

## A REVISION OF THE NEARCTIC SPECIES OF *ARTHROCERAS* (DIPTERA: RHAGIONIDAE)

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*Abstract.* — The genus *Arthroceras* Williston contains seven species and is Holarctic in distribution. This paper revises the four species recorded by Nagatomi (1966) for the Nearctic Region. Of these four species, one species and two subspecies are relegated to synonymy. The immature stages of this genus are unknown and little is known of its biology. Keys to species, with descriptions and distributions of each Nearctic species, are provided.

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The genus *Arthroceras* was erected by Williston (1886) and currently contains seven species (Nagatomi, 1966). It is Holarctic in its distribution, although it does not occur in Europe. This paper revises the four species recorded by Nagatomi (1966) for the Nearctic Region. Of these four species, one species and two subspecies are relegated to synonymy. The immature stages of the genus are unknown and little is known of its biology.

The terminology used here follows McAlpine (1981) and for the male terminalia, Stuckenberg (1973). The range for each measurement or ratio is followed by the average.

### *Arthroceras* Williston

*Arthroceras* Williston (1886: 107): Coquillett (1910: 510); James (1965: 298); James and Turner (1981: 486); Leonard (1930: 52); Nagatomi (1966: 44, 1970: 293, 1982: 142, 1984: 142); Nagatomi and Iwata (1976: 20). Type-species: *A. pollinosum* Williston by original description.

*Pseudocoenomyia* Ouchi (1943: 493): Nagatomi (1955: 57, 1966: 44). Type-species: *P. sinensis* Ouchi.

*Ussuriella* Paramonov (1929: 181): Nagatomi (1970: 293). Type-species: *U. gadi* Paramonov.

Head in lateral view hemispherical. Vertex truncate, not emarginate lateral to ocellar tubercle. Ocelli dark red to black; ocellar tubercle subtriangular, distinctly raised above vertex in male, not raised above vertex in female. Eyes holoptic in male, dichoptic in female; facets in male smaller on ventral third, equal in female; setae absent or very short, scattered; median margin sinuate, ventral half divergent; in lateral view eyes hemispherical to subtriangular. Frons reduced in male, broad in female, divergent dorsally; setae generally absent in male, scattered in female. Antenna (Figs. 1-6) shorter than length of head; scape in both sexes separated by distance greater than width of median ocellus, short, length less than width, shorter than pedicel, setae absent; pedicel short, globose, shorter than wide, setae shorter than length of segment; flagellum subulate, longer than combined length of scape and pedicel, annulate, setae scattered. Gena broad; parafacial setae absent. Clypeus broad, anterior surface dis-



tinctly convex, forming deep lateral grooves; setae scattered. Maxillary palpus 2 segmented; basal segment cylindrical, longer than wide; apical segment cylindrical, curved ventrally, apex rounded, longer than wide, longer than basal segment.

Thorax with dorsum rounded; vitta generally indistinct; setae elongate, scattered, in no distinctive pattern. Postpronotal lobe concolorous with thorax. Postmetaspiracular scale and suprametacoxal pit lacking. Scutellum with caudal margin broadly rounded. Laterotergite of postnotum with elongate setae.

Wing (Fig. 14) longer than wide; membrane opaque; pterostigma variable; microsetae minute, over entire membrane; setulate dorsal on length of  $R_1$ ; thyridium absent. Costa circumambient, broader along anterior margin, setae fuscous, appressed. Humeral crossvein distinct. Subcosta ends distad to middle of wing. Subcostal and marginal cells elongate, open. Radial sector originates from basal fourth of first basal cell, r-m situated above basal third of discal cell.  $R_1$  ends distad to fork of  $R_{4+5}$  and apex of discal cell. Fork of  $R_{4+5}$  originates basad to apex of  $R_1$ , distad to apex of discal cell, angle variable. Cell  $r_4$  elongate, enclosing apex of wing.  $R_4$  ends anterior to apex of wing.  $R_5$  ends posterior to apex of wing.  $M_1$  and  $M_2$  petiolate, contiguous or separate from discal cell. Cell  $m_3$  open.  $M_3$  and  $CuA_1$  parallel. Posterior cells 5. Discal cell elongate, apical margin truncate. Posterior cubital cell open. First basal cell elongate, apex truncate, ends distad to apex of second basal cell. Second basal cell emits 4 veins from apex. Anal lobe broadly rounded, right-angled. Alula rounded. Squama large; marginal setae elongate, entire.

Legs with tibial spurs 0-2-1. Hind coxa with distinct anterior tubercle. Empodium pulvilliform. Apical claws on tarsomere 5 fuscous, paired, simple. Hind legs not raptorial.

Abdomen with tergite 1 subrectangular, anterior margin broadly emarginate. Male

terminalia with tergite 8 broad, rectangular, length 1.5 times width, caudal margin truncate. Epandrium (Figs. 7, 15) with lateral and caudal margins rounded, anterior margin broadly emarginate, length 1.5 times width. Tergite 10 absent. Cerci simple, flattened dorsoventrally. Ventral plate of procotiger subtriangular. Gonocoxite in ventral view (Figs. 8, 16) broad, lateral margins rounded, fused anteriorly with oval sclerotized median plate; in dorsal view (Figs. 9, 17) gonocoxite with narrow caudal arch joining inner margins, aedeagal apodeme elongate, extending anteriorly to anterior margin of gonocoxite. Gonostylus narrow, tapered apically, reflexed. Aedeagus composed of aedeagal sheath, endophallus, and endophallic hilt. Aedeagal sheath broad basally, fused to inner margin of gonocoxite, tapered caudally to form narrow endophallic guide. Endophallus elongate anteriorly forming endophallic apodeme, caudal third oval. Endophallic hilt separated medially, thick, heavily sclerotized, tapered anteriorly. Penis valves and endophallic tines lacking. Female terminalia with tergite 9 (Fig. 19) quadrate, as long as wide, caudal margin truncate. Tergite 10 reduced, caudal margin truncate to broadly rounded. Cerci 2 segmented; basal segment broad, equal in length to apical segment; apical segment clavate with apical depression. Sternite 8 (Fig. 20) broad, widened caudally, 1.3 times longer than wide, caudal margin rounded with deep, median emargination. Sternite 9 greatly modified, invaginated beneath sternite 8 to form internal furca. Sternite 10 broad, membranous, caudal margin sinuate with median groove. Internal reproductive organs (Figs. 11, 21) with furca "Y" shaped, anterior apodeme short, not attached laterally to tergite 9. Common spermathecal duct short, trifurcating anteriorly to form 3 spermathecal ducts. Each spermathecal duct membranous, elongate, ending anteriorly in dark brown, spherical spermatheca (Figs. 11, 21).

