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## THE GENUS *DELPHACODES* FIEBER IN NORTH CAROLINA (HOMOPTERA: DELPHACIDAE)

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### INTRODUCTION

*Delphacodes* Fieber is the largest genus of the largest family (Delphacidae) of the Fulgoroidea. It has more species represented in North Carolina than any other fulgoroid genus known to occur in the state. A descriptive treatment of the known species of *Delphacodes* in this state has never been published, but lists of species have been published and various species have been treated in a general manner in numerous publications. Formerly, specific identification rested almost entirely upon characters such as color, the shape of the head and cranial topography, which are often variable within the same species. For the most part generic concepts also have been based upon these same, somewhat obscure characters. More recently, characters afforded by the male genitalia have been used to much greater advantage and with much more accuracy. This paper brings together the North Carolina species in a single taxonomic treatment, utilizes the chrotic characters formerly used, as well as the male genitalia, for the identification of species and illustrates them in such a way that non-specialists in the group will be able to make specific determinations. The diagnostic specific characters included have not been illustrated as completely heretofore. In addition, distribution notes from all localities within the state have been included. Nine species have not been previously recorded in North Carolina.

### BIOLOGY

Workers in various groups of the fauna and flora in North Carolina have written on the opportunities for collecting wide ranges of organisms because of its geographic location. Three of Merriam's life zones are represented in the topography of the state. On the western boundary, the Appalachian Mountain range affords a sample of the Canadian zone, while directly eastward lies a narrow portion of the

transition zone. The upper austral zone is represented by a wider area, and the lower austral zone by a long coastline area. Even with such limited collecting of *Delphacodes* as has taken place, species are represented in North Carolina that may be found in areas throughout the Nearctic and Subtropical regions. For this reason localities where a given species has been taken outside the state are also listed below.

Many records of the host plants of *Delphacodes* occur in the literature but a large part of these are in relatively early publications, before the use of genital characters for specific determinations. One should carefully consider previously published host records with this in view. It must also be kept in mind that adults of both brachypterous (short-winged) and macropterous (long-winged) forms often may be taken from plants upon which they happen to be resting but upon which they do not breed.

In general, species of *Delphacodes* inhabit clumps of sedges and grasses growing in low, marshy areas. Metcalf and Osborn (1920) published some observations on *D. detecta* (Van D.) of the intertidal zone of the North Carolina coast. This species occurred in great abundance on a tide grass (species unknown) that grew luxuriantly near the level of low tide and where there were enormous swarms of fiddler crabs. At high tide this grass was completely submerged for a considerable time. This species was not found at any point above the intertidal zone. The authors surmised from the shape of the insects, both nymphs and adults, "that they can crowd themselves into the spaces between the leaf-sheath and stem or into the furrows of the leaf blades in such a manner as to hold their attachment to the plant, detachment from which would in all probability mean disaster." *D. detecta* was taken in Trinidad on *Axonopus compressus* P. Beauv. according to Caldwell and Martorell (1951).

*D. puella* (Van D.), probably the commonest species in the state, has been taken from numerous types of plants and locations. It was abundant in a swampy, bank location along a stream in Georgia (Spooner 1920), was confined to

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grassy, moist locations in the Cranberry Lake Region of New York (Osborn 1922), and was frequent in meadow associations in Ohio (Osborn 1939). Caldwell and Martorell (1951) list *puella* as occurring on bushes, trees, weeds, grasses, and shrubs in Puerto Rico.

*D. pellucida* (F.) has been reported from *Potentilla* spp. in Alberta (Strickland 1953), as a cosmopolitan species common to grass lands especially in more humid localities in New York (Osborn 1922), as frequent in meadow associations of Ohio (Osborn 1939), and from *Carex rostrata* Stokes. and *C. limosa* L. growing on the margin of a swampy lake in Finland (Kontkanen 1950).

*D. campestris* (Van D.) has been taken frequently on prairie grass in Alberta (Strickland 1953), *Agropyron* spp. in Manitoba (McClure 1943), in low bluegrass pastures in Ohio (Osborn 1939), and from marshes surrounding a beach pool in Michigan (Metcalf 1924). *D. lineatipes* (Van D.) has been taken on bushes near a boat landing in Ohio (Osborn 1938). *D. basivitta* (Van D.) was collected from grass in a swamp in Indiana (Heaton 1934). *D. kilmani* (Van D.) was noted to breed abundantly on horsetail (*Equisetum* spp.) in Alberta (Strickland 1953). *D. consimilis* (Van D.) was collected on *Scirpus microcarpus* J. & C. Presl. at Granite Dells, Arizona by Beamer (1951b).

#### ACKNOWLEDGMENTS

The writer is indebted to Dr. David A. Young of North Carolina State College under whose direction the present work was done; to Dr. James P. Kramer of the United States National Museum and Dr. George W. Byers of the Snow Entomological Museum of the University of Kansas who loaned specimens from the collections of their institutions; and to many others who contributed suggestions and aid in preparation of this paper.

#### REVIEW OF LITERATURE

The literature on *Delphacodes* in North Carolina consists mainly of several publications which did no more than catalogue and list the species. In "A List of Homoptera of North Carolina" by Metcalf (1915) and in "A Catalogue of the Hemiptera of America" by Van Duzee (1917) the following species are catalogued; *Liburnia puella*, *L. pellucida*, *L. kilmani*, *L. consimilis*, and *L. laminalis*. The following

species (in addition to the five above) are catalogued in Brimley (1938) and Metcalf (1943): *Delphacodes alexanderi*, *D. basivitta*, *D. detecta*, *D. rotundata*, *D. shermani*, and (*D. unda*) equals *D. campestris*. Brimley (1942) also lists an additional species, *Delphacodes analis*.

More detailed treatments of a few North Carolina species are found in Metcalf (1923) in which are described *Liburnia alexanderi*, *L. shermani*, and (*L. unda*) equals *D. campestris* from specimens collected in North Carolina. In a later paper Metcalf (1949) redescribed these species on the basis of the male genitalia. Beamer (1947) had previously published a redescription of *D. shermani* based upon Kansas specimens but mentioning the original description from North Carolina specimens. Except for these few papers, no other published records exist for any species of *Delphacodes* from North Carolina.

#### MATERIALS AND METHODS

Materials from the sources mentioned above in "acknowledgments," were augmented by specimens which the writer collected during the summer of 1958 on field trips and from trap lights and undetermined material from the collection of the late Dr. Z. P. Metcalf, which is now in the museum of the Department of Entomology at North Carolina State College.

In studying the material, the measurements, general structure and color are noted for a particular species. Then the male genitalia are prepared for microscopic examination and for the illustrations of the specific characters. In all the measurements, two total lengths are given. The first of a pair of measurements for a particular sex is taken from the tip of the crown to the end of the abdomen. The second measurement is taken from the tip of the crown to the apex of the forewings in repose.

The following method is used to study the genital capsule and its contents. The specimen is relaxed overnight in a moistening chamber; then the entire abdomen is removed from the specimen and placed in a solution of about 17 percent caustic potash to soak for approximately two hours. In heavily sclerotized specimens the time for clearing is slightly longer. The abdomen is placed in distilled water for about a minute to stop the caustic action; then placed on a hollow-ground slide in a drop of glycerine. The genital capsule is then removed from the abdomen and examined under a binocular dissecting microscope.

When drawings of the ventrocaudal view of the genital capsule are to be made, the ventrocephalic corner of the pygofer is gently pushed into a very small amount of boric acid ointment, an adhesive, which has been previously smeared in the concavity of the slide before the glycerine was added. The capsule is then oriented so that the diaphragm of the pygofer is perpendicular to the plane of vision. The slide is now moved to a monocular compound microscope for drawing.

The slide is moved back to the binocular microscope, and the capsule removed from the boric acid ointment. One fine needle is placed on the inside of the ventral margin of the pygofer and another on the basal plate (the sclerotized connection between the aedeagus and genital styles). A gentle push everts the aedeagus, genital styles and abdominal segment X. After the capsule is oriented and held in position by the boric acid ointment, the lateral view can be drawn under the monocular microscope. The genital capsule is rotated under the binocular microscope so that the left style presents its broadest aspect. The left style is drawn under a monocular microscope.

After the drawings are completed, the genital structures are retracted into the capsule with the needles and it is placed within the abdomen. The abdomen is next placed in a small amount of glycerine in the bottom of a small vial which is then corked. The pin bearing the specimen is thrust diagonally through the cork so that the glycerine cannot come into contact with the cork, but will remain in the bottom of the vial. All drawings were made with the aid of a camera lucida mounted on the monocular compound microscope.

All drawings from a given aspect represent approximately the same magnification except in *D. dentipennis* Beamer. In this species the magnification of the ventrocaudal view of the genital capsule is the same as in the other species, but the magnifications for the other aspects are two-thirds for the lateral view of the pygofer and aedeagus and one-third for the genital style.

Muir and Giffard (1924) and other workers have applied various terms to the structure of the male genitalia. It has been the intent of this writer, however, to describe this important aggregate of structures with a terminology which would be better suited to a non-specialist in the group. It is felt, for example, that "lateral" and "mesal" margins of the genital styles would lead

to less confusion and more rapid determinations than would "outer" and "inner" margins as advocated by Muir and Giffard. In the lateral view of the pygofer, the more caudal, vertical margins have been called the ventrocaudal margins. These margins become the lateral margins when observed from the ventrocaudal view. The "shaft" of the aedeagus is the portion lying between the atrium (the entrance for the ejaculatory duct) and the apex.

The specific synonymies are not complete. Selected references included in the catalogue of the family Delphacidae (Metcalf 1943) are given for each species after the reference to the original description except some instances where the first reference is a *nomen nudum*. All known references subsequent to Metcalf 1943 are listed, except in the cases of *pellucida* and *propinqua* for which references are far too numerous to be listed in this paper. In most cases, references subsequent to Metcalf 1943 are annotated, a feature which distinguishes them from the precatalogue references.

#### SYSTEMATICS

The genus *Delphacodes* Fieber which contains some of the smallest of the fulgoroids may be characterized as follows. The head is fairly broad, usually nearly as broad as the pronotum. The face is narrow and elongate, usually about twice as long as the width at the middle where it is usually broadest. The lateral and median carinae are distinct, with the latter forked near the apex of the head. The crown which is little produced in front of the eyes is usually about as long as broad, with the cranial carinae usually distinct. The eyes are moderate in size. The antennae are terete, the first segment usually longer than broad or at least as long as broad.

The pronotum is as long or a little longer than the crown with the lateral carinae not straight but divergently curved and not reaching the posterior margin. The forewings in both macrop-terous and brachypterous forms are always broadly rounded apically. Each hind tibia possesses two small spines on the outside surface and five spines at its apex. The basal tarsomere and second tarsomere of the hind legs have seven and four spines respectively at the apex. The calcar is cultrate and concave with very minute teeth on the hind margin.

The male genitalia (Figs. 1, 2) are relatively simple and little modified. The genitalia consist of the so-called external and internal structures.

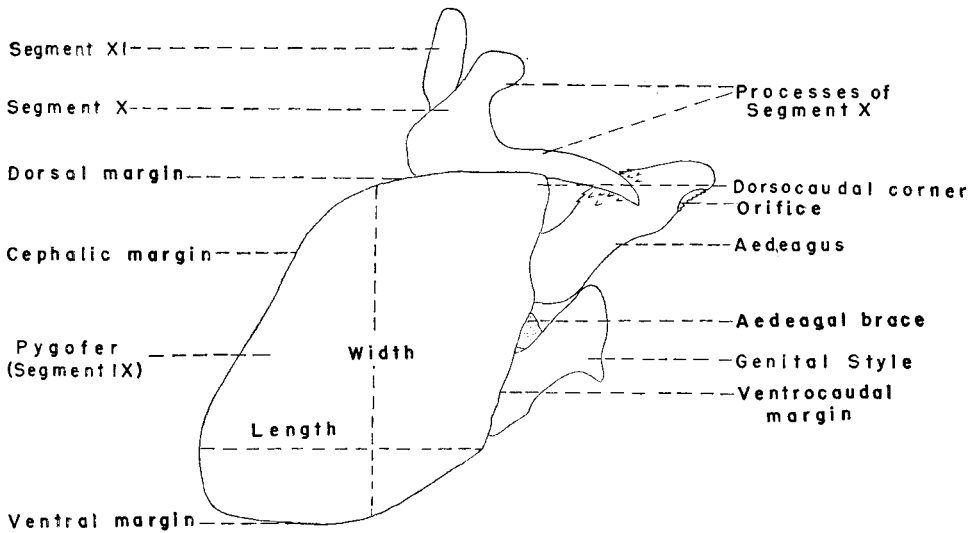


FIG. 1. Lateral view of male genitalia in *Delphacodes*.

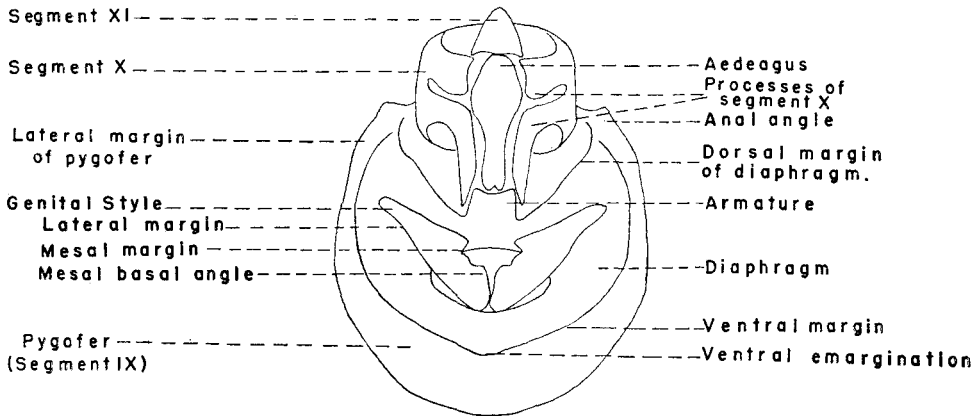


FIG. 2. Ventrocaudal view of male genitalia in *Delphacodes*.

