

***FLEXARIDA CHAOTICA*, NEW GENUS AND SPECIES OF LEAFHOPPER
(HOMOPTERA: CICADELLIDAE) FROM THE
AMERICAN SOUTHWEST**

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Abstract.—In the course of a recent review of the genus *Flexamia*, a new species was discovered that, although apparently related to *Flexamia* and two other related genera (*Spartopyge* and *Alapus*), could not be assigned to an existing genus. The species has a highly reduced aedeagus with little trace of characters of other flexaminoid genera. Characters of the male plates and female sternum VII suggested that ancestors of this new species, which apparently specializes on *Muhlenbergia arenacea* or closely related grasses in alkaline flats of southern Arizona and New Mexico, diverged from the flexaminoid lineage prior to divergence of *Flexamia*. We name this species *Flexarida chaotica*.

Key Words: Leafhopper, grasslands, semiarid, Southwest

In the course of a recent review (Whitcomb and Hicks 1988) of the genus *Flexamia*, we encountered several series of an undescribed species which, although clearly allied with the *Flexamia-Spartopyge-Alapus* lineage of deltocephaline leafhoppers, could not be assigned to an existing genus. The species possessed some characters of the genus *Alapus* and of primitive members of *Flexamia*, but was distinctively different from these genera in lacking all characters autapomorphic for them. The new species was autapomorphic in possession of a small, stout, asymmetrical aedeagus with two tiny subapical lateroventral teeth, and an apodeme consisting of two small semicircular structures.

Most specimens from our collections were taken from a single host, *Muhlenbergia arenacea* (Buckl.) Hitchc., although several individuals were collected from the closely related *M. asperifolia* (Nees & Mey.). *M. arenacea* is a frequent inhabitant of highly saline flats of the American Southwest. In

addition to specimens collected in our surveys, we discovered two specimens in the National Museum of Natural History (NMNH, Washington, D.C.) taken by E. D. Ball in 1932 from southeastern Arizona.

The new species is characterized not only by its bizarre aedeagal morphology, which is unlike that of any *Flexamia* species, but by a highly setose pygofer.

***Flexarida* Whitcomb and Hicks,
NEW GENUS**

Closely resembling *Flexamia* in general habitus, but with the aedeagus much reduced in size. Head wider than pronotum, crown 1½–2 times longer medially than next to the eye, anterior margin acutely angled. Male pygofer (Fig. 1D) truncate, heavily setose on caudodorsal quarter (Fig. 1F), constricted medially both dorsally and ventrally. Plates (Fig. 1F) large, acute, with uniseriate spine-like setae on outer margin; aedeagus (Fig. 1A) small, stout, shorter than connective. Joint distinct between aedeagus