Immature stages unknown.



KEY TO THE NEARCTIC  
SPECIES OF *ARTHROCERAS*

1. Length of apical flagellomere greater than 1.5 times width of flagellum (Fig. 6); setae on hind femur pale yellow, elongate, suberect, length greater than 0.5 times greatest width of femur ..... *pollinosum* Williston

- Length of apical flagellomere less than 1.5 times width of flagellum (Figs. 1-5); setae on hind femur predominately fuscous, short, appressed, length much less than 0.5 times greatest width of femur ..... 2

2. In males, maxillary palpus pale to dark yellow, setae predominately stramineous, apical segment at least 1.5 times length of basal segment. In females, head, antenna, maxillary palpus, thorax, femora and abdomen yellow pollinose to dark yellow ..... *fulvicorne* Nagatomi

- In males, maxillary palpus brown, setae black, apical segment about 1.2 times length of basal segment. In females, head, antenna, maxillary palpus, thorax, femora, and abdomen brown to dark brown ..... *leptis* (Osten Sacken)

*ARTHROCERAS FULVICORNE* NAGATOMI

*Arthroceras fulvicorne* Nagatomi (1966: 46).  
*Arthroceras fulvicorne nigricapite* Nagatomi (1966: 48). NEW SYNONYMY.  
*Arthroceras fulvicorne subsolanum* Nagatomi (1966: 49). NEW SYNONYMY.  
*Arthroceras subaquilum* Nagatomi (1966: 59). NEW SYNONYMY.

*Arthroceras fulvicorne* is separated from *A. pollinosum* by having the length of the apical flagellomere less than 1.5 times as wide as the flagellum and by having the setae on the hind femur predominately fuscous, short, and appressed. *Arthroceras fulvicorne* and *A. leptis* can be separated by the characters given in the key.

Nagatomi (1966) separated the females of *A. fulvicorne* and *A. subaquilum* on the basis of the coloration of the antennal flagellum and the abdomen. At that time he examined four specimens of *A. subaquilum* and 31 females of *A. fulvicorne*. In the 57 females of *A. fulvicorne* from northern Utah that I examined, the antennal flagellum varied from brown to black; the abdominal tergites were generally dark yellow and concolorous, but variation ranged from tergites 2-4 being

dark brown with the caudal margins dark yellowish brown to the entire abdomen being dark brown. On the basis of this variation, I have synonymized *A. subaquilum* with *A. fulvicorne*. Nagatomi (1966) separated *A. fulvicorne fulvicorne* and *A. fulvicorne nigricapite* on the coloration of the female head. In female specimens from California and Utah, the ground coloration of the head varied from fuscous to black. Because of this variation, I have synonymized *A. fulvicorne nigricapite* with *A. fulvicorne*. Nagatomi (1966) separated *A. fulvicorne subsolanum* and *A. fulvicorne fulvicorne* on the basis of the antennal flagellum being 7 or 8 segmented in *A. fulvicorne fulvicorne* and 5 or 6 segmented in *A. fulvicorne subsolanum*. Table 1 shows the variation in the number of completely separated flagellomeres (flagellum cleared in 10% KOH). Because of the variation in flagellum segmentation in specimens examined from Nova Scotia to British Columbia and California, I have synonymized *A. fulvicorne subsolanum* with *A. fulvicorne*.

Male.—Length 6.2-8.2, 7.2 mm. Head with ocellar tubercle fuscous to black, pruinosity light yellow grey; setae fuscous to

Table 1. Segmentation and fusion in the female flagellum of *Arthroceras fulvicorne*. Flagella were cleared in 10% KOH.

Location	Fusion Pattern of Flagellomeres	Number of Distinct Flagellomeres
Nova Scotia	1+2, 3+4+5, 6, 7	4
	1+2, 3, 4, 5, 6, 7	6
	1+2, 3+4, 5, 6, 7	5
Vermont	1, 2, 3, 4, 5	5
Utah	1+2, 3+4, 5, 6, 7	5
	1+2, 3, 4, 5, 6	5
	1, 2, 3, 4, 5, 6, 7+8	7
	1, 2, 3, 4, 5, 6, 7	7
British Columbia	1+2, 3+4, 5, 6, 7	5
	1, 2, 3, 4, 5, 6, 7+8	7
Washington	1+2, 3+4, 5, 6, 7	5
California	1, 2, 3, 4, 5, 6, 7+8	7
	1+2, 3+4, 5, 6, 7	5



black, elongate, abundant. Eyes dark brown to black. Frons fuscous in ground color with dense silver pile. Antenna length 0.6–0.8, 0.7 times length of head; scape fuscous to dark brown, pruinosity light yellow, length 0.4–0.6, 0.5 times width, 0.5–1.0, 0.8 times length of pedicel; pedicel fuscous to dark brown, pruinosity light yellow, length 0.4–0.8, 0.6 times width, setae fuscous, scattered; flagellum fuscous to brown, pruinosity light yellow, basal flagellomere (1, 2, or 1+2) yellowish orange to dark yellow, length 3.0–4.1, 3.5 times width, 2.7–3.9, 3.3 times combined length of scape and pedicel, setae silver and fuscous, variable; annuli 7, apical flagellomere length 0.9–1.3, 1.1 times width of flagellum. Gena pruinosity dense silver grey; facial setae white to pale yellow, elongate, abundant. Clypeus fuscous in ground color, pruinosity dense silver grey; setae white to pale yellow, elongate, scattered on dorsal third. Maxillary palpus with setae pale yellow, elongate, abundant, occasionally with scattered black setae; basal segment generally pale to dark yellow, occasionally brown, length 1.8–2.2, 2.0 times width; apical segment pale to dark yellow, length 2.7–3.3, 3.0 times width, 1.3–1.8, 1.5 times length of basal segment. Labellum fuscous, pruinosity light yellow; setae fuscous, moderately long, scattered. Postocular setae white to pale yellow, elongate, abundant, becoming shorter dorsally.

