

ton, N. Car., Tappahannock, Va. and Victoria, Texas. At Tappahannock Fox (1917) took 29 males and 12 females, July 13—Aug. 18, which he found mostly “in dense stands of the tall marsh-grass, *Spartina cynosuroides* (L.), in tidal marshes, a few occurring in briery thickets on nearby knolls. Observed ovipositing in the *Spartina*.” It probably occurs sparingly over the areas of the marshes covered by this and allied grasses and reeds all along the Atlantic coast from Virginia to extreme southern Florida and also along the gulf coast of Florida on which the type was taken. As Scudder has noted, the male, on account of its short tegmina and blunt rounded fastigium, resembles somewhat a large *Orchelimum*.

Caudell (1918a) records a macropterous female of *H. malivolans* from Victoria, Texas, in which both tegmina and wings are 50 mm. in length, thus giving the “insect an appearance of being larger and more bulky than its brachypterous relatives.”

#### Subfamily IV. CONOCEPHALINÆ.

##### THE MEADOW GRASSHOPPERS.

“The poetry of earth is never dead:  
 When all the birds are faint with the hot sun,  
 And hide in cooling trees, a voice will run  
 From hedge to hedge about the new mown mead:  
 That is the grasshopper’s—he takes the lead  
 In summer luxury—he has never done  
 With his delights; for when tired out with fun  
 He rests at ease beneath some pleasant weed.”—*Keats*.

Species of small or medium size, having the vertex projected upward and forward in the form of a blunt rounded tubercle, concave on each side to accommodate the basal joint of antennæ; eyes rather large, subglobose; antennæ very slender, tapering, often of excessive length; pronotum with not more than one transverse sulcus; prosternum toothed or with two slender spines, rarely unarmed; tegmina usually well developed but often dimorphic in the same species, sometimes reduced to mere pads, or even wanting, their color usually green, rarely pale brown; wings usually present and fully developed, absent or very minute in *Odontoxiphidium* and much aborted in some species of *Conocephalus*. Other characters much as in the Copiphorinæ.

To this sub-family belong those slender-bodied green grass-

hoppers, with long, tapering antennæ which are so common in summer and early autumn in damp meadows and prairies and along the margins of streams, ditches and ponds. They are mostly terrestrial in their habits, and the color of their bodies corresponds closely with that of the stems and leaves of the sedges and grasses among which they dwell, thus protecting them from the sight of the few birds which frequent a like locality. Their songs, produced in the same manner as those of their larger cousins, the katydids, are as frequent by day as by night, but are usually soft and low in comparison with those of the former. Their day song differs from that of the night, and, says Scudder (1868, 116): "It is curious to observe these little creatures suddenly changing from the day to the night song at the mere passing of a cloud and returning to the old note when the sky is clear. By imitating the two songs in the daytime the grasshoppers can be made to represent either at will; at night they have but one note."

The eggs of the *Conocephalinæ* are deposited between the stems and root leaves of grass, in the pith of twigs, or sometimes in the turnip-shaped galls so common on certain species of willows. The ovipositor, being thus used as a piercer, has in time developed into a slender and sharp pointed instrument which is but little curved and is frequently of excessive length, in some species being over twice as long as the remainder of the body.

The subfamily is represented in the eastern United States by three genera, the literature of especial interest regarding them being as follows: Redtenbacher, 1891; Blatchley, 1893, 1903; Scudder, 1898b; McNeill, 1900a; Hancock, 1904, 1911; Karney, 1913; Rehn & Hebard, 1915a, 1915b, 1916.

KEY TO EASTERN GENERA OF CONOCEPHALINÆ.

- a. Cerci of males more or less curved, swollen at middle or base and bearing a single tooth; tegmina present in both sexes.
- b. Prosternal spines rather long cylindrical, slender; ovipositor stouter, usually distinctly falcate or upcurved; tegmina fully developed, surpassing abdomen in all our species; body more robust, usually more than 18 mm. in length.
- I. ORCHELIMUM, p. 535.
- bb. Prosternal spines very short or wholly wanting; ovipositor slender, straight or nearly so; tegmina usually abbreviated, shorter than abdomen in most species; body more slender, usually less than 17 mm. in length.
- II. CONOCEPHALUS, p. 562.
- aa. Cerci of males long, slender, subcylindrical or subdepressed and with both a post-median lateral and a basal dorsal tooth; tegmina and wings absent or the former concealed, in female, tegmina present but very short in male.
- III. ODONTOXIPHIDIUM, p. 584.

## I. ORCHELIMUM Serville, 1839, 522. (Gr., "to dance" + "meadow.")

## THE LARGER MEADOW-GRASSHOPPERS.

Tettigoniids below the medium in size and possessing the characters of the subfamily above noted. They also have the face short, moderately oblique, its dorsal portion prolonged upward at middle to meet the ventral spine of fastigium; pronotum short, usually smooth, more or less saddle-shaped, the metazona prolonged backward to form a posterior lobe, its hind margin usually broadly rounded; lateral lobes deeper than long, their front margin oblique, lower one usually straight and rounded into the hind one, the latter usually with the adjoining lower portion bulging to form what is called the "convex callosity;" humeral sinus usually present but varying much in width and depth; tegmina narrow, usually strongly tapering, the apical width much less than the basal, almost always slightly shorter than wings; stridulating organ of male well developed, its veins prominent, the speculum transparent on both tegmina; front and middle femora subequal in length, unarmed beneath; hind femora slender but stouter than in *Conocephalus*, their under surface either armed with a few short spines or wholly unarmed. Male with apex of supra-anal plate emarginate and usually deflexed; cerci stout, varying much in form, armed near middle with a single stout tooth; subgenital plate with apex U- or V-shaped, its styles short one-jointed, set in sockets at the upper outer margins of the concavity. Ovipositor stout, rather broad, its apical half usually distinctly upcurved; when straight or nearly so above, the apical third, except in *militare*, tapering or curved on under side to a fine point.

This genus is very close to *Conocephalus* (*Xiphidium*) and is, by some writers, united with it. Redtenbacher (1891, 494) placed it as a subgenus of *Xiphidium*, separating its members from those of *Xiphidium* proper by the same characters as did Serville. The species have a general facies or appearance which enables one after a little experience to separate them at a glance from those of *Conocephalus*, but as R. & H. (1915b, 156) have well said, "when the characters of the two are compared, the variation in each leaves us unable to state a single absolute difference." As noted in the key to genera, the larger, heavier body, longer prosternal spines, and shorter and broader falcate ovipositor are the chief distinguishing characters of *Orchelimum*. The tegmina are

more uniform in length, and the color, while of slightly different shades of brown or green in the same species, according to season and habitat, does not run to the extremes of variation as in *Conocephalus*.

The generic name, *Orchelimum*, the literal meaning of which is "I dance in the meadows," is a most appropriate one, for low, moist meadows everywhere swarm with these insects from July to November; and though waltzes and quadrilles are probably not indulged in, yet the music and song, the wooing and love-making which are the natural accompaniments of those amusements, are ever present, and make the short season of mature life of the participants a seemingly happy one.

Allard (1910b) says: "In attempting to capture the *Orchelimums* it is amusing to observe their attempts to hide by moving around the stalk of grass they are resting on. As the hand moves toward the stalk to grasp one, the wary creature always moves to the opposite side so as to keep the stalk directly between it and the observer, just as a gray squirrel moves around a tree trunk to escape the hunter. In this protective movement it hugs the grass stem as close as possible, stretching out its long, slender hind legs behind it, until they are parallel with and almost flat against the grass stem."

Redtenbacher recognized but eleven species of his subgenus *Orchelimum*, ten of these from the United States. Scudder (1900, 73) admitted 18 to his catalogue. Kirby (1906, 371) increased the number to 24. R. & H. in their synopsis (1915a,) founded a new genus for one of these, restricted the genus *Orchelimum* to North America and Mexico, described five new species and relegated so many of those recognized by Redtenbacher, Scudder and Kirby to synonymy that, in the end, they had only 17 North American species treated as valid in their work.

In my opinion the synonymy of the genus is even yet in a very unsettled state. R. & H. made a laudable attempt to straighten it out but their conclusions regarding the older names of the European writers were based on the very brief descriptions of those writers and not on an examination and comparison with the types. For that reason I cannot agree with all their conclusions and synonymy.

The species of *Orchelimum* are so numerous and so alike in general appearance that it is very difficult to prepare a key which is satisfactory and at the same time easily followed. R. & H. have shown that one of the major characters used by both McNeill

(1900a) and myself (1903, 382) in our former treatment of the genus, viz., the presence or absence of spines on the under side of the hind femora, is unreliable as it is variable in the same species. They have used instead the form of the male cerci as their principal differential character and have supplemented this with other characters pertaining to the form of lateral lobes of pronotum, form and size of ovipositor of female, etc. Their keys are open to the objection, that they contain a number of merely comparative terms such as "form more robust" and "ovipositor with general form less arcuate," as against "form more slender" and "ovipositor with general form more arcuate." Such terms, as I long ago discovered by personal experience, are confusing and misleading to a student who has only a few specimens at hand. Aside from this, the keys in their synopsis are so much better than any previously known that I have used them as the basis for the one given below, modifying them here and there in sequence and by the addition of any fixed character which, in my opinion, would make them more simple and more easily understood by the beginner. On account of the great confusion in the synonymy of a number of the species, it is impossible in giving the distribution and notes on habits to always refer each record made by past collectors to the species to which it rightfully belongs. I have, however, where following the synonymy as given by R. & H., assigned the notes and records of synonyms to the species under which they are placed by those authors.

Fifteen species and two varieties of *Orchelimum* are herein recognized as occurring in the territory covered by this work. For convenience of treatment these are first separated into two groups as follows:

KEY TO GROUPS OF EASTERN SPECIES OF ORCHELIMUM.

- a. Cerci of male of moderate length, the apical portion behind the median tooth not much if any longer than the basal portion in front of it (Fig. 179); ovipositor in the majority of the species not distinctly more than half as long as hind femora and (except in *gladiator*) with upper margin always evidently and regularly curved. GROUP I. p. 537.
- aa. Cerci more elongate, the apical portion behind the tooth distinctly longer than the portion in front of it (Fig. 183); ovipositor (except rarely in *concinnum*) distinctly more than half as long as hind femora, its upper margin either straight or curved. GROUP II. p. 551.

GROUP I. THE AGILE GROUP OF ORCHELIMUM.

This group as defined above contains eight species. In general its members are larger and more robust than those of Group II.

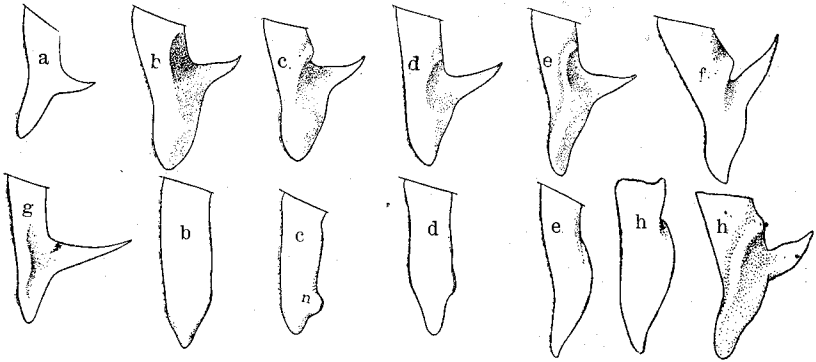


Fig. 179. Dorsal and lateral outlines of left cercus of male *Orchelimum*,  $\times 10$ . a, *agile*; b, *erythrocephalum*; c, *vulgare*; d, *gladiator*; e, *pulchellum*; i, *nigripes*; g, *calcaratum*; h, *bullatum*; n=node on cercus of *vulgare*. (a—g, After R. & H.; h, original.)

KEY TO EASTERN SPECIES OF GROUP I OF ORCHELIMUM.

- a. Tooth of male cercus not longer than apical portion of the shaft and not strongly aciculate (Fig. 179, a—f.)
- b. Upper surface of male cercus without a distinct sinuate carina; ovipositor (except in *gladiator*) not or very little more than half as long as hind femora (Fig. 180.)
- c. Cercus distinctly depressed, its tooth flattened at base and set at right angles to the shaft; ovipositor deeper at base than at any other point; humeral sinus distinct but shallow (Fig. 180, a.) 245. AGILE.
- cc. Cercus not distinctly depressed, its tooth more or less thickened at base; ovipositor deepest at some point beyond the base.
- d. Cercus without a rounded tubercle or node above and between the tooth and apex; head more or less reddish; speculum of stridulating field of male longer than broad (Fig. 182, b.) 246. ERYTHROCEPHALUM.
- dd. Cercus with a rounded tubercle or node above on apical half (Fig. 179, c, n); head rarely reddish; speculum subquadrate (Fig. 182, a.)
- e. Humeral sinus of lateral lobes distinct (Fig. 180, c); tooth of cercus shorter than apical half of shaft, tip of shaft bluntly rounded (Fig. 179, c); ovipositor less than half the length of hind femora, its upper margin distinctly curved. 247. VULGARE.
- ee. Humeral sinus scarcely evident; tooth of cercus as long as apical half of shaft, the tip of shaft subacute; ovipositor almost two-thirds as long as hind femora, its upper margin nearly straight (Figs. 179, 180, d.) 248. GLADIATOR.
- bb. Upper surface of cercus with a distinct obtuse sinuate carina; ovipositor more than half the length of hind femora.
- f. Humeral sinus distinct; tibiæ not blackish; notch of male supra-anal plate U-shaped, as broad or broader than deep; tooth

of cercus distinctly shorter than that portion of shaft behind it, its apical half straight or nearly so (Figs. 179, 180, e.)

- g. Outer carina of hind femur in both sexes armed on apical third with two to eight stout spines; form slender; tegmina in female scarcely reaching the tip of ovipositor.

249. PULCHELLUM.

- gg. Outer carina of hind femur unarmed in male, with one or two minute spines on apical third, female; form much stouter; tegmina of female distinctly surpassing the tip of ovipositor.

250 BULLATUM.

- ff. Humeral sinus almost obsolete; tibiæ all blackish; notch of supra-anal plate V-shaped, deeper than broad; tooth of cercus almost as long as the portion behind it, distinctly inclined toward base of cercus, its apical half curved (Figs. 179, 180, f); tegmina but feebly if at all surpassing hind femora.

251. NIGRIPES.

- aa. Tooth of male cercus distinctly longer than apical portion of shaft and strongly aciculate (Fig. 179, g); humeral sinus scarcely evident (Fig. 182, c); outer lower carina of hind femora always spined.

252. CALCARATUM.

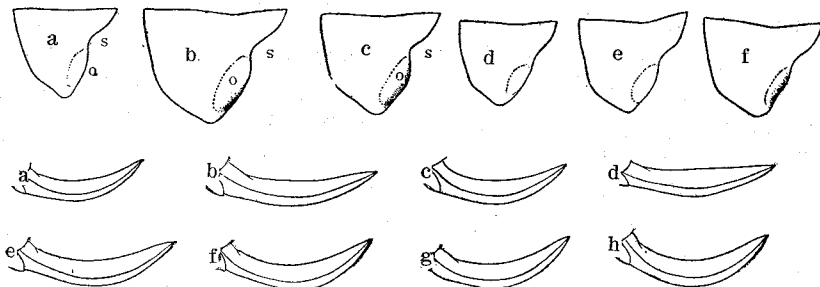


Fig. 180. Outlines of lateral lobes of male pronotum,  $\times 3$ , and of ovipositors,  $\times 2$ , of *Orchelimum*. a, *agile*; b, *crythrocephalum*; c, *vulgare*; d, *gladiator*; e, *pulchellum*; f, *nigripes*; g, *calcaratum*; h, *bullatum*; s, humeral sinus, c=convex callosity. (After R. & H.)

245. ORCHELIMUM AGILE (DeGeer), 1773, 457. Agile Meadow Grass-hopper

Size medium for the genus; form moderately robust. Color variable; usually dull reddish-brown, with lateral lobes of pronotum, costal or lower edge of tegmina, tibiæ and apical half of hind femora green or with a greenish tinge, sometimes nearly uniform pale green with dorsal surface tinged with clay yellow; pronotum often with a pair of dark brown diverging stripes. Fastigium broader at apex than at base, the former rounded and with a fine median line above. Antennæ twice or more as long as body. Disk of pronotum short; lateral lobes with lower margin oblique, its hind angle obtuse; humeral sinus broad, shallow. Tegmina surpassing hind femora about 3 mm., exceeded by wings about 2 mm. Outer lower carina of hind femora with one to five spines. Cerci of male and ovipositor as in key and Figs. 179, 180. Apex of subgenital plate of male subtruncate or very feebly and broadly emarginate. Length of body,  $\delta$  and  $\text{q}$ , 21.5—22.5; of pronotum,  $\delta$ , 5,  $\text{q}$ , 5—5.6; of tegmina,  $\delta$ , 23.5—24.5,  $\text{q}$ , 25—25.7; of hind femora,  $\delta$ , 17.6—18.6,  $\text{q}$ , 18.5—20.8; of ovipositor, 7—8 mm.

Marshall and Vigo Counties, Ind., Aug. 7—Oct. 1; Washington, D. C., Aug. 30; Thomasville, Ga., Aug.—Sept. 8; Dunedin and Gainesville, Fla., Oct. 24 (*W. S. B.*). This species, as determined by R. & H., I have found to be scarce in Indiana, less than half a dozen specimens having been taken; while Fox found but one near Lafayette. It was not included in my Orthoptera of Indiana as I had not then separated it from *vulgare*. My Indiana specimens agree very well with the description of McNeill's *sylvaticum* which R. & H. have made a synonym of *agile*, except that McNeill specifically states that in the male of his species the wings do not exceed the tegmina, which is not true of the Indiana males nor of those from Thomasville, Ga., received from Hebard under the name of *O. nitidum* Redt. The synonyms of *O. agile* as determined by R. & H. (1915a, 29) are *O. glaucum* Serv. (1839, 524), *O. sylvaticum* McNeill (1891, 26), *X. (O.) nitidum* and *spinulosum* Redt. (1891, 503) and *O. molossum* R. & H. (1907, 307), but until some one makes a careful examination of DeGeer's type, if it be still in existence, the fixation of any American form as that species may still be considered an open question.