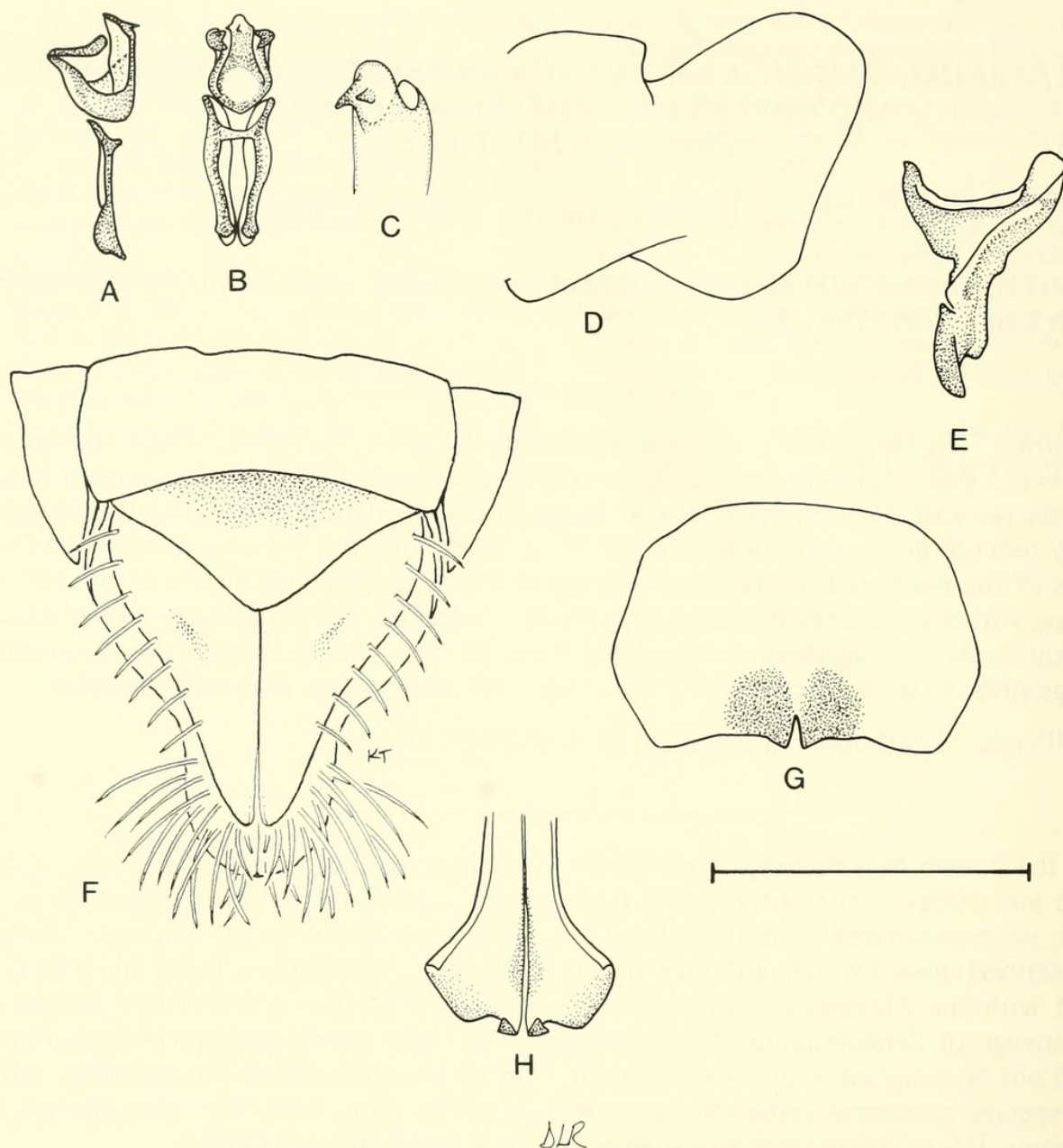


Fig. 1. *Flexarida chaotica*. A. Aedeagus and connective, lateral aspect; B. Aedeagus and connective, ventral aspect; C. Detail of apex of aedeagus; D. Lateral aspect of male pygofer; E. Style, broad aspect; F. Ventral aspect of plates, pygofer and valve of male; G. Female sternum VII; H. Base of first valvulae of ovipositor.

and connective, which together are approximately equal in length to the styles. Apodeme consisting of two small semicircular structures. Female sternum VII (Fig. 1G) with a shallow V-shaped notch at the center of the posterior margin.

***Flexarida chaotica* Whitcomb and Hicks,
NEW SPECIES**

Description.—Length of male 3.6 (3.3–3.9) mm, of female 4.2 (4.0–4.5) mm, head

width of male 1.06 mm, of female 1.10 mm. Crown not strongly produced; median length of crown $0.65 \times$ head width and $1.52 \times$ interocular width (male $n = 24$; female $n = 32$).

Crown with indistinct dark circular areolet at apex with a black dash between the apex and eyes paralleling angled anterior margin of crown, disc of crown pale brown with ivory stripe along medial line in well-marked specimens. Macropterous to sub-

macropterous with opaque elytra usually equalling or exceeding abdomen, occasionally exposing 0.5 pregenital abdominal segments, two dark brown spots on disc, cells with or without variable amounts of brown outlining, costal cells usually with posterior margins heavily infuscated. Cells usually pale brown, veins white. Face variable, in some specimens almost entirely fuscous, diminishing basally to lighter shades of brown, to strikingly bicolored, with a fuscous band above, subtended with ivory. Abdomen and legs with varying amounts of dark brown pattern, femurs striped, tibia spotted along bases of spines.

Male.—Pygofer (Fig. 1D) with posterior margin truncate, angling from a ventrally produced caudoventral lobe, apex of pygofer exceeding that of anal tube. Plates (Fig. 1F) subacute, divergent apically, slightly shorter than pygofer. Valve triangular. Style apices (Fig. 1E) small, digitately tapered, curved ventrally, with subapical ventral lobe barely attaining plate bases. Aedeagus (Fig. 1A, B) foot-shaped, very small, stout, with two tiny subapical teeth (Fig. 1C) on lateroventral side. Gonopore large, apical, asymmetrical. Connective (Fig. 1A, B) much like those in the *pectinata* group of *Flexamia* (Whitcomb and Hicks, 1988), dorsal keel not present.

