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A Review of the Tettigonidaae of North American North of Mexico

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A REVIEW OF THE TETTIGONIDAÆ OF NORTH AMERICA NORTH OF MEXICO.

BY E. D. BALL.

The present paper has been planned to serve a double purpose. Its first object being to furnish a means of separating and determining the members of this family found in the United States and Canada, together with their varieties and the synonomy as far as it has been worked out. Secondly, to give sufficiently accurate and detailed descriptions in all cases, even where not necessary in the separation of our own forms, so that later workers in the group and those from other parts will be able to discriminate between our species and closely allied forms from other regions, or to recognize our forms when found in other countries.

This is all the more necessary from the fact that this group, which forms a very small part of the Jassid fauna in the United States, becomes the dominant one in tropical regions, especially of the Western Continent. Of the five hundred or more described species the great majority are found in the region between Mexico and Brazil. A number of these species, among which are some of our own forms, extend throughout the whole of this territory.

Taking into account these facts and the addditional one that most of the work on the group so far has been done by European authors, whose material was mainly from tropical regions, and who paid little attention to the isolated descriptions of the American authors, it is little wonder that there is much of synonomy. At the same time American authors have paid little attention to the European work, and a goodly number of the later synonyms are from this side of the water. Mr. Walker, of course, con-

tributed to the confusion. There is much in synonomy yet to be worked out which can only be completed when the species of the different countries have been carefully collected and accurately determined as to specific and varietal limits.

The bibliography of our forms in this group has been so carefully and accurately worked out by Van Duzee in his Catalogue of the Jassoidea that it seemed unnecessary to repeat it here. Under each species is given the reference to the original description and the date, and reference to the descriptions of all synonyms and varieties. In addition to this, references are given to systematic works published since the Van Duzee Catalogue, and references that have been changed from that given in the catalogue, are included, when necessary to make them clear.

There are few characters that seem available for generic use, and consequently, the classification within certain parts of the group is very unsatisfactory. With a limited number of species, such as we possess, one may readily lay down characters that will separate them into well-defined genera, but with a large number the task becomes more difficult.

The author has followed Stal in generic disposition, the main objection to this system being that the genus *Tettigonia* is still burdened with an immense number of quite diverse species. Even in our fauna it contains quite widely separated forms. It will, however, be necessary to study carefully a representative series from tropical regions before any rational and permanent separation can be had. On the other hand, the group represented by *mollipes* is mainly temperate in distribution, we having seven species in our fauna, of which Fowler only records two for Mexico and Central America, and it has been thought best to separate it from *Diedrocephala*.

The adoption of a system of describing by means of varieties, in some cases, was but the choice of evils, it seeming to be almost impossible to define some of the variable forms in any other way. Having adopted that method, it seems preferable to designate them by names rather than

by symbols or letters, as is often done, especially as in the majority of cases these varieties have already received names.

In the prosecution of this work, I have had for study the collection of the Iowa State College and the Van Duzee collection, both very rich in material, through the kindness of Prof. H. E. Summers; the National Museum collection, through the kindness of Dr. L. O. Howard; the Ohio State University collection and the private collection of Prof. Herbert Osborn; a series of Florida forms from Prof. H. A. Gossard; and a fine series of Eastern forms from Mr. Otto Heidemann; the Colorado Agricultural College collection; some typical specimens of Woodworth's species, from the Illinois Laboratory, through Prof. Hart; and numerous smaller series sent in for determination. My own collection includes all but one of the forms enumerated in the paper, as well as a large number of species from Mexico, the West Indies and South America, some two hundred species in all.

This large amount of material has made it possible to more thoroughly investigate and define the ordinary variations of a species and to recognize some hitherto very puzzling forms as only extreme variations in a specific type. Some of these variations were found to run through a considerable number of species, disrtibuted through several genera, often the same variation would be found to occur in a majority of the species of a given locality.

The most striking structural variation commonly met with was the broadening of the head and consequent relative shortening of the vertex noticed in the specimens from the Pacific Coast and Mexican points. This was particularly noticeable in the Western specimens of *T. hieroglyphica* var. *confluens* and in the Mexican specimens, *tripunctata* and *bifida*; specimens of *bifida* from the West Indies were intermediate in this character. Another common variation was the change in the ground color in pronotum and elytra from red to blue and even green, with all possible combinations and variations in these colors. The variations in *T. hieroglyphica* and *O. undata* are striking exam-

ples of this, and it is also found in *T. gothica*, *occatoria*, *dohrni*, *bifida* and *tripunctata*. The darkening up of species in their northern limits is also intensified in this group, and, as usual in the Jassoidea, specimens from the Pacific Coast, especially in the northern part, are considerably larger than those from the Mississippi Valley and farther east. Those from the Rocky Mountains and the adjacent plains are somewhat intermediate, grading off on either hand.

The gentalia are of less importance in this group, as a whole, than in many others, but, as in some species, they are strikingly distinctive and in most cases they furnish good characters in one or both sexes they have been made rather prominent, in striking contrast to the treatment of other authors. The venation of the elyta has been found to be of considerable service in defining groups of species, and in some instances furnishing specific characters.

The Tettigonidae are at once separated from the rest of the Jassoidea by the ocelli being situated on the disc of the vertex. They are usually divided into two groups, on the general shape of the body, as follows:

General form, cylindrical, usually elongate.....Tettigoniina
General form, broadly oval, or flattish, usually compact..Gyponnia

The present paper deals only with the first group, excluding some forms like *Euacanthus* and its allies, which are usually placed here.

SUB-FAMILY TETTIGONIINA.

The following key to the genera while emphasizing the fundamental characters separating the genera, as a whole, makes use of other and minor characters that are of value in separating our forms, but that might be untenable in a larger series:

KEY TO THE GENERA.

A. Antennal sockets usually overhung by a distinct ledge, the anterior extremity of which is deflexed and roundingly truncate. Anterior tibiæ sulcate above or dilated at the extremity. Elytra narrow, not covering lateral margin of abdominal tergum. Head and pronotum usually deflexed.

B. Thorax roundingly six-angular, posterior margin rounding, with a slight medianexcavation. Vertex longitudinally furrowed. Claval veins distant.....*Aulacizes.*

BB. Thorax 4-angular, posterior margin broadly, roundingly emarginate, the anterior and posterior margins nearly parallel. Claval veins often united in the middle or approaching and tied by a cross nervure.

C. Vertex long, triangular, longer than width between eyes side margins nearly straight, face as seen from side nearly straight.....*Homalodisca.*

CC. Vertex obtusely rounding, shorter or only equal to width between eyes, face as seen from side roundingly angled ....*Oncometopia.*

AA. Ledge above antennal sockets small, the anterior extremity as seen from above not projecting, included in the curve of the head, Anterior tibiae slender round or triangular, Elytra broad, covering the abdominal tergum. Head and pronotum rarely sloping.

B. Elytra not reticulate veined at the apex, at most with five apical and three anteapical cells. Head not greatly produced.

C. Vertex with the margin rounding obtuse, the front inflated.

D. Antennae setaceous, pronotum not twice as long as scutellum the posterior margin long not strongly emarginate ..*Tettigonia.*

DD. Antennae in the male enlarged at the apex. Pronotum less than twice as long as the scutellum, posterior margin short deeply emarginate..... *Helochara.*

CC. Vertex flat, the margin sharp or line-marked, distinct, vertex and front forming an acute angle, front broadly transversely convex, not inflated... .....*Diedrocephala.*

BB. Elytra reticulate veined from the apex as far back as the forking of the outer branch of the first sector. Head often produced into a triangle, longer than pronotum.. .....*Draeculacephala.*

GENUS AULACIZES AM. AND SERV.

Head slightly inclined, vertex moderately long, bluntly rounding disc, nearly flat longitudinally, furrowed front gibbous, clypeus as seen from side obtusely angled, a distinct ledge over antennal sockets, pronotum inclined anteriorly long, 6-angular widest at the lateral angles, rounding behind with a slight median emargination as in Tettigonia, anterior tibiæ furrowed on upper side, elytra not concealing lateral margin of abdomen.

But one species of this genus has been found in the United States.

AULACIZES IRRORATA FAB. Plate I Fig. I.

Cicada irrorata, Fab. Ent. Syst. IV., p. 33, 1794.
Cicada nigripennis, Fab. Ent. Cyst. IV., p. 32, 1794.
Aulacizes rufiventris, Walk. Homop. III., p. 796, 1851.
Aulacizes guttata, Uhl. Stan. Nat. His.; Van D. Cat. (Nec. Sign.)
Aulacizes pollinosa, Fowl., Bio. Homop. II., p. 218.; pl. 15, fig. 18

Long cylindrical, testaceous, brown, finely irrorate with pale yellow. Length, 12.5mm.; width, 3mm.

Head with eyes but little wider than pronotum, triangular the apex rounded. Vertex slightly shorter than its basal width, disc sloping, on same plane as pronotum, the surface irregular, a deep median furrow, narrow on posterior half and not quite reaching the margin, broadening out on anterior half until it is bounded by the carinate margin at the apex. Front gibbous, forming a right angle with vertex, clypeus obtusely angled. Pronotum sexangular, rounding in front, the submargin depressed with a few deep pits, disc convex coarsely pitted; humeral margins long, straight, posterior margin rounding with a slight median emargination. Elytra long, parallel margined, opaque not covering the lateral margin of abdomen.

Color; rich leather brown variable in shade, a few irregular blotches on vertex and base of scutellum, a large spot before the apex of the latter, numerous oval spots along the costal margin of elytra and fine irrorations over the pronotum and elytra pale yellow. Vertex and scutellum sometimes suffused with yellowish. Front pale yellow with four black spots in a square above, irregularly black below with a pair of oval yellow spots on clypeus. The yellow band above extends back on sides of thorax to the yellow margin of costa. Abdomen red above, yellowish and fuscous below.

Genitalia; female segment but little larger than penultimate, posterior margin broadly rounding, broadly shallowly notched in the middle; male valve minute, plates concavely triangular apically, convex below, clothed with fine hair, a little longer than ultimate segment.

Specimens are at hand from Pennsylvania, District Columbia, Maryland, South Carolina, Florida, Alabama, Kentucky, Missouri. It occurs from New York to Illinois and Missouri south to Florida and Texas and on into Mexico.

All records for *guttata* within the United States refer to this species. The *guttata* is a very different looking insect scarcely half the size of this species. It belong to the genus *Tettigonia* and has not yet been found north of central Mexico.

VARIETY POLLINOSA FOWL.

Aulacizes pollinosa, Fowl. Bio. Homop. II., p. 218, pl. 13, fig 18, 1899.

Size and structure of typical *irrorata*. Color, orange fulvous, claval areas greenish white, entire upper surface finely irrorate with black.

This is an extreme form of the enlargement of the light spots combined with a change in their color. Specimens are at hand from Florida and Fowler describes it from Mexico.

From Signoret's description there seems to be little doubt but that this is the species that he had in hand and which he said was "common in Brazil." Fowler, however, with "a typical example of Signoret," at hand separated *pollinosa* as distinct from the Brazilian form. If this should prove true, which I doubt, still the name *irrorata* would stand for our form as it was described from Carolina and Walker's rufiventris (which both recognize as a synonym) from Florida.

GENUS ONCOMETOPIA STAL.

Head broader than pronotum; vertex obtuse, rounding, disc convex confused with front, a distinct ledge over antennal sockets; eyes prominent; front gibbous, clypeus scarcely angled. Pronotum short, broadly rounding in front, posterior margin concave, very nearly parallel with the anterior, lateral margins straight, subparallel or slightly narrowed behind. Elytra narrow, margins subparallel, the lateral margins of abdomen exposed. Anterior tibiæ slightly sulcate above.

KEY TO THE SPECIES.

A. Front extending fartherest anteriorly at about the middle, much below the level of vertex and pronotum. Costal area narrow, the cross nervure some distance in front of the fork of first sector. Length 13mm.....*undata* Fab.

AA. Front retreating from a point on a line with vertex and pronotum. Costal area broad, first sector forked before the first cross nervure. Size, small, 9mm or less.....*lateralis* Fab.

ONCOMETOPIA UNDATA FAB., Plate I, Fig. 2.

Cicada undata, Fab. Ent. Syst. IV., p. 32, 1794.
Cicada orbona, Fab. Ent. Syst. Supp., p. 520, 1798.
Proconia nigricans, Walk. Homop. III., p. 783, 1851.
Proconia clarior, Walk. Homop. III., p. 784, 1851.
Proconia lucerne, Walk. Homo. III., p. 785, 1851.
Proconia marginata, Walk. Homop. III., 785, 1851.
Proconia badia, Walk Homop. III., p. 786, 1851.
Proconia scutellata, Walk. Homop. III., 786, 1851.
Preconia tenebrosa, Walk. Homop. III., p. 787, 1851.
Proconia plagiata, Walk. Homop. III., p. 788, 1851.
Oncometopia undata, Fowl. Bio. Homop. II., p. 231, pl. xiv, figs. 19 and 20.
Oncometopia alpha, Fowl. Bio. Homop. II., p. 232, pl. xiv, fig. 22.

Resembling *A. irrorata* in size and form, but with a much wider head and more prominent eyes. Head and scutellum yellow with black markings. Pronotum and elytra slaty or reddish with blue mottlings. Length, 13mm; width, 3mm.

Head and anterior part of pronotum inclined in same plane. Head broad, eyes prominent. Vertex two-thirds as long as its basal width, roundingly right angled, the apex blunt. Front gibbous, as seen from side rounding, the apex below the middle. Pronotum convex, elevated, one-half wider than long. Elytra long, narrow, claval veins but slightly approaching each other usually with a cross nervure, costal area norrow, scarcely wider than adjacent discal cell, the cross nervure between the sectors some distance before the fork or the first sector.

Color; vertex anterior margin of pronotum and the scutellum rusty orange, an incomplete circle before the middle of the vertex, open in front giving off eight radiating lines, two running back and curving around the ocelli, two running forward and meeting at the apex, the other two pairs equidistant between these, a line along the margin from the eye to the apex, some irregular markings at the base and on anterior margin of pronotum, black. Scutellum with a transverse oval giving off six lines, two to each margin. Pronotum and elytra varying from slaty blue to brown and bright red, sometimes a large pruinose patch on either side just back of the middle of the elytra. Front orange, a black line on middle and a pair of latteral, converging lines which sometimes meet below the apex. Below dirty yellow, abdomen black above, margins yellow.

