

NEW *ATHYSANELLA* (HOMOPTERA: CICADELLIDAE) SPECIES FROM
SOUTHWESTERN GRASSLANDS: FURTHER EVIDENCE FOR THE
IMPORTANCE OF PHENOLOGY AND TAXONOMIC IDIOSYNCRASY IN
GENERATION OF BIOLOGICAL DIVERSITY

ANDREW L. HICKS,¹ H. DERRICK BLOCKER,² AND ROBERT F. WHITCOMB¹

¹Insect Biocontrol Laboratory, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland 20705; ²Department of Entomology, Kansas State University, Manhattan, Kansas 66506.

Abstract.—Southwestern grasslands are a rich source of species of *Athysanella* Baker; to date 128 species have been recorded. We now describe four new species. *Athysanella* (*Gladionura*) *maycoba* n. sp. was collected from short grasses in Sonora, Mexico. *Athysanella* (*Gladionura*) *itawana* n. sp. was collected on alkali sacaton (*Sporobolus airoides*) in the Four Corners area of the Colorado Plateau. *Athysanella* (*Gladionura*) *raisae* n. sp. was collected from hairy grama (*Bouteloua hirsuta*) in Durango and Zacatecas, Mexico. *Athysanella* *galeana* n. sp. was collected from saltgrass (*Distichlis spicata*) in Chihuahua, Mexico. We also illustrate a common undeveloped form of *Athysanella* (*Gladionura*) *blanda*. Discovery of these new species and the recent discovery of a species endemic to New Mexico gypsum areas confirm previous predictions of *Athysanella* diversity. This diversity appears to be governed by a sedentary life history strategy, the isolation of host grass patches, and marked differences among regional climates that enforce phenological isolation. Future study will probably reveal even more diversity in the genus *Athysanella*.

Key Words: Leafhopper, grasslands, Southwest, brachypterous, phenology

We have previously reported (Hicks et al. 1988) that blue grama (*Bouteloua gracilis* Willd. ex H. B. K.) grasslands of New Mexico were partitioned by *Athysanella* Baker specialists into regions closely allied to recognized climatic regions. Restriction of certain species to short-grass prairie, high plains, Rocky Mountains, and Gila Mountains was documented. Other dominant grasses of the Southwest are similarly partitioned, not only by *Athysanella* species, but also by species of *Flexamia* (Whitcomb and Hicks 1988) and other genera (Whitcomb et al. 1986, 1987, 1988). Given the brachyptery of *Athysanella* species (Ball and

Beamer 1940), their high degree of host specificity, and the existence of a vast mosaic of "climatic habitat islands" in the Southwest, where the genus abounds, we asked (Hicks et al. 1988) why there were not in fact many more than the 128 reported *Athysanella* species. In this and a companion publication (Hicks and Whitcomb 1992), we document five new species of *Athysanella*, confirming our suspicion that alpha discovery in the genus *Athysanella* may continue for some time.

In the following descriptions, we have assigned "character codes" as described by Blocker and Johnson (1990a, b).

