

A TAXONOMIC STUDY OF THE NORTH AMERICAN
LEAFHOPPERS OF THE GENUS DELTOCEPHALUS
(HOMOPTERA: CICADELLIDAE: DELTOCEPHALINAE)

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This study presents the first modern treatment of the genus *Deltocephalus* Burmeister for North America. DeLong (1926d) published the most recent taxonomic study of the genus without reference to the concealed male genitalia. His concept of *Deltocephalus* was extremely broad and included seven subgenera, all of which were treated by Oman (1949a) with full generic standing. Oman further erected six new genera from elements of the old concept of *Deltocephalus* and listed 32 names in a checklist of species under his definition of *Deltocephalus*.

I have studied all of the North American species of *Deltocephalus*, as well as all of the species of the generally conceded allied genera, *Amplicephalus* DeLong, *Graminella* DeLong, *Endria* Oman, *Polyamia* DeLong, *Unoka* Lawson, *Destria* Oman, *Daltonia* Oman, and *Amblysellus* Sleesman. I am convinced that the characters of the forewing venation, used in large part by Oman (1949a: 119) in his key to the North American genera and in his generic definitions, are of limited value. Further, as the genera are presently defined, they can neither be keyed successfully nor defined on a really inclusive or exclusive basis. The only recourse is a further restriction of *Deltocephalus* with major emphasis given to the features of the male genitalia.

Deltocephalus, as delimited here, includes 13 valid species for North America. Two species are described as new, and four are treated as synonyms. The remaining species listed in *Deltocephalus* by Oman (1949a: 173-174) will be discussed elsewhere.

Deltocephalus is Holarctic; the two Old World species, *maculiceps* Boheman and *pulicaris* (Fallén), have been discussed by both Ribaut (1952a: 246-250) and Ossiannilsson (1947b: 195-196).

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Genus DELTOCEPHALUS Burmeister

Jassus subgenus *Deltocephalus* Burmeister (1838b: 15). Type by subsequent designation of Kirschbaum (1858b: 356), *Cicada pulicaris* Fallén (1806: 21).

Revised definition. — Moderately small (2.2-4.1 mm) and comparatively robust leafhoppers; head including eyes as wide as or slightly wider than pronotum; crown produced beyond eyes and bluntly angular at apex, anterior margin of crown broadly and smoothly rounded to face, crown in lateral view usually distinctly inflated or convex; ocelli marginal, small, and rather remote from eyes; clypeal suture usually obscure; clypellus quadrate with sides parallel. Forewings long and extending well beyond abdomen or shortened and exposing apex of abdomen; in forms with shortened forewings, the apical cells and each appendix are much reduced and at times nearly absent. Forewing usually with three anteapical cells, inner cell only rarely open basally, central cell divided or not, outer cell often reduced and sometimes absent.

Male genitalia. — Connective linear and fused with aedeagus; aedeagus transverse in lateral view, broadest in basal half and tapering distally to a slender upturned apex, extreme apex simple or slightly elaborated with small projections or minute teeth on distal margin below apex, gonopore visible in dorsal aspect at aedeagal apex, aedeagal apex in posterior view usually distinctly notched; mesal lobe of style in dorsal view slender and more or less fingerlike (except *gnarus* Ball), often excessively long, always at least three times as long as lateral lobe.

Generic diagnosis. — *Deltocephalus* can be separated from all other North American deltocephaline leafhoppers with a fused connective and aedeagus by the following combination of positive and negative characters: aedeagus essentially simple, without obvious processes or appendages, broadest basally, narrowed and distinctly upturned distally, with gonopore visible in dorsal view at apex, aedeagus in lateral view neither acute at apex nor inflated at basal ventral portion and produced anteriorly to juncture with connective, style with mesal lobe fingerlike and at least three times as long as lateral lobe. Forewings not appearing reticulated due to extra crossveins.

Notes concerning the illustrations and key. — The illustrations of the heads were prepared by Mr. Arthur D. Cushman, technical illustrator for the Systematic Entomology Laboratory, USDA, and I am grateful to him for these additions to this study. The drawings of the male genital structures are the work of the author; these

were prepared with the aid of a camera lucida at various magnifications. Except where noted, all references to the aedeagus pertain to a lateral view, whereas those references to the style pertain to a dorsal view *in situ*. Details of the aedeagal apex are not easily discerned at magnifications less than 100 ×.

KEY TO THE NORTH AMERICAN SPECIES OF DELTOCEPHALUS

1. Apical upturned portion of aedeagus with minute teeth on or near distal margin below apex 2
 Apical upturned portion of aedeagus without teeth of any sort below apex 6
2. Apical portion of aedeagal shaft strongly curved posteriorly (fig. 5), aedeagal apex simple (fig. 2) *nigriventer* Sanders & DeLong
 Apical portion of aedeagal shaft not or but slightly curved posteriorly, aedeagal apex usually appearing hooked on proximal or distal margins or both 3
3. Face marked with a pair of black longitudinal stripes (fig. 7)
 *lineatifrons* Oman
 Face marked with variable black areas, never in form of longitudinal stripes 4
4. Gap between mesal and lateral lobes of style wide and deep (fig. 13); clypellus and lora yellowish to pale brown; length of male 3 mm or more *zephyrius* Van Duzee
 Gap between mesal and lateral lobes of style narrow; clypellus and lora black or heavily embrowned; length of male 3 mm or less 5
5. Aedeagal apex hooked on proximal margin (fig. 24)
 *pulicaris* (Fallén)
 Aedeagal apex rounded or angular on proximal margin (figs. 29-30) *castoreus* Ball
6. Aedeagal apex with proximal margin smoothly rounded and distal margin roundly protuberant (fig. 37); shaft slender *vanfus* n. sp.
 Aedeagal apex with proximal margin hooked or produced anteriorly or smoothly rounded on both proximal and distal margins; shaft slender or stout 7
7. Distal margin of aedeagus below apex with a narrow fin (fig. 44); gap between mesal and lateral lobes of style wide (fig. 40)
 *artemisiae* (Gillette & Baker)
 Distal margin of aedeagus below apex without a fin of any sort; gap between mesal and lateral lobes of style variable 8
8. Mesal lobe of style not fingerlike (fig. 49), gap between mesal and lateral lobes narrow and shallow (fig. 49) *gnarus* Ball
 Mesal lobe of style fingerlike (fig. 69), gap between mesal and lateral lobes variable 9

9. Proximal margin of aedeagal apex hooked or appearing acutely produced 10
 Proximal margin of aedeagal apex smoothly rounded or only appearing bluntly produced 11
10. Mesal lobe of style exceptionally long (fig. 62), longer than aedeagus *vanduzeei* Gillette & Baker
 Mesal lobe of style moderately long (fig. 69), shorter than aedeagus *balli* Van Duzee
11. Forewings with veins whitish and cells embrowned; pronotum usually appearing longitudinally banded with lighter and darker areas or forewings black with or without variable paler areas
 *fuscinervosus* Van Duzee
 Forewings with veins whitish to pale greenish and cells pale, rarely slightly fumose; pronotum rarely appearing longitudinally banded or not at all 12
12. Male plates convex on lateral margins (fig. 87); aedeagus abruptly upturned distally (fig. 89) *beomus* n. sp.
 Male plates straight on lateral margins (fig. 107); aedeagus gradually upturned distally (fig. 104) *minutus* Van Duzee

Deltocephalus nigriventer Sanders and DeLong (Figures 1-5)

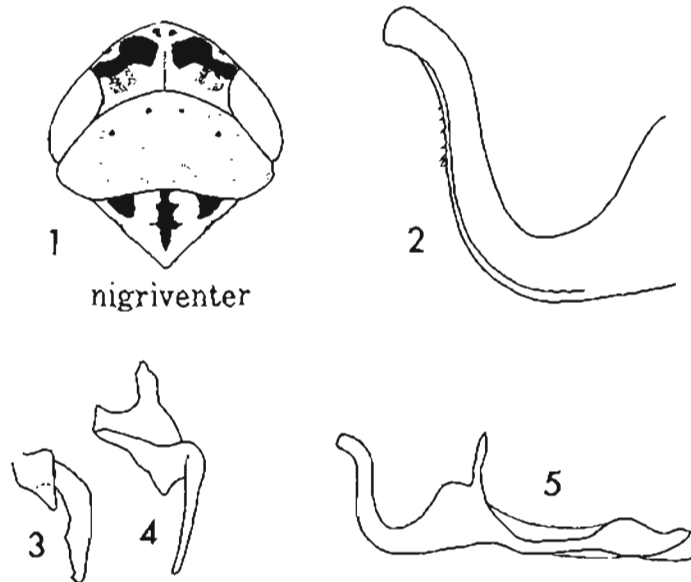
Deltocephalus nigriventer Sanders and DeLong 1917a: 85.