Thorax fuscous to black in ground color, pruinosity light grey to yellowish grey; setae yellow, elongate, scattered; vitta indistinct, occasionally pale fuscous. Postpronotal lobe with setae yellow, elongate, abundant. Pleuron fuscous in ground color, pruinosity variable in density; setae pale yellow, elongate, abundant on propleuron, scattered on dorsal two-thirds to half of anepisternum, scattered ventrally and dorsally on katepisternum, absent on anepimeron, scattered on ventral third and in caudolateral area of meron, scattered along caudal margin of metapleuron. Halter stalk dark yellow to dark yellowish brown, capitulum fuscous to

dark brown, pruinosity light grey; setae fuscous, short, scattered. Scutellum fuscous, pruinosity yellowish grey; setae pale yellow, elongate, abundant. Postnotum fuscous, pruinosity grey; laterotergite fuscous to dark brown, pruinosity light yellowish grey; setae pale yellow, elongate, abundant.

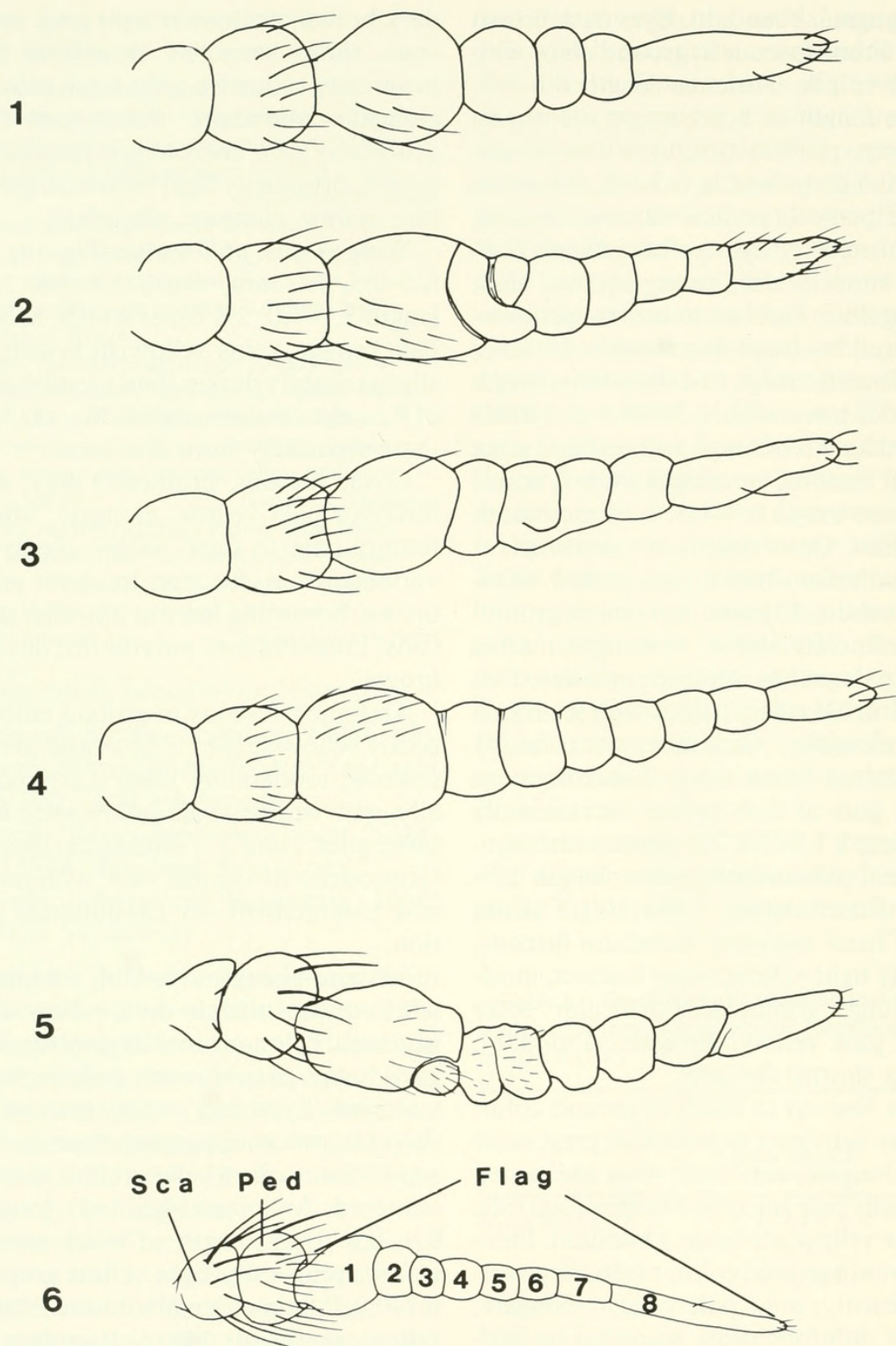
Wing as in *A. pollinosum* (Fig. 14). Length 6.5–7.5, 7.0 mm, width 2.3–2.8, 2.6 mm, length 2.7–3.0, 2.8 times width. Membrane pale brown; veins yellowish brown; pterostigma slightly darker than membrane. Fork of  $R_{4+5}$  almost right angled.  $M_1$ ,  $M_2$ ,  $M_3$  originate separately from discal cell.

Coxae fuscous, pruinosity grey, setae on forecoxa pale yellow, elongate, abundant; femora pale to dark yellow, glossy; tibiae variable from fuscous to dark yellowish brown, becoming fuscous apically; tarsi fuscous. Empodia and pulvilli fuscous to dark brown.

Abdomen fuscous in ground color, pruinosity yellowish grey to brownish grey; setae fuscous, moderately long, scattered medially, with white to pale yellow setae laterally on tergites 1 and 2. Terminalia (Figs. 7–10). Gonocoxite in ventral view with mediolateral enlargement on caudolateral projection.