In Florida *O. agile* has been taken by collectors at a dozen stations, but appears to be rather scarce and to be mostly confined to the northern portion, though recorded as far south as Detroit and Everglade. There it occurs in the undergrowth of pine woods and among weeds in waste places; also in the saw-grass along the edge of the everglades.

The range of *O. agile*, including its synonyms, is given by R. & H. as extending from S. E. Pennsylvania and southern New Jersey south and southwest to southern Florida and Louisiana and north and west to northern Illinois and Wichita, Kansas. Of *sylvaticum* as occurring at Moline, Ill., McNeill (1891, 26) says: "I have found this *Orchelimum* first on corn, afterwards more commonly in open places in woods. Its stridulation is quite distinct from that of *vulgare*. It consists of the same two elements but the *zip* is repeated many times very rapidly so as to make almost a continuous sound and the *zee-e-e-e* is comparatively short and very constant, lasting about eight seconds. The first part of the song lasts from three to five seconds." Of the habits of *agile*, as found in Virginia, Fox (1917) wrote: "Usually abundant, in wet or moist areas, especially in the *Scirpus americanus* Pers. formation of tidal marshes and the marginal fringe of succulent grasses; but never occurring in true salt marsh-grass, *Spartina stricta* (Ait.); also common in cat-tail, sedgy and



grassy bogs inland at the head of sluggish streams. Occasionally it spreads to the adjoining dry land, specimens having been taken in goose-grass, *Eleusine indica* L., crab-grass, foxtail-grass and *Andropogon*."

246. ORCHELIMUM ERYTHROCEPHALUM Davis, 1905, 288. Red-headed Meadow Grasshopper.

Size medium to large for the genus, form robust. Green or greenish-yellow, hind knees and tarsi fuscous; occiput and prozona with a broad median dark brown dorsal stripe, in the larger specimens this often faint or wanting; entire head and face usually blood-red in life, fading to reddish-brown in drying; pronotum short, smooth, its posterior lobe short, with hind margin broadly rounded; lower margin of lateral lobes with hind angle narrowly rounded, hind margin with convey callosity broad; humeral sinus broad, very shallow. Tegmina surpassing tips of hind femora 2—4 mm., exceeded by wings the same distance. Hind femora usually armed beneath on each carina with one to six spines. Cerci as described in key and shown in Fig. 179, the tooth suddenly constricted into a slender, sharp bent spine. Ovipositor as shown in Fig. 180, *b*, slightly less than half the length of hind femora. Length of body, ♂ and ♀, 20—27, of pronotum, ♂, 5.5—8, ♀, 6—7.5; of tegmina, ♂, 22—33, ♀, 23—37; of hind femora, ♂, 17—23, ♀ 18—22; of ovipositor, 9—10.

This meadow grasshopper, as described above, is the species which R. & H. (1915a, 34) call *O. glaberrimum* (Burm.). The original description (1838, 707) of that species is very brief and not distinctive. It is as follows: "Verticis et pronoti medio fulvo, nigro-marginato; elytris ab alis dimidia linea superatis. Long. corp., 11". Burmeister knew but two species from the United States, and this short description was sufficient for him to distinguish these, but of the 18 or more species now known it is impossible to say just which one he had at hand. R. & H. by "tracing the movements of Zimmerman, who collected the material on which Burmeister founded his *glaberrimum*," have concluded that his type came from Georgetown, S. Car., and have picked out the species found in that general region which, in their opinion, fits most closely the above brief description and have called it *glaberrimum*. In doing this they made the *erythrocephalum* of Davis a synonym. They have also placed as a synonym of their *glaberrimum* Burm. the *O. cuticulare* Serv. (1839, 523), a species of which Serville said: "J'ignore sa patrie."

As stated in the introduction to this work, p. 7, in cases of this kind, where the insect cannot be definitely fixed as the one so briefly described by a foreign author, it is better to disregard his name and to adopt a later one of undoubted status.<sup>67</sup>

<sup>67</sup>See quotation from R. & H. under *O. concinnum*, page 555.

I have, therefore, restored the name *erythrocephalum* given to this grasshopper by Davis.

The known range of *O. erythrocephalum* extends from central New Jersey southwest along the coast to southern Florida, Mobile, Ala., and southern Mississippi, and inland to Raleigh, N. Car., Macon, Ga., and Agricultural College, Miss. As will be noted by the measurements it varies much in size, the northern specimens being the smaller. It has been taken at various points in the Pine Barrens of New Jersey and about Norfolk and Cape Henry, Va. Davis (1905) says that in life "its most noticeable feature is a very red face, often the whole head being of a blood red color. It appears as if the insect had eaten of ripe cranberries and gotten its head stained with the fruit, for the color is the same. About Lakehurst it is far more common than *O. vulgare*."

Fox (1914, 527) states that it is apparently restricted to sphagnum bogs, where it frequents the dense growth of chain fern, tall sedges, rushes and associated plants. Of its occurrence about Cape Henry, Va., he says (1917): "In addition to being common in the rank vegetation of dune hollows and ditches, it was not infrequent in the tall bunch grasses on the surrounding dry sand dunes. Farther inland it appeared to prefer areas of stiff, but not always moist soil, occurring in the rank plant growth of ditches, woodland borders and scrub. It evidently has a strong predilection for sylvan surroundings."

I have not taken *erythrocephalum* in Florida but it has been recorded from a number of localities as far south as Everglade, being apparently more common in the northern third of the State. There it occurs for the most part in wet grassy spots along the edges of hammocks and in palmetto barrens.

247. *ORCHELIMUM VULGARE* Harris, 1841, 130. Common Meadow Grasshopper.

Size medium, form robust. General color green or pale reddish-brown; face pale green or light brown without fuscous marks; occiput and disk of pronotum with a reddish-brown band, widening on the latter, where it is often, especially in male, bordered each side with a darker line; male with two short black dashes on each tegmen, the four forming the angles of an assumed square, enclosing the tympanum; legs usually pale brown, tarsi dusky. Pronotum long, its posterior lobe but slightly, if at all, upturned above the plane of prozona; lateral lobes nearly as long as deep, the lower hind angle obtusely rounded; convex callosity wide, prominent; humeral sinus broad but well defined (Fig. 180, c.) Tegmina reaching to or slightly beyond tips of hind femora, and usually equalling, male, or very little shorter, female, than wings. Hind femora rarely armed with one or two spines beneath. Cerci of male as described in key, a little depressed; sub-basal

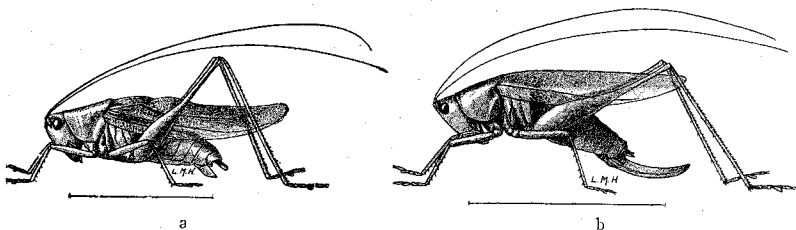


Fig. 181. a, Male; b, female. (After Luggler.)

tooth somewhat flattened with tip sharp, decurved (Fig. 179, c.) Length of body, ♂, 18—22, ♀, 18.5—23; of pronotum, ♂, 5—6, ♀, 5.4—6.5; of tegmina, ♂, 18—26, ♀, 19—27; of hind femora, ♂, 14—19, ♀, 14.5—20; of ovipositor, 7.5—8.5 mm. (Fig. 181.)

This meadow grasshopper is probably the most abundant member of the family Tettigoniidæ found in Indiana. It begins to reach maturity in the central part of the State about July 10th, and more frequently than any other of our species of *Orchelimum* is found in upland localities, along fence rows, and in clover and timothy meadows. In early autumn it seems to be very fond of resting on the leaves and stems of the ironweed, *Vernonia fasciculata* Michx., so common in many blue-grass pastures.

At times *O. vulgare* appears to be somewhat carnivorous in habit, as, on two occasions, I have discovered it feeding upon the bodies of small moths which in some way it had managed to capture; while on another date I surprised a female on the flowers of a golden-rod, feasting upon a soldier beetle, *Chauliognathus pennsylvanicus* DeG. According to Hancock (1904) it is not only carnivorous but also a cannibal, as a female kept in captivity captured her mate and "holding his body between her fore legs ate the larger portion of the soft parts, after first eating a hole in the back." He suggests that the "long spines" of the fore and middle tibiæ are occasionally used and connected in this species with its carnivorous habits."

*O. vulgare* is not only the most common member of the genus locally but is more widely distributed than any other, its known range extending from southern Maine and southern Quebec, north and west through Ontario to northern Minnesota, Colorado and eastern Wyoming, and south and southwest to North Carolina, Macon, Ga. (Fox), northwestern Arkansas and northeastern Texas. The larger, longer winged individuals have by many writers, including myself (1903, 385) been wrongfully recorded as *O. glaberrimum* (Burm.), a species which R. & H. ever replaces *vulgare* in the southern states and which I have included above as *O. erythrocephalum* Davis.

In Ontario Walker (1905, 34) found *vulgare* "the only species of *Orchelimum* distributed generally over a large part of the province. It becomes gradually scarcer to the north of Lake Simcoe, and, I believe, does not range much farther north than Muskoka. Where found it is usually common in upland fields as well as low meadows and is fond of perching in clumps of tall grass. It reaches maturity in this latitude towards the end of July and lasts until about the beginning of October."

Scudder set the call note of the male of *O. vulgare* to scale and (1893, 73) wrote of it as follows:

"When about to sing on a hot, sunny day, the male mounts a stalk of grass to about a foot from the ground where it clings with its four front legs, allowing its hind legs to dangle on either side of the stalk that they may not interfere with the movements of the tegmina. Beginning with *ts* it changes almost instantly to a trill of *rr*; at first there is a crescendo movement which reaches its volume in half a second; the trill is then sustained for a period varying from one to twenty seconds (generally from six to eight seconds), and closes abruptly with *p*. This strain is followed by a series of very short staccato notes sounding like *jip, jip, jip*, repeated at half second intervals; the staccato notes and the trill alternate *ad libitum*. The staccato notes may be continued almost indefinitely, but are very rarely heard more than ten times in direct succession; they ordinarily occur three or four times before the repetition of the phrase, but not more than two or three times when the phrase is not repeated. The night song differs from that of the day in the rarer occurrence of the intermediate notes and the less rapid trill of the phrase; the pitch of both is at B flat."

Hancock (1904) has given an excellent description of the egg-laying habits of *O. vulgare* (*glaberrimum*) in captivity, from which I quote as follows:

"On the 6th of September a female was noticed exhibiting rather restless actions among the loosely spread stems of one of the bouquets of flowers, and soon after I found her ovipositing in a stem of the bur marigold. Before selecting the marigold as the proper plant for her immediate needs, she tested a number of different kinds of plants by biting the stems. When at last the coveted stem was found, she started very vigorously biting, moving her head from side to side in an endeavor to get a stronger hold with her jaws. A gash into the outer layer of the stem was soon made, about an eighth of an inch in length, the insect finally going back over the course of the incision with the evident purpose of more deeply penetrating to the pith. During this first stage in the process the female stood with her head directed downwards, but as soon as the spot was prepared with the mouth she reversed her body preparatory to the act of oviposition. Firmly grasping the plant stem with her feet she curved the abdomen underneath, at the same time bringing the pointed extremity of the ovipositor into the breach made in the stem. Now she stood with her ovipositor under the abdomen with the blades slightly imbedded, but grad-

ually as it was worked within the stem she almost imperceptibly moved forward a little at a time. Finally when the ovipositor was buried to its utmost length it was directed backwards. It was now appreciated how well adapted the beautiful curve and structure of the organ are for this purpose. A moment later the blades were spread apart, allowing the elongate egg to be lodged within the center of the pith, the latter having been pressed to either side for the accommodation of the egg. As soon as the first egg was deposited, she withdrew the ovipositor and immediately turning around she again bit the same spot, spending several minutes chewing the fibers and pinching the sides together with her powerful jaws. This was done in order to use the same opening to deposit the second egg. She next moved a little way down the stem, but this time her head was directed downwards so that she might insert the ovipositor in the same hole, but deposit the second egg in a reversed position to that of the first. When the third and fourth eggs were about to be deposited she moved down the stem to a new site about half an inch away, varying the distance, and the process with its several stages was repeated. The interior of the stem was finally filled for a considerable distance with eggs, about ten minutes being consumed in the deposition of each one, nine incisions being made in the one stem and 18 eggs deposited. It may be of interest to note that Riley (1884, 187) mentions that this species oviposits in the stems of various pithy plants, and especially in the tassel stem of Indian corn."

Notwithstanding its wide distribution and common occurrence *O. vulgare* has not a single synonym. Redtenbacher (1891, 500) placed *vulgare* as a synonym of DeGeer's *Xiphidium agile*, stating as his reason for so doing that Harris and Scudder had separated the two "on account of small differences in the color and size of the wing covers, as well as in the length of the ovipositor." I pointed out (1903, 384) that his relative measurements of *X. agile* as given, did not agree with specimens of undoubted *vulgare* in my possession, and retained the latter species as distinct. In this I have been upheld by recent writers.

248. ORCHELIMUM GLADIATOR Bruner, 1891, 71. Gladiator Meadow Grass-hopper.

Size medium, form robust. Pale transparent grass-green throughout; the usual dark brown markings on the occiput and disk of pronotum; on the latter composed of two well defined, narrow, slightly diverging lines; antennæ rufous, tarsi and extreme tip of ovipositor tinged with rufous. Fastigium short, obtuse, the extreme tip shallowly sulcate. Pronotum much as in *vulgare*, the metazona a little more upturned; lateral lobes deep, their lower hind angle subrectangular. Tegmina somewhat variable in length, usually but slightly passing tips of hind femora, female, more distinctly so, male; inner wings of same length as tegmina, male, a little longer, female. Hind femora usually unarmed beneath, rarely with one or two short spines on outer margin. Cerci of male as in key and Fig. 179; subgenital plate as in *vulgare*, the styles longer. Ovipositor as described in key. Length of body, ♂, 17, ♀, 18—20; of antennæ, ♂, 43, ♀,

35; of pronotum, ♂, 4.3—5, ♀, 4.7; of tegmina, ♂, 19—23, ♀, 19—21; of hind femora, ♂, 12—14, ♀, 15.5—17; of ovipositor 10 mm.

In Indiana this species has been found only in the northern counties, where it is quite common in damp prairies, meadows and marshes, and begins to reach maturity about July 10. A pair were found mating in Marshall County on July 29.

The range of *gladiator* is almost as great as that of *vulgare*, but it is nowhere as common as that species. It is known from Montreal and New England west to Washington and northern California, and south and southwest to New Jersey, Tennessee and northeastern Kansas. Walker (1910, 352) redescribed the male from Ashdown, Manitoba as *O. manitobense*. It is not recorded definitely from Michigan and in Ohio only from Cedar Point. Specimens are at hand from Algonquin, Ill. (*Nason*.) Walden does not include it in his Orthoptera of Connecticut, though it had been taken in that State by Morse in 1894. It has been erroneously recorded a number of times as *O. vulgare*, but the females are easily separated by the form of the ovipositor and the males by the long tooth of cercus and the very feeble humeral sinus.

249. ORCHELIMUM PULCHELLUM Davis, 1909, 33. Handsome Meadow Grasshopper.

Size medium; form moderately robust. Pale green; head often in great part reddish, face yellow; pronotum with the usual dorsal dark stripe; sides bottle green; under surface yellow, that of abdomen notably so; femora lemon-yellow below and within, the apical third of hind pair reddish; tibiæ of all the legs reddish, tarsi fuscous. Fastigium narrow, its apical half scarcely wider; eyes very prominent. Pronotum short, subsellate, metazona less than one-half the length of prozona; lateral lobes deeper than long, lower margin short, its hind angle narrowly rounded; humeral sinus evident but shallow. Tegmina with apical half strongly tapering, surpassing hind femora 3 mm. exceeded by wings the same distance. Cerci as in key and Fig. 179, *e*, its upper outer edge raised in an obtuse carina and apical half oblique, concave within, the tip obtuse. Notch of subgenital plate broadly V-shaped, the styles very short, obtuse. Ovipositor rather wide, moderately curved, distinctly more than half the length of hind femora, its apex slightly surpassing the tips of tegmina (Fig. 180, *e*.) Length of body, ♂, 18—19, ♀, 18.3—22.8; of pronotum, ♂, 5, ♀, 4.2—5.7; of tegmina, ♂, 20—23, ♀, 18.7—28.3; of hind femora, ♂, 16—18, ♀, 15.3—19.2; of ovipositor, 9—11 mm.

Helmetta, Dennisville and Jamesburg, N. Jer., Sept. 5—21 (*Davis*); Tappahannock, Va., Sept. 19 (*Fox*); Rosslyn, Va., Sept. 12 (*Caudell*). Described from the first two localities above mentioned, where Davis found them on the tall grass in a very wet swamp.

R. & H. (1915a, 53) have made this a synonym of *O. laticauda* Redt. (1891, 504) described from a single female taken at New Orleans, La. This was done without examination of the type of *laticauda* and only by comparison with Redtenbacher's brief description. In this there are several notable discrepancies, when compared with undoubted specimens of *O. pulchellum*, viz.: "lobi lateralis pronoti margine postico sinuato." This is not true of *pulchellum* and R. & H., in their key to females of *Orchelimum* separate *laticauda* from *nigripes* by the former having the "caudal margin of lateral lobes gently arcuate ventrad of humeral sinus," whereas in *nigripes* it is said to be "sinuate or subsinuate ventrad." Again, Redtenbacher says: "Elytra femora postica valde superantia, alis multo breviora," whereas in *pulchellum* the tegmina at most surpass the hind femora 3—4 mm., and are only 3—4 mm. shorter than the wings. Finally Redtenbacher in his key separates *laticauda* from four other species by its having the "femora postica utrinque spinulosa," while in *pulchellum*, as R. & H. admit, "the vast majority have the internal margin unarmed." What *laticauda* was or is I know not nor do I believe any one else can tell without an examination of the type. I have therefore restored the name given by Davis to this grasshopper.

