a collection of insects and spiders from Colorado caves. Included were a large female of *Hypochilus* from Fly Cave and excellent photographs of the web and spider. Credit for rediscovery and preliminary study of this extraordinary spider belongs to Ayre. Additional specimens from this cave have been taken by several collectors since that time, as indicated in the records. On August 28, 1961, a party including the then Bea Vogel, Wilton Ivie, and myself searched other suitable habitats along Oil Creek and found a typical *Hypochilus* web on a cliff some distance from the cave. It is clear that the spider is locally rare but lives in situations typical for other members of the genus.

Credit for discovery of the colony in the Black Canyon of the Gunnison River belongs to Jack McCoy, Jr., of the National Park Service and the University of Colorado. On June 28, 1962, he found many living specimens in a small abandoned building previously used as a meat house and gave them to Miss Vogel, who was then at the University of Colorado Museum. A few weeks later I was invited to accompany a group, organized by Miss Vogel and including Patrick Miller, the Chief Naturalist of the Colorado National Monument, and colleagues from the University of Colorado, into the Black Canyon to study the colony at first hand.

Even though the Black Canyon colony lives deep in the canyon, the habitat is at an altitude of 6547 feet. On July 26, the meat house still harbored a series of males and females and immature specimens. The cool, humid climate of the rather tightly closed building seemed ideal for these spiders. Their webs were placed on all surfaces of the walls and ceiling in vertical, horizontal, and intermediate positions. Clusters of egg sacs and deserted webs were also seen. In drier buildings adjacent to the meat house only old webs and egg sacs were found. Nearly a year later, at the end of June, 1963, Miss Vogel and McCoy returned to the meat house in the Canyon and found it again supporting a substantial population of mature specimens.

The natural habitat of these spiders is on the walls of overhanging cliffs and under large rocks on the talus slopes. Some unoccupied webs were noticed in such situations. The spiders probably retreat into the cooler areas under the rocks and then return to their webs at night when the humidity is higher.

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