Length. — Male 2.6-3.2 mm. Female 3.2-3.5 mm.

Structure. — Forewings long, extending well beyond apex of abdomen. Venation complete or not; if not, with but one crossvein between sectors, central antepical cell undivided, and outer antepical cell much reduced or absent. Specimens may have one or various combinations of these venational variations.

Coloration. — Fairly consistent; venter of abdomen and thorax fuscous to black, at times touched with sordid yellowish; legs sordid yellowish and variably touched with black to nearly entirely fuscous or black; face sordid yellowish with all sutures and clypeal arcs fuscous to black, usually with additional darkened areas on genae and clypellus. Ground color of crown, pronotum, and scutellum sordid white or yellowish to pale brown and typically marked with darker shades of brown to black (fig. 1), black markings on crown and scutellum may vary somewhat in size and shape, stripes on pronotum at times more intense than shown or nearly absent. Forewings mottled with white and various shades of brown, some specimens darker than others.

Male genitalia. — Aedeagus in lateral view (fig. 5) with shaft narrowed and strongly upturned distally, extreme apical portion (fig. 2) turned caudad with minute teeth on distal margin below apex. Style in dorsal view (fig. 4) with mesal lobe long and slender. Distal portion of style in lateral view (fig. 3) with mesal lobe curved from base.



Text Figs. 1-5. — *Deltocephalus nigriventer* Sanders and DeLong. Fig. 1, head and thoracic dorsum; fig. 2, distal portion of aedeagus in lateral view; fig. 3, distal portion of style in laterodorsal view; fig. 4, style in dorsal view; fig. 5, aedeagus and connective in lateral view.

Female genitalia. — Posterior margin of pregenital sternum irregularly transverse or slightly produced at middle with a variably developed notch centrally.

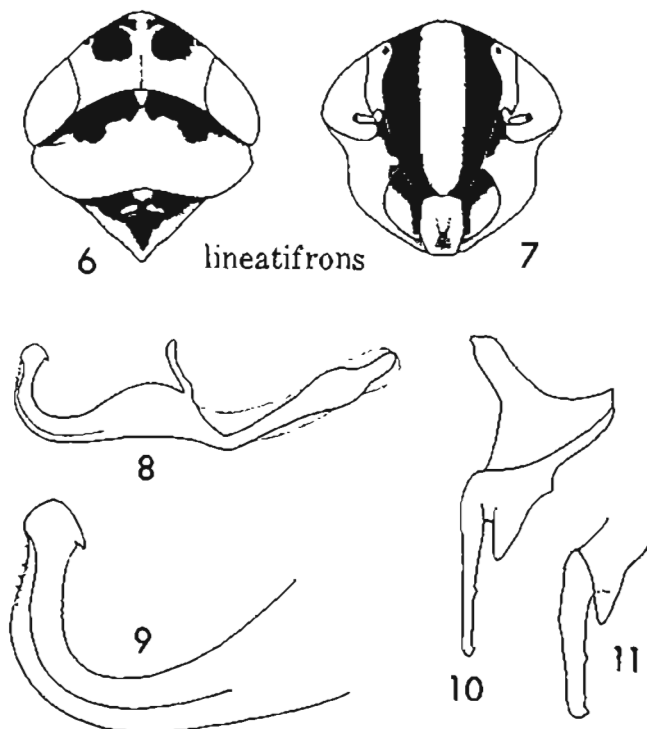
Records. — The type locality is Merrillan, Wisconsin. My confirmed records: ALASKA, Anchorage, Matanuska; BRITISH COLUMBIA, Bear Lake; COLORADO, Chamber's Lake, Gould; MICHIGAN, Escanaba; UTAH, Brighton; WASHINGTON, Colokum Pass; WISCONSIN, Cheboygan; WYOMING, Yellowstone National Park.

Notes. — The aedeagus of *nigriventer* provides the best characters for identifying the species. The coronal marking, mottled forewings, and female pregenital sternum are also useful. The only specimens recorded with host plant data are from Chamber's Lake, Larimer County, Colorado; these were collected in a *Carex* meadow. This northern species has also been recorded in the literature from New York and Quebec.

***Deltocephalus lineatifrons* Oman**

(Figures 6-11)

Deltocephalus lineatifrons Oman 1931b: 432.*Length.* — Male 2.6-3.0 mm. Female 3.1-3.3 mm.*Structure.* — Forewings long and extending well beyond abdomen (macropterous forms) or shortened and exposing tips of abdomen with each appendix reduced and apical cells shortened (submacropterous forms). Central anteapical cell usually undivided and outer anteapical cell usually reduced and sometimes absent.*Coloration.* — Fairly consistent; venter of abdomen, thorax, and legs ivory to yellowish and lightly to heavily infuscated and appearing largely dark; face (fig. 7) ivory to yellowish and marked with a pair of wide longitudinal black stripes as shown, intensity of markings may vary. Crown with same ground color as face and marked with black near anterior margin (fig. 6), markings near extreme apex may be separated and appear as a pair of dots; pronotum largely whitish marked with fuscous to black along anterior margin, intensity and form of marking vary; scutellum ivory to yellowish and nearly unmarked to heavily infuscated. Forewings milky hyaline to hyaline and marked with brownish, fuscous, or black irregular patches; in strongly marked specimens each forewing marked as follows: small patch on clavus just behind lateral margin of pronotum, large elongate oblique patch at center of clavus touching commissural margin and claval suture (when forewings at rest, these markings form an irregular "V" with its apex directed posteriorly), narrow elongate darkening distally on clavus along commissural margin, and large transverse patches on corium at middle of discal cells and apical half of preapical cells. These markings vary but at least traces of the oblique claval patch and the two corial patches present.*Male genitalia.* — Aedeagus in lateral view (fig. 8) with shaft narrowed and strongly upturned distally, extreme apical portion (fig. 9) roundly protuberant on distal margin, sharply hooked on proximal margin, and with minute teeth on distal margin below apex. Roundness of extreme apex, length of proximal hook, and size and number of marginal teeth somewhat variable. Style in dorsal view (fig. 10) with mesal lobe long and slender. Distal portion of style in dorsolateral view (fig. 11) not strongly curved.*Female genitalia.* — Posterior margin of pregenital sternum with lateral margins rounded, central portion rather broadly excavated with a variably developed tooth at center of excavation.*Records.* — The type locality is Spicer's, North Park, Colorado. My confirmed records: BRITISH COLUMBIA, Merritt; COLORADO, Cameron Pass, Gould, North Park, Rabbit Ear's Pass; MANITOBA, Hartney, Red Deer River; MONTANA, Whitehall; NORTH DAKOTA, Tokio; WYOMING, Yellowstone National Park.



Text Figs. 6-11. — *Deltocephalus lineatifrons* Oman. Fig. 6, head and thoracic dorsum; fig. 7, face; fig. 8, aedeagus and connective in lateral view; fig. 9, distal portion of aedeagus in lateral view; fig. 10, style in dorsal view; fig. 11, distal portion of style in dorsolateral view.