Genitalia; female segment a little larger than penultimate, the posterior margin divided into three nearly equal rounding lobes, the median one horizontal, the two lateral ones sloping or curved around ovipositor. The horizontal disc parabolic, with a median and often lateral carinæ; male plates about half as wide as the ultimate segment, together equilaterally triangular or slighly elongate.

Specimens are at hand from District of Columbia, Maryland, Virginia, Georgia, North Carolina, Florida, Alabama, Louisiana, Missouri, Texas and Mexico, Central America, Dutch Guiana and Brazil.

It occurs in our territory from New Jersey, Maryland, Michigan, Illinois and Missouri, through the Southern States to Florida and Texas, and on south to Brazil.

The synonomy of this species is very puzzling, and that given above does not represent in full the conclusion reached by the author, but only that part of it that appears to be unquestionable or that comes in our range. After examining a series from South America and compar-

ing them with Central American and Mexican forms it seems nearly certain that *obtusa* Fab. was but a dark variety of *undata*, and as *obtusa* was described first the species would bear that name, while our forms would be the variety. Stal in Hemip, Fabriciana describes *obtusa* as with the head markings of *undata;* these markings are very constant and can be partially traced, except in the darkest forms, and appear to be one of the best distinguishing characters outside of the genitalia. Signoret does not mention these markings nor figure them in *obtusa*, but he places *clarior* Walker from Fla as a synonym, and it had the head markings distinct, as described by Walker. He gives the claval veins as united in *obtusa*, but Stal gives them as like *undata*. Signoret does not describe genitalia under *obtusa*, but under his next species he describes it in showing how that species differs from it. Fowler follows Signoret in his treatment of the species, and under remarks on *tartarea* describes the genitalia of *obtusa* as like that of our *undata*. He follows Signoret in the synonomy of *undata* and adds *marginata* and its three synonyms; he, however, places *undata* on a very pale form, which he figures, and then describes *alpha* as a possible variety, while in fact it is nearer the typical form, His next species, *rubescens*, and a previous one, *interjecta*, seem also to belong to the *obtusa* group. He suggests *tartarea* and *funebris* as coming in there, but specimens in hand from Mexico which agree with the descriptions of these species are quite distinct. The *funebris* is given as from Calif. by Signoret, but no specimens of it have been seen from there, and it has not been included in the synopsis; possibly Lower Calif., Mexican, is meant.

If, on further examination, the above conclusions prove to be correct, then the full synonmy of *obtusa*, as far as known, will be, in addition to the above, all of which will come under the variety *undata*, as follows:

Cicada obtusa, Fab. Mantissa Ins., p. 269, 1787.
Proconia parallela, Walk. Homop. III, p. 788, 1851.
Tettigonia facialis, Sign Monog. An. Sc. Ent Fr., p. 489, 1854.
Tettigonia herpes, Sign. Monog. An. Sc. Ent. Fr., p. 796, 1855.
Oncometopia obtusa, Fowl. Bio. Homop. II, p. 228, 1899.
? *Oncometopia interjecta*, Fowl. Bio. Homop. II, p. 228, 1899, pl 14, fig. 12.
? *Oncometopia rubescens*, Fowl. Bio. Homop. II, p 233, 1899, pl. 14, fig. 24.

Several more of Fowler's species may fall in this list when the Mexican forms are more thoroughly known. His descriptions are very meagre, and he evidently paid little or no attention to genitalia, so that it is very hard to definitely place any of his species until a specimen comes to hand that has the exact color pattern that he described. as he rarely makes any provision for variation in his descriptions.

For the northern part of its range this species seems to be very constantly of the form figured, but farther south the smaller and darker varieties appear, none having been received, however, from nearer than central Mexico. From the extreme southern part of our range (Florida and Texas), a variety that is somewhat shorter and more robust, proportionally, has been received. These specimens are usually very obscurely marked, and of a uniformly dull brown color, but the head pattern and genitalia are identical with the common form.

The color pattern of the head is quite definite in all of the varieties, except the very darkest, where it is obscured, but even here the "A" of the vertex, and the lines of the front can usually be traced in an oblique light, and form one of the best characters for distinguishing this species. Fowler speaks about the color pattern of the pronotum serving to separate this species. This is one of the most variable things about it, and it is little wonder that with such a character as a guide be added to the confusion, instead of helping to clear up the synonomy.

ONCOMETOPIA LATERALIS FAB.

Cicada lateralis, Fab. Ent. Syst. Sup., p. 524, 1798.
Cicada marginella, Fab. Syst. Rhyng., p. 96, 1803.
Cicada costalis, Fab. Syst. Rhyng. Erata following, p. 314, 1803.
Tettigonia striata. Walk. Homop. III. p. 775, 1851.
Tettigonia lugens, Walk. Homop. III. p. 775, 1851.
Tettigonia pyrrhotelus, Walk. Homop. III; p. 775, 1851.

Much shorter than *undata* but nearly as broad; eyes not as prominent. Black, coarsely irrorate with yellow; Elytra red, veins black. Length, 7-8 mm.; width, 2.75 mm.

Head and pronotum but slightly inclined, eyes moderately prominent, vertex slightly obtusely angled, twice as long on middle as at eye, length equal to half its basal width, four-fifths the pronotal length. Front moderately gibbous, sloping back from the plane

of the vertex, very roundingly angled below. Elytra broad, and short, the costral area wider than adjacent cells, first sector forking before the cross nervure.

Color; vertex and pronotum black, coarsely and irregularly dotted with yellow; on the pronotum the wrinkles are yellow, the pits black. Scutellum black, broken lines on the margins, a median line on the posterior half, and a pair of lines on anterior disc enclosing a number of yellow spots. Elytra red, with the nervures black; sometimes the disc is slaty blue, with light margins to the nervures. Front black, with round white spots. Below black, sometimes marked with yellow. As seen from side, a narrow yellow line extends around the vertex in front on a level with the eye and runs from the lower corner of the eye to the lateral margin of the abdomen and on back to the pygofers.

Genitalia; female segment twice the length of the preceding, truncate, or very slightly emarginate posteriorly, the lateral angles often depressed, leaving a semicircular disc; male plates, triangular, one-fourth longer than their basal width, as long as the pygofers.

Specimens are at hand from Ontario, District of Columbia, Virginia, Florida, Alabama, Tennessee, Mississippi, Manitoba, Minnesota, Iowa, Dakota, Nebraska, Arkansas, Texas, Montana, Wyoming, Colorado, Idaho, Washington, New Mexico, and Nicaraugua, Central America.

VAR LIMBATA. SAY.

Tettigonia limbata, Say. Jour. Acad. Nat. Sc., Phila., IV, p. 340. 1825.
Tettigonia septentrionalis, Walkr Homop. Supp., p. 193, 1858.

Usually somewhat smaller and narrower than the typical form, often with longer elytra, which gives them a somewhat linear appearance.

Color, shining black, vertex and face usually with a few rather large yellow spots; pronotum with two ocellate orange spots well back of the anterior margin and in line with the ocelli; sometimes another pair on the outer angles of the scutellum. Below black, the lateral line extending from the eye back, broad and distinct.

Specimens of this variety are at hand from Colorado, Dakota and Iowa, and it has been reported from Michigan and Canada, and Walker's species was from the Mackenzie river. The white lateral line will at once separate it from the black form of *T. hieroglyphica*, which it somewhat resembles.

The species, as a whole, occurs from the Mackenzie river and Nova Scotia south throughout the whole continent, and to northern South America at least. It is somewhat

local in distribution in some parts. In Colorado it occurs everywhere, but in Iowa it has only been found in a few places along the northern border, and yet it occurs alongside in Missouri and Nebraska. This species is very variable in size and color, the black on vertex and pronotum is fairly constant, while the elytra vary from a bright red to a bright slaty blue and on to shining black, and the irrorations on head and pronotum vary from white to orange, and in some Central American specimens they are rufus. The lateral white stripe, however, remains constant, and will at once distinguish this species.

Fowler, in the Biologia, places this species under *Tettigonia*, along with *punctulata*. This is an error; the resemblance is only superficial. *Lateralis* possesses the angled front, the sulcate anterior tibiæ and the exposed lateral margin to the abdomen, which make it a good *Oncometopia*, and widely separates it from *punctulata*.

GENUS HOMALODISCA, STAL.

Head, large; eyes, prominent, wider than pronotum; vertex and pronotum, inclined; vertex, triangular, the apex obtuse longer than pronotum, the disc with a distinct median furrow. Front and vertex forming an acute angle, the apex bluntly rounded. Front, flat in same plane as clypeus, the disc flat or concave. Pronotum, short, quadrangular, narrowing posteriorly. Elytra, hyaline or sub-hyaline, rarely coriaceous, the claval nervures often united for a considerable distance in the middle. Anterior tibiæ, sulcate above, often broadened apically.

This genus is closely related to *Phera*, of Stal, but may be known by the broader apex of the vertex and the flat or depressed front.

KEY TO THE SPECIES.

A. Elytra, hyaline, at least on basal half, the nervures distinct, apparently raised.

B. Vertex, but slightly longer than pronotum, evenly irrorate, with fuscous; usually several irregular, reticulate veins between the first cross nervure and the fork of the first sector.....*triquetra*, Fab.

BB. Vertex, one-half longer than pronotum, irregularly lined with fuscous, no extra cross-nervures between the sectors of elytra.....*liturata* n. sp.

AA. Elytra, opaque, the nervures concolorous, the first sectors forked half way between the first cross-nervure and the second ....*insolita* Walk.

HOMALODISCA TRIQUETRA FAB., Plate II, Fig. 1.

Cicada triquetra Fab. Syst. Rhyngt., p. 63. 1803.
Tettigonia vitripennis Germ. Mag. Ent. IV, p. 61, 1821.
Tettigonia coagulata Say. Insects, La., p. 13, 1832.
Tettigonia ichthyocephala Sign An. Soc. Ent. Fr., p. 494, 1854. (vide Fowl).
Proconia admittens Walk. Homop. Supp., p. 227 1858.
Proconia aurigera Walk. Homop. Supp., p. 228, 1858.
Phera vitirpennis Fowl. Bio. Homop. II, p 221, Plate XIV. Figure 1, 1899.

Longer and narrower than in the former genera, with a broad, triangular head, which is rounded at the apex. Elytra, hyaline. Length, 13 mm.; width, nearly 3 mm.

Vertex, as long as its basal width, one-fifth longer than pronotum; disc, flat, sloping, with a median furrow and a depression before each ocellus, apex very bluntly rounding, the lateral margins sharp. Front, sloping, disc concave, rounding up to meet the vertex in a right angle. Pronotum, very coarsely pitted, anterior and posterior margins nearly parallel. Elytra, with the venation strong, usually two or three irregular cross-nervures between the sectors at or before the first fork, the claval veins coalescing for a short distance, then widely separated. Anterior tibiæ, sulcate above and somewhat widened apically.

Color; vertex and pronotum deep testaceous brown, finely and regularly irrorate with yellow sometimes obscuring the brown. Elytra smoky subhyaline usually a broad, somewhat milky band, before the middle and an opaque red spot before the apical cells which sometimes extends forward along the costa. Fresh specimens often have a pruinose spot just before the red one. Face and thorax below orange yellow, a spot on clypeus, sometimes a pair on face, the upper side of anterior tibiæ, mottled on all the femora, and spots from which the spines on hind tibiæ arise, black. Abdomen blue-black above, the lateral margins, broadly on the two basal segments, narrowly beyond, ivory white, the spiracles and a few spots along margin brown. The pygofers orange, abdomen below whitish, the disc of each segment black.

Genitalia; female segment about twice the length of the preceding, slightly narrowing to the lateral angles which are acute, between these the posterior margin is triangularly incised one-third its depth, the apex of the incision is blunt and the margins sinuate. Male plates long, triangular, slightly, concavely narrowing to an acute apex.

Specimens are at hand from Georgia, Florida, Alabama, Louisiana, Mississippi, Texas, and Mexico, and it has been reported from South Carolina. It seems probable that the references of this species to California belong to the following species.

The above synonomy is given with some hesitation. Fowler figures it under the name of *vitripennis* and does not include *triquetra* at all. He evidently had our species

in hand, but his references of *ichthyocephala* Sign. to this form seems doubtful.

HOMALODISCA LITURATA N. SP. Plate II, Fig. 2.

Smaller, narrower than *triquetra* with a longer head. Straw yellow, five irregular brown lines on the head. Length, 11mm; width, 2.25mm.

Vertex one-fifth longer than its basal width, half longer than the pronotum, disc flat, very deeply grooved in the middle. Front very long and narrow, disc flat and in same plane as the clypeus. Pronotum short, disc flat, posterior margin more strongly curved than the anterior one. Elytra very narrow, nervures distinct, a single cross nervure between the sectors situated at over one-third the distance from the fork of the first sector to the base.

Color; vertex pale yellow with five brown lines as follows: a narrow median one expanded on the apex, an interrupted line on either side the middle, arising considerably back of the apex and usually somewhat reticulate anteriorly, a pair of heavier stripes arising either side the apex and running back to the ocelli, their basal portions forming part of the loop that runs from the ocelli around to the eye, the striations of the reflexed part of the front brown. Pronotum yellow, irregularly punctured with brown; usually four distinct dark spots on the anterior submargin. Scutellum yellow with large brown spots sometimes arranged in the form of an H. Elytra hyaline, the nervures red, an irregular opaque red patch on the costal half back of the middle, terminating just before the apical cells and omitting an oval hyalin spot in the anterior end of the anteapical cells. Face and legs yellow, a spot on apex of front and anterior tibiæ, fuscous. Abdomen black above, the terminal segment yellow, the lateral margins broadly white, at the base, narrowing apically, the spiracles dark. Below pale, sometimes a median line and the margins of the female segment black.

Genitalia; female segment half longer than the penultimate, the lateral margins parallel, the posterior margin in two slightly rounding divergent lobes, the notch between them narrow and less than half the depth of that in *triquetra*.

Specimens are at hand from Phoenix, Ariz; Yuma, California, and Comondu Lower, Calif, Mexico. The larger head and much narrower form together with the lineate arrangement of the markings will readily separate this form from *triquetra*.