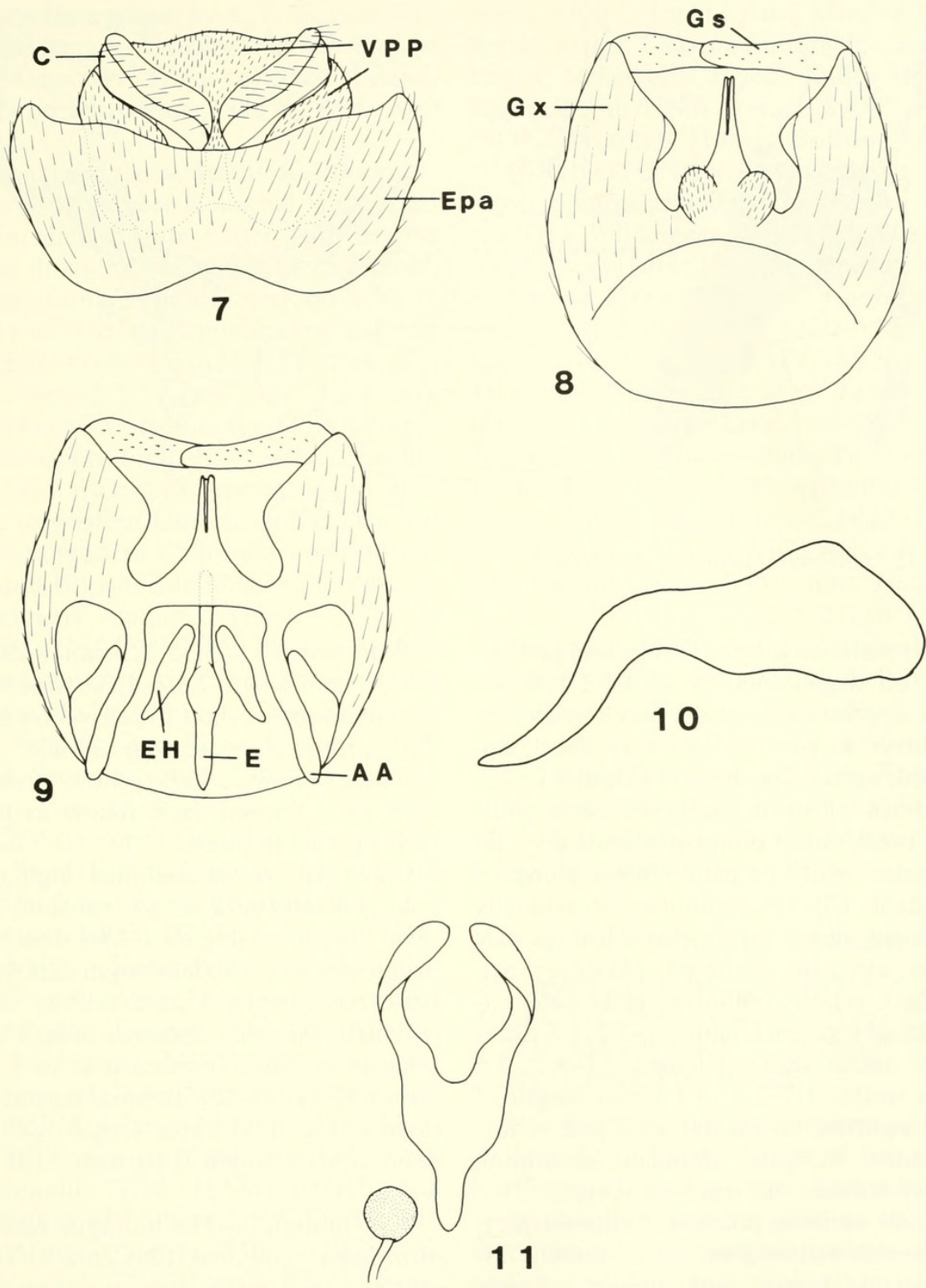
Female.—Length 7.5–11.4, 9.4 mm. Head with ocellar tubercle dark yellow to black in ground color, pruinosity grey to yellowish grey; setae pale to dark yellow, elongate, scattered. Eyes dark red to fuscous. Frons variable, pruinosity greenish grey pollinose; setae white to dark yellow, short to elongate, scattered. Antenna (Figs. 1–4), length 0.7–0.9, 0.8 times length of head; scape dark yellow, pruinosity light yellow grey, length 0.7–0.9, 0.8 times length of head; scape dark yellow, pruinosity light yellow grey, length 0.5–0.7, 0.6 times width, length 0.7–1.0, 0.9 times length of pedicel; pedicel dark yellow, pruinosity light yellow grey, length 0.5–0.8, 0.6 times width, setae pale to fuscous, moderately long; flagellum brown to black, basal half of flagellomere 1 or 1+2 dark yellow, length 3.2–4.0, 3.7 times width, 2.5–3.8, 3.1





Figs. 1-6. Female antenna, lateral view. 1-4, *Arthroceras fulvicorne*. 1, New Hampshire. 2, Utah. 3, Utah. 4, California. 5, *Arthroceras leptis*. 6, *Arthroceras pollinosum*. Abbreviations: (Flag) Flagellum, flagellomeres 1-8. (Ped) Pedicel. (Sca) Scape.





Figs. 7–11. *Arthroceras fulvicorne*. 7, Male epandrium, cerci, ventral plate of proctiger. 8, Male gonocoxite, ventral view. 9, Male gonocoxite, dorsal view. 10, Male endophallus, lateral view. 11, Female furca and spermatheca. Abbreviations: (AA) Aedeagal apodeme. (C) Cerci. (E) Endophallus. (EH) Endophallic hilt. (Epa) Epandrium. (Gs) Gonostylus. (Gx) Gonocoxite. (VPP) Ventral plate of proctiger.





Fig. 12. *Arthroceras fulvicorne*, distribution.

times combined length of scape and pedicel, setae on flagellomere 1 or 1+2 fuscous, short, appressed, on apical flagellomeres setae silver to pale yellow, very short, appressed; apical flagellomere length 1.0–1.2, 1.1 times width of flagellum. Gena pollinose, occasionally pruinosity dense grey; facial setae white to pale yellow, elongate, abundant. Clypeus pollinose, occasionally pruinosity dense grey; setae white to pale yellow, elongate, scattered. Maxillary palpus dark yellow, pollinose, setae pale yellow; basal segment length 1.1–2.2, 1.8 times width; apical segment length 3.1–4.2, 3.6 times width, 1.7–2.8, 2.1 times length of basal segment. Postocular setae pale yellow to golden, elongate, abundant, becoming shorter dorsally but reaching vertex.

Thorax variable, pollinose, yellowish grey, or greenish yellow-grey; vitta variable, indistinct, to faintly dark brown, to grey brown. Pleuron pale to dark yellow, pruinosity light yellow grey; setae as in male. Halter pale to dark yellow brown. Scutellum dark yellow, pruinosity grey. Postnotum variable, dark yellow, occasionally with ventral fourth fuscous; laterotergite dark yellow, pruinosity grey.

