PAPER NO. 1. DESCRIPTIONS AND FIGURES OF ELEVEN CONFUSED SPECIES OF DELTOCEPHALUS INFESTING GRASSES.

INTRODUCTION.

Certain closely allied species and forms of grass-feeding leafhoppers of the genus Deltocephalus for many years have been confused by students of this group. Lack of adequate material and satisfactory figures and descriptions have led to some confusion of characters, with the result that a few unfortunate errors have crept into our literature on this economic and interesting group.

Likewise a lack of material from Europe has resulted in failure to recognize as identical with European species, several species redescribed as new in North America. The purpose of this illustrated review is to assemble comparative descriptions and figures, and a key by which accurate identification of the concerned, somewhat related species may be made, and which we trust may lead to a more satisfactory study and observance of the members of this group.

The economic importance of some of the included species which often occur by the millions in pasture grasses has not been sensed by many entomologists, much less by the farmer. Evidence of injury by sucking insects is not so readily discernable until an extreme stage has been reached and the affected plants become wilted, shriveled or yellow. Chewing insects, however, by eating and consuming portions of plants, display their damage, and the amount of injury to the plant can be more readily judged by casual observation.

A common farm practice that utilizes certain fields for pasture during several or many successive years, tends to the multiplication of many grass infesting pests occurring both above and below the surface of the ground which do much damage, that could be wonderfully modified in severity by more frequent crop rotation.

DISCUSSION OF SPECIES AND SYNONYMY.

A fairly common species of Deltocephalus here described as new apparently has escaped detection as such for years, altho it may have reposed in collections for a considerable number of years probably classified with described species. This new species described in this paper which occurs in plenty in several eastern states doubtless has been confused with what has been called *D. oculatus* O. & B. This latter species must receive a new name as cited below, *D. oculatus* being preoccupied in European literature.

Of special interest however, is the determination that *D. affinis* Gillette & Baker is the very common European *D. striatus* (Linn.), many specimens of which were taken by the senior author in England, Scotland, Ireland and Holland in August and September, 1919.

Examination of the type of *D. melsheimerii* Fitch proves it to be identical with *D. vicilinus* Crumb described in 1915. *D. minimus* Osborn and Ball, which has been placed by Van Duzee et al. as a synonym of *D. melsheimerii* is a distinct and valid species.

Several of the species considered here have not appeared frequently in literature in late years, nor do we have wide distribution records of some species which doubtless would be taken throughout large areas if thorough collecting was done. On account of the economic importance of some of the species, entomologists throughout the country are urged to sweep meadows and grasses generally to determine the relative abundance of species of this group. The authors will be pleased to receive material for examination and determination, and will return carefully identified specimens.

METHODS FOR COLLECTING LEAFHOPPERS.

For the benefit of those who wish to make collections and studies of leafhoppers, a few remarks on the best methods may be desirable. A heavy cloth or muslin bag of fair depth mounted on a strong ring or frame with a stout handle, is most serviceable and effective. A few vigorous sweeps with such a net over grasses and herbage especially close to the ground will often capture dozens of specimens, sometimes comprising several distinct species. Slender yet strong glass tubes, prepared with cyanide in the usual way, make most satisfactory killing bottles. These bottles should be strong with cyanide to kill the hoppers very quickly, in order to facilitate their rapid capture and removal from the net, from which they can best be taken one by one by placing the tube quickly over the active insects as they frequently hop onto the side of the bag. Certain species however will try to hide in such debris as collects in the bag when sweeping, but by carefully removing this little by little and shaking off the hoppers, the individuals can be captured.

Ordinary pill boxes are excellent containers until ready for mounting; and by the use of paper disks cut to exact size, several collections may be placed in the same box, each disk bearing the necessary data. *Is it a hard and fast rule of trained entomologists that raw cotton should never be permitted to come in direct contact with dried insect specimens.* Fine tissue paper should be utilized instead for packing.

METHODS FOR MOUNTING LEAFHOPPERS.

Almost without exception, the smaller Homoptera except aphids and scale insects should be mounted on triangular paper points, always using white pins of sufficient rigidity to pin easily, yet not so

heavy as to appear unattractive, and unwieldy. The paper triangles should be carefully cut with a good point cutter or a razor to insure clean, sharp points; and they should not be over six or seven millimeters long. Impale the triangle near the broad end and move it up by means of a pinning block to about ten or twelve millimeters below the head of the pin.

The specimen should be carefully mounted by placing a tiny bit of glue on the tip and bringing it in contact with the under-thoracic region so that the insect is on the left side of the pin, when facing away from the operator. The locality and collector labels should be pinned through the extreme right end and then moved upward about one-half the distance to the triangle, the labels thus extending underneath the point and protecting the mounted specimen. Host labels add to the value of a specimen provided the host plant is positively identified.

TWO METHODS FOR MAKING ACCURATE ILLUSTRATIONS.

DRAWINGS.—Accurate illustration are of great service as aids in identifying these tiny insects. The method here described has been found to be most satisfactory and always serviceable in securing extremely accurate and bilaterally symmetrical drawings. Plate V, fig. 1 represents an ocular micrometer-disc to be used on the diaphragm of the ocular, and is ruled in 0.5 mm. squares with the alternate lines numbered on adjacent sides. By placing the mounted specimen, or any portion thereof, as nearly horizontal as possible within the field, and by the use of engineer's coördinated ruled paper, absolutely accurate outlines of the object can be drawn. Furthermore, by the use of this method specimens can be drawn in accurate relative proportions. By means of strong transmitted light, tracings from these on drawing paper can be made in pencil, then corrected and inked. Several styles of ruling in coördinated paper are available at stationers, and those styles should be selected according to the enlargement desired.