Of the types of this species Davis wrote: "When seen in life the insect is particularly beautiful and is conspicuous for its bottle-green colored tegmina, with a bluish tinge, its lemon-yellow markings and its reddish legs. Its song was a *zip, zip, zip—z, z, z, —zip, zip, zip—z, z, z,*—quite a distinguishable song from that of *O. vulgare.*"

The range of *laticauda* so-called by R. & H., including *pulchellum* Davis, is given by them (1915a, 54) as "Covering the Atlantic Coastal Plain region from north central New Jersey south to southern Florida, westward to New Orleans, La.; in the eastern states occurring at suitable valley localities in the Piedmont region above the fall line." In Florida it has been recorded from Atlantic Beach, Jacksonville, Ortega, Sanford, Palatka, Detroit, Lakeland and Chokoloskee, most of the records being made under the names *nitidum* and *pulchellum*.

McAtee and Caudell record (1917) *pulchellum* (under the name *laticauda*) from numerous localities about Washington, D. C., and Fox (1917) states that about Tappahannock, Va., it is "occasional in a variety of situations, occurring regularly in tidal and fresh water marshes and pond borders, but the males, at least, spreading in small numbers to upland districts where the

species was taken in a field of dense millet and in a thick growth of ragweed bordering the fence of a town lot. In the tidal marshes it was found in the tall marsh-grass, *Spartina cynosuroides* (L.) and in a marginal fringe of switch-grasses. In fresh water bogs it was taken on various grasses, cat-tails, sedges and bushes. Unlike most members of the genus it appears to have a strong preference for woodland habitats."

250. *ORCHELIMUM BULLATUM* Rehn & Hebard, 1915a, 50.

Size above the medium for the genus; form robust. Pale green fading to dull yellow, the tegmina alone remaining in great part green; the usual dark bars on occiput and pronotum vague, often broken into small oblong fuscous spots; antennæ and tibiæ uniform dull reddish-yellow. Fastigium prominent, its sides divergent from base and rounded beyond the middle, the apex therefore distinctly wider than base. Pronotum short, broad, feebly sellate; metazona two-thirds the length of prozona, the transverse sulcus in male deeply and broadly impressed, lateral lobes slightly deeper than long, lower margin much less oblique, with hind angle much less narrowly rounded than in *nigripes*; humeral sinus distinct, in male deeper than in *pulchellum*. Tegmina surpassing hind femora 3—5 mm., exceeded by wings 3—4 mm.; their cross-veins very prominent, especially so in female. Cercus of male stouter than in *nigripes*, its apical portion more evenly tapering; tooth shorter, stouter, more erect. Ovipositor distinctly wider throughout its length than in either *nigripes* or *pulchellum*, less curved than in the former, longer than in the latter (Figs. 179, 180, *h.*) Other differences as given in key. Length of body, ♂, 18—19, ♀, 19—21; of pronotum, ♂, 5—5.3, ♀, 5.2—6; of tegmina, ♂, 23—25, ♀, 25—27; of hind femora, ♂, 17—18, ♀, 19—20; of ovipositor 10—11.5 mm.

Tippecanoe Co., Ind., three males, five females (*Fox*). This is the *Orchelimum* recorded by *Fox* (1915, 318) as "*O. nigripes* Scudd. (variety.>" He states: "On October 13 and 14 I found a form of this genus in a cat-tail marsh on the upland northwest of Lafayette which I was unable to determine, but which Mr. Rehn, to whom I submitted specimens, informs me is a race of *O. nigripes* from the typical form of which it differs in the absence of black from the tibiæ and, so far as my Lafayette material is concerned, in its somewhat greater size. On the dates mentioned it literally swarmed in the mixed cat-tail and rice cut-grass areas of the marsh, but was entirely lacking in the marginal thickets."

That this is a very distinct species from both *nigripes* and *pulchellum* is shown by the differences I have pointed out in key and description. I was at first inclined to consider it an undescribed form, but Dr. *Fox*, who made for me a drawing of the male cercus, called my attention to its close similarity to that of *bullatum* as figured by R. & H. A comparison with their descrip-



tion shows that while the Indiana males are somewhat smaller than the measurements given, they agree otherwise so closely that there is little doubt but that they represent the northern form of that species, hitherto known only from Louisiana and eastern Texas. R. & H. state that in Texas it was "found frequenting high grasses along streams or in depressions. The note was a long buzzing zzzzzzzz somewhat resembling that of some cicadas, with but few interspersed clicking sounds."

251. ORCHELIMUM NIGRIPES Scudder, 1875, 459. Black-legged Meadow Grasshopper.

Size medium for the genus; form robust. General color green or reddish-brown, the former prevailing in male, the latter in female; occiput and disk of pronotum with the usual brown markings; front and sides of head, and fore and middle femora, reddish-yellow; antennæ and all the tibiæ and tarsi, together with apical third of hind femora, black or dark brown at least above; in one specimen at hand the whole body, except tegmina and femora, black. Fastigium narrow, its sides subparallel, and apex very feebly if at all widened. Pronotum short, distinctly saddle-shaped in male where the metazona is rather strongly upturned; lateral lobes distinctly deeper than long, their lower margin very oblique, its hind angle narrowly rounded; convex callosity narrow but distinct. Tegmina equalling the wings, male, a little shorter, female. Shrilling organ of male unusually large and prominent with strong crossveins; behind it the tegmina taper rapidly on both margins, their shape and the size of the tympanum causing the male to appear somewhat peculiar and more robust than it really is. Hind femora armed on apical half of lower outer carina with one to four small spines. Cerci of male slender, tapering, concave within, its apex obtuse. Ovipositor strongly curved, broadest at middle, tapering to a delicate point (Figs. 179, 180, f.) Length of body, ♂, 18—20, ♀, 19—21; of antennæ, 66—80; of pronotum, ♂ and ♀, 4.3—5; of tegmina, ♂, 20—22, ♀, 22—25; of hind femora, ♂, 16—17, ♀, 17—19; of ovipositor, 9—10.5 mm.

Next to *O. vulgare* this handsome black-legged grasshopper is the most common Conocephalid in Indiana, occurring by hundreds about the margins of every lake, pond and marsh in the State. It is essentially a lowland or hygrophilous species and is seldom found about the drier uplands where *vulgare* has its favorite haunts. It reaches maturity about July 20, and frequents the tall grasses and especially the stems and leaves of the different species of smartweed, *Polygonum*, growing in the shallow water of the larger ponds and lakes. Near Lafayette Fox (1915) found it "an abundant and characteristic species of open grassy bogs and damp situations generally, being especially common in the rice cut-grass, *Homalocenchrus oryzoides* (L.)." Examples of the parasitic hairworm, *Gordius* sp.?, have been taken from the abdomens of a number of specimens.

The type of Scudder was from Dallas, Texas, and the species has its main distribution west of the Mississippi, ranging from Ohio and southern Ontario south to Tennessee and Louisiana, and west to Colorado and central Texas. Of its habits in Ontario Walker (1905, 36) has written: "On August 7, 1901, while collecting at Point Pelee in a low woods bordering a stream, I heard a sound very like the stridulation of *O. vulgare*, but more subdued, the "zips" coming at much shorter intervals, and more of them produced at a time. I succeeded in tracing the song to its source and found an *Orchelimum* quite new to me which proved to be *O. nigripes*. Another male was taken in the same way, and I heard others but was unable to find them. In several cases the sound proceeded from trees at a height of some ten or fifteen feet, but as a rule it came from tall weeds and vines which grow in great luxuriance upon the rich black soil."

At Moline, Ill., McNeill (1891, 25) found it "about as common as *vulgare*. It is not at all shy but even shows a preference, I have thought, for human society. I have known a male to keep a place over the wooden finish of a doorway for more than a week. If he ate during that time he must have been obliged to leave his post to satisfy his hunger and he probably returned many times to the place. The song is difficult to distinguish with certainty from that of *vulgare* but usually the *zip-zip* is repeated only once or twice very rapidly and the *z-e-e-e-e* does not continue so long."

The *X. (O.) robustum* Redt. (1891, 499) described from New Orleans, La., is placed by R. & H. as a synonym of *O. nigripes*.

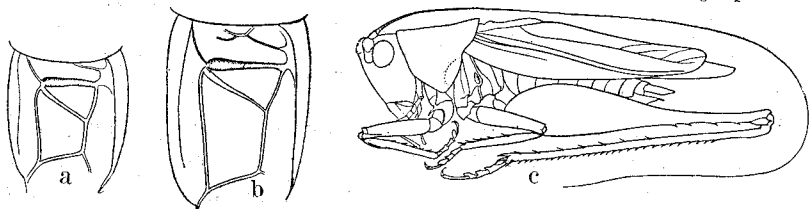


Fig. 182. a, Outline of stridulating field of male of *O. vulgare*; b, same of *O. erythrocephalum*,  $\times 3$ ; c, outline of male type of *O. calcaratum*,  $\times 2$ . (After R. & H.)

252. *ORCHELIMUM CALCARATUM* Rehn & Hebard, 1915a, 46. Long-spurred Meadow Grasshopper.

Size medium for the genus; form moderately robust. Pale green, occiput and disk of prozona with usually a median pale brown stripe, this darker on the sides; stridulating field of male with three spots of blackish brown as in *vulgare*, two at base and one on left near apex; abdomen of male often with a dark blotch above; ovipositor pale brown. Fastigium feebly ascending, but slightly wider than basal joint of antennæ. Antennæ nearly four times as long as body. Pronotum slightly saddle-shaped, met-

azona feebly ascending, two-thirds the length of prozona; lateral lobes slightly longer than deep, lower margin straight, oblique, its hind angle obtuse; humeral sinus scarcely evident. Tegmina not or very rarely reaching tips of hind femora, surpassed by wings about 2 mm. Hind femora robust, armed on lower outer carina with three or four spines. Cerci as in key and Fig. 179, *g*, their tips subdepressed and tapering to a dull point; notch of subgenital plate shallowly U-shaped; styles short, their tips obtuse. Ovipositor about half as long as hind femora, rather broad, regularly curved. Length of body, ♂, 19.5—23, ♀, 17—20; of pronotum, ♂, 5.2—6.2, ♀, 5.6—6; of tegmina, ♂, 16—19, ♀, 16.5—18; of hind femora, ♂, 17—21, ♀, 19—20; of ovipositor, 9—9.6 mm. (Fig. 182, *c*.)

Clarksville, Tenn., Aug. 13, 31 (*Fox*). The known range of this species is mostly southwestern extending from southeastern Illinois and north-central Tennessee west to Colorado and southwest to central Texas. East of the Mississippi it has before been recorded only from Olney, Ill., a female taken there by Ridgeway being in the U. S. National Museum collection.

It is a rather short bulky species, resembling a small *vulgare*, the male being easily known by the long, slender, sharp-pointed tooth of cerci, the female more difficult to separate but known by the less robust fastigium, very faint humeral sinus, and armed hind femora. R. & H. (1915a, 48) state that "This species is clumsy in its actions, and once located, easy to capture. In Texas it was found in a great variety of situations, ranging from high grass to 12 feet above the ground in post oak. It was taken in grass among cotton, in green weeds, low bushes and in tall nettles as well as in bushes in pine woods. The stridulation is not loud."

The *X. (O.) cuticulare* Redt. (1891, 503) nec. Serville is placed by R. & H. as a synonym of *calcaratum*.

#### GROUP II. THE CONCINNUM GROUP OF ORCHELIMUM.

Here belong seven nominal species and two varieties having the apical portion of male cercus distinctly longer than the basal portion. In size and form (except in *superbum*) they are generally smaller and more slender than the members of Group I, and the ovipositor, except rarely in *concinnum*, is always more than half the length of hind femora.

#### KEY TO EASTERN SPECIES OF GROUP II OF ORCHELIMUM.

- a.* Apical portion of male cercus not strongly tapering to an acute apex: tooth of cercus (except in *superbum*) arising as usual from the inner side of shaft and not strongly recurved toward base (Fig. 183, *a—c*); upper margin of ovipositor (except in *delicatum*) regularly and evenly curved.
- b.* Humeral sinus of lateral lobes distinct (Fig. 184, *a*); tooth of male cercus normal in point of origin; smaller and more slender, length of body in both sexes less than 21 mm.

- c. Lower outer carina of hind femora with 3 to 5 spines beneath; lateral lobes of pronotum slightly longer than deep; ovipositor more than two-thirds the length of hind femora (Fig. 184, e.) 253. MINOR.
- cc. Lower outer carina of hind femora very rarely armed beneath; lateral lobes of pronotum deeper than long (Fig. 184, a.)
- d. Ovipositor very slender, distinctly falcate, but little more, or even less, than half as long as hind femora (Fig. 184, a); males larger, (length of body 17 or more mm.) and more robust.
- e. Face with a dark reddish-brown stripe down its center; hind femora more robust and relatively shorter, 14—17 mm. 254. CONCINNUM.
- ee. Face green without a median brown stripe; hind femora relatively longer and more slender, 16—18 mm. 254a. CAMPESTRE.
- dd. Ovipositor distinctly broader and much straighter, nearly three-fourths the length of hind femora (Fig. 184, f); males smaller (not over 16 mm.) and more slender.

254b. DELICATUM.

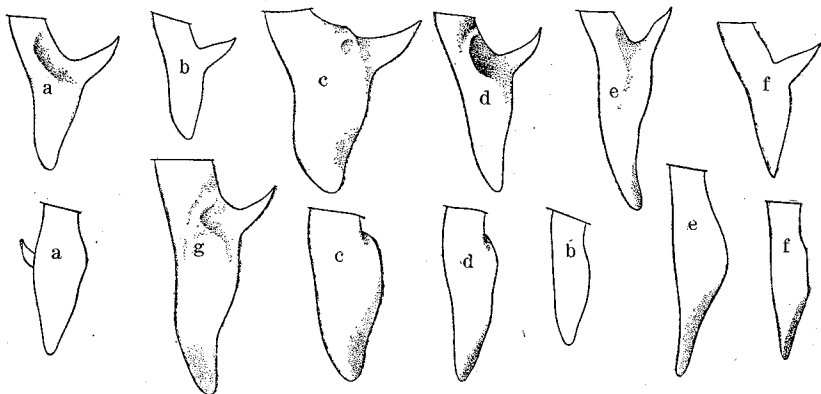


Fig. 183. Dorsal and lateral outlines of left cercus of male *Orchelimum* ( $\times 9$ ). a, *minor*; b, *concinnum*; c, *superbum*; d, *fidicinium*; e, *militare*; f, *volantum*; g, *bradleyi*. (After R. & H.)

- bb. Humeral sinus very faint or obsolete (Fig. 186, b); tooth of male cercus arising from the lower face of shaft and strongly recurved toward base of latter (Fig. 183, c); larger and more robust, length of body, 22—25 mm.; ovipositor broad, but slightly more than half the length of hind femora. 255. SUPERBUM.
- aa. Apical portion of cercus distinctly and strongly tapering to a subacute apex (Fig. 183, d—g); tooth of cercus, except in *volantum*, either arising from the inner lower face of shaft or directed strongly backward; upper margin of ovipositor, except in *fidicinium*, straight or nearly so.
- f. Ovipositor two-thirds or more the length of hind femora; speculum of stridulating field of male but slightly longer than wide (Fig. 187, a); form more slender.

*g.* Lateral lobes of pronotum as long as deep, their humeral sinus evident but shallow; cercus more robust, less tapering; ovipositor less than 12 mm. in length, its upper margin with a slight but evident regular curve (Fig. 184, *b*.)

256. FIDICINIUM.

*gg.* Lateral lobes deeper than long, the humeral sinus very distinct; cercus much longer, more slender, strongly tapering; ovipositor 15 or more mm. in length, its upper margin straight or nearly so (Fig. 184, *c*.)

257. MILITARE.

*ff.* Ovipositor less than two-thirds the length of hind femora (Fig. 184, *d*); speculum of male distinctly longer than wide (Fig. 187, *b*); lower outer carina of hind femora always armed beneath.

*h.* Tooth of cercus diverging on a plane with dorsum of cercal shaft, but slightly recurved toward base of latter (Fig. 183, *f*); apical portion of cercal shaft regularly tapering, quite acute.

258. VOLANTUM.

*hh.* Tooth of cercus diverging from the lower inner face, more strongly recurved; apical portion of shaft subarcuate, less acute, more strongly depressed when viewed from the side (Fig. 183, *g*.)

259. BRADLEYI.

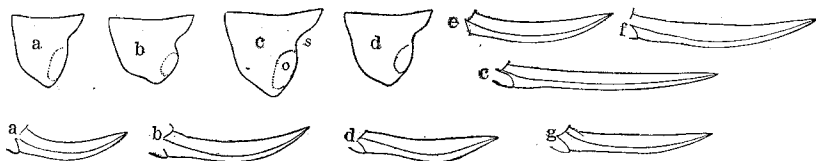


Fig. 184. Outlines of lateral lobes of male pronotum,  $\times 3$ , and of ovipositor,  $\times 2$ , of *Orchelimum*. *a*, *concinnum*; *b*, *fidicinium*; *c*, *militare*; *d*, *volantum*; *e*, *minor*; *f*, *delicatum*; *g*, *bradleyi*; *s*=humeral sinus; *o*=convex callosity. (After R. & H.)

