

Agassiz (*loc. cit.* p. 260) discusses the various ways in which the different kinds of turtles get rid of the older layers of the epidermis. He mentions certain species of fresh-water turtles, among them *M. pseudogeographica* in which he observed in the spring the uppermost layer of the dermal plates to be cast off at once as one continuous, thin, mica-like scale all over the plate. In a number of very young specimens of *M. geographica* taken at Lake Maxinkuckee, the outer layer of the epidermis was lifted up from the underlying layers by a quantity of fluid. This was preparatory, no doubt, to the casting off of the epidermal layer.

THE GRYLLOIDE OF INDIANA. By W. S. BLATCHLEY, A. M., Terre Haute, Ind.

The *Gryllidæ* or crickets are, in the main, distinguished from other *Orthopterous* insects, by having the wing covers flat above and bent abruptly downward at the sides; the antennæ long, slender, and many jointed: the tarsi, or feet, three jointed, without pads between the claws; the ear situated on the tibia of the fore leg; and the abdomen bearing a pair of jointed cerci or stylets at the end.

The ovipositor of the female, when present, is long, usually spear-shaped, and consists, apparently, of two pieces. Each of these halves, however, when closely examined, is seen to be made up of two pieces so united as to form a groove on the inner side, so that when the two halves are fitted together, a tube is produced, down which the eggs pass to the repository in the earth or twig, fitted to receive them.

The inner wings are, for the most part, short, weak, and comparatively useless as flying organs, though, sometimes, they are nearly twice as long as the outer pair. Like their nearest relatives, the grasshoppers and katydids, crickets travel mostly by leaps and, in the course of time, their hind femora have thus become greatly enlarged.

The chirps or love calls of the different species of crickets make up the greater part of that ceaseless thrill which fills the air, usually at night, from mid-August until after frost. These sounds are made only by the males, and are not vocal, as most persons suppose; but are produced by rubbing the veins in the middle of one wing cover upon those of the other. The peculiar structure of this stridulating organ of the male, as well as the high

specialization of the ovipositor in the female, have led entomologists to classify the *Gryllida* as the highest family of the ORTHOPTERA.

Representatives of nine genera and sixteen species of these interesting insects from Indiana are in the writer's collection, several of which are exceedingly abundant throughout the state.

A belief that a brief and popular description of the leading characters of each of these species, together with some account of their habits, as noted during a number of years of observation, would prove acceptable to persons interested in the study of such creatures, has prompted the preparation of this paper. In order to render it as complete as possible for reference purposes, and thereby aid the younger entomologists of the state, a synonymy of each species has been compiled from such works as were accessible and appended to the name of that species. The following is a full list of the authors and publications to which reference is made in the synonymy given:

- Comstock, J. H.—An Introduction to Entomology, I, 1888.
- Fernald, C. H.—The Orthoptera of New England, 1888.
- Fitch, Dr. Asa.—Third Report on the Noxious Insects of New York, 1856.
- Glover, Townsend.—Report of U. S. Entomologist in the U. S. Agricultural Report for 1874.
- Harris, Dr. T. W.—Treatise on Some Insects Injurious to Vegetation. Third edition, 1862.
- McNeill, Jerome.—A List of the Orthoptera of Illinois, Psyche, VI, 1891.
- Packard, A. S., Jun.—Guide to the Study of Insects. Eighth edition, 1883. Fifth report U. S. Entomological Commission, 1890.
- Rathvon, S. S.—In the U. S. Agricultural Report, 1862.
- Riley, Dr. C. V.—Orthoptera in the Standard Natural History, II, 1884.
- Say, Thomas.—The Entomology of North America. LeConte edition, 1859.
- Scudder, Samuel H.—Materials for a Monograph of the N. A. Orthoptera, in the Boston Journal of Natural History, VII, 1862. Catalogue of the Orthoptera of N. A., 1867. The Distribution of Insects in New Hampshire, in the first volume of Final Report upon the Geology of New Hampshire 1874.
- Thomas, Cyrus H.—Insects Injurious to Vegetation in Illinois, in the Transactions of the Illinois State Agricultural Society, V, 1865.
- Uhler, Philip R.—Orthopterological Contributions in the Proceedings of the Entomological Society of Philadelphia, II, 1864.

Walsh, B. D.—In the Practical Entomologist, vols. I and II, 1867.

Various Authors.—Insect Life, vol. II, 1889. Canadian Entomologist, XXIV, 1892.

The following artificial key will enable the student to more readily distinguish the different genera of *Gryllidæ* found in Indiana.

