

larvæ of *Diplosistritici*. The original describer was in doubt as to whether this was really a parasite of this species, the wheat midge, or not. Re-described by Mr. Ashmead from specimens reared by myself as above. (Bull. U. S. Nat. Mus., No. 45, p. 291, 1893.)

A MITE, PROBABLY *HYPODERAS COLUMBE*, PARASITIC IN THE PIGEON. By W. W. NORMAN.

THE LOCUSTIDE OF INDIANA. By W. S. BLATCHLEY, Terre Haute, Indiana.

The order of insects known as the *Orthoptera* comprises seven families, three of which are alike in having the posterior femora more or less enlarged for leaping; the three being therefore classed together in a sub-order called the *Saltatoria*, or jumpers.

In the present paper we have to deal with that family of this sub-order known as the *Locustidae*, which comprises those insects commonly called katydids, green grasshoppers, and stone or camel crickets.

The distinguishing characters of the members of the family *Locustidae* are the long, slender, tapering, many-jointed antennæ; the almost universal absence of ocelli or simple eyes; the four jointed* tarsi or feet; and the ensiform or falcate ovipositor of the females which is made of four flattened plates; the males having, in many instances, abdominal appendages corresponding to the parts of the ovipositor, which are used as clasping organs. The tegmina or wing covers, when present, slope obliquely downwards, instead of being bent abruptly, as in the *Gryllidae*; and in most cases the wings are longer than the tegmina.

The stridulating or musical organ of the males is quite similar in structure to that of the male cricket, being found at the base of the overlapping dorsal surface of the tegmina and usually consisting of a transparent membrane, of a more or less rounded form, which is crossed by a prominent curved vein, which on the under side bears a single row of minute file like teeth. In stridulating the wing covers are moved apart and then shuffled together again when these teeth are rubbed over a vein on the

* The members of the genus *Daihinia*, no one of which occurs in Indiana, have the fore and hind tarsi three-jointed.

upper surface of the other wing cover, producing the familiar, so called "katydid" sound. Each of the different species makes a distinct call or note of its own, and many of them have two calls, one which they use by night and the other by day. Any one who will pay close attention to these different calls can soon learn to distinguish each species by its note as readily as the ornithologist can recognize different species of birds in the same manner. The ear of these insects, when present, is also similar in structure and position to that of the cricket's, being an oblong or oval cavity covered with a transparent or whitish membrane, and situated near the basal end of the front tibiæ.

The young of *Locustidæ*, like those of the other families of the order, when hatched from the egg resemble the adults in form but are wholly wingless. As they increase in size they moult or shed the skin five times, the wings each time becoming more apparent, until after the fifth moult when they appear fully developed, and the insect is mature, or full grown, never increasing in size thereafter. Throughout their entire lives they are active, greedy feeders, mostly herbivorous in habit; and where present in numbers necessarily do much harm to growing vegetation.

Among the families of Orthoptera the *Locustidæ* take a rank second only to the *Gryllidæ*. The high specialization of the ovipositor of the female and the perfection of structure of the stridulating organ of the male place these two families above all others in the scale of Orthopteron life. That the two are very closely related can be readily seen by any one who will carefully compare them, organ with organ. The *Gryllidæ* are placed first, however, by most entomologists, as the great variety of form of almost any given organ among them, when compared with its relative uniformity of structure among the *Locustidæ*, seems to indicate the higher rank of the former.*

In the number of species in any given locality the *Locustidæ* far outrank the *Gryllidæ*, being excelled in this respect among the other Orthopteron families only by the *Acrididæ* or locusts. In Indiana thirty-nine species of *Locustidæ* are known to occur and are listed in the present paper, specimens of all being in my private collection. This is eleven more than are known in any other state from which lists have been published; McNeill having listed twenty-seven from Illinois; Smith, twenty-eight from New Jersey; Osborne, twenty-four from Iowa, and Fernald sixteen from all New England.

* Scudder, Proc. Bost. Soc. Nat. Hist., XII, 1868, 233.

Undoubtedly other species occur in Indiana, especially in the southern half of the state, but having had to rely almost wholly upon my own collecting, which has been done in Putnam, Vigo, Montgomery, Wabash, Marshall and Fulton counties, the eastern and southern parts of the state are wholly unrepresented in the list. Three persons, Prof. E. E. Slick, of Michigan City; Prof. W. P. Hay, formerly of Irvington, and Mr. W. A. Riley, of Greencastle, have sent me small collections from their respective localities which have aided me much in recording the distribution of certain species.

To Mr. S. H. Scudder, of Cambridge, Mass., I am indebted for the loan of typical specimens of the genus *Ceuthophilus* for comparison; and to Prof. Lawrence Bruner, of Lincoln, Nebraska, for aid in identifying and verifying certain species. Prof. Bruner also furnished me some valuable notes concerning the general distribution of a number of the species, which are incorporated under their respective species in the list below.

The descriptions of such species of *Locustidae* as occur in the eastern United States are scattered through many scientific books and papers which are for the most part inaccessible to beginners in entomology. I have thought it best, therefore, to prepare a synopsis of the sub-families and of the genera under each sub-family, which are represented in the state. A short description of each species, with such notes concerning its distribution, food, habits, and comparative abundance, as have been gathered during my collecting, is also given, together with a synonymy of the species, as far as obtainable from the works at hand.

The following is a bibliography of authors and works to which reference is made in this synonymy:

Bruner, Lawrence.—First Contribution to a Knowledge of the Orthoptera of Kansas. (Bulletin of the Washburne College Laboratory of Natural History, Volume I., No. 4., 1885.) Second Contribution to a Knowledge of the Orthoptera of Kansas. (*Loc. cit.*, Vol. I., No. 7, 1886.) Ten New Species of Orthoptera from Nebraska. (Canadian Entomologist, XXIII., 1891.)

Brunner, C. von Wattenwyl.—Monographie der Phaneropteriden. (Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien, 1878.) Monographie der Stenopelmatiden und Gryllacriden. (*Loc. cit.*, 1888.)

Burmeister, Hermann.—Handbuch der Entomologie, II., 1838.

Comstock, J. H.—Report of U. S. Entomologist. (U. S. Agricultural Report, 1880.) An Introduction to Entomology, I., 1888.

Davis, W. T.—The Song of *Thyreonotus*. (*Canadian Entomologist*, XXV., 1893.)

Fernald, C. H.—The Orthoptera of New England, 1888.

Harris, Dr. T. W.—A Treatise on Some Insects Injurious to Vegetation. Third edition, 1862.

McNeill, Jerome.—A List of the Orthoptera of Illinois. (*Psyche*, VI., 1891.)

Osborn, Herbert.—On the Orthopterous Fauna of Iowa. (*Proceedings of the Iowa Academy of Science*, I., Part II., 1892.)

Packard, A. S., Jun.—Guide to the Study of Insects. Eighth edition, 1883.

Rathvon, S. S.—In the U. S. Agricultural Report, 1862.

Redtenbacher, Josef.—*Monographie der Conocephaliden*. (*Verhandlungen der. K. K. Zoologisch-botanischen Gesellschaft in Wien*, 1891.)

Riley, Dr. C. V.—Katydid. (*Sixth Annual Report on the Noxious, Beneficial, and other Insects of the State of Missouri*, 1874.) Orthoptera. (*Standard Natural History*, II., 1884.)

Scudder, Samuel H.—On the Genus *Raphidophora*, Serville. (*Proceedings Boston Society Natural History*, VIII., 1861.) Materials for a Monograph of the North American Orthoptera. (*Boston Journal of Natural History*, VII., 1862.) Notes on the Stridulation of some New England Orthoptera. (*Proceedings Boston Society, Natural History*, XI., 1868.) The Songs of the Grasshoppers. (*American Naturalist*, II., 1868.) Descriptions of New Species of Orthoptera in the Collections of the American Entomological Society. (*Transactions of the American Entomological Society*, II., 1869.) The Distribution of Insects in New Hampshire. (First Volume of the Final Report upon the Geology of New Hampshire, 1874.) Entomological Notes, IV., (*Proc. Bost. Soc. Nat. Hist.*, XVII., 1874-5.) Entomological Notes, VI., (*Loc. cit.*, XIX., 1878.) A Century of Orthoptera, 1879. Locustidæ. (*American Encyclopædia*, Edition 1881.) The Songs of Our Grasshoppers and Crickets. (Twenty-third Annual Report of the Entomological Society of Ontario, 1892.)

Serville, M. Audinet.—*Histoire Naturelle des Insectes. Orthopteres*, 1839.

Smith, Sidney I.—On the Orthoptera of the State of Maine. (*Proceedings of the Portland Society of Natural History*, 1868.)

Smith, John B.—A Catalogue of the Insects Found in New Jersey. (Final Report of the State Geologist, II., 1890.) Grasshoppers, Locusts and

Crickets. (Bulletin 90, New Jersey Agricultural College Experiment Stations, 1892.)

Thomas, Cyrus H.—Insects Injurious to Vegetation in Illinois. (Transactions of the Illinois State Agricultural Society, V., 1865.) A List of Orthoptera collected by J. Duncan Putnam of Davenport, Iowa, in Colorado, Utah, and Wyoming Territories. (Proceedings of the Davenport Academy of Natural Sciences, I., 1876.)

Uhler, Philip R.—In Harris' Report on Insects Injurious to Vegetation, third edition, 1862.

Walsh, B. D.—On Certain Entomological Speculations of the New England School of Naturalists. (Proceedings of the Entomological Society of Philadelphia, III., 1864.)

Wheeler, Wm. M.—Notes on the Oviposition and Embryonic Development of *Xiphidium cnsiferum*, Scud. (Insect Life, II., 1890.)

Blatchley, W. S.—Some New Locustidæ from Indiana. (Canadian Entomologist, XXV., 1893.)

A SYNOPSIS OF THE SUB FAMILIES OF LOCUSTIDÆ FOUND IN INDIANA.

a. Tegmina and wings present.

b. Prosternal spines absent; vertex rounded or deflexed without spine, tubercle or cone; tegmina always shorter than the wings PHANEROPTERINÆ. p. 97

bb. Prosternal spines present; vertex either terminating in a sharp flat spine or produced upwards and forwards in a rounded tubercle or prominent cone.

c. Wing covers leaf like, broadly expanded in the middle, concave within, longer than the wings; vertex terminating in a sharp flat spine . . . PSEUDOPHYLLINÆ. p. 109

cc. Wing covers narrow, not expanded in the middle, of an shorter than the wings; vertex terminating in a rounded tubercle or prominent cone . CONOCEPHALINÆ. p. 111

aa. Tegmina and wings absent, or the former rudimentary.

d. Pronotum short, not covering the whole top of the thorax; prosternal spines absent . . STENOPELMATINÆ. p. 140

dd. Pronotum extending back to the abdomen; prosternal spines present DECTICIDINÆ. p. 149

LOCUSTIDÆ.

PHANEROPTERINÆ.

The species of this sub-family are among the largest of our Locustidæ, and, with those of the next, are commonly known as "Katydid," The apex of the head is obtuse or rounded, without cone or spine, and the prosternum is unarmed. The wing covers are shorter than the wings, usually expanded in the middle, and of a bright, uniform green color. The wings are folded like a fan and are long and strong, the insects being flyers rather than leapers. The hind limbs, being seldom used except to give themselves an upward impetus at the beginning of flight, while long and slender, are proportionally much smaller in diameter than in the sub-family *Conocephalinæ*, whose members leap rather than fly.

The "Katydid" are the most arboreal of all the Locustidæ, the great majority of them passing their entire lives on shrubs and trees where they feed upon the leaves and tender twigs, and when present in numbers often do excessive injury. The color and form of their wings serve admirably to protect them against their worst foes, the birds; and as they live a solitary life, *i. e.*, do not flock together in numbers as do the green grasshoppers, they are but seldom noticed by man. Their love calls, or songs, however, make the welkin ring at night from mid-August until after heavy frost, and though but one or two of the eight species found in the State make a note in any way resembling the syllables "Katy did, she did," yet all are accredited with this sound by the casual observer, and hence the common name usually given to the members of this sub-family. Their call is seldom made by day for the obvious reason that it might attract the attention of the birds and so lead to the destruction of the songster. As twilight approaches, however, the male of each species begins his peculiar note which is kept up with little or no intermission until the approach of day warns him that his feathered enemies will soon be on the alert, and that silence will be, for a time, the best policy to pursue.

From the other Locustidæ, the Katydid differ widely in their habits of oviposition, the eggs not being deposited in the earth or in twigs, but are usually glued fast in double rows to the outer surface of slender twigs or on the edges of leaves. The eggs of the most common species appear like small flattened hemp seeds, and usually overlap one another in the row in which they are placed. On account of this method of oviposition, the ovipositors of the "Katydid" are broader, more curved, and more obtuse

at the end than in the other sub-families whose members oviposit in the earth or in stems of grass. This sub-family is represented in Indiana, so far as known, by three genera and eight species.

KEY TO GENERA OF PHANEROPTERINÆ.

- a.* Wing covers of equal breadth throughout; supra-anal plate of male with a long decurved spine which is notched at the end I. SCUDDERIA.
- aa.* Wing covers widest in the middle; supra-anal plate of male not as above.
- b.* Hind femora but little if any shorter than wing covers; ovipositor well developed, curved gradually upwards II. AMBLYCORYPHA.
- bb.* Hind femora much shorter than wing covers; ovipositor very short, turned abruptly upwards III. MICROCENTRUM.

I. SCUDDERIA, Stål (1873).

This genus includes Katydidids of medium size, with the wing covers long, narrow, of nearly equal width throughout, and rounded at the ends. The vertex is deflexed, compressed, and hollowed out on either side for the better accomodation of the eyes, which are nearly hemispherical. The hind femora are long and slender, almost equalling the length of the wing covers in some of the species. The ovipositor is short, broad, curved sharply upwards, and has the apical third finely crenate on both margins. The males are readily distinguished from those of other genera by having both anal plates projected into long curved processes; the one from the supra-anal plate curving downwards and notched or forked at the end, that from the sub-anal curving upwards, and likewise notched. The form of these processes, together with that of the notches serve as valuable characters in distinguishing the species. Six species have been described from the United States, four of which occur in Indiana.

a. Length of posterior femora 28 or more mm.*

b. Notch of supra-anal spine of male square with a slight median tooth, almost as wide as the middle of the upturned sub-anal spine; the lateral processes slender and compressed.

*NOTE.—The measurements in this paper are given in millimeters, an inch being equal to very nearly twenty-five millimeters. The measurements given are, when possible, the average of a number of specimens, and the "length of body" does not include the sexual appendages of male nor the ovipositor of female.

1. SCUDDERIA CURVICAUDA, (DeGeer.)

"*Locusta curvicauda*, DeGeer, Mem., III., 1773, 446, Pl. 38, fig. 3."

Phaneroptera curvicauda, Burmeister, Handbuch der Ent., II., 1838, 690.
Scudder, Bost. Journ. Nat. Hist., VII., 1862, 448.

(In part.)

Uhler, in Harris' Ins. Inj. to Veg., 1862, 161.

(Note.—In part.)

Scudderia curvicauda, Brunner, Monogr. der Phanerop., 1878.

Riley, Stand. Nat. Hist., II., 1884, 191.

Comstock, Int. to Ent., I., 1888, 118.

Fernald, Orth. N. Eng., 1888, 22. (In part.)

McNeill, Psyche, VI., 1891, 21. (Song of.)

Scudder, Rep. Ent. Soc. Ont., XXIII., 1892, 68.

(Song of.)

Smith, Bull. Ag. Exp. Stat. of N. J., No. 90, 1892,
24.

Phaneroptera septentrionalis, Serville, Hist. Nat. des Orth., 1839., 416.

Tegmina, wings and legs bright grass green; body and face somewhat paler, approaching a whitish in dried specimens. Lateral carinae of the pronotum with a yellowish line. Posterior femora very slender, armed beneath on inner carina with three or four minute spines.

