The Great Lakes Entomologist

Volume 3
Number 3 -- Fall 1970 *Number 3 -- Fall 1970*

Article 1

July 2017

New or Incompletely Known Species of Feltria from North America (Acarina: Feltriidae)

David R. Cook
Wayne State University

NEW OR INCOMPLETELY KNOWN SPECIES OF FELTRIA FROM NORTH AMERICA (ACARINA: FELTRIIDAE)[1]

David R. Cook

Department of Biology, Wayne State University, Detroit, Michigan 48202

The genus *Feltria* has a widespread Holarctic distribution. A few species (Lundblad, 1941, 1969) have also been reported from northern Burma but this latter area, as far as its water mite fauna is concerned, might better be considered part of the southern border of the Palearctic, rather than a part of the Oriental Region. Previously, thirty apparently valid species and subspecies of *Feltria* were known from North America. The present paper describes nine additional forms and brings the total from the Nearctic area to 39, which is nearly identical with the number known from Europe. Most North American species are found in mountainous regions, but four are known from cold streams and springs in Michigan. The majority of Nearctic species are found associated with mosses and other matted aquatic plants, but twelve (including four described in this paper) are typically residents of the interstitial water associated with stream sand and gravel deposits.

For reasons to be listed along with the description of *Feltria testudo* n. sp., the genus *Azugofeltria* is reduced to the rank of subgenus. The terminology used in describing muscle attachment plates and glandularia of the dorsum follows that of Cook (1961). In presenting measurements, those of the holotype and allotype are given first. If a series of specimens is available, the range of variation is given in parentheses following the measurements of the primary types. Holotypes and allotypes will be deposited in the Field Museum of Natural History (Chicago).

Feltria (Feltria) falcicorna, n. sp.
(Figs. 1-5, 7, 13)

Male: Length between anterior end of first coxae and posterior end of genital field 333μ (311μ-333μ), width of coxal area 266 μ (259μ-266μ); coxal groups separated; second coxae extending nearly to midline; posterior apodemes of first coxae very short; both pairs of glandularia located between the fourth coxae and genital field lying free in the integument; genital field separated from coxae; excretory pore and associated glandularia fused with genital field; genital field somewhat triangular, truncate at anterior end (Fig. 3); genital field 114μ (104μ-114μ) in length, 192μ (178μ-192μ) in width; genital acetabula 32-33 (26-33) on each side; gonopore located near anterior end of genital field; ventrolateral plates more or less triangular and lying free in the integument.

Dorsum with a large dorsal shield composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; this shield 289μ (281μ-292μ) in length, 222μ (215μ-226μ) in width; all lateroglandularia small and separate (Fig. 1); glandularia at anterior end all separated from each other; color pinkish.

Dorsal lengths of the palpal segments: P-I, 18μ (17μ-18μ); P-II, 56μ (48μ-56μ); P-III, 29μ (29μ-31μ); P-IV, 65μ (64μ-66μ); P-V, 40μ (38μ-40μ); ventral side of P-IV with a well-developed, curved, sharply - pointed setal tubercle near middle and a much smaller setal tubercle located more distad (Fig. 2); capitulum 97μ-100μ in length, posterior apodemes short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ (52μ-55μ); I-Leg-5, 65μ (59μ-65μ); I-Leg-6, 76μ (73μ-76μ); dorsal lengths of the distal segments of the third leg: III-Leg-4, 70μ (63μ-70μ); III-Leg-5, 95μ (84μ-95μ); III-Leg-6, 87μ (86μ-87μ); fused setae on

[1] Contribution No. 256 from the Department of Biology, Wayne State University. Supported by a grant (GB–6475) from the National Science Foundation.

ventral side of III-Leg-6 triangular in shape and relatively small; suture lines of individual setae slightly indicated (Fig. 13); length of this modified setal group 8μ (8μ-10μ), width at base 15μ (15μ-17μ).

Female: Length between anterior end of first coxae and posterior end of genital field 404μ (370μ-407μ), width of coxal area 311μ (305μ-333μ); coxal groups separated; second coxae not extending to midline; posterior apodemes of first coxae short; both pairs of glandularia located between fourth coxae and genital field lying free in the integument; ventrolateral plates relatively small and unfused (Fig. 4); genital field 255μ (237μ-274μ) in width; the individual acetabular plates 98μ (92μ-111μ) in length, 115μ (104μ-118μ) in width; genital acetabula 29-35 (21-41) on each side; pregenital sclerite longer than wide and extending slightly anterior to the acetabular plates; median sclerite at posteromedial corners of fourth coxae well developed.

Dorsum with a large dorsal plate composed of the fused anteromedial plate, dorsal plates A, B, D, and dorsoglandularia A, B; length of dorsal plate 296μ (285μ-318μ), width 244μ (226μ-244μ); dorsal plate sometimes more oval than in specimen illustrated (Fig. 5); other dorsal plates and glandularia separated; dorsoglandularia D widely separated medially by the excretory pore plate; color as in male.

Dorsal lengths of the palpal segments: P-I, 19μ (17μ-21μ); P-II, 50u (48μ-52μ); P-III, 31μ (31μ-32μ); P-IV, 66μ (64μ-69μ); P-V, 40μ (38μ-40μ); ventral side of P-IV with a moderately - developed, pointed setal tubercle; its companion seta with an extremely small tubercle (Fig. 7); capitulum 100μ (100μ-103μ) in length; dorsal lengths of the distal segments of the first leg; I-Leg-4, 55μ (52μ-57μ); I-Leg-5, 66μ (65μ-69μ); I-Leg-6, 79μ (74μ-79μ).

Holotype: Adult male, collected in gravel deposits in the Tongue River at bridge over U.S. Highway 14, Sheridan Co., Wyoming, July 16, 1969. Temperature 14° C.

Allotype: Adult female, same data as holotype.

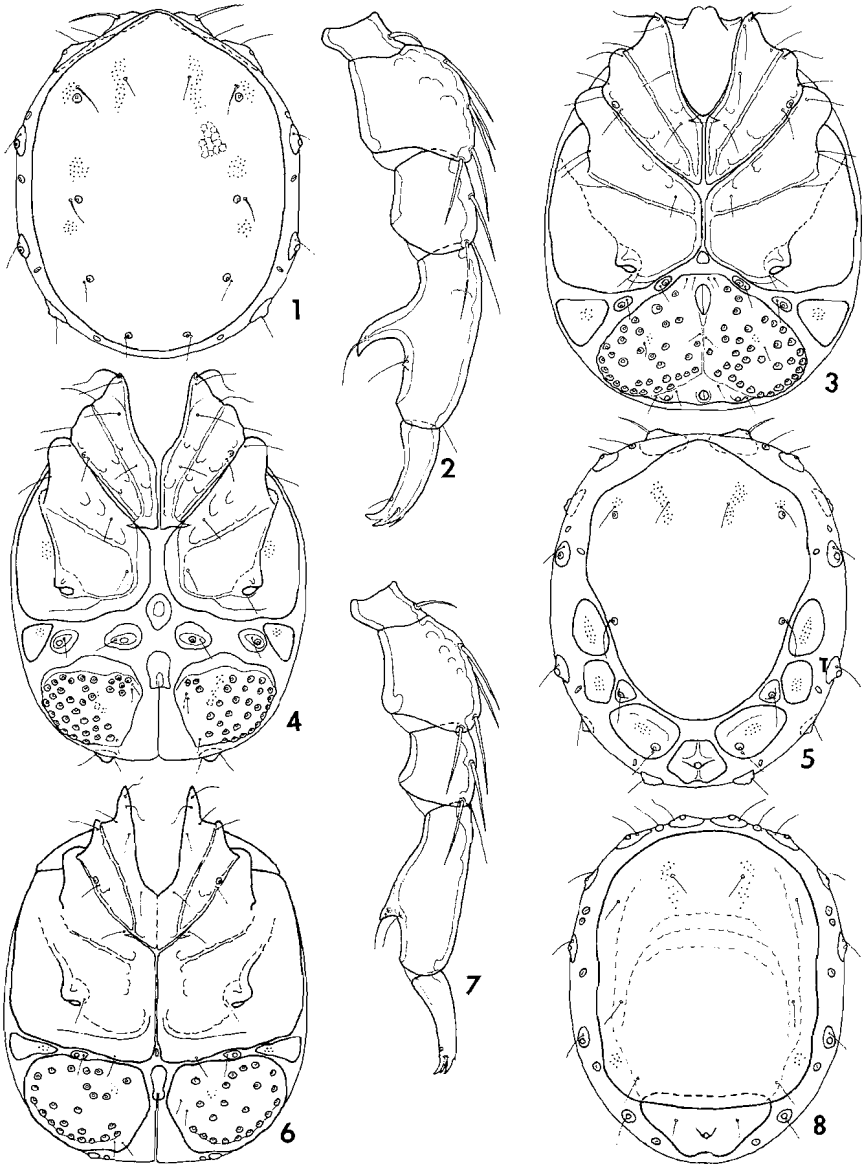
Paratypes: 2 males, 5 females, same data as holotype; 2 females, taken in a sand and gravel bar in the Gibbon River above Virginia Cascades, Yellowstone National Park, Wyoming, July 19, 1969.