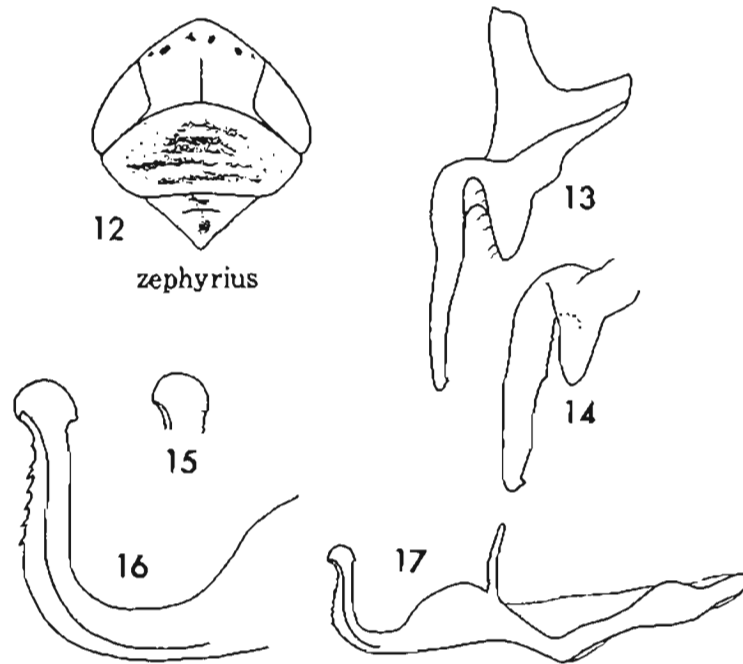
Notes. — The pair of dark stripes on the face distinguish *lineatifrons* at once from all other species of *Deltocephalus*. The aedeagus is not greatly different from that of *pulicaris*, however. The habitus in dorsal aspect resembles the less heavily pigmented specimens of *castoreus*. The type of *lineatifrons* was collected on "grass, *Carex*, and a little *Potentilla*." Other Colorado specimens were recorded "on mostly *Carex*."

***Deltocephalus zephyrius* Van Duzee**

(Figures 12-17)

Deltocephalus zephyrius Van Duzee 1925b: 418.

Deltocephalus chintinomy DeLong 1926d: 86. New Synonymy.



Text Figs. 12-17. — *Deltocephalus zephyrius* Van Duzee. Fig. 12, head and thoracic dorsum; fig. 13, style in dorsal view; fig. 14, distal portion of style in dorsolateral view; fig. 15, aedeagal apex in lateral view (Oregon); fig. 16, distal portion of aedeagus in lateral view (Washington); fig. 17, aedeagus and connective in lateral view (Washington paratype).

Length. — Male 3.0-3.3 mm. Female 3.3-3.8 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or shortened and exposing dorsum of genital segment with each appendix much reduced and apical cells shortened (submacropterous forms). Central anteapical cell usually undivided.

Coloration. — Variable; venter of abdomen and thorax fuscous to black, at times variably touched with yellowish; legs yellowish to pale brown and infuscated or not; face with same ground color as legs, sutures narrowly darkened, arcs on clypeus darkened but usually only on upper three-fourths or less, antennal pits darkened, lower portion of face (genae, lora, and clypellus) usually without definite markings, at times with a small darkened area near middle of apical margin of clypellus. Crown yellowish to pale sordid brown and in strongly marked specimens (fig. 12) with four small spots between ocelli, any or all of the spots may be lacking; pronotum and scutellum with ground color of crown and variably darkened (fig. 12).

Forewings pale brown, veins white to pale brown, cells usually not or only vaguely infuscated.

Male genitalia. — Aedeagus in lateral view (fig. 17) with shaft narrowed and strongly upturned distally, extreme apical portion (figs. 15-16) protuberant on distal margin and bluntly hooked on proximal margin with teeth on distal margin below apex. Style in dorsal view (fig. 13) with gap between mesal and lateral lobes wide and deep. Distal portion of style in dorsolateral view (fig. 14) with mesal lobe not curved.

Female genitalia. — Posterior margin of pregenital sternum highly variable, lateral margins rounded, central portion variably excavated or notched, and with or without a tooth at center of excavation or notch.

Records. — The type locality is Forks, Clallam Co., Washington. My confirmed records: OREGON, Culver, Mary's Peak, Benton Co.; WASHINGTON, Forks, Kalama, Tacoma.

Notes. — The features mentioned in the key to species provide an adequate basis for the recognition of *zephyrius*. The only specimens with host plant association were collected by Dr. P. W. Oman in July, 1969, at 200-300 ft. below the summit of Mary's Peak, Benton Co., Oregon on *Festuca idahoensis*. DeLong's *chintinomy* was also taken at this locality some forty years earlier.

Deltocephalus pulicaris (Fallén) (Figures 18-24)

Cicada pulicaris Fallén 1806a: 21.

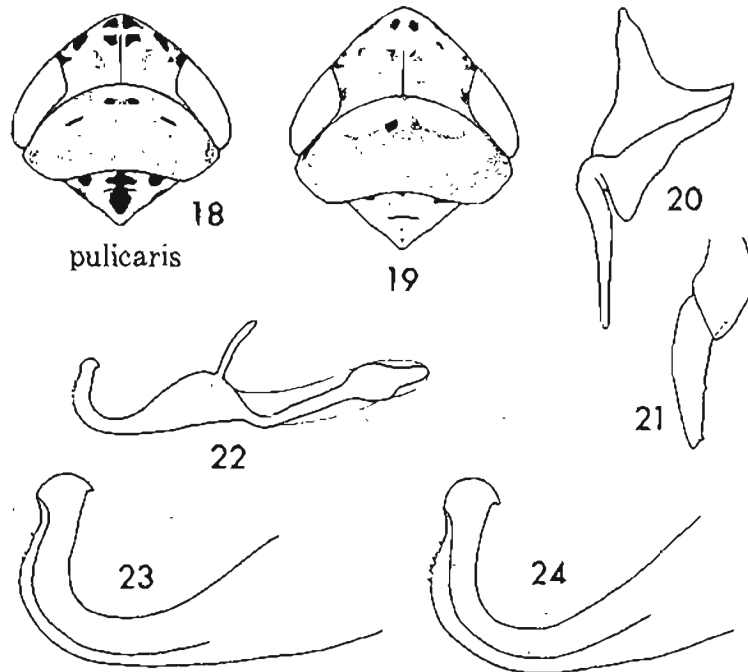
Deltocephalus infumatus Osborn 1915a: 118. Reinstated Synonymy.

Length. — Male 2.5-2.8 mm. Female 2.6-3.1 mm.

Structure. — Forewings long and extending well beyond abdomen (macrop-terous forms) or shortened and exposing dorsum of genital segment with each appendix much reduced and apical cells greatly shortened (submacrop-terous forms). Central antepical cell rarely divided, inner antepical cell rarely open basally.

Coloration. — Variable; venter of abdomen and thorax fuscous to black, abdominal segments at times touched with paler yellowish areas; legs pale brown marked with black to nearly entirely fuscous or black and only pale at apices of femora; face largely fuscous to black, extreme upper margin of clypeus, intervals between clypeal arcs, clypeal suture, lower portion of genae, and lower margin of face variably paler. Crown sordid stramineous to pale brown and with only vague darkened areas or variably marked with irregular spots or dashes (figs. 18-19), markings between ocelli at times, fused and appearing as an irregular transverse band; pronotum and scutellum with same ground color as crown and either unmarked or variably darkened (figs. 18-19). Forewings sordid whitish hyaline and variably embrowned, veins usually whitish.

Male genitalia. — Aedeagus in lateral view (fig. 22) with shaft narrowed and strongly upturned distally, extreme apical portion (figs. 23-24) slightly protuberant on distal margin and narrowly hooked on proximal margin with



Text Figs. 18-24. — *Deltocephalus pulicaris* (Fallén). Fig. 18, head and thoracic dorsum (Oregon); fig. 19, same (Maine); fig. 20, style in dorsal view; fig. 21, distal portion of style in lateral view; fig. 22, aedeagus and connective in lateral view; fig. 23, distal portion of aedeagus in lateral view (Stettin, Prussia); fig. 24, same (Rhode Island).

minute teeth on distal margin below apex. Style in dorsal view (fig. 20) typical of genus, with gap between lobes narrow. Distal portion of style in lateral view (fig. 21) with mesal lobe rather straight.

Female genitalia. — Posterior margin of pregenital sternum variable, lateral margins rounded with central portion concave and with or without a distinct broad blunt tooth at middle of concavity.

Records. — The type locality is Stockholm, Sweden. My confirmed records: MAINE, Dixfield, Fort Kent, Orono; NEW HAMPSHIRE, Crawford House; OREGON, Seal Rock; RHODE

ISLAND, Kingston.

Notes. — The structural features noted in the key to species provide a basis for the identification of *pulicaris*. The only specimens I have seen with host plant data were collected on "lawn grass" at Kingston, Rhode Island. This is a common European species which was probably introduced into North America sometime in this or late in the last century. I believe DeLong (1926d: 92) was correct in synonymizing Osborn's *infumatus* with *pulicaris*, an action reversed by Oman (1949a: 173).

***Deltocephalus castoreus* Ball** (Figures 25-31)

Deltocephalus castoreus Ball 1899d: 308.