Wing length 8.0–10.5, 9.1 mm, width 2.5–3.8, 3.1 mm, length 2.8–3.4, 3.0 times width. Membrane pale yellow to pale yellow brown. Cell  $r_4$  more elongate than in male.

Coxae yellow to dark yellow, pruinosity light grey; femora dark yellow to brown; tarsi fuscous to black.

Color pattern of abdomen highly variable, generally dark yellow, subshiny but in many specimens tergites 2–4 are dark brown, pruinosity grey, caudal margin dark yellowish brown, tergite 5 dark yellow, and occasionally the entire abdomen is dark brown; setae as in male. Terminalia as in *A. pollinosum* (Figs. 19–20). Internal reproductive organs (Fig. 11). Furca length 0.40 mm. Spermatheca length 0.10 mm., 1.0 times width.

Type material.—The holotype female of *Arthroceras fulvicorne* (CNC, no. 9100) was collected at Robson, British Columbia on 21 June, 1948 by H. R. Foxlee. The holotype female of *Arthroceras fulvicorne nigricapite* (USNM, no. 68171) was collected at Yosemite, California on 11 June, 1935 by A. L. Melander. The holotype female of *Arthroceras fulvicorne subsolanum* (USNM, no. 68172) was collected at Mt. Washing-



ton, New Hampshire, by A. T. Slosson. The holotype female of *Arthroceras subaquilum* (USNM, no. 68173) was collected at Banff, Alberta on 27 August, 1935 by A. L. Melander.

Seasonal activity.—Adults of *Arthroceras fulvicorne* have been collected with aerial nets, in Malaise traps baited with dry ice (carbon dioxide), and at lights. In the collections examined adults were taken from 20 May until 20 August, with the majority of specimens collected in July. Females (129) were collected 2.7 times more often than males (47) with no evidence of protandry.

Distribution (Fig. 12).—*Arthroceras fulvicorne* is a widespread species found from Maine to western Ontario in the east and from Colorado to California north to Alberta and British Columbia in the west.

Specimens examined (176).—UNITED STATES: CALIFORNIA: Phillips Station (Placer County); Snowline Camp (Eldorado County); Blodgett Forest, 13 mi E Georgetown; Bumble Bee; Giant Forest Campground, Sequoia National Park; Yosemite; Carson Pass (Alpine County). COLORADO: West slope of Loveland Pass, 9850'; Great Sand Dunes National Monument, 7600'; St. Louis Creek Campground, 3 mi SW Fraser, 8800'. IDAHO: Moscow Mt.; Long Valley, Alpha; Moscow; Chatcolet; Cub River Canyon, Thomas Spring; Bear Valley (Valley County). MAINE: Allagast Point, St. Francis. MICHIGAN: Pequam; shore of Lake Superior, Marquette. MONTANA: Glacier National Park, Medicine Lake; Glacier National Park, Lake MacDonald. NEW HAMPSHIRE: Mt. Washington; Mt. Alpine. NEW YORK: Mt. Slide (Ulster County), 3500'. OREGON: Crater Lake; Chief Joseph Mt., Joseph; Wallowa Lake; Velvet Creek, 28 mi SE Union; Ladd Canyon, 14 mi S La Grande, 4280'; Butte Lookout Station, 25 air mi E Medford; Lake of the Woods; Jordan Creek, 28 mi SSW La Grande, 4840'. UTAH: Logan Canyon; Spring Hollow; Tony Grove Junction; Blacksmith Fork Canyon; Willard

Basin, 9300'; Monte Cristo; Mendon Cold Spring; Green Canyon; Smithfield Canyon; Logan; Millcreek Canyon; Kaller Hollow Camp, 22 mi NNW Vernal, 8900'. VERMONT: Camels Hump, Bolton, 4100'. WASHINGTON: Nooksack River, Mt. Baker; Summerland Trail, Mt. Ranier; Glacier Peak Wilderness, 27 mi ESE Darrington; Moscow Mts.; Field Spring S. P., 4 mi S Anatone, 3500–4000'; Bald Knob Campground, Mt. Spokane S.P., 4800–5200'; Mt. Ranier National Park. WYOMING: Elk Mountain; Old Faithful area, Yellowstone National Park; Trout Lake, 1 mi SW Round Prairie, Yellowstone National Park, 6900'; Grand Teton National Park; Bottle Creek Camp, 7 mi SW Encampment, 8800'; Lower Green River Lake, Wind River Range; Old Faithful area, Yellowstone National Park, 7000–7500'; South Brush Creek Campground, Medicine Bow National Forest, 8000–8500'. CANADA: ALBERTA: Island Lake, Coleman, 4500'; Banff; Waperton; Island Lake, Coleman, 4500'; Mtn. View. BRITISH COLUMBIA: Robson; Hope Mts.; Terrace Mtn. NOVA SCOTIA: Mile 15, Highland Road. ONTARIO: Sudbury; Macdiarmid; Burke Falls.

#### *Arthroceras leptis* (Osten Sacken)

*Arthropeas leptis* Osten Sacken (1878: 223).  
*Arthroceras leptis* (Osten Sacken) (1878: 223); Aldrich (1905: 213); James (1965: 298); Leonard (1930: 52).

*Arthroceras leptis* is easily separated from *A. pollinosum* by the length of the apical flagellomere being less than 1.5 times as wide as the flagellum and the setae on the hind femur being predominately fuscous, short, and appressed. *Arthroceras leptis* and *A. fulvicorne* can be easily separated by the characters in the key.