The external structures are the pygofer (abdominal segment IX), segment X which is the anal tube, and segment XI which is the anal style. The pygofer is a completely fused, sclerotized capsule specific in shape, which houses the internal structures. The length of the pygofer is designated as the greatest distance between the cephalic and ventrocaudal margins; the width is the longest distance between the dorsal and ventral margins. The opening of the pygofer is that area limited by the lateral margins, the ventral margin, and an imaginary line drawn through the anal angles of the pygofer as viewed from the ventrocaudal aspect.

Segment X is a cylindrical structure located immediately dorsad of the anal angles of the pygofer. Processes may be entirely lacking from this segment or one or two pairs may be present. Segment XI appears as a tubular structure partly contained within segment X.

The so-called internal genitalia are composed of the aedeagus and genital styles which vary exceedingly in form, offering many good specific characters. The aedeagus is usually a simple, flattened structure with few to many small teeth scattered over its surfaces. Processes and keels may be present or it may be without ornamentation. The genital styles usually extend

diagonally from their bases toward the lateral margins of the pygofer. They may be flattened, simple structures or long and slender or variously modified.

It is not as difficult to separate the species of *Delphacodes* as it is to recognize the relationships among them. In this paper the twenty-one species of the genus known to occur in North Carolina have been arranged into six groups on the basis of the general structure of the male genitalia with particular emphasis on the number of anal processes and the aedeagal structure.

The largest and most heterogeneous group contains all but two of the first eleven species. Of this group *D. propinqua* and *wetmorei* appear to be very closely related, *pellucida* and *kilmani* are allied, *basivitta* and *detecta* are closely allied, while *alexanderi*, *puella*, and *dentipennis* are more or less isolated. *D. lineatipes* and *consimilis*, completing the first eleven species, appear to be very closely related. Two groups contain four species each, the first group consisting of *adunca* and *andromeda*, which are closely related species, and *recurvata* and *nigripennata* which have several similarities. *D. lutulenta* and *campestris* comprise the more isolated species of the second four-species group while *rotundata* and *laminalis* are very closely related. The two species, *analisis* and *shermani*, each form a group distinct from the other groups and from each other.

KEY TO SPECIES OF *Delphacodes* OCCURRING IN NORTH CAROLINA

Males

1. Abdominal segment X with processes . . . . . 2  
    Abdominal segment X without processes . . . . . 18
2. Abdominal segment X, in lateral view, with a pair of processes arising only from dorsocaudal angle . . . . . 3  
    Abdominal segment X, in lateral view, with a pair of processes arising from ventrocaudal angle . . . . . 15
3. Pygofer with dorsocaudal angles greatly produced (Figs. 24, 28) . . . . . 4  
    Pygofer with dorsocaudal angles slightly or not produced (Fig. 48) . . . . . 5
4. Aedeagus with teeth; apex capitate  
    *wetmorei* Muir and Giffard  
    Aedeagus without teeth; apex acute  
    *propinqua* (Fieber)
5. Aedeagus with large keel on left side . . . . . 6  
    Aedeagus without keel . . . . . 7
6. Aedeagus with atrial portion simple  
    *lineatipes* (Van Duzec)  
    Aedeagus with dorsoatrial portion produced almost to middle of shaft  
    *consimilis* (Van Duzec)
7. Aedeagus curved ventrad in strong arch (Figs. 37, 40, 43) . . . . . 8  
    Aedeagus more or less straight (Figs. 47, 49, 52, 55, 58, 61) . . . . . 10
8. Genital styles, in broadest view, greatly narrowed at apices (Figs. 41, 44) . . . . . 9  
    Genital styles, in broadest view, truncate at apices (Fig. 38) . . . . . *detecta* (Van Duzec)
9. Genital styles each with mesal basal angle produced into a spine  
    *basivitta* (Van Duzec)  
    Genital styles with mesal basal angles not produced . . . . . *pellucida* (Fabricius)
10. Segment X very large, pygofer with dorsocaudal angles slightly produced (Figs. 46, 48) . . . . . 11  
    Segment X small to medium, pygofer with dorsocaudal angles not produced (Figs. 51, 54, 57, 60) . . . . . 12
11. Pygofer with ventrocaudal margins having large teeth . . . . . *dentipennis* Beamer  
    Pygofer with ventrocaudal margins entire . . . . . *alexanderi* (Metcalf)
12. Aedeagus with small teeth on lateral surfaces . . . . . 13  
    Aedeagus without teeth on lateral surfaces . . . . . 14
13. Genital styles, in broadest view, narrow at apices (Fig. 53) . . . . . *kilmani* (Van Duzec)  
    Genital styles, in broadest view, broad at apices, lateral and mesal apical angles much produced (Fig. 56)  
    *puella* (Van Duzec)
14. Aedeagus with two dorsal processes  
    *analisis* (Crawford)  
    Aedeagus without processes; with a short row of teeth on dorsal margin  
    *shermani* (Metcalf)
15. Ventral pair of processes of segment X extending dorsad . . . . . 16  
    Ventral pair of processes of segment X extending ventrad . . . . . *nigripennata* Beamer
16. Dorsal pair of processes of segment X large, robust (Figs. 69, 72) . . . . . 17  
    Dorsal pair of processes of segment X small, almost obscure (Fig. 67)  
    *recurvata* Beamer

17. Dorsal pair of processes of segment X  
capitate at apices  
*andromeda* (Van Duzee)  
Dorsal pair of processes of segment X  
acute at apices.....*adunca* Beamer
18. Aedeagus with two dorsal processes  
*laminalis* (Van Duzee)  
Aedeagus without processes, with or  
without teeth..... 19
19. Aedeagus with teeth..... 20  
Aedeagus without teeth  
*lutulenta* (Van Duzee)
20. Aedeagus, in lateral view, very broad at  
atrium (Fig. 82)  
*campestris* (Van Duzee)  
Aedeagal shaft, in lateral view, of nearly  
uniform width for entire length  
(Fig. 86).....*rotundata* (Crawford)

1. *Delphacodes wetmorei* Muir and Giffard.

Figs. 8, 24, 25, 26

*Megamelus terminalis*, Crawford [nec Van Duzee], Proc. U. S. Nat. Mus. **46**: 623. 1914 [Mis-determination].

*Delphacodes wetmorei* Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 30. 1924.

*Delphacodes wetmorei*, Beamer, Jour. Kansas Ent. Soc. **18**: 100. 1945 [Comp. note].

*Delphacodes wetmorei*, Beamer, Jour. Kansas Ent. Soc. **20**: 66. 1947 [Comp. note].

Resembling *Delphacodes propinqua* (Fieber) but anal angles large, produced into large, flat, triangular processes.

BRACHYPTEROUS FORM: Length of male: 2.1 mm., 2.1 mm.; length of female: 2.2 mm., 1.8 mm.

*Color*: General color light yellow to yellowish brown but male with abdomen black; face brown between carinae, carinae sometimes only brown margined; tip of first and base of second antennal segments brown. *Structure*: First antennal segment about twice as long as wide; frons slightly less than three times as long as wide, narrow on basal third, constant in width on apical two-thirds, carinae well developed; crown longer than width between eyes, carinae well developed; pronotal carinae straight on anterior two-thirds, curving behind eyes on posterior third; forewings three times as long as wide, veins raised.

MALE GENITALIA, *lateral view*: Pygofer slightly wider than long, dorsocaudal corner greatly produced caudad into a somewhat bifurcate

process; segment X elongate, much produced above pygofer, processes long, slender, extending ventrad to form guide for aedeagus; aedeagus long, sides nearly parallel on basal three-fourths of length of shaft, apex globular, with short teeth in anterior region of globular portion, orifice located slightly dorsad of apex; genital styles long, arising immediately ventrad of dorsocaudal corners of pygofer. *Ventrocandal view*: pygofer with opening wider than long, margins entire, anal angles developed caudad on each side of segment X into large, flat, triangular processes; segment X small, produced above pygofer; dorsal margin of diaphragm deeply concave, developed in middle into bifurcate armature which is produced dorsad; genital styles broad at bases, extending dorsad almost parallel, apices truncate, indented near middle, lateral apical angles slightly more produced than mesal apical angles which are slightly produced. In broadest view, styles much the same as in ventrocandal view.

MACROPTEROUS FORM: Length of male: 2.1 mm., 2.8 mm.; length of female: 2.3 mm., 3.5 mm. Similar to brachypterous forms but forewings about one and one-third times as long as abdomen.

This is a new record for North Carolina. Four specimens have been seen which were taken in Raleigh by P. W. Oman in October 1938. Other North Carolina specimens were collected by the author in trap lights at Clayton in July 1958. Specimens from Georgia have also been seen. This species is also recorded from Florida, Alabama, Mexico, and Nicaragua.

2. *Delphacodes propinqua* (Fieber)

Figs. 9, 27, 28, 29

*Delphax propinqua* Fieber, Verh. Zool. Bot. Ges. Wien **16**: 525. 1866.

*Liburnia terminalis* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **8**: 49. 1907.

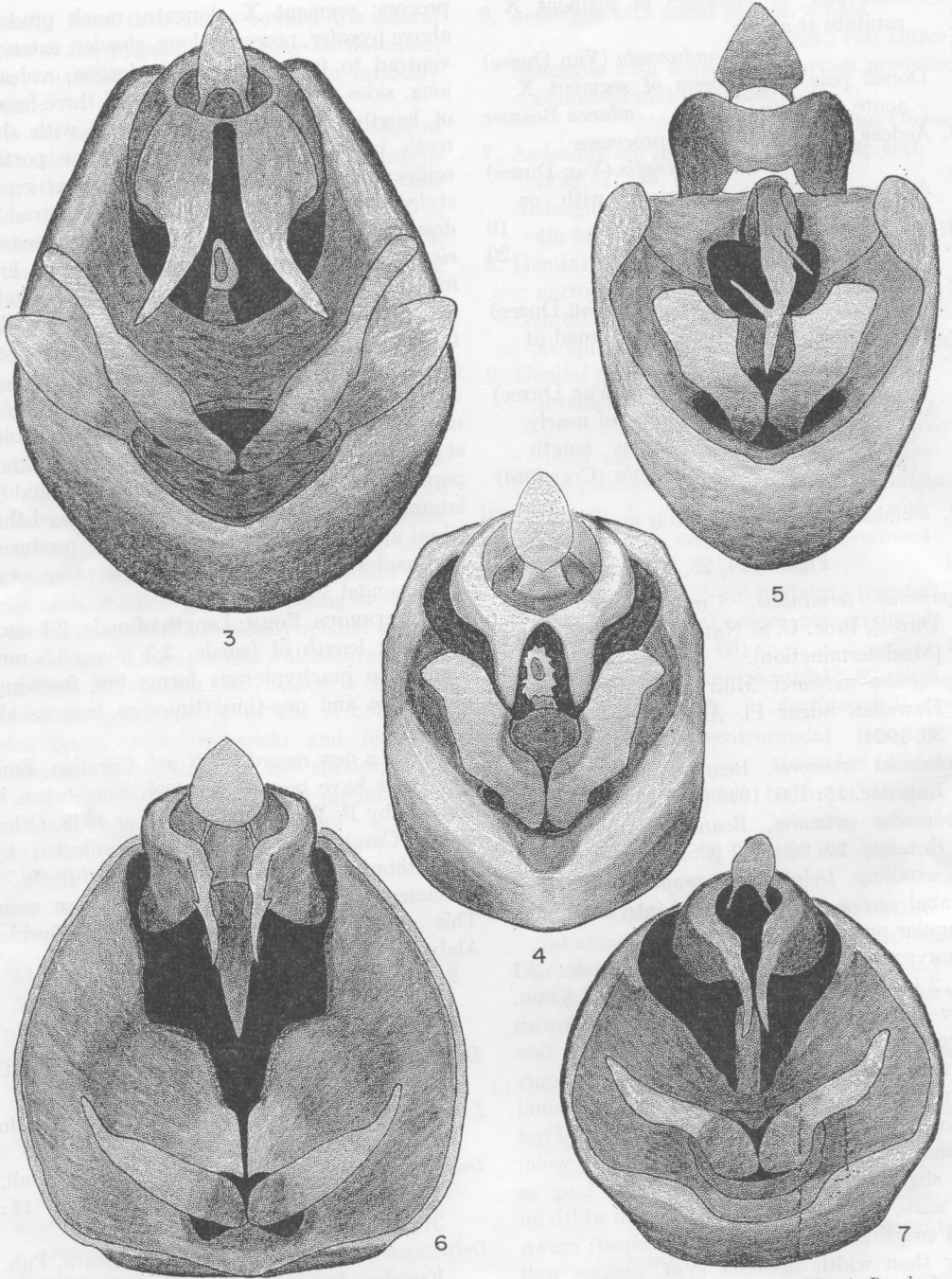
*Delphacodes propinqua*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 31. 1924.

*Delphacodes propinqua*, Esaki and Ishihara, Pub. Kyushu Imp. Univ. Ent. Lab. **14**: 32. 1943 [Cat.].

*Delphacodes propinqua*, [Miwa], [Formosa Agri. Soc. Pub.] **16**: 77. 1943 [Economics].

*Delphacodes propinqua*, Fennah, Proc. U. S. Nat. Mus. **95**: 433. 1945 [Notes].

*Delphacodes propinqua*, Wolcott, Jour. Agr. Univ. Puerto Rico **31**: 222. 1947 [Notes].



FIGS. 3-7. Ventrocaudal views of male genitalia. Fig. 3. *Delphacodes dentipennis*. Fig. 4. *D. alexanderi*.  
Fig. 5. *D. laminalis*. Fig. 6. *D. kilmani*. Fig. 7. *D. pellucida*.

*Delphacodes propinqua*, Ishihara, Sci. Rept.  
Matsuyama Agr. Coll. 2: 52. 1949 [Food  
plants].

*Delphacodes propinqua*, Caldwell and Martorell,

Jour. Agr. Univ. Puerto Rico 34: 183.  
1951 [Des., illus., ecology, cat.].

*Delphacodes propinqua*, Martorell and Adsuar,  
Jour. Econ. Ent. 45: 866. 1952 [Ecology].

*Delphacodes propinqua*, Box, List Sugar-Cane Insects **1953**: 38. 1953 [Food plants].

[*Calligypona*] *propinqua*, Dlabola, Prace Československé Akad. Věd. (Sekce Biol.) **1954**: 64. 1954 [Ecology]: 122. [Notes, illus., cat.].

Resembling *Delphacodes wetmorei* Muir and Giffard but anal angles curved ventrad and mesad.