Habitat: Interstitial waters of cold streams.

Discussion: The present species belongs to the *Feltria cornuta* complex. All previously described members – three in Europe, one in Japan, and two in North America – have been described as subspecies of *cornuta.* However, the distributional patterns of the European forms is not that expected of true subspecies (see Cook, 1963), and it is likely that all are distinct species. The male of *F. falcicorna* differs from all previously described members of the complex in its extremely small setal group on the ventral side of III-Leg-6 (Fig. 13). Females are known for only three previously described forms, *F. cornuta cornuta* Walter, *F. cornuta paucipora* Szalay, and *Feltria cornuta longispina* Motas & Angelier, so comparisons in this sex are relatively meaningless. However, the female of *falcicorna* differs from the European forms in having dorsoglandularia A and B incorporated into the large dorsal plate. In the first two European "subspecies," only dorsoglandularia B are fused with the dorsal plate. In *longispina,* dorsoglandularia A, B, C are incorporated into the plate. See Habeeb (1963) and Cook (1963) for descriptions of the other members of the *cornuta*- complex known from North America.

Feltria (Feltria) echinopalpis projecta, n. ssp.
(Figs. 6, 8-12, 14)

Male: Length between anterior end of first coxae and posterior end of the genital field 366μ (366μ-400μ), width of coxal area 281μ (281μ-289μ); coxal groups very close together but not fused (Fig. 9); second coxae not extending to midline; first coxae relatively sharp - pointed; posterior apodemes of first coxae short; medial pair of glandularia located between the fourth coxae and the genital field lacking the gland portion and fused with the fourth coxae; lateral pair of glandularia with gland portion and either separate or lightly fused with the fourth coxae; genital field separated from the coxae; excretory pore and associated glandularia fused with the genital field; genital field 133μ (133μ-144μ) in length, 214μ (214μ-222μ) in width; genital acetabula 15-16 (15-21) on each side; gonopore located near anterior end of genital field; ventrolateral plates free but extending between fourth coxae



Feltria falcicorna n. sp. Fig. 1, dorsal view, male; Fig. 2 medial view of palp, male; Fig. 3, ventral view, male; Fig. 4 ventral view, female; Fig. 5, dorsal view, female; Fig. 7, medial view of palp, female.
Feltria echinopalpis projecta n. ssp. Fig. 6, ventral view, female; Fig. 8, dorsal view, female.

and genital field; integument colorless or with a slightly greenish cast.

Dorsum with a large, oval dorsal shield composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; gland portion of all dorsoglandularia absent (Fig. 11); a small ridge extending around the periphery of the dorsal shield except at anterior end; dorsal shield 307μ (307μ-313μ) in length, 214μ (214μ-222μ) in width; lateroglandularia

small and lying free in the integument.

Dorsal lengths of the palpal segments: P-I, 24μ (23μ-24μ); P-II, 55μ (55μ-59μ); P-III, 41μ (41μ-43μ); P-IV, 104μ (104μ-107μ); P-V, 28μ; ventral side of P-II with a projection which extends proximoventrally; this projection with several, sharp - pointed extensions of the integument (Fig. 12); tip of P-V down-turned; P-IV relatively long and narrow; capitulum 100μ (100μ-101μ) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ (59μ-60μ); I-Leg-5, 69μ (69μ-73μ); I-Leg-6, 83μ (83μ-85μ); dorsal lengths of the distal segments of the third leg: III-Leg-4, 67μ (67μ-69μ); III-Leg-5, 90μ (90μ-93μ); III-Leg-6, 86μ (83μ-86μ); III-Leg-6 expanded and curved; modified setae on ventral side of III-Leg-6 short, heavy and partially fused; a single, longer, unmodified seta also present (Fig. 14).

Female: Length between anterior end of first coxae and posterior end of genital field 429μ, width of coxal area 340μ; coxal groups close together but separate, except anterior groups which are lightly fused medially; posterior apodemes of first coxae short; tips of first coxae sharp-pointed; medial pair of glandularia located between fourth coxae and genital field lacking gland portion and fused with the fourth coxae; lateral pair of glandularia with gland portion and lying free in the integument; acetabular plates separated from fourth coxae and each other; pregenital sclerite longer than wide, extending even with the anterior margin of the acetabular plates; genital field 303μ in width; the individual acetabular plates 111μ in length, 140μ in width; genital acetabula 15-16 on each side; ventrolateral plates relatively narrow, extending between fourth coxae and genital field (Fig. 6).

Dorsum with a large dorsal plate made up of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-C; dorsal plate 326μ in length, 259μ in width; dorsoglandularia D fused with the excretory pore plate and postgenital sclerite to form a single platelet (Fig. 8); gland portions of all dorsoglandularia absent; all lateroglandularia small and lying free in the integument; color as in male.

Dorsal lengths of the palpal segments: P-I, 28μ; P-II, 66μ; P-III, 52μ; P-IV, 125μ; P-V, 31μ; palp similar to male but proximoventral projection on P-II showing even greater development (Fig. 10); capitulum 105μ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ; I-Leg-5, 80μ; I-Leg-6, 86μ.

Holotype: Adult male, taken in a stream near Griffen (three miles from Warren Co. line on Route No. 8), Hamilton Co., New York, August 19, 1964.

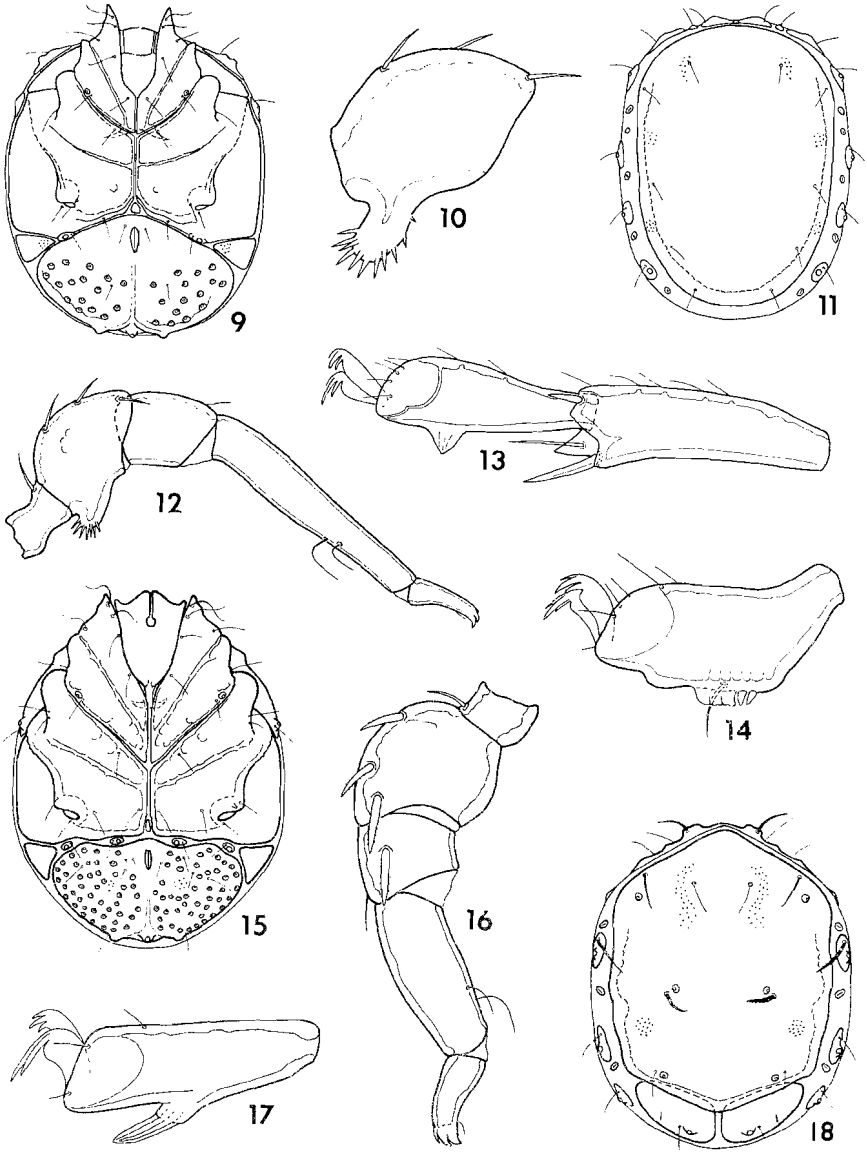
Paratypes: One male, from the Salmon River at bridge over Route No. 22, Victoria Co., New Brunswick, August 26, 1964; one female, collected in a small stream near Pointe-a-la-Crois, Gaspe Peninsula,Quebec, August 27, 1964.

Habitat: Interstitial waters associated with sand and gravel deposits of streams.