Measurements: Male—Length of body, 22 mm.; of tegmina, 37.5 mm.; of wings beyond the tegmina, 6 mm.; of posterior femora, 30 mm.; of pronotum, 6.5 mm. Female—Length of body 25 mm.; of posterior femora, 32 mm.; of ovipositor, 7 mm. Width of tegmina, 6.5 mm.

Curvicauda is a common insect in the central and southern half of Indiana, but northward seems to be replaced by *S. furculata*. The former is probably less arboreal than any other species of Katydid, as it is often found clinging to the tall, coarse grasses and sedges which grow near the borders of ponds and in damp ravines, and to the coarse weeds along the margins of prairies and meadows. When approached it flies readily in a zigzag, noiseless manner for a long distance to another clump of grass or weeds, or to the lower branches of an oak, a tree in which it delights to dwell.

The eggs are laid in the margins of leaves between the upper and lower epidermis, and are so thin that they are not noticeable except when the leaf is held between one's self and the light. Of the song or note made by the male of *curvicauda* McNeill (*loc. cit.*) says: "The note cannot be

*When the author of a species referred it to a different genus from that in which it is now included, his name is put in parenthesis.

supposed to represent more than the first two syllables of the 'Katy did' or 'Katy didn't' of its congeners. It is made but once, and the rasping, jerky sound has been very well represented as *bzrwi*.'²

Curvicauda is a species of wide distribution, occurring throughout the eastern United States, and as far west as the Rocky Mountains. In Central Indiana it reaches maturity about the 25th of July.

- bb.* Notch of supra-anal spine of male acute and much narrower than the middle of the upcurved sub-anal spine; the lateral processes (at side of notch) broadly rounded with the lower margin thinner.

2. *SCUDDERIA FURCULATA*, Brunner.

Scudderia furculata, Brunner, Monog. der Phanerop., 1878.

Smith, Cat., Insects found in N. J., 1890, 410.

Id., Bull. Agr. Exp. Stat. of N. J., No. 90, 24, pl.

II., Fig. 4.

Somewhat larger than *curvicauda* and closely resembling that species in general appearance, the females of the two being difficult to distinguish except by the measurements; the males readily separated by the different form of the notch of the supra-anal spine. The general color is the same, but the yellow carinal line of the pronotum is less distinct or wholly wanting in *furculata*, and the apical third of wings is usually a transparent reddish brown. The wing covers of the latter are broader and the posterior femora proportionally a little shorter.

Measurements: Male—Length of body, 23 mm.; of tegmina, 37.5 mm.. of posterior femora, 30 mm.; of pronotum, 6 mm. Width of tegmina 8 mm. Female—Length of body, 25 mm.; of tegmina, 38 mm.; of posterior femora, 33 mm.; of ovipositor, 7 mm. Width of tegmina, 8.5 mm.

According to Bruner³ *furculata* is usually more southern in its distribution than *curvicauda*, but in Indiana this distribution seems reversed, as the latter is much the more common in Vigo and Putnam counties, while in Marshall and Fulton counties, 150 miles further north, it is very scarce and *furculata* very common. A single male was taken from an oak grove on the border of Lake Maxinkuckee in Marshall county, on August 1st, and on the 26th of the same month it was found in numbers at the same place, and also about the borders of a large tamarack swamp in Fulton county. Its habits of flight and song, as far as noted, are essentially the same as those of *curvicauda*, noted above.

³ Mss. Notes.

In New Jersey, according to Smith (*loc. cit.*), *furculata* is very common on cranberry bogs, and destroys many of the berries. It will probably be found to occur throughout Indiana near the borders of the larger ponds, lakes and marshes.

aa. Length of posterior femora 22 or 23 mm.

3. *SCUDDERIA FURCATA*, Brunner. The Fork-tailed Katydid.

Scudderia furcata, Brunner, Monog. der Phanerop., 1878.

Bruner, Bull. Washb. Coll. Lab. Nat. Hist., I.,
1885, 127.

McNeill, Psyche, VI., 1891, 21.

Smith, Bull. Agr. Exp. Stat. of N. J., No. 90, 1892,
31.

Phaneroptera curvicauda, Riley, Sixth Rep. St. Ent. Mo., 1874, 164, fig.
51. (Text in part. Not fig. 50.)

This is one of the smallest, and at the same time, our most common species of the genus. The general color is a dark leaf green, the head and pronotum paler; the latter without trace of yellow on its carinae. The anterior margin of the pronotum is but slightly narrower than the posterior, whereas in the two preceding species the difference in width is plainly perceptible. The notch of the supra-anal spine of the male is deep and rounded, forming a curious fork-like appendage, the lateral processes of which are much swollen.

Measurements: Male—Length of body, 16 mm.; of tegmina, 31 mm.; of posterior femora, 23 mm.; of pronotum, 5 mm. Width of tegmina, 6 mm. Female—Length of body, 20 mm., of tegmina, 30 mm.; of posterior femora, 22 mm.; of ovipositor, 5 mm.

In Central and Southern Indiana the Fork-tailed Katydid is most frequently seen on the low bushes and trees about the margin of thickets and along fence rows, but in the prairie country north it frequents coarse grasses and weeds in company with the preceding species. Its flight is noiseless and seemingly without direction, and is not so prolonged as that of *S. curvicauda*. Dr. C. V. Riley (*loc. cit.*) gives the following account of the egg laying habits of *furcata*: "The female stations herself firmly by the middle and hind legs on twigs or leaves contiguous to the one selected to receive the eggs. This leaf is then grasped by the front feet and held in a vertical position, while the edge is slightly gnawed or pared off by the jaws to facilitate the entrance of the point of the ovipositor. When thi

is done the abdomen is curved under and brought forward, and the ovipositor is seized on its convex edge by the mandibles and maxillæ, which, with the aid of the palpi, guide the point to that portion of the leaf prepared to receive it. After gentle, but repeated efforts, the point of the instrument is finally inserted between the tissues of the leaf, and gradually pushed in to more than half its length. As soon as the cavity is formed, the egg is extruded, and passed slowly between the semi-transparent blades of the ovipositor. As the egg leaves the ovipositor the latter is gradually withdrawn, while the egg remains in the leaf, retained in its place, probably, by a viscid fluid that is exuded with it. As many as five of the eggs are sometimes deposited in one row in the same leaf but more often they are single."

This is the most common species of the genus, in the United States, and is quite widely distributed over the country from the Atlantic to the Pacific. In Indiana it has been found in numbers in every county in which collections have been made. The first mature specimens appear about August 5th but it does not become plentiful before the middle of the month.

aaa. Length of posterior femora less than 20 mm.

4. *SCUDDERIA ANGUSTIFOLIA* (Harris). The Narrow-winged Katydid.

Phaneroptera angustifolia Harris' Ins. Inj. to Veg., 1862, 161, fig. 76.

Scudderia angustifolia, Brunner, Monog. der Phanerop., 1878.

Smith, Cat. Ins. N. J., 1890, 410.

Scudder, Rep. Ent. Soc. Ont. XXIII., 1892. (Note of set to music.)

Phaneroptera curvicauda, Uhler in Harris' Ins. Inj. to Veg., 1862, 161. (Note. In part.)

Scudder, Bost. Journ. Nat Hist., VII., 1862, 448. (In part.)

Id., Am. Nat. II., 1868, 117, (Song of.)

Id., Distrib. Ins. N. Hamp., 1874, 366. (Song of set to music.)

Riley, Sixth Rep. St. Ent. Mo. 1874, 164, fig. 50. (Not text nor fig. 51.)

Scudderia curvicauda Fernald, Orth. N. Eng., 1888, 22. (In part.)

(Not *Scudderia curvicauda*), (DeGeer.)

This Katydid occurs in abundance in New England and the Middle Atlantic states, and in the past has been confounded by many writers both with *S. curvicauda* and with *S. furcata*. In size, general appearance and structure of anal spines of male it is very similar to *furcata*, but may readily be known by its shorter posterior femora, and by its narrower wing covers.

Measurements: Male—Length of body, 14 mm., of tegmina, 26 mm.; of posterior femora, 19 mm.; of pronotum, 4 mm. Width of tegmina, 5 mm. Female—Length of body, 19 mm.; of tegmina, 25 mm.; of ovipositor, 5.5 mm.

The male of *angustifolia* is our smallest member of the genus. In Indiana it is known only from Fulton county, several specimens of both sexes having been taken on October 7th, from the borders of a peat bog in a tamarack swamp, near Kewanna. This, as far as known, is its first record west of New Jersey. It will probably be found to occur only about the bogs and swamps of the northern half of the State.

Mr. S. H. Scudder, who has studied carefully the songs of many species of Orthoptera and has even set a number of them, including that of *angustifolia*, to music, has given a pleasing account of its song² from which I give the following extract: "It is more noisy by night than by day; and the songs differ considerably at these two times. The day song is given only during sunshine, the other by night and in cloudy weather. I first noticed this while watching one of the little creatures close beside me; as a cloud passed over the sun he suddenly changed his note to one with which I was already familiar, but without knowing to what insect it belonged. At the same time all the individuals around me, whose similar day song I had heard, began to respond with the night cry; the cloud passed away, and the original note was resumed on all sides. Judging that they preferred the night song to that of the day, from their increased stridulation during the former period, I imitated the night song during sunshine, and obtained an immediate response in the same language. The experiment proved that the insects could hear as well as sing. * * *

The note by day is *b z r w i* and lasts for one-third of a second. The night song consists of a repetition, ordinarily eight times, of a note which sounds like *t c h w*. It is repeated at the rate of five times in three quarters of a second, making each note half the length of the day note."

²Distribution of Insects in New Hampshire, 1874, 366.

II. AMBLYCORYPHA, Stål (1873.)

Size medium; wing covers slightly expanded in the middle, regularly rounded at the ends, a little shorter than, or but slightly exceeding, the posterior femora; vertex broad, deflexed but not compressed, without spines; eyes elliptical; stridulating organ of male, brownish, opaque, traversed by a strong green cross vein; ovipositor broad, of medium length, curved gradually upwards from the middle, obtuse or rounded at the end, and with the apical half sharply and strongly serrate on both edges; anal plates of male not prolonged.

Seven species of this genus, which is confined to North America, have been described from the United States. Of these, three have been found in Indiana.

a. Tegmina about 37 mm. in length; exceeding the tip of posterior femora.

5. AMBLYCORYPHA OBLONGIFOLIA, (DeGeer.) The Oblong Leaf-winged Katy-did.

Locusta oblongifolia, DeGeer, "Mem., III., 1873, 445, pl. 38, fig. 2."

Phylloptera oblongifolia, Burmeister, Handbuch der Ent., II., 1838, 693.

Harris, Ins. Inj. to Veg., 1862, 159. (Text only.)

Scudder, Bost. Journ. Nat. Hist., VII., 1862, 444.

Id., Distb. Ins. in N. Hamp., 1874, 366.

Id., Am. Encyc. Ed., 1881, VIII., 170. (Text only.)

Rathvon, U. S. Agr. Rep., 1862, 382.

Thomas, Trans. Ill. St. Agr. Soc., V., 1865, 445.

Amblycorypha oblongifolia, Riley, Stand. Nat. Hist., II., 1884, 188.

Bruner, Bull. Washb. Coll. Lab. Nat. Hist.,
I., 1886, 195.

Comstock, Int. to Entom., I., 1888, 116.

Fernald, Orth. N. Eng., 1888, 21.

McNeill, Psyche, VI., 1891, 21.

Scudder, Rep. Ent. Soc. Ont., XXIII., 1892,
68. (Song of.)

The largest of the three species occurring in the state, measuring about 45 mm. to the end of the wing covers, which are 3.3 times as long as wide. Wings exceeding the wing covers by 6.5 mm. Anterior margin of pronotum much narrower than the posterior, the lateral carinae sharply defined. Inner, lower carina of posterior femora armed with ten or more rather

strong teeth. General color a bright pea-green, the shrilling organ of male brownish with a heavy green cross vein. The abdomen yellowish or brownish green.

Measurements: Male—Length of body, 21 mm.; of tegmina, 38 mm.; of posterior femora, 30 mm.; of pronotum 6.5 mm. Female—Length of body, 23 mm.; of tegmina, 36 mm., of posterior femora, 31 mm.; of ovipositor, 11.5 mm. Width of tegmina of male, 11.5 mm.

This species is rather common throughout the state from August 1st to October, frequenting the shrubbery along fence rows and the edges of thickets and woods, especially in damp localities; and when flushed, flies with a kind of whirring noise, alighting on fence or the lower branch of tree. I have not distinguished the note made by the male, but McNeill (*loc. cit.*), says that it is a "quick, shuffling sound which resembles "Katy" or "Katydid" very slightly."

aa. Tegmina less than 30 mm. in length; sometimes reaching but not exceeding the tip of posterior femora.

b. Greatest breadth of tegmina contained less than three times in their length; ovipositor strongly curved.

6. *AMBLYCORYPIA ROTUNDIFOLIA*, (Scudder.) The Round-winged Katydid.
Phylloptera rotundifolia, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 445.
Amblycorypha rotundifolia, Brunner, Monogr. der Phanerop., 1878.

Scudder, Proc. Bost. Soc. Nat. Hist., XIX.,
1877, 83.

Id., Am. Encyc., VIII., Ed. 1881, 170. (Fig.
only.)

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 68.
(Song of.)

Riley, Stand. Nat. Hist., II., 1884, 188, fig. 265.

Comstock, Int. Ent., I., 1888, 116.

Fernald, Orth., N. Eng., 1888, 21.

McNeill, Psyche, VI., 1891, 22.

Phylloptera oblongifolia, Harris, Ins. Inj. to Veg, 1862, fig. 75. (Not text.)

Riley, Sixth Rep. St. Ent. Mo., 1874, 169, fig. 55.

(Text in part.)

Length about 32 mm. to end of tegmina, which are proportionally much broader than those of *oblongifolia*. Posterior femora reaching tip of tegmina in male, a little longer in the female; armed on the lower, inner carina with four or five minute teeth. Anterior margin of pronotum, es-

pecially in the female, but little narrower than posterior; the lateral carinæ somewhat rounded. The ovipositor is more curved and more strongly serrate than in either the preceding or the following species. The color is essentially the same as that of *oblongifolia*.

Measurements: Male—Length of body, 19 mm.; of tegmina, 27 mm.; of posterior femora, 25 mm.; of pronotum, 5 mm.; width of tegmina, 10 mm. Female—Length of body, 20 mm.; of tegmina, 27 mm.; of pronotum, 6 mm.; of ovipositor, 10 mm.; width of tegmina, 11 mm.

As far as my observation goes, *rotundifolia* is, by far, the most common member of *Amblycorypha* found in Indiana. It is more of a terrestrial species than the preceding, being often seen on the ground, or on the clumps of tall grass and weeds, which grow in damp ravines. Its flight is comparatively noiseless and less prolonged than that of *oblongifolia*. In Central Indiana it makes its first appearance about the fifth of August. Of its note, Mr. Scudder says: "This insect stridulates both by day and by night, and without variation. The song consists of from two to four notes—sounding like *chic-a-chee*, repeated rapidly so as to be almost confounded, and when three requiring just one third of a second; the song is repeated at will, generally once in about five seconds, for an indefinite length of time."

bb. Greatest breadth of wing covers contained from $3\frac{1}{2}$ to $3\frac{3}{4}$ times in their length; ovipositor but moderately curved.

7. *AMBLYCORYPHA UHLERI*, Brunner. Uhler's Katydid.

Amblycorypha uhleri, Brunner, Monogr. der Phanerop, 1878.

Comstock, Int. to Ent., I., 1888, 116.

Smith, Cat. Ins. of N. Jer., 1890, 409.

Our smallest species of the genus measuring but about 27 mm. to end of tegmina. Posterior femora armed as in *rotundifolia*, slightly exceeding the tegmina in both sexes. Pronotum narrower in front, the anterior half of lateral carinæ rounded, the posterior, rather sharp. The male with longer wings and narrower tegmina than the female. Ovipositor less curved than in either of the other species, the apical half with comparatively strong serrations on both margins. General color, a light, grass green.