253. ORCHELIMUM MINOR Bruner, 1891, 72. Pine Tree Grasshopper.

Size small; form slender. Usually pale reddish-brown with face, lateral lobes of pronotum and all the femora green; the usual dark brown stripe of pronotum bordered outside with a narrow yellowish one. Fastigium slender, strongly ascending, its apex but little wider than base with sides feebly rounded. Pronotum of male subsellate, of female with metazona not upturned; lateral lobes with lower margin feebly sinuate, its hind angle narrowly rounded; humeral sinus distinct but shallow. Tegmina short, scarcely reaching tips of hind femora, very slightly shorter than wings, male, surpassing the femora 1.5 mm. and exceeded by wings the same distance, female. Cerci as in key and Fig. 183, *a*, their apical portion feebly concave within, the tip obtuse. Ovipositor broad, three-fourths as long as hind femora, but slightly falcate, Fig. 184, *e*. Length of body, ♂, 15—16.5, ♀, 15.4—19; of pronotum, ♂, 4.2—4.5, ♀, 4.2—5; of tegmina, ♂, 15—16.5, ♀, 14.8—17.5; of hind femora, ♂, 13.2—14, ♀, 14—15; of ovipositor, 11 mm. (Fig. 186, *a*.)

Lakehurst, N. Jer., Sept. 4—6 (*Davis*); Tappahannock, Va., Sept. 14, 22 (*Fox*). A small species of eastern distribution, ranging from central New Jersey to Georgia and west as far as the mountain valleys of North Carolina, at an elevation of 2,500

feet, and the vicinity of Washington, D. C. Bruner's type was from the District of Columbia and was very briefly described. It appears to be a pine-loving arboreal species and Davis (1904) has given an interesting account of its habits from which I quote as follows:

"Those who visit the pine-barrens of New Jersey know what a pleasure it is to ramble along the narrow wooded-paths among the pine trees; old paths that after once being made continue for many years, and may seldom entertain a pedestrian. Along these paths and by the side of the sandy roads, any time during late summer and until frost, one may hear a faint, lisping little song from a grasshopper coming from the pines, often from their topmost branches. It is an easy matter to climb the pitch-pine, which is usually arranged admirably for the purpose, and the grasshopper is also friendly to investigation, and commonly continues to stridulate.

"Two stout insect-nets clapped together suddenly about the center of the music will often disclose the grasshopper in one of them, but not always. He is a tree-loving insect, and being subject to the tossings of the wind, holds on tighter than most grasshoppers that I have had dealings with. It is, in fact, the only arboreal *Orchelimum* that I have found in New Jersey.

"Sometimes *Orchelimum minor* can be observed on the low branches of a pine especially if the tree stands in the open, and the insect may occasionally be beaten into an umbrella. When the trunks of the pines are 'sugared' for moths the little *minor* also attends, and, like many other members of the genus, it is active and musical both by day and night."

Of its habits in Georgia Allard (1910b, 35) wrote: "Its notes are a succession of brief, feeble, silken lisps followed by a pause about as long, then repeated *s-s-s-s-s—s-s-s-s-s—s-s-s-s-s*. I hear it during the warm, sunny hours of the day, even in the high-crowned pines around my house. So faint and fugacious are its notes that it is probably never identified by ordinary ears. If a good breeze is blowing, the feeble lisps are lost amidst the sighing and rustle of the pines upon which they dwell. In no manner do the notes to me recall those of any other *Orchelimum*. The short staccato lisps so characteristic of the songs of most *Orchelimums* are entirely wanting and the tone quality more nearly resembles the leg and wing stridulations of some of the *Stenobothri* than the *Orchelimums*."

254. *ORCHELIMUM CONCINNUM* Scudder, 1862, 452. Dusky-faced Meadow Grasshopper.

Size medium for the genus; form slender. Color variable, fresh specimens usually with tegmina and wings translucent pale brown, tinged with green on costal margin; sides of pronotum and abdomen, and all the femora, pale green; tibiæ and tarsi of a brownish hue; face yellowish-white.

with a dark reddish-brown stripe the width of labrum, starting with mouth and passing upward to vertex, where it narrows to the width of that organ; then, broadening on occiput, passes back to front border of pronotum, where it divides into two narrow streaks which enclose a whitish area and extend slightly onto metazona; subgenital plate of male yellow; basal third of ovipositor dark brown, the remainder pale reddish-brown. Fastigium short, feebly ascending, its apical portion slightly wider than base with sides and apex rounded. Pronotum short, metazona but slightly ascending, male, not at all, female; lateral lobes with lower margin feebly sinuate, its hind angle rounded. Tegmina narrow, tapering; slightly shorter than wings and of a delicate texture. Hind femora slender, shorter than the closed tegmina, unarmed beneath or very rarely with one or two spines on the outer carina. Cercus of male longer than subgenital plate, tapering to a

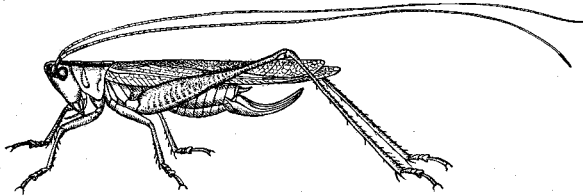


Fig. 185. Female.  $\times 1.5$ . (Original.)

dull point; its tooth short, erect, with a broad base and very sharp, slightly bent point (Fig. 183, b.) Ovipositor of less than average width, about half the length of hind femora, its apical half with a gentle upward curve. Length of body,  $\delta$  and  $\text{q}$ , 16.5—18; of pronotum,  $\delta$ , 4—5.5,  $\text{q}$ , 4—5; of tegmina,  $\delta$ , 19—23,  $\text{q}$ , 17—24; of hind femora,  $\delta$ , 14—16,  $\text{q}$ , 13.5—17; of ovipositor, 7.5—8.2 mm. (Fig. 185.)

In northern Indiana this graceful and prettily marked species is quite common among the rank grasses and sedges growing about the margins of tamarack swamps and lakes, where it reaches maturity about July 20th. It occurs also in small numbers about a large marsh in Marion County but has not been taken in the southern part of the State.

R. & H. (1915a, 60) have restored the *O. concinnum* of Scudder as a valid species and have made my *indianense* (1893c, 90) and six other forms synonyms of it. They are probably correct as regards *indianense*, although Scudder gave an opinion that it was a new form before it was originally described. In his later writings Scudder regarded his *concinnum* as a synonym of *herbaceum* Serv. (1839, 524), a name which R. & H. have placed with a question mark under their *O. fidicinium*, adding: "We have no definite proof that *herbaceum* is the same as *fidicinium* and, until we have some positive information of this sort we do not care to replace a well understood name by another of doubtful status." It would have been better if the same course had been followed with *O. agile*, *glaberrimum*, *nitidum* and *laticauda*.

Scudder's types of *concinnum* were from Cape Cod, Mass., and the species, as determined by R. & H., ranges from southern New

England and Ontario west to northern Michigan, southeastern Minnesota and central Montana and south and southwest to Florida, Mississippi, central Texas and New Mexico.

In Florida it has been taken by me at Dunedin in December and January from tall grasses about the margins of shallow ponds where it occurs in company with *Leptysmia marginicollis* and *Conocephalus gracillimus*. It has also been recorded from scattered localities throughout the State, but the adults were usually scarce, though Hebard (1915b) says that "In July the marshes of the region about Miami swarm with the young."

Under the name of *O. indianense* Walker (1905, 37) recorded it as common in August near Sarnia, Ont., in a large tract of open grassy land, and also as found in marshes at Arner and on Walpole Island. R. & H. (1915a, 65) state that: "From the eastern States we know of no correct record of the occurrence of the species at a locality away from the general vicinity of the coast." In Virginia Fox found it abundant among the grasses and sedges of the tidal marshes.

254a. *ORCHELIMUM CONCINNUM CAMPESTRE* Blatchley, 1893c, 91.

Differs from typical *concinnum* in its slightly larger, more robust form, generally paler color, the ground hue being more often green than pale brown, uniform green face, longer, more narrow and less tapering tegmina and relatively longer and more slender hind femora. Length of body, ♂, 17.5, ♀, 19; of antennæ, 46; of pronotum, ♂, 4.2—4.5, ♀, 4.5—5; of tegmina, ♂, 21—24, ♀, 20—25; of hind femora, ♂, 16—17, ♀, 16—17.5; of ovipositor, 7—7.5 mm.

While this form agrees with *concinnum* in the size and shape of the male cerci, it differs sufficiently in the characters given to justify at least a varietal name. In Indiana it is frequent as far south as Knox County, inhabiting for the most part upland blue-grass pastures and the tall grasses of the dryer prairies and being seldom, if ever found about the lakes and marshes in company with typical *concinnum*. I have taken it at Buffalo, N. Y., on Sept. 4, and it has been definitely recorded from Ontario, Ohio, New Jersey, Illinois and Minnesota. It is also known (Fox Ms.) to occur near Clarksville, Tenn.

254b. *ORCHELIMUM CONCINNUM DELICATUM* Bruner, 1892a, 264. Delicate Meadow Grasshopper.

Smaller and more slender than *O. concinnum*. Color much the same, the face without a dark stripe. Pronotum shorter and narrower, the hind margin of metazona more rounded; lateral lobes less deep, the humeral sinus more evident. Stridulating field narrower, the cross-vein shorter, more slender. Subgenital plate of male narrower, more strongly keeled be-



neath. Ovipositor very feebly curved above, distinctly longer and broader than in *concinnum*, its lower margin more strongly tapering to the acute point (Fig. 184, *f.*) Length of body, ♂, 16, ♀, 17.5; of antennæ, ♂ and ♀, about 50; of pronotum, ♂, 3.8, ♀, 4; of tegmina, ♂, 19, ♀, 20; of hind femora, ♂, 14, ♀, 15; of ovipositor, 10.5—13 mm.

Lincoln and West Point, Neb., September (*Bruner*); Starke and Marshall counties, Ind., July 30—Aug. 20 (*W. S. B.*). I cannot follow R. & H. (1915a, 60) in making this a synonym of *concinnum*. If the size and form of the ovipositor is of any value whatever in separating the females of this genus (and they have used its variations as the principal differential character in their key to the females) its greater length and distinctly straighter form in *delicatum* at once separate it from *concinnum* or its variety *campestre*. In order to accommodate their synonymy R. & H., in this key to females, have had to lead up to *concinnum* in two different places, as when *delicatum* was included with it it would not go under "Ovipositor less than half the length of caudal femur." The differences as given in key and above are sufficient to retain it as a distinct variety.

This *Orchelimum* was described from West Point and Lincoln, Nebr., where Bruner found it common about the margins of ponds and along the edges of streams, also at electric lights. In Indiana it has been noted only in Marshall and Starke counties, where a half dozen specimens were secured in lowland meadows near large lakes on July 30 and August 20, 1902. It probably occurs throughout the lake region of the northern third of the State and is not elsewhere recorded east of Nebraska.

The *O. gracile* Bruner (1891, 70), a preoccupied name, is a synonym.

255. ORCHELIMUM SUPERBUM Rehn & Hebard, 1915a, 76. Superb Meadow Grasshopper.

Size large for the genus; form robust, subcompressed. Pale green; tegmina, basal third of hind femora, and sometimes the fore and middle femora, pale brown; dorsal stripes on prozona chocolate-brown, bordered without by paler; abdomen brown above, dull yellow beneath; tibial spines black, pale at base. Fastigium stout, scarcely ascending, but slightly narrowed at base, rounded at apex. Antennæ twice or more as long as body, the basal joint with a rounded tubercle within. Pronotum distinctly subsellate, male, faintly so, female, lateral lobes as long as deep, their lower margin very oblique, its hind angle narrowly rounded; convex callosity elongate, narrow. Tegmina surpassing hind femora about 9 mm., exceeded by wings 4 mm., their tips narrowly rounded. Stridulating area of male shorter and no wider than disk of pronotum, its main vein nearly transverse. Cercus as in key and Fig. 183, *c*, its middle third robust and inflated, apical third subdepressed and apparently twisted, the tooth stout,

its tip very sharp and bent. Apex of subgenital plate subtruncate; styles slender, cylindrical, obtuse. Ovipositor stout, distinctly though not strongly falcate, the lower margin of apical half strongly tapering to the acute apex. Length of body, ♂, 19.6—24.6, ♀, 24; of pronotum, ♂, 5—6, ♀, 7.5; of tegmina, ♂, 22—25.4, ♀, 28; of hind femora, ♂, 16—18, ♀, 19; of ovipositor, 10 mm. (Fig. 186, b.)

Tappahannock, Va., July 6; Morristown, N. Jer., July 9 (Fox). The types were taken by Fox in a bog among clumps of fern, *Woodwardia virginica* (L.) near Winslow Junction, N. Jer. The species is known only from a few localities in New Jersey and at Tappahannock, Va., where it was found on the three-square rush, *Scirpus americanus* Pers. in tidal marshes. Two of the Virginia specimens had the outer lobes of the hind knees bispinose instead of unispinose as in the types, thus showing that this character has little if any differential value.

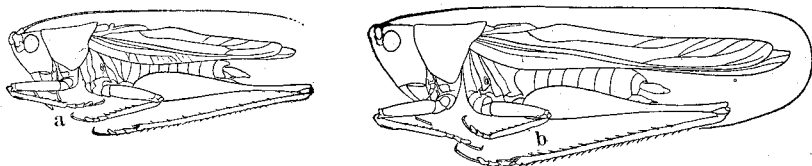


Fig. 186. a, Outline of male of *O. minor*; b, same of *O. superbum*.  $\times 1.8$ . (After R. & H.)

#### 256. ORCHELIMUM FIDICINIUM Rehn & Hebard, 1907, 309.

Size small to medium for the genus; form slender. Pale green, fading to brownish or clay-yellow; occiput with a median dark brown stripe, this usually extending back, but broken and paler, to metazona; fore and middle femora often mottled with numerous small purplish dots; hind tibiae and all the tarsi reddish-brown. Fastigium rather stout, feebly elevated above the occiput, its sides subparallel and apex rounded. Antennæ about three times the length of body. Pronotum with metazona on same plane as prozona, its hind margin very broadly rounded; lateral lobes with lower margin oblique, its hind angle obtusely rounded. Tegmina surpassing tips of femora 1.5 mm., exceeded by wings 2 mm., their tips narrowly rounded. Hind femora usually armed on outer lower carina with one to four spines. Cerci as in key and Fig. 183, d, the tooth strongly recurved, acute; notch of subgenital plate, broad, shallow; styles short, stout, obtuse. Ovipositor more than half the length of tegmina and extending beyond their tips, very feebly curved, tapering beyond the middle to an acute apex (Fig. 184, b.) Length of body, ♂, 16—18.5, ♀, 16—19; of pronotum, ♂, 3.8—4, ♀, 4—4.5; of tegmina, ♂, 17—21, ♀, 21—22; of hind femora, ♂, 14—16, ♀, 16.8—17.5; of ovipositor, 10—11.5 mm.

Tuckerton, N. Jer., Sept. 1 (Davis); Ocean View, N. Jer., and Whitestone, Va., Aug. 30, Sept. 26 (Fox), Described from Cedar Keys, Fla., where 20 or more specimens were taken by R. & H. August 15, from among tall grasses in the flooded salt marshes.

Not known elsewhere from that State. The hind femora in the original description were said to be unarmed, and Davis (1908, 223) therefore redescribed this species as *O. crusculum* from specimens taken at Tuckerton, N. Jer., and on Staten Island, N. Y., most of which had the femora armed. Since that date it has been found at numerous places along the coast from Long Island to south Georgia. It occurs for the most part among the tall marsh grasses, *Spartina*, and rushes, *Scirpus*, growing on the tidal flats and in the adjoining brackish marshes.

257. ORCHELIMUM MILITARE Rehn & Hebard, 1907, 311. Military Meadow Grasshopper.

Size medium for the genus; form moderately slender. Green fading to clay-yellow; head dull yellow, sometimes brick red or with a reddish stripe down middle of face; occiput and prozona with two more or less distinct reddish-brown divergent lines. Fastigium feebly ascending, longer than broad, narrower at base than apex, the latter rounded. Antennæ three and one-half times the length of body. Metazona feebly ascending, male, not at all, female, finely punctate; lateral lobes with lower margin short, very oblique, its hind angle obtusely and narrowly rounded; convex callosity prominent, elliptical. Tegmina very narrow, surpassing hind femora 3 mm., exceeded by wings 2 mm., their tips narrowly rounded. Cerci as in key and Fig. 183, *e*, their tips divergent and tooth directed strongly toward base of shaft; subgenital notch widely V-shaped. Hind femora unarmed, rarely with one or two spines beneath. Ovipositor straight and subequal in width to apical fourth, thence tapering and slightly upcurved to the very acute apex (Fig. 184, *c*.) Length of body, ♂ and ♀, 18–22; of pronotum, ♂ and ♀, 4.5–5; of tegmina, ♂, 23–25.5, ♀, 24–25.4; of hind femora, ♂, 17–17.8, ♀, 17.5–18; of ovipositor, 15.2 mm.

LaGrange, Fla., Sept. 13 (*Davis*). Described from three specimens taken Aug. 17 at Gainesville, Fla., from a marshy sinkhole in pine woods. Other recorded localities in that State are Jacksonville, Atlantic Beach, Crestview and Detroit. The known range of this trim-bodied species extends from Speedwell, N. Jer., south to southern Florida, Nugent, Miss., and southeastern Louisiana. It is an inland species, found for the most part among grasses in open pine woods and along the borders of marshes and lakes.

258. ORCHELIMUM VOLANTUM McNeill, 1891, 26. Nimble Meadow Grasshopper.

Size medium or above; form moderately robust. Pale translucent brownish-green; lower half of lateral lobes and meso- and metapleura brighter green; occiput and prozona usually with two dark stripes which are feebly divergent; hind tibiæ and ovipositor pale reddish-brown. Fastigium narrow at base, moderately ascending, its apical portion wider with sides rounded. Pronotum short, subsellate in male; lateral lobes as long

as deep, both their hind and lower margins oblique and meeting in a rounded angle; humeral sinus distinct but broad and rather shallow (Fig. 184, *d.*) Tegmina surpassing hind femora about 2 mm., exceeded by wings 3 mm., those of female strongly reticulate. Hind femora rather short and stout, armed beneath with one to four very short spines. Cerci as in key and Fig. 183, *f*, the tooth with base broad and flat. Apex of subgenital plate subtruncate, styles short and very slender. Ovipositor very similar to that of *O. gladiator*, being very long and stout, nearly straight above, the under side regularly curved, its apical third sloping rapidly to an acute apex. Length of body, ♂, 17—20, ♀, 20—25; of pronotum, ♂, 3.7—4.5, ♀, 4—5; of tegmina, ♂, 19—24, ♀, 24—30; of hind femora, ♂, 15—16.5, ♀, 17—19; of ovipositor, 9—10.5 mm.