- a. Fore tibiæ broad, fitted for digging.
- b.* Length of body more than one-half of an inch. . . . II. GRYLLOTALPA.
- bb.* Length of body less than one-half of an inch. . . . I. TRIDACTYLUS.
- aa.* Fore tibiæ slender.
- c.* Hind femora slender. IX. CECANTHUS.
- cc.* Hind femora robust.
- d.* Last segment of the maxillary palpus very nearly of the same length as the one preceding.
- e.* Head as broad as or broader than the posterior margin of the pronotum; color black or dark brown. III. GRYLUS.
- ee.* Head narrower than the posterior margin of the pronotum; color light brown or dark yellow. VII. OROCHARIS.
- dd.* Last segment of the maxillary palpus, very nearly, or fully, double the length of the one preceding.
- f.* Last segment of the maxillary palpus broadly flattened. VI. PHYLLOSCIRTUS.
- ff.* Last segment of the maxillary palpus club-shaped but not flattened.
- g.* Ovipositor much compressed, curved strongly upwards. V. ANAXIPHUS.
- gg.* Ovipositor of the normal form (cylindrical) curved but slightly upwards.
- h.* Head as broad as, or broader, than the posterior margin of pronotum. IV. NEMOBIUS.
- hh.* Head narrower than the posterior margin of pronotum. VIII. APITES.

FAMILY. GRYLIDÆ.—The Crickets.

I. TRIDACTYLUS, Olivier (1789.)

To this genus belong some of the smallest of the Gryllidæ, no one of the three species found in the United States being more than 10 mm., or two-

fifths of an inch, in length. The generic name, *Tridactylus*, is based upon the peculiar structure of the anterior tibiae which are much dilated and armed at the end with three strong and slightly curved spurs. The outer wings, or tegmina, are horny and opaque and do not reach the end of the abdomen, while the inner wings are longer and folded lengthwise like a fan. The hind femora are enlarged and the insects are active leapers. But one species has as yet been taken in Indiana, though another one doubtless occurs in the northern half of the state.

I. *TRIDACTYLUS APICALIS*, Say.

Tridactylus apicalis, Say, Ent. N. A., (Ed. Le Conte), II, 239.

Scudder, Bost. Jour. Nat. Hist., VII, 1862, 425.

Packard, Guide Stud. Ins., 1883, 563.

Riley, Stand. Nat. Hist., II, 1884, 180.

McNeill, Psyche, VI, 1891, 3.

This is the largest of the three species occurring in the U. S., its length being 8 or 9 mm.* The body is deep black, the head and thorax with some white markings, and the tegmina with their outer edge and a spot behind the middle white. The hind femora are whitish, with three faint, dark cross bars. The wings of the male extend three mm. beyond the tip of the abdomen.

Apicalis, is stated by most of the authorities cited above, to be a southern species, but has been taken as far north as Quincy, Illinois. In Indiana it has, so far as known, been noted only in Vigo county, where a few specimens were discovered along the banks of a small stream during the latter part of October, 1891. They evidently dwell in little pits or burrows in the soft sand or mud, as numerous openings of such places were found, from one or two of which specimens emerged and leaped into the water on which they floated for an instant and then sprang back onto the bank. The most of the inhabitants of the pits had, no doubt, been killed by the frost before the species was discovered, and another season will have to arrive before anything distinctive of their habits can be learned.

II. *GRYLLOTALPA*, Latreille (1807). The Mole Crickets.

Among the Gryllids found in Indiana the burrowing or mole crickets rank first in size and singularity of structure. When full grown they measure from an inch and a fourth to an inch and a half in length; are light brown in color and have the body covered with very short hairs, giving to it

*The measurements in this paper are usually given in millimetres. An inch is equal to very nearly 25 mm.

a soft, velvety appearance. The females have no visible ovipositor, and, externally, may be separated from the males only by the difference in the veining of the uppermost of the wing covers. By their habit of burrowing beneath the soil in search of such food as the tender roots of plants, earth worms and the larvæ of various insects, the anterior tibiæ of these crickets have, in the course of ages, become so modified in structure as to closely resemble the front feet of the common mole, whence the generic name, *Gryllotalpa*, from "*gryllus*," a cricket, and "*talpa*," a mole. Moreover, the compound eyes have become very much aborted, being not more than one-eighth the size of those of the common field cricket, *Gryllus abbreviatus*, Serv., and, as the insect crawls rather than leaps, the hind femora are but little enlarged. Two species occur in Indiana.