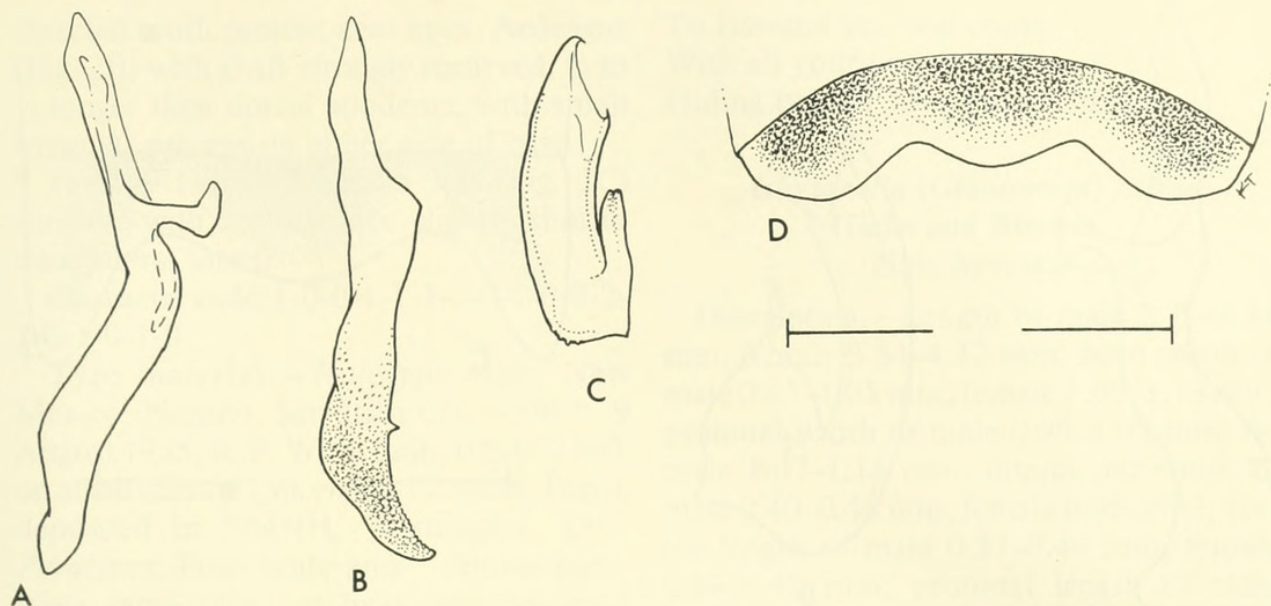


Fig. 1. *Athysanella (Gladionura) maycoba*. A. Style, ventral aspect; B. Style, lateral aspect; C. Aedeagus, lateral aspect; D. Female sternum VII. Bar = 0.5 mm.

DESCRIPTIONS OF NEW SPECIES

Athysanella (Gladionura) maycoba

Hicks and Blocker,

NEW SPECIES

Description.—Length of male 2.66–2.92 mm, female 3.48–3.80 mm; head width of male 1.00–1.04 mm, female 1.08–1.14 mm; pronotal width of male 0.93–1.03 mm, female 1.07–1.11 mm; interocular width of male 0.40–0.44 mm, female 0.48–0.52 mm; vertex length of male 0.40–0.44 mm, female 0.44–0.52 mm; pronotal length of male 0.30–0.38 mm, female 0.36 mm.

Vertex and pronotum stramineous, marked with brown. Wings and abdomen greenish to stramineous, marked with brown; face and venter brown to fuscous.

Forewings brachypterous, exposing 3.5–4.5 pregenital abdominal terga; ocellus approximately its own diameter from eye, hind tibial spur approximately $\frac{4}{5}$ length of first tarsomere.

Male: Pygofer with caudal margin extended, with acute apical process curved ventrolaterally, short, serrate; anal tube exceeding plates; plates with posterior margin truncate; valve bluntly triangular; connec-

tive $\frac{1}{2}$ length of styles. Styles (Fig. 1A, B) curved ventrally at apex, preapically thin with tiny tooth on ventral surface $\frac{1}{4}$ distance from apex, exceeding both plates and pygofer in length; aedeagus (Fig. 1C) acute apically, slightly curved, closely appressed to dorsal apodeme, which it exceeds in length by $\frac{1}{3}$.

Female: Female sternum VII (Fig. 1D) shallowly trilobed.

Character code: 0-1-0-0-1-1-1-0-1-0-1-1-2-2-0-0-1-0.

Type material.—*Holotype male*: Mexico: Sonora, east of Maycoba, 5800 ft, 5 September 1987, A. L. Hicks, IPL 001783, deposited in NMNH, Washington, D.C. *Paratypes*: Six male and four female paratypes, same locality, in California Academy of Sciences, San Francisco, Kansas University, Snow Museum, Lawrence, and NMNH.