In Indiana *volantum* has been taken in Vigo, Fulton, Marshall and Starke counties. It is found most abundantly during August and September on the leaves and stems of a tall, broad-leaved knot-weed, *Polygonum amphibium* L., which grows luxuriantly in the shallow waters about the margins of the larger ponds and lakes. Several other "green grasshoppers," notable among which are *Conocephalus attenuatus* (Scudd.) and *Orchelimum nigripes* Scudd., frequent this plant in large numbers. Keeping company with them an occasional specimen of *O. volantum* is seen, but,

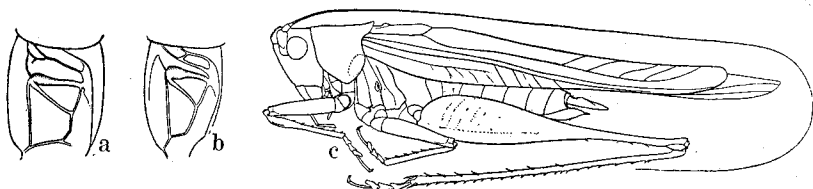


Fig. 187. a, Outline of stridulating field of male of *O. militare*; b, same of *O. volantum*,  $\times 3$ ; c, outline of male type of *O. bradleyi*,  $\times 1.8$ . (After R. & H.)

being an active leaper, it often escapes amidst the dense foliage of the knot-weed before its capture can be effected. Its less robust body, longer armed posterior femora and long tegmina readily distinguish the female of this species from *O. gladiator*, the only other Indiana form which has an ovipositor shaped like that of *volantum*. The *O. bruneri* Blatchley (1893c, 92) is a synonym.

The known range of typical *O. volantum* is rather limited, extending from Sarnia, Ont., and northern Ohio west to eastern Nebraska and south to central Indiana and Douglas Co., Kansas. McNeill (1891,) took his types "from a clump of rank growing *Sagittaria variabilis* Englm., on the banks of Rock River, Henry Co., Ill., being attracted to them by their peculiar stridulation." Their song, he says, "had a new note in it and may be represented as follows: *zip-zip, kr-ze-e-e, kr-ze-e-e*, the last part of the song not lasting more than a half to three-quarters of a second and always preceded by the sound which I represent imperfectly by *kr*."

Walker (1905, 38) found *volantum* very abundant in southern Ontario where it occurs among the rushes and *Sagittaria*, growing in open marshes bordering the streams. He says: "McNeill has well represented its song, but I have never noticed the preliminary *zip-zip*."

259. ORCHELIMUM BRADLEYI Rehn & Hebard, 1915a, 73. Bradley's Meadow Grasshopper.

Very similar to *O. volantum*. Differs in its larger size, with fore and middle femora more distinctly tapering and basal two-thirds of hind femora more swollen. Male with cercus differing as described in key, the dorsal surface of the shaft inflated near middle and with a curved carinate ridge on basal half. Ovipositor more than half the length of hind femora, its apical half gradually narrowing to apex; upper margin nearly straight, the lower one straight from base to middle (Figs. 183, 184, *g.*) Length of body, ♂, 23.2—25, ♀, 21.5—23.6; of pronotum, ♂, 4.8—5, ♀, 4.9—5.2; of tegmina, ♂, 25.7—27.7, ♀, 26—28.9; of hind femora, ♂, 19—20, ♀, 18.9—21.2; of ovipositor, 10.4—11.5 mm. (Fig. 187, *c.*)

Dunedin, Fla., June 10 (*W. S. B.*); Wilmington, N. Car., Aug. 1 (*Davis.*) Ranges from southeastern North Carolina south to central western Florida and inland as far as the Okefenokee Swamp of southern Georgia. In Florida it is known only from Jacksonville, Tallahassee and Dunedin. Dr. J. C. Bradley, who collected the types, furnished the following notes to R. & H. regarding their habits:

"In the eastern half of the Okefenokee Swamp are extensive so-called prairies. These are really inundated plains grown up with sawgrass and maiden-cane, or in places open shallow lakes covered with a multitude of water plants. The natives of the Okefenokee told us of diving grasshoppers which lived on these prairies, and in making the trip to the Chase Prairies in September, 1913, I found these grasshoppers in great abundance in the grass-like plants growing out of the water or along the banks of the old canal. As the boat approached them they jumped from the grass into the water, completely disappearing, and so quick were they to do this when alarmed that it was only after some difficulty that I succeeded in catching a series of specimens."

This aquatic habit is also recorded by Engelhardt<sup>68</sup> who says: "Of interest is the aquatic habit of *Orchelimum volantum* which was abundant about the grassy borders of Greenfield Pond near Wilmington, N. Car. When pursued and hard pressed it would dive into the water and cling to the submerged grass stems or the under side of a water-lily leaf, where it remained for several minutes, sustained by a supply of air which showed in glistening

<sup>68</sup>Journ. N. Y. Ent. Soc., XVIII, 1910, 130. The first records of *O. bradleyi*, R. & H. (1911) and Sherman and Brimley (1911) were made under the name of *volantum* McNeill, to which it is very closely allied and of which it may prove to be only a southern race.

bubbles adhering to its body." R. & H. (1915a, 71) have recorded *O. militare* as having a similar habit, and it may be quite common among the subaquatic species of the genus.

VI. CONOCEPHALUS Thunberg, 1815, 271. (Gr., "conical" + "head")

THE SMALLER MEADOW GRASSHOPPERS.

This genus, the *Xiphidion* or *Xiphidium* of most recent writers and of my former work (1903, 371), comprises the smallest of our winged Tettigoniidæ. The genus is very close to *Orchelimum*, the characters given in the generic key, p. 534 being the principal ones used for their separation. In addition, as stated by R. & H. (1915b, 156), in *Conocephalus* "the stridulating field of the male tegmen is normally smaller, narrower and less extensive than in *Orchelimum*, the vicinity of the arcuate vein not strongly produced or overhanging and, when looking from the dorsum, the humeral trunk is never hidden. The male cerci, though variable, do not in any of our species, exhibit the type found in the majority of the species of *Orchelimum* in which the tooth is placed in a more or less decided socket-like depression. All of the American species have the cerci unispinose and the subgenital plate is truncate distad in the great majority of them." The ovipositor is for the most part straight and often of great length, though distinctly curved in *C. nemoralis* and evidently though faintly so in a few other forms. As already noted under *Orchelimum*, all these minor differences are comparative only, there being not a single fixed differential character to distinguish the two genera. Their separation in literature is therefore really more a matter of convenience for treatment of an otherwise very bulky aggregation of forms than a natural grouping of allied insects.

The tegmina and wings of most of the species of *Conocephalus* are dimorphic in length. A smaller number are dimorphic in color, while a few possess ovipositors differing greatly in length. The variations in wing length and color in the same species seem to be abrupt, with no intervening forms. There are long-winged and short-winged forms of the same species, but none with the wings of medium length; and when a brown form is tinged with green, or *vice versa*, the amount of the different color varies but little. Ten of the 13 eastern species are thus dimorphic as regards the length of the wings, the short-winged individuals, as far as my observation goes, far outnumbering those with the wings fully developed. All the macropterous forms have the wings sur-

passing the tegmina 2 to 4 mm., while in the brachypterous forms the tegmina are as long as or longer than the wings. Of the variations in the length of the tegmina Bruner (1891, 59) has well said: "In the genera *Xiphidium* and *Orchelimum* wing length is a character not to be relied upon as a specific or even varietal difference"; yet Redtenbacher, in his "Monographie der Conocephaliden," separated a number of his species by this character alone, and I can find no mention in his work of the fact that such a variation exists.

The majority of the inland species of *Conocephalus* are more xerophytic in habitat than those of *Orchelimum*, occurring for the most part in dry upland localities rather than in marshes or about the margins of lakes and streams. The borders of cultivated fields, orchards and gardens, edges of thickets and clumps of vines or briars in open woodland are their favorite abiding places. The call notes of the males are in general lower, softer and more lisping than those of the same sex of *Orchelimum*. Allard, (1914) writes of these notes as follows:

"Very noticeable differences in the manner of stridulation characterize many of the species of *Xiphidium*. According to the character of the notes these insects may be grouped into three classes. Those of the first class always produce a few, brief staccato lisps followed by a more or less prolonged, lisping, monotone, or in the case of *X. nemorale* the staccato lisps precede from two to thirty-two brief phrases rapidly repeated. A number of *Xiphidions* in this class stridulate in quite the same manner as the more common species of *Orchelimum*. Although barely audible, the stridulations of *X. fasciatum* in delivery and duration are an almost perfect reproduction of the staccato lisps and succeeding monotone characteristic of *Orchelimum vulgare* or *O. molossus*.

"The notes of *Xiphidions* in the second class consist of weak, lisping phrases alone, as staccato lisps are quite wanting. The stridulations of *X. allardi* are of this character. Among the *Orchelimums* this is also the habit of stridulation of *O. minor*. In the stridulations of *Xiphidions* of the third class, staccato lisps are also wanting, but the note is a long-continued, lisping monotone, similar to that of some of the cone-headed grasshoppers, although not nearly as loud and penetrating. *X. strictum* stridulates in this manner."

The reasons for the replacement of the well known generic name *Xiphidium* by *Conocephalus*, a name formerly used for the large cone-heads now placed under *Neoconocephalus*, are set forth by Caudell (1910a) and by R. & H. (1915b, 156), as follows: "In 1815 Thunberg erected the genus *Conocephalus* including in it 24 species; under one of these *C. hemipterus* (p. 272) he placed as a synonym *Locusta conocephalus* of Fabricius, which citation

forms, under the International nomenclature rules, type designation by tautonomy and in consequence the species becomes the type of the genus *Conocephalus*.<sup>69</sup>

Kirby (1906, 274) did not adopt this ruling but included the species formerly known as *Xiphidion* Serv. (1831) and *Xiphidium* Burmeister (1838) under the name *Anisoptera* Latreille (1829) which has priority over both. While I personally believe that the International ruling in this case is technical, arbitrary and nonsensical, I have followed it for two reasons. (a) It has been adopted by R. & H. in their synopsis of the genus and by other recent American writers, and not to adopt it would cause more confusion than even now exists. (b) If not adopted the name *Anisoptera* would have priority over *Xiphidion* and *Xiphidium* and a change of name would anyhow be necessary.

The genus *Conocephalus* as here recognized comprises a large number of species and is represented in all parts of the world. Kirby included 91 species under *Anisoptera*, 14 of which were from the United States, but of these several are known synonyms. Since his catalogue appeared seven additional species have been described by Caudell, R. & H. and Fox. In their synopsis of the North American forms R. & H. recognized 16 species and one variety. Of these 13 occur in the territory covered by this work. The portions of the following key pertaining to the male cerci and other characters of that sex are based largely on the key of R. & H. in their synopsis which was for the males only.

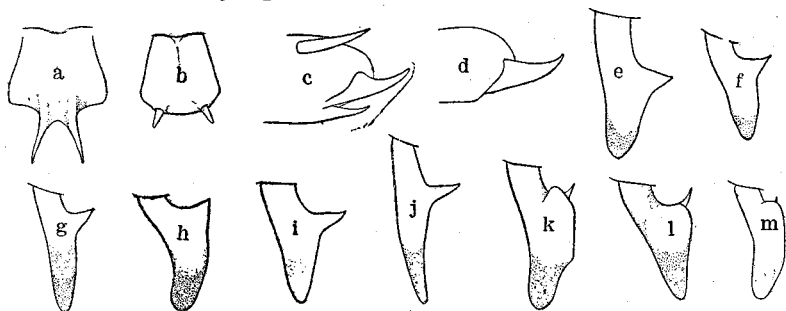


Fig. 188. Outlines of subgenital plates of males of *Conocephalus*. a, *allardi*; b, *fasciatus*,  $\times 5.5$ . Extremities of hind tibiae of *Conocephalus*,  $\times 20$ . c, *fasciatus*; d, *saltans*. e—m, Outlines of male cerci of *Conocephalus*,  $\times 10$ . e, *allardi*; f, *fasciatus*; g, *gracillimus*; h, *brevipennis*; i, *nemoralis*; j, *strictus*; k, *stictomerus*; l, *aigialus*; m, *nigropleurus*. (After R. & H.)

#### KEY TO EASTERN SPECIES OF CONOCEPHALUS.

a. Hind tibiae armed at apical extremity with three pairs of spurs (Fig.

<sup>69</sup>Caudell (Ms.) also states that the properly designated type of *Xiphidion* has been proven to be congeneric with the *Gryllus* (*Tettigonia*) *conocephalus* of Linnaeus, of which *Conocephalus hemipterus* Thunberg, the type of the genus *Conocephalus* is a synonym. As we cannot change the type of *Xiphidion* and its type is in the older genus *Conocephalus*, it falls in synonymy under that genus.



- 188, *c*); prosternum bispinose; tegmina (except in female of *strictus*) always distinctly longer than the pronotum.
- b*. Apex of subgenital plate of male emarginate and armed with two strong, straight, feebly divergent spines (Fig. 188, *a*); styles absent; ovipositor longer than hind femora. 260. ALLARDI.
- bb*. Apex of subgenital plate of male not emarginate, usually truncate, unarmed; styles present, small and filiform (Fig. 188, *b*); ovipositor variable in length.
- c*. Cerci of male armed on inner margin near middle with a stout tooth, the base of which is plainly visible from above (Fig. 188, *e—j*); hind femora very rarely armed beneath.
- d*. Apical portion of cerci more or less depressed, its apex broad and rounded (Fig. 188, *e—h*); smaller and more slender, length of body, female, rarely over 14 mm.
- e*. Tegmina always fully developed and longer than abdomen, exceeded by wings 2 to 3 mm.; form very slender; cerci of male slender, not strongly flattened on the inner side.
- f*. Fastigium broader at apex than base, but slightly produced in front of eyes; abdomen feebly trifasciate, the median dark stripe broad; tympanum of male not unusually elongate; general color green. 261. FASCIATUS.
- ff*. Fastigium with sides parallel or nearly so, produced in front of eyes a distance equal to width of eye; abdomen distinctly trifasciate, all the stripes narrow; tympanum of male unusually elongate; general color pale brown with a pinkish tinge. 262. GRACILLIMUS.
- ee*. Tegmina and wings abbreviated, shorter than abdomen, very rarely fully developed; form more robust; cerci shorter, stouter, strongly flattened on the inner side. 263. BREVIPENNIS.
- dd*. Apical portion of cerci not at all or very weakly flattened, the apex narrow, usually acuminate (Fig. 188, *i, j*); larger, length of body, female, 15 or more mm.
- g*. Ovipositor about three-fourths the length of hind femora, its apical half with a gentle but evident upward curve (Fig. 189, *j*); cerci with apical portion short, conical, the tip rather blunt (Fig. 188, *i*); general color smoky or greenish brown. 264. NEMORALIS.
- gg*. Ovipositor always much longer than hind femora, straight or nearly so (Fig. 189, *k*); cerci with apical portion very elongate, slender, the tip subacuminate (Fig. 188, *j*); general color green. 265. STRICTUS.
- cc*. Cerci swollen at middle and armed on under side with a more slender tooth the base of which is scarcely visible from above (Fig. 188, *k—m*); apical portion of cerci strongly flattened; hind femora very rarely unarmed beneath.
- h*. Cerci with swollen middle portion abruptly strongly narrowed, not attenuate-elongate (Fig. 188, *k, l*); abdomen of male including cerci, with apical portion bright yellow in life. (Submaritime species.)

- i. Ovipositor almost straight, slightly longer than hind femora, the latter in life with prominent spots and dots of coral red (Figs. 189, *l*; 191, *b*); face orange with a vertical median reddish-brown stripe; fastigium narrow, about half the width of basal antennal joint. 266. STICTOMERUS.
- ii. Ovipositor broader, slightly shorter than hind femora, (Fig. 189, *m*), the latter without prominent reddish spots; face without median stripe; fastigium wider, about two-thirds the width of basal antennal joint. 267. AIGIALUS.
- hh. Cerci with swollen middle portion not abruptly narrowed, but gradually attenuate-elongate (Figs. 188, *m*; 189, *a*—*c*.)
- j. Sides of abdomen shining black, its upper surface dark brown; ovipositor straight, rather broad, slightly longer than hind hind femora. 268. NIGROPLEURUS.
- jj. Sides of abdomen not shining black.
- k. Ovipositor much longer than body; cerci stout, feebly tapering, their apical half curved outward and flattened portion horizontal (Fig. 189, *a*.) (Inland species.) 269. ATTENUATUS.
- kk. Ovipositor at most but slightly longer than body; cerci more slender, the apical half distinctly tapering and incurved, the flattened portion, therefore, oblique (Fig. 189, *b*, *c*.) (Submaritime species).

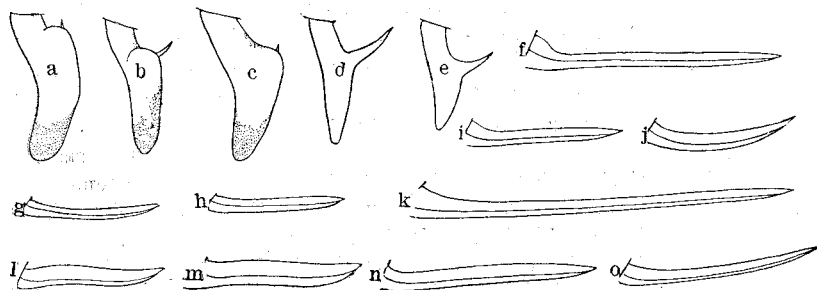


Fig. 189. *a*—*e*, Outlines of male cerci of *Conocephalus*,  $\times 10$ . *a*, *attenuatus*; *b*, *nigropleuroides*; *c*, *spartine*; *d*, *saltans*; *e*, *viridifrons*. *f*—*k*, Outlines of ovipositors of *Conocephalus*,  $\times 2$ . *f*, *allardi*; *g*, *fasciatus*; *h*, *gracillimus*; *i*, *brevipennis*; *j*, *nemorialis*; *k*, *strictus*; *l*, *stictomerus*; *m*, *aigialus*; *n*, *spartine*; *o*, *viridifrons*. (After R. & H.)

