

STUDIES IN AMERICAN TETTIGONIIDAE
(ORTHOPTERA)

III

BY JAMES A. G. REHN AND MORGAN HEBARD

A SYNOPSIS OF THE SPECIES OF THE GENUS
NEOCONOCEPHALUS FOUND IN NORTH AMERICA
NORTH OF MEXICO¹

NEOCONOCEPHALUS Karny

1815. *Conocephalus* Thunberg, Mém. Acad. St. Petersbourg, v, p. 271. (In part.)
1906. *Conocephaloides* Kirby, Synon. Catal. Orth., ii, p. 241. (In part not of Perkins.)
1907. *Neoconocephalus* Karny, Abh. k. k. zool.-bot. Ges. Wien, iv, p. 22.

GENOTYPE—*Neoconocephalus subulatus* [*Conocephalus subulatus*] (Bolivar), selected by Karny, 1907.

Differential Generic Characters.—When compared with the most nearly related genus, *Euconocephalus*, the present genus is given by Karny as differing in the form of the lateral lobes of the pronotum which are deeper with ventral margin obtuse-angulate or rounded, and in the tegmina which have the costal vein abbreviate or obscure and more distinctly divergent from the humeral vein.

History.—Kirby, in 1906, restricted the name *Conocephalus* to the genus called *Anisoptera* by Latreille in 1829, and *Xiphidion* by Serville in 1831, but his views on tautonymic generic and specific names impelled him to use the name *Anisoptera* for that genus and, in place of *Conocephalus* as generally understood by authors, he used the name *Conocephaloides*, which had been proposed by Perkins, in 1899, for an aberrant form of the subfamily from the Hawaiian Islands. The genus *Conocephaloides* is, however, distinct from the present aggregation. Karny, in 1907, recogniz-

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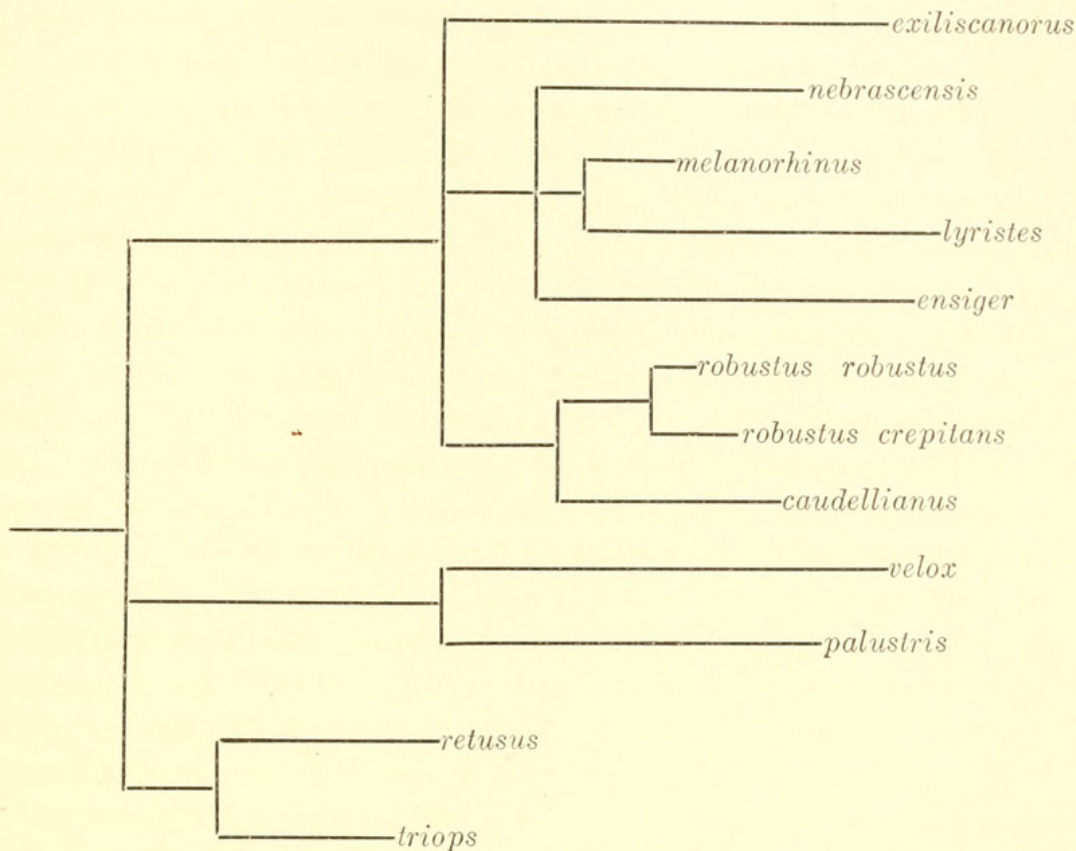
ing that the genus *Conocephalus* of authors was composed of a number of valid sections, erected subgeneric names for the same, *Neoconocephalus* being the one proposed for the present group. That author, however, at that time retained the name *Conocephalus* as a broad generic designation covering these subgenera. The same author, however, in 1912, recognizing the fact that *Conocephalus* by tautonymy should be transferred to the genus called *Anisoptera* by Latreille and *Xiphidion* by Serville, and convinced of the fact that his subgenera previously erected were of generic validity, elevated the names *Neoconocephalus*, *Euconocephalus* and *Homorocoryphus* to generic rank.² It is solely with his genus *Neoconocephalus* that we are dealing at present. Of the other two related genera, but one, *Homorocoryphus*, is represented by a single species, *H. malivolans* (Scudder), in the regions at present under consideration. Scudder's *Conocephalus acutulus*, described in 1878, belongs in the genus *Caulopsis*, as placed with a query by Karny in 1912; we believe that the specimen was recorded from California in error as that genus is confined to tropical America.

Distribution of Genus.—In America north of Mexico the genus is generally distributed east of the Rocky Mountains as far north as the southern limits of the Canadian Zone, west of these mountains it is found only short distances from the Mexican border where it is by no means abundant.

The brevity of some of the earlier descriptions of the species, the use of these names by different authors to designate different species and some recent misconceptions, have caused the literature on the North American species of the present genus to become in places decidedly involved. The eleven species, one of which divides into two geographic races, which are found in the region under consideration, are well defined and it is the purpose of the present paper to state briefly their differential characters and indicate the relative importance of these. The literature on the species under consideration has been carefully examined, but the only corrections made in the present paper are those of which we have the material or other conclusive evidence before us.

² Gen. Ins., Subf. Copiphorinae, pp. 29, 33 and 36.

The species at present under consideration are naturally grouped as follows:



Morphological Notes.—Degree of robustness is frequently of value in distinguishing certain species when the sum total of characters are considered. A certain amount of individual variation is often found in the shape of the vertex; in species having it produced, the female sex has the apex averaging slightly more acuminate. In species having the ventral surface of the vertex marked, the maculation varies individually in intensity in some few specimens of every large series, and in specimens in which the coloration is weak, the area covered by the same is always correspondingly reduced, this reduction being always greater proximad than distad. Thus, in species having the entire ventral surface of the vertex black, among specimens of the palest coloration exceptions occur in which this marking is less extensive, reaching only to the base of, and not including, the proximal tooth. In females the pronotum averages proportionately less ample, the tegmina and wings are more elongate and attenuate, than

in males from the same series. The shape and venation of the stridulating field of the male tegmen shows distinctive characters in almost every species, but these differences are often very difficult to define and are ill suited for use in a key, though in comparison of material their presence is readily noted. The genicular lobes of all the species under consideration are unispinose. The spination of the limbs shows decided variability and is of interest only in showing somewhat greater development or average greater number of spines in some species than in others; very small but conspicuous dark markings on the ventral margins of the caudal femora immediately under the spines are found in *N. palustris*, often in *triops* and sometimes present though weakly defined in *retusus*. In some species minor characters are to be found in the male genitalia; in the supra-anal plate of *exiliscanorus*; in the cerci of *retusus* and *triops*, and the styles of the subgenital plate are decidedly longer in *velox*, *palustris*, *retusus* and *triops* than in the other species studied. The ovipositor shows a greater upward curvature in *exiliscanorus* and *retusus* than in the other species here considered; it shows a distinct downward curvature in *lyristes* and to a less extent in *melanorhinus*; it is rather wider than usual in *exiliscanorus*, *melanorhinus*, *lyristes* and *palustris*, and in the three latter species, and particularly in *palustris*, the widening being more decided meso-distad.

Biological Notes.—The junior author has studied the song and habits of all of the species here treated excepting *N. nebrascensis*, and an opportunity to compare at the same time, or at least on the same day, *N. exiliscanorus*, *melanorhinus*, *lyristes*, *robustus*, *caudellianus*, *palustris* and *retusus* in New Jersey during the summer of 1914, has been of decided assistance. The species either sing with a continuous buzzing or with a succession of brief buzzing notes; to this latter class belong *C. exiliscanorus*, *ensiger* and *caudellianus*.

The species under consideration are all more or less vagrant at times. The distance to which they may wander is problematical but in some cases probably considerable. The records of *N. exiliscanorus* from New Harmony, Indiana, Thompson's Mills, Georgia, and Dallas, Texas, are very possibly due to individuals having strayed long distances from their normal area of distribution, at least this is highly probable for the first two records which

are from regions where the species is very rare, if ever native. Frequently individuals are attracted to lights in cities at night; we have observed this in *N. exiliscanorus*, *robustus crepitans* (in numbers), *retusus* and *triops*. In the pine barrens of New Jersey, miles from their normal environment, several males of *N. lyristes* and one of *N. palustris* were found stridulating vigorously on the low oaks at night.

Key to the Species Treated

- A. Vertex decidedly longer than wide, not broadly and evenly rotundate.
 - B. Vertex strongly produced, much longer than basal width; narrowing decidedly to apex which is very narrowly rounded (except in *melanorhinus*).
 - C. Form robust. (Vertex slender, with ventral surface black as far as or including basal tooth.)
 - D. Vertex exceedingly long, with basal tooth very prominent. Ovipositor very much longer than caudal femur. Size medium to very large, form not as compact as in *nebrascensis*.
 - exiliscanorus* (Davis)
 - DD. Vertex not as long, with basal tooth not as prominent. Ovipositor much longer than caudal femur. Size medium, form very compact.....*nebrascensis* (Bruner)
 - CC. Form slender.
 - D. Vertex heavy, with ventral surface black as far as or including basal tooth.
 - E. Vertex moderately produced, about twice as long as basal width, narrowing decidedly to abruptly truncate apex, which is broad and weakly rounded. Ovipositor distinctly shorter than caudal femur. Size small to large, form moderately slender.....*melanorhinus* (Rehn and Hebard)
 - EE. Vertex very long, longer than in any other species except *exiliscanorus*. Ovipositor distinctly longer than caudal femur. Size medium, form very slender.
 - lyristes* (Rehn and Hebard)
 - DD. Vertex slender (long, but not as long as in *lyristes*), with ventral surface narrowly but continuously margined laterad and distad with black. (Ovipositor much longer than caudal femur. Size medium, form slender.).....*ensiger* (Harris)
 - BB. Vertex moderately produced (for the genus), distinctly longer than basal width, narrowing moderately or very weakly to apex (except in typical *robustus*), which is arcuato-truncate (except in typical *robustus* and to a less degree in *robustus crepitans*).
 - C. Form robust. Pronotum not elongate, not expanding evenly caudad. Ovipositor of normal width, long, slightly shorter than, to (normally) slightly longer than, caudal femur.

- D. Ventral surface of vertex immaculate, or rarely with a very small distal maculation. Longitudinal transparent area of male tegminal tympanum usually not darkened.
- E. Size large. Vertex longer, narrowing decidedly and with apex narrowly rounded. **robustus robustus** (Scudder)
- EE. Size large to (normally) very large. Vertex shorter, not narrowing as decidedly and with apex somewhat broader. **robustus crepitans** (Scudder)
- DD. Ventral surface of vertex rather heavily outlined in black. Longitudinal transparent area of male tegminal tympanum usually darkened. (Size large. Vertex rather similar to but somewhat shorter than that of *robustus crepitans*.) **caudellianus** (Davis)
- CC. Form of males slender, of females robust with abdomen decidedly enlarged.³ Pronotum elongate, expanding evenly caudad. Ovipositor wider than normal, short, (normally) slightly shorter than caudal femur.³ (Vertex narrowing very weakly to apex, which is broader than in *robustus* and narrower than in *caudellianus*, ventral surface immaculate.)
- D. Size of male rather large, form very slender. Head unusually long and narrow with genae somewhat swollen, vertex narrowing more gradually to somewhat more broadly rounded apex. Portions adjacent to bases of spines of ventral margins of caudal femora not darkened. **velox** (Rehn and Hebard)
- DD. Size of male small, form less slender. Head not unusually long with genae not swollen, vertex narrowing more decidedly (though very weakly) to apex which is less broadly rounded. Portions adjacent to bases of spines of ventral margins of caudal femora distinctly darkened. **palustris** (Blatchley)
- AA. Vertex wider than long to very slightly longer than wide, broadly and evenly rotundate (ventral surface narrowly margined distad with an arcuate black line).
- B. Size small to medium, form slender. Vertex small and usually slightly longer than wide. Ovipositor very much longer than caudal femur. **retusus** (Scudder)
- BB. Size large, form robust. Vertex large and usually wider than long. Ovipositor slightly shorter than to (rarely) slightly longer than caudal femur. **triops** (Linnaeus)

Specimens Examined.—In the preparation of the present paper the types of the following species have been before us.

Neoconocephalus exiliscanorus (Davis)

Neoconocephalus nebrascensis (Bruner)

Neoconocephalus melanorhinus (Rehn and Hebard)

³ The female of *velox* is unknown.

Neoconocephalus lyristes (Rehn and Hebard)

Neoconocephalus robustus robustus (Scudder)

Neoconocephalus robustus crepitans (Scudder)

Neoconocephalus caudellianus (Davis)

Neoconocephalus velox Rehn and Hebard

Neoconocephalus retusus (Scudder)

(*Conocephalus atlanticus* Bruner, synonym of *Neoconocephalus retusus* (Scudder).)

The total of specimens examined in the preparation of the present paper is about 1400. Of the 1248 here recorded, 989 are in the Hebard Collection and that of the Academy of Natural Sciences of Philadelphia.⁴ We wish to express our heartiest thanks to Mr. Wm. T. Davis for the privilege of examining his types and several large and interesting series in his collection, to Mr. A. N. Caudell and Dr. Samuel Henshaw for the privilege of studying all of the material in the United States National Museum and Museum of Comparative Zoology respectively, to Prof. A. P. Morse who has most generously requested us to include in this study all of the previously unrecorded material in his collection excepting that from New England, and to Dr. J. Chester Bradley whose work in Georgia has helped our distributional studies decidedly in this and other genera.