2. *Gryllotalpa borealis*, Burmeister. The Northern Mole Cricket.

Gryllotalpa borealis, Scudder, Bost. Journ. Nat. Hist., VII, 1862, 426.

Id., Dist. Ins. in N. H., 1874, 363, pl. A, fig. 7.

Id., Amer. Nat., X, 1876, 97, (The chirp of set to music).

Thomas, Trans. Ill. St. Ag. Soc., V, 1865, 441.

Glover, U. S. Ag. Rep. 1874, 143, fig. 17.

Packard, Guide to Stu. Ins., 1883, 563.

Fernald, Orth. N. Eng., 1888, 14, fig. 6.

Comstock, Int. to Entom., I, 1888, 120, fig. 121.

McNeill, Psyche, VI, 1891, 3.

Fletcher, Can. Entom. XXIV, 1892, 23, fig. 1.

Doran, Can. Entom., XXIV, 270, (Life history of).

Gryllotalpa brevipennis, Harris, Ins. Inj. to Veg., 1862, 149, fig. 68.

Rathvon, U. S. Ag. Rep., 1862, 378, fig. 12.

The northern mole cricket may be known by the shortness of its outer wings which are less than half the length of the abdomen, while the inner wings extend only about one-sixth of an inch beyond them.

In the moist mud and sand along the margins of the smaller streams and ponds their runs or burrows, exactly like those of a mole though much smaller, can in late summer and early autumn be seen by those interested enough to search for them. These runs usually end beneath a stone or small stick, but the insects themselves are very seldom seen, as they are nocturnal, forming their burrows by night, and scarcely ever emerging from beneath the ground.

The note of the male is a sharp disyllabic chirp, continuously repeated

and loud enough to be heard several rods away. It is usually attributed, by those who have given little attention to insect sounds, to the field cricket or to some of the smaller frogs. They are very difficult to locate by this note, and the writer has on several occasions approached cautiously, on hands and knees, a certain spot and has remained silent for minutes while the chirping went on apparently beneath his very eyes; yet, when the supposed exact position of the chirper was determined and a quick movement was made to unearth him he could not be found. Indeed it is only by chance, as by the sudden turning over of a log in a soft, mucky place, that a person can happen upon one of them unawares. Even then quick movement is necessary to capture him before he scrambles into the open mouth of one of the deep burrows which he has ever in readiness.

The eggs of the northern mole cricket are laid in underground chambers in masses of from forty to sixty, and the young are about three years in reaching maturity. On this account, where they exist in numbers, they are very destructive, feeding, as they do during that time, mainly upon the tender roots of various plants. It is therefore fortunate that with us the species is not more common than it is. It has been noted in Wabash, Tippecanoe, Vigo, Putnam and Monroe counties, and is probably found throughout the state, though nowhere abundant.

Average measurements, of twelve specimens: Length of body, 33, mm.; of wing covers, 10 mm.; of wings, 14 mm.

3. *Grylotalpa columbiana*, Scudder.—The Long-winged Mole Cricket.

Grylotalpa longipennis, Scudder, Bost. Jour., Nat. Hist. VII, 1862, 426.

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

Grylotalpa columbiana, Fernald, Orth. N. Eng., 1888, 14.

McNeill, Psyche, VI, 1891, 3.

This cricket was first described by Mr. Scudder, *loc. cit.*, under the specific name of *longipennis* which he afterwards changed to *columbiana*, the former name being pre-occupied by an East India species of this genus.

It appears to be very rare in Indiana, a single male specimen captured in Clinton county, being the only one known from the state. Packard, *loc. cit.*, says that it is a southern species, but it has since been recorded from Illinois, Iowa and Kansas.

In size and general appearance it closely resembles *G. borealis*, but it may be known from that species by the much greater length of the wings which extend, in the specimen mentioned, 10 mm. beyond the tip of the

abdomen; and by the longer and more slender teeth of the anterior tibiae. Nothing of its habits is known to the writer, but they are probably nearly or quite the same as those of the preceding species.

Length of body, 28 mm.; of wing covers, 12 mm.; of wings, 24 mm.

III. GRYLUS, Linnæus (1758). The Field and House Crickets.

To this genus belong those dark colored, thick-bodied crickets, mature specimens of which are so abundant from late summer till after heavy frosts, beneath logs, boards, stones, and, especially, beneath rails in the corners of the old-fashioned and rapidly disappearing Virginia rail fences. Three species of *Gryllus* are known to occur in the state.