PHOTOMICROGRAPHS.—If well-mounted, perfect specimens are at hand, excellent photographs can be secured with a photomicrographic apparatus equipped with a 32 or 45 mm. micro-tessar lens, or one of similar type. Proper lighting of the object is most important, and where good strong daylight can be used, a condenser lens is desirable to concentrate the rays when needed. By careful retouching of the negative or prints reasonably good results can be obtained, which sometimes illustrate the general appearance of a specimen better than a drawing. The latter is more effective for detailed morphologic characters.

KEY TO SPECIES.

1.	Small, not exceeding 3 mm. in length, ...	2
	Larger, 3.25 mm. or more long, ...	5
2.	Vertex distinctly longer than width between eyes angularly pointed; female segment with broad, shallow excavation; male plates almost truncated, ...	*melsheimerii* Fitch
	Vertex less pointed, width between eyes approximating length at middle; female segment incised, roundingly produced or with long sunken tooth; male plates pointed, ...	3
3.	Female segment narrowly incised at middle; male plates convexly rounded, ...	*minimus* O. & B.
	Female segment not incised at middle, ...	4
4.	Female segment produced, median half deeply excavated with a long blunt tooth at middle, ...	*monticolus* G. & B.
	Female segment gradually produced, median third truncated; male plates with outer margins almost straight, ..	*parvulus* Gill.
5.	Vertex wider between eyes than length at middle, bluntly, often roundingly angled, or rounded, in front, ...	6
	Vertex as long or longer on middle than width between eyes,	8
6.	Bright orange yellow, vertex scarcely angled, almost uniformly rounded, ...	*auratus* G. & B.
	Color distinctly greenish yellow; female segment concavely rounded, or produced with median tooth, ...	7
7.	Vertex distinctly wider than long, female segment simple, feebly concave; short, blunt male plates half longer than valve, ...	*striatus* (L.)
	Female segment strongly produced with margins double-curved from base to median tooth, revealing at margins the plates beneath; male plates more than twice as long as valve, ...	*littoralis* Ball
8.	Vertex with sides strongly convex; apex broadly angled; female segment broadly and deeply concave, incised at middle; male plates broadly rounded at tips, ...	*pascuellus* (Fall.)
	Vertex more pointed, sides almost straight; female segment neither excavated nor incised at middle; male plates pointed, ...	9
9.	Female segment sinuated, with three small lobes at middle; male plates tapered to narrow attentuated tips, ...	*nominatus* n. n.
	Female segment distinctly produced at middle, ...	10
10.	Female segment with median third abruptly produced and truncated; male plates with tips quite broad, bluntly pointed and divergent, ...	*sylvestris* O. & B.
	Female segment with median half gradually produced to a pointed, brownish tooth; male plates tapered to narrowly rounded tips, ...	*acus* n. sp.

NOTE

The "Catalogue of the Hempitera of America North of Mexico," by E. P. Van Duzee, University of California Publications, Tech. Bull., Vol. 2 (1917), has been followed in listing and numbering species, except that as noted elsewhere the decimal system, instead of the fractional, has been adopted in the inclusion and addition of new species.

2073. Deltocephalus pascuellus (Fall.).

(Pl. I, fig. 1; Pl. III, fig. 1.)

Fallen, Hemp. Succ., Cicad., p. 32 (1826) Cicada.
punctipes Zett., Ins. Lapp., Column 292 (1840) *Cicada.*
fuscosignatus Dahlb., Kong. Vet. Ak. Handl. (for 1850) p. 195.
minki Prov., Pet. Faune Ent. Can., III, p. 279 (1889) (Cited in error).

A rather robust form with bluntly angled vertex and a black or brown dash either side of apex. Length, female, 3.5 mm.; male, 3 mm.

Vertex as long at middle as width between the eyes, with bluntly rounded tip. Pronotum twice as broad as long, scutellum rather small. Elytra but little longer than abdomen.

Color: Vertex yellowish with a paler band in female along the margin and an oblique dash either side extending toward eye from the apical dashes, pale brown. Pronotum and scutellum yellow. Elytra yellowish-green subhyaline, nervures yellowish. Face dull brown with about seven broken pale arcs, the infra-ocellar line black or brown connecting with brown line or blotch along lower margins of eyes, pale below. Abdomen black beneath, posterior margins of segments yellow. Pleurae yellow with black dotes. Pygofers yellow, ovipositor black.

Genitalia: Female last ventral segment a little longer than preceding, lateral angles prominent, hind margin broadly and deeply excavated with sharp, median, black-margined incision. Male valve one-half longer than last ventral segment, triangular with sides sinuate and apex broadly rounded. Plates twice longer than valve, broad at base, outer margins slightly sinuate, narrowed to rounded tips. Each plate with a median impressed longitudinal line.

This introduced European species is recorded from the New England States where it is very abundant in pastures, and also from New York, Pennsylvania and eastern Canada. It may prove to be a general pest after wider distribution.

2074. Deltocephalus parvulus Gill.

(Pl. I, fig. 8; Pl. IV, fig. 3.)

Gillette, Colo. Agr. Exp. Sta., Bull. 43, p. 23 (1898).

A minute yellowish-green species with produced head and blunt apex, especially in the male. Length, female, 3 mm.; male, 2.5 mm.

Vertex bluntly pointed in female slightly longer than width between eyes and a little longer than pronotum. In male a little broader between eyes than length at middle and shorter than pronotum, ocelli black. Pronotum twice as wide as long, side margins almost obsolete. Elytra decidedly longer than abdomen, venation simple.