**BRACHYPTEROUS FORM**: Length of male: 2.1 mm., 2.1 mm.; length of female: 2.2 mm., 1.8 mm. Color and structure, except in male genitalia, same as for brachypterous form of *D. wetmorei*.

**MALE GENITALIA**, *lateral view*: pygofer about as long as greatest width, dorsocaudal portion greatly produced caudad; processes of segment X extending ventrad, broad at bases, acute at apices; aedeagus more or less straight, gradually narrowing from a moderately broad atrium to acute apex, orifice oval, located near dorsal margin of apex, with two small teeth located immediately anterior to orifice, aedeagal brace extending caudad beyond ventrocaudal margins of pygofer, genital styles extending caudad at basal third of pygofer, bending dorsad and terminating in truncate apices. *Ventrocaudal view*: pygofer with opening wider than long; anal angles curved ventrad and mesad; segment X small, only slightly produced above pygofer, processes long and slender, gradually curving laterad, bases approximate; dorsal margin of diaphragm deeply concave, developed in middle into a short liplike armature; genital styles large, nearly reaching anal angles, sides nearly parallel, mesal apical angles slightly more produced than lateral apical angles, apices truncate, slightly sinuate. In broadest view, genital styles same as in ventrocaudal view but each slightly constricted at middle third of length, mesal basal angles slightly produced.

**MACROPTEROUS FORM**: Length of male: 2.1 mm., 2.8 mm.; length of female: 2.3 mm., 3.5 mm. Similar to brachypterous forms but forewings about one and one-third times as long as abdomen.

This species has been taken from Southport and New Hanover County, North Carolina. This is a new record for the state. A common species, *D. propinqua* is known from almost all large land areas of the world.

### 3. *Delphacodes lineatipes* (Van Duzee)

Figs. 23, 30, 31, 32

*Liburnia lineatipes* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Delphacodes lineatipes*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 21. 1924.

[*Delphacodes*] *lineatipes*, Moore, Canadian Ent. **76**: 44. 1944 [Listed].

*Delphacodes lineatipes*, Oman, Iowa State Coll. Jour. Sci. **21**: 213. 1947 [Listed].

*Delphacodes lineatipes*, Beamer, Jour. Kansas Ent. Soc. **21**: 115. 1948 [Comp. note].

*Delphacodes lineatipes*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 [Listed].

*Delphacodes lineatipes*, Moore, Nat. Canadian **77**: 256. 1950 [Listed].

Resembling *Delphacodes basiwitta* (Van Duzee) but face conspicuously rounded and mesal basal angles of genital styles only slightly produced instead of produced into spines.

**BRACHYPTEROUS FORM**: Length of male: 2.0 mm., 1.6 mm.; length of female: 2.6 mm., 1.5 mm.

**Color**: General color deep brown to fuscous in male, legs generally stramineous with irregular brown stripes; second antennal segment pale brown. Females entirely pale, brownish-yellow to fulvous on abdomen; facial carinae margined with brown, legs marked as in males. **Structure**: First antennal segment as wide as long; face conspicuously rounded on sides, width three-fourths length, carinae well developed, median carina forked precisely on vertex; crown square, distal portion slightly wider, carinae well developed; pronotal carinae straight on anterior three-fourths their lengths then bent laterad on posterior fourth; forewings with width three-fourths length.

**MALE GENITALIA**, *lateral view*: pygofer as wide as long, ventrocephalic corner broadly produced, ventrocaudal margin straight, segment X large, processes small, acute; aedeagus somewhat flattened laterally, with keel on left side produced dorsad, margined with teeth, teeth on shaft slightly larger, orifice large, long, located on ventral margin; genital styles arising from pygofer below middle of ventrocaudal margin, broad at bases, rapidly narrowing to acute apices which bend dorsad. *Ventrocaudal view*: pygofer with opening wider than long, ventral edge deeply emarginate, anal angles rounded, not produced; segment X large, processes varying in size, but generally small, like knobs, far apart, apices acute; diaphragm long, dorsal margin concave, middle produced into small lip; genital styles nearly reaching diaphragm margin, sublanceolate, apices acute. In broadest view, styles same as in ventrocaudal view but mesal basal

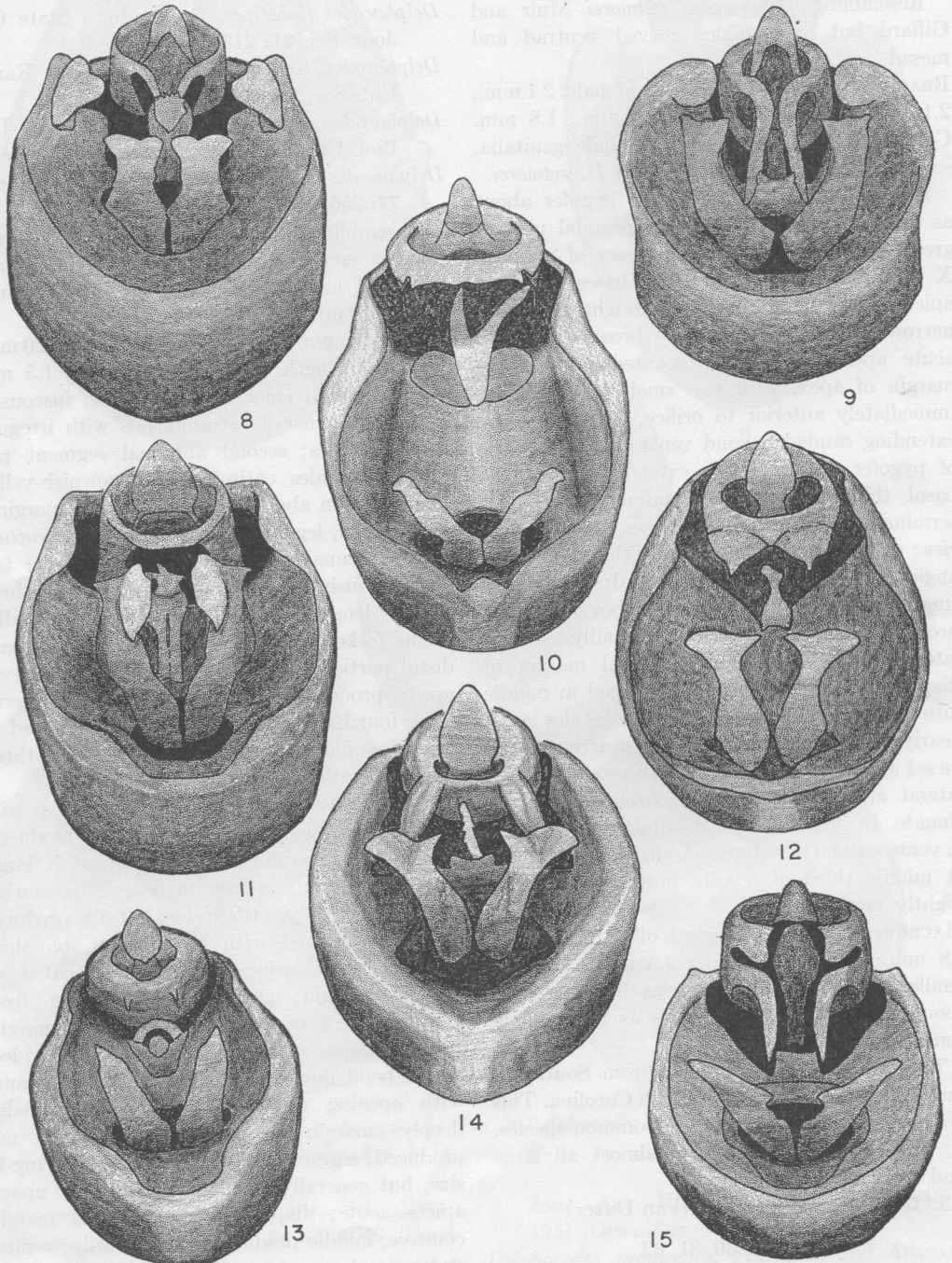


angles slightly produced, lateral margins evenly sinuate.

MACROPTEROUS FORM: Length of male: 2.1 mm., 3.2 mm.; length of female: 2.5 mm., 3.4 mm.

Male and female similar to respective brachypterous forms but forewings of both sexes about one-half longer than abdomen.

Specimens have been seen in the U. S. National



FIGS. 8-15. Ventrocaudal views of male genitalia. Fig. 8. *Delphacodes wetmorei*. Fig. 9. *D. propinqua*. Fig. 10. *D. analis*. Fig. 11. *D. recurvata*. Fig. 12. *D. shermani*. Fig. 13. *D. consimilis*. Fig. 14. *D. puella*. Fig. 15. *D. nigripennata*.

Museum collection which were taken in Raleigh. This is a new record for the state. Besides these specimens, others have been seen from New York, Pennsylvania, Washington, Ohio, Arizona, and California. This species is also recorded from Quebec, Ontario, New Hampshire, and Massachusetts.

#### 4. *Delphacodes consimilis* (Van Duzee)

Figs. 13, 33, 34, 35

*Delphax consimilis* Popenoe, Trans. Kansas Acad. Sci. **9**: 63. 1885 [*nomen nudum*].

*Liburnia consimilis* Gillette and Baker, Bull. Colorado Agr. Exp. Sta. **31**: 69. 1895 [*nomen nudum*].

*Liburnia consimilis* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 249. 1897.

*Delphacodes consimilis*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 21. 1924.

*Delphacodes consimilis*, Oman, Iowa State Coll. Jour. Sci. **21**: 211. 1947 [Cat.].

*Delphacodes consimilis*, Hayward, Ecol. Mon. **18**: 503. 1948 [Ecology].

*Delphacodes consimilis*, Beamer, Jour. Kansas Ent. Soc. **24**: 55. 1951 [Notes, food plants].

Resembling *Delphacodes pellucida* (F.) but processes of segment X short and stout instead of long and slender.

**BRACHYPTEROUS FORM:** Length of male: 2.4 mm., 2.4 mm.; length of female: 2.7 mm., 3.1 mm. **Color:** Similar to *D. pellucida* but general color lighter, tip of clavus black. **Structure:** Similar to *D. pellucida* but carinae well developed, crown longer than wide.

**MALE GENITALIA, lateral view:** pygofer more or less oval; segment X large and well produced above pygofer, caudal margin developed into two small, stout processes which curve ventrad; aedeagus subcylindrical with a large dorsoatrial portion produced almost to middle of shaft, left side with a large, dorsally curved keel extending from apex to middle, keel with teeth along its edge, orifice located on ventral margin of apical third; genital styles appearing as long shafts, almost reaching middle of ventrocaudal margin. **Ventrocaudal view:** pygofer with opening small, much wider than long, anal angles slightly produced and rounded, ventral margin deeply emarginate in middle; segment X well produced above pygofer, processes located far apart on caudal margin of segment X; diaphragm large, dorsal margin extending gradually ventrad to median portion which is deeply concave and

developed into a U-shaped armature which is produced caudad; genital styles wide at bases, gradually narrowing on two-thirds their length, then more strongly tapering to acute apices. In broadest view, styles rapidly narrowing toward apices from broad basal half, mesal basal angles slightly produced.

**MACROPTEROUS FORM:** Length of male: 2.2 mm., 4.0 mm.; length of female: 2.6 mm., 4.1 mm. Macropterous males like brachypterous males but color much darker brown, forewings almost twice length of abdomen; macropterous females like brachypterous females but forewings about two-thirds longer than abdomen.

This species has been taken in Hendersonville, North Carolina. Other specimens have been seen from Washington, Oregon, and California. It is also recorded from Washington, D. C., Kansas, South Dakota, Colorado, Utah, Nevada, Arizona, and British Columbia.

#### 5. *Delphacodes detecta* (Van Duzee)

Figs. 22, 36, 37, 38

*Liburnia detecta* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 248. 1897.

*Liburnia circumcincta* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **9**: 203. 1909.

*Delphacodes detecta*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 26. 1924.

*Delphacodes detecta*, Oman, Iowa State Coll. Jour. Sci. **21**: 211. 1947 [Cat.].

*Liburnia detecta*, Metcalf, Jour. Elisha Mitchell Sci. Soc. **65**: 56. 1949 [Comp. note].

*Delphacodes detecta*, Beamer, Jour. Kansas Ent. Soc. **23**: 68. 1950 [Des., illus., cat.].

*Delphacodes vanduzeei*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 32. 1950 [Listed].

*Delphacodes vanduzeei*, Moore, Nat. Canadien **77**: 257. 1950 [Listed].

*Delphacodes detecta*, Wolcott, Jour. Agr. Univ. Puerto Rico **32**: 144. 1950 [Listed].

*Delphacodes detecta*, Caldwell and Martorell, Jour. Agr. Univ. Puerto Rico **34**: 178. 1951 [Des., illus., ecology, cat.].

**BRACHYPTEROUS FORM:** Length of male: 2.2 mm., 1.7 mm.; length of female: 2.8 mm., 1.7 mm. **Color:** General color stramineous, some coastal specimens soiled whitish; face between carinae and median fovea of crown brown to black, sometimes carinae only brown margined; in male dorsum of first four abdominal segments dark; in female entire dorsum of abdominal segments black or only dark spotted in some

coastal specimens; male genital capsule dark brown except on median third of dorsum. *Structure*: First antennal segment about as long as wide; face about twice as long as greatest width, distinctly narrowed on basal third, very slightly so at apex, strongly tricarinate; crown much longer than wide, extending well in front of eyes; pronotal carinae near and parallel to posterior margin of eyes; forewings slightly longer than wide, apices broadly rounded, veins raised.

**MALE GENITALIA, lateral view**: pygofer more or less rectangular, about a third wider than greatest length, ventrocaudal margin convex; segment X medium in size, processes long, slender, about five times as long as their greatest width; aedeagus widest at atrium, ventral margin strongly converging beyond atrium to about one-third basal width, then curving ventrad in an arch to blunt aedeagal apex, lateral margins of apical half with numerous small teeth; genital styles spatulate, sides more or less parallel. *Ventrocaudal view*: pygofer with opening about twice as wide as long, anal angles stout, produced, ventral emargination shallow; processes of segment X long, slender, curving laterad; dorsal margin of diaphragm concave, middle produced into a lip which extends almost to base of genital styles; genital styles large, each divergent almost at a right angle to the other, mesal margins somewhat more convex than lateral. In broadest view, styles with sides more or less parallel, mesal basal angles slightly produced, lateral apical angles broadly produced and rounded, mesal apical angles acutely produced.