Neoconocephalus exiliscanorus (Davis) (Pl. XV, figs. 1B to 1E.)

1887. *Conocephalus exiliscanorus* Davis, Can. Ent., xix, p. 57. [Staten Island, New York.]

1902. *Conocephalus bruneri* Blatchley, Orth. of Indiana, p. 267, fig. 90. [New Harmony, Indiana.]

In 1907,⁵ Karny first placed *bruneri* correctly in the synonymy here. Blatchley apparently wholly overlooked Davis' *exiliscanorus* when he described *bruneri* (his specimen was apparently pronounced to belong to an undescribed species by Bruner to whom it had been sent for determination).

As is shown by the figure, the vertex of the present species is more produced and specialized in this insect than in any other

⁴ Material collected by either or both of the authors is in these collections and for such material recorded in the present paper we have, as has been our custom, not designated the collection.

⁵ Abh. k. k. zool.-bot. Ges. Wien, IV, p. 30.

treated in the present paper; the latero-caudal projections of the supra-anal plate of the male are also most decided. The stridulating field of the male tegmen is large and very broad; the stridulating vein is very long and evenly but not strongly swollen, with accompanying veins well marked; the veinlets of this field are rather decided. The ovipositor is somewhat broader than usual and more noticeably curved upward.⁶

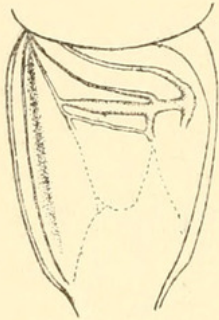


FIG. 1 A—*Neoconocephalus exiliscanorus* (Davis). Staten Island, New York. *Type*. Stridulating field of male tegmen. ($\times 3\frac{1}{2}$.)

This species agrees with *nebrascensis* in having the ventrocephalic margins of the cephalic and median femora usually but not always armed with a few small spines, and the ventral margins of the caudal femora with a number of irregularly spaced short delicate spines.

Types.—Described from two males from a single locality.

Single Type here Designated: ♂; Staten Island, New York. (Wm. T. Davis; in cat-tails on salt marsh.) [Davis Collection.]

The material before us shows that there is a great amount of individual variation in the species, what geographic variation exists can not be definitely ascertained as the species is yet known only from single records over apparently the greater part of its range.

The spines of the cephalic and median tibiae are rather short and heavy; the ventral margins of the caudal femora are armed with numerous short delicate spines, normally internal 5–9, external 4–8, often specimens may be found with several more extremes before us; internal 5–11, external 4–10.

The green color phase is the more abundant, but very frequently specimens are brown in general coloration.

For measurements see page 373.

⁶ Immature females of the present species have the ovipositor curving weakly downward. In the early stages apparently no trace of black marking on the vertex or margins of caudal femora is ever present; in species having the vertex decidedly produced, such production is decidedly less.

NEOCONOCEPHALUS EXILISCANORUS (Davis)
Measurements (in millimeters) of extremes

| ♂ | Number of specimens | Lateral length of vertex ⁷ | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor ⁸ |
|--|---------------------|---------------------------------------|--------------------------|--------------------|------------------|------------------------|-----------------------------------|
| Pleasantville, New Jersey..... | (29) | 4.2-5.2 | 3.2-4.1 | 7.7-9 | 34.8-44.5 | 19.8-24.8 | |
| Mays Landing, New Jersey..... | (1) | 6.1 | 4.9 | 9.1 | 46.4 | 23.8 | |
| Tinicum Island, Pennsylvania.. | (63) | 5.6-6 | 3.2-4.3 | 7.6-8.8 | 33.1-41.7 | 19.3-22.9 | |
| ♀ | | | | | | | |
| Pleasantville, New Jersey..... | (10) | 5.3-6.2 | 4.3-5.3 | 7.7-8.8 | 41.3-46.8 | 25.4-28.8 | 40.8-45.7 |
| Cape May Court House, New Jersey..... | (1) | 7.2 | 6.2 | 9.6 | 49.4 | 30.4 | 48.1 |
| Tinicum Island, Pennsylvania.. | (6) | 5.6-6 | 4.8-5.2 | 7.9-9 | 40.1 | 23.9 | 34.4-38.9 |
| Potomac River, District of Columbia..... | (1) | 6.6 | 5.3 | 9 | 50.7 | | 47.3 |
| Dallas, Texas..... | (1) | 4.4 | 3.1 | 9.2 | 53.3 | 32.7 | 42.6 |

⁷ This measurement is taken from the cephalic margin of the eye to the apex of the vertex.

⁸ Throughout the present paper this measurement is taken from the ventral apex of the basal plica to the apex of the ovipositor.

Song rather loud (louder than that of *N. melanorhinus* and *lyristes*, not as loud as *caudellianus* and not nearly as loud as *robustus*), "ziit-ziit-ziit-ziit"—a vibrant rattling note rising and falling in intensity, often ceasing as if from exhaustion. The number of consecutive times without pause that this sound was produced were on one occasion counted, 26-14-20-20-17; usually on a warm evening an undisturbed singer would average about as above before ceasing for a few seconds. The song is rapid, the sounds being emitted on warm evenings about 3 to the second. Weather conditions probably have some effect upon the song of the species, but elaborate and protracted field study would be necessary to determine the degree of such.⁹ When near a colony of this species on favorable evenings after dark the air is vibrant with the sound, as several singers cease others take up the constantly rising and falling song, but at no very great distance the sound is inaudible. The insects were found not to begin to sing until nearly sunset and before dark often ceased their song upon any attempt to approach the spot,¹⁰ after dark the singing was much more vigorous and the singers could then often be approached with a light and cautiously seized while singing and moving about in the bushy weeds and heavy grasses into which they climbed while stridulating. After the air is chilled toward midnight the singers become audibly fewer and their stridulations less intense. The species is found very local but often in large numbers in the heavier tangles of weeds, low bushy plants or heavy reeds in both fresh and salt water marshes. Females were found often in grasses near the singers; one was taken ovipositing in a grass blade at dusk.

The present species is known on the Atlantic coast from New Haven, Connecticut, to Raleigh, North Carolina. Elsewhere it is known from but single specimens taken at widely separated

⁹ Such differences have probably misled Allard, who describes the song of a single male of this species (as *bruneri*) from Thompson's Mills, Georgia, as being stronger and sharper than that of *exiliscanorus* heard at Washington, District of Columbia. Proc. Ent. Soc. Wash., XII, p. 122 (1910).

¹⁰ These observations are from experience at numerous localities on the New Jersey coast; on Tinicum Island, Pennsylvania, the large series was, however, taken with ease at dusk, on which occasion the males were singularly fearless even at that hour.

localities, Thompson's Mills, Georgia, New Harmony, Indiana, and Dallas, Texas.

Specimens Examined: Previously recorded, 3. Here recorded, 174; 141 males, 30 females and 3 immature females.

Woodhaven, Long Island, New York, VIII, 1912, (W. T. Davis), 7 ♂, 4 ♀, [Davis Cln.].

Utrecht, Brooklyn, New York, VIII, 8, 1908, (W. T. Davis), 3 ♂, [Davis Cln.].

Tysens Lane, New Dorp, Staten Island, New York, VIII, 19 to 28, 1911, (W. T. Davis), 3 ♂, [Davis Cln.].

Richmond, Staten Island, New York, VIII, 22, 1909, (W. T. Davis), 7 ♂, [Davis Cln.].

Runyon, New Jersey, X, 8, 1909, (W. T. Davis), 2 ♂, [Davis and U. S. N. M. Clns.].

Washington Park, New Jersey, VIII, 1, 1911, (H. Fox; border of bog), 1 ♂,¹¹ [A. N. S. P.].

Mullica River flats, Burlington County, New Jersey, VIII, 24, 1914, (H.; in high salt marsh grass, bushes and everywhere in exceptionally heavy cover), 2 ♂.

Pleasantville, New Jersey, VIII, 16 and 17, 1914, (H.; in heavy weeds and grasses along shore margin of salt marsh and 1 ♂ in heavy weeds on high ground west of town); 29 ♂, 10 ♀.

Mays Landing, New Jersey, VIII, 29, 1914, (H.; in low bushy weeds in marshy area), 2 ♂.

Tuckahoe, New Jersey, VIII, 26, 1914, (H.; in heavy marsh grasses, reeds and bushes in fresh water marsh), 2 ♂, 1 ♀.

Ocean City, New Jersey, VIII, 21, 1914, (H.; fresh water marshy area of heavy grasses on barrier beach), 1 ♂.

Swainton, New Jersey, VIII, 21, 1914, (H.; in fresh water marshy meadow among grasses, ferns and low bushes), 1 ♂.

Cape May Court House, New Jersey, VIII, 21, 1914, (H.; in heavy weeds and reedy tangles on shore margin of salt marsh), 6 ♂, 1 ♀.

Erma, New Jersey, VIII, 14, 1912, (W. T. Davis), 1 ♀, [Davis Cln.].

Cold Spring, New Jersey, VIII, 1910, (W. T. Davis), 1 ♂, [Davis Cln.].

Cape May Point, New Jersey, IX, 9, 1911, (H. Fox; shore margin of salt marsh), 1 ♀,¹¹ [A. N. S. P.].

Cornwells, Pennsylvania, IX, 7, 1914, (H.; heavy vegetation in bog), 1 ♂.

Philadelphia, Pennsylvania, VII, 25, 1911, (E. R. Casey), 1 ♀, [Casey Cln.].

Philadelphia Neck, Pennsylvania, IX, 29, 1913, (H.; in low plants in marshy spot), 1 ♂.

¹¹ These specimens have unfortunately been recently recorded as *Conocephalus nebrascensis* by Fox, Proc. Acad. Nat. Sci. Phila. 1914, p. 524 (1914).

Gibson Point, Elmwood, Pennsylvania, VII, 9 and 20, 1911, (H. Fox; cling-grass area in semi-marsh), 2 ♂, 1 ♀,¹¹ [A. N. S. P.].

Tinicum Island, Pennsylvania, VIII, 13, 1911, (R. & H.), 4 ♂; IX, 9, 1904, (H.), 1 ♀; IX, 29, 1913, (E. R. Casey, R. & H.; in bushy weeds in semi-marsh area), 59 ♂, 5 ♀.

Essington, Pennsylvania, VII, 27, 1911, (H. Fox), 1 juv. ♀, [A. N. S. P.].

Washington, District of Columbia, VI, 19, 1911, (W. T. Davis), 2 juv. ♀, [Davis Cln.]; VIII, 5, 1910, (O. Swezey; in restaurant at night), 1 ♀, [U. S. N. M.]; IX, 10 and 14, 1909, (A. N. Caudell; in marsh grasses and weeds), 3 ♂, [U. S. N. M.].

Roslyn, Virginia, VII, 28, 1900, (A. N. Caudell), 1 ♂, [U. S. N. M.].

Clarendon, Virginia, VIII, 1913, (H. A. Allard), 2 ♂, [U. S. N. M.].

Raleigh, North Carolina, VIII, 5, 1903, (Mrs. C. S. Brimley; in garden), 1 ♀,¹² [U. S. N. M.].

Thompson's Mills, Georgia, VII, 1909, (H. A. Allard; grasses and weeds in wet spot), 1 ♂,¹³ [U. S. N. M.].

Dallas, Texas, (Boll), 1 ♀, [M. C. Z.].

Neoconocephalus nebrascensis (Bruner) (Pl. XV, figs. 2B to 2E.)

1891. *Conocephalus nebrascensis* Bruner, Can. Ent., xxiii, p. 72. [Eastern Nebraska; Illinois; Iowa.]

The present insect, though nearest *N. exiliscanorus*, differs from that species very decidedly. In general form only, the species suggests small individuals of *N. robustus*. The vertex when compared with that of *N. ensiger* is found to be differently marked and projects upward more strongly, with distal half more tapering and basal tooth more prominent. The stridulating field of the male tegmen is large and broad, in general form and texture more similar to that of *robustus* than to that of *exiliscanorus*; the stridulating vein is of moderate length and strongly swollen, with accompanying veins weakly developed.

Bruner's measurements are not exact; we give below the measurements of the type¹⁴ and allotype:—length of vertex, lateral, 3.2 and 3.7; of vertex, ventral, 2.2 and 2.7; of pronotum, 8 and 7.5; of tegmen, 36.7 and 41.8; of caudal femur, 20.6 and 24.7; of ovipositor of allotype, 32.6 mm. The length of the ovipositor of the St. Louis female is 34.8 mm.

¹² Recorded as *Conocephalus bruneri* by Brimley, Ent. News, XIX, p. 20 (1908).

¹³ Recorded as *Conocephalus bruneri* by Allard, Proc. Ent. Soc. Wash., XII, p. 122 (1910).

¹⁴ Selected by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 125 (1912).

The armament of the limbs is rather similar to that of *exilis-canorus*; the ventral margins of the caudal femora are armed with short delicate spines, the extremes in the few specimens before us are, internal 7-12, external 4-6.

All of the material before us is of the green color phase.

McNeill states that the song of this species is continuous and that the insect begins singing earlier in the evening than does *ensiger*.

The species is known from Ohio and Sarnia, Ontario, west to Minnesota, extreme eastern Nebraska and northeastern Kansas, south to St. Louis, Missouri.

In addition to one specimen examined by us but previously correctly recorded, we here record the following 7 specimens; 5 males and 2 females, of which the typical material has been previously recorded as from "eastern Nebraska and Illinois."

West Point, Nebraska, VIII, 1887, (L. Bruner), 2 ♂, *type* [Hebard Cln.], *paratype* [M. C. Z.].

Omaha, Nebraska, IX, (L. Bruner), 1 ♀, *allotype* [Hebard Cln.].

Lincoln, Nebraska, IX, (L. Bruner), 1 ♂, *paratype* [Hebard Cln.].

Moline, Illinois, VIII, 26 and IX, 12, (McNeill), 2 ♂, *paratypes* [M. C. Z. and Hebard Cln.].

St. Louis, Missouri, IX, 15, 1876, 1 ♀, [U. S. N. M.].

Neoconocephalus melanorhinus (Rehn and Hebard) (Pl. XV, figs. 3B to 3E.)

1907. *Conocephalus melanorhinus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1907, p. 304, figs. 1, 2. [Cedar Keys, Florida.]

The present insect is more nearly related to *N. lyristes* than to any other known species, differing, however, in the much shorter vertex, decidedly less elongate form, proportionately shorter caudal femora, and notably in the female sex in the similarly rather wide but much shorter ovipositor which is very weakly curved downward. The stridulating field of the male tegmen is similar to that of *lyristes* but somewhat broader, with veinlets of this field slightly more pronounced.