Diagnosis.—*Athysanella (G.) maycoba* is a member of the *diversa-nacazarana* clade. It keys to couplet 18 of the key of Blocker and Johnson (1990a), and within that couplet to *A. (G.) diversa* Ball and Beamer. It can be distinguished from *diversa* by the shape of the style apex, which is more strongly curved ventrad in lateral aspect and

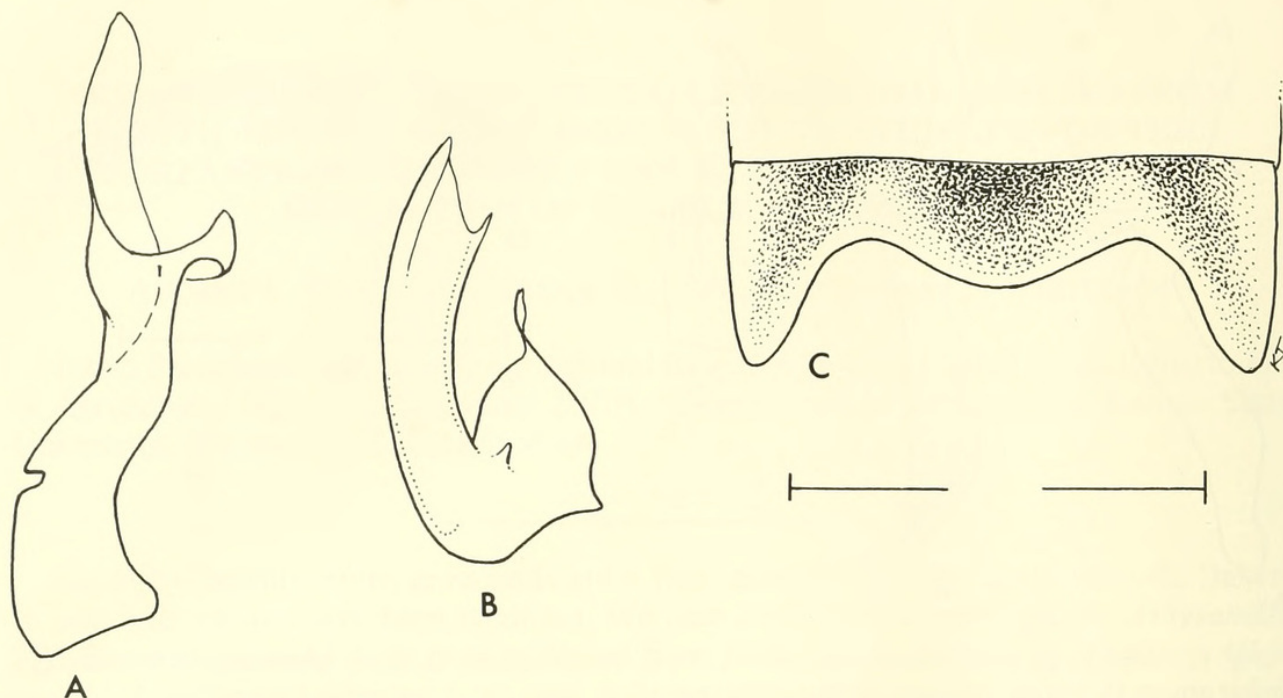


Fig. 2. *Athysanella* (*Gladionura*) *itawana*. A. Style, broad aspect; B. Aedeagus, lateral aspect; C. Female sternum VII. Bar = 0.5 mm.

extends much further beyond the plates. Its styles exceed the plates by a much greater increment than in *A. (G.) nacazarana* Osborn, with which it could possibly be confused. In addition, the style apices of *maycoba* are acute and curved ventrad.

Hosts.—*Athysanella* (*G.*) *maycoba* was collected only from the type locality in Mexico, where it occurred on mixed short grasses including blue grama (*Bouteloua gracilis*) and curly mesquite [*Hilaria belangeri* (Steud.) Nash].

Etymology.—This species is named for the type locality.

Athysanella (*Gladionura*) *itawana*
Hicks and Blocker,
NEW SPECIES

Description.—Length of male 3.24–3.48 mm, female 4.24–4.92 mm; head width of male 1.20–1.28 mm, female 1.36–1.40 mm; pronotal width of male 1.05–1.23 mm, female 1.27–1.33 mm; interocular width of male 0.48–0.52 mm, female 0.52–0.60 mm; vertex length of male 0.40–0.44 mm, female

0.44–0.52 mm; pronotal length of male 0.34–0.36 mm, female 0.38–0.42 mm.