Measurements: Male—Length of body, 14 mm.; of tegmina, 23.5 mm.; of hind femora, 20 mm.; of wings beyond tegmina, 5 mm. Female—Length of body, 17.5 mm.; of tegmina 20.5 mm.; of hind femora, 21.5 mm.; of wings beyond tegmina, 3 mm.; of ovipositor, 8.5 mm.

Much less common than either of the preceding, having been noted, as far as known, only in Vigo county, where it frequents the tall sedges and willows bordering the large ponds in the Wabash River bottoms. The young feed upon the leaves of the scarlet oak, *Quercus coccinea*, Wang., and the perfect insect is often found on or beneath this tree. It has been recorded before from New Jersey, Maryland, and the District of Columbia. August 12 and 27th.*

III. MICROCENTRUM, Scudder (1862.)

Size large. Wing covers moderately expanded in the middle, much longer than the posterior femora, and with the outer border sloping off quite sharply, thus causing the tip to be more pointed than in *Amblycorypha*. Vertex much as in that genus, slightly furrowed. Eyes broadly oval, very prominent. Hind legs slender and very short, the femora but little more than half as long as the tegmina. Ovipositor very short, bent abruptly upwards, bluntly pointed, and with the apical third finely serrate above. Anal plates of male not prolonged.

"This genus differs from *Amblycorypha*, to which it is most nearly allied, especially by the cut of the wing covers and the shortness of the hind legs and ovipositor."—Scudder.

But one species is known to occur in Indiana.

8. MICROCENTRUM LAURIFOLIUM, (L.) The Larger Angular-winged Katydid. The Oblique-winged Katydid.

"*Gryllus laurifolius* L., Syst. Nat. II., 1767, 695, No. 17."

Phylloptera laurifolia, Burmeister, Handb. d. Ent., II., 1838, 693.

Serville, Hist. Nat. des Orth., 1839, 404.

Microcentrum laurifolium, Bruner, Bull. Washb. Coll. Nat. Hist., I., 1885, 127.

Fernald, Orth. N. Eng., 1888, 21.

McNeill, Psyche, VI., 1891, 22.

Smith, Cat. Ins. N. J., 1890, 409.

Microcentrum affiliatedum, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 447, fig 5.

Riley, Stand. Nat. Hist., II., 1884, 191.

Comstock, Int. to Ent., I., 1888, 116.

Microcentrus retinervis, Riley, Sixth Rep. Stat. Ent. Mo., 1874, 155, figs. 43-47.

* Unless otherwise stated, the dates given in this paper are those on which the first mature insects have been taken in Central Indiana.

Microcentrum retinervis, Id., Stand. Nat. Hist., II., 1884, 188, fig. 266, (Not *Microcentrum retinervis*, Burm.)

This is the largest species of "Katydid" found in the State, both sexes measuring two inches and more to the end of the wings. The general color is light, grass green, the body yellowish green, lighter beneath. The vertex is quite broad, with its center hollowed out so as to form a shallow pit, which is more prominent in the male. The pronotum is about as broad as long, its anterior margin a little concave and usually possessing a slight median tooth, though this is sometimes obsolete, or is replaced with a shallow notch. The overlapping dorsal surface of the wing covers form a sharp and prominent angle with the lateral portions, whence the common name.

Measurements: Male—Length of body, 25 mm.; of tegmina, 42 mm.; of posterior femora, 22.5 mm.; of pronotum, 6 mm.; width of tegmina, 13 mm. Female—Length of body, 30 mm.; of tegmina 46 mm.; of posterior femora, 24 mm.; of ovipositor, 5 mm.; width of tegmina, 14 mm.

In the country it is this insect which is most commonly called "the Katydid," and the note of *Cyrtophyllus concurus* is usually attributed to it but its true note may be represented "by the syllable 'tic,' repeated from eight to twenty times at the rate of about four to the second."² It is evidently attracted by light, being often found in the gutters beneath the electric lights in the larger cities and towns. It occurs, probably, throughout the State, but is more common southward and is nowhere found in sufficient numbers to be injurious. The eggs are usually glued in double rows on the sides of slender twigs, which have been previously roughened with the jaws and otherwise prepared for a place of deposit. The two rows are contiguous and the eggs of one alternate with those of the other. Those of the same row overlap about one-fourth of their length. They are of a grayish brown color, long oval in shape, very flat, and measure 5.5x3 mm. They are usually deposited in September, hatch the following May, and the young, in Central Indiana, reach maturity during the first half of August.

The insect whose life history was so well written up by Dr. C. V. Riley, in his Sixth Missouri Report, under the name of *Microcentrus retinervis*, is, in my opinion, the present species, since the measurements of the figures there given correspond exactly with those given above of *laurifolium*. The true *M. retinervis* of Burmeister is found in the eastern United States and

²McNeill, (*loc. cit.*)

probably occurs in Indiana, but has not, as yet, been noted. It is considerably smaller* than *laurifolium*, and with the general color more of a yellowish green.

PSEUDOPHYLLINÆ.

This sub-family is represented in Indiana by the single genus *Cyrtophyllus* the leading characters of which are given below.

IV. CYRTOPHYLLUS, Burmeister (1838).

The members of this genus are at once distinguished from all other Locustidæ by the broad leaf-like form of the tegmina which are longer than the wings, obtuse and rounded at the end, and concave or hollowed within. The vertex extends forward between the eyes in the form of a small flat spine and the prosternum is armed with two sharp spines. Eyes small, globose. The "shrilling" organ of the male is brown in color, with the central portion as transparent as glass, and is set in a strong half oval frame. Ovipositor broad, with the apical half up-curved and denticulate below; apex rather sharply pointed. Sub-anal plate of male produced into a long paddle shaped appendage which is grooved on the upper side.

But two species occur in the United States only one of which is rather common in Indiana.

9. CYRTOPHYLLUS CONCAVUS, (Harris.) The True Katydid. The Broad-winged Katydid.

Pterophylla concava, Harris, Encyclopædia Americana, VIII., 1831, 42.

Platyphyllum concavum, Harris, Ins. Inj. to Veg., 1862, 158, fig. 74.

Walsh, Proc. Ent. Soc. Phil., III., 1864, 233.

Thomas, Trans. Ill. St. Ag. Soc., V., 1865, 445.

Riley, Sixth Rep. St. Ent. Mo., 1874, 167, figs. 52-54.

Cyrtophyllus concavus, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 444.

Id., Encyc. Americ. Ed., 1881, IX., 772, fig.

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 70, fig. 46.

(Note of set to music).

Thomas, Trans. Dav. Acad. Nat. Sci., I., 1876, 267.

Packard, Guide to Stud. Ins., 1883, 566, fig. 563.

Riley, Stand. Nat. Hist., II., 1884, 187, fig. 264.

*The measurements given by Burmeister are: length of body, 5-6 of an in.; of tegmina, 1½ in.

Comstock, Int. to Ent., I., 1888, 115.

Fernald, Orth., N. Eng., 1888, 20, fig. 10.

McNeill, Psyche, VI., 1891, 24.

Smith, Ins. N. J. 1890, 409.

Platyphyllum perspicillatum, Uhler, in Harris Ins. Inj. to Veg., 1862,
158. (Note.)

Rathvon, U. S. Ag. Rep., 1862, 382, figs. 19,

20. (Not *Cyrtophyllus perspicillatus*, Fab.)

The true Katydid is readily known by the characters of this genus. The wing covers and wings of living specimens are dark green; the body pronotum and head lighter, with a tendency to turn yellowish when dried. Harris says the pronotum is "rough like shagreen, and has somewhat the form of a saddle, being curved downward on each side, and rounded and slightly elevated behind and is marked by two slight transverse furrows." The main veins of the wing cover are very prominent with many reticulating branches, giving that organ much the appearance of a leaf. Posterior femora short, slender, and armed on apical half of lower outer carina with about six small spines. The ovipositor is almost as long as the abdomen, cimeter-shaped, sharp-pointed, and with but slight serrations on the lower edge of apical third. Below the curved anal cerci of the male is a spine, resembling in appearance the cerci, which curves beneath the projecting sub-anal plate.

Measurements: Male—Length of body, 30 mm.; of tegmina, 37 mm.; of posterior femora, 21 mm.; of sub-anal spine, 11 mm. Width of tegmina, 18 mm. Female—Length of body, 29 mm.; of tegmina, 36 mm.; of posterior femora, 22 mm.; of ovipositor, 14 mm. Width of tegmina, 16 mm.

The Broad-winged Katydid is found in considerable numbers throughout the State but is much more commonly heard than seen, as it dwells singly or in pairs in the densest foliage which it can find such as the tops of shade trees and the entwining vines of the grape arbor. It is more domestic in its habits than any other species of the "Katydid" group, frequenting, for the most part, the shrubbery of yards and orchards and the trees along fence rows, being seldom, if ever, heard in extensive wooded tracts. Its note is the loudest made by any member of the family, the male having the musical organ larger and better developed than in any other. The call is almost always begun soon after dusk with a single note uttered at intervals of about five seconds for a half dozen or

more times. This preliminary note gives the listener the impression that the musician is tuning his instrument, preparatory to the well known double call which is soon begun and kept up almost continuously from dark till dawn.

Of this call Mr. Scudder, says: "The note, which sounds like *ar*, has a shocking lack of melody: the poets who have sung its praises must have heard it at the distance that lends enchantment. In close proximity the sound is excessively rasping and grating, louder and hoarser than I have heard from any other of the Locustarians in America or in Europe, and the Locustarians are the noisiest of all Orthoptera. Since these creatures are abundant wherever they occur, the noise produced by them, on an evening specially favorable to their song, is most discordant. Usually the notes are two in number, rapidly repeated at short intervals. Perhaps nine out of ten will ordinarily give this number; but occasionally a stubborn insect persists in sounding the triple note—('Katy-she-did'); and as Katydids appear desirous of defiantly answering their neighbors in the same measure, the proximity of a treble-voiced songster demoralizes a whole neighborhood, and a curious medley results; notes from some individuals may then be heard all the while, scarcely a moment's time intervening between their stridulations, some nearer, others at a greater distance; so that the air is filled by these noisy troubadours with an indescribably confused and grating clatter."

According to Riley the eggs are thrust, by means of the sharp ovipositor, into crevices and soft substances, and probably, in a state of nature, into the crevices of loose bark, or into the soft stems of woody plants. They are of a dark slate color, about 6.5x2 mm. in size, very flat, pointed at each end, and with the edges beveled off or emarginate. The song has been heard in Putnam county as early as August 5th, and a single female was captured in Lake county on October 15th, so that the species probably exists more than two months in the mature state.

It was to this species that Oliver Wendell Holmes addressed the well known lines:

"I love to hear thine earnest voice
Wherever thou art hid,
Thou testy little dogmatist,
Thou pretty Katydid."

CONOCEPHALINÆ.

Vertex projecting forward and upward in the form of a tubercle or cone, sometimes blunt, sometimes much prolonged. Prosternum toothed

or with two slender spines. Front coxæ (in our genera) with a spine on the outside. Wing covers seldom expanded in the middle, often shorter than the abdomen, and in color either green or brown. Shrilling organ of male well developed, the cross vein prominent, the color light brown, with the central portion transparent (except in the genus *Conocephalus*). The hind legs are usually stout and much thickened at the base as the insects seldom fly, but are active leapers, and very difficult to capture.

The eggs are deposited within the stems or root leaves of grass, the pith of twigs, or sometimes in the turnip-shaped galls so common on certain species of willow. 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.

To this sub-family belong those slender-bodied green grasshoppers, 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, but one or two of the larger ones ever being found in trees.

The color of their bodies corresponds closely to that of the stems and leaves of the sedges and grasses among which they dwell, and so protects 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 songs differs from that of the night, and, says Scudder, "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."²

Twenty-one species of this sub-family, representing three genera, are known to occur in the state.

KEY TO GENERA OF CONOCEPHALINÆ.

- a. Vertex produced forwards into a long sharp cone;
stridulating organ of male green and opaque . . V. *CONOCEPHALUS*.
- aa. Vertex terminating in a rounded tubercle which
is hollowed out on the sides; stridulating organ
of male light brown and partly transparent.

²American Naturalist, II., 1868, 116.

- b. Prosternal spines very short; ovipositor slender, straight, or very nearly so; insect small . . . VI. NIPIDIUM.
 bb. Prosternal spines long and slender; ovipositor stout, usually upcurved; insect large . . . VII. ORCHELIMUM.

V. CONOCEPHALUS, Thunbergh (1815.)

The Cone-headed Grasshoppers.

The members of this genus are readily known by having the vertex prolonged forward and upward into a cone which much exceeds in length the first segment of the antennæ. Face very oblique. Eyes subrotund, rather prominent. Spines of pronotum long and slender. Wing covers long, narrow, rounded at the end, much exceeding the abdomen and slightly exceeding the wings in all our species. The stridulating organ of the male is opaque and of a coarse texture in the left wing cover, but transparent at the center of the right. Hind femora of moderate length, rather slender, the insects often using the wings as locomotors. Ovipositor rather narrow, nearly straight, oftentimes of excessive length; the eggs of those species in which the oviposition has been noted, being deposited between the stem and the root leaves of plants. Anal plates of male not produced; the cerci much swollen, recurved and toothed.

Although these insects are said to be rather common by those writers who have prepared lists of Orthoptera from other States, yet in Central and Western Indiana they are the least abundant of all the *Locustide*, five years' collecting having yielded less than twenty specimens. In the northern part of the State, however, they appear to be much more common. Of the habits of the species found in Illinois, McNeill has written: "All the species of *Conocephalus* seem to possess more intelligence than is usual in Orthoptera, and they are about the most difficult of the order to approach. In escaping they usually slip or fall into the grass instead of jumping or flying; but they seem to fully understand that they are very well protected by their color and form. If approached very cautiously they often remain quite still upon the stem of grass upon which you have surprised them with the usually well founded expectation that you will not be able to distinguish them from the green herbage around. If they think it worth while to make some active movement to escape they will frequently slip around on the other side of the stem and walk down the stem to the ground or off upon another plant. Unlike most Orthoptera they do not use their front legs in holding to the mouth

the thing upon which they feed. Instead of biting they seem to wrench or tear away pieces from the stems or leaves.”*

The genus is a large one, 101 species being included by Redtenbacher in his monograph. About one dozen are known to occur in the Eastern United States, and four have, up to the present, been taken in Indiana.

- a. Cone of vertex slender, about 3.5 mm. in length, and with either the margin or lower face black.
- b. A black line on each margin of cone extending from the apex half way or more to base; inner, lower carina of posterior femora with four or five minute spines.

10. *CONOCEPHALUS ENSIGER*, Harris. The Sword-bearer.

Conocephalus ensiger, Harris, Ins. Inj. to Veg., 1862, 163, fig. 79.

Scudder, Bost. Jour. Nat. Hist., VII., 1862, 449.

Id., Dist. Ins. in New Hamp., 1874, 367. (Note of to music.)

Id., Am. Ency., Ed. 1881, VIII., 170, fig. .

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 72. (Note of to music.)

Thomas, Trans. Ill. St. Agl. Soc., V., 1865, 445.

Smith, Orthop. of Maine, 1868, 145.

Riley, Stand. Nat. Hist., II., 1884, 187, fig. 263.

Comstock, Int. to Ent., I., 1888, 115.

Fernald, Orth. N. Eng., 1888, 22.

Wheeler, Insect Life, II., 1890, 224.

McNeill, Psyche, VI., 1891, 23.

Smith, Ins. of N. Jersey, 1890, 410.

Id., Bull. Ag. Coll. Ex. Stat. N. Jer., No. 90, 1892, 31, pl. II.

Redtenbacher, Monogr. der Conoceph., 1891, 67, 89.

Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

A slender-bodied species, the general color of which is grass green, the body and face paler; the posterior tibiæ and tip of ovipositor infuscated. Lateral carinæ of pronotum sometimes with a faint yellow line, more plainly visible in the dried specimens. Tegmina very long and slender. Cone of vertex with a small tooth projecting downward from the front of its base. Ovipositor of excessive length, straight, the apex pointed.