**MACROPTEROUS FORM**: Length of male: 2.3 mm., 3.6 mm.; length of female: 3.0 mm., 4.3 mm. Similar to brachypterous forms but forewings much longer than abdomen; color varying as in brachypterous forms.

Specimens of this species have been taken at Fort Fisher, Carolina Beach, and Wrightsville Beach, N. C. Other specimens have been seen from Connecticut, Maryland, Louisiana, and Florida. The species also has been recorded from Quebec, Massachusetts, New York, New Jersey, Virginia, Georgia, Bermuda, Puerto Rico, St. Thomas Island, and Vieques Island.

6. *Delphacodes basivitta* (Van Duzee)

Figs. 18, 39, 40, 41

*Liburnia basivitta* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **9**: 202. 1909.

*Delphacodes basivitta*, Muir and Giffard, Bull.

Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 27. 1924.

[*Delphacodes*] *basivitta*, Moore, Canadian Ent. **76**: 1944. [Listed].

*Delphacodes basivitta*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 [Listed].

*Delphacodes basivitta*, Moore, Nat. Canadian **77**: 256. 1950 [Listed].

[*Delphacodes*] *basivitta*, Beamer, Jour. Kansas Ent. Soc. **24**: 12. 1951 [Comp. note].

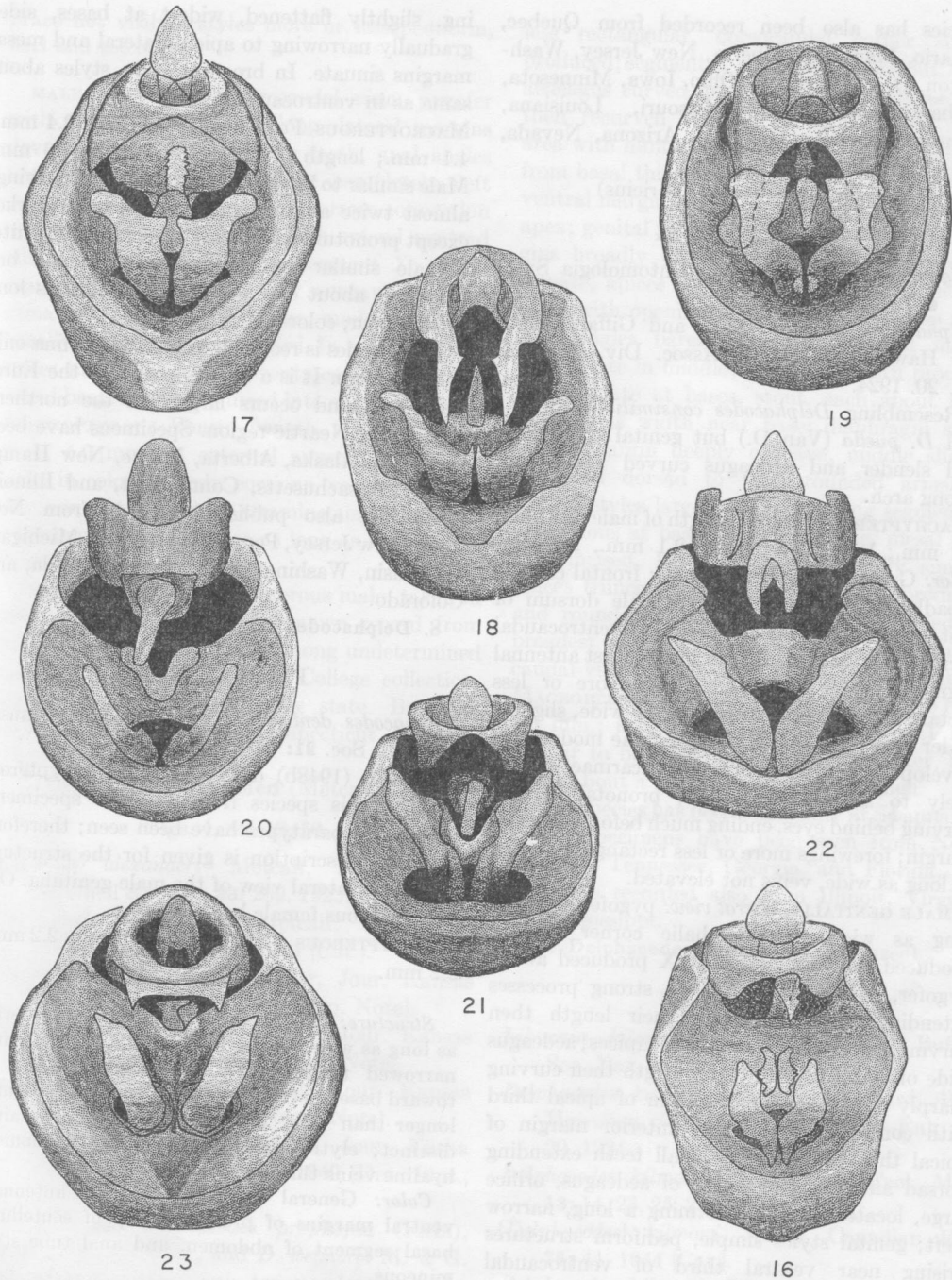
Resembling *Delphacodes lineatipes* (Van D.) but genital styles with basal spines; aedeagus without ventral keel.

**BRACHYPTEROUS FORM**: Length of male: 2.0 mm., 1.7 mm.; length of female: 2.0 mm., 1.7 mm.

*Color*: General color fuscous brown to black, face and scutellum darker; second antennal segment pale; frontal carinae narrowly pale. Female usually lighter throughout. *Structure*: Face twice as long as broad, widest near middle, distinctly tricarinate; crown about square, carinae distinct and moderately developed; pronotal carinae curving behind eyes, ending much before posterior margin; forewings about twice as long as broad.

**MALE GENITALIA, lateral view**: pygofer wider than long, dorsal margin shorter than ventral, ventrocaudal margin slightly concave; segment X large, with large, strong, acute processes; aedeagus flattened ventrally beyond atrium into a circular disc, apical half narrow and curved ventrad, more or less bulbous at apex, with a row of strong teeth extending from apex dorsad along apical half; genital styles broad on ventral two-thirds, narrow on dorsal third. *Ventrocaudal view*: pygofer with opening slightly wider than long, lateral margins slightly emarginate, ventral emargination shallow; segment X well produced above pygofer, giving rise to a pair of strong, slender processes, each process possessing one tooth on mesal margin near its middle; dorsal margin of diaphragm very slightly concave, produced in middle into simple oval armature; genital styles narrowing gradually to blunt apices, mesal basal angles each produced into a strong, straight spine, lateral and mesal margins of styles gently bisinuate. In broadest view, styles essentially same as in ventrocaudal view.

**MACROPTEROUS FORM**: Length of male: 2.0 mm., 3.1 mm.; length of female: 2.0 mm., 2.8 mm. Male and female similar to respective brachypterous forms but forewings much longer than abdomen, transparent with narrow brown veins; all head and thoracic carinae well developed, color darker.



FIGS. 16-23. Ventrocaudal views of male genitalia. Fig. 16. *Delphacodes campestris*. Fig. 17. *D. adunca*. Fig. 18. *D. basivitta*. Fig. 19. *D. andromeda*. Fig. 20. *D. lutulenta*. Fig. 21. *D. rotundata*. Fig. 22. *D. detecta*. Fig. 23. *D. lineatipes*.

This species is probably the second most prevalent in North Carolina. It has been taken at Carolina Beach, Swannanoa, Clayton, Cruso, Harnett County, Raleigh, and Hendersonville.

Other specimens have been seen from New Hampshire, Massachusetts, Connecticut, New York, Pennsylvania, Illinois, Indiana, Virginia, Tennessee, Georgia, Florida, and Texas. The

species has also been recorded from Quebec, Ontario, Manitoba, Alberta, New Jersey, Washington, D. C., Michigan, Ohio, Iowa, Minnesota, Alabama, Mississippi, Missouri, Louisiana, Kansas, Nebraska, Colorado, Arizona, Nevada, and California.

7. *Delphacodes pellucida* (Fabricius)

Figs. 7, 42, 43, 44

*Fulgora pellucida* Fabricius, Entomologia Syst. 4: 7. 1794.

*Delphacodes pellucida*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. 15: 20. 1924.

Resembling *Delphacodes consimilis* (Van D.) and *D. puella* (Van D.) but genital styles long and slender and aedeagus curved ventrad in strong arch.

BRACHYPTEROUS FORM: Length of male: 2.1 mm., 2.2 mm.; length of female: 2.1 mm., 2.2 mm. *Color*: General color stramineous; frontal carinae broadly pale; abdomen except pale dorsum of first three segments fuscous; ventrocaudal corners of pygofer white. *Structure*: First antennal segment longer than wide; face more or less rectangular, about twice as long as wide, slightly wider near basal third; facial carinae moderately developed; crown about square, carinae moderately to slightly developed; pronotal carinae curving behind eyes, ending much before posterior margin; forewings more or less rectangular, twice as long as wide, veins not elevated.

MALE GENITALIA, *lateral view*: pygofer about as long as wide, ventrocephalic corner slightly produced cephalad; segment X produced above pygofer, with a pair of large, strong processes extending caudad for half their length then curving sharply ventrad to acute apices; aedeagus wide on basal two-thirds its length then curving sharply ventrad, caudal margin of apical third with comb of small teeth, anterior margin of apical third with row of small teeth extending dorsad and following curve of aedeagus, orifice large, located on apex, forming a long, narrow cleft; genital styles simple, pediform structures arising near ventral third of ventrocaudal margin. *Ventrocaudal view*: pygofer with opening about three-fourths as long as wide, margins entire except ventral margin which is roundly emarginate; segment X medium in size with two well developed, laterally flattened processes curving laterad near apex, bases approximate; dorsal margin of diaphragm deeply concave, without armature; genital styles strongly diverg-

ing, slightly flattened, widest at bases, sides gradually narrowing to apices, lateral and mesal margins sinuate. In broadest view, styles about same as in ventrocaudal view.

MACROPTEROUS FORM: Length of male: 2.4 mm., 4.1 mm.; length of female: 2.4 mm., 3.6 mm. Male similar to brachypterous male but forewings almost twice as long as abdomen, color darker except pronotum which varies from pale to white. Female similar to brachypterous female but forewings about one and one-half times as long as abdomen; color generally darker.

This species is recorded in North Carolina only from Raleigh. It is a species native to the European area and occurs largely in the northern part of the Nearctic region. Specimens have been seen from Alaska, Alberta, Maine, New Hampshire, Massachusetts, Connecticut, and Illinois. There are also published records from New York, New Jersey, Pennsylvania, Ohio, Michigan, Wisconsin, Washington, Wyoming, Nevada, and Colorado.

8. *Delphacodes dentipennis* Beamer

Figs. 3, 45, 46, 47

*Delphacodes dentipennis* Beamer, Jour. Kansas Ent. Soc. 21: 103. 1948.

Beamer (1948b) described the brachypterous form of this species from 14 male specimens. Only three paratypes have been seen; therefore, Beamer's description is given for the structure, color, and lateral view of the male genitalia. One macropterous female has been seen.

BRACHYPTEROUS FORM: Length of male: 2.2 mm., 2.2 mm.

*Structure*: First antennal segment about twice as long as wide, widest near middle, very slightly narrowed toward each end, slightly more so toward base, distinctly tricarinate; crown slightly longer than wide, widest at apex, carinae fairly distinct; elytra extending to tip of abdomen, hyaline veins thickened.

*Color*: General color dark; legs, antennae, ventral margins of pronotum, tip of scutellum, basal segment of abdomen, and anal tube stramineous.

*Male Genitalia*: In lateral view, pygofer slightly wider than long, longest near middle with a large tooth near middle of caudal margin; anal segment very large with a pair of very long, heavy processes; aedeagus bent ventrally near base about twice as wide near outer third as near base, narrowed at apex, dorsal third of outer half covered with teeth, the basal ones quite large; aedeaga

brace not visible; styles more or less pediform, heel and toe sharp.

**MALE GENITALIA, ventrocaudal view:** pygofer with opening as wide as long, lateral margins developed caudad into large teeth, anal angles not produced; segment X large, completely cleft on ventral margin except on narrow connection at base of large processes which extend ventrad while bending laterad from segment X; dorsal margin of diaphragm evenly concave, without armature; genital styles large, moderately wide basally, narrow on apical third. In broadest view, styles about same as in ventrocaudal view but mesal basal angles produced into short spines.

**MACROPTEROUS FORM:** Length of female: 2.5 mm., 4.0 mm. In external appearance, female paler in color on body portions, ventral margins of pronotum lacking stramineous coloration; forewings not quite twice as long as in brachypterous males.

One specimen, a brachypterous male, taken in 1909 in Raleigh, the only known record from North Carolina, was found among undetermined material in the N. C. State College collection. This is a new record for the state. Beamer's locality records included Connecticut, Virginia, Wisconsin, and New Mexico.

#### 9. *Delphacodes alexanderi* (Metcalf)

Figs. 4, 48, 49, 50

*Liburnia alexanderi* Metcalf, Jour. Elisha Mitchell Sci. Soc. **38**: 209. 1923.

*Delphacodes alexanderi*, Metcalf, Gen. Cat. Hemiptera **4**(3): 404. 1943 [Cat.].

*Delphacodes alexanderi* Beamer, Jour. Kansas Ent. Soc. **19**: 139. 1946 [Comp. Note].

*Delphacodes alexanderi*, Beamer, Jour. Kansas Ent. Soc. **20**: 60. 1947 [Comp. Note].

*Delphacodes alexanderi*, Beamer, Jour. Kansas Ent. Soc. **21**: 6. 1948 [Comp. Note].

*Delphacodes alexanderi*, Metcalf, Jour. Elisha Mitchell Sci. Soc. **65**: 57. 1949 [Des., illus., cat.].

Resembling *Delphacodes propinqua* (Fieb.), *D. nigripennata* Bmr., and *D. wetmorei* M. & G. but forewings rufous, only twice as long as wide, and aedeagus with numerous large teeth.