Color: Vertex, pronotum and scutellum yellowish green, a rather broad indefinite fuscous stripe either side of apex on vertex extending toward ocellus, broadening on disc and continuing to pronotum, leaving a median paler stripe. Impressed median basal line black. Elytra dull hyaline, nervures yellowish green. Frons dull brownish traces of seven pairs of pale arcs, lower portion of face pale, sutures darkened. Venter pale yellowish green.

Genitalia: Female last ventral segment one-half longer than preceding, posterior margin roundingly produced, almost truncated on median third. Male valve longer than last ventral segment, triangular, sides sinuate; plates three times longer than valve, outer margins weakly concave, tips bluntly pointed and appressed.

This very small greenish species seems to be restricted to the prairie regions of the central states where it occurs abundantly on native grasses. There has been no reference to this species in literature since the original description in 1898, in which it was recorded from Colorado. We have numerous specimens from Clay County in northeastern Kansas, and it doubtless occurs also in Nebraska.

2075. Deltocephalus striatus (Linn.).

(Pl. I, fig. 3; Pl. III, fig. 2.)

Cicada striata Linnaeus, and of Schrank, Fabricius, Fallen, Zetterstedt; *Jassus striatus* Herrich-Schaeffer, Thomsen et al.; *Jassus strigatus* Germar; *Deltocephalus striatus* Flor, Marshall, Kirschbaum, Fieber, Sahlberg, Scott, Edwards.

Deltocephalus affinis Gill. & Baker, Hemip. Colo., p. 84 (1895).

A very common species, greenish to brownish, marked with fuscous, vertex broadly angled. Length, female, 4 mm.; male, 3.5 mm.

Vertex very blunt and broadly angled almost one-third broader between eyes than length at middle. Pronotum one-fourth longer than vertex, more than twice as wide as long. Elytra greatly exceeding abdomen, venation simple.

Color: Quite variable, vertex often with definite fuscous spots or blotches, interocellar line pale. Pronotum and scutellum with irregular fuscous markings. Elytra whitish hyaline nervures greenish-yellow, more or less margined with fuscous. Sometimes very dark and giving a striped appearance to the elytra. Face brownish with pale arcs and paler below. Venter black in the male or marked with black in the female.

Genitalia: Female last ventral segment a little longer than preceding, simple, posterior margin produced, median half shallowly concave, lateral angles rounded. Male valve narrower and slightly longer than last ventral segment, roundingly produced to almost truncated apex. Plates exceeding valve by only one-third their length. Apices obliquely truncated and gently sloping to median line. The large rounded valve almost covering the short plates is characteristic of this species.

This variable species is common and abundant in northern Europe, and in northern United States and Canada under many conditions, which seem to cause wide variations in coloration and markings. On account of these factors, the species has been redescribed under different names by authors.

In the United States it has been known for many years as *D. affinis* Gillette & Baker, and appears in many collections as such, but comparison of American specimens with many specimens collected in various habitats during the summer of 1919 by the senior author in the British Isles and Holland prove its identity.

An important and unique character easily distinguishing this species is the peculiar short plates of the male genitalia almost covered by the large semi-circular valve. Specimens from the mountain regions are often more highly colored and marked, thus more closely resembling the usual north European forms.

2076. Deltocephalus monticolus G. & B.

(Pl. I, fig. 5; Pl. III, fig. 7.)

Gillette & Baker, Hemip. Colorado, p. 88 (1895).

Closely allied to *D. striatus* Linn, with vertex more produced and bluntly angled, yellowish green with a pair of oblique brown dashes back of apex. Length female and male 3 mm.

Vertex produced, bluntly angled, a little wider between eyes than length at middle. Pronotum shorter than vertex, twice wider than long, lateral margins almost angled. Elytra decidedly longer than abdomen, venation simple.

Color: Yellowish green, vertex, pronotum and scutellum deeper yellow, median impressed line on vertex, infra-ocellar line, a pair of narrow curved lines extending from this up over apex and a pair of heavy oblique dashes above apex, brownish. Elytra whitish subhyaline, nervures yellowish. Face dark brown with eight pairs of conspicuous pale arcs, clypeus and lorae paler, sutures dark. Venter, except apical segment, principally black and ovipositor black.

Genitalia: Female last ventral segment equal in length to preceding, posterior Posterior margin roundingly produced, median half abruptly, deeply excavated each side of a long, median round-pointed tooth. Lateral angles obsolete. Male valve longer but much narrower than last ventral segment, roundingly produced to sharp-pointed apex. Plates broad at base, almost four times length of valve, convexly rounded then gradually narrowed to pointed appressed tips. Pygofers very long, much exceeding the plates, and with numerous stout bristles.

This species is listed under the above number in Van Duzee's Catalog as *"monticolor."* Originally described as *monticola* by Gillette & Baker, (meaning a mountain dweller) the proper termination is *monticolus* as it has no reference to color or hue.

2081. Deltocephalus nominatus nom. nov.

(Pl. I, fig. 4; Pl. III, fig. 4.)

D. oculatus Osborn & Ball, Pr. Ia. Acad. Sci., IV, p. 212 (1897). Preoccupied by Sahlberg (1876), cf. Scott, Ent. Mo. Mag., XII, p. 274 (1876).

Resembling *D. sylvestris* in size and form but usually pale yellow and with vertex more bluntly angled. Length 3.5 mm.

Vertex slightly longer than width between eyes, apex bluntly angled, a little longer than pronotum. Pronotum twice as wide as long, side margins short but distinct. Elytra distinctly exceeding abdomen, venation simple.

Color: Female usually rather uniform pale dull yellow, male frequently tinted with greenish. Ocelli, impressed line on vertex and eyes dark, inter-ocellar line from apex to ocelli pale brownish. Elytra subhyaline, nervures yellowish. Face with pale arcs on upper portion, paler below. Venter yellowish.