Color stramineous, vertex usually with a pair of fuscous spots; abdomen in dorsal aspect with at least some indication of six irregular fuscous stripes; ventral surface with varying amounts of fuscous along midline, diminishing caudally; wings, face and vertex with varying amounts of fuscous coloring.

Forewings brachypterous, exposing 4.5 pregenital abdominal terga; ocellus approximately its diameter from eye; hind tibial spur approximately $\frac{1}{4}$ to $\frac{1}{5}$ length of first tarsomere.

Male: Pygofer with caudal margin extended, processes long, apically acute, curved ventrad, without serrations; anal tube not reaching apex of pygofer; plates subtruncate, usually slightly embrowned apically; valve with caudal margin broadly rounded. Style (Fig. 2A) in broad aspect with margin bisinuate, expanded subapically with truncate apex angling into prominent medial lobe, lateral lobe small, tiny ventrally

directed tooth present near apex. Aedeagus (Fig. 2B) with shaft strongly recurved, $\frac{1}{2}$ to $\frac{1}{3}$ longer than dorsal apodeme, with small irregular process on either side of base.

Female: Female sternum VII (Fig. 2C) concave with median lobe slightly shorter than lateral lobes.

Character code: 1-0-0-1-1-1-0-0-1-0-0-2-2-0-1-0-1-0.

Type material.—*Holotype male:* New Mexico: Nageezi, San Juan Co., 6600 ft, 9 August 1985, R. F. Whitcomb, IPL 002360, on alkali sacaton (*Sporobolus airoides* Torr.), deposited in NMNH, Washington, D.C. *Paratypes:* Four male and 5 female paratypes, same collection, have been deposited in Canadian National Collection, Ottawa, Kansas University, Snow Museum, Lawrence, and NMNH.

Diagnosis.—*Athysanella* (G.) *itawana* is related to (*A.*) (*G.*) *curtipennis* and will key to this species in the treatment of Blocker and Johnson (1990a). However, it can be distinguished from *curtipennis* by the shape of the styles, which are acute instead of rounded apically, and from the somewhat similar *A. (G.) blanda* by the bisinuate nature of the styles. This species, which has been collected only at the type locality, was taken from alkali sacaton, *Sporobolus airoides*.

Etymology.—The species is named for Itawana, the term used by modern Zuni Native Americans for the mythological site where the Zunis emerged from the third world into the (contemporary) fourth world (Bunzel 1932). The Zunis are the modern descendents of the Anasazis, who colonized the Four Corners region, establishing pueblos and maize economies (Frazier 1986). Itawana, used by corn maidens in creation myths, is also used today in Zuni ritual poetry invoking rain:

Send forth your massed clouds to stay with
us,
Stretch out your water hands,
Let us embrace!

To Itawana you will come
With all your people,
Hiding behind your watery shield . . .

Athysanella (Gladionura) raisae
Hicks and Blocker,
NEW SPECIES

Description.—Length of male 2.76–3.44 mm, female 3.84–4.32 mm; head width of male 0.97–1.05 mm, female 1.09–1.13 mm; pronotal width of male 0.99–1.05 mm, female 1.07–1.15 mm; interocular width of male 0.40–0.46 mm, female 0.48–0.53; vertex length of male 0.37–0.46 mm, female 0.44–0.48 mm; pronotal length of male 0.32–0.36 mm, female 0.34–0.36 mm.

Color stramineous to pale green, vertex and pronotum without fuscous spots, tan and unadorned to marked with dark brown pattern of irregular spots; dorsal portion of abdomen with infuscated anterior margins of abdominal tergites exposed or not, a transverse line of small fuscous dots on each tergite. Venter usually fuscous, legs with variable black spots and stripes. Elytra unadorned.

Forewings brachypterous, exposing 4.0 to 4.4 pregenital abdominal tergites; ocellus approximately twice its own diameter from eye; hind tibial spur about $\frac{1}{2}$ as long as first tarsomere.