Male.—Length 5.8–6.5, 6.2 mm. Head with ocellar tubercle fuscous to black, pruinosity light grey; setae pale yellow to pale fuscous, elongate, abundant. Eyes brown to fuscous. Frons fuscous, pruinosity grey; se-



tae pale yellow to pale fuscous, elongate, scattered dorsally. Antenna length 0.46–0.92, 0.67 times length of head; scape dark brown, length 0.3–0.6, 0.4 times width, 0.5–0.8, 0.6 times length of pedicel, setae absent; pedicel length 0.5–0.8, 0.6 times width, setae pale yellow to pale brown, moderately long, subapical; flagellum length 1.9–3.9, 3.3 times width, 2.1–4.3, 3.0 times combined length of scape and pedicel, setae pale brown, scattered subapically; 7 annuli, apical flagellomere length 0.9–1.4, 1.2 times flagellum width. Gena with dense grey pruinosity; facial setae pale yellow, elongate, abundant. Clypeus with dense grey pruinosity; setae pale yellow to gold, elongate, abundant. Maxillary palpus fuscous, pruinosity grey, setae black, elongate, abundant; basal segment length 2.4–3.0, 2.5 times width; apical segment length 3.2–3.3, 3.2 times width, 1.1–1.4, 1.2 times length of basal segment. Labellum fuscous, pruinosity grey; setae fuscous, elongate, scattered. Postocular setae pale yellow to gold, elongate, abundant ventrally, becoming shorter dorsally, not reaching vertex.

Thorax dark brown, pruinosity yellowish brown to grey; setae gold, elongate, abundant; vitta generally indistinct, occasionally dark brown, faint. Postpronotal lobe with setae brown, elongate, on anterior half. Pleura fuscous in ground color, pruinosity grey; setae dark yellow to gold, elongate, abundant on propleuron, on dorsal half of anepisternum, scattered dorsally and ventrally on katepisternum, absent on anepimeron, in caudodorsal patch on meron, scattered on dorsal half of metapleuron. Halter stalk dark yellowish brown, capitulum fuscous, pruinosity light grey. Scutellum fuscous, with grey pruinosity; setae brown, elongate, scattered. Postnotum fuscous, with dense grey pruinosity; setae dark yellow to brown, elongate, abundant.

Wing as in *A. pollinosum* (Fig. 14). Length 5.7–6.3, 6.1 mm, width 1.8–3.0, 2.2 mm, length 2.2–3.2, 2.9 times length. Membrane pale brown; veins brown; pterostigma

slightly darker than membrane.  $M_1$  and  $M_2$  generally petiolate, occasionally originate contiguously from discal cell. Squama pale brown; setae pale yellow, elongate, entire.

Coxae fuscous, pruinosity grey, setae gold, elongate, abundant; femora fuscous to dark brown, glossy or with pruinosity light grey; tibiae and tarsi pale brown to fuscous. Empodia and pulvilli dark brown.

Abdomen dark brown, pruinosity light grey; setae pale yellow, elongate, abundant. Terminalia as in *A. pollinosum* (Figs. 7–9).

Female.—Length 7.7–8.9, 8.2 mm. Head with ocellar tubercle dark brown; setae golden, shorter than in male. Eyes brown. Frons fuscous, pruinosity pale brown, pruinosity on lateral and ventral margins silver to grey; setae gold, moderately long, scattered subapically. Antenna (Fig. 5), length 0.78–0.86, 0.82 times length of head; scapal length 0.3–0.6, 0.5 times width, 0.4–1.0, 0.7 times length of pedicel; pedicel length 0.5–0.8, 0.6 times width; flagellum length 3.1–3.9, 3.5 times width, 2.8–4.4, 3.3 times combined length of scape and pedicel; apical flagellomere length 0.8–1.3, 1.1 times flagellum width. Clypeal setae not as abundant as in male. Basal segment of maxillary palpus length 1.9–3.0, 2.4 times width; apical segment length 2.7–3.1, 2.9 times width, 1.5–2.7, 1.8 times length of basal segment. Postocular setae reach vertex.

Thoracic setae shorter than in male. Vitta dark brown, separated by yellowish grey pruinosity. Metapleural setae scattered along dorsal margin.

Wing length 7.0–8.0, 7.6 mm, width 2.7–3.0, 2.9 mm, length 1.2–1.6, 1.3 times width. Veins  $M_1$ ,  $M_2$ ,  $M_3$  originate separately from discal cell.

Terminalia and internal reproductive organs as in *A. pollinosum* (Figs. 19–21).

Type material.—The lectotype female, here designated, of *Arthropeas leptis* (MCZ) was collected in the White Mountains, New Hampshire, by E. P. Austin.

Seasonal activity.—In the collections examined *Arthroceras leptis* was taken from 7





Fig. 13. *Arthroceras leptis*, distribution.

July until 14 August. Females (19) were collected 1.4 times more often than males (14), with no evidence of protandry.

Distribution (Fig. 13).—*Arthroceras leptis* is found from New Hampshire to Michigan in the east and from Oregon to Washington in the west.

Specimens examined (33).—UNITED STATES: MICHIGAN: St. Ignace. NEW HAMPSHIRE: Mt. Washington; White Mts. NEW YORK: Whiteface Mts., Adirondacks; Lake Tear (Essex County). OREGON: Mt. Hood. VERMONT: Jay Peak, 3400–3800'. WASHINGTON: Mt. Ranier; Sunrise, Mt. Ranier; Deer Lake near Chewelah; 42 mi SE Randle; Bald Knob Campground, Mt. Spokane S. P., 4800–5200'. CANADA: ALBERTA: Johnston Canyon, Banff. BRITISH COLUMBIA: Manning Park, Valle View. QUEBEC: Mt. Oxford.

#### *Arthroceras pollinosum* Williston

*Arthroceras pollinosum* Williston (1886: 108); James (1965: 298); Leonard (1930: 53, 1931: 322); Nagatomi (1966: 54).