Discussion: The eastern representatives of *F. echinopalpis* differ in their lesser or complete lack of fusion of the coxal groups. In *F. echinopalpis echinopalpis* Cook (known from Colorado, Wyoming, and Montana), all coxal groups are fused without trace of a suture line. The known specimens of both the eastern and western forms are few in number and other apparent differences may not hold true when longer series are available. However, it appears that the modified setae on III-Leg-6 are shorter and blunter in *projecta* males, and the platelet bearing the excretory pore is truncate anteriorly in *projecta* females, but is concave anteriorly in the typical subspecies. The North American species is closely related to the European *F. denticulata* Angelier, which is also a ground water species. *Feltria denticulata* also possesses unfused coxal groups, but the European species exhibits less loss of the gland portions of the dorsal and ventral glandularia. Also, the genital field in the male of *denticulata* is nearly truncate anteriorly, but is blunted pointed anteriorly in the North American species (Fig. 9).

Feltria (Feltria) magniseta, n. sp.
(Figs. 15-18)

Male: Length between anterior end of first coxae and posterior end of genital field 340μ, width of coxal area 266μ; coxal groups very close together but not fused; median margins of second coxae broad and extending to midline; posterior apodemes of first coxae very short; both pairs of glandularia located between the coxae and genital field separated from the coxae; excretory pore and associated glandularia fused with the genital field; genital field



Feltria echinopalpis projecta n. ssp. Fig. 9, ventral view, male; Fig. 10, P-II, female; Fig. 11, dorsal view, male; Fig. 12, medial view of palp, male; Fig. 14, III-Leg-6, male.
Feltria falcicorna n. sp. Fig. 13, III-Leg-5 and 6, male.
Feltria magniseta n sp. Fig. 15, ventral view, male; Fig. 16, medial view of palp, male; Fig. 17, III-Leg-6, male; Fig. 18, dorsal view, male.

103μ in length, 196μ in width; anterior edge of genital field more or less truncate (Fig. 15); genital acetabula numerous; gonopore located near anterior margin of genital field; ventrolateral plates triangular and lying free in the integument; integument amber colored.

Dorsum with a large plate composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-C; this plate bluntly pointed at each end (Fig. 18); dorsal plate 281μ in length, 222μ in width; dorsoglandularia D large, but separated medially; lateroglandularia somewhat enlarged, but unfused; setae associated with dorsoglandularia B and lateroglandularia A enlarged and pectinate.

Dorsal lengths of the palpal segments: P-I, 15μ; P-II, 57μ; P-III, 31μ; P-IV, 70μ; P-V, 37μ; Figure 16 illustrates the proportions and chaetotaxy of the palp; capitulum 117μ in length, posterior capitular apodemes somewhat elongated; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52μ; I-Leg-5, 57μ; I-Leg-6, 66μ; segments of first leg very stocky, I-Leg-6 is 31μ in height; dorsal lengths of the distal segments of the third leg: III-Leg-4, 73μ; III-Leg-5, 79μ; III-Leg-6, 86μ; ventral side of III-Leg-6 with four, long, slightly-fused setae (Fig. 17), these setae approximately 20μ in length and pointed almost directly distally.

Female: Unknown.

Holotype: Adult male, taken in the American Fork River in American Fork Canyon on Route No. 80 (temperature 16°C.), Utah Co., Utah, August 5, 1961.

Habitat: Mosses on rocks.

Discussion: The new species seems most closely related to *F. lundbladi* Cook which is known only from a cold stream in Montana. The structure of the coxae and genital fields are similar in males of the two species, but these sclerites are completely fused in *lundbladi,* completely separated in *magniseta.* The dorsums of the two are somewhat similar but the new species has greatly thickened setae associated with dorsoglandularia B and lateroglandularia A. The setae on the ventral side of III-Leg-6 are also somewhat similar, but arise from a ventral projection in *magniseta* (Fig. 17).

Feltria (Feltria) kurtvietsi, n. sp.
(Figs. 19-22)

Male: Length between anterior end of first coxae and posterior end of genital field 425μ, width of coxal area 333μ; coxal groups separated except anterior group which are fused medially with scarcely a trace of a suture line; second coxae not extending to midline; posterior apodemes of first coxae short; medial pair of glandularia located between the fourth coxae and genital field fused with the fourth coxae; lateral glandularia and ventrolateral plates fused into the genital field (Fig. 19); genital field separated from the coxae; excretory pore lightly fused with the genital field but associated glandularia are free; genital field 103μ in length, 299μ in width; genital acetabula numerous; anterior margin of genital field truncate; gonopore located near middle of genital field; integument amber colored.

Dorsum with a large plate made up of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-C; this plate bluntly pointed anteriorly and bearing lateral ridges near periphery; dorsal plate 344μ in length, 274μ in width; dorsoglandularia D large but separated medially; all lateroglandularia separate, the posterior two pairs enlarged (Fig. 21).

Dorsal lengths of the palpal segments: P-I, 21μ; P-II, 63μ; P-III, 35μ; P-IV, 83μ; P-V, 48μ; Figure 20 illustrates the proportions and chaetotaxy of the palp; capitulum 117μ in length, posterior capitular apodemes somewhat elongated; dorsal lengths of the distal segments of the first leg; I-Leg-4, 60μ; I-Leg-5, 76μ; I-Leg-6, 83μ; dorsal lengths of the distal segments of the third leg: III-Leg-4, 83μ; III-Leg-5, 97μ; III-Leg-6, 90μ; ventral side of III-Leg-6 with five heavy setae which are slightly fused medially (Fig. 22); these setae approximately 20μ in length and extending somewhat distoventrally.

Female: Unknown.

Holotype: Adult male, collected in a spring (temperature 8°C.) flowing into Winsor Creek, one mile west of Winsor Creek Camp Ground, San Miguel Co., New Mexico, July 18, 1961.

Habitat: Mosses on rocks in a cold stream.

Discussion: The present species seems most closely related to *F. montanensis* Cook. The two are similar is structure of the palp, III-Leg-6, and the dorsum. However, the venters differ considerably in the two species. In *montanensis,* there is complete fusion of the coxae and genital field into a solid ventral shield. The gonopore arises near the middle of the genital field in *F. kurtvietsi,* near the anterior margin in *montanensis.*

Feltria (Feltria) gledhilli, n. sp.
(Figs. 23-25, 28)

Male: Length between anterior end of first coxae and posterior end of genital field 355μ, width of coxal area 237μ; coxal groups separate; second coxae not extending to midline; posterior apodemes of first coxae relatively long; both pairs of glandularia located between fourth coxae and genital field small and lying free in the integument; genital field separated from fourth coxae; excretory pore lightly fused with genital field; genital field 118μ in length, 174μ in width; anterior edge of genital field bluntly pointed, gonopore located close to anterior edge (Fig. 25); genital acetabula 28-30 on each side; ventrolateral plates small and rounded medially, these lying free in the integument; integument with a very light pink color.

Dorsum with a large plate made up of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-C; dorsoglandularia D very small and widely separated; dorsal plate 266μ in length, 178μ in width; Figure 28 illustrates the shape of the dorsal plate; lateroglandularia very small and unfused; glandularia at anterior end of body not fused with each other.

Dorsal lengths of the palpal segments: P-I, 17μ; P-II, 55μ; P-III, 27μ; P-IV, 71μ; P-V, 41μ; Figure 24 shows the proportions and chaetotaxy of the palp; capitulum 121μ in length, capitular apodemes somewhat elongated; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ; I-Leg-5, 66μ; I-Leg-6, 76μ; dorsal lengths of the distal segments of the third leg: II-Leg-4, 69μ; III-Leg-5, 66μ; III-Leg-6, 86μ; ventral side of III-Leg-6 with five, enlarged setae which are very slightly fused medially; modified setae of III-Leg-6 approximately 31μ in length, the whole setal group slightly tapered distally, but not coming to a point (Fig. 23).

Female: Unknown.

Holotype: Adult male, taken in Half Moon Creek (temperature 8°C.) near Half Moon Creek Camp Ground, Lake Co., Colorado, July 24, 1961.

Habitat: Mosses on rocks in a cold stream.

Discussion: The new species seems most closely related to the widespread Western species, *F. parva* Cook, but differs as follows: The posterior apodemes of the first coxae are much longer in *parva* and extend to the middle of the fourth coxae. Dorsoglandularia D are much smaller in the new species and the anterior glandularia are not fused with each other. The posterior capitular apodemes are comparatively much longer in *F. parva.* There are two or three fused setae on III-Leg-6 which taper to a point in *parva,* but there are five homologous setae in *gledhilli* and these are only slightly tapered at the distal end.