- l*. Fastigium distinctly ascending, about one-half the width of basal antennal joint, its sides parallel; lateral lobes in great part dark brown; abdomen of male (in life) with basal half dark brown above, apical half bright orange. 270. NIGROPLEUROIDES.
- ll*. Fastigium slightly ascending, two-thirds as wide as basal antennal joint, its sides feebly diverging from base forward; lateral lobes green or pale brown; abdomen of male pale brown above, its apical half pale orange. 271. SPARTINÆ.
- aa*. Hind tibiæ armed at apex with but one pair of spurs (Fig. 188, *d*); prosternum without spines; tegmina pad-like, scarcely longer than pronotum; hind femora unarmed beneath.

*m.* Face with a median reddish-brown stripe or blotch; apical portion of male cercus (beyond the tooth) longer than basal portion, distinctly incurved or twisted, its inner face near tip flattened, the tooth bent inward and downward (Fig. 189, *d.*)

272. SALTANS.

*mm.* Face a pale uniform green; apical portion of cercus short, conical, not twisted or flattened within, the tooth stouter, horizontal or nearly so (Fig. 189, *e.*)

273. VIRIDIFRONS.

260. CONOCEPHALUS ALLARDI (Caudell), 1910, 58. Allard's Meadow Grasshopper.

Size medium for the genus; form robust. General color green; head and pronotum with a dark stripe extending from vertex to hind margin of metazona, less distinct posteriorly; tegmina pale brownish-green, male, uniform green, female; hind femora spotted with reddish-brown, the knees fuscous; dorsum of abdomen including cerci dark brown. Fastigium feebly ascending, its greatest width about two-thirds that of basal joint of antennæ. Lateral lobes of pronotum very broad, their front margin straight, oblique and broadly rounded into the lower one which is nearly horizontal, its hind angle narrowly rounded; humeral sinus obsolete; convex callosity very broad. Tegmina covering three-fourths of abdomen, male, one-half, female, their tips broadly rounded. Hind femora unarmed beneath. Cerci of male stout, the tooth triangular, flat and broad at base, the apical portion of cercus behind it about twice as long as the basal width, the apex depressed, concave (Fig. 188, *e.*) Ovipositor straight, its apical fourth abruptly tapering (Fig. 189, *f.*) Length of body, ♂, 12, ♀, 15; of pronotum, ♂ and ♀, 3—3.4; of tegmina, ♂, 6.5, ♀, 5; of hind femora, ♂, 11.5—12.5, ♀, 13; of ovipositor, 15—17 mm.

Caudell's types were taken by Allard on Tray Mountain, North Georgia, at an altitude of 4,309 feet. Known elsewhere only from Wytheville, Va., and Rabun Co., Georgia. Of the type specimens Allard furnished Caudell the following notes:

"I first heard and captured specimens of this *Xiphidion* late in September, in a sunny, grassy spot in the woods at Indian Grave Gap, Towns County, North Georgia. A few days later I found it in similar sunny, open situations on Tray and Blue Mountains, in the immediate vicinity of Indian Grave Gap. It prefers the low weeds and short grass, and was very musical during the sunny hours of the day. Its song is strikingly unlike the notes of *Xiphidion fasciatum* or *Xiphidion nemorale*, as no staccato notes whatever precede the more or less prolonged lisping phrases. These phrases are soft, faint and often greatly prolonged. In sound quality they recall to mind the notes of *Orchelimum minor*."

261. CONOCEPHALUS FASCIATUS (DeGeer), 1773, 458. Slender Meadow Grasshopper.

Size small for the genus, form very slender. Face, sides of pronotum

and abdomen, and basal portion of ovipositor, green; tegmina and apical third of ovipositor pale reddish-brown; upper side of abdomen, and stripe on occiput and disk of pronotum darker brown; legs green, tarsi tinged with fuscous. Fastigium not ascending, its sides feebly diverging from base forward. Lateral lobes deeper than long, lower margin strongly oblique, its hind angle narrowly rounded; humeral sinus obsolete; convex callosity low, narrow. Tegmina surpassing hind femora 1 to 2 mm., exceeded by wings 2 to 3 mm. Cerci as in key and Fig. 188, *f*. Subgenital plate of male truncate. Ovipositor straight, about two-thirds as long as hind femora. Length of body, ♂, 12—13.5, ♀, 12—14.5; of pronotum, ♂, 3—3.5, ♀, 2.8—3.2; of tegmina, ♂, 14—18, ♀, 15—19; of hind femora, ♂, 11—12, ♀, 11.5—13; of ovipositor, 7.3—9.4 mm.

This handsome little meadow grasshopper is abundant throughout Indiana in timothy and clover meadows and especially so about small streams in low-ground, blue-grass pastures. It is one of the first of the Tettigoniidæ to reach maturity, specimens having been taken in Vigo County as early as July 5, and it may be found until mid-October. In Florida it is also a common species having been taken by me at Gainesville, Lakeland and Dunedin, Oct. 24—Jan. 26, and recorded by other collectors from numerous stations, as far south as Miami and Detroit, but not from the southern keys. About Dunedin it occurs in old fields, along railway embankments and among the undergrowth in open pine woods. If no frosts occur adults are found until midwinter, and nymphs are very frequent in March and April.

The known range of *C. fasciatus* is probably the widest of any American Tettigoniid, extending from New England and Nova Scotia north and west to Aweme, Manitoba, Wyoming and New Mexico, and south at least to Bermuda, southern Florida and northern Mexico. Piers (1918, 324) records it as very common throughout Nova Scotia, where it is the only true meadow grasshopper known. He says: "It frequents damp situations such as wet meadows and marshes and is found among moist thick patches of succulent and rank-growing grasses. Adults are met with from the middle of July until after hoar-frosts. The stridulation of the male is rather weak and to me sounds like the syllables, *plee-e-e-e-e*, *tzit, tzit, tzit, tzit*, the first part of the call being a rapid, vibrating note." Walker (1904, 338) says it is much the most abundant locustid found in Ontario, being as abundant at North Bay as along the southern boundary, adults appearing about mid-July and remaining until October.

Allard (1911) notes its habits in New England as follows: "The tiny *Xiphidium fasciatum* DeGeer prefers the tangles of weeds and grasses bordering the grass fields, and may oftentimes

be found in large colonies. Its notes are extremely faint and in manner of delivery are the exact counterpart of an *Orchelimum's* notes. The staccato lisps nearly always precede the phrase *tseeeeeeeeeeeeeeee*. The entire song may be written thus: *Tip-tip-tip-tseeeeeeeeeeeeeeee*. The entire stridulation is so faint as to almost escape the hearing. The staccato lisps *tip-tip-tip* were so feeble the writer could hear them only by the closest attention, although the wings could be seen in motion at the time."

McNeill (1891, 24), writing of it about Moline, Ill., says: "It is abundant everywhere, in blue-grass meadows especially. Its song is a faint echo of that of *Orchelimum vulgare*, with the 'zip-*zip*' omitted. It is, I believe, the first of the green grasshoppers to reach maturity and its faint little quaver is the first note of the great chorus that sounds in all the meadows from mid-July until the first of October."

The *Orchelimum gracile* Harris (1841, 131) is placed by R. & H. as a synonym of *C. fasciatus*, although not so considered by Bruner (1892a, 265) and not so figured by Harris, *loc. cit.*

262. CONOCEPHALUS GRACILLIMUS (Morse), 1901, 236. Graceful Meadow Grasshopper.

Size and form of *fasciatus*. Pale brown; face and sides of abdomen usually greenish; occiput and disk of pronotum with a conspicuous dark brown median stripe; lateral lobes often also with a median dark stripe; abdomen usually with three narrow dark stripes, one above and one each side, the intervening spaces yellowish. Fastigium very narrow, feebly ascending, its sides very faintly divergent. Disk of pronotum subsellate, male, not at all, female; lateral lobes slightly longer than deep, subtriangular in outline, their front and lower margins continuous with a scarcely visible angle, lower hind angle narrowly rounded; humeral sinus distinct, shallow; convex callosity broad. Tegmina fully developed, very narrow, surpassing hind femora about 1.5 mm., exceeded by wings 2—3 mm., their tips narrowly rounded. Hind femora very slender, unarmed. Cerci as in Fig. 188, *g*, more elongate than in *fasciatus*, their apical third strongly depressed. Ovipositor straight, about two-thirds the length of hind femora the apical half tapering evenly to an acute point (Fig. 189, *h*.) Length of body, ♂, 12—14, ♀, 13—15; of antennæ, 40—58; of pronotum, ♂, 3, ♀, 3.2; of tegmina, ♂, 14.5—17, ♀, 17—18.5; of hind femora, ♂, 10.5—12, ♀, 12—13; of ovipositor, 8 mm.

Biscayne Bay, Miami, Cape Sable, Key West, Ft. Myers, Passe Grille and Dunedin, Fla.; Dec. 12—March 14 (*W. S. B.*). The types of Morse were from Capron and Biscayne Bay, and the species is recorded from numerous localities in the southern half and on the southern keys of Florida to which region it is apparently confined. About Dunedin it is found in small numbers throughout the winter, on both Hog Island and the mainland,

occurring mostly in the tall grasses about the margins of shallow ponds and low places in open pine woods. At Miami and Homestead R. & H. found the nymphs in great abundance during March in the high grass of the everglades, while in July it was found to be common among the grasses on several of the keys. Dunedin is the most northern point at which it has been taken on the west coast.

This is one of the smallest of our meadow grasshoppers and closely resembles *C. fasciatus* in general facies. It is readily distinguished, however, by its more slender form, more reddish-brown hue, with stripe of head and pronotum darker, and stripes of abdomen more distinct and especially by the different shape of lateral lobes and the longer, more tapering and more flattened male cerci.

263. CONOCEPHALUS BREVIPENNIS (Scudder), 1862, 451. Short-winged Meadow Grasshopper.

Size medium for the genus; form rather robust. Pale reddish-brown; the face and sides of pronotum usually green; stripe on occiput and disk of pronotum a very dark brown, margined each side with a narrow yellow line; tegmina and wings pale reddish-brown; ovipositor reddish-brown, darker toward apex. In the larger specimens (*ensifer* Scudd.) the general color is more green than brown; the sides of abdomen and fore and middle femora being usually green. Fastigium scarcely ascending, its sides feebly divergent, apex not as wide as basal joint of antennæ. Lateral lobes of pronotum about as long as deep; lower margin oblique, its front angle obtuse, hind one broadly rounded; humeral sinus scarcely evident. Tegmina usually reaching bases of cerci, male, covering only two-thirds of abdomen, female, rarely fully developed. Wings slightly shorter than tegmina in the common form, exceeding them 2—3 mm. in the long-winged form. Hind femora rather short, stout, usually unarmed beneath, rarely with 1—4 short spines. Cerci of male as in key and Fig. 188, *h*, the apical third strongly compressed and obtuse, armed behind the middle with a rather flat, sharp-pointed tooth. Ovipositor straight, varying much in length, rarely with a faint upward curve, the lower margin with apical fifth tapering to the acute apex (Fig. 189, *i*). Length of body, ♂, 11—12.5, ♀, 11—14; of pronotum, ♂, 3—3.5, ♀, 3—4; of tegmina, short-winged, ♂, 7—10, ♀, 7—8.5; of tegmina, long-winged, ♀, 14; of hind femora, ♂, 10—13, ♀, 11—13.5; of ovipositor, 9—14 mm. (Fig. 190.)

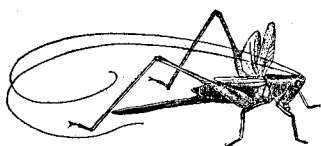


Fig. 190. Female. Natural size.  
(After Beutenmuller.)

An abundant species throughout Indiana, frequenting the same localities as *fasciatus* and reaching maturity about a fortnight later. The *X. ensifer* Scudder (1862, 451), described from Illinois has, as suggested by me (1903, 375), been shown to be only a large form of

*C. brevipennis* and has been placed by R. & H. as a synonym of that species.

This larger form differs from other meadow grasshoppers in the manner of oviposition, as, instead of always depositing its eggs in the stems of grasses, it sometimes seeks the turnip-shaped gall so common on certain species of *Salix* (willow), and oviposits between their scales. The gall is not formed by the grasshopper, but by a dipterous insect belonging to the family *Cecidomyidæ*. Although I have never seen the eggs deposited I have on a number of occasions found them within the galls, but did not know to what insect they belonged until Wheeler (1890) published his excellent account of the oviposition of this species as noted in Wisconsin. From that I quote as follows:

"On September 8th I observed a female in the act of oviposition. She was perched with her head turned toward the apex of the gall. Slowly and sedately she thrust her sword-like ovipositor down between the leaves, and, after depositing an egg, as slowly withdrew the organ in order to recommence the same operation, after taking a few steps to one side of where she had been at work. She soon observed me and slipped away without completing her task. The number of eggs found in a gall varies considerably. Sometimes but two or three will be found, more frequently from 50 to 100. In one small gall I counted 170. The egg is cream-colored, very thin, elongate oval in outline, and measures 4x1 mm."<sup>70</sup>

In Indiana the young of *C. brevipennis* emerge about the middle of May and reach maturity about August 10. One which was still in the nymph stage on October 21st, was found to have a white hairworm, *Gordius* sp? eight and a half inches long in its abdomen. The development of the nymph had probably been retarded by the presence of the parasite. Long-winged forms of this species are occasionally met with, but I have taken only one, and R. & H. state that only 3.2 per cent of the 555 specimens examined by them were macropterous. Two macropterous females sent in by Hubbell from Jackson Co., Mich., vary but slightly in size, yet the ovipositors measure respectively 9.3 and 12 mm. in length.

The known range of *C. brevipennis* is a wide one, extending from Maine and Montreal north and west to Algonquin Park, Ontario, northern Minnesota and Nebraska, and south and southwest to northern Florida and Dallas, Texas. In Florida it appears to be very scarce, being known definitely only from Atlantic Beach, South Jacksonville and Gainesville.

<sup>70</sup>B. D. Walsh (Proc. Ent. Soc. Phil., III, 1864, 232), recorded the finding on numerous occasions, of the eggs of an *Orchelimum* in the turnip-shaped galls of *Salix cordata*. Their shape and proportional dimensions, as given by him, differ much from those of *C. brevipennis*, as they were cylindrical, .16 to .17 of an inch long, and seven times as long as wide (*W. S. B.*).

Walker (1904a, 339) says that *C. brevipennis* is "nearly as common as *fasciatus* in southern Ontario, but becomes scarcer to the north of Muskoka. It reaches maturity about the first of August and remains well into October. It was not very common in Algonquin Park where it seems to prefer the vicinity of rank herbs and bushes in more or less shady spots. The note of the male is very like that of *fasciatus*. The zips are emitted at intervals of about one second, one or two being produced at a time."

Of the song of *C. brevipennis* Allard (1911) has written:

"I could not determine its stridulations in the field, so a number of males and females were placed in a pasteboard box together with some grass. In a few minutes a number were in continuous song throughout the afternoon and night. The stridulations of this *Xiphidium* are the least audible of any locust the writer has ever observed. Although a persistent singer, the notes become inaudible only a few feet away. In the fields they are quite lost amidst the sounds of rustling foliage, the chirpings of crickets, etc. The notes of *brevipenne* are very brief and much more hurried in their delivery than those of *X. fasciatum*. In this respect they approach more nearly the dainty stridulations of *X. nemorale* Scudd. In the song of *brevipenne* usually only one or two almost inaudible staccato lisps precede one, two or even three of the brief, faint phrases, *tseeeeeee-tseeeeeee*. These are of much longer duration in the song of *fasciatum*, and are rarely heard without the preceding staccato lisps which are of indefinite number."

In addition to *X. ensifer* Scudder, R. & H. have made *X. gossypii* Scudd., (1875, 461), described from Texas and Mississippi, a synonym of *C. brevipennis*.

264. CONOCEPHALUS NEMORALIS (Scudder), 1875, 462. Woodland Grasshopper.

Size medium; form robust. General color dark greenish-brown; tegmina yellowish-brown with front or costal area fuscous; dorsal stripe of occiput and pronotum a paler grayish-brown margined each side with a narrow yellowish line; all the femora punctate with reddish dots; tarsi and knees of hind femora dusky. Fastigium but faintly ascending, its sides strongly diverging from base forward, the apical portion bluntly rounded, as wide as or slightly wider than basal joint of antennæ. Pronotum distinctly subsellate, male, very feebly so, female; lateral lobes with front margin broadly curved into the lower one, the usual intervening angle obsolete, lower hind angle broadly rounded, humeral sinus wanting. Tegmina covering two-thirds of abdomen, male, about one-half, female; very rarely fully developed, their tips broadly rounded; veins and cross-veins unusually prominent, giving them a coarse and scabrous look; tympanum of male broad and elevated. Hind femora unarmed beneath. Cerci and ovipositor as in key and Figs. 188, 189. Length of body, ♂, 13—14, ♀, 14—15; of pronotum, ♂ and ♀, 3.7—4.2; of tegmina, ♂, 6—8, ♀, 5.5—6.2; of hind femora, ♂, 11—12, ♀, 13; of ovipositor, 8—9.2 mm.