HOMALODISCA INSOLITA WALK. Plate II, Fig. 3.

Preconia insolita, Walk. Homop. Supp., p. 227, 1858.
Phera insolita, Fowl. Bio. Homop. II., p. 222, pl. xiv, fig. 2, 1899.

Resembling *triquetra*, but smaller and with a smaller head. Dark testaceous, with the anterior half of pronotum and vertex irrorate with yellow. Male sometimes almost black. Length, 10.5 mm.; width, 2.25 mm.

Vertex, no longer than the pronotum, very flat, but little inclined, margins acute, nearly right angled before. Front, convex, disc flat above. Face, as seen from side, much deeper than in *triquetra*, the outline sinuate. Elytra, rather broad, coriaceous; venation, regular, not prominent, the claval veins united for a short distance, the cross-nervure at about the middle of the first sector.

Color: dark reddish brown; a slightly olive tinge in the female. Vertex and anterior half of pronotum irrorate with pale yellow, sometimes a light median line in the furrow. Male very much darker, almost piceus on pronotum and elytra. Front and below, orange yellow; an ivory band arises on either side the apex of the vertex, below which it is indistinct, running back below the eyes, widening on the thorax and narrowing again on the margin of the abdomen. This stripe is narrowly margined with black, above and below, on the thorax. Fore tibiæ, dark fuscous.

Genitalia: Female segment twice longer than penultimate, the posterior margin triangularly emarginate. The emargination rounds off into a narrow median slit, which extends two-thirds of the distance to the base. Male plates about as long as the ultimate segments, equilaterally triangular, rather stout.

Specimens are at hand from Texas and Arizona, and it is reported from several points in Mexico in the Biologia.

The evenly coriaceous elytra readily separates this from either of the other species. Neither Walker nor Fowler describe the genitalia, which is quite distinct, but there seems little doubt but that this is the form Walker described.

GENUS TETTIGONIA GEOFF.

Head, bluntly conical, but slightly sloping, eyes rarely prominent; ledges over antennal sockets, as seen from above, fused with the vertex margin at apex, not prominent. Front, convex, but not gibbous; vertex convex, confused with the rounding front. Pronotum, rather long, broadest at the lateral angles, the lateral and humeral margins nearly equal in length; posterior margin straight or roundingly emarginate. Elytra, covering the abdominal tergum; venation, simple non-reticulate, often obscured by the color markings. Anterior tibiæ simple.

This genus is world-wide in distribution, and contains a very large number of species of many different forms. Our

species very readily fall into two groups, the first of which under "A" is the more typical and would include most of the tropical species. The second group, "AA," has a reduction in the number of cross-nervures, narrower heads, and the face pushed downwards and forwards, instead of rounding back at the apex, giving the head a much greater depth. This is extremely emphasized in *tripunctata*, and if it occurred here alone there might be reason for generic separation, but a most complete gradation in this character is found running back from this species through *bifida*, *hartii*, *occatoria* and *gothica* to the other extreme in *hieroglyphica*.

KEY TO THE SPECIES.*

A. Elytra with three anteapical cells; head as wide as the pronotum, not as deep as the length of vertex and pronotum together. Face, in profile, strongly curved backwards, usually with the clypeus somewhat angled.

B. Head with a pattern sometimes obscure, but not in the form of definite spots.

C. Head pattern very complex, no parallel lateral bars. Length, over 6 mm..... *hieroglyphica* Say.

CC. Head pattern simple, the lateral bars running back parallel with the median pair. Length, 6 mm. or less ..... *gothica* Sign.

BB. Head with definite spots, not coalescing into a pattern.

C. Greenish blue, face with two stripes, posterior half of pronotum with black spots .... *atropunctata* Sign.

CC. Reddish, face with three stripes, posterior half of pronotum with four longitudinal stripes..... .... *dohrni* Sign.

AA. Elytra with no cross-nervures between the branches of the first sector before the apical cell (occasional in *occatoria*). Head narrower than pronotum, deeper than the length of vertex and pronotum. Face, in profile, straight or in a single curve, rather long.

*NOTE:—*Tettigonia lineata* Sign. (= *coeruleovittata* Sign.) although credited to the "United States" in the original description, has not been included in this synopsis as no specimens have been seen from points nearer than central Mexico, and it seems probable that the original reference was an error.

Tettigonia aestuans Walk. is credited to California by Van Duzee, in his catalog, on what authority I do not know. Walker gave "West Coast of America" and Signoret "Para" as habitat for this species. It belongs to a group of distinctly tropical forms, and is doubtless South American in distribution.

B. Head and pronotum with definite longitudinal stripes. ....*occatoria* Say.

BB. Head and pronotum with transverse bands parallel with margin, or none.

C. The outer branch of the first sector forking to form an anteapical cell. Pronotum with transverse bands parallel to the margins.

D. Green, vertex blunt, alternate transverse bands of light and dark on pronotum and vertex.

E. Elytra green, the nervures black. Length, 5.5—6 mm.....*bifida* Say.

EE. Elytra green, the nervures pale or obscure, three white spots before the the apex. Length, 4.5—5 mm., much narrower than above.*geometrica* Sign.

DD. White, vertex longer, with three black spots. Elytra white, the nervures brown. .....*tripunctata* Fitch.

CC. The outer branch of the first sector, with its outer fork running to the margin. Pronotum, without marginal bands. Form, short and stout..... .... *hartii*

TETTIGONIA HIEROGLYPHICA SAY. Plate III.

Tettigonia hieroglyphica Say. Jour. Acad. Nat. Sc. Phil. VI, p. 313, 1831.

Rather stout; vertex bluntly conical. General color, reddish or greenish on pronotum and elytra usually mottled, costa and claval suture often broadly light, the markings on vertex in a complex pattern. The broad median band of scutellum light. A black spot on apex of vertex. Face, mottled; sometimes the whole insect is black. Length, 6—7 mm.; width, 1.5 mm.

Vertex, slightly conical, bluntly right-angled, the lateral margin in advance of the margin of the eye; over three-fourths the length of the pronotum not quite three-fourths its basal width. Face, as seen from side, rounding back. Elytra, rather broad and compact; five apical and three anteapical cells.

Genitalia; female segment two and one-half times as long as the penultimate, slightly narrowing posteriorly; posterior margin triangularly produced, the apex produced and rounding, who e segment thin and membranous, strongly curved around the pygofers. Male plates two and one-half times as long as the ultimate segment, long-triangular, their apices acute, margins fringed with soft hairs.

The following varieties intergrade, but most of the specimens will readily fall into one of the following forms:

VAR. HIEROGLYPHICA, SAY. Plate III, Fig. 1.

Red form—Structure as above. Color, a round black spot on the apex of vertex and face surrounded by a broad circular

band of white; from this on either side there is a band around the margin of the vertex to the eye, and usually a band runs down the middle of the front. Front irregularly mottled with black and white. Lorae and genae pale, clypeus white, with a median black band. Vertex with a median light line arising from a transverse spot at base, forking just before the middle the two forks angularly divergent, and again angularly recurved, forming a T, with the top piece broken upward to form nearly a right angle above; a band against either eye, from the anterior end of which a crescent extends in, nearly to the top of the T, an oblique line running in from behind either eye, sometimes interrupted to form a spot just inside either ocellus, white. Pronotum, reddish, with irregular creamy markings, usually the anterior margin is lighter, with definite markings, often a creamy band extends back from either eye and joins a band around the posterior margin. Scutellum, with the median half white, interrupted in the middle, a pair of round black dots in the anterior quadrangular part, a pair of white dashes along the middle of the lateral margins. Elytra, reddish, the costal and sutural margins, a line on either side the claval suture and a line between the claval nervures pale creamy, sometimes some irregular mottlings on the disc of the corium.

Slaty form—Size and structure of the preceding form. Color slaty green, varying to fuscous, markings as in the preceding species, except that the light markings of the vertex are usually reduced in size. Face in the female often nearly all light, except for the black spots on the clypeus and apex of head; in the male, often black, with small light spots. Pronotum with a pale area behind each eye, in the middle of which there is a black spot, the dark marking along the anterior margin sometimes forming definite spots. Light stripes on elytra, often broad, especially the pair next the claval suture. Light markings, often with a tinge of blue.

VAR. DOLOBRATA NOV, VAR., Plate III, Fig. 2.

Somewhat smaller than the preceding. Shining black, a few of the white markings of the typical form persisting, as follows: the margins of the clypeus, the genae, a line below the margin of the pronotum, the circle around the apex of head, a line against the eye, and the marking of the scutellum. Often there is part of a median line on vertex and a pair of slender lines running from the inner corner of the eye back across the pronotum to the light margined claval suture.

VAR. UHLERI NOV. VAR., Plate III, Fig. 3.

Slightly stouter than typical *hieroglyphica*, elytra often considerably longer; grayish green, with light blue-green mottlings; black markings on vertex and scutellum much reduced in size and intensity, remaining only as narrow lines margining the original white pattern, giving quite a strikingly different appearance to the vertex. The whole central area is now light from the apical circle back, a pair of approximate lines on the basal half and a heavier pair between them and the ocelli converging before the middle. The

areas between the ocelli and the eyes are ligh', often partly enclosed by a black circular line and with a heavy black spot in the middle. The reflexed portions of the front striated with dark. Pronotum, as in other forms, the markings smaller and more numerous. Elytra mottled with blue-green, the nervures somewhat fuscous, claval sutures often broadly light.

Reddish form—Reddish, pronotum and elytra mottled with creamy, anterior margin of pronotum and scutellum distinctly reddish, dark markings often obscure or wanting, the outer pair of lines on vertex often enlarged, somewhat lobed.

VAR. CONFLUENS UHL., Plate III, Fig. 4.

Proconia confluens, Uhler. Proc. Acad. Nat. Sc., Phila., p. 285, 1861.

Stouter than even the preceding varieties, elytra usually long nearly parallel margined. Dark testaceous, shading to fuscous, elytra slightly and obscurely mottled. Vertex and scutellum fuscous, a few of the light markings of *uhleri* persisting, as follows: a dash back of the apex of vertex, three lines on the disc, a transverse spot at base and a margin next the eyes. Often light markings on pronotum, the lateral ones arranged in rows, apex of scutellum light. The face is usually light, with dark mottlings. Elytra often with the mottlings arranged in light stripes, especially along costa and claval suture.

This species, as a whole, is very variable in size and color, and recalls *O. undata* and *lateralis* in their red, green and black forms. The varieties readily fall into two series on structural characters. The first has *hieroglyphica*, and *dolobrata* as the extreme in darkening up. These forms are the only ones found in the Mississippi valley and as far west as central Kansas; they occur also in Texas, Arizona and Mexico. The second series has *uhleri* as the common form, and *confluens* as the dark extreme. The *uhleri* is the common form in Wyoming, Colorado, Arizona and New Mexico, and extends westward to the coast. The specimens from the western coast, including Idaho, are much larger, and have longer elytra, and are mostly *confluens*.

Specimens of this species are at hand from Illinois, Iowa, Missouri, Nebraska, Kansas, Arkansas, Texas, Wyoming, Colorado, Utah, New Mexico, Arizona, Idaho, Washington, Vancouvers Island, Oregon, California and Mexico. All specimens received as *hieroglyphica* from points east of Illinois belonged to the following species:

TETTIGONIA GOTHICA SIGN., Plate IV, Fig. 1.

Tettigonia gothica Sign. An. Soc. Ent. Fr., p. 345, 1854.

Tettigonia similis Woodw. Bull. Ill. St. Lab. III., p. 25, 1887.
Tettigonia hieroglyphica, in ref. from Eastern States (nec Say).

Smaller than *hieroglyphica*, which it much resembles, pale reddish or grayish green, with several nearly parallel lines on the disc of the vertex and a point at apex black. Length, 5.5—6 mm.; width, 1.25 mm.

Vertex slightly narrower and more pointed than in *hieroglyphica*, three-eighths wider than its middle length, over two-thirds the length of the pronotum, the margins rounded, apex slightly conical, the lateral margin rounding directly to and confluent with the margin of the eye. Front and clypeus as seen from side are evenly rounding, the rostrum reaching back to the scutellum. Elytra with the nervures somewhat more pronounced than in *hieroglyphica*, venation similar.

Color; head pale reddish or greenish yellow, apex with a black point surrounded by a light circle. Front all light or with a light median stripe and numerous short fuscous arcs. Clypeus unmarked or with but a minute black point. Vertex with the margins of the reflexed portions slightly angularly lined, a line from the angle following the suture to the ocelli, inside of these on the disc there is a pair of loops, their outer limbs often curving around to the ocelli and sending a branch back to the posterior margin. These loops often reduced in size to feeble lines, and their inner limbs sometimes broken or wanting. Pronotum with the anterior third light yellow, disc olive or brownish, sometimes with a distinct pattern, often without definite marking. Scutellum with the median half of posterior disc light, margins and anterior disc often clouded with fuscous. Elytra grayish green or reddish unicolorous with the nervures light, or mottled with creamy yellow, the nervures slightly darkened.

Genitalia; female segment nearly three times the length of the penultimate, the posterior margin triangularly produced, whole segment transversely convex. Male plates long, triangular, two and one-half times as long as the penultimate segment, nearly half longer than their combined basal width, their margins fringed with hair.

Specimens have been examined from Maine, New Hampshire, Vermont, District of Columbia, New York, Ohio, Illinois, Kentucky, Alabama, Iowa, Nebraska, Kansas, Colorado, Arizona and southern California; and besides these, it has been reported from New Jersey (*similis*), and Ottawa, Can. and Massachusetts (as *hieroglyphica*). This species has been very generally confused with *hieroglyphica* and reported under that name. All specimens determined as that species that have been received and examined from points east of Illinois have proved to

belong to this one, and it seems quite certain that all records for *hieroglyphica* from farther east than that, should be referred to this species. Typical examples of *similis* determined by Woodworth have been examined.

TETTIGONIA ATROPUNCTATA SIGN., Plate IV, Fig. 2.

Tettigonia atropunctata Sign. An. Soc. Ent. Fr., p. 354, 1854.
Tettigonia cir illata (Uhler MS.). Baker (descrip.) Psyche VIII, p. 285, 1898.
Tettigonia atropunctata Fowl. Bio. Homop. II, p. 256, Pl. 17, Fig. 27, 1900.