**BRACHYPTEROUS FORM:** Length of male: 1.8 mm., 1.5 mm.; length of female: 2.2 mm., 1.8 mm. Color and structure, except for male genitalia, same as for *D. propinqua*, *nigripennata*, and *wetmorei*.

**MALE GENITALIA, lateral view:** pygofer more or

less rectangular, dorsocaudal corner slightly produced; segment X large, processes stout, acute; aedeagus curved dorsad on basal third of shaft then recurved ventrad at apical third, apical area with numerous stout teeth, comb extending from basal third of shaft to apex, three teeth on ventral margin near apex, orifice located at blunt apex; genital styles large, spatulate, dorsal margins broadly convex, ventral margins strongly sinuate, apices rounded. *Ventrocaudal view:* pygofer with opening deep, about as long as wide, anal angles barely indicated, ventral margin emarginate in middle; segment X with processes approximate at bases, stout, each about twice as long as width near base; diaphragm short, dorsal margin deeply concave, middle slightly produced dorsad to form rounded armature; genital styles large, almost reaching segment X, contiguous at bases, then diverging, mesal margins incised, lateral margins strongly sinuate, apices truncate, lateral apical angles produced, and rounded, mesal apical angles rounded. In broadest view, styles about same as in ventrocaudal view but lateral margins slightly sinuate.

**MACROPTEROUS FORM:** Length of male: 1.8 mm., 3.0 mm.; length of female: 2.3 mm., 3.1 mm. Similar to brachypterous form but darker, forewings about a third longer than abdomen.

This species has been taken only at Swannanoa, N. C. Specimens have been seen from North Carolina, Tennessee, Georgia, and Florida. The species is recorded also from Illinois, Virginia, and Mississippi.

#### 10. *Delphacodes kilmani* (Van Duzee)

Figs. 6, 51, 52, 53

*Liburnia kilmani* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Delphacodes kilmani*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 20. 1924.

*Delphacodes kilmani* (?), McClure, Ecol. Mon. **13**: 14, 23, 25, 27. 1943 [Ecology].

*Delphacodes kilmani*, Moore, Canadian Ent. **76**: 44. 1944 [Cat.].

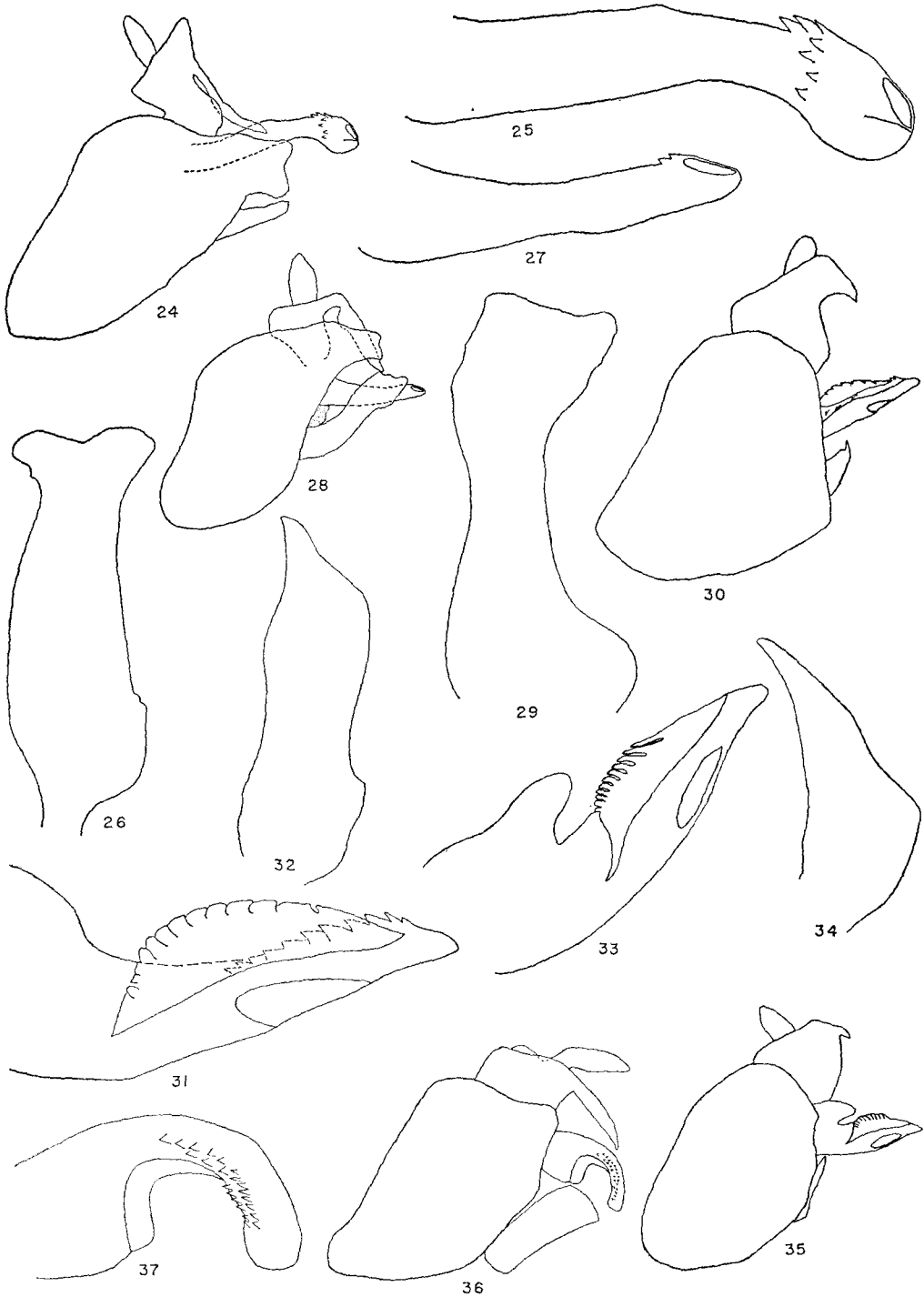
*Delphacodes kilmani*, Oman, Iowa State Coll. Jour. Sci. **21**: 212. 1947 [Cat.].

*Delphacodes kilmani*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 [Listed].

*Delphacodes kilmani*, Moore, Nat. Canadien **77**: 256. 1950 [Listed].

*Delphacodes kilmani*, Strickland, Canadian Ent. **85**: 209. 1953 [Food Plants].





Figs. 24-37. Figs. 24-26. *Delphacodes wetmorei*. 24, lateral view of male genitalia; 25, lateral view of aedeagus; 26, broadest view of left genital style. Figs. 27-29. *D. propinqua*. 27, lateral view of aedeagus; 28, lateral view of male genitalia; 29, broadest view of left genital style. Figs. 30-32. *D. lineatipes*. 30, lateral view of male genitalia; 31, lateral view of aedeagus; 32, broadest view of left genital style. Figs. 33-35. *D. consimilis*. 33, lateral view of aedeagus; 34, broadest view of left genital style; 35, lateral view of male genitalia. Figs. 36-37. *D. detecta*. 36, lateral view of male genitalia; 37, lateral view of aedeagus.

Resembling *Delphacodes recurvata* Bmr. but dorsal margin of diaphragm cleft in middle, genital styles long, simple, neither large nor flanged.

**BRACHYPTEROUS FORM:** Length of male: 2.0 mm., 1.7 mm.; length of female: 3.0 mm., 1.8 mm. *Color:* Head, thorax, legs, ventral margin of abdomen, stramineous; abdomen except dorsum and ventral margins of abdominal segments reddish brown; a yellow vitta extending from crown to pygofer; forewings rufous in male with stramineous margin on rounded apices. Female generally lighter. *Structure:* First antennal segment as long as wide; face more or less rectangular, widest slightly below middle, not quite twice as long as wide, carinae well developed, median carina forking slightly above antennal pits, sometimes forking near middle of face; crown quadrate, carinae moderately to well developed; pronotum with well developed straight carinae which diverge laterad behind eyes.

**MALE GENITALIA, lateral view:** pygofer much wider than long, ventral margin about twice as long as dorsal; segment X large, possessing a pair of strong processes which bend ventrad near middle, rapidly narrowing to acute apices; aedeagus nearly straight, only slightly curved dorsad sides parallel on basal two-thirds of shaft then rapidly narrowing to apex, with a single row of teeth on dorsal margin, with a row of small teeth located more basad on ventral margin, sometimes both rows appearing joined by a semi-circle of small teeth, orifice located at apex; aedeagal brace visible; genital styles appearing as small, dorsally curved processes near middle of ventrocaudal margin. *Ventrocaudal view:* pygofer with opening slightly wider than long, nearly circular but slightly flattened ventrally, margins entire except for shallow ventral emargination; segment X well produced above pygofer, processes large, projecting ventrad with a single, small hook near middle outer margin on each; dorsal margin of diaphragm very deeply excavated, then with a vertical cleft extending almost to bases of genital styles; genital styles widely divergent, extending nearly to lateral margins of pygofer, each broad on basal two-thirds, then rapidly narrowing to slender apical third. In broadest view, styles broad on basal third, gradually narrowing to slender, broadly rounded apices, mesal margins slightly concave on outer half.

**MACROPTEROUS FORM:** No specimens of macropterous forms have been seen by the author.

This species has been taken in Raleigh, North Carolina. Specimens have also been seen from Alberta, New Hampshire, and Michigan. This species is also known to occur in Quebec, Manitoba, New York, and Ohio.

11. *Delphacodes puella* (Van Duzee)

Figs. 14, 54, 55, 56

*Liburnia puella* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Delphacodes puella*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 32. 1924.

[*Delphacodes*] *puella*, Moore, Canadian Ent. **76**: 44. 1944 [Listed].

*Delphacodes puella*, Oman, Iowa State Coll. Jour. Sci. **21**: 214. 1947 [Cat.].

*Delphacodes peulla* [sic], Beamer, Jour. Kansas Ent. Soc. **21**: 2. 1948 [Comp. note].

*Delphacodes puella*, Beamer, Jour. Kansas Ent. Soc. **21**: 102. 1948 [Comp. note].

*Delphacodes puella*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 32. 1950 [Listed].

*Delphacodes puella*, Moore, Nat. Canadien **77**: 257. 1950 [Listed].

*Delphacodes puella*, Wolcott, Jour. Agr. Univ. Puerto Rico **32**: 144. 1950 [Listed].

*Delphacodes puella*, Caldwell and Martorell, Jour. Agr. Univ. Puerto Rico **34**: 184. 1951 [Des., illus., cat., ecology].

Resembling *Delphacodes pellucida* (F.) but smaller, male genitalia distinct. It can be easily separated from *pellucida* by the black tipped clavus of its forewings. The macropterous form appears to be much more prevalent than the brachypterous form.

**MACROPTEROUS FORM:** Length of male: 1.9 mm., 3.0 mm.; length of female: 2.0 mm., 3.1 mm. *Color:* General color black; in male, cranial carinae, posterior half of pronotum, tip of scutellum, margins of dorsum of abdomen, broad margins of propleura, white; legs stramineous; forewings pellucid white, tip of clavus black. Female as in male but cranial carinae, pronotal carinae, and posterior margins of pronotum, pale. *Structure:* First antennal segment almost twice as long as wide; face more than twice as long as wide, narrowing at both ends, more so toward base, carinae well developed; crown slightly longer than width at base, carinae well developed.

**MALE GENITALIA, lateral view:** pygofer more or less rectangular, ventrocaudal margin unevenly sinuate; segment X with a pair of strong, slightly curved processes; aedeagus widest at atrium,



constricted near basal third of shaft, curved slightly dorsad, with small teeth scattered on lateral surfaces of apical two-thirds, with an irregular row of teeth on both dorsal and ventral margins, orifice at acute apex; genital styles each with basal half broad, apical half narrow, apex notched, forming two unequal lobes. *Ventrocaudal view*: pygofer with opening slightly wider than long, anal angles rounded, slightly produced, ventral emargination shallow; segment X with processes rather lanceolate; diaphragm short, dorsal margin straight, with a bilobed armature in middle; genital styles pediform, lateral apical angles acute, produced mesal apical angles more acute, produced, mesal basal angles slightly produced. In broadest view, styles each broad at base, narrow on outer half, mesal basal angle greatly produced, mesal apical angle produced into rectangular process.

**BRACHYPTEROUS FORM**: Length of male: 1.7 mm., 1.7 mm.; length of female: 2.0 mm., 2.1 mm. Similar to macropterous form but forewings about as long as abdomen, twice as long as wide, apical margin white in male; female lighter than male.

This species is probably the most abundant in North Carolina. It has been taken in numbers from the following localities in the state: Elizabeth City, Windsor, New Hanover Co., Wilmington, Carolina Beach, Willard, Brunswick, Sampson Co., Clayton, Harnett Co., McCullers, Raleigh, Southern Pines, Grandfather Mountain, Linville Falls, Montreat, Swannonoa, Cullowhee, Hendersonville, Mt. Pisgah, Highlands, and Andrews. Other specimens have been seen from New Hampshire, Connecticut, Ohio, Illinois, Tennessee, Florida, Missouri, and Nebraska. It also occurs in many other areas from Canada to the Caribbean area.

12. *Delphacodes analis* (Crawford)

Figs. 10, 57, 58, 59

*Megamelus analis* Crawford, Proc. U. S. Nat. Mus. **46**: 620. 1914.

*Delphacodes analis*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 24. 1924.

[*Delphacodes*] *analis*, Moore, Canadian Ent. **76**: 44, 1944 [Listed].

*Delphacodes analis*, Beamer, Jour. Kansas Ent. Soc. **20**: 62. 1947 [Comp. note].

*Delphacodes analis*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 [Listed].

*Delphacodes analis*, Moore, Nat. Canadien **77**: 256. 1950 [Listed].