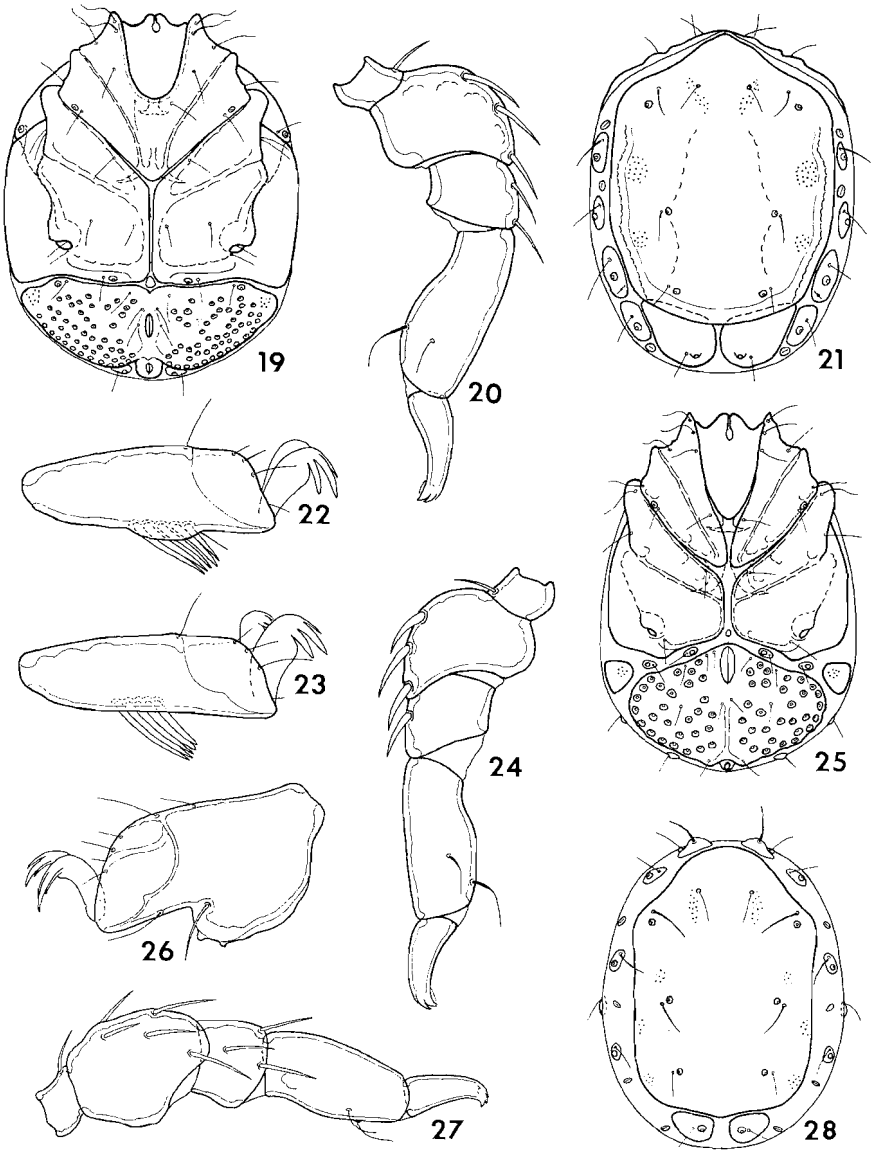
Feltria (Feltria) gennada Cook
(Figs. 26, 27, 29, 31)

Cook (1963) described the female of this species from specimens taken from interstitial waters in Oregon and Montana. A single individual taken in Montana seems to be the male and is here described.

Male: Length between anterior end of first coxae and posterior end of genital field 396μ, width of coxal area 273μ; coxal groups separated medially but fused on their respective sides; first coxae pointed and projecting; second coxae extending medially to midline; both pairs of glandularia located between fourth coxae and genital field fused with the fourth coxae; gland portion of more medial pair of these glandularia absent; ventrolateral plates also fused with fourth coxae (Fig. 31); genital field separated from fourth coxae; excretory pore fused with genital field; genital field 129μ in length, 204μ in width; anterior edge of genital field pointed medially, gonopore near anterior edge; genital acetabula 25-31 on each side; integument colorless, eye pigment greatly reduced.

Dorsum with a large dorsal shield composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; gland portions of dorsoglandularia absent; dorsal shield 355μ in length, 299μ in width; dorsal plate oval, somewhat pointed at anterior end (Fig. 29); lateroglandularia all separated; glandularia at anterior end of body fused with each other.

Dorsal lengths of the palpal segments: P-I, 17μ; P-II, 52μ; P-III, 26μ; P-IV, 59μ; P-V, 29μ; Figure 27 shows the proportions and chaetotaxy of the palp; one of the setae on the ventral



Feltria kurtvietsi n. sp. Fig. 19, ventral view, male; Fig. 20, medial view of palp, male; Fig. 21, dorsal view, male; Fig. 22, III-Leg-6, male.

Feltria gledhilli n. sp. Fig. 23, III-Leg-6, male; Fig. 24, medial view of palp, male; Fig. 25, ventral view, male; Fig. 28, dorsal view, male.

Feltria gennada Cook. Fig. 26, III-Leg-6, male; Fig. 27, medial view of palp, male.

side of P-IV with a small setal tubercle; capitulum 107μ in length, capitular apodemes relatively long; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ; I-Leg-5, 66μ; I-Leg-6, 60μ; dorsal lengths of the distal segments of the third leg: III-Leg-4, 62μ,

III-Leg-5, 80μ; III-Leg-6, 60μ; ventral side of III-Leg-6 greatly expanded, ventral side with one unmodified seta associated with the projection; modified setae either absent or reduced to the tubercle-like structures shown in Figure 26.

Female: Described by Cook (1963).

Material examined: One male, taken in Doyle Creek at Upper Doyle Creek Camp Ground (T47N/R85W), Johnson Co., Wyoming, July 15, 1969.

Habitat: Interstitial waters associated with stream sand and gravels.

Feltria (Feltria) wyomingensis, n. sp.

(Figs. 30, 32-34)

Male: Length between anterior end of first coxae and posterior end of genital field 355μ, width of coxal area 274μ; coxal groups separated medially but very slightly fused on their respective sides; second coxae extending medially to midline; both pairs of glandularia located between the coxae and genital field small and unfused; genital field separated from the coxae; excretory pore fused with the genital field; genital field 107μ in length, 222μ in width; genital acetabula numerous; genital field truncate at anterior end (Fig. 32); gonopore small and located near anterior edge of genital field; ventrolateral plates triangular and lying free in the integument.

Dorsum with a large dorsal plate composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-C; this plate 281μ in length, 222μ in width; dorsal plate bluntly-pointed at anterior end, bearing a lateral ridge on each side and shorter ridges extending between the posterior two pairs of glandularia on their respective sides; dorsoglandularia D relatively large but separated medially, and partially incorporating a pair of slit-like glands (Fig. 34); laterglandularia somewhat enlarged but lying free in the integument; integument light pink in color.

Dorsal lengths of the palpal segments: P-I, 18μ; P-II, 59μ; P-III, 34μ; P-IV, 73μ; P-V, 42μ; Figure 30 illustrates the proportions and chaetotaxy of the palp; capitulum 128μ in length; dorsal lenghts of the distal segments of the first leg: I-Leg-4, 59μ; I-Leg-5, 62μ; I-Leg-6, 69μ; leg segments comparatively short and stocky, I-Leg-6 is 31μ in height; dorsal lengths of the distal segments of the third leg: III-Leg-4, 86μ; III-Leg-5, 97μ; III-Leg-6, 93μ; ventral side of III-Leg-6 with five, heavy setae which are partially fused and projecting somewhat distally (Fig. 33); this setal group 24μ in length, 10μ in width, and tapering nearly to a point at the distal end.

Female: Unknown.

Holotype: Adult male, taken in Merle Creek (temperature 9°C.) near Sheep Mountain Lookout, Johnson Co., Wyoming, July 14, 1969.