General form of *hieroglyphica* somewhat narrower, vertex and pronotum each with about five black spots. Posterior half of pronotum and elytra blue. Length, 6—7 mm.; width, 1.25 mm.

Vertex bluntly rounded, slightly narrowed at the eyes, two-thirds the length of the pronotum. Face, as seen from side, similar to *gothica*. clypeus slightly prominent, elytral venation similar to that of *gothica*.

Color; head pale yellow, sometimes washed with pale blue, a black spot at the apex, surrounded by a pale circle. Front with a stripe either side of the middle, the lateral margin and the clypeal suture black, the two stripes are often effaced in the middle, leaving only a dash at the ends, clypeus with a black dash, vertex with a spot on the middle, a dash against each ocellus on the outside, and a crescent on either side anteriorly along the line of the frontal suture. Pronotum with the anterior half pale, broadest behind the eyes, a black spot behind the outer corner of either eye, a pair just inside the eyes on the sub-margin, and three dots between these latter. Posterior half bright blue, with a large transverse spot behind the middle on either side, and a small dot or longitudinal spot between them. Elytra bright blue, the nervures narrowly black. Legs, orange.

Genitalia; female segment three times the length of the preceding, the median line elevated into a strong keel, posterior margin strongly angled, the apex formed by the convex keel. Male plates long, slender, style-like, about three times the length of the ultimate segment, the margins with fine hairs.

Numerous specimens are at hand from Arizona and California. It is reported as being one of the most abundant and injurious Jassids in southern California.

Signoret described this species from Brazil, and Fowler has it (figured) from Mexico. Neither author's figures are very good for the insect as it occurs in our territory, but Signoret's description, which is very full and complete, and includes face markings and genitalia, both very striking and distinctive, leaves no doubt as to this being the species

described. Specimens labeled *circillata*, in Baker's handwriting, are in the National Museum collection.

TETTIGONIA DOHRNII SIGN. Plate IV, Fig. 3.

Tettigonia dohrnii Sign. An. Soc. Ent. Fr., p. 792, Pl. 24, Fig. 13, 1855.
Tettigonia aurora (Uhler MS.) Baker (description) Psyche VI, p. 286, 1898.
Tettigonia dohrnii Fowl. Bio. Homop. II, p. 268, 1900.
Tettigonia delicata Fowl. Bio. Homop. II, p. 269, Pl. 18, Fig. 5, 1900.

Resembling *atropunctata* in structure, rather longer and narrower. Head and anterior part of pronotum pale, with transverse rows of spots, rest of pronotum and elytra pale reddish, with darker stripes. Length, 7 mm.; width, 1.25 mm.

Vertex, bluntly rounding, three-fourths the length of the pronotum, narrower than in the preceding species, the disc very flat, slightly transversely depressed. Eyes, small, hardly as wide as the pronotum at the lateral angles; pronotum, rather long, narrowing anteriorly. Elytra, long and narrow; venation of the *hieroglyphica* pattern, the anteapical cells longer and narrower; outline of face as in that species.

Color; vertex, pale creamy; a spot at the apex, which is one of five equidistant ones on the anterior margin, and behind these a pair of oblique dashes with their inner ends enlarged and obliquely truncate; black. Posterior sub margin with four quadrate reddish spots, the inner pair elongate. Front, pale; three longitudinal lines, the median line not reaching the apical dot, either side of which there is a black dash below, a pair of spots below the antennal pits, another pair below these, and a third pair on the genæ. Clypeus, with a black dash above. Pronotum, with the anterior part light, broadening out behind the eyes, the sub-margin with six quadrangular reddish fuscous spots in a row; posterior disc tinged with reddish, with four longitudinal testaceous lines, the outer pair short and divergent; scutellum, yellow, with the transverse suture, and three dots at base, reddish fuscous; sometimes the basal dots are extended into longitudinal lines. Elytra, broadly pale along the nervures, the central portion of the cells darker. Legs, yellow.

Genitalia; female segment over twice the length of the penultimate; posterior margin, broadly roundingly produced; disc, convex. Male plates, one-third longer than the ultimate segment; rather broad at base, rapidly narrowing to the long acute points, which are much exceeded by the pygofers.

Specimens are at hand from Arizona and Mexico. The Arizona specimens are from the Van Duzee collection, and bear the label, "Ariz. C. U., Lot 34," and under this, "Cornell U., Lot 45, Sub. 410." They were sent to Prof. Van Duzee as *T. aurora* Uhler, and are doubtless from the

same lot as the two specimens Baker described. The Mexican specimens are paler and answer the Signoret description, except that there are four longitudinal stripes on the pronotum. One of the Arizona specimens has the median pair coalesced, which would give the three stripes of his description and figure.

TETTIGONIA OCCATORIA SAY. Plate IV, Fig. 4.

Tettigonia occatoria Say. Jour. Acad. Nat. Sc. Phila. VI, p. 311, 1831.
Tettigonia compta Fowl. Bio. Homop. II, p. 271, Pl. 18, Fig. 11, 1900.
Tettigonia occatoria Fowl. Bio. Homop. II, p. 279, Pl. 18, Fig. 29, 1900.

Smaller than *dohrnii*, which it resembles in form; longer and narrower than *gothica*. Pale, with four divergent stripes on head and five parallel ones on pronotum; dark brown. Elytra, with a transverse white band before the apex. Length, 6 mm.; width, 1 mm.

Vertex, nearly flat, rather long, angled with a blunt point, the length and breadth at base equal; almost as long at pronotum. Pronotum, broader than the eyes. Elytra, long and narrow; venation, obscure; two apical cells, sometimes three. Outline of face, as seen from side, almost straight, resembling *bifida*.

Color; vertex, yellow, a black spot on the apex just below the margin; a stripe arising just outside and behind the apex on either side running back between the ocellus and the eye; a median dash some distance from apex, which abruptly terminates in a pair of stripes, which run back parallel with the first pair, but inside the ocelli. Pronotum, with five stripes, the median one arising on the base of the vertex and continuing to the apex of scutellum; another pair of stripes arising beneath the eyes and running back below the margin of the pronotum onto the elytra, where, together with the two pairs from the head, they break up into six stripes on each side, of which the outer pair furnishes three on the corium and the other two pairs the three on the clavus. These stripes are of a velvety brown, the outer pair darker anteriorly. The space between these stripes, the margins of the elytra, except the apical, some shade of yellow. Just before the apex of the elytra is a crescent-shaped, transverse band, which may be yellow or hyaline. Face and below, pale yellow; a few short fuscous arcs on the side of the front. Legs, pale.

Genitalia; female segment scarcely twice the length of the preceding; posterior margin obtusely rounding or almost truncate. Male ultimate segment very short; plates rather broad-triangular, their apices slightly produced; much exceeded by the pygofers.

Specimens are at hand from Florida, Mississippi and Texas, where it is apparently common. It is also a common Mexican insect. Specimens are at hand from many localities, but the two commoner forms are somewhat

different in color and both strikingly different from the form from the United States. One of these forms has the stripes black, the disc of the pronotum and elytra blue-green, with very faint stripes; often a bright blue band inside the claval suture. The other variety has the stripes very broad and definite, of a blue-black; the spaces between the stripes yellow on vertex, becoming greenish on the pronotum and bright green on the elytra. Throughout this variation the structure and pattern remains the same, except that the transverse light band at the apex of the elytra is often much broader or doubled by a narrow, black line. Fowler figured this latter variety as *occatoria*, and described our common form as *compta*. His two following species, *tunicata* and *sororia*, probably also belong here.

TETTIGONIA BIFIDA SAY. Plate V., Fig. 1.

Tettigonia bifida Say. Jour. Acad. Nat. Sc., Phil. IV, p. 313, 1831.
Tettigonia tenella Walk. Homop. III, p. 770, 1851.
Tettigonia fasciata Walk. Homop. III, p. 780 1851.
Tettigonia bifida O. & B. Ia. Acad. Sc. IV, p. 175, 1897.

Head short and blunt. Color green, alternate circular bands of light and black on head and pronotum, nervures broadly black. Length, 5.5—6 mm.; width, 1.2 mm.

Vertex short, conical, half the length of the pronotum, nearly twice wider than long, eyes small, narrower than pronotum at the lateral angles. Elytra broad, venation simple, no cross nervures between the sectors before apical cells, outer fork of first sector again forking near its middle. Face, as seen from side, very gently curved.

Color; vertex black, the concave posterior margin with a light band which extends behind the eyes, another light band parallel with this across the disc, just in front of the ocelli, a spot on either side of the apex, sometimes connected with the anterior band by divergent lines. Ledge above antennæ black, margined with light. Face pitchy, outer margin of genæ and the suture between front and genæ narrowly light, sides of front against antennæ rufous. Pronotum with a broad black band on the anterior margin, broadest in the middle, bordered behind by a narrow light band, the humeral and posterior margins with a narrow band of ivory white, in front of which there is a broader band of black, sometimes this band margined in front by another pale one, the disc green. Scutellum yellow, with the transverse impression black. Elytra green, the nervures black, except for the apical cells, which are entirely smoky. Legs, yellow.

Genitalia; female segment about half longer than the preceding one, the posterior margin with the median half slightly roundingly produced, whole segment very convex. Male plates scarcely as long as the ultimate segment, equilaterally triangular, their apices slightly divergently produced. Plates less than half the length of the pygofers.

Specimens are at hand from New Hampshire, Vermont, New York, District of Columbia, Ohio, Iowa, Kansas, Florida, Tennessee, Alabama, Mississippi, Mexico and the West Indies. It occurs all over the eastern half of the United States from Canada to Florida, west to Iowa and Mississippi, and on into eastern Kansas and Nebraska; but a careful search in the west ends of these states and in Colorado has failed to find it.

TETTIGONIA GEOMETRICA SIGN. Plate V, Fig. 2.

Tettigonia geometrica Sign. An Soc. Ent. Fr., p. 12, Pl. 1, Fig. 12, 1854.
Tettigonia geometrica Bak. Psyche VIII, p. 285, 1898.

Resembling *bifida* in form and color, but smaller and lacking the black lines on the elytra. Length, 4.5—5 mm.; width, scarcely 1 mm.

Vertex slightly shorter than in *bifida*, elytra narrower, venation similar, the fork of the outer branch of the first sector occurring well behind the middle instead of at or before it, as in *bifida*, and its branches somewhat more divergent.

Color; vertex black, with the two light crescentiform bands as in *bifida*, the anterior one narrower and almost broken on the frontal sutures; the two spots at the apex larger, approximate. Face black, the antennæ and the margins of the ledge above light. Pronotum and scutellum as in *bifida*. Elytra bright green, the apical cells smoky, margined in front by three pale spots, the outer one the largest; the costal margin and usually the outer branch of the first sector light yellow. Some Florida males are much darkened up, but the light spots on the wings remain or become enlarged.

Genitalia; as in *bifida*, but so much smaller that they are made out with difficulty.

Specimens are at hand from the District of Columbia, Ohio, Kentucky, Florida, Arkansas and Mexico. Besides these, it has been reported from Illinois, Alabama and Louisiana. The Ohio River seems to be nearly its northern limit, as it has only been taken in southern Ohio and Illinois, and careful collecting in Iowa has not revealed it. It doubtless occurs throughout all the Southern States from

Maryland and Illinois south to Florida and Texas, and on through Mexico to South America.

Readily separated from *bifida* by the much smaller size and the green elytra with the three white spots before the smoky apex. Some Florida males are almost black, and might be confused with *hartii* males, if they were not so much more slender than that species.

TETTIGONIA TRIPUNCTATA FITCH. Plate V, Fig. 3.

Tettigonia tripunctata Fitch. Homop. N. Y. St. Cab., p. 55, 1851.
Not *Tettigonia tripunctata* Sign. Monog. No. 175; Fowler Bio., p. 253.

Resembling *bifida* in form and structure, smaller, and with a longer head. White, with the nervures and three spots on vertex, black. Length, 5 mm.

Vertex long, conically pointed, almost as long as the pronotum. Pronotum as wide as the eyes at the lateral angles, narrowed in front. Elytra inclined to be flaring, venation simple, no cross nervures between the sectors, the second fork of the first sector occurring beyond the middle of the outer branch, the two veins often scarcely separated. Face, as seen from side, gently curved, very deep.

Color; white, vertex with a spot on the apex, and circles around the ocelli black, a few brown arcs on the reflexed portion of front and often a brown point on the middle of the disc. Front with very short brown arcs, the ends of which are enlarged and form four longitudinal lines, the two on either side uniting just before the clypeus and extending below the middle of that piece where they unite. Pronotum with the margins very narrowly lined with brown, two transverse bands on the disc, one parallel with each margin, equidistant on the median line, the posterior one abbreviated. Scutellum with an abbreviated median brown line. Elytra with the margins, nervures and claval suture narrowly lined with brown, paler at the apex. Legs and below pale.

Genitalia; female segment nearly twice the length of the preceding, slightly rounding or truncate posteriorly. Male plates broad at base, obtusely triangular, their apices produced into attenuate points; the whole scarcely as long as the large ultimate segment.

Specimens are at hand from Maryland, District of Columbia, New Hampshire, New York, Ohio and Mexico, and it has been reported from Canada, Illinois, Mississippi and Missouri.

The Mexican specimens have the vertex much broader and blunter, as in the Mexican form of *bifida*, and the spot on the center of the disc is distinct and black. Fowler in

the Biologia follows Signoret in his use of *tripunctata*, but as suggested by Van Duzee, Ent. News V, p. 155, this is evidently a mistake and refers to a distinct species which should be called *nigrifasciata* Walk., and which should not only include *pallida* and *albida* but also *uniguttata* and *candida* of Walker. The markings on the head and pronotum are quite different and the genitalia as described by Signoret could not apply to the true *tripunctata*. As described and figured by Signoret *nigrifasciata* should be close to *venusta* Stal., which belongs to the *gothica* group with the retracted face.

TETTIGONIA HARTII, Plate V, Fig. 4.

Tettigonia hartii Wood. MSS.

Form and structure of *tripunctata*, but shorter and much stouter built, especially the head. Female slaty gray, median line of front and nervures lighter. Male much smaller, shining black. Length, ♀ 4.5--15 mm.; ♂ 3.75--4 mm; width, ♀ 1.25 mm.; ♂ scarcely one mm.