Female.—Sternum VII (Fig. 1G) with posterior margin slightly concave, with a notched medial projection, heavily infuscated on either side of notch. Ovipositor with recurved basal processes of first valvula small, dark and triangular (Fig. 1H).

Type material.—*Holotype male*: Arizona, Cochise Co., Dos Cabezas, mile 336, Arizona Route 186, 5 October, 1987, 4100 ft, A. L. Hicks, IPL 002811, on *Muhlenbergia arenacea*. Deposited in NMNH. *Paratypes*: Arizona, Cochise Co., Dos Cabezas, same data as holotype, on *M. arenacea*, 7 males, 13 females, 2 nymphs; Cochise Co., Johnson (Interstate 10 near Johnson Rd Exit, between mi 324 and 325), 5 Oct., 1987, 4100 ft, A. L. Hicks, IPL 002812, on *M.*

arenacea, 6 males, 11 females; Arizona, Cochise Co., Cochise, between mile 329 and 330 on Interstate 10, 7 Oct., 1987, 4500 ft, A. L. Hicks and J. E. Lowry, 4500 ft, IPL 002813, 3 males, 5 females; Arizona, Cochise Co., Dos Cabezas, 7 Oct., 1987, A. L. Hicks and J. E. Lowry, 4100 ft, IPL 002814, on *M. arenacea*, 8 males, 7 females; Arizona, Cochise Co., Rucker Canyon, 8 Oct. 1987, A. L. Hicks and J. E. Lowry, 4500 ft, IPL 002815, on *Muhlenbergia arenacea*, 2 males, 2 females; Arizona, Cochise Co., Douglas, Aug. 21, 1932, E. D. Ball, 1 male, 1 female. New Mexico, Chaves Co., Roswell, 20 August 1985, 3900 ft, R. F. Whitcomb, IPL 001929, on *Muhlenbergia arenacea*, 3 males, 5 nymphs; Luna Co., New Mexico Rt 9, mi 66, near Columbus, 6 Sept. 1987, 4500 ft, on *M. asperifolia*, IPL 003496, 1 male, 1 nymph. Deposited in BARC, Beltsville, Maryland; California Academy of Sciences, San Francisco; Canadian National Collection, Ottawa; Monte L. Bean Museum, Brigham Young University, Provo, Utah; Kansas State University, Manhattan; University of Kansas, Snow Museum, Lawrence; Ohio State University, Columbus; and NMNH. Localities are mapped in Fig. 2.

PHYLOGENY OF *FLEXARIDA CHAOTICA*

To assess the phylogenetic position of *F. chaotica*, we determined the placement of the species in the 18 character transformations used to reconstruct *Flexamia* phylogeny (Whitcomb and Hicks 1988). A phylogeny showing the position of *F. chaotica* with respect to *Flexamia* and *Spartopyge* is presented in Fig. 3. Definitive placement of this genus awaits full consideration, on a world basis, of flexaminoid genera in the general context of evolutionary trends in the Deltocephalinae as a whole, or at least in the cluster of grass-inhabiting genera characterized by a Y-type connective that is not fused (or is incompletely fused) with the aedeagus (see scattergram of Oman 1949, p. 110).