This species is now known to be very abundant and widely distributed in the areas of *Spartina patens* on the tidal marshes of the New Jersey coast. The large series before us agrees perfectly with the type except in size, which is decidedly less in these northern examples. The type has the ventral surface of the

vertex black as far as, and not including, the basal tooth; the majority of the specimens before us have the entire ventral surface of the vertex black (this is true of all in the dark brown color phase), but in occasional specimens this coloration covers only the distal half, while a number are marked as in the type.

In both this species and *lyristes* the spines of the ventral margins of the caudal femora are delicate and rather long, distinctly longer than in *N. exiliscanorus*.

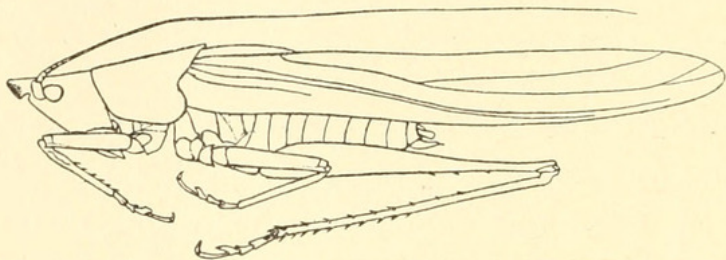


FIG. 3—*Neoconocephalus melanorhinus* (R. & H.). Cape May Court House, New Jersey. Male. (Natural size.)

There are no specimens in the large series before us having the ventro-cephalic margins of the cephalic and median femora armed. The caudal femora have the number of spines of the ventral margins decidedly fewer than in *lyristes*, the external margins are usually unarmed, sometimes supplied from one to several spines, in the material before us the extremes are, internal 3-8, external 0-3.

For measurements see page 379.

This species was found in large numbers on the salt marsh tidal flats of New Jersey in areas of *Spartina patens* growing near one foot in height, but it was also found there rather abundant in areas of low *Distichlis spicata*. When first met with in the summer of 1914, the males of a large colony were stridulating vigorously early on a somewhat cloudy afternoon; the song was a weak, high-pitched continuous buzzing, giving much the same vibrating resonance as a bit of rubber stretched in the wind. The note was very much weaker, richer in quality and less harsh than that of *N. robustus*. During daylight the singers invariably seemed further away than was the case, and time and again specimens were passed over until this fact was realized. At night the song is somewhat louder and very similar to that of *N. lyristes*, almost inappreciably higher pitched and more strident.

NEOCONOCEPHALUS MELANORHINUS (R. and H.)
Measurements (in millimeters) of extremes

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---------------------------------------|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Mullica River, New Jersey..... | (55) | 2.3-2.8 | 1.6-2.1 | 6.4-8.5 | 29.3-37.5 | 17.5-21.3 | |
| Cape May Court House, New Jersey..... | (71) | 2.6-2.8 | 1.8-2.1 | 6.9-8.1 | 25.4-35.4 | 17.4-20.3 | |
| Ocean City, Maryland..... | (1) ¹⁵ | | | 8.1 | 36.2 | 21.5 | |
| ♀ | | | | | | | |
| Mullica River, New Jersey..... | (1) | 2.8 | 1.8 | 6.2 | 34 | 18 | 16.3 |
| Cape May Court House, New Jersey..... | (15) | 2.9-3.1 | 1.9-2.1 | 6.7-7.2 | 34.7-39.3 | 19.3-21.2 | 17-18.3 |
| Ocean City, Maryland..... | (1) | 3.3 | 2.2 | 7.3 | 43 | 22 | 19.1 |
| Cedar Keys, Florida. Type..... | (1) | 3.7 | 2.7 | 8 | 47.5 | 27 | 22.8 |

¹⁵ This specimen has the vertex damaged.

When an individual was alarmed while singing the note ceased abruptly, the singer dropping or leaping down to the ground and remaining motionless there, perfectly concealed. One specimen was noticed to have fallen on its back, in which position it remained motionless several seconds, then turning over quickly it sought the nearest grass stem. The abundant green color phase of this insect blends perfectly with the broader green leaves of *Spartina patens*, while the brown individuals of pale to very dark shades blend as perfectly with the brown and yellowish bases of the same plant and the bare dark muck beneath.¹⁶ The insects were seen to fly but short distances. While singing, individuals were observed to be resting motionless on the grass or climbing nervously about.

The species is confined to the salt marsh; we have never found it even on the borders of the salt marsh near the mainland in areas of *Juncus* and high marsh grasses, one of the localities in which *lyristes* is often abundant.

The present species is known only from the type locality and Tuckerton, New Jersey, besides the localities listed below. In addition to the two specimens mentioned above we have examined the following series of 169 specimens; 149 males, 19 females and 1 immature female.

Mullica River flats, Burlington County and Atlantic County, New Jersey, VIII, 24, 1914, (H.; in low grasses of salt marsh flats), 55 ♂, 1 ♀.

Ocean City, New Jersey, VIII, 21, 1914, (H.; rare in *Spartina patens* on tidal flats), 1 ♂.

Ocean View, New Jersey, VII, 23 to VIII, 30, 1911, (H. Fox; in *Spartina* and *Iva frutescens*), 7 ♂, 1 ♀,¹⁷ [A. N. S. P.].

Van Gilder's Landing, New Jersey, VII, 13 and 24, 1910 and 1911, (H. Fox; in *Spartina*), 5 ♂,¹⁷ [A. N. S. P.].

Sea Isle Turnpike, New Jersey, VIII, 20, 1910, (H. Fox; salt marsh), 4 ♂,¹⁷ [A. N. S. P.].

Goshen Landing, New Jersey, VIII, 22, 1910, (H. Fox; in *Spartina*), 5 ♂, 1 ♀,¹⁷ [A. N. S. P.].

Cape May Court House, New Jersey, VIII, 14 and 21, 1914, (H.; in *Spartina patens* and *Distichlis spicata* on tidal marsh flats), 71 ♂, 15 ♀, 1 juv. ♀.

¹⁶ In the entire series of 171 specimens, 26 are dark brown, 16 pale brown while the remaining 129 are green.

¹⁷ Recorded by Fox as *Conocephalus lyristes*, Proc. Acad. Nat. Sci. Phila., 1914, p. 524 (1914).

Ocean City, Maryland, VII, 21, 1905, (E. Daecke), 1 ♂, 1 ♀,¹⁸ [Hebard and Daecke Clns.].

Neoconocephalus lyristes (Rehn and Hebard) (Pl. XV, figs. 4B and 4C.)

1905. *Conocephalus lyristes* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1905, p. 45, pl. I, figs. 8, 9. [Chokoloskee, Florida.¹⁹ (Unique male.)]

The present species is nearest to *N. melanorhinus*, under which species the two are compared. The stridulating field of the male tegmen is moderately large, rather narrow and elongate, in texture normal and similar to that of *N. robustus*; the stridulating vein is heavy and of medium length, with accompanying veins rather heavy only where they join this vein. The ovipositor of *lyristes* is rather wide, long, and distinctly curved downward.

Under *melanorhinus* are recorded the specimens previously misidentified as *lyristes* by Rehn and Fox. The present species has been misidentified as *N. nebrascensis* from Lakehurst, New Jersey, by Davis,²⁰ and again by Smith from that locality, Sea Isle City and Cold Spring, New Jersey.²¹ Fox has recently added to the confusion by quoting again the latter two records as *nebrascensis*, and adding to them under the same name several records which apply correctly to *N. exiliscanorus*.²²

The present insect is locally common in New Jersey in bogs, fresh water marshes and in the coastal salt water marshes in areas of *Scirpus* and high marsh plants near

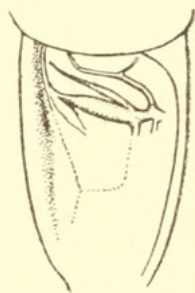


FIG. 4 A—*Neoconocephalus lyristes* (R. & H.). Chokoloskee, Florida (?). Type. Stridulating field of male tegmen. ($\times 3\frac{1}{2}$.)

¹⁸ Recorded by Rehn as *Conocephalus lyristes*, Ent. News, XVII, p. 366 (1909).

¹⁹ We are not certain that the type locality is authentic as the dealer from whom the specimen was purchased is now known by us to be unreliable.

²⁰ Can. Ent., XXXVII, p. 289 (1905).

²¹ Ins. of New Jersey, Orth., p. 189 (1910).

²² Proc. Acad. Nat. Sci. Phila., 1914, p. 524 (1914). It is unfortunate that Fox has included a portion of the Tettigoniidae (Locustidae of authors) in this paper; elsewhere it is correct, instructive and in the main complete, but in this family the confusion of species, misidentifications and lack of material, makes this portion of the work largely valueless.

the mainland, but never out on the tidal flats where *melanorhinus* is found.

The ventral surface of the long heavy vertex is almost always jet black, very rarely pale green individuals have the portion about the proximal tooth less darkened, and in one specimen before us the dark coloration extends only to the base of the tooth, leaving the tooth and brief proximal portion green.

The present species usually has the ventro-cephalic margins of the cephalic and median femora unarmed, occasionally bearing single spines; the ventral margins of the caudal femora are supplied with a number (though averaging somewhat fewer than in *exiliscanorus*) of irregularly spaced delicate spines which are similar to those of *melanorhinus* and longer than those of *exiliscanorus*, extremes in number here studied, internal 7-12, external 3-6.

For measurements see page 383.

This insect varies from very dark brown to a rich and brilliant green in general coloration, several specimens from Tuckahoe, New Jersey, were when fresh and still are absolutely intermediate between the two extremes, being a pale greenish-yellow in general coloration; every other gradation is to be found in the series before us.

On several occasions during the summer of 1914, the junior author was during the late afternoon in localities where this species was abundant, but at no time were males heard stridulating until after dark. Mr. Davis, however, writes that he has found the males stridulating on an afternoon during the summer of 1914 on Staten Island; we are of the opinion that at favorable times all of the species at present under consideration stridulate during the day time, but probably never as vigorously as they do on similar occasions at night. This insect's song is a weak and high-pitched continuous buzzing, very much like that of *N. retusus*, but, though weak, distinctly stronger than in that species. In this way during night collecting at Tuckahoe, New Jersey, where both species were plentiful and stridulating constantly on all sides, it was usually possible to determine individuals of this species and of *retusus* before approaching closely. This song is compared with the very similar stridulation of *melanorhinus* under that species. Individuals were easily taken after dark by aid of

NEOCONOCEPHALUS LYRISTES (R. and H.)
Measurements (in millimeters) of extremes²³

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---------------------------------------|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Tuckahoe, New Jersey..... | (41) | 3.7-4.3 | 2.8-3.3 | 7.6-8.8 | 35.9-42.1 | 19.9-23.2 | |
| Cape May Court House, New Jersey..... | (7) | 3.7-4.5 | 2.7-3.6 | 7.7-8.4 | 35.7-42.4 | 20.3-24.8 | |
| ♀ | | | | | | | |
| Tuckahoe, New Jersey..... | (1) | 5.1 | 3.9 | 8 | 52.1 | 26.7 | 30.7 |
| Cape May Court House, New Jersey..... | (5) | 4.3-5.1 | 3.3-4 | 7.2-8.1 | 44.1-51.7 | 23-25.6 | 23.3-29 |

²³ For further measurements see Rehn, Ent. News, XVII, p. 367 (1906). As we have remarked, the material from Maryland there measured represents *melanorhinus* and not the present species.

a flash-lamp, the males while stridulating, and both sexes while feeding on the seeds of *Scirpus* and tall marsh grasses.

The species is known from Long Island, New York, to the extremity of southern New Jersey; nowhere has it been found more than a few miles from the sea coast. As we have stated, the type locality for the species is extremely questionable, the type having been taken very possibly in the vicinity of New York City and incorrectly labelled.

Specimens Examined: Previously recorded, 10. Here recorded, 84; 59 males, 22 females, 2 immature males and 1 immature female.

Long Island, New York, IX, 1 ♀, [Morse Cln.].

White's Bog, New Jersey, IX, 28 to X, 12, 1914, (H. K. Plank), 1 ♂, 1 ♀, [U. S. N. M.].

Mullica River flats, Burlington County, New Jersey, VIII, 24, 1914, (H.; in *Scirpus* on border of marsh), 1 ♀.

Pleasantville, New Jersey, VIII, 17, 1914, (H.; ♀ on edge of salt marsh in high reeds, ♂ stridulating in low oak in pine barrens two miles west of town), 1 ♂, 2 ♀.

Ocean City, New Jersey, VIII, 21, 1914, (H.; small colony in heavier grasses on salt marsh near mainland, few in fresh water marshy areas on barrier beach), 6 ♂, 2 ♀.

Tuckahoe, New Jersey, VIII, 26, 1914, (H.; common and widely distributed through cat-tails and high grass in fresh water marsh), 41 ♂, 1 ♀.

Cedar Springs, New Jersey, VIII, 26, 1914, (H.; in high grass, *Panicum virgatum*, on border of fresh water marsh), 1 ♂, 3 ♀.

Ocean View, New Jersey, VIII, 29 and 30, 1910 and 1912, (H. Fox), 2 ♀, [A. N. S. P.].

Swainton, New Jersey, VIII, 21, 1914, (H.; in marshy meadow of grass, ferns and reeds), 1 ♂.

Cape May Court House, New Jersey, VIII, 14, 1914, (H.; border of salt marsh), 1 ♀ juv.; VIII, 21, 1914, (H.; occasional in bordering *Scirpus* area of salt marsh), 7 ♂, 5 ♀, 2 ♂ juv.

Erma, New Jersey, VIII, 18, 1912, (W. T. Davis), 1 ♂, 2 ♀, [Davis Cln.].

Cold Spring, New Jersey, VIII, 1910, (W. T. Davis), 1 ♀, [Davis Cln.]; IX, 4, 1907, (B. Long), 1 ♀,²⁴ [A. N. S. P.].

***Neoconocephalus ensiger* (Harris) (Pl. XV, figs. 5B to 5E.)**

1841. *Conocephalus ensiger* Harris, Rept. Ins. Mass. Inj. Veget., p. 131. [Massachusetts.]

²⁴ Recorded as *Conocephalus nebrascensis* by Smith, Ins. of New Jersey, Orth, p. 189 (1910).

1872. *Conocephalus attenuatus* Scudder, Final Rept. U. S. Geol. Surv. Nebr., p. 249. [Banks of Platte River, Nebraska.]

Comparison of series of New England and Nebraskan material and study of the original descriptions of *ensiger* and *attenuatus* show that the latter name is an absolute synonym of the former. All of the references for *attenuatus* in the literature belong under the present species.