Genitalia: Female last ventral segment equal in length to preceding, posterior margin with median third slightly produced, dark margined and scarcely trilobate. Male valve triangularly produced, almost twice length of last ventral segment. Plates convex, narrowed to produced, attenuated tips.

This species was described by Osborn and Ball, and is commonly known in collections as *D. oculatus,* but since the name has been long preoccupied by *D. oculatus* Sahlberg in European literature, a new

name is here proposed. The distribution of this species is much wider than is indicated by the locality records in the Van Duzee Catalog. It is an abundant species on Andropogon in the eastern central states, and its range extends northward through Pennsylvania and northwestward to Wisconsin and Iowa, and occurs in Colorado. The produced, attenuate, cylindrical tips of the male plates serve as a readily distinguishable character of this sex.

This is apparently a species widely distributed throughout northern areas.

2081.5* Deltocephalus acus n. sp.

(Pl. I, fig. 11; Pl. IV, fig. 4.)

Resembling *D. sylvestris*, but slightly longer and generally paler in color; almost buff with triangularly pointed head. Length, female and male, 4 mm.

Vertex flat, sharply pointed, one-fifth longer on middle than between eyes, and one-fifth longer than pronotum. Pronotum strongly arcuate in front and slightly emarginate behind; lateral margins very short. Elytra distinctly longer than abdomen, almost hyaline, broadly rounded at tips, venation simple.

Color: Pale buff with greenish yellow tinge on head and pronotum. Vertex in well-marked specimens with median impressed line, ocelli and arcuate line from apex toward eye, pale brown. Elytra milky hyaline revealing the dark yellow margined segments; veins paler, faintly bordered with fuscous especially toward apex. Face above sordid yellow with paler arcs; clypeus and genae yellow. General color of venter yellow, except median line and border of abdominal segments fuscous.

Genitalia: Female last ventral segment slightly longer than preceding, hind margin with median half produced forming a broad pointed tooth with sinuate sides margined with brown. Male valve triangularly rounded as long as, but narrower than last ventral segment. Plates at base as broad as last ventral segment, twice length of valve, concavely narrowed to round-pointed tips.

Described from large series of males and females collected in Pennsylvania at Northeast, Hartstown, Kane and Charter Oak, from June 26 to Aug. 23, 1917-'19 by D. M. DeLong and H. B. Kirk. In New York at Speculator, Aug. 5 & 6, 1912, and Karner, Oct. 4, 1912, collected by D. B. Young; Lake Placid, Aug. 12, 1904, collected by E. P. Van Duzee; Bayshore, L. I., July 4-7, 1912 collected by C. E. Olsen. In Wisconsin at Tomah, Merrillan, Amery and Ladysmith and at Taylor's Falls, Minn., throughout August, 1916, by the authors.

This distinct species here presented has been confused for a long time by various workers and collectors with *D. sylvestris* and *D. nominatus (oculatus* O. & B.). Although closest to *D. sylvestris* it is readily distinguished by the broad pointed brownish median tooth on the hind margin of the ultimate female ventral segment and the long abruptly tapering genital plates of the male.

*The use of the decimal system in making additions to a catalog with numbered species seems more elastic and adaptable than the use of fractions, hence the adoption of this method here.

2082. Deltocephalus littoralis Ball.

(Pl. I, fig. 2; Pl. III, fig. 3.)

Ball, Proc. Biol. Soc. Wash., XVIII, p. 120 (1905).

A large robust form resembling *D. collinus* in general appearance. Length, female, 4.4 mm.; male, 3.5 mm.

Vertex strongly produced but very blunt, as long on middle as width between eyes, slightly rounded to front. Pronotum as long as vertex, twice wider than long, side margins very short, posteriorly concave. Elytra shorter than abdomen in brachypterous females and longer in macropterous females, slightly longer than or equaling abdomen in male. Venation usually simple, but often with middle anteapical cell divided by a cross nervure.

Color: Dull green, vertex pronotum and scutellum often yellowish green. Ocelli and eyes black, a strongly curved line from either side of apex extending beneath ocelli and two arcs on margin visible from above, fuscous. Usually with two triangular fuscous area back of apex. Elytra smoky hyaline, nervures greenish yellow. Front brown, about nine or ten pairs of arcs and median line pale. Lower part of face paler.

Genitalia: Female last ventral segment about twice the length of preceding, lateral margins short, concavely narrowed to strongly produced median third which is abruptly narrowed to a rounded median tooth; a brown spot either side of tooth appearing as a notch. An oval plate either side projecting beyond lateral margins. Male valve about one-third as long as last ventral segment and convexly rounded. Plates quite long, concavely rounded to acutely pointed tips.

This is apparently an Atlantic Coast species found on short grasses along tidewater flats only, from Massachusetts to Florida, according to records at hand. Woods Hole, Mass., July 15, Aug. 6, 1917; New Haven, Ct., Sept. 4, 1911, by C. E. Olsen; Battle Pt., Va., June 22, 1918, by the senior author, may be added to previous records from New York, New Jersey, North Carolina, and Florida coastlines.

2083. Deltocephalus sylvestris O. & B.

(Pl. I, fig. 10; Pl. III, fig. 6.)

Osborn & Ball, Proc. Ia. Acad. Sci., IV, p. 213 (1897).

A greenish species with sharp head, often bearing two rather conspicuous dark stripes, and with distinct genitalia. Length 3.5 mm.

Vertex distinctly and rather sharply pointed, about one-fourth longer than width between eyes. Pronotum shorter than vertex, almost twice as wide as long, side margins longer than in allied species and rounded. Elytra exceeding abdomen, venation simple. Face gradually narrowed to clypeus.