Vertex obtusely rounding, conical, two-thirds the length of the pronotum, twice wider than long, the ocelli placed near the anterior margin and on the inner margins of depressed areas. Pronotum broad, flat. Elytra broad, venation similar to *bifida*, a cross nervure forming the inner anteapical cell, the second fork of the outer sector rarely closed behind to form the outer anteapical cell, usually curving away to the costa. Outline of face as seen from side, rounding, face very deep.

Color; female; vertex pale yellowish or brownish, the ocelli and a pair of spots within and behind them, on the posterior margin black. Ocelli often with light circles; in front of the ocelli the vertex is abruptly darker, except for the light spot on apex. Front piceus or brown, a definite median white stripe which enlarges above to form a spot on apex of vertex and often extends onto the dark clypeus below, about twelve pairs of pale arcs on either side. Loræ and genæ pale. Pronotum slaty or brownish, the anterior margin pale, broadening out behind the eyes where it enclosed a black spot; sometimes a pair of spots on the anterior sub-margin behind the basal pair on the vertex. Scutellum pale, a triangular spot within either basal angle. Elytra slaty gray, the nervures pale yellow, claval margins often lined with light blue. Male; shining black, often with circles around the ocelli and the apex of scutellum pale, the spot on apex of vertex white, the median line on front black, the rest of front tinged with rufous, margin of genae pale.

Genitalia; female segment about half longer than the preceding one, posterior margin truncate, slightly incised either side the middle

forming a very slight median tooth; male plates very short, bluntly triangular, not as long as the ultimate segment, less than half the length of the pygofers.

Specimens are at hand from southern Ohio, a pair each from southern Illinois, Florida and Mississippi, and several females from Texas, New Mexico and Cuba. The specimens from New Mexico and Cuba have the elytra very dark, with the light nervures in sharp contrast.

Genus Helochara, Fitch.

Similar to *Tettigonia* in form, head wider than thorax, much broader than long, slightly conical, slightly obtusely angled, reflexed portions of front elevated, prominent. Face well rounded back, profile convex. Pronotum very long, sexangular, resembling *Aulacizes*, lateral margins short, humeral margins very long, the humeral angles rounding to the short medially emarginate posterior margin. Scutellum very small, covered almost to the transverse suture by the pronotum. Elytra coriaceous, veins distinct, raised; venation simple, regular; three anteapical cells and five apical ones. Male antennae with the apical third developed into a flat plate.

Helochara communis Fitch. Plate VI, Fig. 1.

Helochara communis Fitch. Homop. N. Y. State Cab., p. 56, 1851.
Tettigonia herbida Walk. Homop. III. p. 769, 1851. (Not Sign. Monograph No. 167, nor Uhler Hemip. Homop. St. Vinc., p. 77 (=*similis* Walk.))

Small, robust, deep green, superficially resembling *reticulata* or the male of *mollipes* var., *minor*. Length, ♀ 6--7 mm.; ♂ 4--5.5 mm.; width, 1.25 mm.

Vertex a trifle less than two-thirds the length of the pronotum roundly, obtusely angled, the margin blunt, reflexed portion of front prominent, striated. Front sloping well backwards, outline convex or slightly angled above the middle, again on clypeus. Pronotum very long, deeply angled behind. Scutellum very small, less than half the length of the pronotum. Elytra coriaceous except at apex, venation regular, the anteapical cells almost parallel margined. Whole dorsal surface microscopically pustulate.

Color deep green, often fading to pale yellowish olive, except for stripes along the claval suture. The eyes ocelli frontal suture and about four concentric lines on the reflexed portions of front dark. Face and below, pale olive, with about nine dark arcs on front in the female, front usually black in the male.

Genitalia; female segment but little longer than the penultimate, broad and flat, the posterior margin slightly produced in the middle. Male valve broad and short, plates finger-like, triangular, very slightly longer than the ultimate segment.

Specimens are at hand from Ontario, Vermont, New York, District of Columbia, Virginia, Ohio, Tennessee,

Iowa, Colorado, Vancouvers Island, British Columbia and Mexico, and it has been reported from Nova Scotia and Hudson Bay, by Walker. It appears to range the continent from Hudson Bay and British Columbia on the north to at least southern Mexico on the south.

Genus Diedrocephala Spin.

Head narrower than pronotum, eyes small, vertex flat or concave except on posterior margin, roundingly angulate, the apex obtusely rounding, the margins sharp, acute, or very slightly rounded and usually dark lined. Front broad, almost flat above, as seen from side evenly rounding, in the same curve with clypeus. Pronotum broadest across lateral angles, the side margins continuous with the curve of anterior margin, strongly curved in front, posterior margin broadly, slightly emarginate. Elytra rather long, coriaceous, obscuring the venation; venation of the same pattern as in *Tettigonia*, except that the apical cells are usually longer and narrower. Anterior tibiæ round or prismatic.

This genus was founded on a South American species (*variegata*) in which the head is very similar to that of *coccinea*, but the apex of the elytra is slightly emarginate in the middle and the outer cells very weak and obscure; the venation, however, is essentially the same as in *coccinea*, and the notch in the elytra, while distinct in a few species, is variable or wanting in others from the same region and appears to be a specific rather than a generic character.

KEY TO THE SPECIES.

A. Vertex unmarked except for a black band on the anterior margin. Species robust 8 mm. or over.....*coccinea* Forst.

AA. Vertex with black markings nearly parallel with the anterior margin which is usually black lined, often a pair of approximate median lines on the disc. Smaller 6 mm. or under..... ....*versuta* Say.

Diedrocephala coccinea Forst. Plate VI, Fig. 2.

Cicada coccinea Forst. Nov. Spp. Ins., p. 96. 1781.
Tettigonia quadrivittata Say. Jour. Acad. Nat. Sc. Phila. VI. p. 312, 1831.
Tettigonia picta Walk. Homop. III, p. 758, 1851.
Tettigonia teliformis Walk. Homop. III, p. 764, 1851.
Diedrocephala coccinea Osb. & Ball. Iowa Acad. Sc. IV. p. 177, 1807.
Tettigonia quadrivittata Fowl. Bio. Homop. II, p. 276, Pl. 18, Fig. 20, 1900.
Tettigonia idonea Fowl. Bio. Homop. II, p. 276, Pl. 18, Fig. 22, 1900.

Reddish with green stripes on pronotum and elytra. Vertex orange, black margined. Length, 8–9 mm.; width, 1.75 mm.

Vertex slightly convex except before the apex, slightly acutely angled, margins rounding to the acute apex, two-thirds the length of the pronotum. Face distinctly convex as seen from side, the front broad. Elytra long, narrow at the apex, the apical cells long and narrow—the second one especially so, outer anteapical cell acuminate anteriorly.

Color; face and vertex yellow, separated by a broad black band, striated just below the margin, a line on either side extending in on the suture, sometimes angled to the ocellus. Pronotum reddish, a narrow band on the anterior margin in the middle, a broad median stripe extending in from the posterior margin, connected behind with a pair of oblique stripes from the humeral angles, deep green. Scutellum yellow, impressed line often dark. Elytra red, the costal margin, the sutural margin before the middle, the claval suture and a median stripe on corium, green, the appendix black, legs and below yellow. The black margin to vertex continued across eye and under the margin of pronotum. Sometimes the vertex and scutellum are washed with red or the green stripes on pronotum coalesce leaving only a spot on either side of the disc, red.

Genitalia; female segment nearly twice as long as the preceding, posterior margin acutely rounding back to the lateral margins. Male plates long triangular, concavely attenuate, two-thirds the length of the pygofers nearly half longer than the ultimate segment.

Specimens have been examined from Ontario, New Hampshire, Vermont, New York, Connecticut, District of Columbia, Georgia, Alabama, Tennessee, Florida, Kentucky, Mississippi, Ohio, Illinois, Iowa, Michigan, Minnesota, Missouri, Nebraska and Kansas. It ranges from Canada and Maine to Florida, west to central Nebraska and Kansas, and south to Mississippi and Texas and on to Mexico and Central America.

DIEDROCEPHALA VERSUTA SAY. Plate VI, Figs. 3, 4, and 5.

This is another very variable species in color markings and somewhat so in form. Nearly all gradations between these three varieties will be found but the following key will readily place all the specimens examined in their correct variety.

A. A black band on anterior margin of vertex.....*versuta* Say.

AA. The anterior margin of vertex without a band, a black spot at apex.

B. A pair of black spots against eye in front sometimes wanting, a few fuscous arcs on margin but not reaching spot at apex..... ... .*lineiceps* Spin.

BB. **Margin all pale except for spot at apex and one on each side near it**.....*cythura* Bak.

VAR. VERSUTA SAY. Plate VI, Fig. 3.

Tettigonia versuto, Say. Jour. Acad. Nat. Sc, Phila., p. 311, 1831.
Tettigonia redacta, Fowl. Bio. Homop. II, p. 276, pl. 18, fig. 21, 1900.

Resembling *coccinea* but smaller, reddish or yellowish, with definite lines on vertex and scutellum. Length, 5-6 mm.; width, 1.25 mm.

Vertex flat, except for posterior margin between the ocelli, nearly right angled the apex blunt, the lateral margins very slightly rounding, four-fifths the length of the pronotum. Face feebly convex, acutely angled with vertex. Elytra moderately long, venation as in *coccinea*, the outer anteapical cell sometimes broken up or wanting.

Color; vertex pale yellow, a black stripe just over the margin on front, a pair of slender, approximate, median lines which are joined anteriorly to a pair of broken lines just inside and almost parallel with the margins and running back inside the eyes, interrupted by the black sutures which inclose the ocelli. The space between these lines almost white. Pronotum, pale yellow in front, green behind. Scutellum yellow, three longitudinal stripes in front of the transverse suture and two behind; sometimes a pair of dots inside the basal angles. Elytra geen, the claval suture with a blue stripe, either side of which is a broader red one, the inner pair of stripes sometimes extending forward across the pronotum and converging on the vertex, apical margin and posterior third of costa pale, with numerous triangular spots. Face and below, pale yellow.

Genitalia; female segment nearly twice as long as the penultimate, the disc longitudinally elevated, posterior margin obtusely, angularly produced, the sides a little concave; male plates a little longer than the ultimate segment, concavely acuminate, their black tipped apices curving up around the pygofers, side margins with fine hairs.

Specimens of this form are at hand from the District of Columbia, Maryland, Virginia, North Carolina, Georgia, Florida, Ohio, Illinois, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, and various parts of Central Mexico.

VAR LINEICEPS, SPIN. Plate VI, Fig. 4.

Tettigonia liniceps, Spin. Fauna Chilena, p. 283, 185-.

Form and size of variety *versuta* nearly. Vertex slightly shorter, blunter. Color green, vertex yellow, the marginal band reduced to three spots, one on apex and one against either eye. The stripe on either side just inside the margin, with a broad green margin behind, extending back to the oscelli. Scutellum orange yellow.

Elytra without the red stripes, and with but two or three black spots at tip. Sometimes the spots next the eye in front are wanting, and there are two or three fuscous arcs on the upper part of front, which leads to the next variety.

Specimens of this variety are at hand from Texas and Mexico. It was described from South America.

VAR CYTHURA, BAK. Pl. VI, Fig. 5.

Tettigonia cythura, Baker. Psyche VIII, p. 268, 1898.

Vertex slightly shorter than in the preceding variety. Slightly smaller.

Color; vertex and anterior part of pronotum pale yellow, the marginal band reduced to a spot at apex and a smaller one each side one-third the distance to the eyes, the lines inside the margin and dashes against the eye as in the typical form, median lines a little broader and shorter, often about five spots along the front margin of pronotum. Elytra bright green, red bands obsolete, blue ones pale, black spots at apex small or wanting, nervures slightly fuscous.

Specimens are at hand from California, and Lower California and Mexico, and Baker reports it from Arizona. This variety represents the same change in form and color for this species that is shown in the Mexican varieties of *occatoria*, and the same broadening and shortening of the vertex that is seen in the Mexican forms of *bifida* and *tripunctata* and the *confluens* form of *hieroglyphica*. Specimens of this form labeled *Tettigonia cythura*, Uhl., in Baker's handwriting are in the National Museum collection.

GENUS DRAECULACEPHALA NOV. GEN.

Similar to *Diedrocephala* the vertex usually longer and more acutely angled. Face, as seen from side, usually straight, or slightly concave to the middle of clypeus, where it is broken backwards. Disc of clypeus quite gibbous. Pronotum with the lateral margins parallel, narrower than or only equaling the eye. Elytra long, narrowing apically greenish, the nervures raised distinct, the apical and the anteapical cells irregularly reticulate veined. Anterior tibiae slender, round. Type of the genus *D mollipes*, Say.

This is quite distinctively a temperate region group, only a few of the forms extending very far southward. The reticulate venation, while only a trivial character, will at once distinguish the typical forms. The

larvæ of these forms show quite as much divergance from the general Tettigonia form as do the adults.

A. Front, as seen from side, straight or concave above, clypeus definitely angled. Sides of front with numerous dark arcs.

B. Vertex long, acute, margins as seen from above straight, apex with minute spots or none. Profile of front straight. A pair of black stripes beneath the eyes in line with the margins of the elytra.

C. Vertex in the female longer than the pronotum, distinctly longer than broad. Lines on vertex rarely broad. Size small, male segment broad..... ..... *mollipes*, Say.

CC. Vertex in female slightly shorter than pronotum, distinctly shorter than broad, face deep; lines on vertex broad, distinct. Size large, female 10 mm. or over. Male segment long, cylindrical .... *angulifera*, Walk.

BB. Vertex shorter, stouter, margins as seen from above slightly rounding, two dark spots on apex and another pair on margin against eye. Profile of front slightly rounding.

C. Vertex acutely angled, longer than pronotum in the female, the lines distinct, heavy; male vertex with a dark wedge back of the apex and a pair of oblique ovals on the disc. Spots at apex and against eye small..... *manitobiana*, n. sp.

CC. Vertex scarcely less than a right angle, eyes much wider than pronotum, the lines on vertex pale, spots at apex and against eye large, black..... .... *novaeboracensis*, Fitch.

AA. Front, as seen from side, slightly rounding. Clypeus rounding or weakly angled, front and vertex mottled with brown or unmarked, never lined.