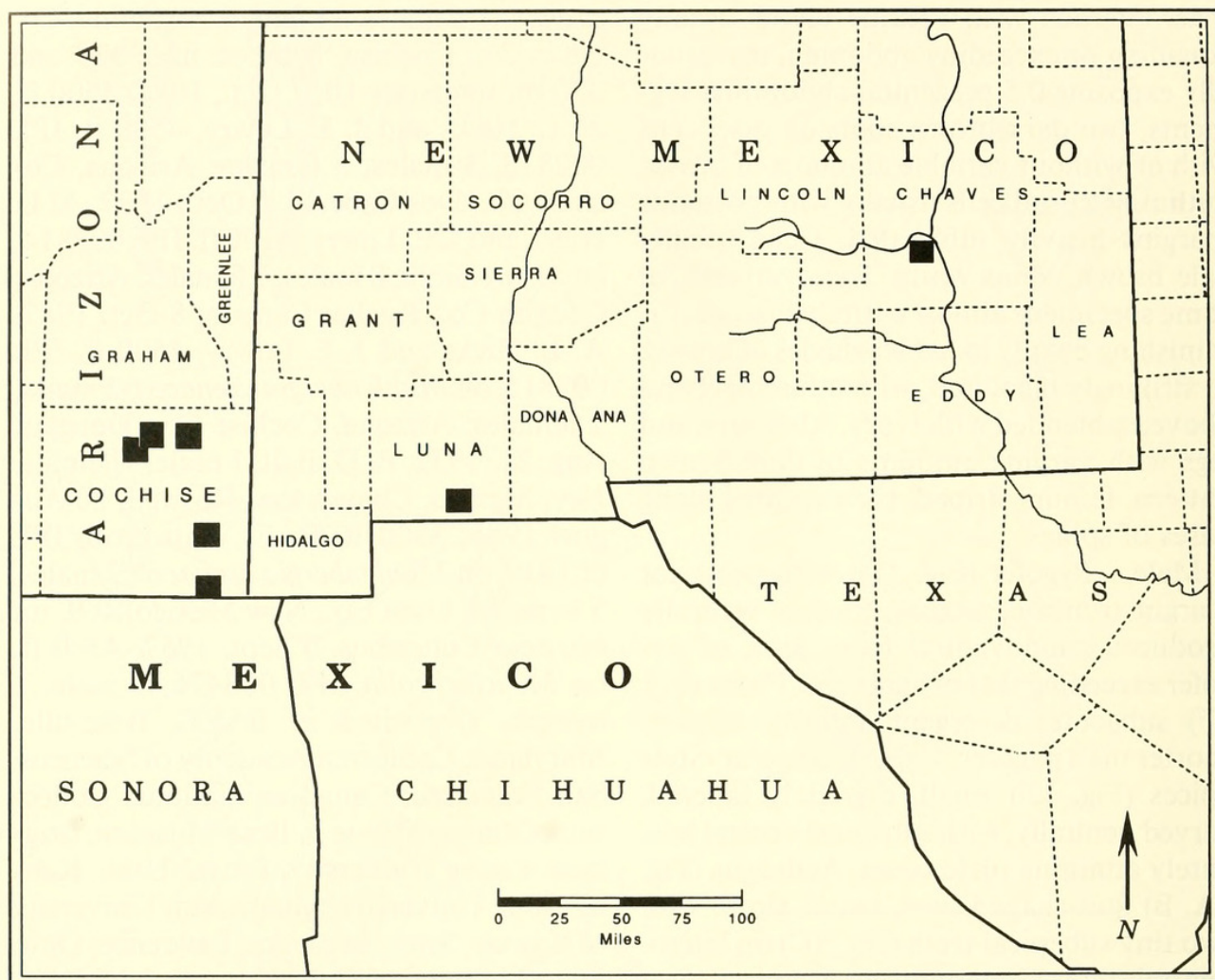


Fig. 2. Collection localities for *Flexarida chaotica*.

DISCUSSION

We have surveyed a number of *Muhlenbergia* species in the Southwest (Whitcomb et al. 1986, 1987, 1988) but have found *F. chaotica* only on *M. arenacea* or the closely related *M. asperifolia*. The lowland habitats of *M. arenacea* are presumably often high in inorganic salts. We regarded the first specimens of *chaotica* that we collected in New Mexico as examples of aberrant genitalic development. However, after several series were taken in southeastern Arizona it became clear that this was not the case. Furthermore, a specimen collected by E. D. Ball in 1932 in southeastern Arizona had identical aedeagal morphology. We therefore believe that the highly unusual genitalia are unlikely to be products of a teratogenic pro-

cess, but instead represent the normal genitalia of a bizarre, previously undescribed genus and species.

Although the genitalia are clearly not the result of proximate environmental influences, it is possible that saline and/or alkaline habitats have nevertheless influenced the evolution of this species. We are also reminded that the aedeagus of the Four Corners "Anasazi" population of *Flexamia arenicola* Lowry and Blocker are invariably broken (Whitcomb and Hicks 1988). This region of the Colorado Plateau at the intersection of Utah, Colorado, Arizona, and New Mexico (the San Juan Basin) is currently undergoing salinization during an interglacial dry period. Given the aedeagal simplification of other desert cicadellids, for example *Athysanella* (Blocker and Johnson