The peculiar markings of the vertex in this distinctive species are found in the large series before us to be extremely constant, varying but little in intensity. The stridulating field of the male

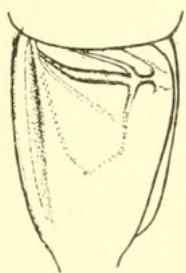


FIG. 5 A—*Neoconocephalus ensiger* (Harris). Saunders-town, Rhode Island. Stridulating field of male tegmen. ($\times 3\frac{1}{2}$.)

tegmen is of similar proportions to that of *N. exiliscanorus* but relatively decidedly smaller, in texture normal; the stridulating vein is very long and rather weakly swollen, with accompanying veins weakly defined. The length of the ovipositor in material from the Atlantic coast ranges from 27.3 to 33.3 mm., in that from Nebraska from 29.3 to 37.1 mm.

The ventral margins of the femora are usually unarmed; the ventro-cephalic margins of the cephalic and median femora are very rarely found to bear single spines, while of the ventral margins of the caudal femora the internal is more frequently found to bear a few small spines.

The green color form is usually strongly predominant, only occasional brown individuals being encountered.

At night the incessant song of this species was everywhere heard at Saunderstown, Rhode Island, excepting in the marsh areas. It is well described by Allard as, "tzip-tzip-tzip-tzip-tzip, rapidly repeated for indefinite periods." The note is not loud, in volume more similar to that of *N. retusus* than to that of *N. exiliscanorus*.

The present species is known from Norway, Maine, southward to the vicinity of Philadelphia, Pennsylvania, while in the southeastern United States the species is known from the Appalachians in North Carolina and Tennessee. Westward its distribution extends across southern Ontario as far northwest as the Red

River of the North, Minnesota, the westernmost records being Bismarck, North Dakota; Colorado, and the Rio Grande River in (probably northern) New Mexico. Little is known of the southern limits of the species' range, south of the latitude of Wichita, Kansas, it is probably distributed only at relatively high elevations.

Specimens Examined: In addition to a large series previously recorded, we here record 74 specimens; 49 males, 23 females and 2 immature females.

Rye Beach, New Hampshire, IX, 2, 1913, (H.; near salt marsh in high grasses), 1 ♂.

Seabrook, New Hampshire, (A. A. Eaton), 1 ♂, [U. S. N. M.].

Nantucket, Massachusetts, VIII, 29, 1911, (H. Fox), 1 ♂, [A. N. S. P.].

Saunderstown, Rhode Island, IX, 3 to 9, 1913, (H.; common in open overgrown with bayberry bushes and interspersed with high grasses), 11 ♂, 2 ♀.

Wesquage Beach, Rhode Island, IX, 10, 1913, (H.; in grasses on beach dunes), 1 ♂.

Ithaca, New York, VIII, 6 and 8, 1890, (A. P. Morse), 1 ♂, 1 ♀, [Morse Cln.].

Oxford, New York, (S. S. Hale), 1 ♀, [U. S. N. M.].

Honesdale, Pennsylvania, VII, 22, 1 ♀, [Pa. St. Dept. Zool.].

Philadelphia, Pennsylvania, (Westcott), 2 ♂, [Hebard Cln.]; 1910, (E. R. Casey), 1 ♂, [Casey Cln.].

Devon, Pennsylvania, IX, 13, 1905, 1 ♂, [A. N. S. P.].

Blairsville, Pennsylvania, VIII, 27, 1 ♂, [Pa. St. Dept. Zool.].

Beatty, Pennsylvania, (Brugger), 3 ♂, 1 ♀, 1 juv. ♀, [A. N. S. P.].

Beaver, Pennsylvania, VIII, 1, 1 ♂, [Pa. St. Dept. Zool.].

Roan Mountain Station, Tennessee, IX, 3, 1903, (A. P. Morse), 1 ♂, [Morse Cln.].

Roan Mountain, Tennessee, VIII, 31, 1903, (A. P. Morse), 1 ♂, [Morse Cln.].

Grand Rapids, Michigan, VIII, 27, 1899, 1 ♂, [Hebard Cln.].

West Spring Green, Wisconsin, VIII, 21, 1906, 1 ♂, [Pa. St. Dept. Zool.].

Watertown, Illinois, VIII, 9, (McNeill), 1 ♂, 1 ♀, [M. C. Z.].

Dallas County, Iowa, VIII, (Allen), 1 ♂, [Hebard Cln.].

Bismarck, North Dakota, VIII, 9, 1885, (L. Bruner), 1 ♂, [Hebard Cln.].

Glen, Nebraska, VIII, 6 to 20, 1903, (L. Bruner), 1 ♀, [Hebard Cln.].

Valentine, Nebraska, 1 ♀, [U. S. N. M.].

West Point, Nebraska, VII to IX, 1884 to 1887, 3 ♂, 5 ♀, [Hebard Cln.].

Lincoln, Nebraska, VIII to IX, 3, (L. Bruner; majority attracted to light), 4 ♂, 7 ♀.

North Platte, Nebraska, 2800 ft., VII, 28, 1910, (R. & H.; in river-bottom grass land), 3 ♂.

Kearney, Nebraska, 2146 ft., VII, 27, 1910, (R. & H.; in river-bottom grass land), 5 ♂, 2 ♀, 1 juv. ♀.

Haigler, Nebraska, VIII, 5, 1904, 1 ♂, [Hebard Cln.].

Julesburg, Colorado, 3460 ft., VII, 29, 1910, (R. & H.; in river-bottom grass land), 1 ♂.

Neoconocephalus robustus robustus (Scudder) (Pl. XV, figs. 6B to 6E, 7B and 7C.)

1813. [*Gryllus* (*Tettigonia*)] *acuminata* Stoll (not *Gryllus acuminatus* Linnaeus, 1758), *Natuur. Afbeeld. Besch.* der Spook., Zabelspr., p. 18, pl. 8a, figs. 27, 28. [Pennsylvania.]

1862. *Conocephalus robustus* Scudder, *Bost. Journ. Nat. Hist.*, vii, p. 449. [Cape Cod, Massachusetts.]

Stoll's name *acuminata*, based unquestionably upon material of this species, is preoccupied; the name which has been in general use, *robustus* of Scudder, in consequence fortunately stands. Other species have never been recorded as this insect, but all southern and western records of *robustus* are properly referred to *robustus crepitans*.

A considerable amount of variation in size and shape of the vertex is to be found in the present race; this is also true of the southern and western race *robustus crepitans*, but in the latter normally larger and more robust insect, the vertex is always broader and more truncate at the apex. In the northeastern race, *robustus robustus*, the vertex is always immaculate. The stridulating field of the male tegmen is very large and rather broad, more ample than in *N. nebrascensis*, in texture normal; the stridulating vein is heavy, though not quite as heavy as in *nebrascensis*, and moderately long, with accompanying veins weakly developed.

Types.—An unspecified series of both sexes from one locality.

Single Type here Designated: ♂; Cape Cod, Massachusetts. (Samuel H. Scudder; by the sea-beach.) [Museum of Comparative Zoology.]

The ventro-cephalic margins of the cephalic and median femora are either smooth or bear single or a few small spines; the ventral margins of the caudal femora bear usually a few small spines, in the series before us the extremes in number being internal 5–12, external 0–5.

For measurements see page 388.

The green color phase is greatly predominant, brown individuals are rarely found.

NEOCONOCEPHALUS ROBUSTUS ROBUSTUS (Seudder)
Measurements (in millimeters) of extremes

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Cape Cod, Massachusetts. <i>Type</i> Penzance, Massachusetts..... Wesquage Beach, Rhode Island Chatsworth, New Jersey..... Ventnor, New Jersey..... | (1) | 2.8 | 1.9 | 8.3 | 40.7 | 23 | |
| | (2) | 2.7-2.8 | 1.8-1.9 | 8.8-9.1 | 41.2-43.1 | 23.9-24 | |
| | (8) | 2.8-3.3 | 1.8-2.3 | 8.1-9.2 | 40.8-44.6 | 22.7-24.2 | |
| | (4) | 2.8-3 | 1.8-2 | 8.5-8.9 | 41.6-44.6 | 23.3-24.2 | |
| | (89) | 2.7-3.6 | 1.9-2.4 | 7.9-9.9 | 40.2-48.6 | 22.6-28.4 | |
| ♀ Wesquage Beach, Rhode Island Staten Island, New York..... East Plains, New Jersey..... Ventnor, New Jersey..... | (1) | 3.3 | 2.2 | 7.7 | 49.6 | 26.4 | 26.7 |
| | (1) | 3.4 | 2.3 | 8.2 | 52.8 | 28.1 | 30.4 |
| | (4) | 3.1-3.2 | 2.2-2.3 | 7.3-7.9 | 42.5-47 | 24-26.3 | 25-26 |
| | (21) | 3.4-3.7 | 2.2-2.6 | 7.8-8.3 | 48.3-54.7 | 26.2-28.3 | 27.6-31.6 |

The song of this insect is a very loud and continuous buzzing which is very penetrating and usually audible to a distance of at least 600 feet. This song is given loudly and persistently after dark, rarely lone individuals will be heard singing lustily even on clear days as early as four o'clock. During the day males sometimes at long intervals give a short hesitating and irregularly harsh note which would not be readily associated with their song. Study of material in the field and in captivity as well, was necessary to determine the author of this sound, which could often be heard on summer days in the sand grass areas of the New Jersey barrier beaches. This day song, or what might well be termed sleep-song, is in reality a brief and drowsy impulse giving just sufficient energy to the act of stridulation to demonstrate the sound produced when the vibrations are not at full speed, the irregularity of the sound resulting from the same cause. A species of the genus carefully studied in Jamaica was found to have an even more distinctive note during the day, but due apparently to the identical cause. Other species of the genus will doubtless be found to have similar habits and this, combined with the established fact that in certain species of Orthoptera the speed of the normal stridulation varies with the atmospheric warmth, must be remembered in studying the song of various species in different places if confusion is to be avoided. In the sand grass areas of the New Jersey barrier beaches the sound produced at night by myriads of this insect is often astoundingly loud. While stridulating the males frequently rest head downward, occasionally moving nervously about without ceasing their song.

The area of intergradation between typical *robustus* and *robustus crepitans* is very unusually narrow. Large collections of the insect made on the Atlantic coast show that the intergradation takes place in the vicinity of Ocean View, New Jersey, and on the Delaware River in the vicinity of Philadelphia, Pennsylvania. On the fall line occasional specimens of such intermediate material is before us from as far south as Washington, District of Columbia. In the large series from elsewhere in the range of *robustus robustus*, the vertex, though showing some variation, is never as blunt as in material from the range of *robustus crepitans*. There appears to be little or no geographic variation in the range of the present race, though such variation is marked in the very extensive distribution of *robustus crepitans*.

Davis has noted an apparent difference in the song of the two forms which have been long considered distinct species; those from Erma, New Jersey (*crepitans*), appeared to sing less loudly than those from Chatsworth, New Jersey (*robustus*), heard on consecutive evenings. We have noted climatic conditions to have a decided effect on the song of the species under consideration and this may be the explanation of the above, or *robustus crepitans* from the northeastern portion of its distribution may sing less loudly than *robustus robustus*, but in the west, in the center of its typical distribution, we have heard it singing with the full burring, buzzing whirr which is characteristic of, and fully as loud as, the song of typical *robustus*.

The present geographic race is known from Cape Cod, Massachusetts, to Philadelphia, Pennsylvania and Ocean View, New Jersey, in which latitude the intergradation with *robustus crepitans* is found. The species has not yet been taken over sixty miles from the coast.

In addition to a number of specimens examined but previously recorded we here record the following series of 159 specimens, 120 males, 32 females, 1 immature male and 6 immature females, and of racial intermediates, 63 specimens, 58 males, 4 females and 1 immature male.

Penzance, Massachusetts, VIII, 20 and 21, 1911, (H. Fox), 2 ♂, [A. N. S. P.].

Saunderstown, Rhode Island, IX, 7, 1913, (H.; stridulating after dark on trunk of haw), 1 ♂.

Wesquage Beach, Rhode Island, IX, 8 and 9, 1913, (H.; widely scattered and plentiful over extensive open grassy areas along coast), 15 ♂, 1 ♀.

Woodhaven, Long Island, New York, VIII, 1912, (W. T. Davis), 1 ♀ [Davis Cln.].

Coney Island, New York, (W. T. Davis), 1 ♂, [Hebard Cln.].

Staten Island, New York, VIII, 4, 1906, (W. T. Davis; in salt meadow), 1 ♀, [Davis Cln.].

Atsion, New Jersey, VII, 30, 1911, (R. & H.), 1 ♂, 1 ♀.

East Plains, New Jersey, VIII, 24, 1914, (H.; in glade of tall grass out on plains), 4 ♀.

Stafford's Forge, Ocean County, New Jersey, VIII, 24, 1914, (R.; in huckleberry and sweet fern undergrowth of pine barrens), 1 ♀.

Spray Beach, Long Beach Island, New Jersey, IX, 24, 1907, (B. Long), 1 ♀, [A. N. S. P.].

Mullica River flats, Atlantic County, New Jersey, VIII, 24, 1914, (H.; high grasses on edge of marsh), 1 ♂.

Reega, New Jersey, VII, 31 to VIII, 29, 1914, (H.; rare in grasses of fields in pine barrens), 3 ♂, 1 ♀.

Pleasantville, New Jersey, VIII, 17, 1914, (H.; fields), 4 ♂.

Ventnor, New Jersey, VII, 31 to VIII, 23, 1914, (H.; in great numbers in sand grass areas), 89 ♂, 21 ♀, 1 juv. ♂, 5 juv. ♀.

Margate City, New Jersey, VII, 24, 1914, (H.; grasses on edge of salt marsh), 1 juv. ♀.

Sea Isle Junction, New Jersey, IX, 5, 1908, (H. Fox; in shrubby fields), 3 ♂, [A. N. S. P.].

Intermediate material between *N. robustus robustus* and *N. robustus crepitans*.

Ocean View, New Jersey, VII, 30 to VIII, 29, 1908 to 1912, (H. Fox; lowlands near salt marsh, in bunch grass, in house), 9 ♂, 1 ♀, [A. N. S. P.].

Van Gilder's Landing, New Jersey, VII, 29, 1911, (H. Fox; grassy upland), 11 ♂, [A. N. S. P.].

Sea Isle City, New Jersey, 3 ♂, [A. N. S. P. and Hebard Cln.].

Swainton, New Jersey, VIII, 8, 1914, (H.; in grassy field stridulating in bright sunshine), 1 ♂, 1 juv. ♂.

Anglesea, New Jersey, VIII, 8, 1901, (H. L. Viereck), 1 ♂, 1 ♀, [A. N. S. P.].

Manumuskin, New Jersey, VIII, 14, 1912, (H. Fox), 2 ♂, [A. N. S. P.].