4. GRYLUS ABBREVIATUS, Serville. The Short-winged Field Cricket.

Acheta abbreviata, Harris, Ins. Inj. Veg., 1862, 152, fig. 69.

Rathvon, U. S. Agr. Rep., 1862, 380, fig. 15.

Thomas, Trans. Ill. St. Ag. Soc., V, 1865, 442.

Walsh, Practical Entomologist, I, 1866, 126.

Gryllus abbreviatus Scudder, Bost. Jour. Nat. Hist., VII, 1862, 427.

Packard, Guide to Stud. Ins., 1883, 564.

Fernald, Orth. N. Eng., 1888, 15.

Comstock, Intr. to Entom., I, 1888, 121, fig. 108 a.

McNeill, Psyche, VI, 1891, 5.

This is the most common and familiar species of the genus occurring in the state. The males have the wing covers usually reaching to the end of the abdomen, but those of the females are much shortened and reach but little beyond its middle. The wings are sometimes wanting but are usually present and much shorter than the wing covers. The ovipositor is almost as long as the body, and the hind femora are exceedingly thick and have a brick red spot at the base on the under side.

Each of the authorities cited above, who says anything of the life history of this cricket states that the eggs are laid in the ground in autumn and hatch the following summer, but the writer has, many times, taken the half grown young from beneath logs in late autumn and in mid winter. On such occasions they are usually found in a dormant condition, each one at the bottom of a cone shaped cavity which it has formed for itself, and which is very similar to the pits made in loose sand by the larva of the ant lion, *Myrmoleon obsoletus*, Say. Many specimens which had evidently moulted twice were taken thus on February 8th, 1890, and during the three months just passed, (Oct., Nov., and Dec., 1891), the young have

been noted in numbers each time the woods were visited, though no mature specimens have been seen since October 20th. The young seen in winter are not numerous enough to develop into the mature specimens of the succeeding autumn, and, in my opinion,³ those eggs which are laid in early fall hatch and the insects hibernate in the burrows mentioned above; while the greater number of eggs, deposited later, do not hatch till the following season.

The short-winged field cricket is nocturnal, omnivorous, and a cannibal. Avoiding the light of day, he ventures forth, as soon as darkness has fallen, in search of food, and all appears to be fish which comes to his net. Of fruit, vegetables, grass and carrion, he seems equally fond and does not hesitate to prey upon a weaker brother when opportunity offers. I have often surprised them feasting on the bodies of their companions, and of about forty imprisoned together in a box, at the end of a week but six were living. The heads, wings, and legs of their dead companions were all that remained to show that the weaker had succumbed to the stronger—that the fittest, and in this case the fattest, had survived in the deadly struggle for existence.

Average measurements: Females—Length of body, 24 mm.; of posterior femora, 15 mm.; of wing covers, 11 mm.; of ovipositor, 22 mm. Male—Length of body 21 mm.; of posterior femora, 14 mm.; of wing covers, 11 mm.

5. *Gryllus luctuosus*, Serville. The Long-winged Cricket. The House Cricket.

Gryllus luctuosus, Scudder, Bost. Jour. Nat. Hist., VII, 1862, 427.

Id., Distribt. of Ins. in N. Hamp., 1874, 363.

Thomas, Geol. Surv. Terr., 1871, 433, pl. I, figs. 10, 11.

Packard, Guide to Stud. Ins., 1883, 564.

Fernald, Orth. N. E., 1888, 15.

Comstock, Intro. to Ent., 1888, 121.

McNeill, Psyche. VI, 1891, 4.

This is a species of wide range, occurring throughout the entire United States, but it appears to be somewhat rare in Indiana, having been taken only in Vigo and Parke counties. From the preceding species, which it

³Since verified by a letter received from Dr. C. V. Riley, in which he states that "the periods are very irregular and the egg laying undoubtedly continues for a considerable space of time."

almost equals in size, it is readily distinguished by the shorter ovipositor of the female, and by the greater length of the inner wings which, in both sexes, extend about 7 mm. beyond the tip of the abdomen.

Mature specimens have been taken as early as June 1, so that it, also, must winter in the larval state. It seems to be more fond of the society of man than any other species, and is the one which was usually heard chirping about the hearths of the large, old-fashioned fire-places. It is often found about houses and barns in towns and cities, and a number of specimens have been secured by the writer from beneath electric lights.

All the measurements of both this and *G. abbreviatus*, exceed those given by Mr. Scudder, in his paper in the Boston Journal, *loc. cit.*, yet, otherwise, Indiana specimens fully agree with the descriptions.