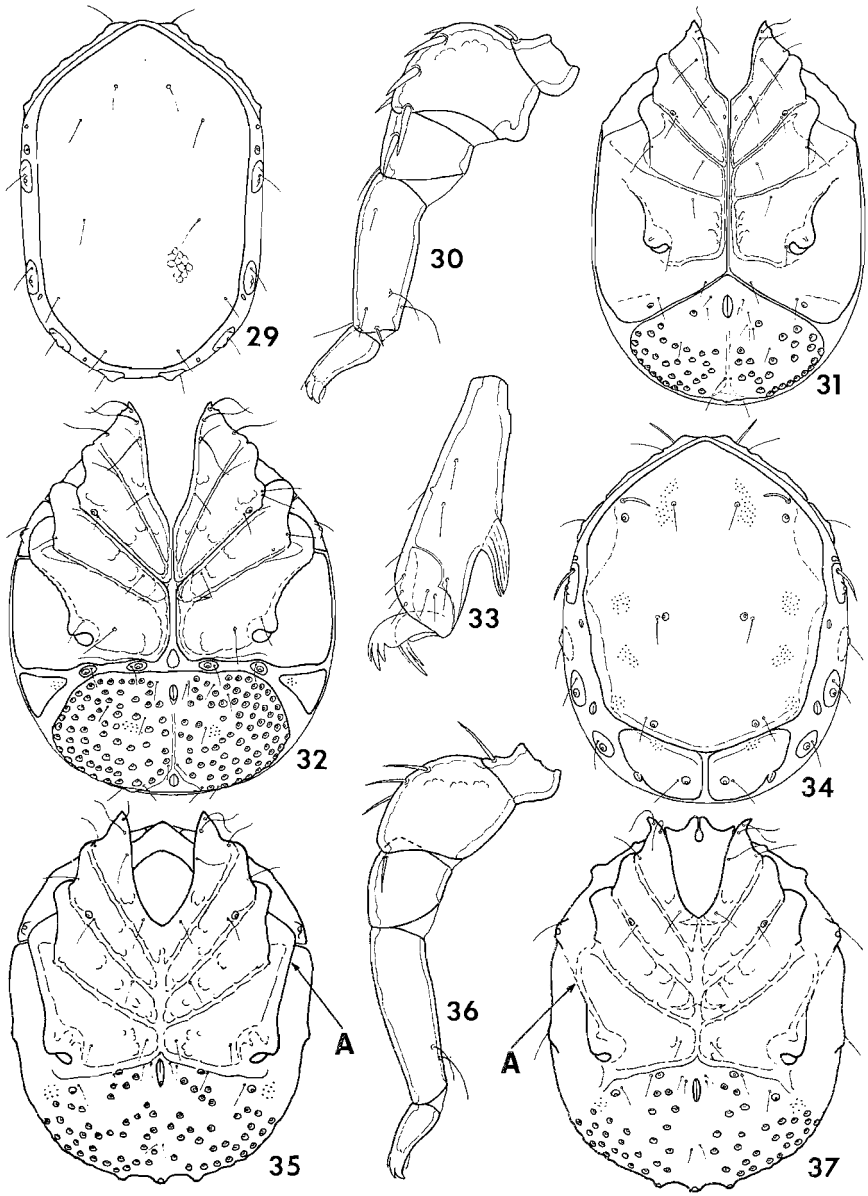
Habitat: Mosses on rocks in a cold stream.

Discussion: Structure of the venter is very similar in *F. wyomingensis* and the Holarctic species, *F. minuta* Koenike. The dorsums of the two species are also somewhat alike, but glandularia D are comparatively much wider (distance measured at right angles to the long axis of the body) in *F. minuta.* The modified setae on III-Leg-6 in the male is very different in the two species. These setae are shorter, more distally-placed, and directed downwards in *minuta.* There is also a more proximally-placed, unmodified seta associated with the modified setal group in *F. minuta.*

THE *Feltria faceta* GROUP

Males belonging to this group are characterized as follows: ventral sclerites fused into a solid ventral shield; medial margins of fourth coxae very short (Figs. 35, 37); anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D fused into a dorsal shield; lateroglandularia B and D always fused with the ventral sheild; lateroglandularia A and C lying free in the integument (Figs. 46, 48) or lateroglandularia C also fused with ventral shield; mofidied setae on ventral side of III-Leg-6 large, somewhat triangular, and usually fused with little trace of suture lines (Figs. 48, 51).

The group may be divided into subgroups based on both ecological and morphological



Feltria gennada Cook. Fig. 29, dorsal view, male; Fig. 31, ventral view, male.
Feltria wyomingensis n. sp. Fig. 30, medial view of palp, male; Fig. 32, ventral view, male; Fig. 33, III-Leg-6, male; Fig. 34, dorsal view, male.
Feltria appalachiana Habeeb Fig. 35, ventral view, male; Fig. 36, medial view of palp, male.
Feltria plana n. sp. Fig. 37, ventral view, male.

differences. There are two known species in "surface" waters, *F. appalachiana* Habeeb and *F. plana* n. sp. These exhibit a rather deep blue or purplish integumental pigmentation and the lateroglandularia A and C are free in the male (Figs. 46,48). Two names have been given to members of the other subgroup, *F. faceta* Cook and *F. ozarkensis* Cook, but, for reasons to be given later, the latter is here considered a synonym of the former. This subgroup is found in interstitial waters, lacks integumental pigmentation, and only the lateroglandularia A are free in the male. Females of the two subgroups may also be separated by habitat and color. In addition, dorsoglandularia D are widely separated medially by the excretory pore plate in the interstitial species (Fig. 43).

Feltria (Feltria) appalachiana Habeeb
(Figs. 35, 36, 39, 41, 45, 48, 49)

Male: Coxae, genital field, excretory pore plate, ventrolateral plates, and ventral glandularia all fused into a solid ventral shield; ventral shield 281μ-288μ in length, 222μ-224μ in width; first coxae pointed and projecting; second coxae extending medially to midline; medial margins of fourth coxae reduced; lateral margins of fourth coxae extending anteriorly from insertions of fourth legs well anterior to suture line between third and fourth coxae (Fig. 35, arrow A); a suture evident on lateral margins of ventral sheild near anterior portion of fourth coxae; genital acetabula 28-35 on each side, gonopore located very close to anterior edge of genital field; integumental pigmentation purple.

Dorsum with a large dorsal shield composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; dorsal shield 229μ-244μ in length, 181μ-189μ in width; lateroglandularia A and C lying free in the integument between the dorsal and ventral shields (Fig. 48), lateroglandularia B and D fused with the ventral shield; slit-like glands not fused with the laterglandularia.

Dorsal lengths of the palpal segments; P-I, 17μ-18μ; P-II, 57μ-59μ; P-III, 33μ-36μ; P-IV, 76μ-83μ; P-V, 34μ-35μ; Figure 36 illustrates the proportions and chaetotaxy of the palp; capitulum 97μ-104μ in length, capitular apodemes very short; dorsal lenghs of the distal segments of the first leg: I-Leg-4, 50μ; I-Leg-5, 60μ; I-Leg-6, 69μ; dorsal lengths of the distal segments of the third leg: III-Leg-4, 57μ-59μ; III-Leg-5, 73μ-78μ; III-Leg-6, 80μ-83μ; modified setae on ventral side of III-Leg-6 fused as indicated in Figure 49, this setal group 26μ-28μ in width at base.

Female: Length between anterior end of first coxae and posterior end of genital field 363μ, width of coxal area 303μ; coxal groups separated; second coxae not extending to midline; posterior apodemes of first coxae short; both pairs of glandularia located between the fourth coxae and genital field free; ventrolateral plates small; more or less oval in shape, and free in the integument (Fig. 41); genital field 251μ in width; the individual acetabular plates 92μ in length, 115μ in width; a rounded projection present near middle of anterior margin of acetabular plates; genital acetabula 33-34 on each side; pregenital sclerite longer than wide, extending anterior to the anterior margin of the acetabular plates.

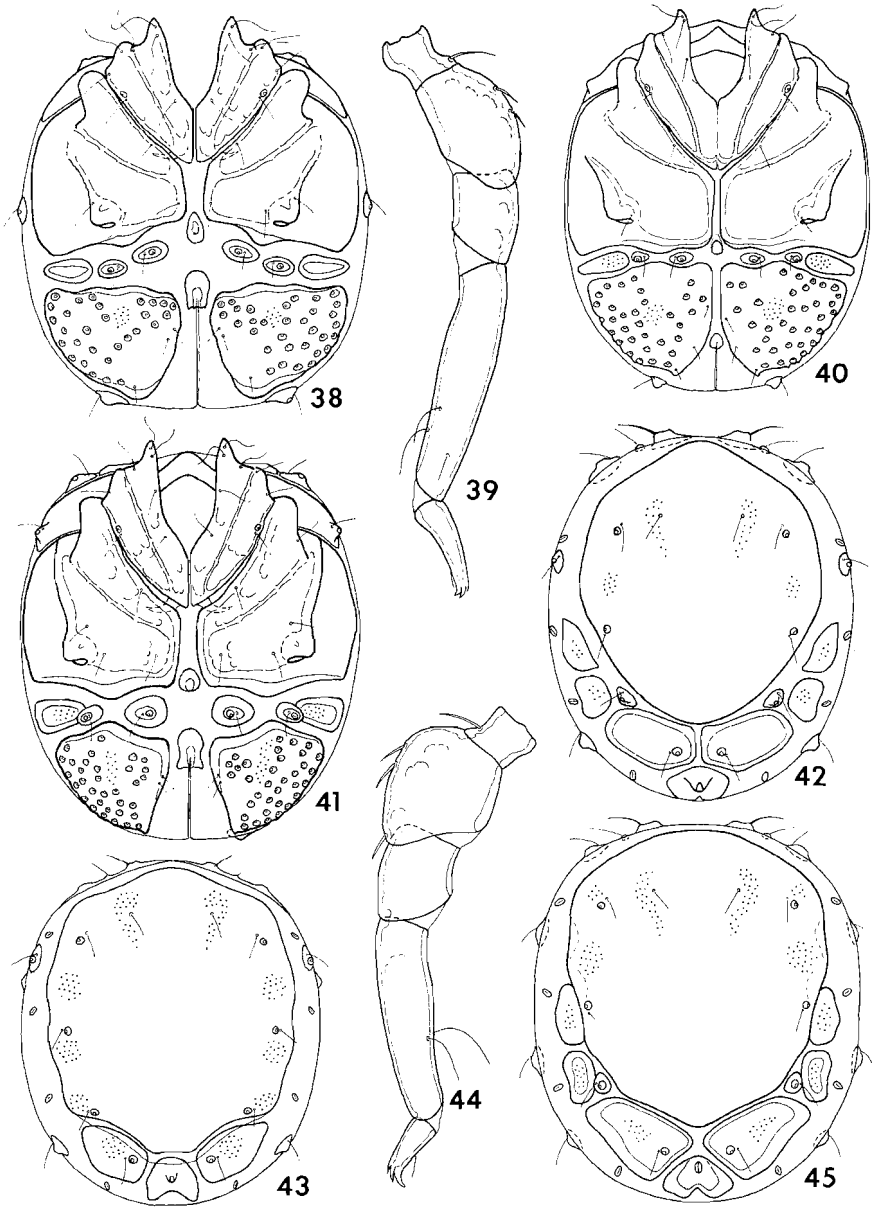
Dorsum with a large plate composed of the fused anteromedial plate, dorsal plates A, B, D, and dorsoglandularia A, B; dorsal plate somewhat oval, bluntly pointed at posterior end; dorsal plate 270μ in length, 251μ in width; dorsoglandularia D with medial margin reduced to a medial angle (Fig. 45); excretory pore plate extending slightly between the dorsoglandularia D; color as in male.