North Cramer Hill, Camden County, New Jersey, X, 1910, (Connor), 1 ♀, [A. N. S. P.].

Washington Park, New Jersey, VIII, 1 and 8, 1911, (H. Fox; uplands), 14 ♂, 1 ♀, [A. N. S. P.].

Philadelphia Neck, Pennsylvania, IX, 25, 4 ♂, [A. N. S. P.]; IX, 29, 1913, (H.; very scarce in tall dry weeds), 3 ♂.

Gibson Point, Pennsylvania, VIII, 2 to 11, 1912, (H. Fox; tall grass and weeds), 5 ♂, [A. N. S. P.].

Essington, Pennsylvania, VII, 27, 1911, (H. Fox; upland grasses), 5 ♂, [A. N. S. P.].

Neoconocephalus robustus crepitans (Scudder) (Pl. XVI, figs. 8B to 8G.)

1862. *C[onocephalus] crepitans* Scudder, Bost. Journ. Nat. Hist., vii, p. 450. [Texas; Nebraska.]

The sudden intergradation between this widely distributed race and typical *robustus* is discussed under that insect. In the south and middle west the race attains proportions distinctly greater and more robust than are ever found in typical *robustus*, and in the northernmost portions of the insect's range the smallest individuals are found. Though showing some variation, the vertex is, in the present race, distinctly broader and more truncate at the apex and in western material is occasionally there very

briefly and narrowly darkened ventrad.²⁵ The stridulating field of the male tegmen is similar to that of *robustus robustus*, in very large individuals of proportionately greater size. In other respects we find the two races inseparable.

Types.—Two females from Texas and Nebraska.

Single Type here Designated: ♀; Texas. (Alexander Agassiz.) [Museum of Comparative Zoology.]

The armament of the limbs is generally similar to that of typical *robustus*; the ventral margins of the caudal femora bear likewise usually a few small spines, in the series before us the extremes being, internal 1–12, external 0–7.

For measurements see page 393.

The green color phase is predominant.

The present geographic race is distributed from extreme southern New Jersey, over the entire coastal plain of the southeastern United States, as far south as Hastings, Florida, but on the Piedmont plateau is only known from Georgia. Westward it is widely distributed over the entire Mississippi Valley region, the limits of distribution being La Porte County, Indiana; White Bear Lake, Minnesota; Garden City, Kansas, and Clarendon and Cisco, Texas. It is apparently not found in southeastern Texas, and we have no records from Louisiana where much field work remains to be done; Nugent, Mississippi, is as yet the only record for that state.

In addition to a series of 14 specimens examined by us but previously recorded we have had before us 93 specimens; 45 males, 38 females, 5 immature males and 5 immature females.

Cold Spring, New Jersey, VIII, 1910, (W. T. Davis), 2 ♂, [Davis Cln.].²⁶

Cape May, New Jersey, VIII, 11, 1903, (H. L. Viereck), 1 ♂; IX, 9, 1911, (H. Fox, dune grass areas), 1 ♀, [all A. N. S. P.].

Newcastle, Delaware, VIII, 6, 1911, (H. Fox), 1 ♂, [A. N. S. P.].

Chesapeake Beach, Maryland, VIII, 2, 1912, (Wm. Palmer), 1 ♂, [U. S. N. M.].

²⁵ Bruner separated his Nebraskan material with weakly marked vertex from that with unmarked vertex, including a supposed but not really constant difference in the width of the same, naming one *crepitans* and the other *robustus*. This is unwarranted, all of this material belonging under *robustus crepitans*.

²⁶ In addition to this southern New Jersey material, Mr. Davis has kindly sent us the series of 21 males and 1 female from Erma, New Jersey, which he has recorded as *crepitans*, and which does belong to this race showing no variation whatever toward *robustus robustus*.

NEOCONOCEPHALUS ROBUSTUS CREPITANS (Scudder)
*Measurements (in millimeters) of extremes*²⁷

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|----------------------------------|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Erma, New Jersey..... | (21) | 2.7-3 | 1.7-2 | 8.2-9 | 39.2-44.2 | 22.8-26.6 | |
| Virginia Beach, Virginia..... | (1) | 3 | 2 | 9.9 | 46.7 | 28.9 | |
| Atlanta, Georgia..... | (1) | 3.3 | 2.1 | 10.1 | 50.1 | 31.1 | |
| Tybee Island, Georgia..... | (1) | 3.6 | 2.7 | 10.8 | 53.8 | 31 | |
| Clarendon, Texas..... | (1) | 3.2 | 2.1 | 10 | 50.2 | 29.8 | |
| Lincoln, Nebraska..... | (4) | 2.8-3 | 1.8-1.9 | 9.6-9.7 | 48-49.2 | 25.6-28.2 | |
| Lake Maxinkuckee, Indiana..... | (1) | 2.7 | 1.8 | 8 | 38 | 20.1 | |
| ♀ | | | | | | | |
| Erma, New Jersey..... | (1) | 3 | 1.9 | 8.3 | 49.8 | 29.7 | 36.9 |
| Wrightsville, North Carolina.... | (1) | | | | | | |
| Albany, Georgia..... | (2) | 3.2-3.8 | 2.1-2.5 | 8.3-9.3 | 49.4-55.3 | 29.3-32 | 27-33.5 |
| Warchard, Florida..... | (1) | 3.7 | 2.5 | 9 | 57.8 | 35.1 | 34.2 |
| Texas. <i>Type</i> | (1) | 3.3 | 2.3 | 9.2 | 58.4 | 33.8 | 34.4 |
| Cisco, Texas..... | (1) | 3.3 | 2.2 | 8.8 | 57.7 | 28.8 | 34.7 |
| Lincoln, Nebraska..... | (6) | 3.2-3.3 | 2.1-2.2 | 8.9-9.1 | 57.7-58.2 | 29.7-30.9 | 32-32.7 |

²⁷ These length measurements, when compared with those of typical *robustus*, would lead one to suppose that the two races are closer than is the reality, for typical *robustus crepitans* is distinctly heavier in every respect, with broader pronotum and wings and heavy blunt vertex.

Somerset Heights, Maryland, IX, 24, 1905, (E. S. G. Titus), 1 ♀, [U. S. N. M.].

Plummer's Island, Maryland, VIII, 27, 1913, (W. L. McAtee), 2 ♂, [U. S. N. M.].

Washington, District of Columbia, VII, 29 to X, 2, 1883 to 1910, (Pergrande; Caudell, 1 ♂ at light), 6 ♂, 3 ♀, [U. S. N. M. and Hebard Cln.].

Herndon, Virginia, VIII, 1911, (W. T. Davis), 1 ♂, [Davis Cln.].

Clarendon, Virginia, VIII, 1913, (H. A. Allard), 2 ♂, [U. S. N. M.].

Ocean View, Virginia, VIII, 9, 1904, (Caudell), 1 ♀, [U. S. N. M.].

Virginia Beach, Virginia, VII, 20 and X, 6, (latter F. Knab), 1 ♂, 1 ♀, [U. S. N. M. and Davis Cln.].

Tarboro, North Carolina, VII, 6, 1903, (A. P. Morse), 1 juv. ♀, [Morse Cln.].

Raleigh, North Carolina, VII, 9, 1903, (A. P. Morse), 1 juv. ♂, [Morse Cln.].

Salisbury, North Carolina, VII, 11, 1903, (A. P. Morse), 1 juv. ♂, [Morse Cln.].

Southern Pines, North Carolina, IX, 20 and X, 30, 1912, 2 ♀, [Davis Cln.].

Wrightsville, North Carolina, IX, 7, 1911, (R. & H.; high grass on edge of dry ground near swamp), 2 ♂, 1 ♀.

Columbia, South Carolina, VII, 28, 1913, (R. & H.), 1 juv. ♂.

Denmark, South Carolina, VIII, 15, 1913, (A. P. Morse), 1 juv. ♀, [Morse Cln.].

Atlanta, Georgia, VIII, 1 ♂, [Ga. St. Cln.].

Augusta, Georgia, VII, 29, 1913, (R. & H.), 1 juv. ♂.

Tybee Island, Georgia, VIII, 12 and 13, 1903, (A. P. Morse), 1 ♂, 2 ♀, 1 juv. ♂, 1 juv. ♀, [Morse Cln.]; IX, 2, 1911, (H.; in high grass on edge of salt marsh), 2 ♂.

Albany, Georgia, VIII, 1, 1913, (R. & H.; somewhat swampy undergrowth in pine woods), 2 ♀.

Atlantic Beach, Florida, VIII, 24, 1911, (R. & H.; in tangle of vines in "hammock"), 1 ♀.

Hastings, Florida, (A. J. Brown), 1 ♀, [Morse Cln.].

Fort Barrancas, Florida, VIII, 3, 1903, (A. P. Morse), 1 ♀, [Morse Cln.].

Nugent, Mississippi, VII, 20, 1905, (A. P. Morse), 1 ♀, 1 juv. ♀, [Morse Cln.].

Lake Maxinkuckee, Indiana, IX, 1906, (B. W. Evermann), 1 ♂, [U. S. N. M.], dried alcoholic.

St. Louis, Missouri, VIII, 15 to IX, 25, 1909, (C. L. Heink; 1 at light), 2 ♂, 3 ♀, [Hebard Cln.]; IX, 14 and 26, 1876 and 1889, (S. S. Case; E. J. Longueman), 2 ♀, [U. S. N. M.].

Kirkwood, Missouri, IX, 20, 1877, 1 ♂, [U. S. N. M.].

West Point, Nebraska, IX, 1887, (L. Bruner), 2 ♂, [Hebard Cln.].

Lincoln, Nebraska, VIII to IX, (L. Bruner; several at light at night), 4 ♂, 6 ♀, [Hebard Cln.].

Emporia, Kansas, IX, 13, 1909, (H.; many about arc light after shower at dark), 1 ♂.

Dodge City, Kansas, IX, 13, 1909, (H.; grass prairie), 1 ♂.

Wilburton, Oklahoma, VIII, 27, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].

Shawnee, Oklahoma, VIII, 26, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Caddo, Oklahoma, VIII, 9, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Summit of Mt. Sheridan, Wichita Mountains, Oklahoma, \pm 2600 ft., VIII, 24, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Cache, Oklahoma, VIII, 23, 1905, (A. P. Morse), 1 ♂, 1 ♀, [Morse Cln.].

Dallas, Texas, IX, 8, 1904, 1 ♀; XII, 17, 1908, (E. S. Tucker; at light), 1 ♀, 1 ♂, [all U. S. N. M.].

Wichita Falls, Texas, VIII, 15, 1905, (A. P. Morse), 2 ♂, 2 ♀, 1 juv. ♀, [Morse Cln.].

Cisco, Texas, IX, 21 and 22, 1912, (R. & H.; high grasses in meadow), 1 ♀.

Clarendon, Texas, VIII, 11 and 18, 1905, (C. R. Jones and A. P. Morse), 3 ♂, 2 ♀, [Morse Cln. and U. S. N. M.].

Neoconocephalus caudellianus (Davis) (Pl. XVI, figs. 9B and 9C.)

1905. *Conocephalus caudellianus* Davis, Can. Ent., xxxvii, p. 289. [Lakehurst, New Jersey.]

The present insect closely resembles *N. robustus robustus*, but the vertex is very decidedly shorter with sides usually very weakly convergent distad and apex rotundato-truncate, more so than in typical *robustus crepitans*, and with ventral surface rather heavily outlined in black, this marking showing but little variation in the series before us. The stridulating field of the male tegmen is very similar to that of *robustus robustus* but very slightly more elongate; the stridulating vein is somewhat more decidedly swollen in proximal two-thirds with accompanying veins distinctly heavier where they join this vein.

The green color phase appears to greatly outnumber the brown, and in such individuals the green is distinctly richer than in *robustus*. With species showing such close relationship, it is surprising to find *caudellianus* differing greatly in both habits and song.

The females here listed from Yemassee, South Carolina, are the first of this sex to be recorded.

They differ from females of *robustus* in the characters mentioned above and also have the pronotum proportionately slightly shorter.

Types.—Described from three males from a single locality.

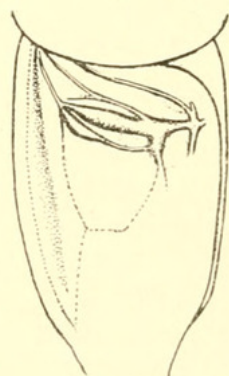


FIG. 9 A—*Neoconocephalus caudellianus* (Davis). Tuckerton, New Jersey. Stridulating field of male tegmen. ($\times 3\frac{1}{2}$.)

Single Type here Designated: ♂; Lakehurst, New Jersey. September 1903. (Wm. T. Davis.) [Davis Collection.]

The armament of the limbs is generally similar to that of *robustus*; the ventral margins of the caudal femora likewise bear a few small spines, in the series before us the extremes in number being, internal 8-13, external 0-8.

For measurements see page 397.

Of the twenty specimens now before us, but three males are of the brown color phase.

The present insect is not only the least plentiful of the species of the genus found in New Jersey, but is also much the most wary and difficult to capture. It is very widely distributed not only along the coastal strip in truck gardens, waste fields and marshy fresh water areas, but also in boggy portions of the adjacent pine barrens and in fields there located. The insect was to be heard at intervals everywhere during two evening's collecting between Cape May Court House, and Port Republic, New Jersey, but at no locality were more than three or four widely scattered individuals to be heard at one time. In the pine barrens it was much less often heard, but in one boggy area near Mays Landing, New Jersey, numerous widely scattered individuals were encountered. The song of this species is loud, resonant and constant, dzeeeet-dzeeeet-dzeeeet, always the same, not rising and falling, the notes given deliberately, counted as averaging 12 to 10 seconds. The males would continue their loud song fearlessly until approached to within about eight feet, then ceasing abruptly they would almost at once fly into the darkness with a swift powerful zigzagging flight. In alert swiftness this species and *N. velox* are distinctive.

The present species is known only from the type locality, Jamesburg and Tuckerton, New Jersey, in addition to these given below.

Specimens Examined: Previously recorded 6. Here recorded 19, 17 males, 2 females.

Atsion, New Jersey, VIII, 30, 1911, (R. & H.), 1 ♂.

Port Republic, New Jersey, VIII, 24, 1914, (H.; in waste field in pine barrens), 1 ♂.

Mays Landing, New Jersey, VIII, 26 and 29, 1914, (H.; in boggy pine barrens), 6 ♂.

Pleasantville, New Jersey, VIII, 16, 1914, (H.; in truck garden stridulating after dark on corn stalk five feet from ground), 1 ♂.