This handsome brown species is a common insect in central



and southern Indiana, but has not yet been taken north of Lafayette. It reaches maturity about August 1st, and from then until after heavy frosts may be found in numbers along the borders of dry, upland woods, fence rows, and roadsides, where it delights to rest on the low shrubs, blackberry bushes, or coarse weeds usually growing in such localities. On sunny afternoons of mid-autumn it is especially abundant on the lower parts of the rail and board fences, the male uttering his faint and monotonous love call—a sort of *ch-e-e-e-e—ch-e-e-e-e*, continuously repeated—the female but a short distance away, a motionless, patient, and apparently attentive listener. When in *coitu* the male does not mount the back of the female, but, with his body reversed, is dragged about by her, this being the common practice of all the species of *Conocephalus* and *Orchelimum*. The females at times evidently oviposit in decaying wood, as on several occasions I have found them on old fence posts and rails with their ovipositors inserted the full length in the wood.

The types of Scudder were from Dallas Co., Iowa, and the known range of *nemoralis* extends from eastern New York and Pennsylvania north and west to Minnesota and Lincoln, Nebr., and south and southwest to Asheville, N. Car., Clarksville, Tenn., and Wichita, Kansas. It is not known from Michigan but Bruner says it is common in the wooded portions of Nebraska, and McAtee and Caudell mention it as the most common species of the genus about Washington, D. C. At Moline, Ill., McNeill (1891) found it “most commonly on sparsely wooded and rather barren hillsides. The song is louder than that of *fasciatum*. It consists of two parts, the first a short, abrupt *zip*, and the second the familiar *z-e-e*, which lasts about half a second, and is made from one to five times. The *zip* is not repeated.”

*C. nemoralis* appears to be a sort of connecting link between *Orchelimum* and *Conocephalus*. In its rather bulky body, large tympanum of male and curved ovipositor it resembles an *Orchelimum* but the short tegmina and the truncate subgenital plate of male agree better with the characters of *Conocephalus*. Macrop-terous individuals are very rare, fewer than half a dozen having been recorded. The *Xiphidium curtipenne* Redt. (1891, 522) is a synonym.

265. CONOCEPHALUS STRICTUS (Scudder), 1875, 460. Straight-lanced Grasshopper.

Size large for the genus; form rather slender. Sides of head and body and all the femora green; occiput and pronotum with the usual reddish-

brown stripe narrowly edged with whitish, especially on the fastigium; tegmina reddish-brown; dorsum of abdomen with a dark brown band, darker where it meets the green on sides; cerci and ovipositor dark brown. Fastigium not at all ascending, its sides diverging, broadly rounded, its greatest width more than one-third the interocular space. Pronotum not at all sellate; lateral lobes deeper than long, their front and lower margins straight, their angle broadly obtusely rounded, the lower hind angle broadly rounded; humeral sinus evident but very shallow. Tegmina about half the length of abdomen, male, one-third its length, very short and pad-like, female, their tips broadly rounded; in the very rare long-winged form almost reaching the hind knees and exceeded by wings 4 mm. Hind femora unarmed beneath. Cerci as in key and Fig. 188, *j*. Ovipositor straight, very slender, longer than the body (Fig. 189, *k*.) Length of body, ♂, 14—15, ♀, 17—18; of pronotum, ♂, 3.5—4, ♀, 4—4.5; of tegmina, short-winged, ♂, 5—6, ♀, 3.5—4.5; long-winged, ♀, 16; of hind femora, ♂, 13—14, ♀, 15—16.5; of ovipositor, 18—32 mm. (Fig. 190a.)

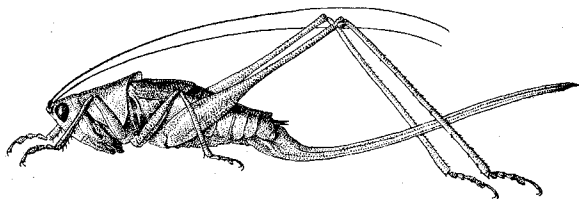


Fig. 190a. Female.  $\times 2$ . (After Forbes.)

This is a common species in the western and northern parts of Indiana, where it frequents, for the most part,

dry upland meadows, open pastures and prairies, and reaches maturity about August 1st. The mature females are usually much more abundant than the males and vary much in size. It is an active leaper and tumbler and like several of its allies, often strives to escape detection by burrowing beneath fallen weeds and grasses. About Lafayette Fox (1915) found it "abundant in dry open grass land and a common associate of *Syrbula admirabilis* (Uhler). Adults were taken July 31, were common until Sept. 5, but by October 3 had become very scarce." The long-winged form is everywhere very scarce, only one female from Vigo County having been noted in Indiana, while R. & H. report only eleven in more than 500 adults examined. The species is the largest of the genus occurring in the United States and the range in the length of the ovipositor is greater than in any other, being over 14 mm.

The types of Scudder were from Dallas, Texas, but it is known from Staten Island, N. Y., north and west to western South Dakota and Nebraska and south and southwest to North Carolina, Oklahoma, Texas and Arizona. Mead (1904) reported it as common in central and northern Ohio, but in Michigan it is known only from Washtenaw County. In Virginia Fox (1917) found it

“moderately frequent in open undisturbed dry grasslands, especially partial to *Andropogon*, but taken also on *Danthonia*.” In the dune region of northwestern Illinois Hart found it “common in damp grassy bottoms of old blow-outs,” and in Nebraska Bruner (1893a) says it “is found over the entire State but is more common southward than elsewhere.” Regarding the song of the male, Allard (1914) says:

“The notes of this species are much louder than those of any *Xiphidion* known to me. No staccato lisps precede the long lisping monotone *s-s-s-s-s-s-s-s-s-s*, which may continue several minutes without pause. Its note is thus similar to that of certain species of *Neoconocephalus* which have acquired the habit of prolonged stridulation. Although the Xiphidions usually keep well within the grass and low herbage of fields and meadows, the writer has observed *X. strictum* resting on shrubs several feet from the ground during stridulation.”

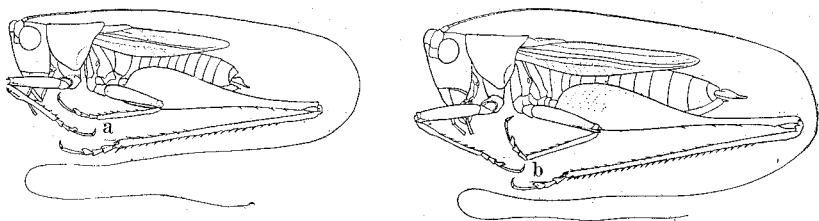


Fig. 191. a, Lateral outline of male type of *Conocephalus aigialis*; b, same of *C. stictomerus*,  $\times 2.5$ . (After R. & H.)

266. CONOCEPHALUS STICTOMERUS Rehn & Hebard, 1915b, 199. Spotted-legged Meadow Grasshopper.

Size rather large; form slender. General color pale green; occiput and disk of pronotum with a broad median stripe of the same hue; tegmina and wings translucent pale yellowish-brown; all the femora with numerous small spots and dots of reddish-brown. Fastigium distinctly ascending, its sides feebly divergent. Lateral lobes deeper than long, front margin nearly straight, broadly obtusely rounded into the weakly concave lower one, the hind angle of latter broadly rounded; humeral sinus scarcely evident. Tegmina usually covering three-fourths of abdomen, male, half its length, female, their tips sharply rounded. Hind femora armed beneath on outer carina with one to six short stout spines. Cerci as in key and Fig. 188, *k*. Length of body, ♂, 12.4–15, ♀, 11.1–16; of pronotum, ♂, 3–3.5, ♀, 2.9–3.7; of tegmina, short-winged, ♂, 8–11.6, ♀, 6.9–9.8; long-winged, ♂, 18.3, ♀, 18.5; of hind femora, ♂, 12.3–15, ♀, 12.6–15.6; of ovipositor, 13.7–19.8 mm. (Fig. 191, *b*.)

Tappahannock, Va., Sept. 10 (*Fox*). The types of R. & H. were from Cedar Springs, N. Jer., and were taken from “a heavy growth of panic grass, *Panicum virgatum* L., interspersed with various marsh plants in a limited marshy area on the border of a brackish stream.”

The known range of the species extends from the type locality to Raleigh, N. Car., along the middle Atlantic coastal plain where it inhabits the luxuriant grasses growing about the borders of marshes near both fresh and brackish water. In Virginia Fox (1917) found it "Occasional in tidal marshes, especially in the tall reeds, *Spartina cynosuroides* (L.) upon the spikelets of which it was observed feeding. It was apparently active only at night."

267. *CONOCEPHALUS AIGIALUS* Rehn & Hebard, 1915b, 202. Sea Shore Meadow Grasshopper.

Size medium; form robust, compact. Pale green; occiput and disk of pronotum with a broad pale brown stripe. Tegmina pale translucent brownish-yellow; apical half of male abdomen (in life) bright yellow, fading to dull clay-yellow; hind knees and all the tibiae tinged with fuscous. Fastigium slightly ascending, its sides almost parallel. Eyes very large and prominent. Lateral lobes with front and lower margins merged, without evident angle; lower hind angle narrowly rounded; humeral sinus very shallow. Tegmina of delicate structure, usually abbreviate and covering three-fourths of abdomen, male, two-thirds, female, their tips obliquely sharply rounded; in macropterous form, surpassing hind femora 3 mm., exceeded by wings 4 mm. Hind femora armed beneath on outer margin with one to seven spines. Cerci as in key and Fig. 188, *l*. Length of body, ♂, 12—15, ♀, 11.6—17.2; of pronotum, ♂, 3.1—3.8, ♀, 3.2—4.1; of tegmina, short-winged, ♂, 6.8—9.6, ♀, 7.1—9.3; long-winged, ♂, 16—17.7, ♀, 18—19.7; of hind femora, ♂, 10.7—13, ♀, 12.1—15.3; of ovipositor, 10.6—13.7 mm. (Fig. 191, *a*.)

South Jacksonville, Fla., Sept. 7 (*Davis*). The types were from Wrightsville, N. Car., and the known range of the species extends from Cape Henry, Va., to Pablo Beach, Fla. According to R. & H. (1915b, 203) it "inhabits salt marsh vegetation on the beaches and along the tidal rivers of the Atlantic coast where its habits are very similar to those of *C. spartinae* (Fox); in the present case, however, the insect is found not out on the marshes, but in the halophytic vegetation along their borders and in similar vegetation on the beaches."

268. *CONOCEPHALUS NIGROPLEURUS* (Bruner), 1891, 58. Black-sided Meadow Grasshopper.

Size medium; form robust. Dimorphic in color; either with tegmina. legs, margins of lateral lobes and metazona bright grass-green or with these parts brownish-yellow, the green wholly absent; both forms with stripe on occiput and sides of abdomen shining black, the former narrowing in front to the width of fastigium and bordered each side with yellowish-white; the usual brown stripe on disk of pronotum but faintly defined in green form, in the brown one very evident; face and median areas of lateral lobes dark brown. Fastigium feebly ascending, its sides slightly di-

vergent, greatest width one-half that of basal antennal joint. Lateral lobes with front margin broadly rounded into the lower one, the angle between them very obtuse, scarcely evident; lower hind angle narrowly rounded, humeral sinus obsolete. Tegmina usually abbreviated, covering four-fifths of abdomen, male, two-thirds, female, their tips narrowly rounded; rarely macropterous, then exceeding hind femora 1.5 mm., surpassed by wings 3.5 mm. Hind femora armed beneath on outer margin with one to five spines. Cerci as in key and Fig. 188, *m*. Length of body, ♂, 14—17, ♀, 15—16; of pronotum, ♂, 3—3.5, ♀, 3.2—3.6; of tegmina, ♂, 8—9, ♀, 8—8.5, ♀, long-winged, 17—19; of hind femora, ♂, 13—14, ♀, 13.5—15; of ovipositor, 16—17.5. mm.

This, one of the most handsome of North American Orthoptera, occurs in suitable localities throughout Indiana, but is nowhere very common. It is a hygrophilous species, inhabiting only the margins of streams, ditches, large ponds and lakes, where it abides in the tall, rank grasses and sedges growing in the shade. It reaches the perfect stage about July 1st in southern Indiana, and in Fulton County has been taken as late as October 24th. The males leap actively when approached. The females are more clumsy and usually dive headlong into a bunch of fallen grass. They can then be most readily captured by clasping the hand about a bunch of grass stems or branches of shrubs, on the under side of which the insects have taken refuge. The long-winged form is very rare but a single female from Wells County being in the collection at hand. About Lafayette, Fox (1915, 33) found *nigropleurus* frequent in herbaceous thickets, especially those forming the margins of bogs dominated by the rice cut-grass, *Homalocenchrus oryzoides* (L.), in both open and woodland situations and usually associated with *Orchelimum nigripes* Scudd."

The known range of *nigropleurus* is somewhat limited, extending from Ithaca, N. Y., and southwestern Ontario west to Wisconsin and Nebraska, and south, so far as recorded, only to the Ohio River in Indiana. Bruner's types were from eastern Nebraska, and of its habits in that State he wrote: "This beautiful insect, which is our most active species of the genus, is quite plentiful among the rank vegetation on low moist ground, and is especially common in wet places where the 'cut grass' (*Leersia oryzoides* Swartz) grows. The supposition is that this grass offers a better place than usual for the deposition of its eggs, which are deposited between the leaves and stems of grass. Grapevines and other creeping plants which form matted clusters that afford shelter from the noonday sun and the bright light of day are favorite haunts of this and other species of our nocturnal grasshoppers and a few of the arboreal crickets. It occurs throughout

the eastern half of Nebraska along all the streams the banks of which are lined with shrubs and trees.”

269. *CONOCEPHALUS ATTENUATUS* (Scudder), 1869, 305. Lance-tailed Meadow Grasshopper.

Size rather large; form very slender. General color dull brownish yellow, in some specimens tinged with greenish; occiput and pronotum with the usual median stripe reddish-brown; abdomen pale brown, male, reddish-brown, female; femora greenish-brown, rarely bright green, mottled with numerous small reddish dots; tibiæ and tarsi darker. Fastigium distinctly ascending, three-fourths as wide as basal joint of antennæ, its sides subparallel. Antennæ very long, 73 mm. in one specimen at hand. Lateral lobes with front and lower margins merged without visible angle, lower hind angle sharply rounded, the margins forming it strongly up-curved; humeral sinus obsolete. Tegmina, when abbreviated covering about three-fourths of abdomen, female, reaching or slightly surpassing its tip, male; when fully developed, twice the length of abdomen and exceeded by wings 4 mm. Hind femora long, slender, armed beneath on outer carina with one to five spines. Cerci of male long, broad, with apical third

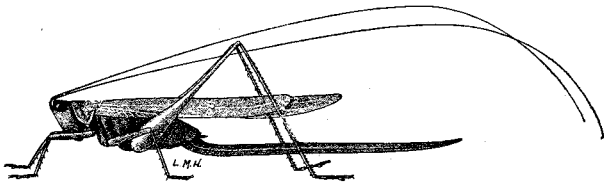


Fig. 192. Female. (After Lugger.)

curved outward, the basal tooth minute, slender (Fig. 189, a.) Ovipositor excessively long and slender, straight or

gently curved upward, the margins very finely serrulate and apex acuminate. Length of body, ♂, 12—15, ♀, 13—16; of pronotum, ♂, 2.6—3, ♀, 2.9—3.2; of tegmina, short-winged, ♂, 8.5—9.5, ♀, 8.5—10; long-winged, ♂, 16.5—19, ♀, 19; of hind femora, ♂, 11—14, ♀, 12—14; of ovipositor, 20—28 mm. (Fig. 192.)

The short-winged form of this species is much more abundant locally in Indiana than the long-winged one. In Vigo County it was, at one time very plentiful about the borders of two large ponds in the Wabash River bottoms. In Knox County a few specimens were secured from the margin of a similar pond bordering a large cypress swamp, while in Kosciusko County it was found to be quite common in some marshes near Tippecanoe and Turkey lakes. In all these places the insects dwelt among the tall rank grasses and rushes growing in shallow water. The males are, as far as my experience goes, the most active leapers among the winged Tettigoniidæ, jumping a half dozen or more times without pause when flushed, and in the net leaping so rapidly from side to side as to prevent capture with the fingers. The females are evidently handicapped in their leaping powers by the excessive

length of the ovipositor, and so more often endeavor to escape by burrowing beneath the dense masses of fallen grass and reed stems which are always found in their accustomed haunts.

The long winged form was first taken in some extensive low ground meadows in Kosciusko County. Here the long and short winged forms were about equally abundant. The former flew readily when approached, but to no great distance. A few of the long winged ones were also taken near Bass Lake, Starke County. The specimens from these northern counties are more slender bodied than those from the south, where only the short winged form has been found.

Scudder's types were from Illinois and the known range of the species extends from eastern Pennsylvania and southwestern Ontario west to Minnesota, eastern Nebraska and Kansas, while Knox County, Ind., is the most southern station recorded east of the Mississippi. Walker states (1904, 341) that in southern Ontario it is plentiful but limited in distribution. "It frequents open marshy borders of creeks and ponds, where it leaps about with wonderful agility among the tall grasses and sedges."

R. & H. (1915b, 209) state that at Cornwells, Pa., they found *attenuatus* "very scarce in high grasses and plants along the shore of the Delaware River, and in moderate numbers in a small marshy area adjoining. The males were usually found in the grass or perched on nearby plant leaves, whence they sprang away with alacrity. The females were never as conspicuous and sprang away with great swift leaps, then, hiding on the opposite sides of grass stems and leaves in the deepest tangles of vegetation, they proved very difficult to locate. Over its wide distribution it is doubtless restricted to damp spots and marsh areas."

My *Xiphidium scudderi* (1892b, 26) was based on the short-winged form of *C. attenuatus* while the *X. lanceolatum* mentioned by Bruner (1891, 59) also refers to *attenuatus*. I find that the length of the ovipositor among the different species of *Conocephalus* is not at all dependent upon the age of the insect. In *attenuatus* it is almost as long after the third, and fully as long after the fourth moult as it is in the adult; while a female of *strictus* has been taken, with no vestige of tegmina, in which the ovipositor measured 18 mm. The eggs of *attenuatus*, as the length of the ovipositor indicates, are laid between the stems and leaves of the tall rank grasses among which the insect lives.