Acucephalus giffardi Van Duzee 1917a: 293.

Length. — Male 2.5-2.7 mm. Female 2.6-2.8 mm.

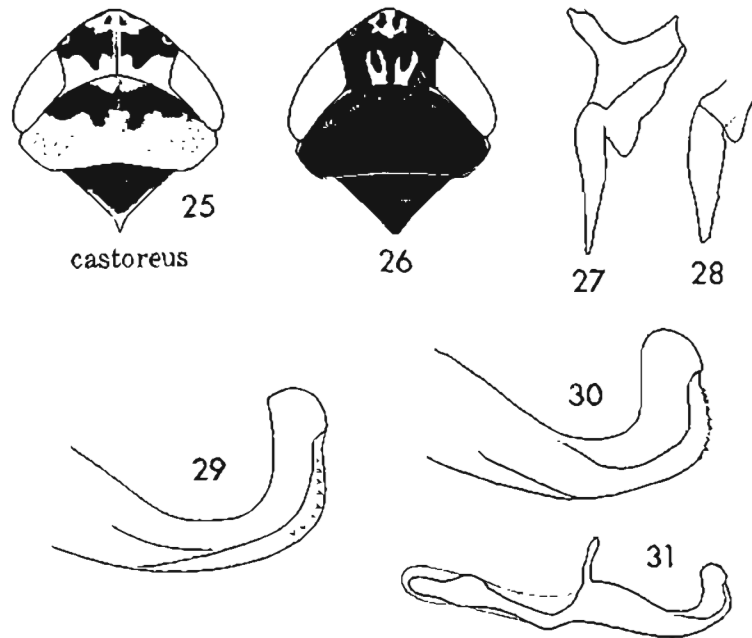
Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or shortened and exposing dorsum of genital segment with each appendix reduced and apical cells shortened (submacropterous forms). Central anteapical cell usually undivided. Venation difficult to discern in heavily pigmented specimens.

Coloration. — Highly variable; venter of abdomen and thorax fuscous to black, segments often touched with small yellowish areas on margins; legs pale brown with femora, except apices, and hind tibiae variably infuscated or blackened; face like that of *pulicaris* except often with small paler areas on lora and clypellus. Crown sordid white or yellowish with variable darker markings (fig. 25) or fuscous with a few highly variable paler areas (fig. 26) or entirely fuscous; pronotum varying from sordid whitish or yellowish with only area along anterior margin variably fuscous or black to entirely dark fuscous; scutellum darkened basally and mesally to entirely dark fuscous. Forewings sordid whitish and marked with fuscous like those of *lineatifrons* grading to darker heavily infuscated forms with only traces of paler areas on veins or apical cells.

Male genitalia. — Aedeagus in lateral view (fig. 31) with shaft somewhat narrowed and strongly upturned distally, extreme apical portion (figs. 29-30) comparatively stout, slightly protuberant on distal margin and rounded or angular on proximal margin with minute teeth on or near distal margin below apex. Style in dorsal view (fig. 27) typical of genus. Distal portion of style in lateral view (fig. 28) with mesal lobe rather straight.

Female genitalia. — Posterior margin of pregenital sternum variable, lateral margins rounded, central portion concave with a variously developed tooth at center.

Records. — The type locality is the headwaters of the Little Beaver (9500 ft. alt.), Larimer Co., Colorado. My confirmed



Text Figs. 25-31. — *Deltocephalus castoreus* Ball. Fig. 25, head and thoracic dorsum; fig. 26, same (dark form); fig. 27, style in dorsal view; fig. 28, distal portion of style in lateral view; fig. 29, distal portion of aedeagus in lateral view (Colorado holotype); fig. 30, same (Colorado); fig. 31, aedeagus and connective in lateral view.

records: BRITISH COLUMBIA, Merritt; CALIFORNIA, Echo, Soda Springs, Placer Co.; COLORADO, Cameron Pass, Gould, headwaters of the Little Beaver, Northgate, Waldon; MONTANA, Anaconda; UTAH, Ephraim; WYOMING, Yellowstone National Park.

Notes. — Because this species is both variable in color pattern and in the critical features of the aedeagus, it is not possible to point out any features in addition to those noted in the key. The minute teeth on the upturned portion of the aedeagal shaft are frequently much reduced and difficult to see with less than 150 \times . The shape of the distal upturned portion of the shaft approaches that of some specimens of *fuscinervosus*, but the minute teeth are absent in that species. The only specimens bearing host plant data

are from Cameron Pass, Colorado, and were taken "on mostly *Carex*."

***Deltocephalus vanfus* n. sp.** (Figures 32-37)

Length. — Male 2.2-3.2 mm. Female 3.0-3.5 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or shortened and exposing tip of abdomen (submacropterous forms). Central anteapical cell divided or not, outer anteapical cell at times much reduced. Venation difficult to discern in heavily pigmented specimens.

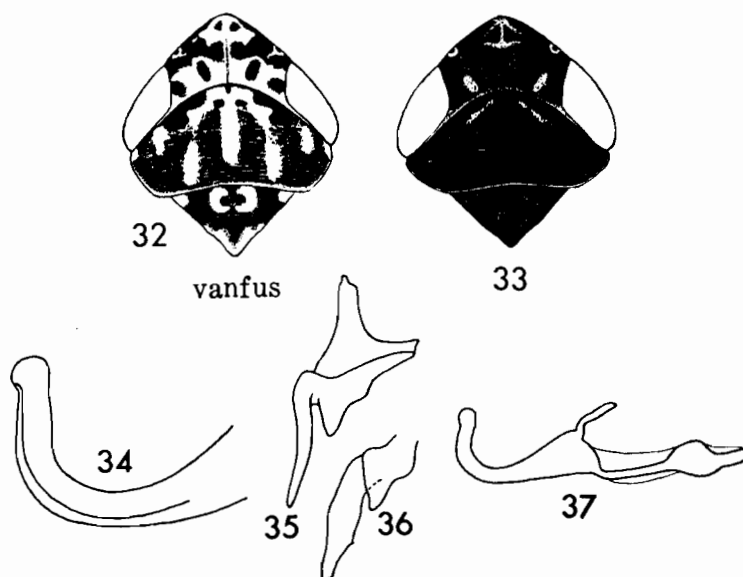
Coloration. — Highly variable; venter of abdomen and thorax fuscous to nearly black, usually without paler areas; legs pale brown and heavily infuscated to entirely fuscous; face fuscous to nearly black, intervals between clypeal arcs pale, sometimes lower portion of face with touches of paler areas. Crown, pronotum, and scutellum varying from pale brown with fuscous to black markings (fig. 32) to nearly entirely fuscous with a few paler areas (fig. 33); forewings varying from pale brown with veins whitish and cells infuscated to entirely fuscous.

Male genitalia. — Aedeagus in lateral view (fig. 37) with shaft narrowed and strongly upturned distally, extreme apical portion (fig. 34) roundly protuberant on distal margin and smoothly rounded on proximal margin. Style in dorsal view (fig. 35) typical of genus. Distal portion of style in dorsolateral view (fig. 36) with mesal lobe stout.

Female genitalia. — Posterior margin of pregenital sternum variable, lateral margins rounded, central portion concave with or without a short broad tooth at center.

Records. — Holotype male (fig. 32), Paulina, Oregon, 27 September 1947, J. E. Davis (USNM type no. 70811). My confirmed records: BRITISH COLUMBIA, Saanich District; CALIFORNIA, Sequoia National Park; IDAHO, Catalo, Moscow; MONTANA, Deborgia; OREGON, Black Butte, Cannon Beach, Corvallis, Dufur, Hot Lake, Klamath Falls, Lapine, Mary's Peak, McMinnville, Medford, Merlin, Paulina, Seal Rock, Sparks, Talent, Yoncalla; WASHINGTON, Vancouver, Sumner, Kalama, Puyallup.

Notes. — The features noted in the key provide a basis for separating *vanfus* from its congeners. This species has been confused in the past with *fuscinervosus*. Some of the aedeagal variants of *fuscinervosus* resemble *vanfus*, but they are more robust with a less well defined round protuberance on the distal margin of the extreme apical portion. The host plant of *vanfus* is not known.