Color dull greenish, tinged with yellow, eyes and ocelli dark, a rather heavy fuscous stripe either side of apex extending obliquely onto disc, then broadening and continuing to pronotum. Pronotum often with fine pale stripes. Elytra whitish or dull hyaline, nervures greenish yellow, often broadly margined with fuscous, especially on apical portion and along sutural line. Face brownish with about six pairs of paler arcs, clypeus and lorae paler, sutures dark. Venter dark with pale areas, ovipositor black.

Genitalia: Female last ventral segment one-half longer than preceding, lateral angles prominent either side of which the posterior margin is slightly excavated,

then abruptly produced on median third into a black truncated process almost one-third the length of the segment. Male valve one-half longer than last ventral segment, triangular with rounded apex. Plates twice as long as valve, sides concavely narrowed to bluntly pointed divergent tips.

A generally abundant and widely distributed species on pasture and meadow grasses throughout the states east of the Rocky Mts. As a rule this species is rather distinctly marked, especially with a rather definite head pattern.

2083.5. Deltocephalus minimus O. & B.

(Pl. I, fig. 7; Pl. IV, fig. 1.)

Osborn & Ball, Proc. Ia. Acad. Sci., IV, p. 211 (1897). Placed in Van Duzee Catalog as synonym of *D. melsheimerii*.

Resembling *parvulus* in size and general appearance. Greenish-yellow, vertex bluntly angled, sides evenly convexed. Length, female, 2.75-3 mm.; male, 2.5 mm.

Vertex produced and angled but tip broadly blunt, longer on middle than between eyes. In male as wide as long, tip blunter. Pronotum quite small, very convex anteriorly, sides extremely short. Elytra a little longer than abdomen.

Color: Greenish-yellow, vertex, pronotum and scutellum paler, traces of two brownish arcs on each side of vertex extending from apex toward ocellus. Elytra milky hyaline, nervures yellowish, faintly bordered with fuscous especially in male. Face dull brownish, pale arcs almost meeting on median line in female. Venter pale, basal segments dark at middle, ovipositor black.

Genitalia: Female last ventral segment almost twice as long as preceding, posterior margin roundingly produced, narrowly incised at middle with a very small rounded notch either side; median third black-margined. Male valve convexly, roundingly triangular, almost twice as long as last ventral segment; plates more than twice longer, convexly tapering to bluntly pointed tips. A black spot on middle of each.

This small species described in 1897 by Osborn and Ball has been variously confused and classified by authors, and appears as a synonym of *D. melsheimerii* in the Van Duzee Catalog. It is, however, very distinct and valid as proven by the examination of the types of both species. It is slightly larger than *D. parvulus* and has a more bluntly rounded head, and occurs, according to present records, on native grasses in the northern central states.

2084. Deltocephalus melsheimerii (Fitch).

(Pl. I, fig. 9; Pl. IV, fig. 2.)

Amblycephalus melsheimerii Fitch, Homoptera N. Y. St. Cabinet, p. 61 (1851).
D. vicilinus Crumb, Ann. Ent. Soc. Amer., VIII, p. 193 (1915).

Equaling *D. minimus* in size, but vertex more sharply angled and females paler in color. Size, female, 2.75 mm.; male, 2.5 mm.

Vertex strongly produced and sharply angled, distinctly longer than width between eyes, and longer than pronotum. Elytra exceeding abdomen, venation simple.

Color: Female usually rather uniform yellowish, elytra subhyaline, nervures milky white, face with faint arcs. Male head, pronotum and scutellum brighter yellow; a faint brown arc either side from apex to black ocelli. Elytra subhyaline, nervures milky white, faintly bordered with fuscous throughout. Face pale brown with six or seven pairs of arcs and lower portion of face pale.

Genitalia: Female last ventral segment about equaling preceding, median half of posterior margin with simple, very shallow, black bordered excavation. Male valve almost semi-circular, considerably longer than preceding segment; plates broad at base, only slightly narrowed to broadly rounded upturned tips, appearing from below as almost truncate. A median brownish line expanding toward tip of each plate.

The exact indentity of this species has been in doubt for over a half-century, and no adequate figures nor descriptions have appeared in literature. Therefore Crumb, who in 1915 described a supposedly new species, cannot be censured for redescribing as *D. vicilinus* what proves on examination of types to be the genuine *D. melsheimerii* Fitch.

This appears to be a widely distributed species in the eastern and central states on small, fine grasses, and is one of the most abundant species of this group in Pennsylvania. It doubtless is of considerable economic importance as a pasture pest.

2091. Deltocephalus auratus G. & B.

(Pl. I, fig. 6; Pl. III, fig. 5.)

Gillette & Baker, Hemip. of Colorado, p. 85 (1895).

An orange yellow species with vertex almost rounded. Length, female, 3 mm.; male, 3.25 mm.

Vertex very blunt and rounded at apex, variable in length from as wide as long in female to one-fourth wider than length at middle in male. Pronotum twice as wide as long. Elytra considerably longer than abdomen in macropterous forms, but reaching only to penultimate dorsal segment in brachypterous females; venation simple.

Color: Varying from dull yellow to bright orange yellow, margin of vertex and face often deeper orange. Elytra slightly smoky subhyaline, nervures bright orange. Legs and venter same as above, basal segments black on dorsum in males. Face often with paler arcs.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles obsolete, posterior margin slightly excavated either side of a median, low, obtuse black-margined tooth which is very blunt or slightly bifid at apex. Male valve one-half longer than last ventral segment, broad, triangular. Plates almost twice longer than valve, gradually narrowed to broadly rounded tips. A dark spot on inner apex of each, and a large semi-circular hyaline area at base of each, appearing dark.