Dorsal lengths of the palpal segments: P-I, 23μ; P-II, 62μ; P-III, 39μ; P-IV, 104μ; P-V, 39μ; palpal segments comparatively long and slender (Fig. 39); capitulum 104μ in length, posterior capitular apodemes very short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ; I-Leg-5, 69μ; I-Leg-6, 74μ.

Material Examined: One male, one female, taken in the Cullasaja River (temperature 14°C) one mile north of Highlands, Macon Co., North Carolina, May 14, 1961. This is the type locality for the species. One male, found in a small stream (temperature 10°C.) near Bridal Veil Falls, northeast of Highlands on U.S. Highway 64, Macon Co., North Carolina, May 15, 1961.

Habitat: Mosses on rocks in streams.

Discussion: See discussion section for the following species.



Feltria plana n. sp. Fig. 38, ventral view, female; Fig. 42, dorsal view, female;
Feltria appalachiana Habeeb Fig. 39, medial view of palp, female; Fig. 41, ventral view, female; Fig. 45, dorsal view, female.
Feltria faceta Cook Fig. 40, ventral view, female; Fig. 43, dorsal view, female; Fig. 44, medial view of palp, female.

Feltria (Feltria) plana, n. sp.
(Figs. 37, 38, 42, 46, 47, 50, 51)

Male: Coxae, genital field, excretory pore plate, ventrolateral plates, and ventral glandularia fused into a solid ventral shield; ventral shield 292μ in length, 251μ in width; first coxae sharp-pointed and projecting; second coxae extending medially to midline; medial margins of fourth coxae reduced; lateral margins of fourth coxae extending anteriorly from insertion of fourth legs, but grading into the ventral shield posterior to the suture line between the third and fourth coxae (Fig. 37, arrow A); genital acetabula 25-26 on each side; gonopore located near anterior edge of genital field; integumental color a light purple.

Dorsum with a large plate made up of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; dorsal shield 266μ in length, 211μ in width; dorsal shield with raised areas as indicated by broken lines in Figure 46; lateroglandularia A and C lying free in the integument between the dorsal and ventral shields, lateroglandularia B and D fused with the ventral shield; slit-like glands fused with lateroglandularia A.

Dorsal lengths of the palpal segments: P-I, 17μ; P-II, 55μ; P-III, 36μ; P-IV, 73μ; P-V, 38μ; Figure 47 illustrates the proportions and chaetotaxy of the palp; capitulum 90μ in length, capitular apodemes very short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ; I-Leg-5, 59μ; I-Leg-6, 69μ; dorsal lengths of the distal segments of the third leg: III-Leg-4, 62μ; III-Leg-5, 78μ; III-Leg-6, 76μ; modified setae on ventral side of III-Leg-6 fused with little indication of suture lines (Fig. 51), this setal group 28μ in width at base.

Female: Length between anterior end of first coxae and posterior end of genital field 348μ, width of coxal area 288μ; coxal groups separate; second coxae not extending to midline; posterior apodemes of first coxae short; both pairs of glandularia located between the fourth coxae and genital field free in the integument; ventrolateral plates small and somewhat oval (Fig. 38); genital field 273μ in width; the individual acetabular plates 89μ in length, 118μ in width; acetabular plates truncate at anterior end; genital acetabula 29-32 on each side; pregenital sclerite longer than wide, extending anterior to anterior end of acetabular plates.

Dorsum with a large plate composed of the fused anteromedial plate, dorsal plates A, B, D, and dorsoglandularia A, B; dorsal plate somewhat oval, bluntly - pointed at anterior end; dorsal plate somewhat oval, bluntly-pointed at anterior end; dorsal plate 259μ in length, 222μ in width; dorsoglandularia D close together medially, with broad medial margins which exclude the excretory pore plate (Fig. 42); color as in male.

Dorsal lengths of the palpal segments: P-I, 17μ; P-II, 53μ; P-III, 32μ; P-IV, 79μ; P-V, 40μ; Figure 50 illustrates the proportions and chaetotaxy of the palp; capitulum 97μ in length, capitular apodemes short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 50μ; I-Leg-5, 64μ; I-Leg-6, 73μ.

Holotype: Adult male, taken in a stream (temperature 9°C.) at Cowen's Gap State Park, Fulton Co., Pennsylvania, May 21, 1961.

Allotype: Adult female, same data as holotype.

Habitat: Mosses on rocks in a cold stream.

Discussion: The new species is most closely related to the previous species, *F. appalachiana*, but differs in a number of characters. The lateral margins of the fourth coxae are long and distinct in *appalachiana* males, but grade into the general ventral shield on *plana* males (compare Figures 35 and 37). Slit-like glands are fused with lateroglandularia A in males of *F. plana* (Fig. 46), but not in males of *F. appalachiana.* Palpal segments are comparatively much longer and thinner in the female of *appalachiana* (compare Figs. 39 and 50). Also, the medial margins of dorsoglandularia D are reduced to median angles in the female of *F. appalachiana* (Fig. 45), but are very broad in the female of *F. plana* (Fig. 42).

Feltria (Feltria) faceta Cook
(Figs. 40, 43, 44)

Feltria faceta was originally described from a specimen collected in Bath Co., Virginia. In the same paper (Cook, 1963), *F. ozarkensis* was described from an individual taken in extreme eastern Oklahoma. Collections made by the author in Eastern North America in 1964 and 1968 have added specimens from Maine, Vermont, New York, New Jersey, and additional material from Virginia. The newer collections contain individuals similar to *ozarkensis,* but which show gradations towards the morphology of *faceta.* The distributional patterns as now known show *ozarkensis* extending from Eastern Oklahoma to Maine, with *faceta* restricted to a very limited area in Virginia. This seems a very unlikely distributional pattern for two closely related species, but it should be pointed out that there are a relatively large number of interstitial water mites presently known only from Bath Co., Virginia. Although none of the additional specimens show the very elongated dorsal and ventral shields and elongated genital field found in the holotype of *F. faceta,* it seems probable that that specimen is an extreme variant of a rather variable species. *F. faceta* has page priority over *F. ozarkensis,* and the latter is tentatively placed in synonymy. The female described below is of the *"ozarkensis"* type and, if it were later proven that both species are valid, it should be placed in *F. ozarkensis.*

Female: Length between anterior end of first coxae and posterior end of genital field 337μ, width of coxal area 274μ; coxal groups separate except for medial margins of first coxae which are lightly fused; second coxae not extending to the midline; both pairs of glandularia located between the fourth coxae and genital field small and lying free in the integument; ventrolateral plates small and somewhat oval, these also free; genital field 233μ in width; the individual acetabular plates 103μ in length, 115μ in width; genital acetabula 32-34 on each side; pregenital sclerite small, not extending far anteriorly between the acetabular plates (Fig. 40).

Dorsum with a large plate made up of the fused anteromedial plate, dorsal plates, A-E, and dorsoglandularia A-C; dorsal plate 255μ in length, 226μ in width; dorsoglandularia D widely separated medially by the excretory pore plate which extends between them nearly to the dorsal plate (Fig. 43); integument colorless.

Dorsal lengths of the palpal segments: P-I, 18μ; P-II, 55μ; P-III, 36μ; P-IV, 91μ; P-V, 31μ; Figure 44 shows the proportions and chaetotaxy of the palp; capitulum 97μ in length, capitular apodemes short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 48μ; I-Leg-5, 60μ; I-Leg-6, 62μ.