Text Figs. 32-37. — *Deltocephalus vanfus* n. sp. Fig. 32, head and thoracic dorsum; fig. 33, same (dark form); fig. 34, distal portion of aedeagus in lateral view; fig. 35, style in dorsal view; fig. 36, distal portion of style in dorsolateral view; fig. 37, aedeagus and connective in lateral view.

***Deltocephalus artemisiae* (Gillette and Baker) (Figures 38-47)**

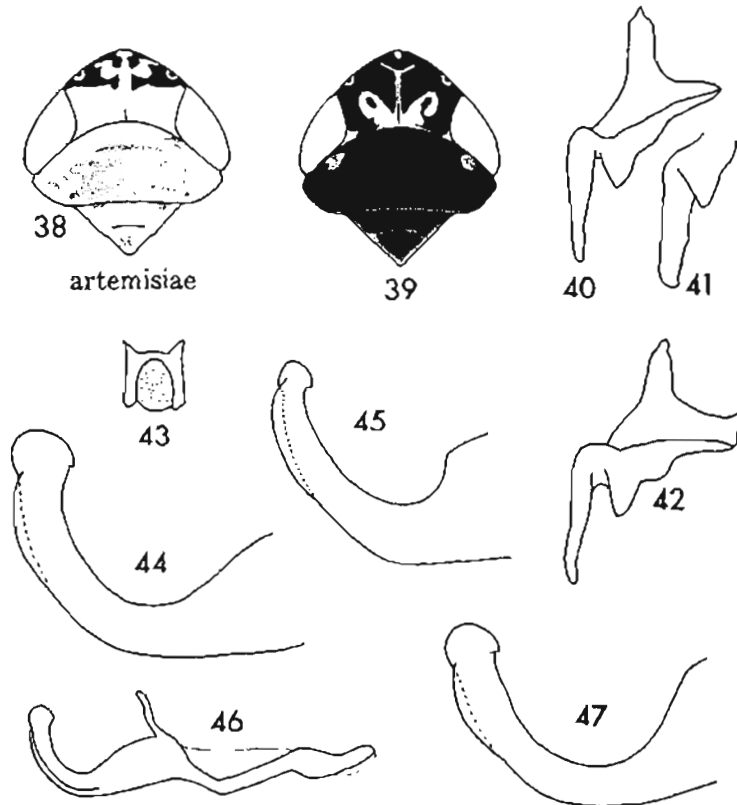
Athysanus artemisiae Gillette and Baker 1895a: 91.

Length. — Male 2.4-2.8 mm. Female 2.8-3.3 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or much shortened and exposing dorsum of genital segment and often dorsum of pregenital segment with apical cells much shortened (submacropterous forms). Inner anteapical cell at times open basally, central anteapical cell rarely divided, outer anteapical cell sometimes reduced or absent.

Coloration. — Highly variable; venter of abdomen and thorax stramineous with slight or no darkened areas to entirely fuscous or black; legs unmarked stramineous to entirely fuscous or black; face stramineous with or without slightly darkened clypeal arcs to entirely fuscous or black with only intervals between clypeal arcs irregularly paler. Crown, pronotum, and scutellum sordid stramineous to pale brown and unmarked to with variable darkened areas along anterior margin (fig. 38) grading to entirely fuscous forms with few paler areas (fig. 39), sometimes entirely fuscous to

black; forewings stramineous with or without variable infuscation to entirely fuscous except for pale apical third.



Text Figs. 38-47. — *Deltocephalus artemisiae* (Gillette and Baker). Fig. 38, head and thoracic dorsum; fig. 39, same (dark form); fig. 40, style in dorsal view; fig. 41, distal portion of style in dorsolateral view; fig. 42, style in dorsal view; fig. 43, aedeagal apex in dorsal view; fig. 44, distal portion of aedeagus in lateral view (Oregon); fig. 45, same (Utah); fig. 46, aedeagus and connective in lateral view; fig. 47, distal portion of aedeagus in lateral view (Colorado).

Male genitalia. — Aedeagus in lateral view (fig. 46) with shaft narrowed and strongly upturned distally, extreme apical portion (figs. 44-45, 47) variably rounded, slightly hooked near apex on proximal margin, and with a

narrow fin below apex on distal margin, fin at times extremely finely serrated. Style in dorsal view (figs. 40, 42) with gap between lobes comparatively wide and deep. Distal portion of style in dorsolateral view (fig. 41) with mesal lobe stout.

Female genitalia. — Posterior margin of pregenital sternum somewhat variable, lateral margins rounded, middle third excavated, and with or without a small blunt tooth at center of excavation.

Records. — The type locality is "on Grizzly Creek, in mountains southwest of North Park [Colorado]." My confirmed records: COLORADO, Chamber's Lake, Fort Collins, Greeley, North Park; OREGON, French Glen; UTAH, Brighton, Ephraim, Strawberry Dam.

Notes. — The narrow aedeagal fin and the widely separated lobes of the style distinguish this species. The fin is actually a pair of fins (fig. 43), but only one is visible in lateral view. The color variations of *artemisiae* are among the most extensive in the genus. The type was collected on *Artemisia tridentata* according to the original description.

Deltocephalus gnarus Ball

(Figures 48-52)

Deltocephalus gnarus Ball 1900c: 345.

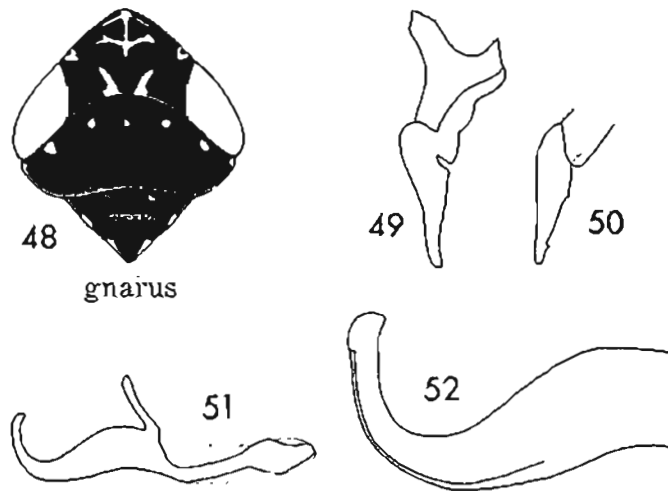
Length. — Male 2.2-2.4 mm. Female 2.6-2.9 mm.

Structure. — Forewings long and extending well beyond abdomen (macrop-terous forms). Outer anteapical cell often reduced and sometimes absent. No specimens seen with central anteapical cell divided. No submacropterous specimens seen.

Coloration. — Fairly consistent; venter of abdomen and thorax fuscous to black, edges of segments sometimes paler; legs yellowish and lightly or heavily infuscated; face mainly fuscous to black with intervals between clypeal arcs, clypeal suture, small irregular markings on lower face (genae, lora, and clypellus) yellowish; crown, pronotum and scutellum dark fuscous to black with variable yellowish areas (fig. 48). Forewings milky hyaline and either unicolorous or variably embrowned.

Male genitalia. — Aedeagus in lateral view (fig. 51) with shaft narrowed and strongly upturned distally, extreme apical portion (fig. 52) produced somewhat on proximal margin. Style in dorsal view (fig. 49) with gap between lobes narrow and shallow, mesal lobe not fingerlike. Distal portion of style in lateral view (fig. 50) tapering toward apex.

Female genitalia. — Posterior margin of pregenital sternum with lateral margins rounded, middle half broadly excavated with margins of excavation converging at center to a short blunt tooth.



Text Figs. 48-52. — *Deltocephalus gnarus* Ball. Fig. 48, head and thoracic dorsum; fig. 49, style in dorsal view; fig. 50, distal portion of style in lateral view; fig. 51, aedeagus and connective in lateral view; fig. 52, distal portion of aedeagus in lateral view.

Records. — The type locality is Ames, Iowa. My confirmed records: ILLINOIS, Beach, Champaign, Oak Lawn, Urbana; IOWA, Ames; KANSAS, Hutchinson, Larned, Medora.