This is a distinctly western species now known to occur in Colorado, Wyoming, Montana and North Dakota. From a study of the material at hand, we are unable to separate *D. unicoloratus* Gill. & Baker from this species. Prof. Herbert Osborn, who has collected at several points in the above mentioned states, reports that the more highly colored specimens occur at the higher altitudes, which fact may account for the paler forms described as *D. unicoloratus*.

Brachypterous females seem to vary in shape of head from the normal form, but otherwise the accepted specific characters are identical.

EXPLANATION OF PLATES.

PLATE I.

1 *Deltocephalus pascuellus* (Fall.)
2. *D. littoralis* Ball.
3. *D. striatus* (Linn.)
4. *D. nominatus* n. n. S. & DeL.
5. *D. monticolus* G. & B.
6. *D. auratus* G. & B.
7. *D. minimus* O. & B.
8. *D. parvulus* Gill.
9. *D. melsheimerii* (Fitch)
10. *D. sylvestris* O. & B.
11. *D. acus* n. sp. S. & DeL.

PLATE II.

1. *Deltocephalus arcolatus* Ball.
2. *D. pictus* Osborn.
3. *D. configuratus* Uhler.
4. *D. sayi* (Fitch).
5. *D. interruptus* DeLong
6. *D. weedi* VanD.
7. *D. miscllus* Ball
8. *D. compactus* O. & B.
9. *D. obtectus* O. & B.

PLATE III.

1. *Deltocephalus pascuellus* (Fall.) 1a—female segment; 1b—male segment.
2. *Deltocephalus striatus* (Linn.), 2a—female; 2b—male.
3. *Deltocephalus littoralis* Ball, 3a—female; 3b—male.
4. *Deltocephalus nominatus* n. n. S. & DeL.; 4a—female; 4b—male.
5. *Deltocephalus auratus* G. & B., 5a—female; 5b—male.
6 *Deltocephalus sylvestris* O. & B., 6a—female; 6b—male.
7. *Deltocephalus monticolus* G. & B., 7a—female; 7b—male.

PLATE IV.

1 *Deltocephalus minimus* O. & B., 1a—female; 1b—male.
2. *Deltocephalus melshcimerii* (Fitch), 2a—female; 2b—male.
3. *Deltocephalus parvulus* Gill., 3a—female; 3 b—male.
4. *Deltocephalus acus* n. sp. S. & DeL., 4a—female; 4b—male.

PLATE V.

1. Ocular diaphragm as used in microscope for measuring and drawing.
2. *Phlepsius particolor* n. sp., 2a—face; 2b—side view of head; 2c—female genitalia.
3. *Phlepsius sabinus* n. sp.; 3a—female genitalia.
4. *Thamnotettix aureovittatus* n. sp.; 4a—female segment.
5. *Euscelis cuneatus* n. sp.; 5a—female genitalia; 5b—male genitalia.
6. *Euscelis striolus* (Fall.) 6a—female genitalia; 6b—male genitalia.
7. *Euscelis parallelus* (VanD.); 7a—female genitalia; 7b—male genitalia.

Plate I.

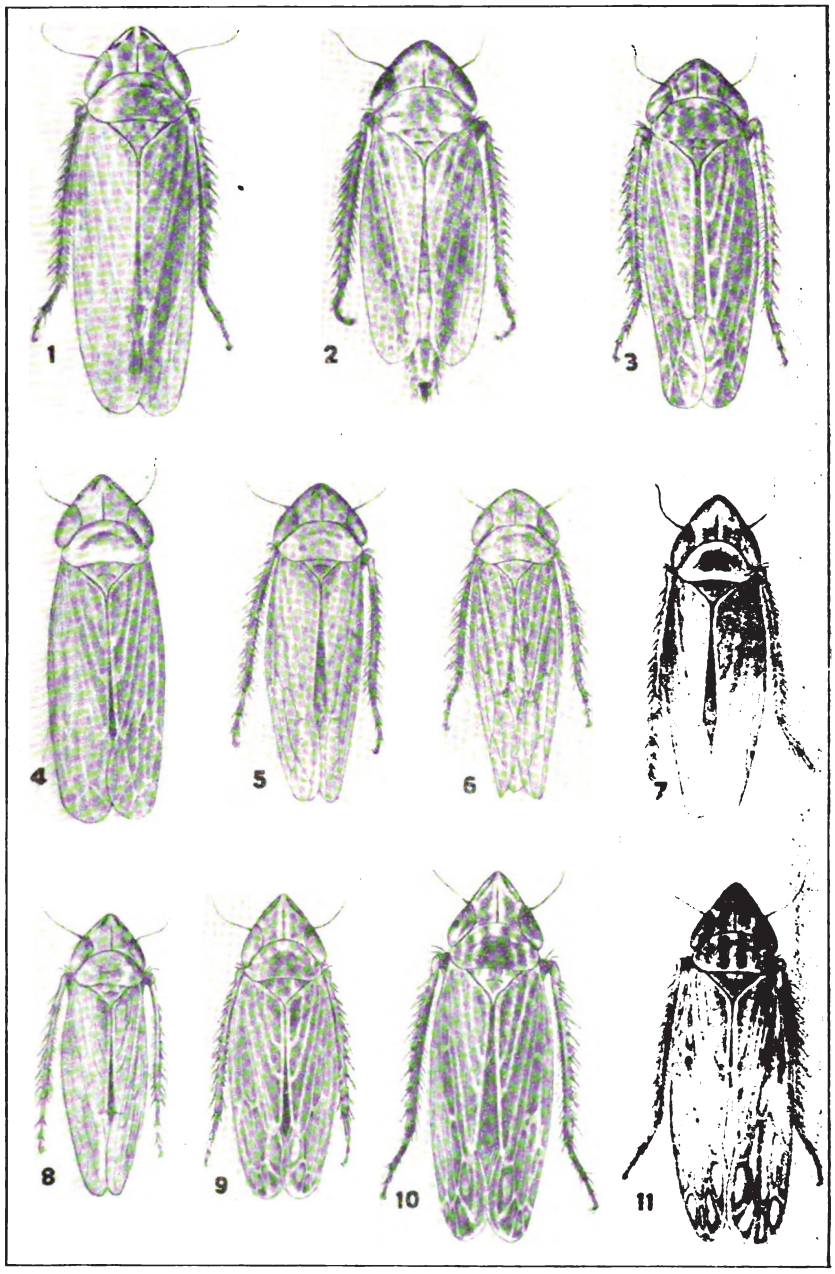

Plate II.