Male: Pygofer (Fig. 3C) with caudal margin extending into a short, smooth, robust, laterally curved process (Fig. 3D); anal tube attaining apex of pygofer; plates slightly shorter than pygofer, inner margins evenly curved from separated bases to subacute, outer apex slightly embrowned; valve triangular; style (Fig. 3A) in broad aspect with inner margin irregularly curved, apex acute, caudal margin concave, angling to one of two preapical lobes, widest about $\frac{1}{3}$ length from apex; apices exceeding plates, in lateral aspect, two ventrally directed denticulations present, one apical, one subapical on inner margin; aedeagus (Fig. 3B) evenly curved, minutely serrate at basal angle in

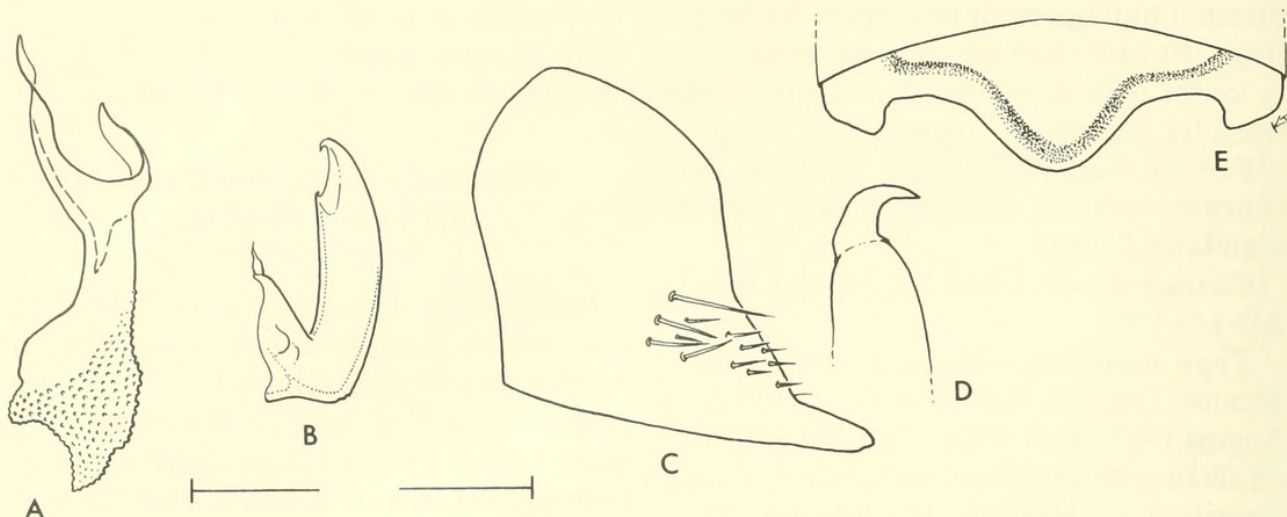


Fig. 3. *Athysanella (Gladionura) raisae*. A. Style, broad aspect; B. Aedeagus, lateral aspect; C. Pygofer, lateral aspect; D. Detail of pygofer hook, ventral aspect; E. Female sternum VII. Bar = 0.5 mm.

lateral aspect, base slightly expanded in caudal aspect, shaft a little more than twice length of apodeme.

Female: Female abdominal sternum VII often totally or partially fuscous (Fig. 3E), strongly trilobed, medial lobe broadly rounded.

Character code: 0-1-1-1-2-1-1-0-1-0-0-2-2-1-0-0-1-0.

Type material.—*Holotype male:* Mexico: Durango, 7 miles east of Nombre de Dios (Mexican Highway 45), 1 October 1988, A. L. Hicks, from *Bouteloua hirsuta* Lag., IPL 002823, deposited in NMNH, Washington, D. C. *Paratypes:* Three female paratypes, same data as holotype; and 6 males, 1 female from Mexico: Zacatecas, near Sombrere (ca 64 mi east of Durango), 7800 ft, 1 October 1988, A. L. Hicks and P. D. Cubbage, 6 males and 1 female, IPL 002824, have been deposited in California Academy of Sciences, San Francisco, Canadian National Collection, Ottawa, Kansas University, Snow Museum, Lawrence, Kansas State University, Manhattan, and NMNH.