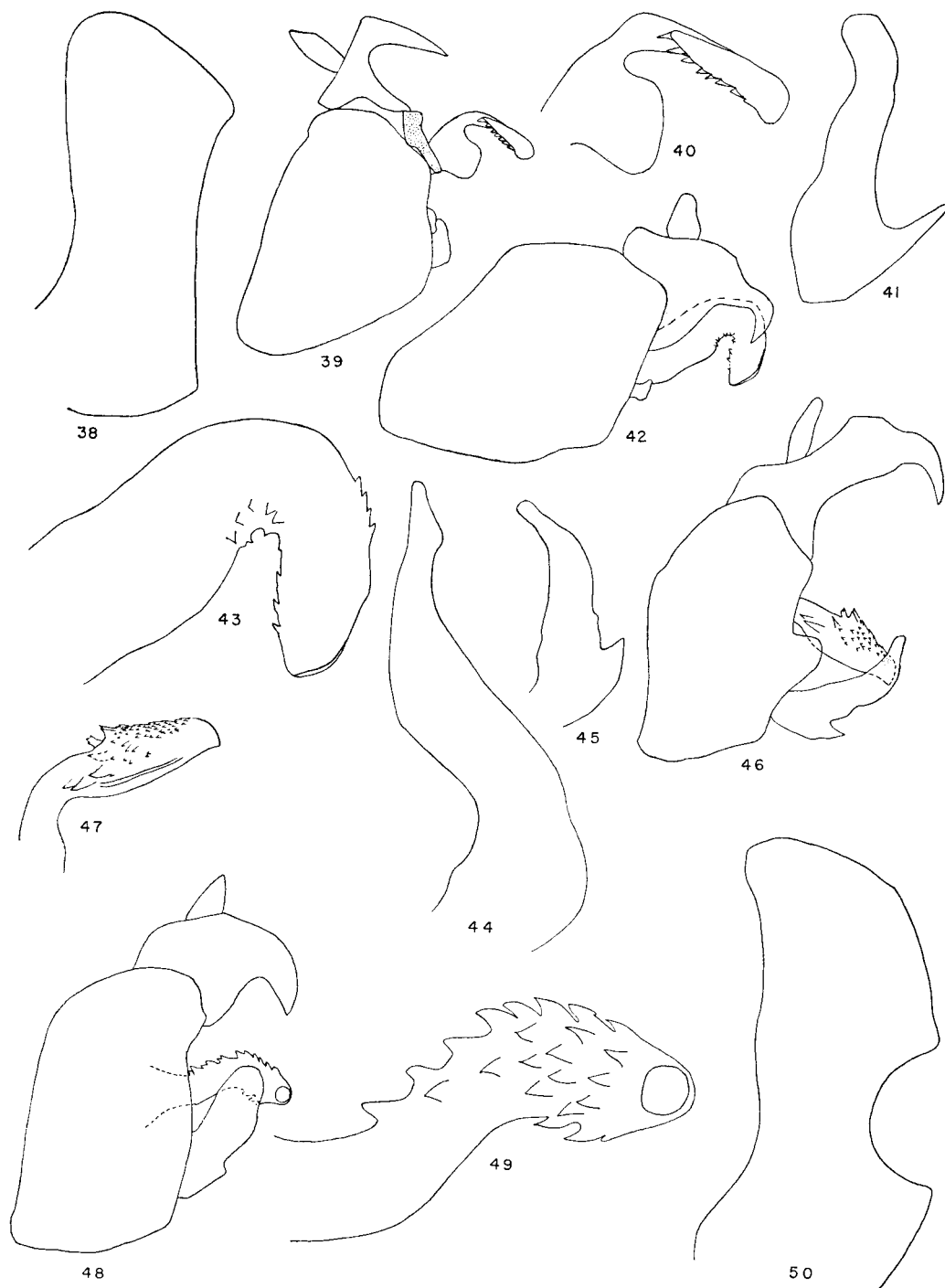
[*Delphacodes*] *analis*, Strickland, Canadian Ent. **85**: 209. 1953 [Listed].

**BRACHYPTEROUS FORM**: Length of male: 1.8 mm., 1.2 mm.; length of female: 2.0 mm., 1.2 mm. *Color*: Face stramineous; crown, entire thorax, and legs yellow; abdomen rufous; dorsum and ventrocaudal margin of pygofer yellow. Female abdomen generally lighter. *Structure*: First antennal segment as wide as long; face rectangular, width two-thirds length, carinae moderately developed; vertex broadly rounded, carinae obscure; crown square, strongly widened at apex, carinae slightly developed; pronotal carinae slightly developed, curved behind eyes; forewings somewhat square, veins raised.

**MALE GENITALIA**, *lateral view*: pygofer somewhat trapezoidal, much wider than long, ventrocaudal corner produced dorsad, ventrocaudal margin almost straight; segment X of medium size, well produced above pygofer, processes short, stout, straight; aedeagus with basal half of shaft laterally flattened into semicircular basal disc, apical half globular, a pair of strong, somewhat slender processes extending dorsad from dorsal margin of apical half, orifice located at broadly rounded apex; genital styles small, stout, extending dorsad from ventral third of pygofer. *Ventrocaudal view*: pygofer with opening as wide as long; ventral margin developed at middle into short spine which is produced dorsad, anal angles produced caudad and broadly rounded; processes of segment X short, small, extending laterad on caudally produced ledge of segment X; diaphragm very large, strongly convex along median line, dorsal margin short, straight, developed in middle into an armature of a pair of flattened, reniform structures; genital styles small, generally slender, wide at bases, lateral and mesal margins sinuate, forming alternating narrow and wide sections. In broadest view, styles each with basal half broad, apical half narrow, extending almost at a right angle from basal half.

**MACROPTEROUS FORM**: Length of male: 1.8 mm., 3.1 mm.; length of female: 2.2 mm., 3.3 mm. Similar to brachypterous form but forewings about a third longer than abdomen and general color darker, especially mesonotum; abdomen of female light brown.

This species has been taken in Moore County, North Carolina, and specimens have also been examined from Alberta, New York, Michigan,



FIGS. 38-50. Fig. 38. *Delphacodes detecta*. Broadest view of left genital style. Figs. 39-41. *D. basivitta*. 39, lateral view of male genitalia; 40, lateral view of aedeagus; 41, broadest view of left genital style. Figs. 42-44. *D. pellucida*. 42, lateral view of male genitalia; 43, lateral view of aedeagus; 44, broadest view of left genital style. Figs. 45-47. *D. dentipennis*. 45, broadest view of left genital style; 46, lateral view of male genitalia; 47, lateral view of aedeagus. Figs. 48-50. *D. alexanderi*. 48, lateral view of male genitalia; 49, lateral view of aedeagus; 50, broadest view of left genital style.

and Minnesota. It is also recorded from Wisconsin.

13. *Delphacodes shermani* (Metcalf)

Figs. 12, 60, 61, 62

*Liburnia shermani* Metcalf, Jour. Elisha Mitchell Sci. Soc. **38**: 207. 1923.

*D* [*elphacodes*] *shermani*, Beamer, Jour. Kansas Ent. Soc. **19**: 143. 1946 [Comp. note].

*Delphacodes shermani*, Beamer, Jour. Kansas Ent. Soc. **20**: 59. 1947 [Des., illus., cat.].

*D*[*elphacodes*] *shermani*, Beamer, Jour. Kansas Ent. Soc. **20**: 62. 1947 [Comp. note].

*Delphacodes shermani*, Metcalf, Jour. Elisha Mitchell Sci. Soc. **65**: 55. 1949 [Des., illus., cat.].

Resembling *Delphacodes campestris* (Van D.) but both sexes with at least several black spots; in male genitalia, segment X with processes, aedeagus more or less rectangular in lateral view. BRACHYPTEROUS FORM: Length of male: 2.3 mm., 1.8 mm.; length of female: 3.0 mm., 2.1 mm. *Color*: Generally buff-yellow; male with entire face polished black, black spots at each of the following locations; under the ocelli, above each coxa, on each side of terga of basal abdominal segments, and additional spots forming a broad crossband near middle of abdomen; genital capsule black except on extreme dorsum and segment XI; female with face tan, black spots in area beneath ocelli, above middle and hind coxae, on lateral margin of each tergum of abdomen. *Structure*: First antennal segment slightly more than twice as long as wide; face about twice as long as wide, sides almost parallel but narrowed at both ends, more so at base, carinae moderately developed; crown about a third longer than width at base, carinae slightly developed; forewings more than twice as long as wide, apices rounded, veins raised, heavy.

MALE GENITALIA, *lateral view*: pygofer more or less triangular, dorsal margin much shorter than ventral; segment X with two short, acute processes; aedeagus more or less rectangular, apex truncate, with a row of small teeth on dorsal margin, orifice located at ventrocaudal corner; aedeagal brace evident; genital styles avicephaliform, "beak" short, blunt, "head" flat on top. *Ventrocaudal view*: pygofer with opening nearly circular, about as long as wide, anal angles obscure, ventral emargination shallow; processes of segment X short, spines produced from lobes on segment X; dorsal margin of diaphragm concave, slightly raised into a lip at middle; genital

styles pediform, mesal apical angles acute, lateral apical angles somewhat blunt. In broadest view, styles avicephaliform, "beak" short, "head" blunt, high, large, "neck" very narrow.

MACROPTEROUS FORM: Length of male: 2.4 mm., 3.3 mm. Similar to brachypterous form but forewings much longer than abdomen, pronotum almost exclusively white. No female macropterous specimens have been seen.

This species has been previously collected in Raleigh, the only record for North Carolina. Specimens have been seen from North Carolina and Kansas. These are the only known localities for this species.

14. *Delphacodes nigripennata* Beamer

Figs. 15, 63, 64, 65

*Delphacodes nigripennata* Beamer, Jour. Kansas Ent. Soc. **19**: 139. 1946.

*D*[*elphacodes*] *nigripennata*, Beamer, Jour. Kansas Ent. Soc. **19**: 140. 1946 [Comp. note].

Resembling *Delphacodes alexanderi* (Metc.) but face without black longitudinal stripes, segment X with two pairs of processes and aedeagus bent dorsad near atrium. No females are known. Only one specimen, a macropterous male has been seen. Beamer's (1947a) description is given for the brachypterous form.

BRACHYPTEROUS FORM: Length of male: 2.0 mm.

*Structure*: Front about three times as long as wide, widest slightly below middle, slightly narrowed on apical third to apex, narrowed about one-fourth on basal third, definitely tricarinate; crown longer than width between eyes, crinae barely visible; elytra widest near middle, reaching to genital capsule, apices broadly rounded.

*Color*: Head, pronotum and most of body except abdomen tawny, abdomen mostly dark brown to black, with two dorsal light crossbands, some light spots on lateral margins of dorsum and narrow light hind margins of ventral segments; large dark spot above hind coxae; elytra black or very dark brown, shining, veins raised.

*Genitalia*: In lateral view anal segment with two pairs of processes; aedeagus bent dorsally near base with dorsal margin bulged near middle, some small teeth in region of this bulge; styles avicephaliform, beak sharp, head high and fairly sharp.

MACROPTEROUS FORM: Length of male: 2.0 mm., 2.6 mm. Similar to the brachypterous form but forewings about a third longer than abdomen. Color dark brown, legs somewhat lighter.

MALE GENITALIA, *ventrocaudal view*: pygofer

with opening about as wide as long, very shallow, anal angles produced, ventral emargination shallow; segment X well produced above pygofer; dorsal margin of diaphragm deeply concave, developed in middle into rectangular armature which is produced dorsad; genital styles broad at apices, lateral apical angles produced more than slightly produced mesal basal angles. In broadest view, genital styles much the same as in ventrocaudal view.

One specimen, a macropterous male, was taken from a trap light in Clayton in July 1958; this is a new record for the state. Beamer described this species from specimens from Kansas and Florida.

15. *Delphacodes recurvata* Beamer

Figs. 11, 66, 67, 68

*Delphacodes recurvata* Beamer, Jour. Kansas Ent. Soc. **21**: 3. 1948.

Resembling *Delphacodes kilmani* (Van D.) but segment X with two pairs of processes and genital styles each with a flange on apical third. BRACHYPTEROUS FORM: Length of male: 2.3 mm., 1.4 mm.; length of female: 2.6 mm., 1.6 mm. *Color*: Stramineous to light brown; forewings with a small brown spot near middle of apical margin, semblance of brown longitudinal lines on abdomen, aedeagus and genital styles brown. *Structure*: First antennal segment twice as wide as long; face about twice as long as wide, widest near middle, narrowed toward each end, slightly so toward apex, more so toward base, carinae well developed; crown slightly less than twice as long as width at base, carinae slightly developed; pronotal carinae straight, only slightly divergent, almost reaching posterior margin; forewings barely longer than wide, apices truncate, hyaline.

MALE GENITALIA, *lateral view*: pygofer wider than long, ventrocaudal margin concave; segment X small with a pair of long, slender processes arising ventrocaudally and recurved dorsad, extending length of caudal margin of segment; aedeagus slightly widest near atrium, slightly curved ventrad, with three fairly large antecapical teeth in a dorsal row, two teeth on left side near apex, single tooth on right side anterior to row; orifice on ventral margin near apex, its edges drawn out into a short membranous funnel; aedeagal brace evident; genital styles swollen on mesal margins near middle, lateral margins each with a flange on apical third. *Ventrocaudal view*: pygofer with opening wider than long, anal

angles roundly produced, lateral margins entire, ventral emargination deep; processes of segment X hidden behind styles; dorsal margin of diaphragm concave; genital styles long, reaching to segment X. In broadest view, styles arcuate, widest at middle, each with somewhat rectangular flange on mesal margin.

MACROPTEROUS FORM: Length of male: 2.3 mm., 3.1 mm.; length of female: 2.6 mm., 3.5 mm. Similar to brachypterous form but both pairs of wings about a third longer than abdomen.

This species has been taken in Raleigh, North Carolina. This is a new record for this state. The only other known localities are Washington, D. C. and Florida.

16. *Delphacodes andromeda* (Van Duzee)

Figs. 19, 69, 70, 71

*Liburnia andromeda* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **8**: 46. 1907.

*Delphacodes andromeda*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 36. 1924.

*Delphacodes andromeda*, Beamer, Jour. Kansas Ent. Soc. **21**: 98. 1948 [Comp. note].