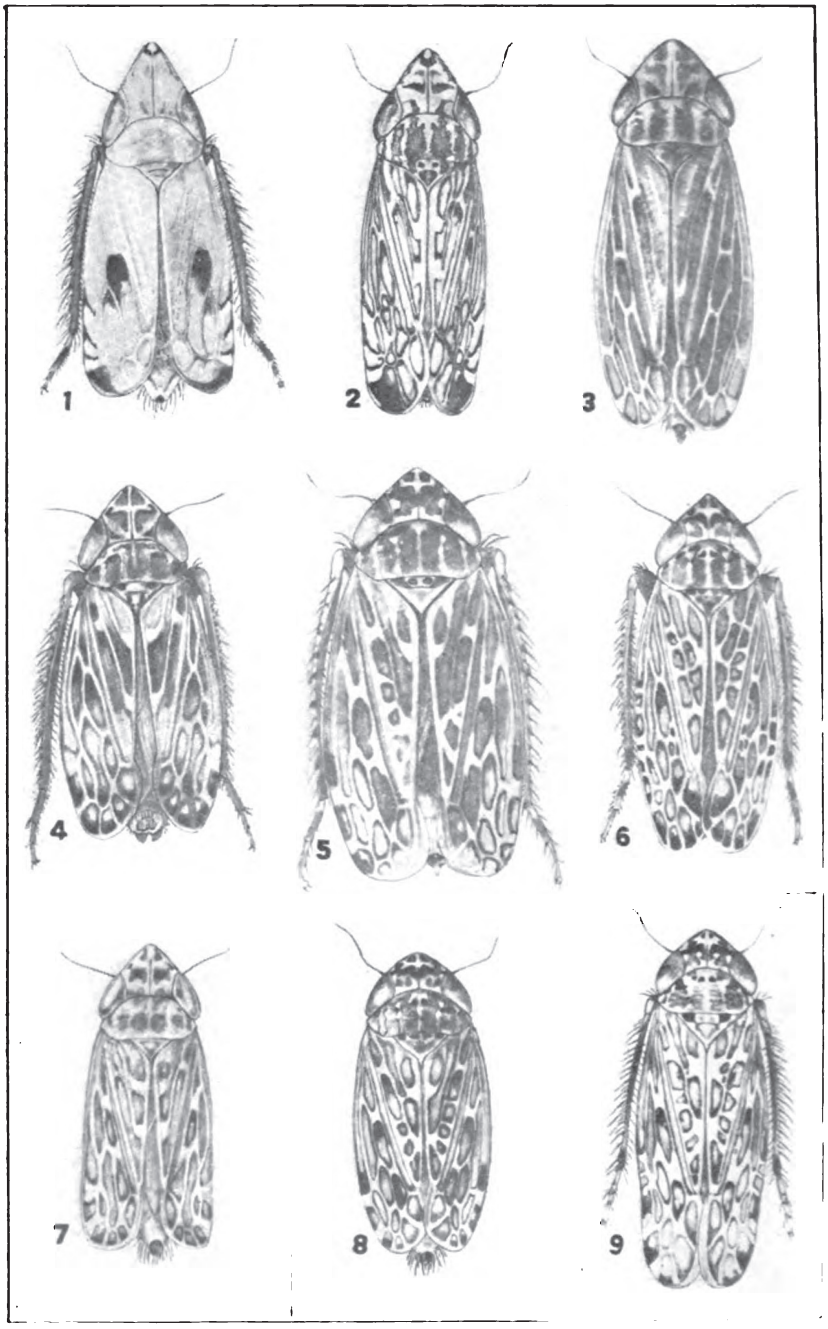

Plate III.