Diagnosis.—*Athysanella (Gladionura) raisae* is closely related to *A. (G.) nita* Wesley and Blocker, but, because of the length of its tibial spur, keys (Blocker and Johnson 1990a) to *A. (G.) gisela* Wesley and Blocker. It can be distinguished from *gisela* by the

apex of the style, which has an inner margin that is longer than the outer. *Athysanella (G.) raisae* can be distinguished from *nita* by the laterally directed pygofer processes and by the apices of the styles, which are broader and extend further beyond the plates, are more acute and longer, and the preapical lobes, which are more produced. It should be noted that (as is often the case in geographical representatives of *Athysanella*) the two collections of *raisae* show some variation in style morphology. Style apices of the eastern population have caudal margins less evenly concave than those of the western population, but not as produced and acute; also, the preapical indentations on the inner margins are less pronounced than those of the western representatives.

Host.—The type specimens were collected on hairy grama (*Bouteloua hirsuta*).

Etymology.—We have named this species in honor of the then first lady of the USSR, in commemoration of her visit to the United States on the occasion of the June 1990 summit visit of President Gorbachev.

Athysanella galeana Hicks and Blocker, NEW SPECIES

Description.—Length of male 2.96 mm, female 4.36 mm; head width of male 1.08 mm, female 1.16 mm; pronotal width of

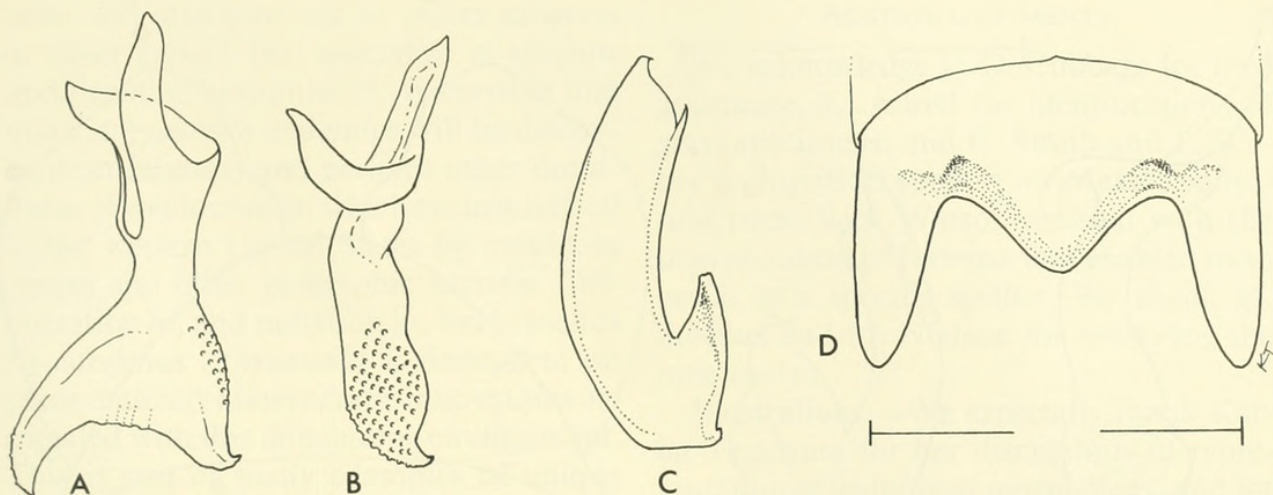


Fig. 4. *Athysanella galeana*. A. Style, broad aspect; B. Style, ventral aspect; C. Aedeagus, lateral aspect; D. Female sternum VII. Bar = 0.5 mm.

male 1.03 mm, pronotum of single female allotype with damaged pronotum; interocular width of male 0.48 mm, female 0.52 mm; vertex length of male 0.48 mm, female 0.52 mm; pronotal length of male 0.34 mm.

Color stramineous, vertex and pronotum marked with indistinct brown pattern, vertex without fuscous spots; abdomen with dark brown pattern, wings plain to alternating light and dark stripes.

Forewings brachypterous, exposing 3.5 to 4.5 pregenital abdominal tergites; ocellus about its own diameter from eye; hind tibial spur slightly shorter than first tarsomere.