B. Vertex acutely angled, longer or about equalling the pronotum, elytra with few coarse reticulations.

C. Vertex very acutely pointed, apex curved upwards, half longer than between ocelli, vertex evenly mottled. Length of male, 6.5 mm..... ..... *floridana*, n. sp.

CC. Vertex moderately acute, the apex blunt, rounding. No longer than the distance between ocelli, a triangular mark back of apex. Male 5 mm. or less ..... *gillettei*, n. sp.

BB. Vertex right angled, shorter than the pronotum. Elytra with numerous fine reticulations ..... *reticulata*, Sign.

DRAECULACEPHALA MOLLIPES SAY. Pl. VII, Fig. 1.

Tettigonia mollipes, Say. Jour. Acad. Nat. Sc. Phila. VI., p. 312, 1831.
Tettigonia innotata, Walk. Homop. III. p. 770, 1851.
Tettigonia antica, Walk. Homop. III. p. 771, 1851.

Tettigonia producta, Walk. Homop. III, p. 772, 1851.
Tettigonia acuta, Walk. Homop. III, p. 773, 1851.
Acopsis viridis. Prov. Nat. Can., p. 352, 1872.
Diedrocephala mollipes, Osb. & Ball. Ia. Acad. Sc. IV, p. 176, 1897.
Tettigonia mollipes. Fowl. Bio. Homop. II, p. 273, Pl. 18, Fig. 15, 1900.
Aulacizes lineata, Fitch, MSS.

Bright green. Vertex pale yellow, narrowly lined with black, acutely triangular, longer than the pronotum. Length, ♀ 7.5 mm., ♂ 6 mm.; width, 1.5 mm.

Vertex acutely angular, produced, disc flat or concave, margin straight, somewhat variable in length, always distinctly longer than the pronotum, in the female, slightly longer or almost equaling it in the male. Face long, retreating in an acute angle, in profile straight to the clypeus which is transversely inflated and angled slightly with the front. Elytra long, coarsely reticulate from apex back to the forking of the outer branch of the first sector, nervures raised, distinct.

Color; vertex, straw yellow, eyes, ocelli, a median line, a pair of posteriorly divergent lines on the disc, three concentric arcs on reflexed portion of front on each side and a pair of dots at apex, fuscous. Anterior part of pronotum and scutellum pale green to yellow, disc of pronotum and elytra bright grass green, nervures pale green, costal and apical margins light. Face pale yellow, sometimes washed with fuscous, about nine pairs of brown arcs on sides of front. Legs and below pale yellow, sometimes washed with fuscous or brown, especially in the male, a black line running back beneath the eyes on either side above which the brown or fuscous never extends.

Genitalia; female segment with the posterior margin truncate, the middle half obtusely, angularly produced. Male valve short and broad, rounding, plates long acutely pointed, half longer than the ultimate segment, the margins with a few weak hairs.

Specimens of this widely distributed and variable species are at hand from Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Ontario, New York, Maryland, District of Columbia, Virginia, Kentucky, Ohio, Illinois, Michigan, Tennessee, Florida, Mississippi, Texas, Minnesota, Iowa, Missouri, Nebraska, Kansas, Wyoming Colorado, New Mexico, Arizona, Vancouvers Island, California, Cuba, and various places in Mexico as far south as Vera Cruz, and the Biologia reports it from Central America, and Walker's *innotata*, the identification of which is in doubt, was from Brazil.

VAR 7-GUTTATA, WALK. Plate VII, Fig. 2.

Tettigonia guttata, Walk. Homop. III, p. 773, 1851

Similar to typical *mollipes* in form and structure, a black spot on the disc of vertex, a pair at the base, another pair just inside the basal angles of the scutellum, and sometimes a third pair on the pronotum.

Specimens of this variety are at hand from Florida, Mississippi and Mexico. Signoret considered this a distinct species and described it as with a longer head than *mollipes*. There is nothing in Walker's description to indicate this, and the spots on vertex and scutellum are about equally common in Var. *minor*. Many specimens of typical *mollipes* possess the spots on vertex at the base in the form of oblique lines, and some of them have trace of fuscous on the disc in place of the spot there.

VAR MINOR, WALK. Plate VII, Fig. 3.

Tettigonia minor, Walk. Homop. III p. 772, 1851.

Form and structure of typical *mollipes*, nearly, shorter and more robust. Vertex shorter, especially in the males, where it is shorter than the pronotum and with a strongly depressed disc. Length, ♀ 6.7 mm., ♂ 5 mm.

Color; bright green, the anterior part of pronotum and vertex pale yellow, often washed with green. The males usually have the frontal sutures, ocelli, and tip of vertex, dark, and any or all of the spots of the preceding variety may be present. Face and below from smoky brown in the females to black in some of the males.

Specimens that have been referred to this variety are at hand from Florida, Mississippi, Texas, Arizonia, California, and Mexico, and forms intermediate in structure, but with the black face from points as far north as New York. This is the commonest form in the Southern states along the Gulf, and in California and Mexico, while on the other hand the females from Vancouvers Island and Cuba have the longest heads seen.

DRAECULACEPHALA ANGULIFERA WALK. Plate VII, Fig. 4,

Tettigonia angulifera, Walk. Homop. III, p. 771, 1851.

Form and color of *mollipes*, nearly, much larger with a broader, shorter, heavier lined vertex. Length of ♀ 10-11 mm., ♂ 8 mm.; width, 2.5 mm.

Vertex broad, slightly sloping from the elevated pronotum, disc concave in front, the lateral margins straight, length slightly less

than the basal width or the length of the pronotum. Face in profile straight, deeper than in *mollipes*, clypeus larger and more strongly angled. Pronotum broad, side margins long. Elytra strong, venation as in *mollipes*.

Color; as in *mollipes*. Pronotum and elytra deeper green, the nervures paler. Lines on vertex broad and distinct, black lined, extending back of the eye and margining the reflexed portion of front half way to the apex, a line along the margin from the suture to the eye, curving in to form a spot on the disc inside the eye. Face pale yellow, about nine short arcs on the sides of front, a spot on genae and a dot on the outside the lorae, black. Below usually pale, a line running back from under the eye black, sometimes all below this line clouded with fuscous.

Genitalia; female segment with the posterior margin rounding, the apex slightly, angularly produced, pygofers long and narrow.

Male, ultimate segment longer than wide, cylindrical, from the open end of which appears a semi-circular valve and a pair of long, strong, slightly, divergent, pincer-like plates, longer than the long ultimate segment, their tips curving upwards and inwards.

Specimens have been examined from New York, Pennsylvania, Ohio and Iowa and Walker described it from New Foundland, and it has been reported from Canada and Kansas. The strikingly large size, especially of the female, will at once separate this species. The male genitalia is also very distinct.

DRAECULACEPHALA MANITOBIANA N. SP. Plate VII, Fig. 5.

Form of *novaeboracensis* nearly, with a longer head, as long as in *angulifera*, but much narrower. Color as in the latter species, the males often with a black wedge and a pair of ovals on disc of vertex. Length, ♀ 8-9 mm., ♂ 7-8 mm.; width, 2 mm.

Vertex one-fourth longer than the pronotum, as long as its basal width, disc flat the margins thick, slightly but distinctly rounding. Face moderately deep, profile convex or slightly angled before the clypeus, which is gibbous and gives a second angle to the profile. Pronotum small, elytra and venation as in *mollipes*.

Color; deep green as in *angulifera*; vertex washed with green. Female with a light band around the broad margin of the vertex; inside of this on either side are five concentric lines, the rest of the markings as in *angulifera*. Spots at the apex rather large, separated by an elongate ivory white mark. Front with ten pairs of rather long arcs and a median line fuscous, a black mark above the antennae and a dot outside the lorae. The male has a large triangular spot behind the apex of vertex and the broadened lines on the disc, black, the lines often becoming confluent and forming an

oval around each ocellus, which is connected in front with the posterior angle of the triangle. Pronotum and elytra as in *angulifera*, much deeper green than in *novaeboracensis*, a black spot just under the margin of pronotum back of the eye.

Genitalia; female segment nearly truncate posteriorily with a triangular median production as in *mollipes*. Male ultimate segment nearly square, valve broad, obtusely triangular, plates thick, slightly divergent, roundingly triangular, their apices attenuate, curved up. Pygofers longer than the plates, keel shaped from below.

Described from eleven examples from Happy Hollow, North Park and Gunnison, Col., and a pair from Winnepeg, Manitoba. The longer head and heavier marking will at once separate this from *novaeboracensis*, to which it is allied structurally.

DRAECULACEPHALA NOVAEBORACENSIS Fitch., Pl. VII, Fig. 6.

Aulacizes novaeboracensis, Fitch. Homop. N. Y. St. Cab. p. 56, 1851.
Tettigonia prasina Walk. Homop. III. p. 768, 1851.
Diedrocephala mollipes Prov Pet. Faune Ent. Can. III, p. 266, 1889.
Diedrocephala novaeboracensis, Osb. & Ball. Ia. Acad. Sc. IV, p. 177, 1897.

Form of *manitobiana* head broader and shorter, wider than pronotum, a pair of black spots at apex and another pair against the eyes in front, the rest of the lines pale brown. Length, 8 mm.; width, nearly 2 mm.

Vertex in the female equalling the pronotum in length, distinctly shorter than its basal width, slightly less than right angled disc flat or a trifle convex margins thick and slightly rounded to the blunt point. Profile of front very slightly convex, not at all angled below, extending onto the clypeus which is angled above the middle. Pronotum rather short, elytra as in *manitobiana*.

Color; pale green, vertex pale lemon yellow, a pair of large triangular spots at the apex, separated by an ivory line, a pair of quadrangular ones on the margins in front of the eyes, the ocelli, and sometimes the sutures, black, remainder of the lines brown, somewhat obscure. Face pale yellow, arcs on front brown or fuscous often obscure, a large black spot above antennal sockets, a spot on genae, a dot outside lorae on either side, and often a dot on disc of clypeus, black. Disc of pronotum and elytra pea green, a black dot behind the eye below the margin of pronotum.

Genitalia; Female segment roundingly emarginate posteriorly with an obtuse median tooth. Male, valve large roundingly pointed a third the length of the plates, plates thick, finger-like, bluntly pointed, a little longer than the ultimate segment, a little shorter than appressed pygofers.

Specimens are at hand from Vermont, New York, Ontario, Iowa, Nebraska, Colorado, Idaho and Vancouvers Island,

and it has been reported from Maryland and Hudson's Bay (*prasina*). In this species the vertex and anterior part of pronotum are pale yellow, the lines on vertex obscure while the spots are distinct, while in the preceding species the vertex and anterior part of pronotum are washed with greenish and the lines are all dark and distinct.

DRAECULACEPHALA FLORIDANA N. SP. Plate VI, Fig. 6.

Resembling *mollipes* in size and length of head, the vertex slightly longer. the margin thicker, the apex acute conical, upturned. Front and vertex mottled with brown. Length of male, 6.5-7 mm.

Vertex acute conical, the lateral margins thick, one-fourth longer than the pronotum, disc concave anteriorly, front in profile broadly convex, the clypeus small, in the same curve. Pronotum as in *mollipes*, elytra similar to *reticulata*, but with fewer reticulations.

Color; front and vertex mottled with light brown and pale, a minute polished dot of light at the apex slightly margined with dark brown, a light median line ending in an irregular spot in front of the middle, the inner margin of the ocelli broadly white, frontal sutures with black lines to the ocelli. Pronotum pale the disc, omitting a median line, green. Elytra green, the margins and nervures pale.

Genitalia; male, ultimate segment nearly square, valve almost concealed, plates a little longer than the segment, attenuately pointed.

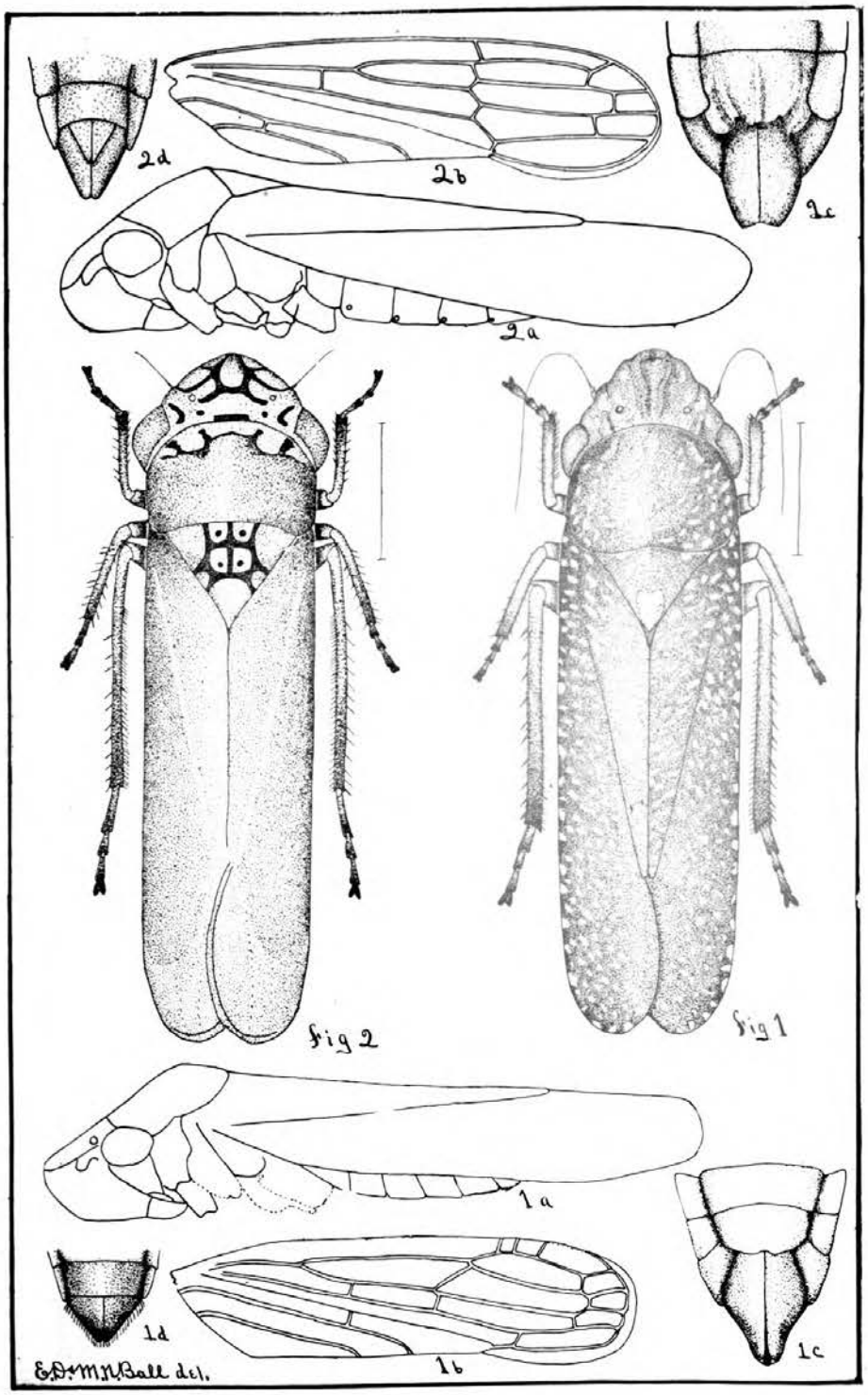
Described from two males from Charlotte Harbor, Florida, from the Iowa State College collection (Van. D. Coll.), through the kindness of Professor Summers.