*Psyche, VI., 23.

Measurements: Male—Length of body, 26 mm.; of tegmina, 42 mm.; of posterior femora, 21 mm. Female—Length of body, 28 mm.; of tegmina 47 mm.; of posterior femora, 23 mm.; of cone of vertex 3.25 mm.; of pronotum, 7.5 mm.; of ovipositor, 31 mm.

This is probably the most widely distributed species occurring in the Eastern United States, having been recorded from Maine to Nebraska. It is the most common one occurring in Northern Indiana, where it frequents the tall rank grasses along ditches and the borders of damp prairies. In Vigo and Putnam counties it is scarce, being replaced by *C. nebrascensis*, Bruner.

The female has been recorded as depositing her eggs between the stem and root leaves of *Andropogon*, a genus of tall, coarse grasses which grow in dry, sandy localities. The young, hatched in May, reach maturity about the 5th of August. Mr. Scudder, who has set the note of the male to music, says of the song: "This insect has but a single song and stridulates only by night, or during cloudy weather. It begins its song as soon as the sky is obscured or the sun is near the horizon. It commences with a note like *b r w*, then pauses an instant and immediately emits a rapid succession of sounds like *c h w i* at the rate of about five per second, and continues them for an unlimited time. Another writer likens its note to the syllable '*ik-ik-ik*,' as if sharpening a saw, enlivening low bushes, and particularly the corn patch, as it seems to especially delight in perching near the top of a cornstalk and there giving forth its rather impulsive song."

bb. Cone of the vertex entirely black beneath; posterior femora armed on both of the lower carinae with a number of plainly visible spines.

11. *CONOCEPHALUS NEBRASCENSIS*, Bruner.

Conocephalus nebrascensis, Bruner, Canadian Ent., XXIII., 1891, 72.

McNeill, Psyche, VI., 1891, 23. -

Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

Scudder, Rep. Ent. Soc. Ont., XXIII., 1892, 72.

A heavier bodied and shorter winged species than the preceding. The cone of the vertex projecting upward more strongly and with the apical half more tapering than in *ensiger*; the basal tooth quite prominent. "Anal cerci of male stout, with strong internal hooks. Ovipositor long and slender, lanceolate, a little curved upwards and extending about one-fourth of an inch beyond the closed tegmina."

"General colour bright grass green (rarely a yellowish brown or tan) with narrow, yellowish lines along the lateral carinæ of the pronotum. Posterior tibiæ together with all the feet more or less infuscated."—Bruner.

Measurements: Male—Length of body, 28 mm.; of tegmina, 37 mm.; of pronotum, 8 mm.; of cone of vertex, 3.5 mm.; of posterior femora, 21 mm. Female—Length of body, 33 mm.; of tegmina, 42 mm.; of posterior femora, 23 mm.; of ovipositor, 29 mm.

The above measurements are very nearly the same as those given by Mr. Bruner in the original description of the species, and are the average of a half dozen specimens in my collection. I have one female, however, which is so much larger that at first I was inclined to think it a different species, but the color and structure, except the measurements, agree in every particular with those given above of *nebrascensis*. The following are the measurements of the specimen in question:

Length of body, 36 mm.; of cone, 4.5 mm.; of tegmina, 49 mm.; of posterior femora, 30 mm.; of ovipositor, 39 mm.

This species has not before been recorded east of Illinois, but in Central Indiana it is the most common of the three species occurring there. A number of specimens have been taken in Putnam county by Mr. Riley and in Vigo and Fulton counties by myself. When approached it often attempts to escape by burrowing beneath the fallen grass. It frequents the same localities as *C. ensiger* and is very liable to be mistaken for that species by the casual observer, but may at once be distinguished by the characters given above.

- aa. Cone of vertex rather stout, less than 3 mm. in length, devoid of black markings.
- c. Lateral carinæ of pronotum with a yellow line; wing covers with irregularly distributed black dots; ovipositor exceeding 25 mm. in length.

12. *CONOCEPHALUS ROBUSTUS*, Scudder.

Conocephalus robustus, Scudder, Bost. Journ. Nat. Hist., VII., 1862, 449.

Id., Proc. Bost. Soc. Nat. Hist., XI., 1868, 7.

(Song of.)

Id., Am. Naturalist, II., 1868, 117. (Song of.)

Id., Distb. Ins. in N. Hamp., 1874, 367. (Song of.)

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 72. (Song of.)

- Riley, Stand. Nat. History., II., 1884, 187.
 Comstock, Int. to Ent., I., 1888, 115.
 Fernald, Orth. N. Eng., 1888, 23.
 McNeill, Psyche, VI., 1891, 23.
 Smith, Ins. N. Jer., 1890, 410.
 Redtenbacher, Monog. der Conoceph., 1891, 89.
 Pl. III., fig. 36.

A larger and thicker bodied species than either of the preceding; and the wing covers broader. Cone of the vertex more like that of *C. ensiger* but shorter, with the apex more obtuse; the frontal basal spine distinct but blunt. Posterior femora armed beneath on both carinæ with a number of rather weak spines. Wings of male equalling the tegmina in length, in the female a little shorter. Ovipositor shorter than in either of the above species. General color either pea-green or dirty brown* or a mixture of both. The cone rarely with a black spot at apex, its sides often with a narrow yellowish line.

Measurements: Male—Length of body, 30 mm.; of tegmina, 44 mm.; of hind femora, 23 mm.; of pronotum, 8 mm.; of cone, 2 mm. Female—Length of body, 31 mm.; of tegmina, 48 mm.; of hind femora, 26 mm.; of ovipositor, 26 mm.

This species seems to be an inhabitant of sandy districts and occurs only along the Atlantic sea coast and the shores of the Great Lakes. In Indiana it has been noted only in Lake county, where Prof. E. E. Slick found it quite frequently along the shore of Lake Michigan during September and October. Of the specimens sent to me—a half dozen males—he wrote: They were caught off of trees, in the dusk of the evening, as they were singing. They sang (“whetted”) continuously for ten minutes or longer while I watched them.

Mr. Scudder thus describes the note as heard in New England: “Robustus is exceedingly noisy and sings equally, and I believe similarly, by day and night. The song resembles that of the harvest fly, *Cicada caniculæ* *laris*. It often lasts for many minutes, and seems, at a distance, to be quite uniform; on a nearer approach one can hear it swelling and decreasing in volume * * * and it is accompanied by a buzzing sound, quite audible near at hand, which resembles the humming of a bee or the droning of a bagpipe.”

**C. ensiger* is said also to be thus dimorphic in coloration, but all that I have seen from this state are of the green variety.

- c. Lateral carinae of pronotum without trace of yellow; wing covers a bright, grass green, immaculate; ovipositor less than 20 mm. in length.

13. *CONOCEPHALUS PALUSTRIS*, Blatchley.

Conocephalus palustris, Blatchley, *Canad. Ent. XXV.*, 1893, 89.

A small but comparatively heavy-bodied species, having the cone of the vertex devoid of black markings and without a basal tooth; ovipositor very short and broad; posterior femora armed beneath on both carinae.

Cone of the vertex short and stout, the tip round, the deflexed front with a dull median carina. Pronotum short, broad, the posterior margin regularly rounded, the lateral carinae well defined, the entire surface thickly and rather deeply punctate. Tegmina long and rather narrow, regularly rounded to the apex; of a more delicate texture than in either *C. ensiger*, Harris, or *C. robustus*, Scudder. Fore and middle femora with two short spines on the apical third of the lower outer carina. Hind legs short, the tibiae but little more than half as long as the closed tegmina; the femora with plainly visible spines on both of the inferior carinae, eight on the outer and six on the inner. Ovipositor a little shorter than the hind tibiae, broadest at a point about two-thirds the distance from the base, thence tapering regularly to a sharp apex.

General color a very bright grass green. Fastigium tipped with dull yellow, which extends half way down the sides. Labrum and apical segments of all the palpi a rose red tinged with violet. Tarsi somewhat infuscated. Antennae and apical third of ovipositor reddish-brown.

Measurements: Female—Length of body, 27 mm.; of fastigium in front of eye, 2.75 mm.; of pronotum, 7 mm.; of tegmina, 37 mm.; of hind femora, 20 mm.; of hind tibiae, 19.5 mm.; of ovipositor, 19 mm.

This handsome species of *Conocephalus* belongs to the same group as *C. robustus* and *C. crepitans*, Scudder, but is smaller and of a more uniform and brighter green than either of those species, besides having shorter legs, ovipositor, etc. It is described from a single female taken October 24, from the fallen grasses on the margins of a large low-land pond in Vigo county. This pond is surrounded on all sides by heavy timber, and its margins have yielded a number of interesting Orthoptera found nowhere else in the county. Among them are *Leptysmia marginicollis*, Serv., *Paroxya atlantica*, Scudder, *Anaxiphus pulicarius*, Sauss., *Phylloscirtes pulchellus*, Uhler, and *Niphidium nigropleurum*, Bruner. The first four mentioned are insects of a southern range, and perhaps *C. palustris* will in time be found to be more common southward.

VI. NIPHIDIUM, Serville (1831).

This genus includes our smallest winged Locustidae. The vertex projects forward and slightly upward in the form of a rounded tubercle which is hollowed out on the sides for the reception of the basal joint of the antennæ. Face rounded, somewhat oblique. Eyes rather large, sub-globose. Spines of prosternum very short and weak; often mere cone-shaped protuberances. Wing covers narrow, straight, rounded at the end, often varying much in length in the same species, but for the most part shorter than the abdomen. Wings usually a little shorter than the wing covers. Stridulating organ of male well developed, the veins prominent, light brown in color, and with the middle transparent. Hind femora of medium length, stout at base. Ovipositor narrow, straight, or but slightly curved, oftentimes of excessive length. Anal plates of male not prolonged; the cerci usually much swollen, and toothed at base on the inner margin. Eight species are known to occur in the State.

These insects are more variable in color and in the length of wings than those of any other genus of Orthoptera known to me. The variations, however, 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. Five of our eight species are thus dimorphic as regards the length of wings, the short-winged individuals, as far as my observation goes, far outnumbering those with the wings fully developed; and at least three of the eight are variable with respect to color.

a. Ovipositor shorter than the body.

b. Ovipositor straight.

c. Wings a little longer than the wing covers; the latter always fully developed.

14. NIPHIDIUM FASCIATUM, (DeGeer.) The Slender Meadow Grasshopper.

Locusta fasciata DeGeer, "Mem., III., 1778, 458, Pl. XL., fig. 4."

Niphidium fasciatum, Burmeister, Handb. der Ent., II., 1839, 708.

Scudder, Boston Jour. Nat. Hist., VII., 1862, 451.

Id., Distr. of Ins. in N. Hamp., 1874, 368.

Id., Rep. U. S. Ent. Com., II., Appen. II., 1880, 23.

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 75. (Song of.)

Smith, Orthop. of Maine, 1868, 145.

- Packard, Guide, Stud. Ins., 1883, 567.
 Riley, Stand. Nat. History., II., 1884, 186.
 Bruner, Bull. Washb. Coll. Nat. Hist., I., 1885,
 128.
 Id., Ent. News, III., 1892, 265.
 Comstock, Int. to Ent., I., 1888, 114.
 Fernald, Orth. N. Eng., 1888, 24.
 Smith, Ins. of N. Jer., 1890, 411.
 Id., Bull. 90, Ag. Coll. Exp. Stat. N. Jer., 1892, 31,
 pl. II.
 McNeill, Psyche, VI, 1891, 24.
 Redtenbacher, Monog. der Conoceph., 1891, 192,
 pl. IV., fig. 82.
 Osborne, Proc. Ia. Acad. Sci., I., 1892, 118.

One of the most slender bodied species belonging to our fauna, and the only one whose wings are never shorter than the body. Posterior femora reaching to or slightly beyond the tip of tegmina in the female, distinctly shorter in the male. Face, sides of pronotum and abdomen, and basal portion of ovipositor green; tegmina and apical third of ovipositor light reddish brown; upper side of abdomen, and stripe on occiput and disk of pronotum darker brown; legs green, brownish on the knees and tarsi.

Measurements: Male—Length of body, 13.5 mm.; of tegmina, 17.5 mm.; of hind femora, 11.5 mm.; of pronotum, 3.5 mm. Female—Length of body, 14 mm.; of tegmina, 16 mm.; of hind femora, 13 mm.; of ovipositor, 8 mm.

Abundant everywhere in timothy and clover meadows and especially so about small streams in low ground, blue-grass pastures. One of the first of the Locustidæ to reach maturity, specimens having been taken in Vigo county as early as July 5th. The note of the male is very faint—a kind of *zr r-r-r* long drawn out.

Fasciatum has, perhaps, the widest distribution of any of our American Locustidæ, its range, according to Redtenbacher, being from British America to Buenos Ayres, S. A.

The *Orchelimum gracile* of Harris, usually quoted as a synonym of *X. fasciatum*, has been shown by Bruner (Ent. News, *loc. cit.*) to be a distinct and valid species.

- cc.* Wings shorter than the wing covers; the latter variable in length.

15. *XIPHIDIUM BREVIPENNE*, Scudder.

Xiphidium brevipennis, Scudder, Boston Jour. Nat. Hist., VII., 1862, 451.

Xiphidium brevipenne, Id., Dist. Ins. in N. Hamp., 1874, 368.

Id., Sec. Rep. U. S. Ent. Comm., 1880 Appen., II., 23.

Smith, Orth. of Maine, 1868, 145.

Riley, Stand. Nat. Hist., II., 1884, 186.

Bruner, Bull. Washb. Coll. Lab. Nat. Hist., 1885, I., 128.

Comstock, Int. Ent., I., 1888, 114.

Fernald, Orth. N. Eng., 1888, 24.

Smith, Ins. of N. Jer., 1890, 411.

Id., Bull. 90, Ag. Coll. Exp. Stat. N. Jer., 1892, 31, pl. II.

McNeill, Psyche, VI., 1891, 24.

Redtenbacher, Monog. der Conoceph., 1891, 206, pl. IV., fig. 91.

Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

Blatchley, Can. Ent., XXIV., 1892, 26.

A little shorter and thicker bodied species than *X. fasciatum*. Posterior femora rather short and stout, unarmed beneath, or rarely with one to four minute spines. Cerci of male swollen, the apex strongly compressed and obtuse, armed below the middle with a rather flat, sharp-pointed tooth.

General color light reddish brown; the face and sides of pronotum usually green; stripe on occiput and disk of pronotum a very dark brown, margined on each side with a narrow yellow line; ovipositor reddish brown throughout.

Measurements: Male—Length of body, 12 mm.; of tegmina, 8 mm.; of posterior femora, 11.5 mm.; of pronotum, 3.5 mm. Female—Length of body, 13 mm.; of tegmina, 7.5 mm.; of posterior femora, 11 mm.; of pronotum, 3 mm.; of ovipositor, 9–10 mm.

This is also an abundant species throughout the State, frequenting the same localities as *fasciatum* and reaching maturity about a fortnight later. Long-winged forms of it occasionally occur, but in Indiana they are very scarce, but one or two having come under my notice. Of the variations in the length of the wing covers of it and allied species Prof. Bruner has well said: "That in the genera *Xiphidium* and *Orchelimum* wing length is

a character not to be relied upon as specific or even varietal difference* ;” yet Redtenbacher in his *Monographie der Conocephaliden* has 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.

bb. Ovipositor a little curved ; tegmina constant in length, covering about two-thirds of the abdomen in the male ; shorter in the female.

16. *XIPHIIDUM NEMORALE*, Scudder.

Xiphidium nemorale, Scudder, Proc. Bost. Soc. Nat. Hist., XVII., 1875, 462.

Id., Entom. Notes, IV., 1875, 65.

Id., Cent. Orth., 1879, 15.

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 75.

McNeill, Psyche, VI., 1891, 24.

Bruner, Can. Ent., XXIII, 1891, 59.

Xiphidium curtipenne, Redtenbacher, *Monograph der Conoceph.*, 1891, 208.