Male: Pygofer subquadrate, with few macrosetae; valve broadly rounded; plates rounded apically, separated basally and diverging distally; anal tube attaining apex of pygofer; connective $\frac{3}{4}$ length of styles; styles (Fig. 4A, B) bifid apically, dorsal arm slender, acute, exceeding caudal margin of pygofer, ventral arm thickened, equalling apex of plates, apices with numerous papillae, particularly on ventral surface; aedeagus (Fig. 4C) recurved, almost parallel-sided, but widest at midlength; slightly tapered in apical half to a small single hook.

Female: Female abdominal sternum VII (Fig. 4D) with medial lobe less than $\frac{1}{2}$ length of prominent lateral lobes on posterior margin.

Character codes: 0-1-0-0-1-0-1-0-0-2-1-1-0-0-1-0-0-0.

Type material.—*Holotype male and female allotype:* Mexico, Chihuahua, Galeana, about 25 mi south of Nuevo Casas Grandes, 3 Sept. 1987, IPL 001775, on saltgrass (*Distichlis spicata* (L.) Greene, deposited in NMNH, Washington, D.C. *Paratype:* A single paratype male, same collection data, is deposited in Kansas University, Snow Museum, Lawrence.

Diagnosis.—*Athysanella galeana* is related to *A. strobila*, to which it keys (Blocker and Johnson 1988), but can be distinguished from it by the shape of the pygofer, which has a truncate caudal margin without a lobe, by the shaft of the aedeagus, which is nearly parallel-sided with the apical hook less developed, and by the female sternum VII, which has a longer medial lobe.

Host.—This species is known only from the type locality, where it was collected on saltgrass.

Etymology.—This species is named for the type locality.

Athysanella (*Gladionura*) *blanda*
Ball and Beamer "vana" form

Discussion of confusing variant

Athysanella blanda variety *vana* was described earlier (Ball and Beamer 1940), but

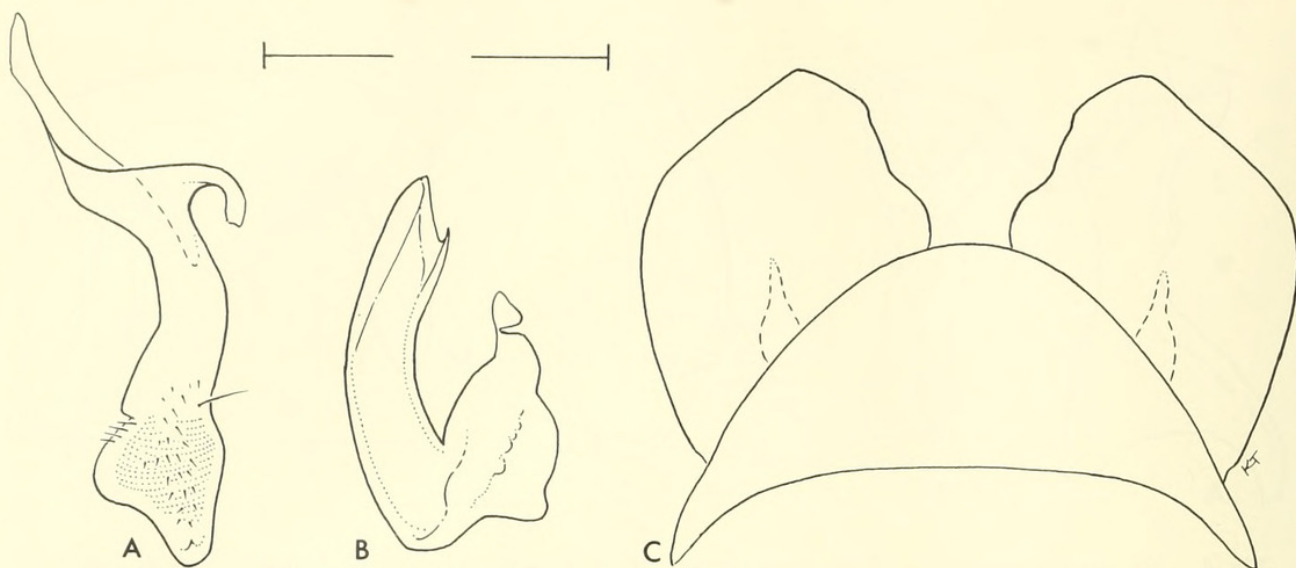


Fig. 5. *Athysanella* (*Gladionura*) *blanda* "vana" form. A. Style, ventral aspect; B. Aedeagus, lateral aspect; C. Male valve and plates, ventral aspect. Bar = 0.5 mm.