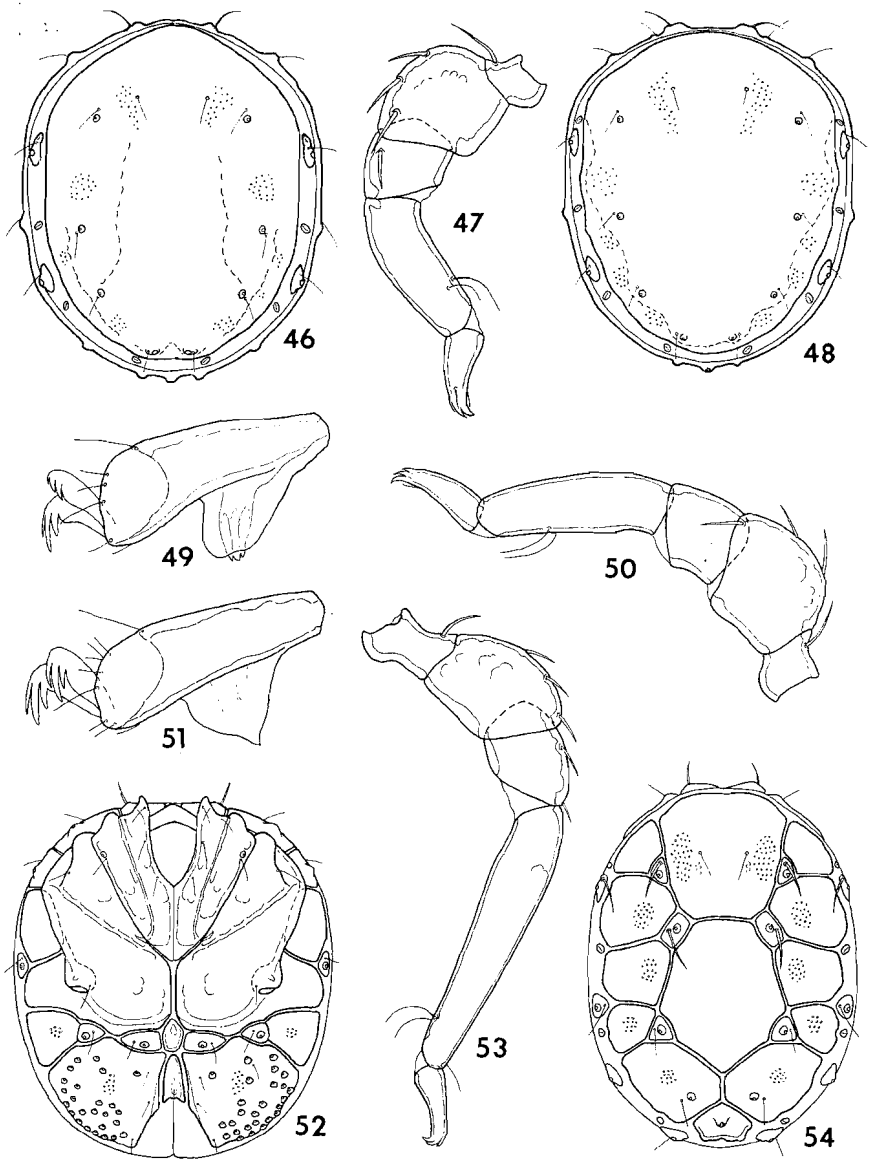
Habitat: Interstitial waters associated with stream sand and gravel deposits.

Feltria (Feltriella) exilis, n. sp.
(Figs. 52-54)

Female: Length between anterior end of first coxae and posterior end of genital field 392μ (392μ-400μ), width of coxal area 355μ (348μ-355μ); posterior coxal groups separated medially, other coxal groups lightly fused; second coxae not extending to midline; medial margins of third coxae reduced to medial angles; posterior apodemes of first coxae very short; both pairs of glandularia located between the fourth coxae and genital field lying free in the integument; ventrolateral plates large but not fused; genital field 296μ (281μ-296μ) in width; the individual acetabular plates 113μ (111μ-113μ) in length, 127μ (118μ-127μ) in width; 25-26 (25-31) genital acetabula present on each side; pregenital sclerite longer than wide, separating anterior portions of the acetabular plates; medial sclerite located at posteromedial corners of fourth coxae well developed; Figure 52 illustrates the structure of the venter.

Dorsum with all plates and glandularia separate with the exception of dorsal plates D which are fused medially; platelets and glandularia occupying most of the area of the dorsum; size and shape of these sclerites better illustrated (Fig. 54) than described; anteromedial plate 148μ (141μ-148μ) in length, 141μ (140μ-141μ) in width; fused dorsal plates D 177μ (177μ-185μ) in length, 159μ (155μ-159μ) in width; integument without pigment, eye pigment greatly reduced.

Dorsal lengths of the palpal segments: P-I, 27μ (25μ-27μ); P-II, 61μ (59μ-61μ); P-III, 42μ (42μ-43μ); P-IV, 117μ (115μ-117μ); P-V, 31μ; P-IV relatively long and narrow, tip of P-V down-turned; Figure 53 illustrates the proportions and chaetotaxy of the palp; dorsal lengths



Feltria plana n. sp. Fig. 46, dorsal view, male; Fig. 47, medial view of palp, male; Fig. 50, medial view of palp, female; Fig. 51, III-Leg-6, male.
Feltria appalachiana Habeeb Fig. 48, dorsal view, male; Fig. 49, III-Leg-6, male.
Feltria exilis n. sp. Fig. 52, ventral view, female; Fig. 53, medial view of palp, female; Fig. 54, dorsal view, female.

of the distal segments of the first leg: I-Leg-4, 52μ (51μ-52μ); I-Leg-5, 66μ (64μ-66μ); I-Leg-6, 73μ (72μ-73μ).

Male: Unknown.

Holotype: Adult female, taken in gravel deposits in Doyle Creek at Upper Doyle Creek Camp Ground (T47N/R85W), Johnson Co., Wyoming, July 15, 1969.

Paratype: One female, collected in a gravel bar in the North Branch of Crazy Woman Creek at Crazy Woman Creek Camp Ground, Johnson Co., Wyoming, July 13, 1969.

Habitat: Interstitial waters of streams.

Discussion: A similar lack of fusion of the dorsal plates and dorsoglandularia is found in the females of only two other species, *Feltria multiscutata* Cook and *F. crassipalpis* Lundblad. However, in both *multiscutata* and *crassipalpis* the dorsal plates and glandularia occupy only a small portion of the dorsum. The new species seems most closely related to *F. macroplata geometrica* Habeeb and *F. polyplacophora* Cook, but differs in numerous characters, some of which are listed below. Dorsoglandularia D are fused medially in *geometrica,* separate in *polyplacophora* and *exilis.* However, the medial margins of dorsoglandularia D are broad in *polyplacophora* and exclude the excretory pore plate. In *F. exilis,* these dorsoglanduarlia have reduced medial margins and the excretory pore plate extends partially between them. Dorsal plates A and dorsoglandularia A are fused on their respective sides in *polyplacophora* and *geometrica,* but separate in the new species. The very long pregential sclerite restricts the actual gonopore to the posterior half of the acetabular plates in *F. exilis,* but the gonopore extends much farther anteriorly in the other two species. *F. exilis* possesses a comparatively long and narrow palp as in *geometrica,* but lacks the strongly convex ventral side of P-II (Fig. 53).

Feltria (Azugofeltria) testudo, n. sp.

(Figs. 55-61)