A rather robust species with the general color a dark, greenish brown ; tegmina light reddish brown with the front or lower area fuscous. Dorsal stripe of occiput and pronotum not contrasting so strongly with the general color as in the preceding species, margined with a narrow yellow line on each side. All the femora punctate with reddish dots, the tarsi and tip of hind femora dusky. Tegmina with the veins and cross veins unusually prominent giving them a coarse and scabrous look ; the tympanum of male stout and elevated. Cerci conical, the apex obtuse, but little compressed. Ovipositor as long as the abdomen, the apical half with a gentle but evident upward curve.

Measurements: Male—Length of body, 14 mm. ; of tegmina, 8 mm. ; of hind femora, 12 mm. ; of pronotum, 3.5 m. Female—Length of body, 15 m.m. ; of tegmina, 5.5 mm. ; of hind femora, 13 mm. ; of ovipositor, 9 mm.

Redtenbacher, in his *Monographie*, has evidently described this species as new under the name of *curtipenne*. His specimens were from Missouri.

Nemorale is a very common insect in Vigo and Putnam counties but has not as yet, been taken in the northern part of the State. It reaches maturity about August 15th and from then until after heavy frosts may be found in numbers along the borders of dry, upland woods, fence rows, and

* Canadian Ent., XXIII, 59.

roadsides where it delights to rest on the low shrubs, blackberry bushes, or coarse weeds usually growing in such localities. On the 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-c—ch-c-e-e-c*, 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 *Xiphidium* and *Orchelimum*. *Nemorale* has been recorded only from Nebraska, Iowa, and Illinois and seems to be confined to the northern half of the middle United States.

aa. Ovipositor equal to or longer than the body.

d. Length of posterior femora almost equal to that of ovipositor.

e. Body rather stout; the tegmina always covering more than half the abdomen.

f. Abdomen with the dorsal surface light brown, the sides green, or greenish yellow.

17. *XIPHIDIUM ENSIFERUM*, Scudder.

Xiphidium ensifer, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 451.

Xiphidium ensiforme, Id., Bull. U. S. Geol. and Geog. Surv. Terr., 1876, II., 261.

Xiphidium ensiferum, Id., Sec. Rep. U. S. Ent. Comm., 1880, Appen II., 23. Riley, Stand. Nat. Hist., II., 1884, 186.

Comstock, Int. to Ent., I., 1888, 114.

Wheeler, Insect Life, II., 1890, 222. (Oviposition of.)

McNeill, Psyche, VI., 1891, 24.

Redtenbacher, Monog. der Conoceph., 1891, 209.

Very similar in general appearance to *X. brevipenne*, Scudder, and may be only a variety of that species. Typical examples are larger with a much longer ovipositor. The general color is also more of a green than in *brevipenne*; the face, sides of pronotum and abdomen, and the four anterior femora being of that hue. The tegmina and wings are light, reddish brown, as are also the tibiæ and ovipositor; the latter becoming a deeper brown towards the apex. Cerci of male rather stout, with the apical half curved slightly outward and depressed. Ovipositor slender, straight.

Measurements: Male—Length of body, 13.5 mm.; of tegmina, 9 mm.; of hind femora, 13 mm.; of pronotum, 3.5 mm. Female—Length of body, 14.5 mm.; of tegmina, 8.5 mm.; of hind femora, 14 mm.; of ovipositor, 15 mm.

Although found in Indiana wherever collections have been made, this species appears to be less common than either *fasciatum* or *brevipenne*. It differs from them also in the manner of oviposition, as, instead of depositing its eggs in the stems of grasses, it seeks the turnip-shaped galls so common on certain species of *Salix* (willow) and oviposits between their scales. The gall is not formed by the Locustid, but by a Dipterous insect belonging to the family of *Cecidomyiidae*. 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 Mr. Wheeler published (*loc. cit.*) his excellent account of the oviposition of this species. 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-shaped 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 fifty to one hundred. In one small gall I counted one hundred and seventy." The egg is cream colored, very thin, elongate oval in outline, and measures 4x1 mm.⁶ The young emerge about the middle of May and reach maturity about August 10th. Long-winged forms of this species are occasionally met with.

On October 21 a pupa was taken which had a white hair worm (*Gordius*) 8½ inches long in its abdomen.

Ensiferum was first described from Illinois, and, as yet, has not been recorded east of the Alleghany Mountains.

ff. Abdomen with the dorsal surface a fuscous brown, the sides shining black.

⁶Mr. B. D. Walsh, in the 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 *X. ensiferum*, as they were cylindrical, .16 to .17 of an inch long, and seven times as long as wide.

18. *XIPHIDIUM NIGROPLEURUM*, Bruner. The Black-sided Grasshopper.

Xiphidium nigropleurum, Bruner, *Canad. Entom.*, XXIII., 1891, 58.
 Osborne, *Proc. Ia. Acad. Sci.*, I., 1862, 118.
 Blatchley, *Canad. Ent.*, XXV., 1893, 90.

A medium sized, rather robust species, easily distinguished from all others of the genus by its peculiar coloration. In Indiana dimorphic forms occur; one having the pronotum, tegmina and legs bright grass green, the other with these parts brownish yellow, the green wholly absent. Both forms have the stripe on the occiput and the sides of the abdomen shining black; the former narrowing in front to the width of the tubercle, and bordered on each side with yellowish white. In the green forms the usual brown stripe on the disk of pronotum is but faintly defined, in the other it is very evident.

"The tegmina are usually abbreviated, reaching only four-fifths of the length of the abdomen, but an occasional specimen is to be found in which the wings are fully developed and then reach to the extremity of the ovipositor in the female. Ovipositor straight, quite broad and heavy. Male cerci of medium length, rather stout, tapering gently toward the apex, and with a strong sub-basal tooth."—Bruner, (*loc. cit.*)

Measurements: Male—Length of body, 14 mm.; of tegmina, 9 mm.; of hind femora, 13.5 mm.; of pronotum, 3.5 mm. Female—Length of body, 15 mm.; of tegmina, 8.5 mm.; of hind femora, 14 mm.; of ovipositor, 16 mm.

In Indiana this handsome insect is known to occur in the two widely separated counties of Fulton and Vigo, but in restricted localities and small numbers, as far as noted, in each. In Fulton county it was found only in a broad, shallow ditch by the side of a railway and near the border of a large tamarack swamp, where it inhabited a space not more than twenty feet square, which contained several dead willow branches, surrounded by a dense growth of sedge and *Polygonum*. Here, on August 26th, four females were taken and on September 24th two males and two females. These were all that were seen, although a careful search was made over a wide area in every direction for others. The most of those secured were taken by clasping the hand about the slender willow branches which were raised a few inches above the ground, on the under side of which the insects took refuge when pursued. A single male taken from the margin of the large pond mentioned under *Conocephalus palustris*, is the only specimen as yet seen in Vigo county. The species has been

noted before only in Iowa and Nebraska, but probably occurs in suitable localities throughout northern Illinois and northwestern Indiana. Of its habits in Nebraska, Bruner has written as follows: "It 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. Grape vines 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."

Since writing the above I have received a pair of this species from Mr. A. P. Morse, Wellesly, Mass., which were labelled "Ithaca, N. Y.," thus extending eastward its known habitat by more than 700 miles.

ee. Body very slender; the tegmina exceedingly short, pad-like, covering only one-third of abdomen.

19. *NIPHIDIUM MODESTUM*, Bruner.

Niphidium modestum, Bruner, Can. Ent., XXIII., 1891, 56.

This is the smallest and most slender-bodied Locustid found in the state. It is a dull, reddish brown in color, except the stripe on the occiput and disk of pronotum, which is a dark, chocolate-brown, the two colors being separated by a rather wide yellowish line which in living specimens is very distinct.

The cone of vertex is short and rather narrow. Tegmina, especially those of the female, very short and obtusely rounded. Cerci of male elongate, tapering, a little curved outward and armed with a rather long sub-basal tooth. Ovipositor equalling the body in length, very slender and tapering, with its apical half slightly upcurved.

Measurements: Male—Length of body, 10 mm.; of tegmina, 3 mm.; of hind femora, 9 mm.; of pronotum, 3 mm. Female—Length of body, 11 mm.; of tegmina, 2.5 mm.; of hind femora, 9.5 mm.; of ovipositor, 11 mm.

As yet noted only at one point in the state, namely, the border of a raw prairie near Heckland, Vigo county, where it was found in small numbers on October, 21st. It appears to be less active than any other *Niphidium*, 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 throughout the prai-

rie region of the state, but has not before been recorded east of the Mississippi river, although it is said by Bruner to be very plentiful in Nebraska, Iowa and Kansas.

dd. Posterior femora much shorter than the ovipositor: the latter of excessive length.

g. The common form with the tegmina very short, less than half the length of the abdomen; the sides of the body green.

20. *XIPHIIDUM STRICTUM*, Scudder.

Xiphidium strictum, Scudder, Proc. Bost. Soc. Nat. Hist., XVII., 1875, 460.

Id., Entom. Notes, IV., 1875, 63.

Id., Cent. of Orthop., 1879, 13.

Bruner, Bull. Washb. Coll. Lab. Nat. Hist., I., 1885, 128.

McNeill, Psyche, VI., 1891, 24.

Redtenbacher, Monog. der Conoceph., 1891, 205.

This is a species with the body rather slender, of more than average length; constant in color but dimorphic as respects the length of wings, the long winged forms, however, being very scarce. Sides of head and body together with all the femora green. The usual reddish brown stripes on occiput and pronotum narrowly edged with whitish, especially on the fastigium of the vertex. Tegmina reddish brown; in the females exceedingly short and pad like, or well developed and reaching almost to knees; when the former, a little longer than the wings; when the latter, 5 mm. shorter than the wings. In the brachypterous males (the only ones I have seen) the tegmina are somewhat less than half the length of the abdomen. A reddish brown band on dorsal surface of abdomen, darker where it meets the green on sides. Ovipositor pale red, straight, one and a half times the length of the posterior femora. Cerci of male, long, the apical half acuminate, curved slightly inward near the tip.

Measurements: Male—Length of body, 14 mm.; of tegmina, 5.5 mm.; of pronotum, 3.5 mm.; of hind femora, 13.5 mm. Female—Length of body, 17 mm.; of tegmina, short winged form, 3.5 mm.; long winged form, 16 mm.; of hind femora, 15.5 mm.; of ovipositor, 23 mm.

A common species in the prairie country of the western and northern parts of the state, where it frequents, for the most part, dry upland meadows and prairies and reaches maturity about August 5th. An active leaper and tumbler and, like the next species, often striving to escape de-

tection by burrowing beneath fallen weeds and grasses. Its general range is to the west and southwest, it having first been described from Texas, and it has not heretofore been recorded east of Illinois.

gg. The common form with the tegmina covering three-fourths or more of abdomen; sides of body dull, reddish brown.

21. *XIPHIDIUM ATTENUATUM*, Scudder. The Lance-tailed Grasshopper.

Xiphidium attenuatum, Scudder, Trans. Am. Ent. Soc., II., 1869, 305.

(Long winged form.)

Bruner, Canad. Entom., XXIII., 1891, 57.

Id., Entom. News, III., 1892, 265.

Redtenbacher, Monog. der Conoceph., 1891, 191.

(Long winged form.)

Xiphidium scudderi, Blatchley, Canad. Entom., XXIV., 1892, 26. (Short

winged form.)

? *Xiphidium lanceolatum*, Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

A medium sized grasshopper with the sides of head and body dull reddish brown. Vertex, disk of pronotum, and tegmina greenish brown in life, the former with the usual dark brown median stripe. Femora greenish brown, very rarely bright green, the tibiae and tarsi darker. Tegmina and wings either abbreviated or fully developed—when the former, covering about three-fourths of the abdomen, when the latter considerably surpassing its tip in both sexes. Antennae with the basal third reddish, the remainder fuscous, longer than in any other member of the genus belonging to our fauna, measuring 73 mm. in one specimen at hand. Ovipositor also longer than in any other; slender and nearly straight, the apex very acuminate; cerci of male long, broad, with the apical third gently tapering, the basal tooth minute, slender.

Measurements: Male—Length of body, 14 mm.; of pronotum, 3 mm.; of tegmina, short form, 10 mm.; of hind femora, 14.5 mm. Female—Length of body, 16 mm.; of tegmina, 9.5 mm.; of hind femora, 15 mm.; of ovipositor, 27—30 mm.

In Indiana the "Lance-tailed Grasshopper" has, up to the present, been recorded only in Vigo county where it is common about the margins of two large ponds in the Wabash river bottoms, but is found nowhere else. The distance between these two ponds is 15 miles and the one to the south is surrounded on all sides with heavy timber. About its margins on September 5th, 1892, mature specimens of *X. attenuatum* were very plentiful

but no young were seen. On the next day the young in all stages were found at the north pond, which lies in an open prairie region, while but one imago was noted. Ten days later the north pond was again visited and many imagoes secured, although the young were still plentiful.

The difference in time of development at the two ponds is probably due to the surrounding forest which shelters the one to the southward, as about its margins occur the four southern species of Orthoptera mentioned above in the notes on *Conocephalus palustris*, not one of which has been found at the north pond.

The males of *attenuatum* are, as far as my experience goes, the most active leapers among the winged Locustidæ, jumping a half a 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.

I find that the length of the ovipositor among the different species of *Xiphidium* is not at all dependent upon the age of the insect. In *attenuatum* it is almost as long after the third, and fully as long after the fourth moult as it is in the imago; while on August 11th a female of *strictum* was taken with no vestige of tegmina in which the ovipositor measured 18 mm. The eggs of *attenuatum*, as the length of the ovipositor indicates, are laid between the stems and leaves of tall, rank grasses.

Only the short winged form of this species has been noted in Indiana, but Prof. Bruner has taken the long winged form in Nebraska, and Mr. Scudder described it from the latter taken in Illinois; though McNeill makes no mention of the species in his list of Orthoptera from that state. Redtenbacher, in his Monographie, has copied Scudder's description and has separated the species from all others of those from America to which it is closely allied, placing it next to *fasciatum*, with which it has little affinity, by virtue of the wing characters alone.

VII. ORCHELIMUM, Serville (1831).

Locustidæ of medium size, but with a short and stout body. Vertex, face and eyes much as in *Xiphidium*. Spines of the prosternum well developed, cylindrical and slender. Antennæ slender and tapering, usually of excessive length. Wing covers narrow, the apical half often much less in width than the basal, exceeding the abdomen in all of our species;

almost always shorter than the wings. Stridulating organ of the male as in *Xiphidium*, but proportionally larger. Ovipositor stout, broad, with the apical half usually upcurved; when straight the apical third tapers rather abruptly on the under side to a fine point. Anal plates and cerci of males as in *Xiphidium*.

Very close to *Xiphidium*, and by some writers united with that genus. Redtenbacher places it as a sub-genus of *Xiphidium*, separating its members from those of *Xiphidium* proper by the same characters as did Serville. As scientists differ in opinion with respect to what characters are necessary to constitute a genus, and as, at the best, it is but an artificial and arbitrary grouping of species for the sake of convenience, I follow Serville, Scudder and Bruner in separating the two, believing that the prime idea of convenience can thus be better subserved.

As seen above, the larger, heavier body, longer prosternal spines, and shorter and broader falcate ovipositor are the chief distinguishing characters of *Orchelimum*. The wing covers 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 *Xiphidium*.

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.

Nine species of the genus have been taken by the writer within the State, and probably several others occur which have not as yet been discovered.

- a. Ovipositor with a very evident curve; its length less than 10 mm.
- b. Face without a median brown stripe.
- c. Posterior femora unarmed beneath.
- d. Tegmina broadest at base; the apical third narrower; body robust.
- e. Tegmina and wings sub-equal in length; size, medium.

22. *ORCHELIMUM VULGARE*, Harris. The Common Meadow Grasshopper.
Orchelimum vulgare, Harris, Ins. Inj. to Veg., 1862, 162, fig. 77.