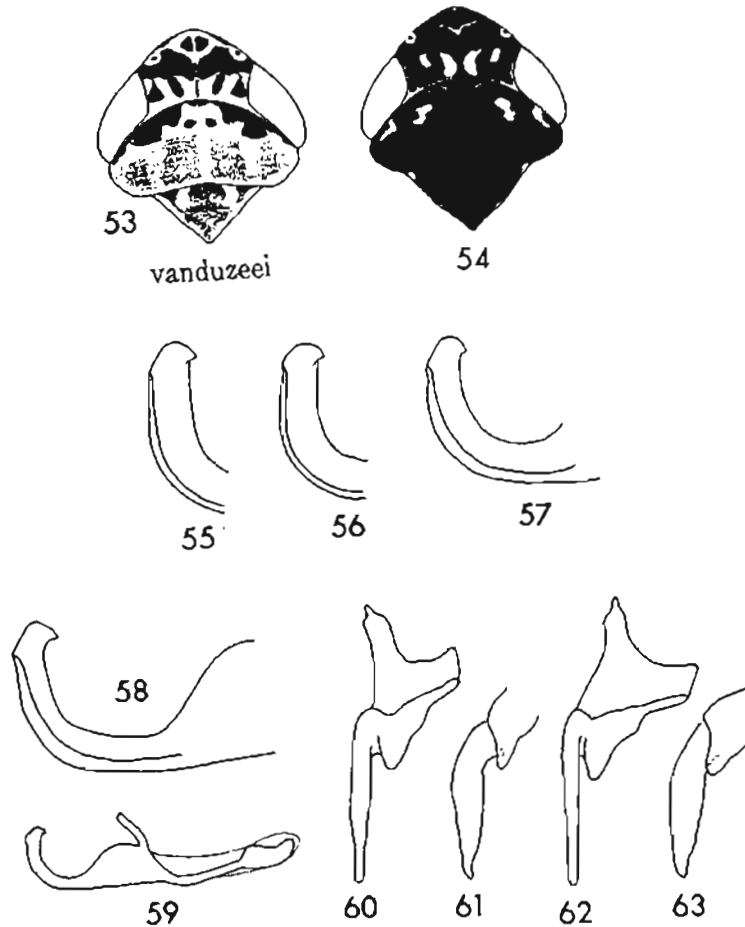
Notes. — The shape of the style distinguishes this species from its congeners. In dorsal aspect, the habitus, a dark head and thorax contrasting quite sharply with the paler forewings, is helpful in the recognition of *gnarus*. The type series was collected on "dog-hair," *Juncus*, growing on the margins of a pond. DeLong (1948a: 250) reported *gnarus* as occurring on *Eleocharis* and similar aquatic plants. Other published state records include Tennessee and South Dakota.

***Deltocephalus vanduzeei* Gillette and Baker (Figures 53-63)**

Deltocephalus vanduzeei (sic) Gillette and Baker 1895a: 90.

Length. — Male 2.5-2.8 mm. Female 2.7-3.2 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or shortened and exposing dorsum of genital segment with apical cells much shortened (submacropterous forms). Inner antepical cell



Text Figs. 53-63. — *Deltocephalus vanduzeei* Gillette and Baker. Fig. 53, head and thoracic dorsum; fig. 54, same (dark form); figs. 55-58, distal portion of aedeagus in lateral view showing variations in apex; fig. 59, aedeagus and connective in lateral view; fig. 60, style in dorsal view (Colorado); fig. 61, distal portion of style in dorsolateral view; fig. 62, style in dorsal view (Oregon); fig. 63, distal portion of style in dorsolateral view.

rarely open basally, central anteapical cell divided or not, outer anteapical cell usually not reduced.

Coloration. — Highly variable; venter of abdomen and thorax fuscous to black with edges of segments sometimes paler; legs varying from pale brown with light infuscations to nearly black and paler only at apices of femora;

face varying from pale brown with black clypeal arcs to nearly entirely fuscous or black with only intervals between clypeal arcs paler and a few paler areas on lower face. Crown, pronotum, and scutellum varying from sordid stramineous or pale brown variably marked with fuscous or black (fig. 53) to nearly all fuscous or black with a few paler areas (fig. 54), pronotum in lighter forms often appearing irregularly striped longitudinally; forewings varying from sordid stramineous with light or moderately heavy infuscations to entirely fuscous with veins almost always paler.

Male genitalia. — Aedeagus in lateral view (fig. 59) with shaft narrowed and strongly upturned distally, extreme apical portion (figs. 55-58) variably rounded, hooked near apex on proximal margin and usually more or less flattened near apex on distal margin. Style in dorsal view (figs. 60, 62) with mesal lobe excessively long. Distal portion of style in dorsolateral view (figs. 61, 63) with mesal lobe stout and tapering to a weakly defined hook.

Female genitalia. — Posterior margin of pregenital sternum fairly consistent, lateral margins rounded, middle half with a broad, moderately deep, v-shaped incision, without a tooth at center of incision.

Records. — The type locality is Leadville, Colorado. My confirmed records: ARIZONA, Kaibab, Mt. Graham; BRITISH COLUMBIA, Goldstream, Oliver; COLORADO, Cameron Pass, Chamber's Lake, Creede, Fort Collins, Gould, Happy Hollow, Little Beaver, Muddy Pass, Northgate, North Park, Pingree Park, Rabbit Ears Pass, Ward; IDAHO, Moscow; MONTANA, Missoula; OREGON, North Powder; UTAH, Brighton, Strawberry Dam, Uintah; WYOMING, Yellowstone National Park.

Notes. — The excessively long mesal lobe of the style, which is longer than the aedeagus, is the best single distinctive feature of this variable species. The only host plant associations recorded with some of the Colorado specimens are "grass and *Carex* meadows."

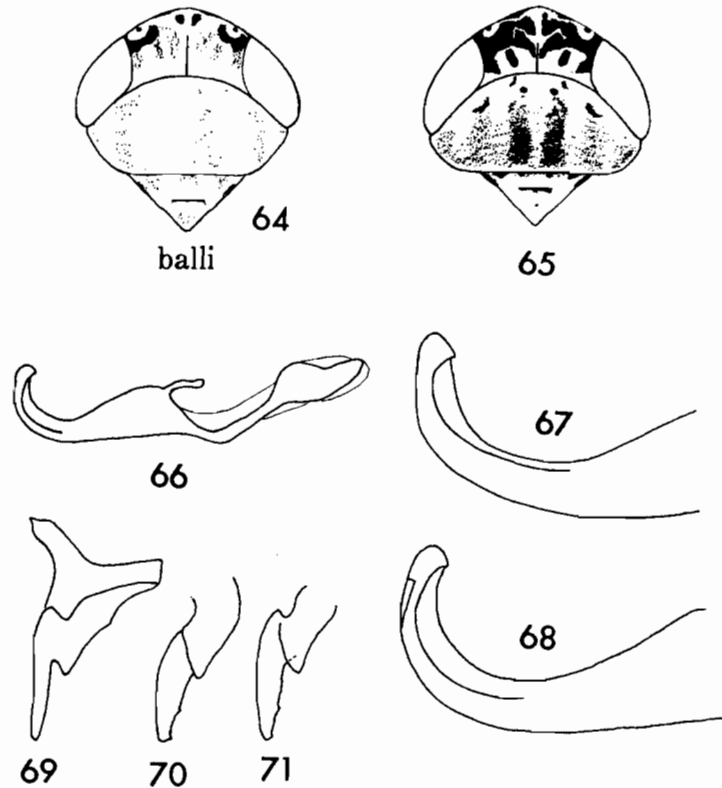
Deltocephalus balli Van Duzee (Figures 64-71)

Deltocephalus balli Van Duzee 1894a: 293.

Length. — Male 2.8-3.3 mm. Female 3.5-4.1 mm.

Structure. — Head tending to be less angular apically than in congeners. Forewings long and extending well beyond abdomen (macropterous forms). Central anteapical cell divided or not, outer anteapical cell sometimes reduced. Submacropterous forms not seen.

Coloration. — Somewhat variable; venter of abdomen and thorax dark fuscous to black, edges of segments variably paler; legs pale brownish and variably infuscated; face pale brown to sordid stramineous and marked with



Text Figs. 64-71. — *Deltocephalus balli* Van Duzee. Fig. 64, head and thoracic dorsum (northern Illinois); fig. 65, same (California); fig. 66, aedeagus and connective in lateral view; fig. 67, distal portion of aedeagus in lateral view (Oregon); fig. 68, same (New Hampshire); fig. 69, style in dorsal view; fig. 70, distal portion of style in lateral view; fig. 71, distal portion of style in dorsolateral view.

black on clypeal arcs and irregularly on genae, lora, and clypellus. Crown, pronotum, and scutellum rarely without definite markings, usually marked with various shades of brown to black (figs. 64-65), pronotum often appearing irregularly striped longitudinally. Forewings sordid whitish or stramineous to pale brown, cells not or lightly to heavily infuscated.