NEOCONOCEPHALUS CAUDELLIANUS (Davis)
Measurements (in millimeters)

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|-------------------------------|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Mays Landing, New Jersey..... | (6) | 2.4-2.8 | 1.7-2 | 8-8.9 | 42-45.6 | 23.6-26.6 | |
| Billys Island, Georgia..... | (2) | 3-3 | 2-2.1 | 8.7-8.8 | 45.8-47.9 | 28.3-28.9 | |
| ♀ | | | | | | | |
| Yemassee, South Carolina..... | (2) | 3.1-3.2 | 2.1-2.2 | 8-8.1 | 54.5-54.7 | 31.3-31.9 | 35.1-35.7 |

NEOCONOCEPHALUS PALUSTRIS (Blatchley)
Measurements (in millimeters) of extremes

| ♂ | Number of specimens | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|------------------------------|---------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|----------------------|
| Cornwells, Pennsylvania..... | (11) | 2.3-2.8 | 1.3-1.8 | 6.3-7.8 | 28.6-32.2 | 15.2-18.7 | |
| Tuckahoe, New Jersey..... | (19) | 2.8-3 | 1.8-2 | 7.1-8.1 | 28.3-34.2 | 17.8-18.8 | |
| Raleigh, North Carolina..... | (1) | 2.6 | 1.6 | 7 | 31.4 | 19.4 | |
| ♀ | | | | | | | |
| Cornwells, Pennsylvania..... | (49) | 2.6-3.2 | 1.6-2.1 | 5.6-7 | 28.1-35.9 | 15.9-21.8 | 15.4-20.4 |
| Tuckahoe, New Jersey.... | (7) | 3.4-3.8 | 2.2-2.7 | 7.3-8.7 | 35-41.9 | 20.2-24.6 | 18.2-21.7 |
| Raleigh, North Carolina..... | (2) | 3.2 | 2.2 | 8.3 | 45.3 | 27.3 | 21.6 |
| New Orleans, Louisiana..... | (1) | 4 | 2.6 | 8.6 | 43.4 | 26.7 | 22 |

Swainton, New Jersey, VIII, 21, 1914, (H.; in fresh water marshy meadow choked with ferns, grasses and rushes), 3 ♂.

Cold Spring, New Jersey, VIII, 1910, (W. T. Davis), 2 ♂, [A. N. S. P.].

Yemassee, South Carolina, IX, 4, 1911, (R. & H.; in swampy undergrowth of low short-leaf pine woods), 2 ♀.

Billy's Island, Okeefenokee Swamp, Georgia, VII and IX, 1 to 5, 1912 and 1913, (J. C. Bradley), 2 ♂, [Cornell Univ.].

Atmore, Alabama, VI, 21, 1897, (A. P. Morse), 1 ♂, [Morse Cln.].

Neoconocephalus velox Rehn and Hebard (Pl. XVI, figs. 11B and 11C.)

1914. *Neoconocephalus velox* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1914, p. 402. [Homestead, Florida.] (Unique male.)

The present insect shows nearest relationship to *N. palustris*, but differs decidedly in the considerably larger size and much more elongate form; vertex which tapers more gradually and evenly to the somewhat more broadly rounded apex; tegmina which are decidedly longer but even proportionately decidedly broader, with stridulating field of male more evenly coriaceous and stridulating vein alone prominent and broader; caudal femora with proximal portion less contrastingly swollen and areas adjacent to teeth of ventral margins not darkened.

The stridulating field of the male tegmen is proportionately small and broad, of the same size and form approximately as in small northern males of *N. melanorhinus*; the stridulating vein is heavy and of medium length with accompanying veins very weakly defined; veinlets of this field very weak.

Measurements (in millimeters)

| ♂ | Lateral length of vertex | Ventral length of vertex | Length of pronotum | Length of tegmen | Length of caudal femur |
|---------------------------------|--------------------------|--------------------------|--------------------|------------------|------------------------|
| Billy's Island, Georgia.... | 2.6 | 1.7 | 8.7 | 41.5 | 24 |
| Homestead, Florida. <i>Type</i> | 3 | 1.9 | 9 | 42 | 25.2 |

One of the caudal limbs of the specimen here recorded is aborted, no longer than the median limb, with only the median pair of the distal tibial spurs present. The ventral margins of the caudal femora are armed with small spines, internal 6-7, external 6-8 in number.

Both specimens before us are rather pale tawny olive in general coloration.

The song of this very shy and vigorous species is a loud and continuous buzzing. The species is known from but two specimens, though others were observed at Homestead, Florida; it is apparently a native of the undergrowth of the pine forests of the extreme southeastern United States.

Specimens Examined: Previously recorded 1. Here recorded, 1; 1 male.

Billy's Island, Okeefenokee Swamp, Georgia, VI, 1912, (J. C. Bradley), 1 ♂, [A. N. S. P.].

Neoconocephalus palustris (Blatchley) (Pl. XVI, figs. 10B to 10E.)

1893. *Conocephalus palustris* Blatchley, Can. Ent., xxv, p. 89. [Vigo County, Indiana.] (Unique female.)

The present species is one of the most distinctive of the genus known from North America, showing nearer relationship to the peculiar *N. velox* than to any other species. The size of the males is small and the form slender; the females average distinctly larger and more robust, with abdomen unusually enlarged and ovipositor short and broad, distinctly broadest meso-distad. The insect has a generally more coriaceous appearance than the other species here considered, and the ventral margins of the caudal femora are distinctly darkened beneath each of the spines a distance equal to the length of the spine. The present species, unlike the others here treated, has the external of the ventral margins of the caudal femora bearing on an average more (but smaller as in the other species) spines than the internal.

The stridulating field of male tegmina is small and broad; the proximal three-fourths of stridulating vein is very heavy, the distal fourth is very weak, no heavier than weakly defined accompanying veins; the veinlets of this area are exceedingly weak.

The ventro-cephalic margins of the cephalic and median femora are armed with 0-3 small stout spines, normally 1-2; the ventral margins of the caudal femora are in the series before us armed normally with 7-8 small, short and only moderately slender spines which have their apices darkened, extremes—internal 3-9, external 5-8 in number.

For measurements see page 397.

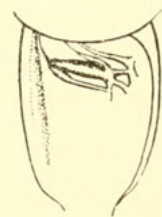


FIG. 10 A
Neoconocephalus palustris
(Blatchley).
Raleigh.
North Carolina. Stridulating field of male tegmen. ($\times 3\frac{1}{2}$.)

In the female sex the green color form is strongly predominant, but in the series of males before us brown individuals are somewhat the more numerous. In the brown phase the variation is decided, extreme individuals are; of pale general coloration, naples yellow; of dark general coloration, mummy brown.

The males of the present species were found to be at night very alert and shy, in New Jersey much the most difficult of the species to take excepting *N. caudellianus*. The method of escape is, however, to hide with agility in the tangles of vegetation in which the species is usually found, not to seek safety in flight. The song is a continuous dzěěěěěěěěěě, very high pitched (higher than that of *N. lyristes* or *N. retusus*) and very weak (as weak as that of *retusus*).

The series taken at Cornwells, Pennsylvania, was captured during the day by beating the tangled vegetation and particularly a small area of *Panicularia septentrionalis* in a marshy spot. In the latter plant the females were exceedingly numerous, nearly all being taken there. These specimens showed that in the day-time individuals are sluggish, moving but slowly about, but the clinging powers were found to be remarkable and the use of the spines on the limbs for this purpose was quickly apparent.

Probably owing to the very local distribution of the species, it is known from a number of widely separated localities; on the Atlantic coast from New Brunswick, New Jersey, south to Raleigh, North Carolina and westward from Vigo County, Indiana, south to New Orleans, Louisiana.

Specimens Examined: Previously recorded 1. Here recorded, 112; 36 males, 65 females and 11 immature females.

Cornwells, Bucks County, Pennsylvania, IX, 7, 1914, (H.; in marshy area), 11 ♂, 49 ♀, 6 juv. ♀.

Philadelphia Neck, Pennsylvania, IX, 21, 1904, (H. W. Wenzel), 1 ♀, [A. N. S. P.].

Gibson Point, Pennsylvania, VIII, 9, 1911, (H. Fox), 1 ♂, 4 juv. ♀; IX, 17, 1911, (H. Fox), 1 ♀, 1 juv. ♀, [A. N. S. P.].

Tinicum Island, Pennsylvania, IX, 29, 1913, (R.; in tall marsh vegetation), 1 ♀.

Reega, New Jersey, VIII, 16, 1914, (H.; stridulating at night on low oak in pine barrens), 1 ♂.

Tuckahoe, New Jersey, VIII, 26, 1914, (H.; in cat-tails and grasses in wet spots in fresh marsh). 19 ♂, 7 ♀.

Plummer's Island, Maryland, VIII, 27, 1909, (H. A. Allard), 1 ♂, 1 ♀; X, 1908, (Wm. Palmer), 1 ♂, [all U. S. N. M.].

Washington, District of Columbia, VIII to IX, 17, 1907, (H. A. Allard), 2 ♂, 2 ♀, [U. S. N. M.].

Raleigh, North Carolina, VIII, 22, 1906 and IX, 18, 1905, 2 ♀, [U. S. N. M.].

New Orleans, Louisiana, XI, 14, 1882, (Shufeldt), 1 ♀, [U. S. N. M.].

Neoconocephalus retusus (Scudder) (Pl. XVI, figs. 12B to 12I.)

1879. *Conocephalus retusus* Scudder, Proc. Bost. Soc. Nat. Hist., xx, p. 93. [Georgia.] (Unique female.)

Conocephalus dissimilis of American authors (except Harris).

Conocephalus triops of numerous recent American authors.

1899. *Conocephalus atlanticus* Bruner, Ent. News, x, p. 38. [Philadelphia Neck, Pennsylvania; New Jersey; Maryland; Virginia.]

It is surprising that recent American authors have generally considered this species *dissimilis* or *triops*, which names apply to the very different species which is last studied in the present paper.²⁸ The confusion surrounding the proper name for this species, doubtless, was at least partially the cause of Bruner's considering material before him undescribed, and erecting the synonymic *atlanticus*. We have his type series before us, the only material of the present species which he had, and, excepting a gradual but pronounced increase in size southward accompanied by a general proportionate elongation of the members, this smaller material is inseparable from Scudder's larger type of *retusus* from Georgia. Countless species of Orthoptera vary geographically in similar fashion, and we are convinced that such size variation without other difference is insufficient to constitute a geographic race; when other differences do occur geographically, or where certain organs are diminished while others increase in size, these characters being constant over certain areas of distribution (as in *Nemobius fasciatus* and *N. fasciatus socius*),²⁹ it is equally certain that geographic races do exist.

²⁸ This may in part have occurred through the various records of *retusus*, *atlanticus*, *triops*, *dissimilis* and *gladiator* in the New Jersey lists, which all apply to the present species. This really amazing confusion was due to the fact that J. B. Smith himself compiled these lists from a list compiled by the present senior author, adding other records from past literature and determinations of various other individuals, republishing the final results without consulting any authority on the subject.

²⁹ See Hebard, Proc. Acad. Nat. Sci. Phila., 1913, p. 422 (1913).

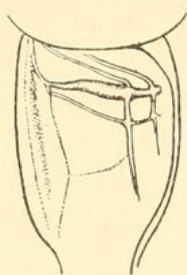


FIG. 12 A—*Neoconocephalus retusus* (Scudder). Chestnut Hill, Pennsylvania. Stridulating field of male tegmen. ($3\frac{1}{2}$.)

This species and *N. triops* are distinctive in the form of the vertex when compared with other North American species. From that insect, *retusus* is easily distinguished by the much smaller size, more attenuate form and proportionately very much longer ovipositor.

The stridulating field of the male tegmen is small and rather broad; the stridulating vein is of moderate length and rather weakly swollen, with accompanying veins not decided but well defined throughout their length; the veinlets of this area are weakly defined.

A minor difference is apparent in the male cercus of the present species, the longer (ventral) of the distal arms being distinctly compressed dorsad along the caudal margin.

Measurements (in millimeters)

| ♀ | Number of specimens | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---------------------------------------|---------------------|--------------------|------------------|------------------------|----------------------|
| Philadelphia Neck, Pennsylvania..... | (6) | 6.5-7.3 | 29.8-40.7 | 20.8-23.7 | 31.4-37 |
| Tinicum Island, Pennsylvania..... | (19) | 5.3-7.1 | 23.5-32 | 16.9-23 | 27.7-34.3 |
| Plummer's Island, Maryland. | (1) | 5.3 | 25.9 | 17.8 | 23.9 |
| Washington, District of Columbia..... | (4) | 6.9-7.1 | 32-36.4 | 22.8-24.4 | 33.3-36 |
| Falls Church, Virginia..... | (3) | 6.4-6.6 | 30.6-36.8 | 22-22.7 | 31.9-33.2 |
| Asheville, North Carolina .. | (1) | 6.8 | 33.5 | 21.8 | 32.5 |
| Fayetteville, North Carolina | (4) | 6-6.7 | 30.5-30.7 | 22-23.2 | 35.2-37 |
| Florence, South Carolina. ... | (2) | 6.9-7 | 33.7-37.4 | 24.2-25.1 | 36.5-37.4 |
| Georgia. Type..... | (1) | 6.9 | 37.7 | 28.1 | 31.3 |
| Albany, Georgia..... | (1) | 7.7 | 40.6 | 27.2 | 39.2 |
| Thomasville, Georgia..... | (1) | 7.8 | 42.7 | 27.4 | 39.7 |
| Bainbridge, Georgia..... | (2) | 7.1-7.8 | 36-41.1 | 24.4-28.9 | 36-38.2 |
| St. Augustine, Florida..... | (2) | 7.3-8 | 35.1-37.9 | 27.7-29.1 | 35-36.7 |
| St. Louis, Missouri | (1) | 7 | 35.8 | 22.7 | 33.9 |

The type measures in length of vertex, lateral 2.1, ventral 1.2; the males before us give the following extremes of these dimensions, lateral 1.8-2.2, ventral, 1.-1.4 mm. We have not given a table of measurements for the male sex, for, though averaging

slightly smaller, the male proportions are quite similar to those of the female.

The ventral margins of the cephalic and median femora are almost always unarmed, bearing rarely a single very small spine; the ventral margins of the caudal femora are armed with very small spines with the adjacent areas of the femora sometimes very weakly darkened; in the series before us the number of spines is: internal 2-8, external 2-5.

The green color phase is usually decidedly more numerous than the brown.

The present insect is an inhabitant of the grasses in waste fields, along the borders of marshes and in the drier portions of the marshes proper, and is usually to be found in large numbers. The song is of the exact pitch of that of *N. lyristes* but weaker (as in *N. palustris*), a continuous zēēēēēēēēē. In New Jersey the species is the last of the genus to appear, reaching the adult condition toward the end of August.