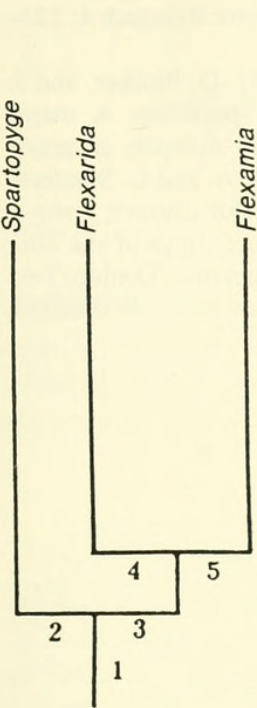


Fig. 3. Tentative phylogeny of North American flexaminoid genera (see Whitcomb and Hicks 1988). We hypothesize an ancestral form (1) with dorsal stripes and a pale face with contrasting black interocular band, relatively wide male plates, a broad aedeagus jointed with the connective, without apical processes but with tiny subapical processes, and an antepical gonopore on the caudoventral surface. Division of this lineage led (2) to *Spartopyge* and (3) to the *Flexarida*-*Flexamia* lineage, in which the dorsal aedeagal apodeme plesiomorphically had a pair of appendages directed caudoventrally or caudad. This was modified in *Flexarida* (4) to form an apodeme consisting of two semicircular structures, a condition autapomorphic for the genus. Other autapomorphies defining *Flexarida* are narrow tapered plates, and various characters of the aedeagus, which is short, stout, and asymmetrical, has a pair of lateroventral teeth, and a large apical gonopore. In *Flexamia* (5), the aedeagus is narrow, and plesiomorphically symmetrical; the plates, in more plesiomorphic species, are relatively wide; and the dorsal apodeme in all species has a pair of appendages directed caudoventrally or caudad.

The PHYSYS matrix data for *Flexarida chaotica*, compatible with those presented for *Flexamia*, *Alapus*, and *Spartopyge* (Whitcomb and Hicks 1988) are:

DISTIN	CHAOT	ASYM	ABSENTP	STRAIT	THICK	1	CHAOTICA
SHORT	UNTAPER	ABSNT	APICALG	APODEXP	APOCH	2	CHAOTICA
CONNAR	BULBPY	CHAPL	UNITOO	ABSTR	CONBLF	3	CHAOTICA

where CHAOT, APOCH, and CHAPL are autapomorphic for the genus.

1988, 1990a, b, Hicks and Whitcomb 1991), it seems possible that the stress conditions of drought and salinization may favor aedeagal simplification.

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LITERATURE CITED

Blocker, H. D. and J. W. Johnson. 1988. Classification of the subgenus *Athysanella*, genus *Athysanella* (Homoptera: Cicadellidae: Deltocephalinae). Great Basin Naturalist Memoirs 12: 18–42.

———. 1990a. Classification of *Athysanella* (*Gladionura*) (Homoptera: Cicadellidae: Deltocephalinae). Journal of the Kansas Entomological Society 63: 9–45.

———. 1990b. Classification of *Athysanella* (*Amphipyga*) (Homoptera: Cicadellidae: Deltocephalinae). Journal of the Kansas Entomological Society 63: 101–132.

Hicks, A. L. and R. F. Whitcomb. 1994. Notes on the leafhopper (Homoptera: Cicadellidae) fauna of southeastern New Mexico, with emphasis on gypsum grasslands and a description of a new species of *Athysanella*. Proceedings of the Entomological Society of Washington. (In press.)

Oman, P. W. 1949. The nearctic leafhoppers (Homoptera: Cicadellidae). A generic classification and check list. Memoirs of the Entomological Society of Washington. Entomological Society of Washington, Washington, D.C.

Whitcomb, R. F. and A. L. Hicks. 1988. Genus *Flexamia*: New species, phylogeny, and ecology. Great Basin Naturalist Memoirs 12: 224–323.

Whitcomb, R. F., A. L. Hicks, D. E. Lynn, K. Allred,

- and H. D. Blocker. 1987. Geographic variation in host relationships of leafhoppers (Homoptera: Cicadellidae) in North American grasslands, pp. 293-325. *In* Wilson M. R. and L. R. Nault, eds., *Proceedings of the 2nd International Workshop on Leafhoppers and Planthoppers of Economic Importance*. Commonwealth Institute of Entomology, London.
- Whitcomb, R. F., J. Kramer, M. E. Coan, and A. L. Hicks. 1986. Ecology and evolution of leafhopper-grass relationships in North American grasslands. *Current Topics in Vector Research* 4: 125-182.
- Whitcomb, R. F., A. L. Hicks, H. D. Blocker, and J. P. Kramer. 1988. Host specificity: A major mechanism enhancing insect diversity in grasslands. Paper 11.06. *In* Davis, A. and G. Stanford, eds., *The Prairie: Roots of Our Culture; Formulation of our Economy*. *Proceedings of the 10th North American Prairie Conference*, Denton, Texas, 1986. Native Prairies Association, Wheatland, Texas.



Whitcomb, Robert F. and Hicks, A L. 1993. "Flexarida chaotica, new genus and species of leafhopper (Homoptera: Cicadellidae) from the american southwest." *Proceedings of the Entomological Society of Washington* 95, 605–610.

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