- Scudder, Bost. Jour. Nat. Hist., VII., 1862, 452.
 Id., Proc. Bost. Soc. Nat. Hist., XI., 1868. (Note of set to music.)
 Id., Am. Naturalist, II., 1868, 117. (Note of set to music.)
 Id., Distrib. Ins. in N. Hamp., 1874, 368. (Note of set to music.)
 Id., Rep. Ent. Soc. Ont., XXIII., 1892, 73. (Note of set to music.)
 Rathvon, U. S. Agr. Rep., 1862, 382.
 Smith, Orthop. Maine, 1868, 145.
 Thomas, Geol. Surv. Wyoming, 1870, 269.
 Packard, Guide to Stud. Ins., 1883, 567.
 Riley, Stand. Nat. Hist., II., 1884, 187.
 Bruner, Bull. Washb., Coll. Lab. Nat. Hist., I., 1885, 129.
 Comstock, Int. Entom., I., 1888, 114.
 Smith, Ins. of N. Jersey, 1890, 411.
 Id., Bull. Ag. Coll. Exp. Stat. N. Jer., No. 90, 1892, 5, 22, 31, fig. 13, pl. II.
 McNeill, Psyche, VI., 1891, 25.
 Osborne, Proc. Ia. Acad. Sci., 1892, 118.
Xiphidium vulgare, Fernald, Orth. N. Eng., 1884, 24.
Xiphidium fasciatum, Thomas, Trans. Ill. St. Agr. Soc., V., 1865, 444. (Not *X. fasciatum*, DeGeer.)
Xiphidium agile, Redtenbacher, Monog. der Conoceph., 1891, 186. (In part.)

A medium sized, robust species, with the general color green or light reddish brown. Face light green or light brown without fuscous marks. The occiput and disk of pronotum with a reddish brown band, widening on the latter, where it is often, especially in the male, bordered on each side with a darker line. The male (as in most of our species) with two short, black dashes on each wing cover, the four forming the angles of an assumed square, enclosing the tympanum. The legs usually pale brown, the tarsi dusky. Pronotum long, its posterior lobe but slightly, if at all, upturned above the plane of the anterior, its hind margin broadly rounded. Tegmina reaching to or very slightly beyond the apex of hind femora, and equalling or very little shorter than the wings. Cerci of male rather

long, the apex bluntly rounded, a little depressed; sub-basal tooth somewhat flattened, with the tip sharp and decurved.

Measurements: Male—Length of body, 18 mm.; of pronotum, 6 mm.; of tegmina, 21 mm.; of hind femora, 18 mm. Female—Length of body, 19 mm.; of pronotum 6.2 mm.; of tegmina, 21 mm.; of hind femora, 18.5 mm.; of ovipositor, 7.5 mm.

Redtenbacher places *vulgare* as a synonym of DeGeer's *Xiphidium agile*, stating as his reason for so doing that Harris and Scudder have 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." He may be right in thus combining them, but his relative measurements of *X. agile*, as given, do not agree with specimens of undoubted *vulgare* in my possession. Scudder, who has had ample opportunity to compare the two, says (Bost. Journ. Nat. Hist.) that the pronotum is shorter in *agile* than in *vulgare*. Redtenbacher's measurements of this organ, as well as those of the hind femora, are much less than the average measurements given above. Harris, as well as Burmeister, states that the tegmina of *agile* are 2.5 mm. shorter than the wings, while McNeill, in his description of *O. silvaticum*,* says that *agile* has the hind femora armed beneath. Taking all these facts into consideration, though having no typical example of *agile* for comparison, I have concluded not to follow Redtenbacher but to retain for the species at hand the name *vulgare*, by which it is best known to the entomologists of the United States.

This is probably the most abundant member of the family Locustidæ found in Indiana. It begins to reach maturity in the central part of the State about July 20th, and more frequently than any other of our species of *Orchelimum* it 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. *Vulgare* seems 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. The note of the male has been well represented by McNeill as "the familiar *zip-zip-zip-zip-ze-e-e-e*—the staccato first part being repeated about four times, usually about twice a second; the *ze-e-e-e* continuing from two or three to twenty or more seconds."

*Psyche, VI., 26.

cc. Tegmina distinctly shorter than wings; size large.

23. ORCHELIMUM GLABERRIMUM, (Burmeister.)

Niphidium glaberrimum, Burmeister, Handb. der Ent., II., 1838, 707.

Fernald, Orth. N. Eng., 1888, 25.

Redtenbacher, Monog. der Conoceph., 1891, 187.

Orchelimum glaberrimum Scudder, Bost. Journ. Nat. Hist., VII., 1862, 453.

Walsh, Proc. Ent. Soc. Phil., III., 1864, 232.

Riley, Stand. Nat. Hist., II., 1884, 186.

Bruner, Bull. Washb. Coll. Lab. Nat. Hist., I.,
1885, 128.

Comstock, Int. to Entom., I., 1888, 114.

Smith, Ins. N. Jer., 1890, 410.

McNeil, Psyche, VI., 1891, 25.

Very close to and perhaps only a larger form of *O. vulgare*. The general color is the same, but the brown line on the disk of pronotum is, in the female, more plainly margined with black, while in the male the black dashes at ends of tympanum are larger and more completely enclose that organ. The tegmina of the male exceed the hind femora by about 4 mm., and are exceeded by the wings about the same distance; those of the female are proportionally a little shorter.

Measurements: Male—Length of body, 22.5 mm.; of pronotum, 6 mm.; of tegmina, 25 mm.; of hind femora, 19 mm. Female—Length of body, 23 mm.; of pronotum, 6.5 mm.; of tegmina, 24 mm.; of hind femora, 19 mm.; of ovipositor, 8.5 mm.

Burmeister's original description of this species is very short 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 twenty or more species now known it is difficult to say just which one he had in mind when he wrote the above. Of the specimens referred to this species I have but three examples. One is from Fulton county, the other two from Vigo. They were taken from tall grass growing near the margin of ponds. Nothing distinctive of their habits is known.

dd. Tegmina of equal width throughout; body slender.

24. ORCHELIMUM CAMPESTRE, Blatchley.

Orchelimum campestre, Blatchley, Canad. Entom., XXV., 1893, 91.

A species of less than medium size, with the wing-covers narrow and of almost equal width throughout, the posterior femora unarmed beneath, and the ovipositor short and narrow.

Cone of the vertex prominent, narrow, rounded at the apex; the sides of the frontal deflexed portion rapidly converging to form a very acute wedge. Wing-covers long, slender, not narrowed in the middle as in *O. vulgare*, *glaberrimum*, etc., tapering slightly on the apical third to a rounded end; their length equalling that of the wings in the male, a little shorter in the female. Posterior femora with the basal half quite stout, the length less than that of the tegmina. Cerci of male slender, cylindrical, somewhat pointed, the apical half curved slightly outwards, the basal tooth short and weak. Ovipositor short, narrow, moderately upcurved, and tapering to a delicate point.

Color.—Tegmina and wings almost uniform transparent olivaceous brown. The usual dark reddish-brown band upon the occiput and disk of pronotum is margined on the latter with two very narrow and darker brown stripes, which extend back to the middle of the posterior lobe of the pronotum. Face, and usually the hind femora, a dirty olive brown; the latter, when dry, with a blackish longitudinal band on the exterior face. In the female the only green on the body is on the lower part of the sides of the pronotum and on the anterior femora. The only male at hand has the posterior femora green, but otherwise is colored like the females. Ovipositor light reddish-brown.

Measurements.—Length of body, male, 17.5 mm.; female, 19 mm.; of pronotum, male, 4.5 mm.; female, 5 mm.; of tegmina, male, 20.5 mm.; female, 24.5 mm.; of antennæ, male, 46 mm.; of posterior femora, male, 17 mm.; female, 17.5 mm.; of ovipositor, 7 mm.

This dull colored grasshopper has been found in small numbers in both Vigo and Fulton counties, in upland prairie meadows, where it frequents the tall grasses, usually in company with *Xiphidium strictum*, Scudder.

It is a smaller and more slender bodied insect than the common *O. vulgare*, Harris, and has a shorter and narrower pronotum and a much smaller ovipositor than that species.

cc. Apical half of posterior femora armed beneath with several small spines.

f. All the tibiæ and tarsi black or dark brown.

25. ORCHELIMUM NIGRIPES, Scudder. The Black-legged Grasshopper.

Orchelimum nigripes, Scudder, Proc. Bost. Soc. Nat. Hist., XVII., 1875, 459.

Id., Entom. Notes, IV., 1875, 62.

Id., Cent. Orthop., 1879, 12.

Id., Rep. Ent. Soc. Ont., XXIII., 1892, 73.

Bruner, Bull. Washb., Coll. Lab. Nat. Hist., I., 1885, 128.

McNeill, Psyche, VI., 1891, 25.

Redtenbacher, Monog. der Conoceph., 1891, 188.

Osborne, Proc. Ia. Acad. Sci., I., 1892, 118.

Blatchley, Canad. Ent., XXV., 1893, 93.

Somewhat smaller than *O. vulgare*; the body moderately robust. Pronotum short, the posterior lobe, especially in the male, rather strongly upturned. Tegmina a little shorter than the wings, surpassing slightly the hind femora. The shrilling organ of the male is unusually large and prominent with strong cross veins, and 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 much more robust than it really is. Hind femora armed on apical half of lower outer carina with from one to four small spines. Cerci of male slender, tapering, the apex a little obtuse; the sub-basal tooth long, slender and a little curved. Ovipositor rather long, broadest in the middle, tapering to a delicate point. The males vary much in size. General color green or reddish-brown, the former prevailing in the male, the latter in the female. Occiput and disk of pronotum with the usual brown markings. Front and sides of head, and four front femora, reddish yellow. All the tibiae and tarsi, together with the apical third of hind femora, black or dark brown; in one specimen at hand the whole body, except the wing-covers and femora, black.

Measurements: Male—Length of body, 18 mm.; of pronotum, 5 mm.; of tegmina, 21 mm.; of hind femora, 16 mm. Female—Length of body, 19 mm.; of tegmina, 22 mm.; of hind femora, 17 mm.; of ovipositor, 9 mm.

A lowland species, which, in Vigo county, is excessively common from August 1st to October 15th, about the river bottom ponds mentioned above, where it frequents the stems and leaves of the different species of *Polygonum*, or smart weed, growing in the shallow water. A few specimens have been taken in Putnam county, and a single male from the margin of a tamarack swamp at Kewanna, Fulton county, so that it probably occurs

in suitable localities throughout the state. It was first described from Texas and has not before been recorded east of Illinois, though it has been taken by myself at Celina, Ohio. Its song is much more faint than that of *O. vulgare*, and the *z-e-e-e-e* is much less prolonged.

ff. The tibiae and tarsi green or reddish-brown.

26. *ORCHELIMUM SILVATICUM*, McNeill.

Orchelimum silvaticum, McNeill, Psyche, VI., February, 1891, 26.

Scudder, Rep. Ent. Soc. Ont., XXIII., 1892, 73.

? *Xiphidium spinulosum*, Redtenbacher, Monog. der Conoceph., April, 1891, 189.

A somewhat smaller and less robust species than *O. vulgare*, though the proportional measurements of the two are almost the same. The pronotum is shorter, the tegmina more narrow, and in the female the latter are slightly exceeded by the wings; equalling them or a little shorter in the male. The hind femora reach to or slightly beyond the apex of tegmina and are armed on the lower outer carina with three or four minute spines. The general color is the same as that of *vulgare*, but the blackish stripes on the margin of the brown discal stripe of pronotum are more distinct than in that species.

Measurements: Male—Length of body, 17.5 mm.; of pronotum, 4.5 mm.; of tegmina, 16.5 mm.; of hind femora, 15 mm. Female—Length of body, 17.5 mm.; of tegmina, 17 mm.; of hind femora, 15 mm.; of ovipositor, 8 mm.

I am inclined to believe that Redtenbacher's *Xiphidium spinulosum* is this species. The measurements as given by him are somewhat greater, but otherwise the description agrees. McNeill's name, however, has the priority.

In Indiana this species has, up to the present, been taken only in Vigo county, where it frequents the borders of cultivated fields and open woods, reaching maturity about August 20th. "Its stridulation," says McNeill, "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 *z-e-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."

bb. Face with a dark reddish-brown stripe down the center.

g. Stripe broadly expanded on the lower half of face. Size medium.

27. *ORCHELIMUM CONCINNUM*, Scudder.

Orchelimum concinnum, Scudder, Bost. Journ. Nat. Hist., VII., 1862, 452.

Riley, Stand. Nat. Hist., II., 1884, 187.

Comstock, Int. to Entom., I., 1888, 115.

Smith, Ins. N. Jer., 1890, 410.

McNeill, Psyche, VI., 1891, 25.

Bruner, Canad. Entom., XXIII., 1891, 71.

Xiphidium concinnum, Fernald, Orth. N. Eng., 1888, 25.

Redtenbacher, Monog. der Conoceph., 1891, 188.

A species of medium size with a body less robust than that of *O. vulgare*. General color brownish-green; the female darker. The reddish-brown dorsal stripe of pronotum and occiput passes over the fastigium and down the face broadening above the labrum to cover the whole lower half of face. The tegmina of male brownish-green, a little shorter than the wings; of the female darker and equal to or a little longer than the wings. Pronotum short. Hind femora rather slender, unarmed beneath. Cerci of male with the apex obtuse, a little compressed, the sub-basal tooth rather slender. Ovipositor less curved than that of *O. vulgare* and with a very sharp point.

Measurements: Male—Length of body, 18 mm.; of pronotum, 5.5 mm.; of tegmina, 21 mm.; of hind femora, 16 mm. Female—Length of body, 19 mm.; of tegmina, 20 mm.; of hind femora, 17 mm.; of ovipositor, 8 mm.

A rare species in Vigo and Putnam counties, and as yet not noted in the northern part of the state. It frequents the weedy and grassy margins of marshes and lowland ponds and reaches maturity about August 15th.

gg. Facial stripe of equal width throughout. Size small.

28. *ORCHELIMUM INDIANENSE*, Blatchley.

Orchelimum indianense, Blatchley, Canad. Entom., XXV., 1893, 90.

A slender-bodied insect, with a dark median streak down the face, and having the posterior femora unarmed beneath. The cone of the vertex is short, rather narrow, with a rounded apex. The tegmina, narrow, tapering, a little shorter than the wings, and of a delicate, almost gauze-like texture. Posterior femora slender, shorter than the closed tegmina. Anal cerci of male of medium size, longer than the subgenital plate, tapering to a dull point; the basal tooth short, with a broad base and a very sharp point. The ovipositor of female of less than average width and length, the apical half with a gentle upward curve.

Color of dried specimens: Tegmina and wings a transparent whitish, tinged with green on the front or lower longitudinal nerves; the cross nervules of the latter darker. Sides of pronotum and abdomen, and all the femora, light green; the tibiæ and tarsi of a brownish hue. Face yellowish white, with a dark reddish brown stripe the width of the labrum, starting with the mouth and passing upward to the vertex, where it narrows to the width of that organ; then, broadening on the occiput, it passes back to the front border of the pronotum, where it divides into two narrow streaks, which enclose a whitish area and extend a little beyond the posterior transverse suture, where they taper to an end. Subgenital plate of male yellow. Basal third of ovipositor dark brown, the remainder light reddish-brown.

Measurements: Length of body, male, 17 mm.; female, 17.5 mm.; of pronotum, male and female, 4 mm.; of tegmina, male, 21 mm.; female, 19 mm.; of hind femora, male, 14 mm.; female, 15.5 mm.; of ovipositor, 7.5 mm.

This graceful and prettily marked species was found to be quite common among the rank grasses and sedges growing about the margins of a tamarack swamp near Kewanna, Fulton county. It was first taken on August 26th and again on September 24th, when it appeared more plentiful than before. It is the smallest and most slender of the nine species of the genus so far known to occur in the state, and its markings are very distinct from those of any of the others.

aa. Ovipositor straight or nearly so, the under side of apical third tapering rather abruptly to a fine point; its length 10 or more mm.

h. Posterior femora smooth beneath.