The long, brown mottled, upturned vertex will at once distinguish this species.

DRAECULACEPHALA GILLETTEI N. SP. Plate VI, Fig. 7.

Intermediate in form and size between *floridana* and *reticulata*, somewhat stouter, vertex not quite as long as the pronotum. Color grayish cinereous, a dark wedge on vertex. Length, ♀ 6 mm., 5.25 ♂ mm.; width, 1.5 mm.

Vertex broad, slightly convex, apex blunt, not quite as long as the pronotum, lateral margins rounding to the convex front. Front in profile convex, lower part of clypeus rounding back from the curve of the front. Pronotum broad, slightly angularly emarginate


2d
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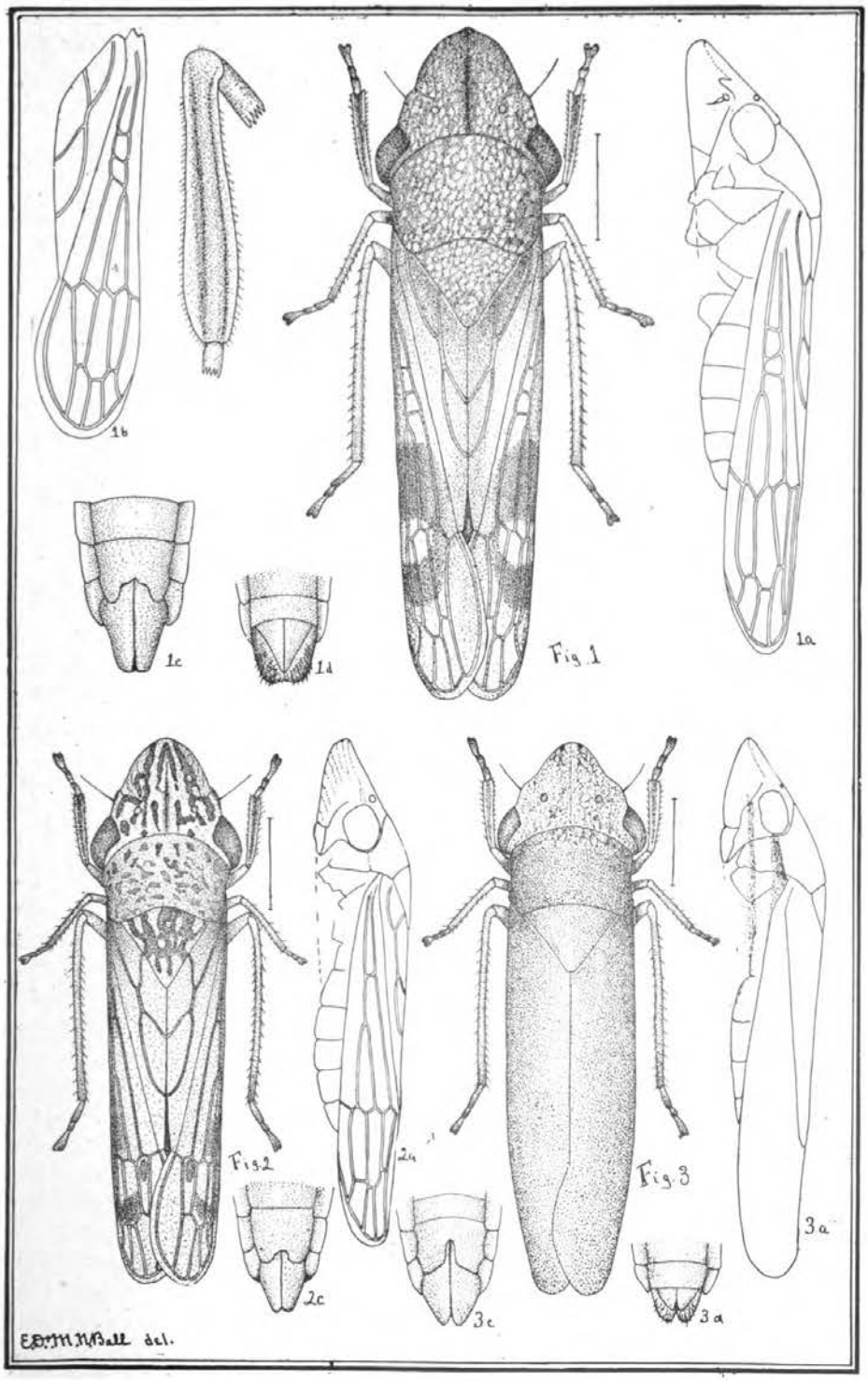
E.D. & M.N. Ball del.

IOWA ACADEMY OF SCIENCES. Plate ii.



in the middle posteriorly. Elytra rather broad, venation distinct, similar to that of *floridana;* female less reticulate.

Color; vertex and face pale yellow, finely irrorate with brown, the frontal sutures including the ocelli, a basal median line and an irregular wedge on anterior half, fuscous. Pronotum olive grayish, a row of submarginal creamy spots sometimes extending back onto the disc as pale lines. Scutellum pale impressed line, spots inside basal angles and a pair on anterior disc, dark. Elytra cinereous or sometimes greenish, nervures pale. The male sometimes darkened up to a slaty brown. Below pale, margins of abdomen often red.

Genitalia; female segment half longer than the penultimate, posterior margin nearly truncate, a somewhat variable obtuse, median tooth. Male valve almost concealed, plates stout, coriaceous, scarcely longer than the ultimate segment, their apices bluntly pointed, upturned, whole genitalia reddish.

Described from eighteen specimens from La Salle and Fort Collins, Col. The first specimens were collected by Professor Gillette.

DRAECULACEPHALA RETICULATA SIGN. Plate VI, Fig. 8.

Tettigonia reticulata. Sign. An. Ent. Soc. Fr., p. 22, Pl 2, Fig, 10, 1854.
Diedrocephala flaviceps, Riley. Amer. Ent. III, p. 78, 1880.
Tettigonia diducta, Fowl. Bio. Homop II, p. 274, Pl. 18, Fig. 17, 1900.
Helachara fulvicephala, Fitch MSS.

Small, moderately stout, vertex blunt, shorter than pronotum. Elytra densely reticulated before the apex. Green with the head pale, washed with reddish. Length, ♀ 5.5 mm., ♂ 4-5 mm.

Vertex bluntly conical, nearly right angled, two-thirds the length of the pronotum, ocelli large. Face in profile convex. The clypeus slightly elevated, front broad rounding with the vertex. Pronotum rather long, strongly emarginate on the median third posteriorly. Elytra as in *mollipes*, but with the reticulations more numerous, much more numerous than in the two preceding species.

Color; vertex and face pale, finely irrorate with brown and washed with reddish orange, a pair of spots against the ocelli on the inside and a marginal line sometimes emphasized in the spots at the apex, creamy; ocelli shining black; anterior margin of pronotum and the scutellum pale yellow; disc of pronotum and elytra green or grayish green; nervures and margin pale, distinct. Legs and below pale yellow, margins of the abdominal sternites in the female reddish.

Genitalia; female segment half longer than the penultimate, posterior margin truncate, the median half roundingly produced. Male valve short, nearly as wide as the plates at base, plates long, acutely triangular, slightly longer than the ultimate segment.

Specimens are at hand from South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, California, and Mexico, and it was described from Cuba.

Signoret's description is very good, and fits our species in every particular except that he gives the length as 3 mm.; this would be too small, but the length line on the plate is fully 4 mm., which would fit the males of this species, and they also more often possess the "three white points at the apex," which he describes.

EXPLANATION OF PLATES.

The figures on a plate, except where otherwise noted, are drawn to the same scale.

The drawings were made by my wife from my pencil sketches and under constant supervision as regards structural accuracy.

PLATE I.

Fig. 1.—*Aulacizes irrorata*. Female, typical form.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 2.—*Oncometopia undata*. Female, typical form.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

PLATE II.

Fig. 1.—*Homalodisca triquetara*. Female, typical.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 2.—*Homalodisca liturata*. Female.
a, profile; *b*, elytron; *c*, ♀ genitalia.

Fig. 3.—Head and etc., of *Homalodisca insolita*. Female.
a, profile; *c*, ♀ genitalia; *d*, ♂ genitalia.

PLATE III.

Fig. 1.—*Tettigonia hieroglyphica*. Typical form from Iowa.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 2.—Variety *dolobrata* from Iowa.

Fig. 3.—Head, etc., of variety *uhleri* from Col.
k, variety *uhleri* from Washington showing long elytra.

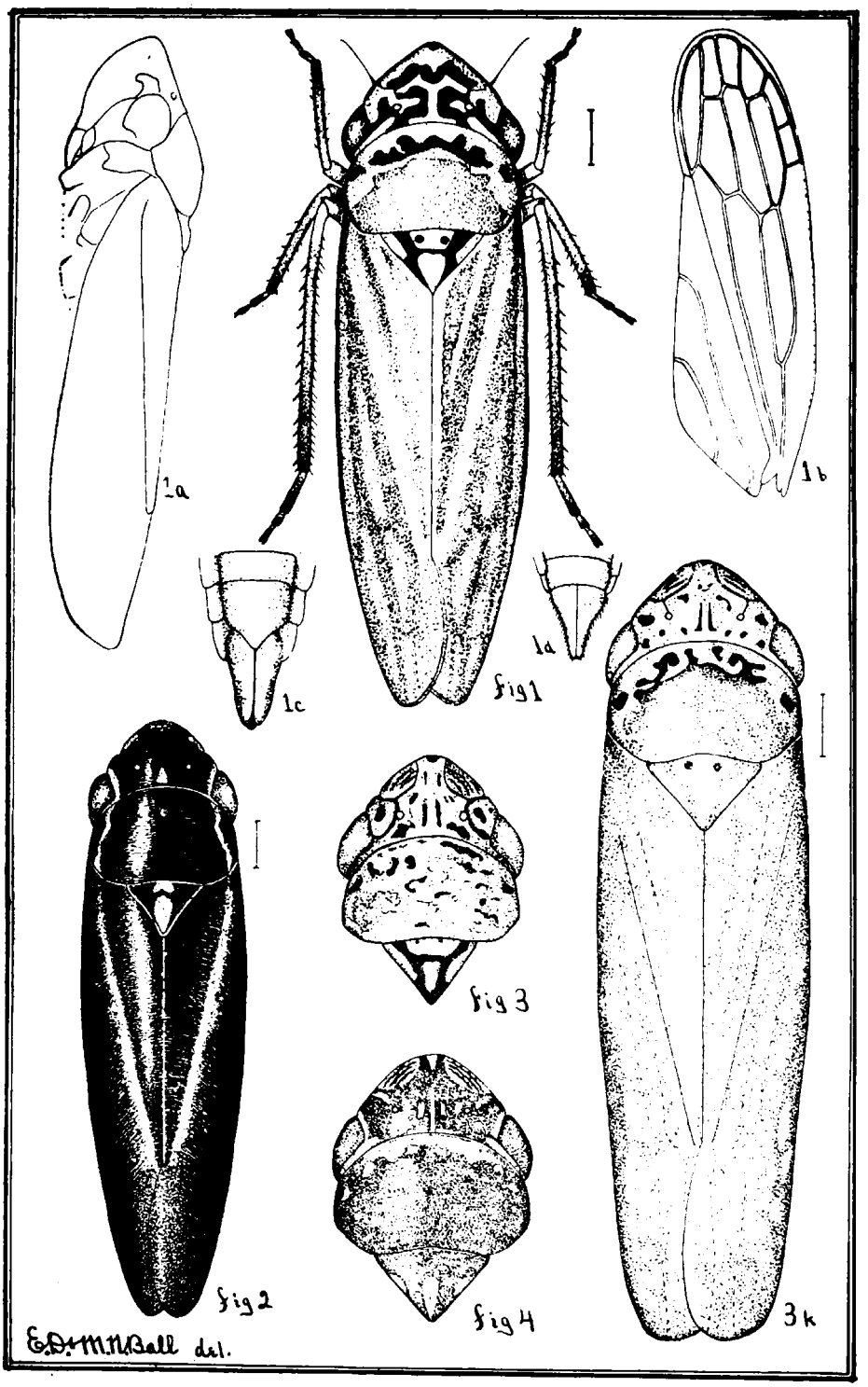
Fig. 4.—Head, etc., of variety *confluens* from Washington.

PLATE IV.

Fig. 1.—*Tettigonia gothica*. Typical markings.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d* ♂ genitalia; *e*, face; *k*, head, etc., of same with light markings.

Fig. 2.—Head, etc., of *Tettigonia atropunctata* from California.
c, ♀ genitalia; *d*, ♂ genitalia.

Fig. 3—Head, etc , of *Tettigonia dohrni* from Arizona.
c, ♀ genitalia; *d*, ♂ genitalia.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1b
1c
1a
fig 1
fig 2
fig 3
fig 4
3k
E.D.M.Ball del.