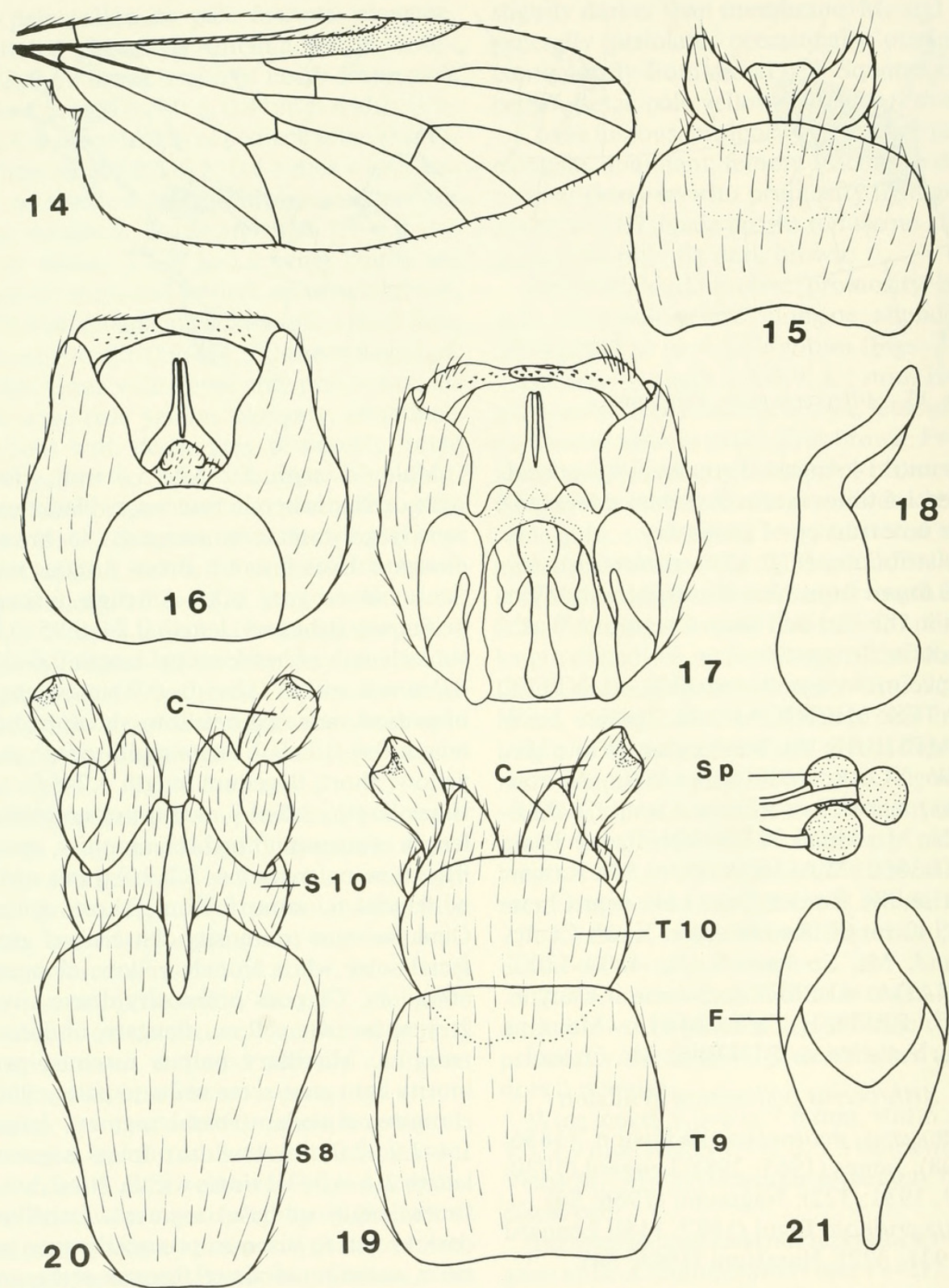
*Leptis pruinosa* Bigot (1887: 115); Leonard (1931: 322); Nagatomi (1966: 54).

*Arthroceras pollinosum* is easily separated from both *A. fulvicorne* and *A. leptis* by the length of the apical flagellomere being greater than 1.5 times the width of the flagellum and the setae on the hind femur being pale yellow, elongate, and suberect.

Male.—Length 5.2–5.8, 5.6 mm. Head with ocellar tubercle fuscous to black, pruinosity grey; setae stramineous to brown, elongate. Eyes fuscous. Frons fuscous with dense silver grey pile. Antenna fuscous, pruinosity light grey, length 0.84–0.95, 0.89 times length of head; scapal length 0.6–0.8, 0.7 times width, 0.8–1.0, 0.9 times length of pedicel, setae pale yellow, short; pedicel length 0.6–0.7, 0.7 times width, setae pale yellow, short; flagellum length 4.7–6.0, 5.3 times width, 3.5–4.3, 4.0 times combined length of scape and pedicel, annuli 7, apical flagellomere length 1.6–2.2, 1.9 times width of flagellum, setae fuscous, short, apical. Gena fuscous, pruinosity dense silver grey; facial setae white to pale yellow, elongate, abundant. Clypeus pruinosity dense silver grey; setae pale yellow, elongate, on lateral margins. Maxillary palpus fuscous, pruinosity light grey, setae white to pale yellow, elongate, abundant; basal segment length 1.4–2.2, 2.0 times width; apical segment length 2.4–4.3, 3.3 times width, 1.1–2.1, 1.5 times length of basal segment. Labellum dark brown to fuscous, pruinosity grey; setae a mixture of short fuscous setae and elongate, pale yellow setae. Postocular setae pale yellow, elongate, abundant ventrally, absent dorsally.

Thorax fuscous in ground color, pruinosity dense grey yellow; vitta indistinct; setae pale yellow, elongate, scattered. Postprono-





Figs. 14–21. *Arthroceras pollinosum*. 14, Wing. 15, Male epandrium, cerci, ventral plate of proctiger. 16, Male gonocoxite, ventral view. 17, Male gonocoxite, dorsal view. 18, Male endophallus, lateral view. 19, Female terminalia, dorsal view. 20, Female terminalia, ventral view. 21, Female furca, spermatheca. Abbreviations: (C) Cerci. (F) Furca. (Sp) Spermatheca. (S8) Sternite 8. (S10) Sternite 10. (T9) Tergite 9. (T10) Tergite 10.



tal lobe with setae pale yellow, elongate on anterior half. Pleura fuscous in ground color, pruinosity dense silver grey; setae pale yellow on propleuron, dorsal and caudal margin of anepisternum, scattered along dorsal margin of katepisternum, along dorsocaudal margin of meron, scattered dorsocaudally on metapleuron, absent on anepimeron. Halter stalk yellow to dark brown, capitulum fuscous. Scutellum with pruinosity dense grey yellow; setae pale yellow, elongate, abundant. Postnotum with pruinosity grey, laterotergite with pruinosity grey; setae pale yellow, elongate, abundant.

Wing (Fig. 14) length 4.8–5.7, 5.2 mm, width 1.7–2.0, 1.9 mm, length 2.7–2.9, 2.8 times width. Membrane pale yellow; veins pale brown; pterostigma absent to pale brown. Fork of  $R_{4+5}$  originates above or distad to apex of discal cell. Squama and marginal setae pale yellow.

Coxa fuscous, pruinosity dense grey; femora fuscous, pruinosity grey, setae pale yellow, elongate; tibiae pale brown; tarsi fuscous. Empodia and pulvilli fuscous.