The present species is known from Westville, Connecticut, southward to Daytona, Florida (the authors' Chokoloskee, Florida, record of this species is based on material the labelling of which we have subsequently found cause to question, and the record is therefore discredited). Westward in the Mississippi Valley region it is known from as far as Nugent, Mississippi, and northward to St. Louis, Missouri, and Morristown, Tennessee.

Specimens Examined: In addition to a large series previously recorded, we here record 184 specimens; 110 males, 58 females, 6 immature males and 10 immature females.

Yonkers, New York, X, 20, 1914, (H. A. Allard), 4 ♂, [U. S. N. M.].

Rockville Center, Long Island, New York, IX, 5, 1904, (B. H. Walden), 1 ♂, [Morse Cln.].

Staten Island, New York, IX, 19, (W. T. Davis), 1 ♂, [Hebard Cln.].

Middlesex County, New Jersey, X, 5, 1 ♂, [Hebard Cln.].

Riverton, New Jersey, IX, 8, 1901, (H. L. Viereck), 1 ♂, [A. N. S. P.].

Mullica River flats, Burlington County, New Jersey, VIII, 24, 1914, (H.; border of salt marsh), 1 juv. ♂.

Mays Landing, New Jersey, VIII, 29, 1914, (H.; in low herbage of marshy area), 1 ♂.

Reega, New Jersey, VIII, 29, 1914, (H.; occasional in undergrowth of pine barrens), 1 ♂, 1 juv. ♀.

Pleasantville, New Jersey, VIII, 17, 1914, (H.; grasses on edge of salt marsh), 1 juv. ♀.

Ventnor, New Jersey, VIII, 26, 1914, (H.; marshy depression in sand area), 1 ♀, 1 juv. ♂, 1 juv. ♀.

Margate City, New Jersey, VIII, 17, 1914, (H.; grasses on edge of marsh), 1 juv. ♂, 1 juv. ♀.

Tuckahoe, New Jersey, VIII, 26, 1914, (H.; very common in fresh water marsh grasses), 22 ♂, 8 ♀.

Cedar Springs, New Jersey, VIII, 26, 1914, (H.; adults occasional, immature examples numerous in areas of high grass near marsh), 6 ♂, 3 ♀, 1 juv. ♂, 1 juv. ♀.

Petersburg, New Jersey, VIII, 31, 1910, (H. Fox; in boggy field), 1 ♂, 1 ♀, [A. N. S. P.].

Cornwells, Pennsylvania, IX, 7, 1914, (H.; in marsh vegetation), 3 ♂, 3 ♀.

Roslyn, Pennsylvania, X, 18, 1914, (B. Long), 1 ♂, [A. N. S. P.].

Bluebell, Pennsylvania, X, 23, 1914, (H.; few stridulating in field on clear but chilly afternoon), 1 ♂.

Ardsley, Pennsylvania, VIII, 26, 1906, (B. Long), 3 ♂, [A. N. S. P.].

Elkins Park, Pennsylvania, IX, 6, 1912, (B. Long; under electric light), 1 ♀, [A. N. S. P.].

Chestnut Hill, Pennsylvania, IX, 6 to 19, 1903 to 1914, (H.; grassy uplands), 11 ♂, 1 ♀.

Philadelphia Neck, Pennsylvania, IX, 29, 1913, (H.; grassy lowlands), 2 ♂.

Gibson Point, Pennsylvania, IX, 17, 1911, (H. Fox), 1 ♀, [A. N. S. P.].

Tinicum Island, Pennsylvania, IX, 9 to 29, 1903 to 1913, (R. & H.; grasses near marsh), 19 ♂, 19 ♀.

Laurel, Maryland, (E. S. G. Titus), 1 ♂, [U. S. N. M.].

Plummer's Island, Maryland, IX, 2 to 29, 1904 to 1907, (Caudell, W. L. McAtee), 3 ♂, 1 ♀, [U. S. N. M.].

Washington, District of Columbia, X, 29, 1883, (L. Bruner), 1 ♂, [Hebard Cln.]; VIII, 24 to IX, 20, 1904 to 1906, (Caudell), 5 ♂, 4 ♀, [U. S. N. M.].

Analostan Island, District of Columbia, IX, 6, 1912, (Caudell), 1 ♂, [U. S. N. M.].

Rossllyn, Virginia, IX, 9, 1906, (F. Knab), 1 ♂, [U. S. N. M.].

Falls Church, Virginia, IX, 4, 1906, (Caudell), 1 ♂, 3 ♀, [U. S. N. M.].

Roanoke, Virginia, IX, 6, 1903, (A. P. Morse), 1 ♂, [Morse Cln.].

Fayetteville, North Carolina, IX, 9, 1911, (R. & H.), 2 ♂, 4 ♀, 1 juv. ♀.

Wrightsville, North Carolina, IX, 7, 1911, (R. & H.), 2 ♂.

Winter Park, North Carolina, IX, 7, 1911, (R. & H.), 1 juv. ♂.

Florence, South Carolina, IX, 6, 1911, (R. & H.), 3 ♂, 2 ♀, 3 juv. ♀.

Atlanta, Georgia, VIII, 27, 1 ♂, [Ga. St. Cln.].

Albany, Georgia, VIII, 1, 1913, (R. & H.), 1 juv. ♂; IX, 1, 1910, (J. C. Bradley), 1 ♀, [Ga. St. Cln.].

Bainbridge, Georgia, IX, 3 to 7, 1913, (J. C. Bradley), 6 ♂, 2 ♀, [Ga. St. Cln.].

Fargo, Georgia, VIII, 31, 1913, (J. C. Bradley), 1 juv. ♀, [Cornell Univ.].

South Jacksonville, Florida, IX, 28, 1913, (W. T. Davis), 1 ♂, [Davis Cln.].

Daytona, Florida, XI, 11, 1911, (G. P. Englehardt), 1 ♀, [Bklyn. Inst. A. & S.].

St. Louis, Missouri, IX, 5, 1876, 1 ♀, [U. S. N. M.].

Morristown, Tennessee, VIII, 27, 1903, (A. P. Morse), 1 ♂, [Morse Cln.].

Chehawhaw Mountain, Alabama, 2400 ft., VII, 13, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Nugent, Mississippi, VII, 20, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].

Neoconocephalus triops (Linnaeus) (Pl. XVI. figs. 13B to 13E.)

1758. [*Gryllus* (*Tettigonia*)] *triops* Linnaeus, Syst. Nat., Ed. X, i, p. 430. ["Indiis," probably the West Indies.]

1838. *C[onocephalus] obtusus* Burmeister, Handb. Ent., ii, Abth. ii, pt. i, p. 705. [Unknown locality.]

1839. *Conocephalus dissimilis* Serville, Hist. Nat. Ins., Orth., p. 518. [North America; Latreille's collection, very possibly from Louisiana.]

1859. *Conocephalus mexicanus* Saussure, Rev. et Mag. Zool., 2e Ser., xi, p. 208. [Mexico.]

1862. *Conocephalus dissimilis* Harris, Ins. Inj. Veg., Flint Ed., p. 164. [South Carolina.]

1874. *Conocephalus triops* Stål, Recens. Orth., ii, p. 110.

1878. *Conocephalus hebes* Scudder, Proc. Bost. Soc. Nat. Hist., xx, p. 92. (In part.) [New Orleans, Louisiana.]

1891. *Conocephalus fusco-striatus* Redtenbacher, Verh. zool.-bot. Ges. Wien, xli, p. 399. [Georgia; Missouri; Carolina; Texas; Mexico; Cuba; Hayti; Quita; Antilles.]

1907. *Neoconocephalus mexicanus* var. *tibialis* Karny, Abh. k. k. zool.-bot. Ges. Wien, iv, p. 33. [North Carolina.]

(Recent authors in America have generally considered the green form *mexicanus* and the brown form *fusco-striatus*.)

The synonymy of *triops*, *obtus* and *dissimilis* has long been established. The descriptions originally given under each of these names are wholly uncertain, but Stål, in 1874, having examined the type of *triops* and studied Harris' adequate description of 1862 of *dissimilis* of Serville, stated these two to be the same. Serville's species in unquestionably that which we have been calling *mexicanus* (green color phase), and *fusco-striatus* (brown color phase), as all other recent American authors have done, but, unlike the majority of these, we have not applied the name *triops* to the form properly designated as *retusus*. It is not surprising that Saussure, in 1859, described *mexicanus*, thereby erecting another

synonym for *triops*, for at that time the descriptions then extant of the species were all very inadequate; but the inclusion of material of the present species in the series of *hebes* described by Scudder, in 1878, can only be attributed to carelessness, and Redtenbacher's evident naming of the brown color phase, in 1891, as *fusco-striatus* should have been avoidable to one whose knowledge of the genus was so extensive. Karny's variety *tibialis* is even less deserving of name recognition, based solely on dark examples of the brown color phase.

In recording material from the United States, the names *niëtoi* and *obs curellus* have been used, the former a number of times and the latter once;³⁰ the majority of these records we know apply to the present insect and we feel certain that the others do likewise, these species (of which Saussure's type of *Conocephalus niëti* is apparently a member of the genus *Homorocoryphus*) being found south of the region at present under consideration.

The present insect is easily recognized, and as it is the only large and robust species of the genus having a very short broad vertex which is found in the region under consideration.

The stridulating field of the male tegmen is of medium size and rather broad; the stridulating vein is heavy and rather long, with accompanying veins heavy where they join this vein, which, at its distal extremity, has two very small but conspicuous pits, one on each side; the veinlets of this area are exceedingly numerous and extremely weakly defined.

The male cerci of the present species are slightly different from those of the other forms here considered, having a more or less decided knoblike production at the base of the distal arms.

The ovipositor is distinctly compressed beyond the enlarged basal portion; distad the shaft has a distinct but very weak downward curvature.

The moderate amount of size variation which occurs in this species has no geographic significance, as is shown by the large series before us.

³⁰ It is this record of Saussure and Pictet, Biol. Cent. Amer., Orth., I, p. 392 (1898), which unfortunately causes the name *obs curellus* to appear in Scudder's Catalogue of the Described Orthoptera of the United States and Canada. See foot note No. 35.

Measurements (in millimeters)

| ♀ | Lateral length of vertex | Ventral length of vertex | Width of vertex beyond eye | Length of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|----------------------------|--------------------------|--------------------------|----------------------------|--------------------|------------------|------------------------|----------------------|
| Atlanta, Georgia | 2.1 | 1.6 | 1.9 | 9.1 | 48.4 | 26.1 | 24.6 |
| Thomasville, Georgia | 2.3 | 1.7 | 1.9 | 9 | 48.7 | 25.9 | 25.3 |
| Bainbridge, Georgia..... | 2.3 | 1.8 | 2 | 9 | 50.8 | 26.6 | 26 |
| Homestead, Florida..... | 2.3 | 1.7 | 1.9 | 7.7 | 42.5 | 23.1 | 23.8 |
| Hot Springs, Arkansas..... | 2.4 | 1.9 | 2 | 9.2 | 49.9 | 25.8 | 26.1 |
| Hot Springs, Arkansas..... | 2.3 | 1.7 | 1.9 | 8.3 | 47.8 | 25.4 | 25.6 |
| Tiger Mills, Texas..... | 2.8 | 2 | 2.1 | 9.7 | 53.2 | 28.2 | 27.1 |
| Beaumont, Texas..... | 2.3 | 1.7 | 1.8 | 8.1 | 43.3 | 24.4 | 20.9 |
| Gregory, Texas..... | 2.3 | 1.8 | 1.8 | 8.1 | 43.4 | 22.9 | 22.3 |
| Brownsville, Texas..... | 2.4 | 1.7 | 2 | 9.2 | 51.7 | 27.7 | 25.1 |
| Yuma, Arizona..... | 2.6 | 1.6 | 1.9 | 8.2 | 45.7 | 24.9 | 23.8 |

We have not given a table of measurements for the male sex, for, though averaging slightly smaller, the male proportions are quite similar to those of the female.

The cephalic and median femora are unarmed or supplied with very small, moderately heavy spines on the cephalic margins, in the series before us the range being 0-3; the caudal femora have the ventral margins armed with very small spines (smallest on the external margins), the extremes in the series before us are, internal 6-11, external 6-10 in number. Occasionally in individuals of both green and brown color phases the areas beneath each of these very small spines are darkened, but seldom as noticeably as in *N. palustris*.

In the brown color phase variation exists with degree of intensity of general coloration. Very pale examples often have the femora and tibiae of the general coloration (such material having been recorded occasionally as *obscurus*), darker specimens have the ventral margins of the femora very dark (these appearing in the literature frequently as *fusco-striatus*) while the extreme intensity of coloration found in the darkest specimens have such markings still more decided, the tibiae correspondingly infuscated, the jaws more yellow, and the lateral stripes of the pronotum more distinct, (unfortunately described by Karny as var. *tibialis*). The types of *triops*, *obtusum*, *dissimilis* and *mexicanum* are of the green color phase; the latter name has been

generally used to designate green individuals of the present species by recent American authors.

The green color phase is somewhat more frequently encountered than the brown.

The present species is found almost everywhere in the southern United States; it inhabits the forest undergrowth, fields and semi-marsh situations. Over much of its range it is one of the earliest Tettigonids to appear, adults being found in south Georgia in late March. The few midsummer records, accompanied by numerous early winter captures and the finding of specimens in midwinter apparently hibernating, suggest that the species may be double brooded, or that appearing adult very late in the fall it is one of the few species of the family in that latitude to pass the winter in the adult condition. The song is a very loud, sharp, z-z-z-z-z-z-z-z-z-z-z-z, indefinitely prolonged; when closely approached a constantly recurring impulse gives an audible krzzzzkrzzzzkrzzzz with no break, though a recurrent clicking is to be heard, as described by us recently.³¹ It was heard frequently at twilight in the spring of 1904 at Thomasville, Georgia, the song of brown males being at that time of day not as intense as that of green males previously captured at night; this leading the junior author to think that the supposed *fusco-striatus* was a less loud singer than the supposed *mexicanus*.³² Such mistakes are likely to occur in field observations unless extreme care is exercised.³³

The species is widely and generally distributed from Washington, District of Columbia, southward over the entire southeastern United States and thence westward to central Texas, the westernmost record in this region being Carrizo Springs, Texas, and the northernmost definite record Stillwater, Oklahoma. In the Pacific drainage of the southwest, the species is known on the Mexican border from Benson, Arizona, to San Diego and Los Angeles, California.

Specimens Examined: Previously recorded as *mexicanus* and *fusco-striatus*, 36. Here recorded, 109; 43 males, 59 females, 1 immature male and 6 immature females.

³¹ Proc. Acad. Nat. Sci. Phila., 1914, p. 402 (1914).

³² Proc. Acad. Nat. Sci. Phila., 1904, p. 795 (1905).