29. *ORCHELIMUM GLADIATOR*, Bruner.

Orchelimum gladiator, Bruner, *Canad. Entom.*, XXIII., 1891, 71.

"In its general structure this species resembles the more robust forms like *O. glaberrimum* and *O. concinnum*. It differs from these however in having shorter legs and antennæ. The posterior femora are rather slender; the cone of the vertex is short and obtuse, with the extreme tip shallowly sulcate; the hind wings are little if any longer than the tegmina, which do not quite reach the tip of the ovipositor.

"Color, pale transparent grass-green throughout, save the usual markings upon the occiput and disk of pronotum, which are dark brown, on the latter composed of two well defined, narrow, slightly diverging lines.

Antennæ rufous, feet and extreme tip of the ovipositor tinged with rufous.

“Measurements: Female—Length of body, 18 mm.; of antennæ, 35 mm.; of pronotum, 4.75 mm.; of tegmina, 19 mm.; of hind femora, 15.5 mm.; of ovipositor, 10 mm.”—Bruner.

A single female of this species was taken in Fulton county, August 26th, 1892, from the borders of the tamarack swamp previously noted. It agrees exactly with Mr. Bruner's description, and therefore I have copied the latter verbatim. He described the species from two females taken from the flowers of a prairie golden rod, *Solidago rigida*, L., at West Point, Neb. The male is not as yet known. The species probably occurs in small numbers in low, damp prairies, but as, aside from the long, straight ovipositor, it bears a somewhat general resemblance to *O. vulgare*, it has heretofore been overlooked, or confounded with that common insect.

hh. Posterior femora armed on the lower outer carina with several small spines.

30. ORCHELIMUM BRUNERI, Blatchley.

Orchelimum bruneri, Blatchley, Canad. Entom., XXV., 1893, 92.

A species of medium size and rather slender body with the posterior femora armed beneath, and the ovipositor very broad, nearly straight and of more than average length.

Cone of the vertex narrow, moderately elevated, rounded at apex. Tegmina long and narrow, a little shorter than the wings. Posterior femora rather stout, the apex, when appressed, not quite reaching the tip of ovipositor; armed beneath on the apical half with three or four small spines. Cerci of male stout, acuminate, with the internal tooth prominent.

Ovipositor very similar to that of *O. gladiator*, Bruner, being very long and stout, nearly straight above, and with the under side of apical third sloping rapidly to the acute apex.

Color of dried specimens.—With the exception of the ovipositor, which is a light reddish-brown, and the usual stripe on occiput and disk of pronotum, the whole body is a pale, transparent brownish-green, the green showing plainly only on the lower half of the side of pronotum and on the meso and metapleura. The reddish-brown dorsal stripe of occiput and pronotum is bordered laterally throughout its *entire* length with a very narrow one of much darker brown. When immersed in alcohol the

reddish-brown stripe fades to a yellowish white, leaving the two lateral ones as prominent dark streaks, widest on the central portion of the frontal disk.

Measurements: Length of body, male, 18 mm.; female, 20.5 mm.; of tegmina, male, 21 mm.; female, 25 mm.; of pronotum, male and female, 4.75 mm.; of hind femora, male, 16 mm.; female, 17 mm.; of ovipositor, 10 mm. Described from two males and four females.

This species, the female of which is at once conspicuous by reason of the shape and size of its ovipositor; has been taken in small numbers only in Vigo county,^{*} where it is found 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 two or three large ponds in the Wabash River bottoms. Several other "green grasshoppers," notably among which are *Xiphidium attenuatum*, Scudder, and *Orchelimum nigripes*, Scudder, frequent this plant in immense numbers. Keeping company with them an occasional specimen of *O. bruneri* is seen, but, 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 and longer, armed posterior femora will readily distinguish this species from *O. gladiator*, the only other one which, to my knowledge, has an ovipositor shaped like that of *bruneri*. The latter is named in honor of Prof. Lawrence Bruner, of Lincoln, Neb., one of the leading authorities on N. A. Orthoptera.

STENOPELMATINÆ.

The Indiana members of this subfamily comprise those insects which are commonly called "stone" or "camel crickets," and, so far as known, belong to the single genus *Ceuthophilus*, which is characterized below.

VIII. CEUTHOPHILUS, Scudder (1862).

Wingless Locustidæ of medium or large size with a thick body and arched back. Head large and oval, bent downwards and backwards between the front legs. Antennæ long, slender, cylindrical and tapering to a fine point. Eyes sub-pyriform, the narrow end downwards, placed close to the basal joint of the antennæ. Maxillary palpi long and slender; the apical joint longest, somewhat curved, split on the under side three-fourths of its length, which is nearly equal to that of the two preceding taken together. Pronotum short, not extending over the meso and meta-notum. Prostern-

^{*}Since the above was written this insect has been found to be very plentiful about the margin of Lost Lake, Marshall county, Ind.

um unarmed. Hind femora thick and heavy, turned inwards at the base, channelled beneath, with the margins of the channels either serrate or spined in the males, seldom armed in the females. Ovipositor well developed, nearly straight, a little upturned at the tip, the inner valves usually strongly serrate on the under side of the apical fourth. Cerci of males long, slender, usually very hairy.

These insects are seldom seen except by the professional collector. They are nocturnal in their habits, and during the day hide beneath stones along the margins of small woodland streams, or beneath logs and chunks in damp woods, in which places seldom less than two, nor more than three or four, are found associated together. Being wingless they make no noise, and, like most other silent creatures, are supposed to be deaf, as no trace of an ear drum is visible.

That they are wellnigh omnivorous in their choice of food, I have determined by keeping them in confinement, when they fed upon meat as well as upon pieces of fruit and vegetables, seemingly preferring the latter. The majority of the species evidently reach maturity and deposit their eggs in the late summer or early autumn, as the full grown insects are more common then, but have been taken as late as December 1st. The eggs, which are supposed to be laid in the earth, usually hatch in April, but some are hatched in autumn and the young live over winter (an anomaly among the *Locustidæ*?) as I have taken them in January and February, and at this writing, December 24th, have one in confinement which has just passed the second moult.

Several of the species inhabit caves and are usually of much larger size, with longer antennæ and smaller compound eyes than those found above ground.

The males of these insects are quite readily separated by the size, number and relative positions of the spines on the under side of the hind femora, as well as by the degree of curvature of the corresponding tibiæ. The females, having neither the spined posterior femora nor the curved tibiæ, are less readily distinguished by the color and the relative measurements of the different organs. As the two sexes are colored alike and are usually found in close proximity there will be little difficulty in placing the female after determining the male by the keys given below, which mainly pertain to that sex alone.

Seven species have, up to the present, been taken by the writer in Indiana.

a. Hind tibiæ of male with the basal half very distinctly undulated or waved; the hind femora with about 16 small sub-equal spines on each of the lower carinæ.

31. *CEUTHOPHILUS MACULATUS*, (Say). The Spotted Wingless Grasshopper. "*Ephippigera maculata*, Say, (Mss.) Harris Cat. Ins. Mass., 1835, 56."

Rhaphidophora maculata, Scudder, Proc. Bost. Soc. Nat. Hist., VIII., 1861, 7, 11, 14.

Id., Encyc. Amer. 1881, VIII., 170.

halangopsis maculata, Harris, Ins. Inj. to Veg. 1862, 155, fig. 73.

Ceuthophilus maculatus, Scudder, Bost. Journ. Nat. Hist., VII., 1862, 434.

Id., Distb. Ins. of N. Hamp., 1874, 366.

Smith, Orth. of Maine, 1868, 145.

Packard, Guide Stud. Ins., 1883, 565.

Riley, Stand. Nat. Hist., II., 1884, 184, fig. 259.

Bruner, Bull. Washb. Col. Lab. Nat. Hist., I., 1885, 126.

Fernald, Orth. N. Eng., 1888, 19.

Brunner, Monog. der Stenop. und Gryll., 1888, 307.

Smith, Ins. N. Jers., 1890, 409.

McNeill, Psyche, VI., 1891, 27.

Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

Rhaphidophora lapidicola, Scudder, Proc. Bost. Soc. Nat. Hist., VII., 1861, 7. (In part.)

Thomas, Trans. Ill. St. Ag. Soc., V., 1865, 444.

(Not *Ceuthophilus lapidicolus*, Burmeister.)

General color: Above, sooty brown with the anterior half of each segment dotted with a number of rather large, more or less confluent, pale spots; below pale brown, unspotted. Antennæ and legs light, reddish brown; the hind femora barred on the outer surface with numerous short lines of darker brown arranged in parallel rows. Anterior femora short, a little longer than pronotum with one or two spines on the lower front carina. Hind femora moderately swollen, the inferior sulcus narrow, with each margin armed, in the male, with about 16 rather small, sub-equal spines; in the female, each margin bears a row of numerous minute teeth. Hind tibiæ of male distinctly undulate or waved at base; a little longer than the femora.

Measurements: Male—Length of body, 14 mm.; of pronotum, 4.5 mm.;

of front femora, 6 mm.; of hind femora, 15 mm.; of hind tibiae, 16 mm.; Female—Length of body, 18 mm.; of pronotum, 6 mm.; of front femora, 6 mm.; of hind femora, 17 mm., of ovipositor, 10 mm.

This insect has a wide range, having been recorded from New England to the Rocky Mountains. In Indiana it is, as far as my observation goes, much less common than some of the other species of the genus, having so far been taken only in Putnam county where, on August 1st, I took several specimens from beneath a log in a deep and damp ravine. It probably occurs sparingly in like situations throughout the state.

- aa. Hind tibiae of male not undulated at base; sometimes with a single, slight curve.
- b. Hind femora but little, if any, shorter than the corresponding tibiae; species living above ground.
- c. Upper sides of body each with a broad, dark reddish-brown stripe.

32. *CEUTHOPHILUS LATENS*, Scudder. The Black-sided Camel Cricket.

Ceuthophilus latens, Scudder, Bost. Journ. Nat. Hist., VII., 1862, 437.

McNeill, Psyche, VI., 1891, 27.

General color, light, reddish brown "with darker streaks upon the hind femora and two broad bands of dark, reddish brown along the whole dorsum, extending half way down the sides, dotted irregularly with brownish yellow spots, most profusely on the abdomen, and separated from one another by a narrow, irregular band of the same color; below yellowish brown; tips of the hind femora dark."

Anterior tibiae one-third longer than the pronotum, with two spines on the outer lower carina. Middle femora bispined on each carina beneath. Hind femora thick and stout, the inferior sulcus wide and deep, the margins unarmed in the female; in the male with three or four minute spines on the apical third of each carina. Hind tibiae straight, a little longer than the femora.

Measurements: Male—Length of body, 18 mm.; of pronotum, 5 mm.; of front femora, 6.5 mm.; of hind femora, 14 mm.; of hind tibiae, 14.5 mm. Female—Length of body, 19 mm.; of hind femora, 14.5 mm.; of hind tibiae, 15 mm.; of ovipositor, 10 mm.

The above description applies to the species as usually found in the State. I have, however, a pair of specimens taken in Putnam county, which, while agreeing fully with the peculiar coloration and relative measurements of *latens*, differ so markedly in size and in the spination

of the femora that I have more than once been inclined to think them a distinct and undescribed species. They have the middle femora armed beneath with 3 spines on each carina; the hind femora of male with 9 spines on the outer carina, the 4 or 5 middle ones of which are very strong and prominent, the inner carina with 11 small and sub-equal spines. The hind tibiæ with an evident downward curve at base. The hind femora of the female have 5 small spines on the outer and 11 on the inner carina.

Measurements: Male—Length of body, 22 mm.; of pronotum, 6.5 mm.; of front femora, 9 mm.; hind femora, 19 mm.; of hind tibiæ, 21 mm. Female—Length of body, 25 mm.; of pronotum, 7 mm.; of front femora, 9 mm.; of hind femora, 19.5 mm.; of hind tibiæ, 20.5 mm.; of ovipositor, 13 mm.

If, as is most likely, these are only greatly developed forms of *latens*, the spining of the femora of these insects varies greatly with the age, and, unless one has adult specimens, it is not therefore a character of as much specific worth as is usually attributed to it.

C. latens is not an uncommon species in Vigo and Putnam counties. It is most commonly found beneath flat stones near the margins of small streams in upland, hilly localities. It reaches maturity in June or July, probably from specimens hatched in spring, though I have taken the young on two different occasions in February. It has been recorded heretofore only from Illinois and the male is herewith described for the first time, Mr. Scudder's description having been based upon a single female.

cc. Sides of body without a dark, reddish brown stripe.

d. Hind femora of male with the inferior sulcus very deep; the outer carina with about 9 spines of unequal length and not equi-distant.

33. *CEUTHOPHILUS UHLERI*, Scudder.

Ceuthophilus uhleri, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 435.

Riley, Stand. Nat. Hist., II., 1884, 184.

Smith, Ins. N. Jer., 1890, 409.

Ceuthophilus lapidicola, Brunner, Monog. der. Stenopel. und Gryllac, 1888, 307. (Not *C. lapidicolus* Burm.)

General color light reddish brown, the meso and meta-notum usually darker. The pronotum rather thickly and irregularly mottled with paler spots; the other segments with the pale spots for the most part in a

transverse row near the hind margin. The legs yellowish brown, the hind femora with the apex a little dusky above and with three longitudinal, and numerous obliquely transverse, dusky bars on the outer face.

The anterior femora but little longer than the pronotum; the lower, front margin armed with from one to four spines. Hind femora of the male of average width but very stout, the lower, outer carina prominent, the inferior sulcus rather narrow and very deep, the sides meeting at an angle above. The spines of the outer carina are arranged in three sets, the basal set containing 4 equi-distant graduated spines the apical one largest; the middle set contains but a single strong spine equal in size to the one before it and separated from it as well as from the first one of the apical set, by a space almost twice as great as between the members of the basal set; the apical set of 4 small sub-equal spines. The inner carina is armed with about 16 small sub-equal spines. The female has the inner carina also armed in like manner with still smaller spines. Hind tibiae of male straight, a little longer than the femora.

Measurements: Male—Length of body, 14 mm.; of pronotum, 5.2 mm.; of front femora, 6.2 mm.; of hind femora, 16.5 mm.; of hind tibiae, 17 mm.

C. Brunner, in his *Monographie*, has evidently described this species under the name of *C. lapidicola* Burm. At the close of his description he says of *lapidicola*: "Neither the diagnosis of Burmeister nor the description of Scudder are sufficiently exact to recognize the species; for which reason I have designated by this name any new species whatever at hand." In another place he describes under the name *C. uhleri* Scudder, a species having the spines on the outer carina of the hind femora equal in length; whereas Mr. Scudder, in his description of *uhleri* distinctly states that they are "of unequal length, and irregularly arranged."

Specimens of the insect described above were sent to Mr. Scudder, who pronounced my identification correct. In central Indiana *uhleri* is the most common species of *Ceuthophilus*. It is found from July to November beneath rails and logs in rather dry situations. The young have been taken from similar places in December and February, but evidently the larger number of eggs do not hatch until spring.

dd. Hind femora of male with the inferior sulcus shallow; the spines of the outer lower carina sub-equal in size and equi-distant from one another.

- c.* The sulcus very broad; the spines of the outer carina much larger than those of the inner.

34. *CEUTHOPHILUS LATISULCUS*, nov. sp.

? *Ceuthophilus uhleri*, Brunner, Monog. der Stenopel. und Gryll., 1888, 308, pl. VII., fig. 33 b.

General color, light brownish or clay yellow, irregularly mottled with fuscous, especially on the pronotum and abdomen; the female somewhat darker. The anterior femora much longer than the pronotum with two sub-equal spines near the apex of the lower front carina. The intermediate femora with three spines on each of the lower carinae. The hind femora not so broad as in the preceding, the outer lower carina much less prominent; the upper half of the exterior face very scabrous, with small projections. The inferior sulcus very broad and shallow, about twice the breadth and one-half the depth of that of *C. uhleri*; the sides not meeting in an angle as there, but the upper surface of the sulcus flat. The outer carina with 8 sub-equal spines borne at equal distances apart on the apical half; the middle two slightly the larger but much less strong than the corresponding one of *C. uhleri*. The inner carina armed with 20 or more very small teeth. The hind tibiae with a very slight curve just below the base; a little longer than the corresponding femora.