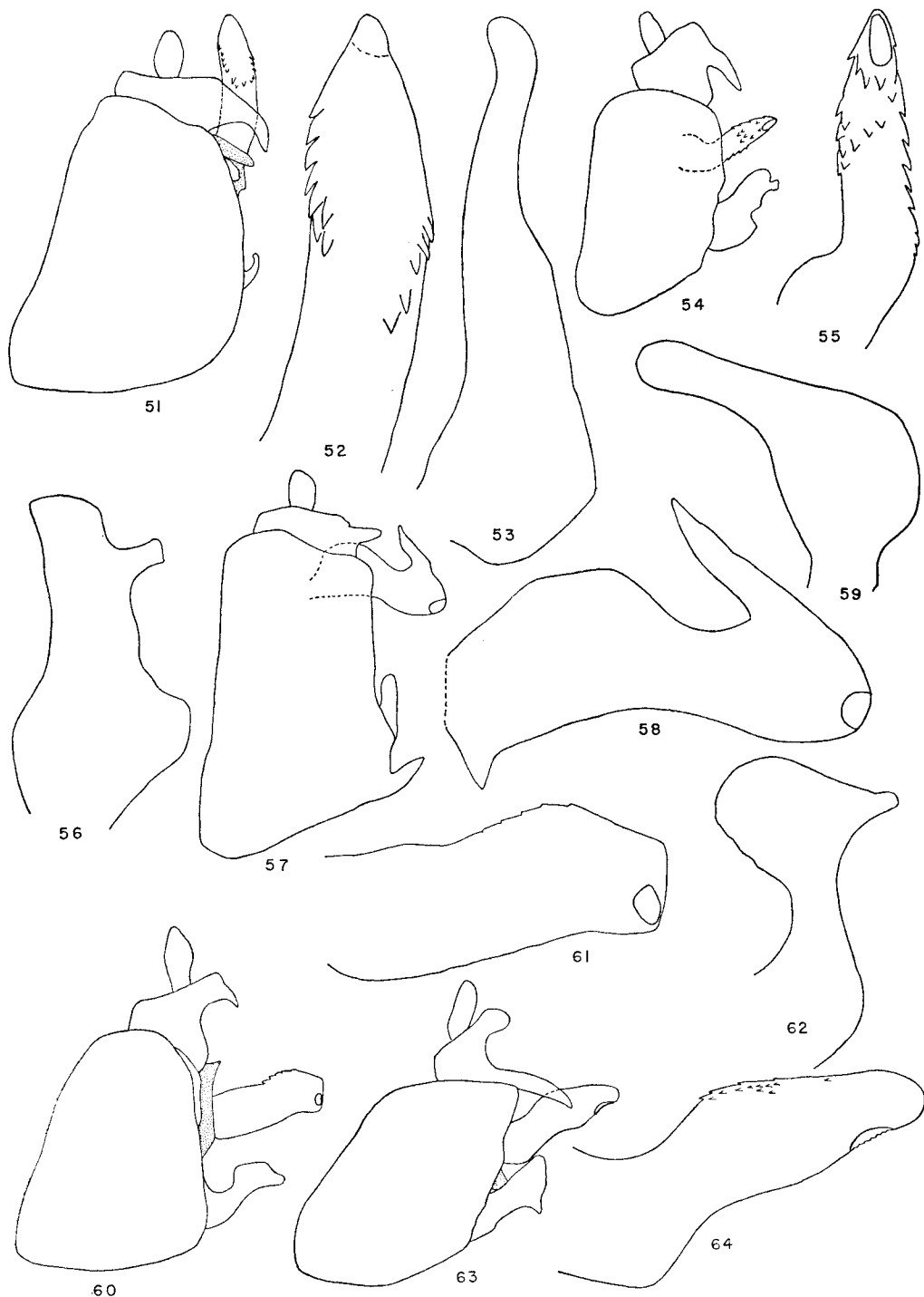
*Delphacodes andromeda*, Morgan and Beamer, Jour. Kansas Ent. Soc. **22**: 142. 1949 [Cat.].

*Delphacodes andromeda*, Wolcott, Jour. Agr. Univ. Puerto Rico **32**: 144. 1950 [Listed].

Resembling *Delphacodes adunca* Bmr. But more dorsal pair of anal processes long and broadly rounded at apices instead of short and acute.

BRACHYPTEROUS FORM: Length of male: 1.8 mm., 1.3 mm.; length of female: 2.0 mm., 1.5 mm. Color and structure, except for male genitalia, same as for *D. adunca*.

MALE GENITALIA, *lateral view*: pygofer about twice as wide as long, ventrocaudal margin concave exposing aedeagal brace; segment X large, bearing two pairs of processes, more ventral pair aciculate, more dorsal pair large, stout; aedeagus medium in size, slender for basal two-thirds of shaft, apical third semicircular, with a few small teeth extending diagonally from dorsal margin of apex to ventral margin, with teeth on ventral margin at middle third, orifice small, located at apex; genital styles each shaped like a meat cleaver, flattened, extending dorsad, with a semicircular spur near base. *Ventrocaudal view*: pygofer with opening about as long as wide, shallow, margins entire; segment X large, caudal margin developed into a pair of long processes which are broadly rounded at apices; dorsal mar-



FIGS. 51-64. Figs. 51-53. *Delphacodes kilmani*. 51, lateral view of male genitalia; 52, lateral view of aedeagus; 53, broadest view of left genital style. Figs. 54-56. *D. puella*. 54, lateral view of male genitalia; 55, lateral view of aedeagus; 56, broadest view of left genital style. Figs. 57-59. *D. analis*. 57, lateral view of male genitalia; 58, lateral view of aedeagus; 59, broadest view of left genital style. Figs. 60-62. *D. shermani*. 60, lateral view of male genitalia; 61, lateral view of aedeagus; 62, broadest view of left genital style. Figs. 63-64. *D. nigripennata*. 63, lateral view of male genitalia; 64, lateral view of aedeagus.

gin of diaphragm deeply concave, developed in middle into awl-shaped armature extending almost to bases of genital styles; genital styles subcylindrical at bases, spatulate toward apices, diverging at basal halves, then bending mesad to extend parallel, overlapping anal processes, mesal basal angles produced into spur-like processes. In broadest view, styles each twice as wide on apical half as on basal half.

MACROPTEROUS FORM: Length of male: 1.8 mm., 2.6 mm.; length of female: 2.0 mm., 2.7 mm. Similar to brachypterous form except forewings one-half longer than abdomen; general color slightly darker.

This species has been taken in North Carolina at Raleigh and Linville Falls. This is a new record for the state. Specimens have also been seen from Florida. This species has been reported from numerous localities extending from Maryland and Ohio down the Atlantic coastal area into the Caribbean area.

17. *Delphacodes adunca* Beamer

Figs. 17, 72, 73, 74

*Delphacodes adunca* Beamer, Jour. Kansas Ent. Soc. **21**: 98. 1948.

Resembling *Delphacodes andromeda* (Van D.) but more dorsal pair of anal processes short and acute at apices instead of long and broadly rounded.

BRACHYPTEROUS FORM: Length of male: 1.5 mm., 1.1 mm.; length of female: 1.7 mm., 1.5 mm. *Color*: General color stramineous in male; face, crown, anterior half of pronotum, all of scutellum except apex, and genital capsule except dorsum, black; posterior portion of pronotum and scutellum white; abdomen more or less tinged with dark shades on basal half. Female much lighter in color, sometimes without black on face, crown, pronotum, and scutellum; when dark, much paler than in males. *Structure*: Face not quite twice as long as wide, slightly wider at apex than at base, distinctly tricarinate, carinae moderately developed; crown as wide as long, slightly wider at apex than at base, carinae only slightly developed; pronotal carinae straight, diverging caudally but not curved behind eyes; forewings about as long as wide, apices rounded.

MALE GENITALIA, *lateral view*: pygofer one-third wider than long, much narrower on dorsal margin than on ventral, ventrocaudal margin convex; segment X with two pairs of processes, more dorsal pair short and acute, more ventral pair long and slender, extending ventrally through about half their length then curving

sharply dorsad and almost touching first pair apically; aedeagus slightly wider near apex than at atrium, bent dorsad on basal third of shaft then ventrad near apical third, orifice located at apex, with teeth scattered over aedeagus; genital styles nearly hidden except for apices. *Ventrocaudal view*: pygofer with opening wider than long, lateral margins slightly produced, ventral emargination slight; ventrolateral corners of segment X extending in two short processes, each as long as width near its base; dorsal margin of diaphragm deeply concave, with middle portion forming simple, more or less square armature; genital styles pediform, lateral apical angles each terminating in a bulbous "toe", mesal apical angles produced into somewhat acute "heels." In broadest view, styles about same as in ventrocaudal view, but "heels" blunt, mesal basal angles produced.

MACROPTEROUS FORM: Length of male: 1.8 mm., 2.6 mm.; length of female: 1.9 mm., 2.6 mm. Male and female like respective brachypterous forms but forewings three times as long as wide, transparent with light stramineous veins, broadly rounded at apices. General color darker than brachypterous forms.

The discovery of specimens from undetermined North Carolina material establishes a new record for this state. This species has been taken on several occasions in Raleigh and also in the mountains of North Carolina. Beamer's locality records included Florida and Georgia.

18. *Delphacodes laminalis* (Van Duzee)

Figs. 5, 75, 76, 77

*Liburnia lateralis* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Liburnia laminalis* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 251. 1897.

*Delphacodes laminalis*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 38. 1924.

[*Delphacodes*] *laterana* Metcalf, Gen. Cat. Hemiptera **4**: (3): 458. 1943 [Cat.].

*Delphacodes laminalis*, Moore, Canadian Ent. **46**: 44. 1944 [Listed].

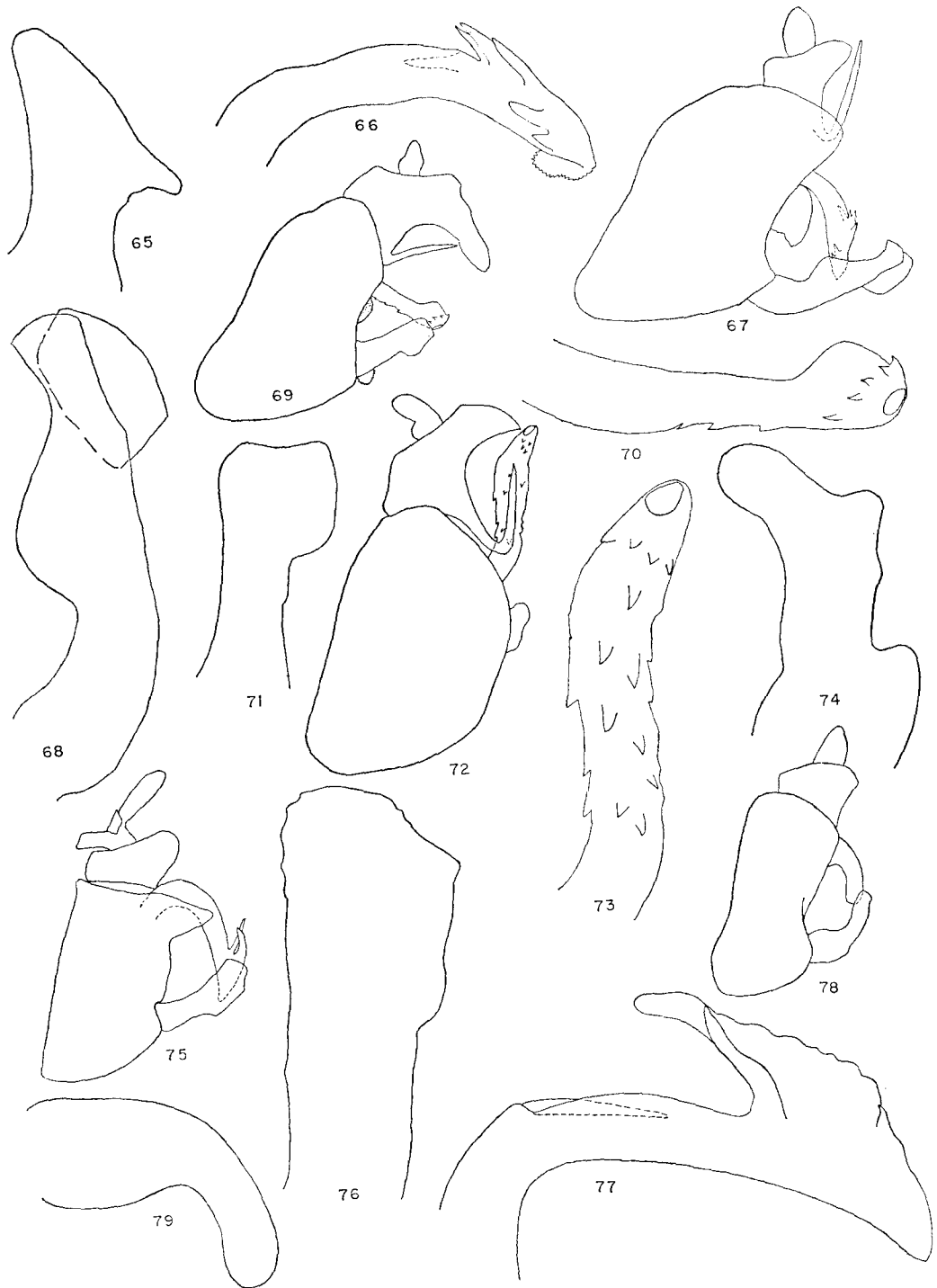
*Delphacodes laminalis*, Oman, Iowa State Coll. Jour. Sci. **21**: 212. 1947 [Cat.].

*Delphacodes laminalis*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 (Listed).

*Delphacodes laminalis*, Moore, Nat. Canadien **76**: 256. 1950 [Listed].

*Delphacodes lateralis*, Moore, Nat. Canadien **76**: 256. 1950 [Listed].

Resembling *Delphacodes kilmani* (Van D.)



FIGS. 65-79. Fig. 65. *Delphacodes nigripennata*. Broadest view of left genital style. Figs. 66-68. *D. recurvata*. 66, lateral view of aedeagus; 67, lateral view of male genitalia; 68, broadest view of left genital style. Figs. 69-71. *D. andromeda*. 69, lateral view of male genitalia; 70, lateral view of aedeagus; 71, broadest view of left genital style. Figs. 72-74. *D. adunca*. 72, lateral view of male genitalia; 73, lateral view of aedeagus; 74, broadest view of left genital style. Figs. 75-77. *D. laminalis*. 75, lateral view of male genitalia; 76, broadest view of left genital style; 77, lateral view of aedeagus. Figs. 78-79. *D. lutulenta*. 78, lateral view of male genitalia; 79, lateral view of aedeagus.

but first antennal segment twice as long as wide; in male genitalia, segment X without armature and anal angles of pygofer greatly produced.