³³ See foot note No. 9.

Town Bank, Cape May County, New Jersey, X, 24, 1909, (H. W. Fowler; dead on strand, very possibly washed ashore in drift), 1 ♀,³⁴ [A. N. S. P.].

Washington, District of Columbia, II, 1914, (B. A. McKinney; in market), 1 ♀; IX, 10, 1908, (E. L. Walter), 1 ♂; X, 2, 1910, (A. N. Caudell; at light), 1 ♂, [all U. S. N. M.].

Hampton, Virginia, II, 4, 1892, 1 ♀, [U. S. N. M.].

Virginia Beach, Virginia, 1907, (Hopkins), 1 ♂, 1 ♀, [U. S. N. M.].

Fayetteville, North Carolina, IX, 9, 1911, (R. & H.), 1 juv. ♂.

Florence, South Carolina, IX, 6, 1911, (R. & H.), 1 juv. ♀.

Yemassee, South Carolina, IX, 4, 1911, (R. & H.), 1 juv. ♀.

Atlanta, Georgia, VIII, 30, 1913, (J. C. Bradley), 1 ♀, [Ga. St. Cln.].

Jesup, Georgia, IX, 1, 1911, (R. & H.; bull rushes in sink in pine forest), 1 ♀.

St. Simon's Island, Georgia, VIII, 30, 1911, (R.), 1 ♂; IX, 22, 1910, (J. C. Bradley), 1 ♂, [Ga. St. Cln.].

Cumberland Island, Georgia, VIII, 31, 1911, (H.; in beach plants), 1 juv. ♀.

Billy's Island, Okeefenokee Swamp, Georgia, VI, 1912, (J. C. Bradley), 3 ♀, [Cornell Univ.].

Thomasville, Georgia, III, 1906, (H.; undergrowth in long-leaf pine woods), 2 ♂.

Bainbridge, Georgia, IX, 17 to X, 19, 1910, (J. C. Bradley), 2 ♀, [Ga. St. Cln.].

Jacksonville, Florida, IX, 28, 1913, (W. T. Davis), 1 ♂, [Davis Cln.].

Daytona, Florida, XI, 11, 1911, (G. P. Englehardt), 3 ♂, [Bklyn. Inst. A. & S.].

Hastings, Florida, IV to IX, 1900 and 1901, (A. J. Brown), 1 ♂, 4 ♀, [Morse Cln.].

Brooksville, Florida, VIII, 5, 1913, (E. R. Sassor), 1 ♂, [U. S. N. M.].

Miami, Florida, III, 5, 1905, (H. G. Dyar), 1 ♂,³⁵ [U. S. N. M.].

Key Largo, Florida, III, 1898, (G. N. Collins), 1 ♀, [U. S. N. M.].

Agricultural College, Mississippi, 1892, (C. M. Weed), 1 ♂, [Hebard Cln.].

Hattiesburg, Mississippi, VII, 17, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

³⁴ This specimen may very possibly have been washed ashore in drift; this record and also that of a specimen found in the winter in a bunch of spinach at West Newton, Massachusetts and in the Morse Collection, we do not advise using in mapping the species' distribution, as one is very possibly and the other undoubtedly an accidental occurrence.

³⁵ Redtenbacher has, we feel certain, recorded specimens of *triops* as *Conocephalus niētoi* from Texas and Louisiana, Verh. k. k. zool.-bot. Ges. Wien, XLI, p. 405 (1891), which has unfortunately caused Scudder to include this name in his Catalogue of the described Orthoptera of the United States and Canada. Caudell has, as a result, recorded this specimen as *niētoi*, Ent. News, XVI, p. 219 (1905).

- Biloxi, Mississippi, (Alice Tracy), 1 ♀, [Hebard Cln.].
 Gulfport, Mississippi, VII, 21, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].
 Milneburg, Louisiana, VII, 22, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].
 New Orleans, Louisiana, (Shufeldt), 1 ♂, 1 ♀, [U. S. N. M.].
 Daleville, Arkansas, IX, 13, 1904, (C. R. Jones), 1 ♂, [U. S. N. M.].
 Hot Springs, Arkansas, IV, 23 to 26, 1906, (C. S. Hebard; in hotel at night), 4 ♀. [Hebard Cln.].
 Fort Towson, Red River, Arkansas, (L. A. Edwards), 1 ♀, [M. C. Z.].
 Paris, Texas, III, 14 to IX, 23, 1904, (F. C. Bishopp, A. A. Girault, W. D. Hooker; 1 ♀ at sugar), 2 ♂, 5 ♀, [U. S. N. M.].
 Denison, Texas, VIII, 11, 1905, (A. P. Morse), 1 juv. ♀, [Morse Cln.].
 Dallas, Texas, XI, 10, 1903, (at light), 1 ♂; XII, 17, 1908, (E. S. Tucker; at light), 1 ♀; 4 ♂, 1 ♀, [U. S. N. M. and Hebard Cln.].
 Tiger Mills, Texas, (F. G. Schaupp), 2 ♀, [Hebard Cln.].
 Shovel Mountain, Burnet County, Texas, XI, 16, 1901, (F. G. Schaupp), 1 ♂, [A. N. S. P.].
 Beaumont, Texas, VII, 23, 1912, (H.; swampy spots in pine woods), 1 ♂, 2 ♂, 1 juv. ♀; X, 11, 1904, (E. S. G. Titus), 1 ♂, 3 ♀, [U. S. N. M.].
 Virginia Point, Texas, VII, 21, 1912, (H.; near salt marsh), 1 ♀.
 Washington County, Texas, IV, 1886, 6 ♀, [Hebard Cln.].
 Rosenberg, Texas, VII, 25 and 26, 1912, (H.; in high grasses along streams), 2 ♂, 2 ♀.
 Victoria, Texas, VII, 26 and 27, 1912, (H.; scarce in grassy field), 1 ♂; XII, 27, 1910, (J. D. Mitchell; apparently hibernating in rotten log), 2 ♂, 1 ♀, [U. S. N. M.].
 Goliad, Texas, IX, (J. D. Mitchell), 1 ♀, [U. S. N. M.].
 Beeville, Texas, VII, 28, 1912, (H.), 1 ♀.
 Corpus Christi, Texas, II, 2, 1904, (A. A. Girault), 1 ♂, [U. S. N. M.]; VII, 29, 1912, (H.), 1 ♂.
 Gregory, Texas, VII, 30, 1912, (H.; very common in marshy area of high grass, males very noisy after dark), 5 ♂, 2 ♀.
 Lyford, Texas, VIII, 6 and 7, 1912, (R. & H.), 1 ♂.
 Brownsville, Texas, VII, 31 to VIII, 5, 1912, (H.), 1 ♀.
 Piper Plantation, Brownsville, Texas, VIII, 3, 1912, (H.; high green grasses in opening of jungle), 1 ♂.
 San Antonio, Texas, VIII, 15 and 16, 1912, (H.), 1 juv. ♀.
 Carrizo Springs, Texas, IX, 1884, (A. Wadgymar), 1 ♀, [Hebard Cln.].
 Benson, Arizona, X, 13, 1910, (R. & H.; high weeds in San Pedro River valley), 1 ♀.
 Yuma, Arizona, X, 1, 1910, (H.; night at light in town), 1 ♂, 1 ♀.
 Los Angeles, California, (Coquillett), 1 ♀, [Hebard Cln.].
 San Diego, California, (A. L. Babcock), 1 ♀, [Morse Cln.].

EXPLANATION OF PLATES

All the figures on these plates are six times the size of nature.

Plate XV

FIG. 1 B—*Neoconocephalus exiliscanorus* (Davis). Staten Island, New York. *Type*. Male. Lateral view of fastigium.

FIG. 1 C—*Neoconocephalus exiliscanorus* (Davis). Staten Island, New York. *Type*. Male. Ventral view of fastigium.

FIG. 1 D—*Neoconocephalus exiliscanorus* (Davis). Washington, District of Columbia. Female. Lateral view of fastigium.

FIG. 1 E—*Neoconocephalus exiliscanorus* (Davis). Washington, District of Columbia. Female. Ventral view of fastigium.

FIG. 2 B—*Neoconocephalus nebrascensis* (Bruner). West Point, Nebraska. *Type*. Male. Lateral view of fastigium.

FIG. 2 C—*Neoconocephalus nebrascensis* (Bruner). West Point, Nebraska. *Type*. Male. Ventral view of fastigium.

FIG. 2 D—*Neoconocephalus nebrascensis* (Bruner). Omaha, Nebraska. *Allotype*. Female. Lateral view of fastigium.

FIG. 2 E—*Neoconocephalus nebrascensis* (Bruner). Omaha, Nebraska. *Allotype*. Female. Ventral view of fastigium.

FIG. 3 B—*Neoconocephalus melanorhinus* (R. & H.). Cape May Court House, New Jersey. Male. Lateral view of fastigium.

FIG. 3 C—*Neoconocephalus melanorhinus* (R. & H.). Cape May Court House, New Jersey. Male. Ventral view of fastigium.

FIG. 3 D—*Neoconocephalus melanorhinus* (R. & H.). Cedar Keys, Florida. *Type*. Female. Lateral view of fastigium.

FIG. 3 E—*Neoconocephalus melanorhinus* (R. & H.). Cedar Keys, Florida. *Type*. Female. Ventral view of fastigium.

FIG. 4 B—*Neoconocephalus lyristes* (R. & H.). Chokoloskee, Florida (?). *Type*. Male. Lateral view of fastigium.

FIG. 4 C—*Neoconocephalus lyristes* (R. & H.). Chokoloskee, Florida (?). *Type*. Male. Ventral view of fastigium.

FIG. 5 B—*Neoconocephalus ensiger* (Harris). Saunderstown, Rhode Island. Male. Lateral view of fastigium.

FIG. 5 C—*Neoconocephalus ensiger* (Harris). Saunderstown, Rhode Island. Male. Ventral view of fastigium.

FIG. 5 D—*Neoconocephalus ensiger* (Harris). Saunderstown, Rhode Island. Female. Lateral view of fastigium.

FIG. 5 E—*Neoconocephalus ensiger* (Harris). Saunderstown, Rhode Island. Female. Ventral view of fastigium.

FIG. 6 B—*Neoconocephalus robustus robustus* (Scudder). Wesquage Beach, Rhode Island. Male. Lateral view of fastigium.

FIG. 6 C—*Neoconocephalus robustus robustus* (Scudder). Wesquage Beach, Rhode Island. Male. Lateral view of fastigium.

FIG. 6 D—*Neoconocephalus robustus robustus* (Scudder). Atsion, New Jersey. Female. Lateral view of fastigium.

FIG. 6 E—*Neoconocephalus robustus robustus* (Scudder). Atsion, New Jersey. Female. Ventral view of fastigium.

FIG. 7 B—Intermediate between *Neoconocephalus robustus robustus* and *N. r. crepitans*. Sea Isle City, New Jersey. Male. Lateral view of fastigium.

FIG. 7 C—Intermediate between *Neoconocephalus robustus robustus* and *N. r. crepitans*. Sea Isle City, New Jersey. Male. Ventral view of fastigium.

Plate XVI

FIG. 8 B—*Neoconocephalus robustus crepitans* (Scudder). Lincoln, Nebraska. Male. Lateral view of fastigium.

FIG. 8 C—*Neoconocephalus robustus crepitans* (Scudder). Lincoln, Nebraska. Male. Ventral view of fastigium.

FIG. 8 D—*Neoconocephalus robustus crepitans* (Scudder). Lincoln, Nebraska. Female. Lateral view of fastigium.

FIG. 8 E—*Neoconocephalus robustus crepitans* (Scudder). Lincoln, Nebraska. Female. Ventral view of fastigium.

FIG. 8 F—*Neoconocephalus robustus crepitans* (Scudder). St. Louis, Missouri. Female. Lateral view of fastigium.

FIG. 8 G—*Neoconocephalus robustus crepitans* (Scudder). St. Louis, Missouri. Female. Ventral view of fastigium.

FIG. 9 B—*Neoconocephalus caudellianus* (Davis). Tuckerton, New Jersey. Male. Lateral view of fastigium.

FIG. 9 C—*Neoconocephalus caudellianus* (Davis). Tuckerton, New Jersey. Male. Ventral view of fastigium.

FIG. 10 B—*Neoconocephalus palustris* (Blatchley). Raleigh, North Carolina. Male. Lateral view of fastigium.

FIG. 10 C—*Neoconocephalus palustris* (Blatchley). Raleigh, North Carolina. Male. Ventral view of fastigium.

FIG. 10 D—*Neoconocephalus palustris* (Blatchley). Cornwells, Pennsylvania. Female. Lateral view of fastigium.

FIG. 10 E—*Neoconocephalus palustris* (Blatchley). Cornwells, Pennsylvania. Female. Ventral view of fastigium.

FIG. 11 B—*Neoconocephalus velox* (R. & H.). Homestead, Florida. *Type*. Male. Lateral view of fastigium.

FIG. 11 C—*Neoconocephalus velox* (R. & H.). Homestead, Florida. *Type*. Male. Ventral view of fastigium.

FIG. 12 B—*Neoconocephalus retusus* (Scudder). Chestnut Hill, Pennsylvania. Male. Lateral view of fastigium.

FIG. 12 C—*Neoconocephalus retusus* (Scudder). Chestnut Hill, Pennsylvania. Male. Ventral view of fastigium.

FIG. 12 D—*Neoconocephalus retusus* (Scudder). St. Augustine, Florida. Male. Lateral view of fastigium.

FIG. 12 E—*Neoconocephalus retusus* (Scudder). St. Augustine, Florida. Male. Ventral view of fastigium.

FIG. 12 F—*Neoconocephalus retusus* (Scudder). Chestnut Hill, Pennsylvania. Male. Lateral view of fastigium.

FIG. 12 G—*Neoconocephalus retusus* (Scudder). Chestnut Hill, Pennsylvania. Male. Ventral view of fastigium.

FIG. 12 H—*Neoconocephalus retusus* (Scudder). New Brunswick, New Jersey. Female. Lateral view of fastigium.

FIG. 12 I—*Neoconocephalus retusus* (Scudder). New Brunswick, New Jersey. Female. Ventral view of fastigium.

FIG. 13 B—*Neoconocephalus triops* (Linnaeus). Thomasville, Georgia. Male. Lateral view of fastigium.

FIG. 13 C—*Neoconocephalus triops* (Linnaeus). Thomasville, Georgia. Male. Ventral view of fastigium.

FIG. 13 D—*Neoconocephalus triops* (Linnaeus). Thomasville, Georgia. Female. Lateral view of fastigium.

FIG. 13 E—*Neoconocephalus triops* (Linnaeus). Thomasville, Georgia. Female. Ventral view of fastigium.



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