Measurements: Male—Length of body, 15 mm.; of pronotum, 5.1 m.m.; of front femora, 7 mm.; of hind femora, 17.5 mm.; of hind tibiae, 18.5 mm.

From *C. uhleri*, which it most resembles, this species may at once be known by the longer anterior femora, the much broader and shallower sulcus of the hind femora, as well as by the difference in size and arrangement of the teeth upon the latter. The adult male is larger with longer hind limbs than that of *uhleri*, though the males of both these species are much more robust when mature than those of *maculatus* and *lapidicolus* which have come under my notice.

C. Brunner, in his Monographie, has described a species of *Ceuthophilus* under the name of *uhleri*, Scudder, which may be the same insect as *latisulcus*. As shown above, however, the name of *uhleri* belongs to the preceding species. Brunner's measurement of his so-called *uhleri*, as well as the number of spines on the femora, differ from those given above.

Latisulcus is described from two males and a female taken in Vigo county, August 25, from beneath a log on a sandy hillside.

- ee. The sulcus of average width and depth; the spines of both carinae small and sub-equal in size.
- f. General color clear reddish brown, mottled with paler; each of the carinae of the hind femora with about 28 crowded minute spines.

35. *CEUTHOPHILUS LAPIDICOLUS*, (Burmeister.)

Phalangopsis lapidicola, Burmeister, Handb. der Entom. II., 1838, 723.

Raphidophora lapidicola, Scudder, Proc. Bost. Soc. Nat. Hist., VIII., 1861, 7. (In part.)

Ceuthophilus lapidicolus, Id., Bost. Journ. Nat. Hist., VII., 1862, 435.

Riley, Stand. Nat. Hist., II., 1884, 184.

Smith, Ins. N. Jer., 1890, 409.

Osborne, Proc. Ia. Acad. Sci., I., 1892, 119.

Clear reddish-brown, mottled with small pale spots, especially on the abdomen, where the spots have a tendency to arrange themselves in longitudinal rows. The legs paler, the exterior face of the hind femora with the usual darker bars, but not so prominent as in *C. maculatus*. Anterior femora a little longer than pronotum, unarmed beneath. Intermediate femora also unarmed or with a single apical spine on front margin. Hind femora of medium thickness, the inferior sulcus of average width, rather deep; the spines of both carinae more like the fine teeth of a saw, about 25 in number and crowded on the apical two-thirds of the segment. Hind tibiae straight, a little shorter than the femora.

Measurements: Male—Length of body, 18 mm.; of pronotum, 5 mm.; of front femora, 6.5 mm.; of hind femora, 18.5 mm.; of hind tibiae, 16 mm. Female—Length of body, 18.5 mm.; of hind femora, 18 mm.; of ovipositor, 9 mm.

As Brunner has well said it is impossible to distinguish *C. lapidicolus* from Burmeister's description, which was founded upon two female specimens from South Carolina, and undoubtedly many references to it are wrong. If any person is competent to judge as to what *lapidicolus* really is, that person is Mr. Scudder, and I have determined the form described above from specimens bearing that name kindly loaned me by him.

In Indiana, *lapidicolus* is not a common insect, its range probably being more southern. Several specimens have been taken in Putnam county from beneath logs in damp woods.

ff. General color dull yellowish brown, with very numerous paler spots; each of the carinæ of the hind femora with about seven very small and distinct teeth.

36. *CEUTHOPHILUS BREVIPES*, Scudder.

Ceuthophilus brevipès, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 434.

Smith, Orth. of Maine, 1868, 145.

Fernald, Orth. N. Eng., 1888, 19.

Dull yellowish brown, a little darker on the dorsum of the thorax where there is a narrow median line of clay yellow. Very profusely spotted with dirty white spots, especially on the abdomen, and near the apex of hind femora, where they nearly form an annulation.

Front femora a little longer than the pronotum, with a single spine on lower front carina. Hind femora short and stout; the inferior sulcus of average width and depth; each carina armed with about seven very small teeth. Hind tibiæ straight, of the same length as the femora.

Measurements: Male—Length of body, 14 mm.; of pronotum, 4.5 mm.; of front femora, 5.5 mm.; of hind femora, 12 mm.; of hind tibiæ, 12 mm.

A single male from Vigo county agrees in every respect, except slight differences in measurements, with typical examples from Mr. Scudder's collection. Not before recorded west of New England.

bb. Hind femora distinctly shorter than the corresponding tibiæ; cave inhabiting species.

37. *CEUTHOPHILUS STYGIUS* (Scudder.)

Raphidophora stygius, Scudder, Proc. Bost. Soc. Nat. Hist., VIII., 1861, 9.

Ceuthophilus stygius, Id., Bost. Jour. Nat. Hist., VII., 1862, 438.

Riley, Stand. Nat. Hist., II., 1884, 184.

Brunner, Monog. der Stenop. und Gryll., 1888, 309.

Pale, reddish-brown, the hind border of each segment with a dark brown band, the pronotum with a similar band on the front margin, and an indistinct, dark median band connecting the two. Face pale with a black dash below each eye, and a shorter median one. Antennæ brownish yellow, paler towards the tip, of excessive length. Front femora, in the specimens at hand, double the length of the pronotum, with three spines on the lower front carina. Middle femora shorter than the anterior with both of the lower carinæ armed with three or four distinct spines. Hind femora rather slender, the lower outer carina prominent; the inferior sulcus narrow and of average depth; both margins armed with num-

erous small spines, those on the outer carina double the size of those on the inner. Hind tibiæ straight, much longer than the corresponding femora.

Measurements: Male—Length of body, 26 mm.; of pronotum, 6 mm.; of front femora, 12 mm.; of antennæ, 100 mm.; of hind femora, 23 mm.; of hind tibiæ, 27 mm. Female—length of body, 23 mm.; of pronotum, 5.5 mm.; of front femora, 11 mm.; of hind femora, 21 mm.; of hind tibiæ, 24 mm.; of ovipositor, 14 mm.

These measurements are much greater than those given by Mr. Scudder, but otherwise the specimens agree with his description in every respect.

Two males and one female of this large and handsome *Ceuthophilus* were taken by Mr. W. P. Hay from a small cave in Crawford county and kindly presented to me. It evidently inhabits only the smaller caves as Mr. Hay saw no specimens in Wyandotte, and Mr. Scudder, in the Proc. Bost. Soc., says of the original types taken in Kentucky: "Though careful search was made in the larger cave, a mile or more in extent, no *Raphidophoræ* were found, but in the remotest corner of the small cave, a few hundred feet only in extent, in a sort of hollow in the rock, not particularly moist, but having only a sort of cave dampness, the *stygia* was found plentifully these were also found exclusively upon the walls. Even the remotest part of the cave is not so gloomy but that some sunlight penetrates it."

DECTICIDINÆ.

In the western states this sub-family is represented by several genera and a large number of species, but east of the Mississippi River there are but two species of a single genus belonging to it, both of which are found in Indiana.

IX. THYREONOTUS, Serville (1839).

These are Locustidæ of large size with the pronotum extending back over the first joint of the abdomen, thus forming a buckler or shield for the back. Face broad, rounded, but slightly oblique. Eyes small, subglobose. Vertex with a blunt decurved projection between the antennæ which is slightly excavated on the sides. Pronotum truncate in front, rounded behind, flattened above, bent abruptly downwards on the sides. Prosternum armed with two short, blunt spines. Tegmina of the females rudimentary, wholly covered by the pronotum; those of the males fairly well developed, extending in our most common species 5 mm. back of the pronotum. The shrilling organ, which is covered by the pronotum, is

circular, and rather large for the size of the tegmina. Wings very rudimentary or wanting. Hind femora long and rather slender, extending, in our species, beyond the abdomen in both sexes, notably so in the males. Ovipositor as long as the body, very stout at the base, straight.

The "Shield-back Grasshoppers," so called on account of the large protective pronotum, are often quite numerous from April 1st to September in dry upland woods and on sloping hillsides with a southern exposure, but are seldom if ever found in damp localities.

On the first warm days of early spring the young begin to emerge and in suitable places for a month or more are among the most common Orthopterons seen. They are much more active during early life than in the mature state when they crawl rather than leap. In captivity they feed as readily upon animal as upon vegetable food, and in the natural state probably feed upon the dead bodies of such small animals as they can find. The earliest hatched reach maturity in Central Indiana about the middle of July, and may then often be found resting on the leaves and stems of low shrubs and weeds, but seldom climb over two or three feet from the ground. The adults are far less numerous than the young, the vast majority of the latter probably falling a prey to the many ground frequenting sparrows and other birds, as they do not hide by day as do the members of the preceding genus.

a. Front margin of pronotum much narrowed, but little more than half as wide as hind margin; the latter broadly rounded.

38. *THYREONOTUS PACHYMERUS*, (Burmeister.)

Decticus pachymerus, Burmeister, Handb. der Entom., II., 1838, 712.

Thyreonotus pachymerus, Scudder, Bost. Jour. Nat. Hist., VII., 1862, 453.

Comstock, Int. Ent., I., 1888, 118, fig. 106.

Fernald, Orth. N. Eng., 1888, 26.

Smith, Ins. N. Jer., 1890, 411.

McNeill, Psyche, VI., 1891, 24.

Osborne, Proc. Ia. Acad. Sci., 1892, 119.

Davis, Canad. Entom., XXV., 108 (Song. of).

Color: Male—Grayish or fuscous brown; the sides of pronotum and tegmina black, the former often shining; a narrow, curved yellow line above the posterior lateral angle of pronotum; the exposed dorsal field of tegmina light brown; the femora with numerous minute pale spots. Female—Usually reddish-brown throughout except the yellow line on side of pronotum which is bordered above with a dash of black.

The lateral carinae of pronotum are much sharper in this species than in the next; the pronotum itself is a little longer, and appears more so than it really is on account of the broadly rounded posterior lobe. The latter has in the female a faint median carina which is absent in *dorsalis*. The hind femora, as well as the ovipositor, are a little shorter than in that species, and the apex of the ovipositor is more bluntly rounded from above.

Measurements: Male—Length of body, 20 mm.; of pronotum, 10 mm.; of hind femora, 16 mm. Female—Length of body, 22 mm.; of pronotum, 9 mm.; of hind femora, 18 mm.; of ovipositor 17 mm.

Pachymerus is, in Indiana, by far the more common of the two species known to occur. So far it has been noted only in Putnam and Vigo counties, but undoubtedly is to be found throughout the State, frequenting the localities mentioned above under the generic description. In a pleasing account of the note and habits of the species, Mr. W. T. Davis says as follows: "Its song much resembles that of *Orchelimum vulgare*, with the preliminary *zip, zip*, omitted. It is a continuous *z-e-e-e*, with an occasional short *ik*, caused by the insect getting its wing covers ready for action after a period of silence. * * * * Starting with raspberries, one kept in captivity had the rest of the fruits in their season, including watermelon, of which he showed marked appreciation. If I offered him a raspberry and then gradually drew it away he would follow in the direction of the departing fruit, and would finally eat it from my hand."

aa. Front margin of pronotum but little narrowed, about three-fourths the width of the hind margin, the latter almost square.

39. *THYREONOTUS DORSALIS*, (Burmeister.)

Decticus dorsalis, Burmeister, Handb. der Entom., II., 1838, 713.

Thyreonotus dorsalis, Scudder, Bost. Journ. Nat. Hist., VII., 1862, 454.

Id., Distb. Ins. N. Hamp., 1874, 370.

Id., Proc. Bost. Soc. Nat. Hist., XIX., 1877, 83.

Id., Ent. Notes, VI., 1878, 24.

Comstock, Int. Ent., I., 1888, 118.

Fernald, Orth. N. Eng., 1888, 26.

Smith, Ins. N. Jer., 1890, 411.

Color: Female—Dull, yellowish brown; the posterior lobe of pronotum, dorsum of abdomen and ovipositor dark brown. A blackish spot on the face below each eye; the sides of the pronotum with obsolete fuscous markings. The chief structural distinctions between this insect and *Pachymerus* are given above under the latter species.

Measurements: Female—Length of body, 24 mm.; of pronotum, 8.5 mm.; of hind femora, 21 mm.; of ovipositor, 22 mm.

This species is represented in my collection by two females taken in Vigo county, in August, 1891. It has not heretofore been recorded west of the Alleghany Mountains.

The above thirty-nine species comprise all the Locustidæ which, to the present knowledge of the writer, inhabit Indiana. Others undoubtedly occur, especially in the southern half, and throughout the prairie region of the northwestern part, where no collecting has been done. The present paper will, perhaps, aid in the identification of the more common kinds of this much neglected group of insects; but collectors throughout the state should be on the lookout especially for the following twelve species whose known range implies that they are probably inhabitants of Indiana; and when the careful and systematic biological survey of the state, now instituted, has been completed, a number of them will no doubt have been added to our known insect-fauna:

1. *Scudleria pistillata*, Brunner.

Should be looked for in the northern half of the state. Resembles *furcata*, but has much wider tegmina. Ranges from New Jersey to Nebraska.

2. *Amblycorypha scudderi*, Bruner.

Resembles *oblongifolia*, but is smaller, with comparatively shorter hind legs, and with apex of ovipositor more strongly serrate. Common in Eastern Nebraska.

3. *Microcentrum retinervis*, (Burmeister.)

(See under *M. laurifolium*.) Should be found in Southern Indiana.

4. *Cyrtophyllus perspicillatus*, (Fabricius.)

Has shorter and broader tegmina, more robust legs, and musical organ of male broader than *concurvus*. A southern form.

5. *Xiphidium saltans*, Scudder.

Should be found in the prairie region northwest. Resembles *strictum*, but is smaller, with longer tegmina, and shorter ovipositor. Common in Kansas and Nebraska.

6. *Orchelimum delicatum*, Bruner.

A more slender and smaller insect than *vulgare*, with a much

shorter (4 mm.) pronotum, and a much longer (11.5 mm.) and straighter ovipositor. To be looked for northward.

⁴ Nebraska.

7. *Orchelimum volantum*, McNeill.

Described from Henry county, Illinois. Larger than *vulgare*, with much longer tegmina. Posterior femora armed beneath.

8. *Ceuthophilus ensifer*, Packard.

A cave form described from Kentucky.

9. *Ceuthophilus niger*, Scudder.

Allied to *latens*, but wholly black with a reddish tinge. Hind femora short and unusually slender. Described from Illinois.

10. *Ceuthophilus divergens*, Scudder.

Color of *lapidicolus*, but with five, long spines on each side of hind tibiae, which turn outward at right angles to tibiae. Nebraska, Iowa.

11. *Hadenocus cavernarum*, Saussure.

A stone cricket, said by Prof. E. D. Cope to inhabit Wyandotte Cave,⁵ but not included in the list proper, as I have seen no specimens.

12. *Undeopsylla nigra*, Scudder.

A stone cricket, recorded from Iowa, Nebraska and Illinois, and therefore to be looked for in Indiana.

BIOLOGICAL LABORATORY, TERRE HAUTE HIGH SCHOOL, May 10, 1893.

THE BLATTIDE OF INDIANA BY W. S. BLATCHLEY, Terre Haute, Ind.

The members of the family *Blattidae*, commonly known as cockroaches, are classed among the *Orthoptera* by reason of their biting mouth parts, and direct or incomplete metamorphosis. From the other families of that order the *Blattidae* may be known by their depressed, oval form; their nearly horizontal head, which is bent under and almost concealed by the broad prothorax; their slender legs of equal length and size; their five jointed tarsi; and by the absence of either ovipositor or forcipate appendages at the end of the abdomen.

⁵Cope, in Repts. Ind. Geol. Surv., IV., 1872, 161, and X., 1878, 493, mentions this species under the name of *Raphidophora subterranea*, Scudder—a synonym of *H. cavernarum*.