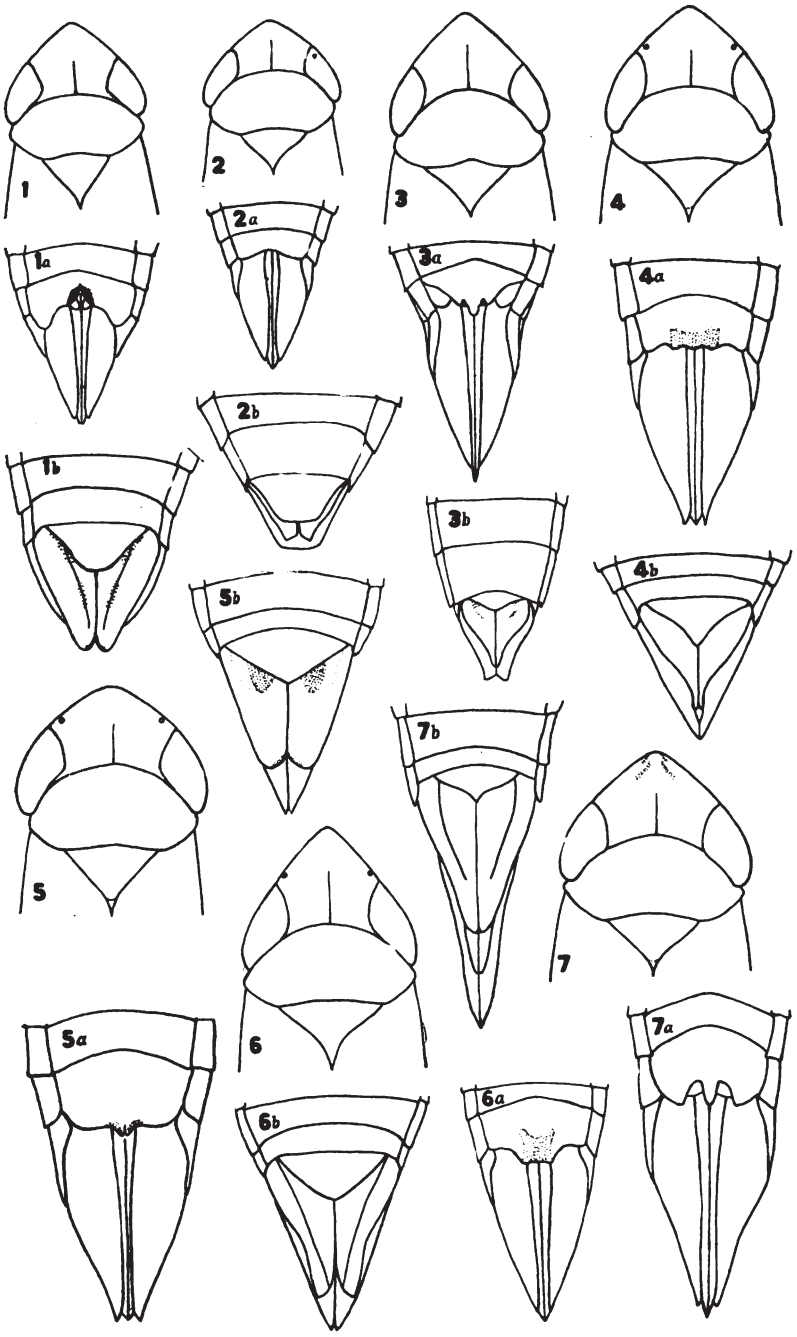

Plate IV.

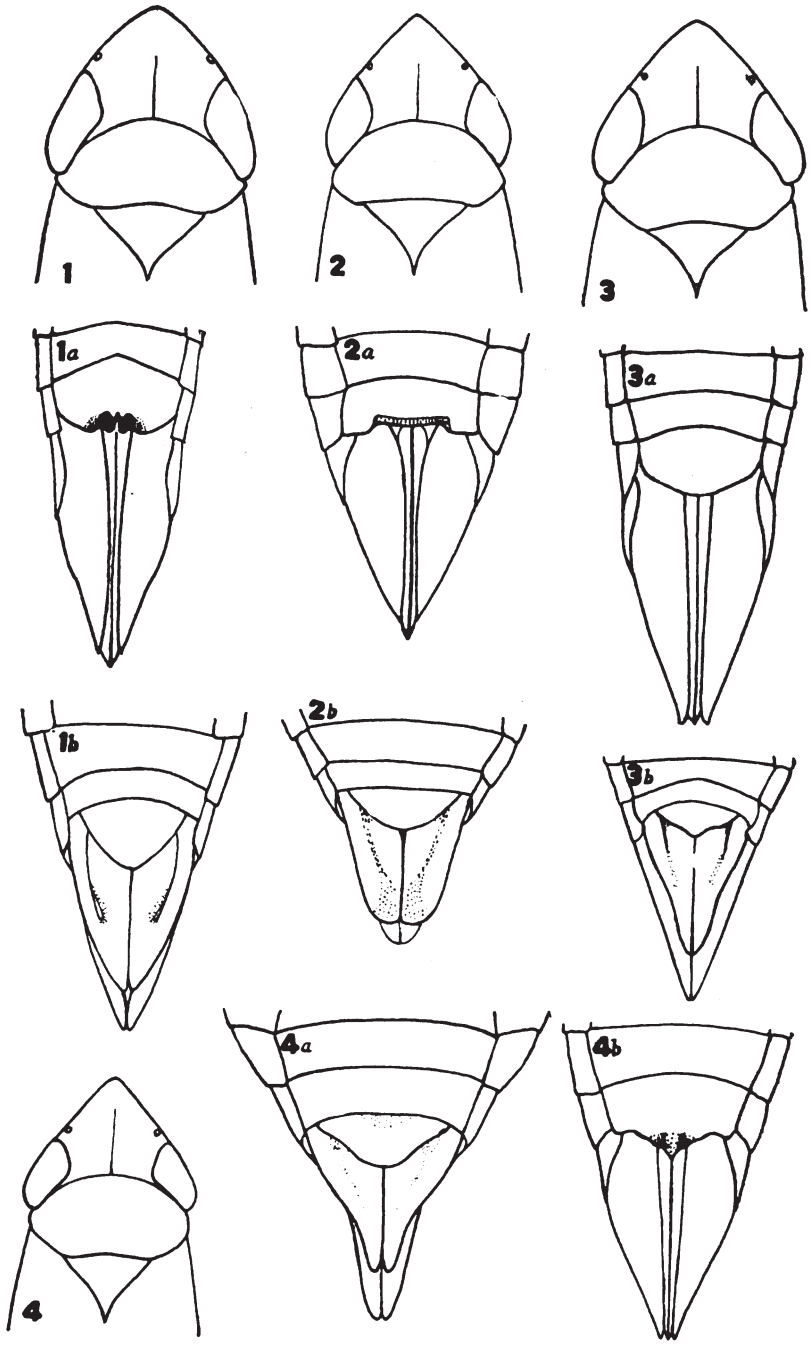

Plate V.