Male genitalia. — Aedeagus in lateral view (fig. 66) with shaft narrowed and strongly upturned distally, extreme apical portion (figs. 67-68) variably rounded, hooked near apex on proximal margin and rounded near apex on distal margin. Style in dorsal view (fig. 69) with mesal lobe comparatively short. Distal portion of style in lateral view (fig. 70) and in dorsolateral

view (fig. 71) stout and not strongly curved.

Female genitalia. — Posterior margin of pregenital sternum fairly uniform, lateral margins sharply rounded, middle half strongly concave, with a short and usually acute tooth at center of concavity.

Records. — The type locality is Ames, Iowa. My confirmed records: ALBERTA, Lethbridge; CALIFORNIA, Grass Valley, Lemon Cove, Lissonx; COLORADO, Akron, Fort Collins; ILLINOIS, Algonquin; IOWA, Ames; KANSAS, Douglas Co., Ellsworth Co., Hodgeman Co., Pratt Co., Republic Co., Saline Co., Washington Co.; MARYLAND, Beltsville; NEW HAMPSHIRE, Bath; OREGON, Eagle Rock, Fields, French Glen, Lily Lake, Malheur Wild Life Refuge, Van Horn Creek; UTAH, Logan, Richfield, St. George, Salt Lake City.

Notes. — The comparatively short mesal lobe of the style and apical portion of the aedeagus provide the best basis for the identification of *balli*. This is the only species of *Deltocephalus* with a transcontinental distribution. *D. balli* has been collected in Maryland on *Juncus tenuis* and *Juncus acuminatus*.

***Deltocephalus fuscinervosus* Van Duzee (Figures 72-83)**

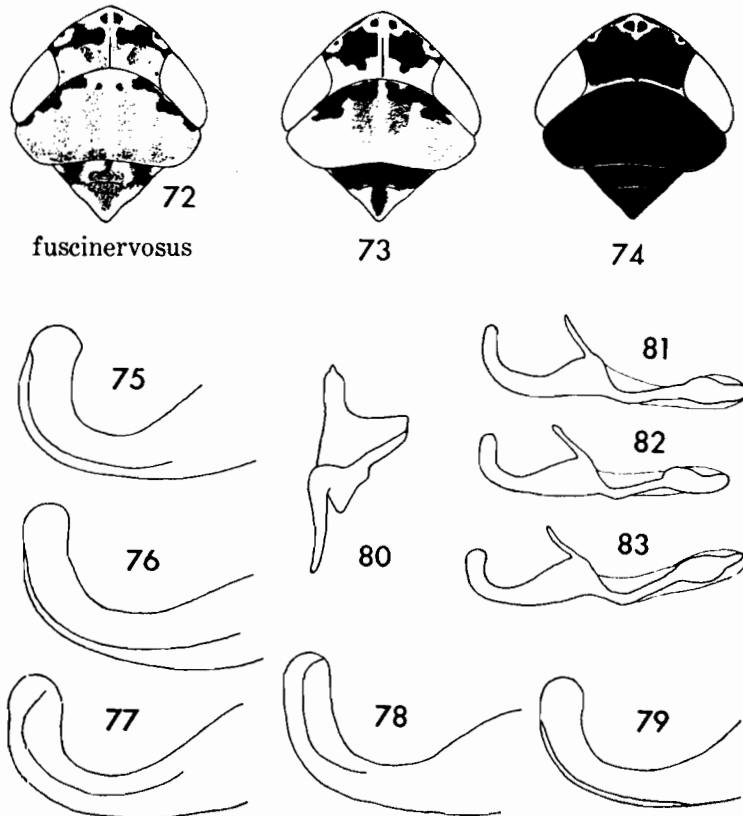
Deltocephalus fuscinervosus Van Duzee 1894f: 207.

Length. — Male 2.2-3.0 mm. Female 2.6-3.5 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or reduced and exposing dorsum of genital segment with apical cells much shortened (submacropterous forms). Central antepical cell divided or not.

Coloration. — Highly variable; venter of abdomen and thorax fuscous to black with edges of segments sometimes paler; legs pale brownish with light infuscation to nearly entirely black; face varying from pale brownish with clypeal arcs black and lower portion of face irregularly blackened to entirely black except for paler areas between clypeal arcs. Crown, pronotum, and scutellum pale brown or sordid stramineous and marked with various shades of brown to black (figs. 72-73) to nearly completely black with a few paler areas (fig. 74). Forewings exceedingly variable, light brown with cells lightly or heavily infuscated grading to forms where infuscations produce irregular transverse markings similar to some forms of *castoreus* to entirely dark fuscous or black with a few pale areas on claval veins and crossveins of corium.

Male genitalia. — Aedeagus in lateral view (figs. 81-83) with shaft variably narrowed and strongly upturned distally, extreme apical portion (figs. 75-79) rounded and not strongly produced on either proximal or distal



Text Figs. 72-83. — *Deltocephalus fuscinosus* Van Duzee. Fig. 72, head and thoracic dorsum (California); fig. 73, same (Washington); fig. 74, same (dark form, Oregon); figs. 75-79, distal portion of aedeagus in lateral view showing variations; fig. 80, style in dorsal view; figs. 81-83, aedeagus and connective in lateral view showing variations.

margins near apex. Style in dorsal view (fig. 80) typical of genus.

Female genitalia. — Posterior margin of pregenital sternum variable, lateral margins rounded or acutely rounded, middle half broadly or narrowly concave, with sides of concavity converging to a variably developed blunt tooth at middle.

Records. — The type locality is California. My confirmed records: CALIFORNIA, Alameda Co., Berkeley, Big Bear Lake, Boulder Creek, Bray, Califa, Cuyamaca Lake, Delta, Dunsmuir,

El Portal, Giant Forest, Honda, Lemon Cove, Leona Heights, Marin Co., Mojave, Montara, Mt. Diablo, Perris, Redding, Sacramento, San Jacinto Mts., Sequoia National Forest, Strawberry, Weed, Winters, Yosemite Valley; IDAHO, Wendell; MONTANA, Garrison; OREGON, French Glen, Klamath, Lost Prairie, Mary's Peak, Medford, Merlin, Mt. Hood; UTAH, Brighton, Logan, Strawberry Dam, Richfield; WASHINGTON, Cheney, Fort Lewis, Puyallup, Spokane, Sumner; WYOMING, Yellowstone National Park.

Notes. — This is the most variable species in *Deltocephalus*. There are all sorts of intergrading color forms even between individuals collected at the same locality on the same date. Some of the variations approach *castoreus* both in color and structure (see notes under that species) and may represent hybrids with that species. *D. fuscinervosus* might prove to be a complex of species, but I have not been able to find consistent structural characters to support this view. In spite of the fact that this species is obviously common, there are no data available concerning its host plant or plants.

***Deltocephalus beomus* n. sp.**

(Figures 84-89)

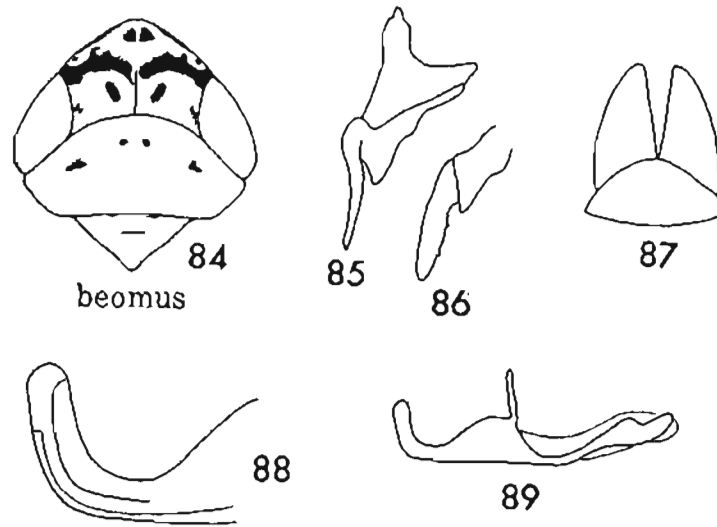
Length. — Male 2.0-2.2 mm. Female 2.4-2.6 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or much shortened and entirely exposing dorsum of genital and pregenital segments with apical cells nearly absent (submacropterous forms). Central anteapical cell not divided, outer anteapical cell often much reduced and at times absent.