**BRACHYPTEROUS FORM:** Length of male: 2.2 mm., 1.6 mm.; length of female: 2.8 mm., 2.2 mm. *Color:* General color yellowish; face sprinkled with faint pale spots between carinae; lateral margins on outside of lateral carinae of pronotum and scutellum, lateral margins of abdominal segments, dark brown; pygofer of male white with dark spot on each side, genital styles and segment XI black. Females generally darker. Forewings brown. *Structure:* First antennal segment twice as long as wide; face about twice as long as greatest width, narrowed on both ends, more so near base, carinae well developed, median carinae forking on face below vertex; crown almost square, carinae well developed; forewings with width about twice length.

**MALE GENITALIA, lateral view:** pygofer with dorsocaudal corner produced, forming a large tooth; segment X short; aedeagus slender, bent ventrad at basal third of shaft, with two processes, one arising from dorsal margin near basal third of shaft extending caudad on right side, the other arising dorsad from dorsal margin at half distance from origin of first to apex, orifice located near dorsal margin, sides produced dorsad into membranous funnel; genital styles each with dorsal margin slightly concave, ventral margin produced on apical half. *Ventrocaudal view:* pygofer with opening wider than long, anal angles produced, ventral emargination slight; segment X short, without processes; dorsal margin of diaphragm concave, without armature; genital styles large, each with apex broader than base, lateral and mesal margins sinuate, mesal apical angle slightly produced. In broadest view, genital styles each with lateral and mesal margins subparallel, mesal margin with slight bulge near middle, apical margin slightly convex on lateral half, concave on mesal half.

**MACROPTEROUS FORM:** Length of male: 2.3 mm., 3.8 mm.; length of female: 2.8 mm., 4.1 mm. Similar to brachypterous form but colors more prominent, forewings extending almost two-thirds length of abdomen.

This species has been taken in Hendersonville and Clayton, North Carolina. Specimens have been seen from Pennsylvania, Maryland, Washington, D. C., Indiana, North Carolina, and Florida. It has also been recorded from Quebec, Ontario, Massachusetts, Connecticut, New York,

Ohio, Illinois, Mississippi, Louisiana, and California.

19. *Delphacodes lutulenta* (Van Duzee)

Figs. 20, 78, 79, 80

*Liburnia lutulenta* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Delphacodes lutulenta*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 23. 1924.

[*Delphacodes*] *lutulenta*, Moore, Canadian Ent. **46**: 1944 [Listed].

*Delphacodes lutulenta*, Oman, Iowa State Coll. Jour. Sci. **21**: 213. 1947 [Cat.].

*Delphacodes lutulenta*, Beamer, Jour. Kansas Ent. Soc. **21**: 5. 1948 [Comp. note].

*Liburnia lutulenta*, Buyckx, La Cellule **56**: 66. 1948 [Parasites].

*Delphacodes lutulenta*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 32. 1950 [Listed].

*Delphacodes lutulenta*, Moore, Nat. Canadien **77**: 257. 1950 [Listed].

*Delphacodes lutulenta*, Wolcott, Jour. Agr. Univ. Puerto Rico **32**: 144. 1950 [Listed].

**BRACHYPTEROUS FORM:** Length of male: 2.0 mm., 1.6 mm.; length of female: 2.3 mm., 1.7 mm. *Color:* General color dull testaceous brown; facial carinae brown margined; abdomen darker, in male rufous, in female segments edged with rufous; females somewhat lighter than males, sometimes stramineous. *Structure:* First antennal segment as wide as long; face square, width two-thirds length, carinae moderately developed; carinae on apex obscure; crown varying from slightly wider than long to condition in which crown is square with carinae only slightly developed, slightly wider at apex than at base; pronotal carinae varying, sometimes straight, extending caudad, sometimes curved laterad behind eyes; forewings much longer than wide.

**MALE GENITALIA, lateral view:** pygofer more or less rectangular, width twice length, dorsal and ventral margins evenly convex, cephalic and ventrocaudal margins concave; segment X well produced above dorsum, without processes; aedeagus small, flattened laterally, about twice as wide on basal half as on apical half of shaft, strongly curved ventrad near middle, without teeth or processes; genital styles moderately large, similar to aedeagus in appearance, each wide on basal half, narrowing on apical half, curved dorsad near middle. *Ventrocaudal view:* pygofer with opening slightly wider than long, all margins entire; dorsocaudal margins of segment X emarginate; diaphragm cordate with



dorsal margin concave, developed in middle into cordate armature which is produced caudad; genital styles almost reaching dorsal margin of diaphragm, wide at bases then narrowing into slender, straight shafts, mesal and lateral margins parallel. In broadest view, styles almost same as in lateral view.

MACROPTEROUS FORM: No macropterous forms were available for study.

This species has been taken in Raleigh, North Carolina, a new record for the state. Other specimens have been seen from Alberta, New Hampshire, Connecticut, New York, and South Dakota. It has also been listed from Quebec, Ontario, Massachusetts, Ohio, Minnesota, Kansas, Colorado, California, and Puerto Rico.

20. *Delphacodes campestris* (Van Duzee)

Figs. 16, 81, 82, 83

*Liburnia campestris* Van Duzee, Bull. Buffalo Soc. Nat. Sci. **5**: 191. 1894.

*Liburnia unda* Metcalf, Jour. Elisha Mitchell Sci. Soc. **38**: 207. 1923.

*Delphacodes campestris*, Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. Div. Ent. **15**: 35. 1924.

*D[elphacodes] campestris*, McClure, Ecol. Mon. **13**: 14, 28. 1943 [Ecology].

*[Delphacodes] campestris*, Moore, Canadian Ent. **46**: 44. 1944 [Listed].

*D[elphacodes] campestris*, Beamer, Jour. Kansas Ent. Soc. **20**: 59, 70. 1947 [Comp. note].

*Delphacodes campestris*, Oman, Iowa State Coll. Jour. Sci. **21**: 210. 1947 [Cat.].

*Delphacodes campestris*, Beamer, Jour. Kansas Ent. Soc. **21**: 99, 100, 103, 116. 1948 [Comp. note].

*L[iburnia] campestris*, Buyekx, La Cellule **56**: 66. 1948 [Parasites].

*Liburnia campestris*, Kretschmar, Jour. Econ. Ent. **41**: 588. 1948 [Food plants].

*L[iburnia] campestris*, Metcalf, Jour. Elisha Mitchell Sci. Soc. **65**: 55. 1949 [Comp. note].

*Delphacodes campestris*, Metcalf, Jour. Elisha Mitchell Sci. Soc. **65**: 56. 1949 [Des., illus., cat.] Equals *Liburnia unda* Metc.

*Delphacodes campestris*, Moore, Contr. Inst. Biol. Univ. Montreal **26**: 31. 1950 [Listed].

*Delphacodes campestris*, Moore, Nat. Canadian **77**: 256. 1950 [Listed].

*Delphacodes campestris*, Beamer, Jour. Kansas Ent. Soc. **24**: 12. 1951 [Comp. note].

*Delphacodes campestris*, Dowdy, Ecology **32**: 50. 1951 [Ecology].

*Delphacodes campestris*, Beamer, Jour. Kansas Ent. Soc. **25**: 114. 1952 [Comp. note].

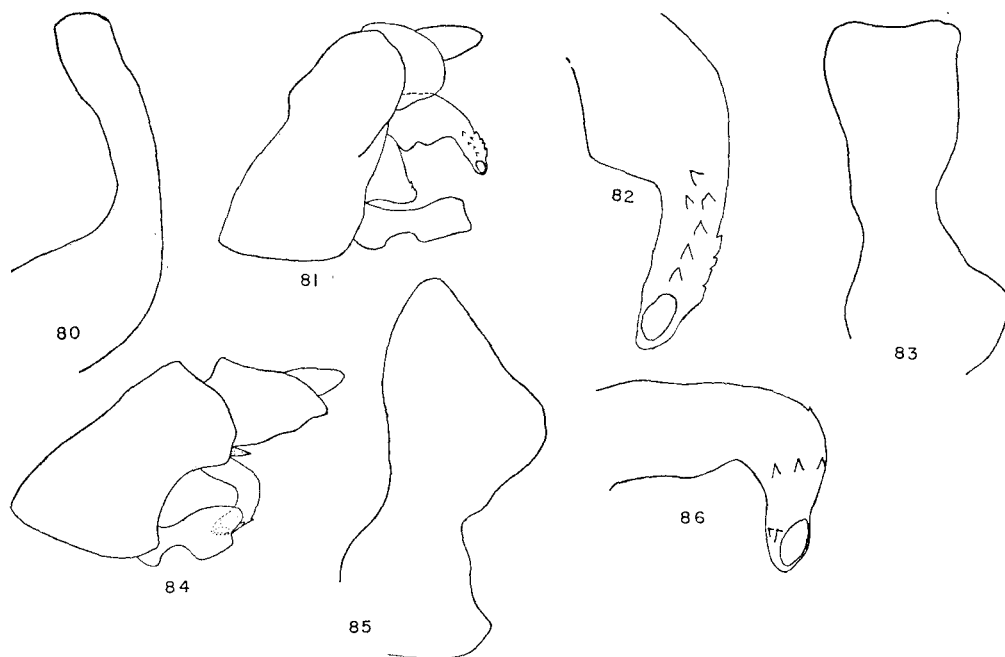
*[Delphacodes] campestris*, Strickland, Canadian Ent. **85**: 209. 1953 [Food plants].

Resembling *Delphacodes shermani* (Metc). But with only one dark brown pleural spot and segment X without processes.

BRACHYPTEROUS FORM: Length of male: 2.3 mm., 1.8 mm.; length of female: 2.5 mm., 2.2 mm. *Color*: General color ochraceous-buff; abdomen fulvous or rufous; male genital capsule and legs stramineous; basal angles of scutellum and large pleural spot dark brown; coastal specimens much paler. *Structure*: First antennal segment about as wide as long; face slightly less than twice as long as wide, lateral carinae varying from nearly straight to broadly rounded, but constant in narrowing near base of face, carinae moderately to well developed; crown varying from nearly square to a condition in which length is greater than basal width, carinae moderately to well developed; forewings varying from slightly longer than wide to twice as long as wide.

MALE GENITALIA, *lateral view*: pygofer about twice as wide as long, dorsal margin rounded; segment X without processes; aedeagus widest at atrium, ventral margin strongly converging near middle to cylindrical apical half, dorsal margin regularly convex, orifice located at apex; diaphragm armature large, broad at base extending caudad to terminate in broadly rounded apex, apical portion with numerous small teeth; genital styles large, each broad at base, narrowing on ventral margin near middle, terminating in truncate apex, dorsal margin concave. *Ventro-caudal view*: pygofer with opening shallow, a third wider than long, anal angles rounded, not produced, lateral margins produced near their middle, ventral margin entire; segment X short, dorsal margin concave; diaphragm produced in middle by two subrescentiform ridges running from near dorsal margin to near bases of genital styles, their convex mesal margins contiguous, ventral half of ridges with minute teeth; genital styles extending caudad, each acute at mesal basal and lateral apical angles, lateral margin convex, mesal margin concave. In broadest view, styles large, each with mesal basal angle developed, lateral and mesal margins convergent near basal third, gradually diverging to truncate apex, apical margin slightly concave.

MACROPTEROUS FORM: Length of male: 2.3 mm., 3.8 mm.; length of female: 2.6 mm., 4.0 mm. Similar to brachypterous form but color



FIGS. 80-86. Fig. 80. *Delphacodes lutulenta*. Broadest view of left genital style. Figs. 81-83. *D. campestris*. 81, lateral view of male genitalia; 82, lateral view of aedeagus; 83, broadest view of left genital style. Figs. 84-86. *D. rotundata*. 84, lateral view of male genitalia; 85, broadest view of left genital style; 86, lateral view of aedeagus.

darker, markings more distinct, forewings much longer than abdomen.

This species has been taken in North Carolina at Carolina Beach. Specimens have been seen from Alberta, New Hampshire, Connecticut, Illinois, and Nebraska. It has also been recorded from Quebec, Ontario, Massachusetts, New York, New Jersey, Pennsylvania, District of Columbia, Michigan, Ohio, Iowa, Minnesota, Louisiana, Mississippi, Missouri, Kansas, Colorado, Arizona, and Nevada.

#### 21. *Delphacodes rotundata* (Crawford)

Figs. 21, 84, 85, 86

*Megamelus rotundata* Crawford, Proc. U. S. Nat. Mus. 46: 606. 1914.

*Delphacodes rotundata*, Metcalf, Gen. Cat. Hemiptera 4: (3): 503. 1943 [Cat.].

BRACHYPTEROUS FORM: Length of male: 2.3 mm., 1.8 mm. No female specimens were available for study. *Color*: Head, pronotum, scutellum, soiled whitish; abdomen dark brown except dorsum of last three segments and pygofer which are rufous. *Structure*: First antennal segment about twice as long as wide; face slightly more than one and one-half times as long as wide,

widest near middle, narrowing at both ends, carinae well developed; crown much longer than wide, carinae moderately developed; forewings about twice as long as wide, hyaline, veins prominent.

MALE GENITALIA, *lateral view*: pygofer one-third wider than long, ventrocaudal margin concave, dorsocaudal and ventrocaudal corners somewhat produced; segment X large, ventral margin much longer than dorsal, without processes; aedeagus small, widest at atrium, bent ventrad near middle of shaft at almost a right angle, with a few small teeth on apical half, orifice located on dorsum near apex; aedeagal brace evident; genital styles constricted below middle, spatulate at apex. *Ventrocaudal view*: pygofer with opening much wider than long, anal angles rounded, little produced; segment X without processes; dorsal margin of diaphragm concave, developed in middle into concave lip extending almost to bases of genital styles; genital styles reaching to dorsal margin of diaphragm, each broad at base, constricted near middle on mesal margin, spatulate at apex. In broadest view, styles obliquely truncate at apices, mesal basal angles produced.

MACROPTEROUS FORM: Length of male: 2.3 mm., 3.0 mm. Similar to brachypterous form but general colors darker, pronotum sometimes rufous; forewings much longer than abdomen. No female specimens were available for study.

This species has been taken in North Carolina at Raleigh and Swannanoa. Specimens have been seen from New York, New Jersey, North Carolina, and Arizona. It is also recorded from Ohio, Alabama, and Florida.

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