Abdomen fuscous in ground color, pruinosity dense grey; setae pale yellow, elongate, abundant. Epandrium, cerci, and ventral plate of proctiger (Fig. 15). Gonocoxite in ventral view (Fig. 16); in dorsal view (Fig. 17). Endophallus (Fig. 17) flattened laterally in dorsal view, length 0.36 mm, elongate; in lateral view endophallus (Fig. 18) with anterior third expanded. Endophallic hilts (Fig. 17) thick, heavily sclerotized, tapered anteriorly, separated medially.

Female.—Length 5.5–7.5, 6.7 mm. Head with ocellar tubercle pollinose; setae pale to dark yellow. Frons pollinose; setae pale to dark yellow, elongate. Antenna (Fig. 6) fuscous, apical third of pedicel and basal half of flagellomere 1 + 2 yellow, length 1.0–1.1, 1.1 times length of head; scapal length 0.6–0.8, 0.7 times width, 1.3 times length of pedicel; pedicel length 0.4–0.6, 0.5 times width; flagellum length 5.3–6.0, 5.6 times width, 4.1–6.0, 4.9 times combined length of scape and pedicel, apical flagellomere

length 1.9–2.5, 2.2 times width of flagellum. Gena pollinose. Clypeus pollinose, setae pale to dark yellow, elongate, lateral. Maxillary palpus pollinose to fuscous, setae pale to dark yellow, elongate, abundant; basal segment length 1.8–2.4, 2.1 times width; apical segment length 2.3–2.8, 2.5 times width, 1.5–1.7, 1.6 times length of basal segment. Postocular setae pale to golden yellow, elongate, abundant, extending to vertex.

Thorax pollinose, setae fuscous, elongate, with small fuscous spot at base of each. Postpronotal lobe with setae entire. Pleura with pruinosity dark yellow to grey. Halter dark yellow, pruinosity light grey. Scutellum dark yellow, glossy or pruinosity light grey. Postnotum dark yellow, pruinosity of median area light grey.

Wing length 6.0–7.0, 6.5 mm; width 2.2–2.5, 2.4 mm; length 2.6–3.0, 2.8 times width.

Coxa dark yellow, pruinosity grey; femora dark yellow, glossy; tibiae and tarsi pale brown to fuscous, pruinosity light grey.

Abdomen fuscous in ground color, pruinosity dense yellowish grey. Terminalia in dorsal view (Fig. 19), in ventral view (Fig. 20). Internal reproductive organs (Fig. 21). Furca “Y”-shaped, anterior apodeme short. Spermatheca length 0.09 mm, width 0.10 mm.

Type material.—The lectotype male, here designated, of *Arthroceras pollinosum* (SEM, no. 5846) has no locality data on the specimen. The lectotype male, here designated, of *Leptis pruinosa* (BMNH) was collected at Mount Hood, Oregon.

Seasonal activity.—Adults of *Arthroceras pollinosum* have been collected at elevations as high as 9800 feet, from *Phacelia*, with an aerial net, or in Malaise traps, and at lights. In the collections examined, adults were taken from 6 June until 27 July. Males (45) were collected 1.1 times more often than females (40), with no evidence of proterandry.

Distribution (Fig. 22).—*Arthroceras pollinosum* is a western species found from California and New Mexico north to Wy-





Fig. 22. *Arthroceras pollinosum*, distribution.

oming and Washington. A single female was collected in Wisconsin.

Specimens examined (85).—UNITED STATES: CALIFORNIA: Smith River, Rowdy Creek; Prairie Creek; Weott; mountains near Orick; Dry Lagoon Beach State Park; Blacksburg Road; Arcata. COLORADO: St. Louis Creek Camp, 3 mi SW Fraser, 8800'; Aspen; Dolittle Ranch, Mt. Evans, 9800'; Chicago Creek, 8800'; Happy Hollow; Little Beaver; Clear Creek; 7 mi N

Ward; Lake City, 9000'; Science Lodge; west end of Grand Mesa. NEW MEXICO: Thermo; Tajique; Hyde State Park, 8 mi NE Santa Fe, 8700'; Santa Fe Campground near Santa Fe. OREGON: Robinson Butte Look Out, 25 air mi E Medford; Oregon Creek; Portland; Corvallis; Forest Grove; 14 mi S Ranier; 20 mi E Waldport; Black Rock, 10 mi SW Dallas; Beverly Beach. UTAH: Kaller Hollow Camp, 22 mi NNW Vernal. WASHINGTON: Canyon Creek; Seattle;



Vancouver; Electron; 7 mi E Randle, Rt. 12. WISCONSIN. WYOMING: Bottle Creek Camp, 7 mi SW Encampment, 8800'; Lower Green River Lake, Wind River Range, 8000'.

#### ACKNOWLEDGMENTS

I thank L. M. Page, G. L. Godfrey, and W. E. LaBerge for reviewing this manuscript and E. Steger for her editorial comments. I thank the curators of the following institutions and collections for the loan of material relevant to this study: American Museum of Natural History, P. Wygodzinsky; British Museum of Natural History (BMNH), J. Chainey; California Academy of Sciences, P. H. Arnaud, Jr.; Canadian National Collection (CNC), H. J. Teskey; Cornell University, L. L. Pechuman; Florida State Collection of Arthropods, H. V. Weems, Jr.; Kansas State University, H. D. Blocker; Museum of Comparative Zoology, Harvard University; Ohio State University, C. A. Triplehorn; Oregon State University, J. D. Lattin; Royal Ontario Museum, G. Wiggins; W. J. Turner Collection; United States National Museum (USNM), W. Mathis; University of British Columbia, S. G. Cannings; University of California, Berkeley (California Insect Survey), E. I. Schlinger; University of California, Davis, R. O. Schuster; University of Colorado, U. N. Lanham; University of Georgia, C. L. Smith; University of Idaho, J. B. Johnson; University of Kansas, Snow Entomological Museum (SEM), G. W. Byers; University of Michigan, T. E. Moore; University of New Hampshire, D. S. Chandler; University of Vermont, R. T. Bell; Utah State University, W. J. Hanson; Washington State University, W. J. Turner. This paper is a contribution of the Illinois Natural History Survey supported in part by a grant from the University of Illinois Research Board and an Ernst Mayr Grant from the Museum of Comparative Zoology, Harvard University.

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