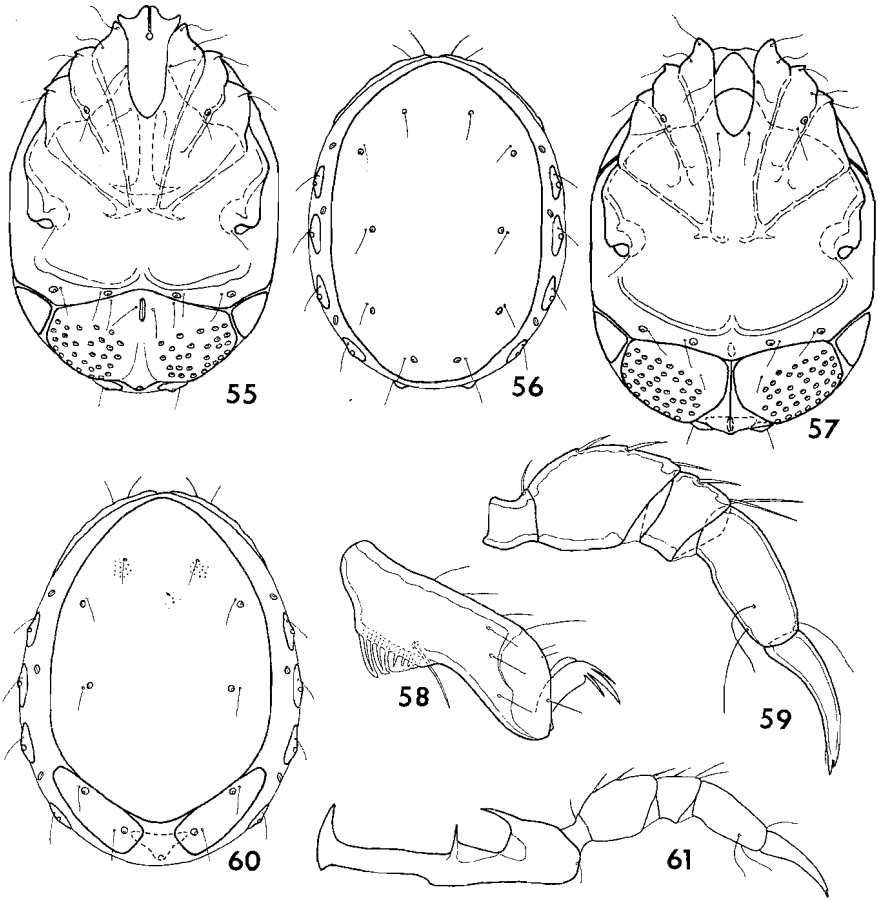
Male: Length between anterior end of first coxae and posterior end of genital field 385μ (362μ-400μ); width of ventral shield 266μ (266μ-296μ); coxal groups completely fused, median suture line obliterated (Fig. 55); apodemes of first coxae extending to fourth coxae, first coxae extending far posteriorly; second and third coxae not extending to midline; both pairs of glandularia located between coxae and genital field fused with fourth coxae; genital field and the ventrolateral plates separated from the coxae; genital field 103μ (96μ-110μ) in length, 189μ (178μ-207μ) in width; genital acetabula difficult to discern but apparently there are approximately 30 on each side; gonopore located near anterior edge of genital field; excretory pore fused with the genital field but associated glandularia lying free in the integument.

Dorsum with a large dorsal shield composed of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A-D; this shield 344μ (318μ-365μ) in length, 222μ (215-237μ) in width; dorsal shield oval (Fig. 56); lateroglandularia slightly enlarged and lying free in the integument; integument colorless or with a very light greenish cast.

Dorsal lengths of the palpal segments: P-I, 17μ (17μ-21μ); P-II, 66μ (66μ-73μ); P-III, 33μ (30-34μ); P-IV, 62μ (62μ-69μ); P-V, 62μ, (62μ-66μ); P-V comparatively long and slender; Figure 59 illustrates the proportions and chaetotaxy of the palp; capitulum 194μ (183μ-201μ) in length; capitular apodemes extremely long (Fig. 61); dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ (57μ-64μ); I-Leg-5, 69μ (66μ-72μ); I-Leg-6, 72μ (70μ-80μ); dorsal lengths of the distal segments of the third leg: III-Leg-4, 72μ (69μ-80μ); III-Leg-5, 100μ (95μ-109μ); III-Leg-6, 96μ (88μ-98μ);structure of modified setae on ventral side of III-Leg-6 illustrated in Figure 58, this setal group 26μ (17μ-27μ) in width at base.

Female: Length between anterior end of first coxae and posterior end of genital field 414μ (392μ-436μ), width of ventral shield 314μ (314μ-333μ); coxal groups fused as in male; pregenital sclerite and both pairs of glandularia located between fourth coxae and genital field fused with the fourth coxae (Fig. 57); genital field and ventrolateral plates separated from the coxal groups; genital field 235μ (235μ-259μ) in width; the individual acetabular plates 81μ (74μ-81μ) in length, 120μ (111μ-125μ) in width; genital acetabula difficult to discern, but apparently there are approximately 35-40 on each side.

Dorsum with a large plate made up of the fused anteromedial plate, dorsal plates A-E, and dorsoglandularia A,B; dorsal plate 340μ (333μ-377μ) in length, 246μ (237-261μ) in width; dorsal shield oval, bluntly-pointed at anterior end; dorsoglandularia C, D fused on their respective sides to form elongated plates which are widely separated medially (Fig. 60);



Feltria testudo n. sp. Fig. 55, ventral view, male; Fig. 56, dorsal view, male; Fig. 57, ventral view, female; Fig. 58, III-Leg-6, male; Fig. 59, medial view of palp, male; Fig. 60, dorsal view, female; Fig. 61, lateral view of palp and capitulum, male.

lateroglandularia separate; color as in male.

Dorsal lengths of the palpal segments: P-I, 18μ (17μ-18μ) P-II, 69μ (68μ-73μ); P-III, 28μ (27μ-29μ); P-IV, 57μ (55μ-57μ); P-V, 67μ (65μ-67μ); structure of the palp similar to male except P-V is comparatively longer in the female; capitulum 211μ (194μ-218μ) in length, capitular apodemes extremely long as illustrated for the male; dorsal lengths of the distal segments of the first leg: I-leg-4, 52μ (46μ-54μ); I-Leg-5, 59μ (58μ-62μ); I-Leg-6, 67μ (65μ-69μ).

Holotype: Adult male, collected in gravel deposits in Salmon Creek, on Route No. 1 slightly north of county line, Monterey Co., California, July 23, 1966.

Allotype: Adult female, same data as holotype.

Paratypes: 5 males, 2 females, same data as holotype.

Habitat: Interstitial waters of stream sand and gravel deposits.

Discussion: The genus *Azugofeltria* and the subfamily Azugofeltriinae were established by Motas and Tanasachi (1948) for the European species *A. mira.* Motas, Tanasachi and Orghidan (1957) later characterized the differences between the Azugofeltriinae and the

Feltriinae as follows: The Azugofeltriinae are larger (over 500μ in length in the male), possess very long capitular apodemes, P-II is longer than P-IV, and P--IV and P-V are of approximately the same length. I-Leg-6 of Azugofeltriinae is expanded distally and even more expanded in the male to give a slight sexual dimorphism. In the female, the excretory pore plate is greatly expanded and fused with the genital field.

Species described since 1957 exhibit characters which have filled in most of the gaps separating the two subfamilies. If the present species is assigned to *Azugofeltria,* as is here suggested, only the characters of palpal segment proportions and long capitular apodemes separate the two. However, two species, *F. acutipalpis* and *F. miurai,* described by Habeeb (1954) and Imamura (1957) respectively, exhibit a "typical" *Azugofeltria* palp but apparently lack the long capitular apodemes. Also palpal segment proportions and length of the capitular apodemes may vary greatly between closely related species of Feltriidae. Two species belonging to the subgenus *Neofeltria* were described by Cook (1963). One of these, *F. virginiensis,* has palpal segment proportions and capitular apodemes similar to "typical" *Azugofeltria.* However, the closely related *F. similis* has much shorter capitular apodemes and P-V is short as in "typical" *Feltria* species.

If only *A. mira* and the closely related *A. motasi,* described by Schwoerbel (1961) from Germany (the only two European species in which the adults are known), are assigned to *Azugofeltria,* the following characters separate the two genera: I-Leg-6 is greatly expanded distally in both sexes of *Azugofeltria* and the excretory pore platelet is enlarged in the female and fused with the genital field. In either case, the differences separating *Feltria* and *Azugofeltria* are not profound and it is suggested that the latter be reduced to a subgenus of the former.

LITERATURE CITED

Cook, D. R. 1961. Water mites of the genus *Feltria* in central and western United States (Acarina: Feltriidae). Ann. Entomol. Soc. Amer. 54: 118-133.

———. 1963. Studies on the phreaticolous water mites of North America: The genus Feltria (Acarina: Feltriidae). Ann. Entomol. Soc. Amer. 56: 488-500.

Habeeb, H. 1954. North American Hydrachnellae, Acari. Leaflets of Acadian Biology 4: 1-8.

———. 1963. Two novel mites from Rain Creek in the Mogollon Mountains of New Mexico. Acadian Biology 30: 1-2.

Imamura, T. 1957. Subterranean water-mites from the middle and southern Japan. Arch. Hydrobiol. 53: 350-391.

Lundblad, O. 1941. Neue Wassermilben. Vorlaufige Mitteilung. Ent. Tidskr. 62: 97-121.

———. 1969. Indische Wassermilben, hauptsächlich von Hinterindien. Arkiv Zool. 22: 289-443.

Motas, C. and J. Tanasachi. 1948. Diagnoses de trois nouvelles Hydrachnelles phreatocoles de Roumainie. Ann Scient. Univ. Jassy 31: 146-151.

Motas, C., J. Tanasachi and T. Orghidan. Uber einige neue phreatische Hydrachnellae aus Rumanien und über Phreatobiologie, ein neues Kapitel der Limnologie. Abh. Naturw. Ver. Bremen 35: 101-122.

Schwoerbel, J. 1961. Subterrane Wassermilben (Acari: Hydrachnellae, Porohalacaridae und Stygothrombiidae), ihre Ökologie und Bedeutung für die Abgrenzung eines aquatischen Lebensraumes zwischen Oberfläsche und Grundwasser. Arch. Hydrobiol., Suppl. Band. 25: 242-306.