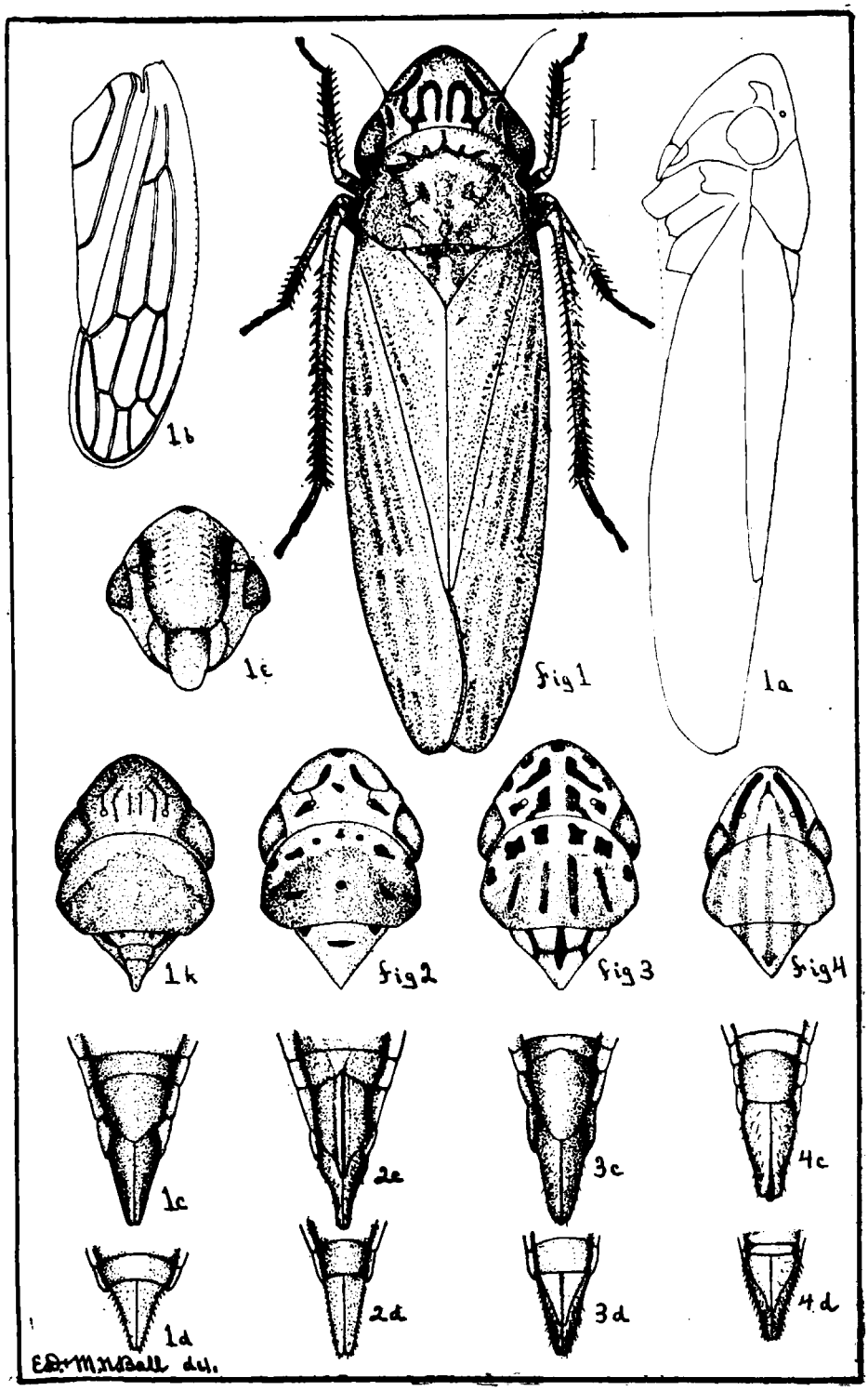

1b
1c
Fig 1
1a
1k
Fig 2
Fig 3
Fig 4
1e
2e
3e
4e
1d
2d
3d
4d
E.B.M. Ball del.

Fig. 4.—Head, etc., of *Tettigonia occatoria* from Mississippi.

The figures on the lower half of the plate are drawn to a smaller scale than those on the upper.

PLATE V.

Fig. 1.—*Tettigonia bifida.* Female.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 2.—Head, etc., of *Tettigonia geometrica.*
b, elytron.

Fig. 3.—*Tettigonia tripunctata.*
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 4.—*Tettigonia hartii.* Female from Ohio.
a, profile; *b*, elytron; *c* ♀ genitalia; *d*, ♂ genitalia.

e, Male of same from Ohio.

PLATE VI.

Fig. 1—Head, etc., of *Helochara communis.*
a, profile; *c*, ♀ genitalia; *d*, ♂ genitalia; *e*, antenna (enlarged).

Fig. 2.—Head, etc., of *Diedrocephala coccinea.*
a, profile; *b*, elytron (reduced); *c*. ♀ genitalia; *d*, ♂ genitalia.

Fig. 3.—Head, etc., of *Diedrocephala versuta.* Typical form from Tennessee.

Fig. 4.—Head, etc., of *D. versuta*, var. *lineiceps* from Texas.

Fig. 5.—Head, etc., of *D. versuta*, var. *cythura* from California.

Fig. 6.—Head, etc., of *Draeculacephala floridana* from Florida.
d, ♂ genitalia.

Fig. 7.—*Draeculacephala gillettei.* Female, Colorado.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

Fig. 8.—Head, etc , of *Draeculacephala reticulata.*
d, ♂ genitalia.

PLATE VII.

Fig. 1.—Head, etc., of *Draeculacephala mollipes.* Female from Iowa.
a, profile; *b*, elytron; *c*, ♀ genitalia; *d*, ♂ genitalia.

k, Head, etc., of male of same.

Fig. 2.—Head, etc., of *D. mollipes*, var. *7-guttata.* Female from Florida.
k, Head, etc., of male of same from Mississippi.

Fig. 3.—Head, etc., of *D. mollipes*, var. *minor.* Female from California.
k, Head, etc., of ma e of same from Mexico.

Fig. 4 —Head, etc., of *Draeculacephala angulifera.* Female from Iowa.
a, profile; *d*, ♂ genitalia.

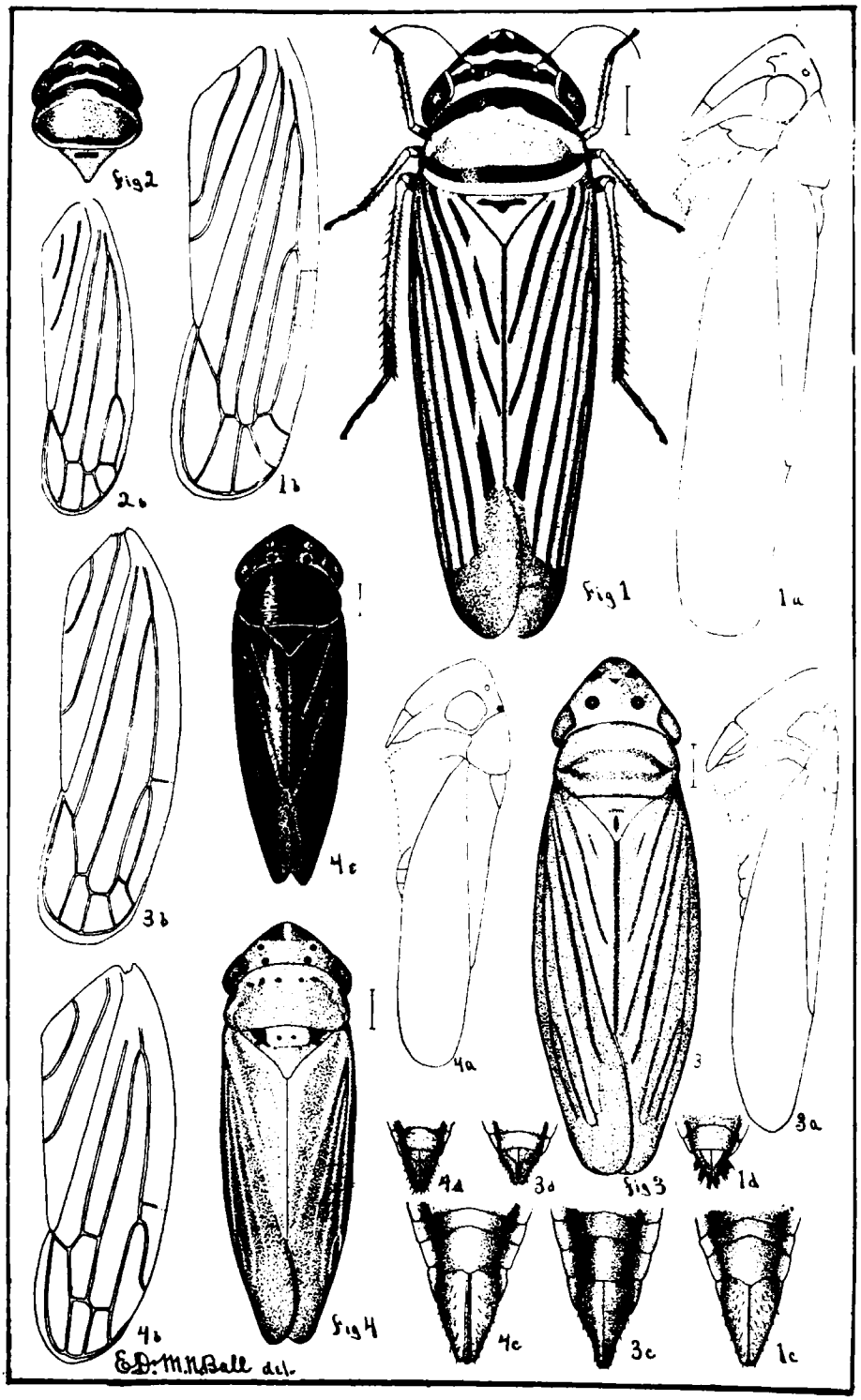
k, Head, etc., of male of same from Iowa.

Fig. 5.—Head, etc., of *Draeculacephala manitobiana,* Female from Colo.
a, profile; *d*, ♂ genitalia.

k, Head, etc., of male of same from Colorado.

Fig. 6.—Head, etc., of *Draeculacephala novaeboracensis.* Female from Iowa.
a, profile; *d*, ♂ genitalia.
k, Head, etc., of male of same from Iowa.

IOWA ACADEMY OF SCIENCES. Plate v.



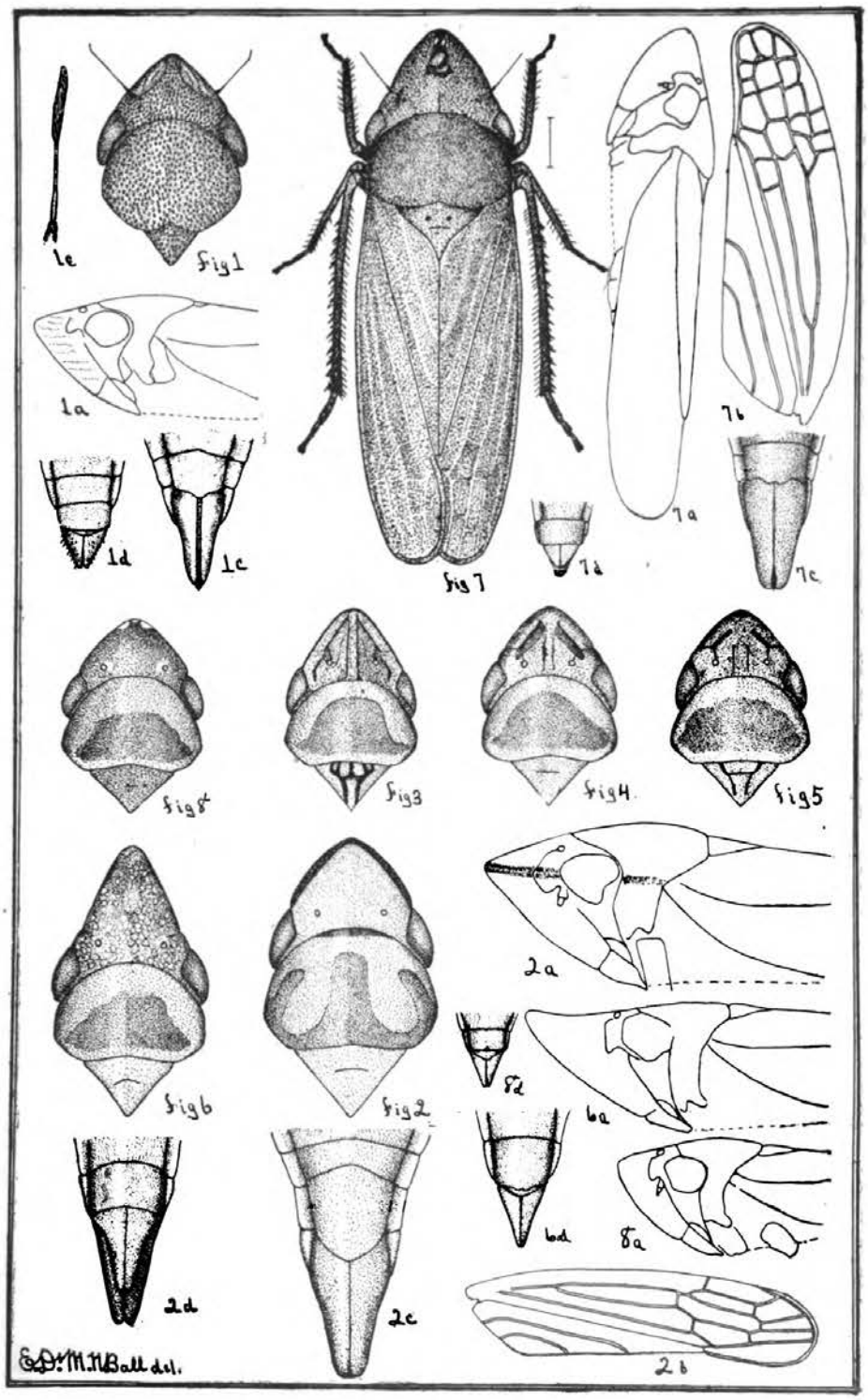

1e
fig1
1a
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fig7
7d
7a
7b
7c
fig4
fig3
fig4
fig5
fig6
fig2
2a
8a
6a
6d
2d
2c
2b
S.D.M.M.Ball del.

IOWA ACADEMY OF SCIENCES. Plate vii.