270. CONOCEPHALUS NIGROPLEUROIDES (Fox), 1912, 116.

Size small, form slender. Dark brown, often with a grayish-olive tinge; occiput and prozona with the usual median stripe broad and very

dark brown on the former, paler and often ill-defined on the latter, bordered each side with grayish-white; tegmina, legs and male cerci usually bluish- or sea-green, the base of tegmina often pale brown; abdomen as described in key, the sides grayish-brown. Tegmina almost reaching base of cerci, male, covering two-thirds or slightly more of abdomen, female, their tips narrowly rounded. Hind femora usually unarmed beneath, sometimes with one or two spines on lower outer margin. Cerci very similar to but more attenuate than those of *spartina* (Fig. 189, *b.*) Ovipositor slightly longer than hind femora, usually straight, sometimes with a distinct upward curve. Length of body, ♂, 11—13.2, ♀, 11.2—13.5; of pronotum, ♂, 2.3—2.6, ♀, 2.6—3; of tegmina, ♂, 7, ♀, 5.5—6.8; of hind femora, ♂, 10, ♀, 11—12; of ovipositor, 11—16 mm.

Ocean View, N. Jer., August 30 (*Fox*). The types of *Fox* were from Cape May County, N. Jer., and the species ranges from that State along the Atlantic coast to southern Georgia, while on the Gulf coast it is known only from Cedar Keys, Fla. It occurs only on the salt marsh tidal flats, where, says *Fox*, "it is associated with *C. spartina* but is much scarcer than the latter and is almost entirely restricted to the tall *Spartina* grasses which fringe the banks of the numerous channels and ditches traversing the marshes."

271. *CONOCEPHALUS SPARTINÆ* (*FOX*), 1912, 111. Salt Marsh Meadow Grasshopper.

Size small; form slender. Usually grass-green in life, sometimes pale brown; tegmina translucent pale brown tinged with green, especially near apex; dorsal stripe of occiput and pronotum dark brown, sharply defined, bordered each side with yellowish; lateral lobes often with median area brown; abdomen of female with tip only orange; all the femora green with numerous reddish-brown dots; hind tibiae tinged with dusky; tarsi brown. Fastigium as in key. Lateral lobes with front margin broadly rounded into lower one, their intervening angle absent; lower hind angle broadly rounded, humeral sinus wanting. Tegmina usually reaching last abdominal segment, male, covering about three-fourths of abdomen, female, their tips narrowly rounded; sometimes fully developed and then exceeding tips of hind femora by 3 mm. Hind femora usually armed beneath with one to four spines. Cerci as in key and Fig. 189, *c.* Ovipositor almost or fully as long as hind femora, rather broad and with a very slight upward curve (Fig. 189, *n.*) Length of body, ♂, 10.8—13.5, ♀, 11—15; of pronotum, ♂, 2.3—3, ♀, 2.5—3; of tegmina, ♂, 6—10.8, ♀, 5—5.8; of hind femora, ♂, 8.2—10.5, ♀, 9.2—11.2 mm., of ovipositor, 7.1—9.9 mm.

Whitestone, Va., Sept. 26 (*Fox*); Cape Sable, Fla., Feb. 23 (*W. S. B.*) This is also a coastwise species ranging from Maine and Massachusetts to Cape Sable, Fla., and on the Gulf coast from Everglade, Fla., to southeastern Texas. As its specific name indicates, it occurs mostly among the salt marsh grasses of the genus *Spartina*. Only two males, one a nymph, were taken at



Cape Sable and they by sweeping these grasses on the tidal flats. Elsewhere in Florida it has been recorded definitely only from Miami and Everglade.

R. & H. (1915b, 215) state that on the coast of New Jersey *spartinae* is frequently to be found in great numbers on the salt marshes both in *Spartina patens* (Ait.) and *Panicularia fluitans* (L.) and can there be taken with ease. At Virginia Point, Texas, the series taken was chiefly macropterous and found in high and heavy grasses. "It was there difficult to capture as individuals were very restless and immediately sought shelter by jumping down low in the bunches of grass where they were very hard to follow."

Morse, (1919) states that it is locally abundant on salt marshes along the New England coast from Old Orchard, Me., to Stamford, Conn., thus agreeing closely in extent of distribution with the seaside locust, *Trimerotropis maritima* (Harr.)

The true status of the subarctic species, *C. spartinae*, *stictomerus*, *aigialus* and *nigropleuroides*, is, in my opinion, as yet an unsolved problem. The first two named are very close to *brevipennis* and the last one to both *attenuatus* and *nigropleurus*. They differ mainly from these older named species in the form of the male cerci, length and form of ovipositor and details of coloration, all exceedingly plastic and variable characters. They are also closely related among themselves. For example, Fox states that the males of *spartinae* and *nigropleuroides* are so close "that it was only after a long and arduous analysis and comparison that I was enabled to determine some apparently constant structural differences." Again, R. & H. (1915b, 210) state that *nigropleuroides*, though decidedly smaller and more slender than *spartinae* in New Jersey, increases southward in size and robustness so that in Florida it is distinctly the larger and more robust of the two. They also say: "The variation in shape of the ovipositor is far greater in *nigropleuroides* than in any other American species of the genus," ranging from rather broad and approximately straight in New Jersey specimens to a distinctly though not strongly upward curve in part of the series from Cedar Keys, Fla. Before the descriptions of any of the four species as new forms were made, R. & H., one or both of them, had recorded *spartinae* as *X. nemorale* and *brevipennis*; *stictomerus* as *C. ensiferus*; *aigialus* as *X. nigropleurum?* and *C. brevipennis*, and *nigropleuroides* as *X. nigropleurum*. This fact is mentioned to show which of the older species each of the new forms superficially most closely resembles.

From these statements and from the study of the individuals at hand I believe that it will eventually be found that some of the four forms mentioned are only southern races or offshoots of one or more of the better known northern species, and that the modifications of color and secondary sexual organs have been brought about by the environment of the salt marsh areas which they inhabit. The series of specimens of each at present available is not sufficient for me to express a more exact opinion of their relationship, and I have therefore left them as placed by their authors.

272. *CONOCEPHALUS SALTANS* (Scudder), 1872, 249. Wingless Prairie Grasshopper.

Size very small; form very slender. General color dull reddish-brown; occiput and pronotum with the dark brown stripe bordered as usual each side with one of pale yellow, the latter prominent in fresh specimens; sides of abdomen also with a narrow yellow stripe. Fastigium strongly ascending, its sides rounded or distinctly divergent forward, the apex one-third wider than basal joint of antennæ. Lateral lobes with lower front angle obsolete, hind one obtusely rounded; humeral sinus evident, very shallow; convex callosity prominent. Tegmina usually strongly abbreviate, covering only about one-fourth of abdomen, their tips rounded; rarely macrop-terous, with the tegmina slightly exceeding the tips of hind femora, and exceeded by wings 5 mm. Cerci as in key and Fig. 189, *d*. Ovipositor as long as or longer than body, very feebly curved. Length of body, ♂, 11—14, ♀, 12.8—15.5; of pronotum, ♂ and ♀, 3—3.5; of tegmina, short-winged ♂, 3—3.5, ♀, 2.5—2.7; long-winged ♀, 22; of hind femora, ♂ and ♀, 11—12; of ovipositor, 13.5—15 mm. (Fig. 193.)

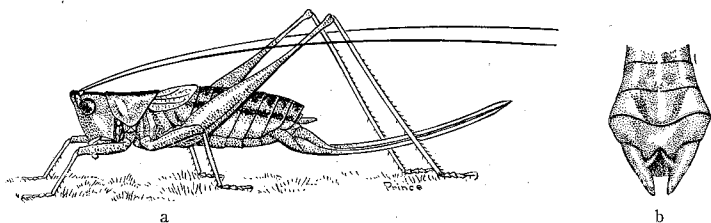


Fig. 193. (a) Female. Two and one-half times natural size. (b) Tip of male abdomen, showing form of cerci. (Original.)

This, one of the smallest of the *Conocephalinae*, has as yet been noted only at four localities in Indiana, namely, the border of a raw prairie near Heckland, Vigo Co., where it was found in small numbers Sept. 29—Oct. 21; near Lafayette, where Fox took a single male in company with *C. attenuatus* in a cat-tail cut-grass marsh; at Dune Park, Porter Co., Oct. 12, where a few individuals were taken from the clumps of grass on the base of a sand ridge, and near Pine, Lake Co., where a female was taken Sept. 3 by J. D. Hood. It appears to be less active than any other *Cono-*

*cephalus*, leaping a shorter distance when disturbed, and frequenting the surface of the ground rather than the stems of the tall prairie grasses among which it makes its home. It will probably be found, by close search, to inhabit most of the few remaining patches of raw prairie in the western part of the State.

The known range of *saltans* cannot be definitely stated as it has heretofore been confused with the next species. Scudder's types were from the Platte River, Nebr., and its natural home and center of distribution is probably on the prairies of the middle west, extending from western Indiana north and west to Mandan and Hillsboro, N. Dak., Livingston, Mont., and Manitou, Col., and south and west to Thomasville, Ga., Dallas, Texas, and Springer, N. Mex. Long-winged examples from Dallas are in the Cambridge collection. It appears to be xerophilous in habits, as it occurs mainly on dry upland prairies and sandy barrens. The *X. modestum* Bruner (1891, 57) from Nebraska, and the *X. tæniatum* Redt. (1891, 520) are synonyms.

273. CONOCEPHALUS VIRIDIFRONS sp. nov. Green-faced Grasshopper. = 5a

Shorter and more compact than *saltans*. Pale bluish-green, fading to dull greenish-yellow, the face immaculate; median stripe of vertex and pronotum paler brown than in *saltans*, the yellow stripe below less prominent; that on abdomen vague or wanting. Fastigium but slightly ascending, its sides subparallel, but slightly rounded, apex scarcely as wide as basal joint of antennæ. Pronotum as in *saltans*. Tegmina of male reaching nearly to middle of abdomen; one-fourth longer, better developed, with tips more narrowly rounded in both sexes than in *saltans*. Cerci as described in key and Fig. 189, *e*, their apical portion conical, not at all twisted, incurved or flattened within near tip as in *saltans*. Ovipositor shorter a little stouter and with a less evident upward curve than there. Length of body, ♂, 11—13, ♀, 12.5—14; of pronotum, ♂ and ♀, 2.8—3.2; of tegmina, ♂, 4.5—5, ♀, 3; of hind femora, ♂ and ♀, 10—12; of ovipositor, 9.5—12.5 mm.

Toronto, Ont., Aug. 10 (*Walker*); Central Park, Long Island, N. Y. Sept. 8 (*Davis*). This species is very distinct from *saltans* by the characters given in key and description. Comparisons have been made with the types of both *saltans* and its synonym, *modestum* at Cambridge and Philadelphia. The male in the Scudder collection from Red River Settlement, Man. mentioned by him (1862a, 288) as *X. brevipenne* but placed by R. & H. (1915b, 216) under *C. saltans* is a specimen of *viridifrons*.

Walker (1904a, 340) took the Toronto specimens above mentioned Aug. 9—Sept. 8, at High Park in company with *Melanoplus dawsoni* (Scudd.). They were found in open grassy uplands on sandy soil, where they were plentiful among Jersey-tea, sweet

fern and lupine. He stated: "My specimens are all peculiar in their coloration, being of a pale, almost bluish-green, instead of dull reddish-brown the usual color of *saltans*, according to the description."

On account of the previous confusion of *viridifrons* with *saltans* the definite range of the former cannot be given. It is known, as stated, from the Red River of the North east to Toronto and south and southwest to Long Island, N. Y., New Jersey and Virginia.

Morse (1919, 17) reports it, under the name of *saltans*, as "locally common on the sandy moors of Nantucket, Mass., among bunch grass, wild indigo and huckleberry bushes. The presence of this flightless grasshopper on Nantucket is of especial significance in its bearing on the geological conditions which resulted in the dispersal and present distribution of the characteristic plants and animals of the sandy coast-plain of New Jersey northeastward." In Virginia Fox found it at numerous localities during September and October, usually in coarse dry grasses, *Andropogon*, in the vicinity of wooded areas.

VII. ODONTOXIPHIDIUM Morse, 1901b, 129. (Gr., "toothed" + "sword.")

Closely allied to *Conocephalus*. Differs by the characters given in the generic key, and in having the "pronotum subsellate, prolonged backward, covering the base of abdomen both above and on the sides, in correlation with the absence of flight organs." (*Morse*).

274. ODONTOXIPHIDIUM APTERUM Morse, 1901b, 129. Wingless Meadow Grasshopper.

Size small for the subfamily; form moderately robust. Reddish-brown; face, hind femora and sides of body green or greenish; occiput and prozona with the usual median stripe reddish-brown bordered each side by a narrow yellowish one; sides of abdomen, male, entire abdomen, female, fuscous-brown; all the femora thickly mottled with small reddish-brown dots. Antennæ very slender, four times as long as body. Fastigium feebly ascending, its sides slightly diverging forward, apex two-thirds as wide, male, fully as wide, female, as basal joint of antennæ. Disk of pronotum exceedingly smooth, the usual transverse sulcus obsolete; lateral lobes longer than deep, their front margin broadly rounded into the feebly sinuate lower one, the latter with hind angle obtusely rounded; hind margin straight, oblique; humeral sinus absent. Tegmina of male conjointly oval, shorter than pronotum, the speculum of left tegmen strongly convex, its basal cross vein slender, covered by metazona, oblique vein abbreviated, the others subobsolete. Hind femora elongate, unarmed beneath, the basal third very stout. Cerci of male straight, very slender, cylindrical, bear-

ing on inner side of apical third a stout, straight, obtusely pointed tooth and at basal third a small black-pointed subdorsal denticle. Subgenital plate prolonged, almost reaching tips of cerci, broadly scoop-shaped, its tip subtruncate; styles very short, blunt. Ovipositor slender, straight, usually about five-sixths the length of hind femora but sometimes nearly one and a half times that of body. Length of body, ♂, 11—14, ♀, 11—18; of pronotum, ♂, 3.5—4, ♀, 4.5—5.3; of tegmina, ♂, 2—3; of hind femora, ♂, 10—12, ♀, 13—15; of ovipositor, 10.5—15 mm.

Hastings, Orlando and Dunedin, Fla., July 5—Jan. 1 (W. S. B.). About Dunedin this small Tettigoniid is frequent in late autumn and early winter but apparently succumbs to the first frost. It occurs mainly amidst the wire-grass and low huckleberry bushes of open pine woods, but also among the taller grasses growing in old fallow fields and on the sites of wet-weather ponds. It was described from Hastings, Fla., and is recorded by other collectors from numerous localities throughout the entire mainland and on the southern keys. As will be noted by the measurements, the females vary much in size and in the length of ovipositor. They have been heretofore described as being totally apterous, but they have rudimentary tegmina concealed by the pronotum. In a specimen from Orlando these are large enough to protrude slightly beyond the pronotum. The males usually carry the cerci in a reflexed, almost perpendicular position within the cavity of the long projecting scoop-shaped subgenital plate.

The known range of *O. apterum* extends from Fayetteville, N. Car., to Key West, Fla., its main distribution being in Georgia and Florida. R. & H. (1916, 267) say that "Throughout the low country of the Carolinas, Georgia and Florida this is one of the most ubiquitous species in the undergrowth of the pine woods and on the palmetto flats. At a number of localities it was particularly numerous about oak shoots in such situations. The stridulation is a very faint and intermittent *zip-zip-zee-zee-zee-zip-zee-zee*, etc. The males when stridulating often climb high up in the undergrowth, sometimes three or four feet from the ground."

274a. ODONTOXIPHIDIUM APTERUM AFFINE var. nov.

Size and form of *O. apterum*. Differs as follows: Color paler; median dark stripe of occiput and prozona vague, the yellowish ones below it faint or wanting; abdomen without dark markings in either sex. Fastigium of vertex more strongly ascending, its apical half with sides rounded, distinctly wider than middle. Pronotum less sellate; humeral sinus evident but faint. Cerci of male distinctly stouter, subdepressed, their apical portion subtriangular, the tooth at apical third stouter and slightly curved

inward and downward. Ovipositor more slender, and with an evident but faint downward curve beyond the middle. Other characters as in *apterum*, the measurements approximately the same.

Ft. Myers and LaBelle, Fla., March 2—5; three males, two females (*W. S. B.*). Swept from low huckleberry bushes and other foliage along the margins of swales. The differential characters as above given are deemed sufficient to place this as a form of *apterum* worthy of a varietal name. It will probably be found only in the southern third of Florida.

#### Subfamily V. DECTICINÆ.

##### THE SHIELD-BEARERS.

Tettigoniids of large size and peculiar appearance in that they are nearly wingless and have the pronotum more or less prolonged backward over one or more of the basal segments of abdomen, thus forming a buckler or shield, whence the common name. Our eastern forms agree in having the face broad, perpendicular or nearly so; eyes small, subglobose, separated by at least three times their own diameters; antennæ very slender, arising from between the inner lower margins of eyes, but little longer than the body; vertex short, one-third or more the width of interocular space, strongly declivent between the antennæ; pronotum with front margin truncate, hind one rounded or subtruncate; lateral lobes longer than deep; prosternum usually armed beneath with two erect spines; tegmina very short, rarely as long as pronotum, developed only as shrilling organs in male, often scarcely visible, female; wings absent or rudimentary; tarsi more or less depressed, their first two segments sulcate lengthwise on the sides; front tibiæ with a slit-like foramen (hearing organ) each side near base and an apical spine on their upper outer side; front coxæ spined; hind tibiæ armed below with four apical spines; hind tarsi with a free lobe (plantula) at base of first joint; cerci of male variable as to genera and species; ovipositor stout, nearly straight.

According to Caudell only about 225 species of Decticinae distributed among 47 genera, were known in 1908. They are confined mostly to the temperate zones, 20 or more of the genera occurring in the United States. The main distribution of these is west of the Mississippi, where some of the species are very abundant and do much damage to vegetation. East of that stream but two genera are represented, one of them by a single species. But little is known of the life history of our eastern forms. They ap-