not illustrated. Later, this form was synonymized with *A. blanda* by Blocker and Johnson (1990a), who considered it to be an undeveloped form. Because we occasionally found this form in the gyp areas of southeastern New Mexico and found it to be very confusing, we illustrate it here (Fig. 5). The "vana" form is similar to *A. (G.) blanda* Ball and Beamer, but differs from it by the length and straightness of the pygofer processes, by the shape of the plates, which are not quadrate, and by the apex of the style, which has a rounded apex and does not have the inner margin produced. It should be noted that typical *blanda* and the "vana" form are sympatric and occur together in southeastern New Mexico. Whether the underlying basis for the variation is genetic or environmental is unknown. We believe that these figures will assist in future determinations of *Athysanella* species from this interesting biogeographic region.

DISCUSSION

Three of the four new species described are Mexican. Given the small ranges of many *Athysanella* species, it is reasonable to speculate that these species may not occur in the

United States. Like all or most *Athysanella* species (Blocker and Johnson 1988, 1990a, b, Wesley and Blocker 1985) with small ranges, these species were collected only as brachypters.

One of the species, *A. (G.) maycoba*, was collected from a mixed stand of two short grasses—curly mesquite (*Hilaria belangeri*) and blue grama (*Bouteloua gracilis*). This leafhopper species is a member of a clade (Blocker and Johnson 1990a) of specialists that occur on short grasses (*Bouteloua*, *Hilaria*, and *Scleropogon* species).

A second Mexican species, *A. (G.) raisae*, is most closely related to *A. (G.) nita*. Although it was collected on hairy grama (*Bouteloua hirsuta*), it is unknown whether it is a specialist.

The third Mexican species, *A. (A.) galeana*, was collected in very small numbers from saltgrass (*Distichlis spicata*) and possibly specializes on that host. It is closely related to *A. strobila* Blocker, a species of the northern Great Basin. The subgenus *Athysanella* appears to have diversified extensively in alkaline and/or saline lowlands, particularly on saltgrass. It is not unlikely that members of the subgenus with unknown host affilia-

tions will also turn out to utilize saltgrass or other grasses that specialize in alkaline and/or saline bottomlands. We predict that other *Athysanella* endemics will be discovered on saltgrass and perhaps other dominants of wet lowlands, which are insularized in the western United States by mountain ranges and other geographic barriers. Colonization of, and radiation in, wet lowlands by subgenus *Athysanella* is dependent on taxonomically idiosyncratic innovations associated with this demanding environment. This is one of many examples of unique evolutionary events that result in biotic enrichment.

A. (G.) itawana was collected from a dominant grass, alkali sacaton (*Sporobolus airoides*), of the San Juan Basin in northwestern New Mexico. It is related to *A. (G.) curtispennis* (Gillette & Baker), a specialist of *Sporobolus cryptandrus* (Torr.) Gray. Another recently described species, *Athysanella (G.) andyi* Blocker was collected from another grass dominant, galleta [*Hilaria jamesii* (Torr.) Benth.], in the same region. Previous collectors may well have overlooked the San Juan Basin as a source of endemics. Indeed, the entire Colorado Plateau and Great Basin regions should be systematically explored for areas that harbor presently unknown endemic species. The climatic (or other) factors that enforce the range boundaries of species like *A. (G.) itawana* in a region where their hosts are dominant and do not appear to be particularly patchy, are at present unknown.

Discovery of the species reported herein confirms previous speculation (Hicks et al. 1988) that the true diversity of *Athysanella* species has yet to be assessed. This and other recent contributions suggest that *Athysanella* diversity in Mexican and Southwestern grasslands is governed by a sedentary life history strategy that only rarely includes macroptery, isolation of habitat (host grass) patches, and marked interregional differences in climate that enforce phenological isolation.

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