Coloration. — Variable; venter of abdomen, thorax, and legs stramineous to pale brown and varying from barely or not infuscated to moderately heavily infuscated and largely dark; face stramineous to pale brown and varying from nearly immaculate to nearly all black with only intervals between clypeal arcs, lateral edges of genae, and apex of clypellus irregularly paler. Crown, pronotum, and scutellum with same ground color as face and varying from immaculate to distinctly marked with black (fig. 84). Forewings varying from hyaline to stramineous hyaline and lightly fumose.

Male genitalia. — Aedeagus in lateral view (fig. 89) with shaft narrowed and rather abruptly upturned distally, extreme apical portion (fig. 89) smoothly rounded and not produced on either proximal or distal margins near apex. Male plates (fig. 87) with lateral margins convex. Style in dorsal view (fig. 85) with mesal lobe slender. Distal portion of style in lateral view (fig. 86) with mesal lobe moderately stout.

Female genitalia. — Posterior margin of pregenital sternum variable, lateral margins rounded, middle half or slightly more strongly excavated, with a variably developed tooth at center of excavation present or absent.



Text Figs. 84-89. — *Deltocephalus beomus* n. sp. Fig. 84, head and thoracic dorsum; fig. 85, style in dorsal view; fig. 86, distal portion of style in lateral view; fig. 87, male plates and valve in ventral view; fig. 88, distal portion of aedeagus in lateral view; fig. 89, aedeagus and connective in lateral view.

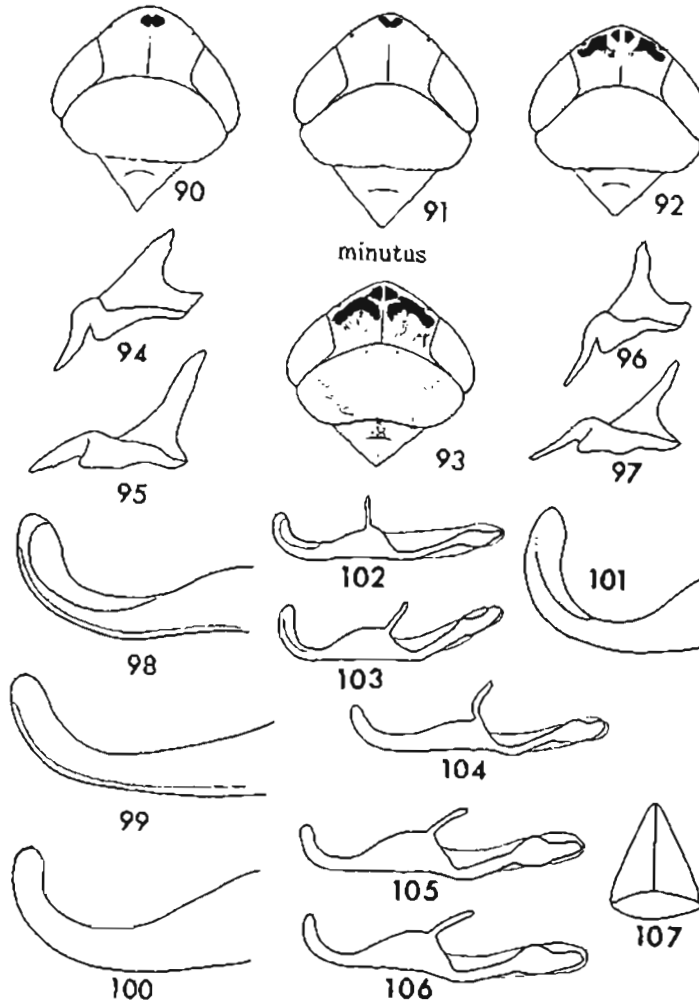
Records. — Holotype male (figs. 84-89), White Mountains, Arizona, 19 June 1950, R. H. Beamer (USNM type no. 70812). My confirmed records: ARIZONA, White mountains.

Notes. — This species is very close to *minutus* but can be separated from that species by the convex male plates. *D. beomus* is known from three males and three females collected at the same time and place. The males are all macropterous and darker than the paler submacropterous females. No host plant is known.

Deltocephalus minutus Van Duzee (Figures 90-107)

Deltocephalus minutus Van Duzee 1890g: 96.

Deltocephalus playensis Oman 1940a: 202. New Synonymy.



Text Figs. 90-107. — *Deltocephalus minutus* Van Duzee. Fig. 90, head and thoracic dorsum (California); fig. 91, same; fig. 92, same (Arizona); fig. 93, same (New Mexico); fig. 94, style in dorsal view (Arizona); fig. 95, style in lateral view; fig. 96, style in dorsal view (California); fig. 97, style in lateral view; figs. 98-101, distal portion of aedeagus in lateral view showing variations; figs. 102-106, aedeagus and connective in lateral view showing variations; fig. 107, male plates and valves in ventral view.

Length. — Male 2.2-2.7 mm. Female 2.8-3.3 mm.

Structure. — Forewings long and extending well beyond abdomen (macropterous forms) or much shortened and exposing entire dorsum of genital segment and most of pregenital segment, with apical cells much shortened and each appendix reduced or absent (submacropterous forms). No specimens seen with central anteapical cell divided; outer anteapical cell often reduced and at times absent.

Coloration. — Variable; venter of abdomen and thorax yellowish tinged with greenish, stramineous, to pale brown and lightly infuscated to heavily infuscated or blackened and appearing largely dark except for edges of segments; legs with ground color of thorax and abdomen and without definite darkened areas or darkened only on femora; face with same ground color of legs and varying from unmarked except for blackened arcs on upper portion of clypeus to nearly entirely dark fuscous or black with only paler areas at upper edge of clypeus and intervals between clypeal arcs and sometimes edges of genae, with intermediates between these extremes. Crown, pronotum, and scutellum stramineous, greenish yellow, to pale brown and immaculate or variably marked with black or shades of brown (figs. 90-93). Forewings hyaline with veins yellowish green to pale brownish, cells not infuscated or fumose.

Male genitalia. — Aedeagus in lateral view (figs. 102-106) with shaft narrowed and variably upturned distally, extreme apical portion (figs. 98-101) variably rounded and not produced on either proximal or distal margin near apex. Male plates (fig. 107) with lateral margins straight. Style in dorsal view (figs. 94, 96) or in lateral view (figs. 95, 97) with mesal lobe variable, moderately stout to slender.

Female genitalia. — Posterior margin of pregenital sternum somewhat variable, lateral margins rounded, middle half excavated, with a variably developed tooth at center of excavation.

Records. — The type locality is California. My confirmed records: ARIZONA, Buckeye, Kirkland Junction, St. John's, Tucson, Yuma; CALIFORNIA, Alpine, Califa, Del Mar, Lancaster, Lemon Cove, Long Beach, Los Angeles, Mint Canyon, Newton, Oxnard, Tulare, Turlock; COLORADO, Grand Junction; MONTANA, Gardiner, Manhatten, Whitehall; NEW MEXICO, Alma Gordo, Cloudcroft, Elks, Pecos, Santa Fe, Silver City, White Sands; NEVADA, Glendale, Overton; OREGON, Klamath, Worden; TEXAS, Alpine, Marfa; UTAH, Richfield, St. George, Salina, Salt Lake City; WASHINGTON, Prosser, Ritzville, Sprague; WYOMING, Laramie.

Notes. — The features noted in the key to species provide a basis for the identification of *minutus*. I synonymize Oman's *play-*

ensis with misgivings because this form tends to be larger and more robust than specimens from the type series of *minutus*. Van Duzee knew *minutus* only from specimens collected along the coast of southern California on "fine matted grasses." Oman's *playensis* was based on material from Arizona and New Mexico without host data. The species, *minutus*, as defined here, has a much more extensive range than previously recorded under either name and includes much of western North America. The differences in the male genital structures in the various forms are matters of degree rather than kind, and for this reason, I am considering *minutus* a single variable species.

LITERATURE CITED

Note. — All citations can be found in:

- METCALF, Z. P. 1964. General Catalogue of the Homoptera. Fascicle VI. Cicadelloidea. Bibliography of the Cicadelloidea (Homoptera: Auchenorrhyncha). Agriculture Research Service. U.S. Dept. of Agriculture. Pp. 1-349.