Measurements: Male and female—Length of body, 21 mm.; of posterior femora, 13 mm.; of ovipositor of female, 14 mm.

6. *Gryllus pennsylvanicus*, Burmeister.

Gryllus pennsylvanicus, Scudder, Bost. Jour. Nat. Hist., VII, 1862, 429.

Thomas, Trans. Ill. St. Agr. Soc., V, 1865, 443.

McNeill, Psyche, VI, 1891, 4.

Several females of a short, broad-bodied cricket have been taken in Vigo county, which are evidently distinct from either of the above members of this genus, and are referred with some doubt to this species. The wing covers reach to the end of the abdomen while the posterior femora and ovipositor are much shorter than those of the two preceding species. The body in the longest specimen measured but 15 mm., and the wings of all were very much abbreviated or absent. They were taken in September from beneath logs.

Average measurements: Length of body, 14 mm.; of wing covers, 10 mm.; of posterior femora, 8 mm.; of ovipositor 7 mm.

IV. *NEMOBIUS*, Serville (1839). The Striped Ground Crickets.

Of all the Gryllidæ which occur in the Northern states, the little brown ground crickets are the most numerous and the most social. Unlike their larger cousins, the field crickets, they do not wait for darkness before seeking their food, but wherever the grass has been cropped short, whether on shaded hillside, or in the full glare of the noonday sun along the beaten roadway, mature specimens may be seen by hundreds during the days of early autumn. They are all of small size, being never more than half an inch in length. The color is a dark brown, and the bodies and legs are

sparsely clothed with brown hairs. The head is broad, the ovipositor of normal shape, and the last segment of the maxillary palpus is twice the length of the one preceding it, whereas in the species of *Gryllus* the two segments are of equal length. Three species of *Nemobius* occur in Indiana.

7. *NEMOBIUS VITTATUS*, Harris. The Wingless Striped Cricket.

Acheta vittata, Harris, Ins. Inj. to Veg., 1862, 152, fig. 70.

Rathvon, U. S. Agr. Rep., 1862, 380, fig. 16.

Nemobius vittatus, Scudder, Bost. Jour. Nat. Hist., VII, 1862, 430.

Id. Dist. of Ins. N. H., 1874, 364, (Chirp set to music).

Thomas, Trans. Ill. St. Ag. Soc., V, 1865, 443.

Scudder, Am. Naturalist, II, 1868, 115, (Song of).

Packard, Guide Stud. Ins., 1883, 564.

Fernald, Orth. N. Eng., 1888, 16.

Comstock, Int. to Ent., I, 1888, 121.

In both sexes of this, our most abundant species, the inner wings are wholly wanting. In the female the wing covers are dark brown, about half the length of the abdomen, and have many rather coarse, whitish, parallel veins; whereas in the male they are light brown, reach to the end of the abdomen and have but few reticulated veins. There are usually three narrow, blackish lines on top of the head and one along each side of the prothorax, but all of these are sometimes very dim or wholly wanting.

These small crickets are omnivorous, feeding upon all kinds of decaying animal matter as well as upon living vegetation, freshly dropped cow dung being also especially attractive to them. When disturbed they are very difficult to capture, making enormous leaps with their stout hind legs, no sooner striking the ground than they are up again, even if not pursued, until they find a leaf or other shelter beneath which to take refuge.

From their enormous numbers, as well as from the fact that they are constant, greedy feeders from the time the eggs hatch in spring until laid low by the hoar frost of autumn, it follows that they must be classed among our most injurious orthoptera, but as yet no effective means for their destruction have been discovered.

Mr. S. H. Scudder, in an article entitled the "Songs of the Grasshoppers," has given the following pleasing account of the sounds made by this species: "The chirping of the striped cricket is very similar to that of the black field cricket; and may be expressed by *r-r-r-u*, pronounced as though it were a

French word. The note is trilled forcibly, and lasts a variable length of time. One of these insects was once observed while singing to its mate. At first the song was mild and frequently broken; afterwards it grew impetuous, forcible and more prolonged; then it decreased in volume and extent until it became quite soft and feeble. At this point the male began to approach the female, uttering a series of twittering chirps; the female ran away, and the male, after a short chase, returned to his old haunt, singing with the same vigor but with more frequent pauses. At length finding all persuasions unavailing, he brought his serenade to a close."

Average measurements: Length of body of male, 9 mm.; of female, 12 mm.; of hind femora, 9 mm.; of ovipositor, 9 mm.

8. NEMOBIUS EXIGUUS, Scudder. The Lesser Striped Ground Cricket.

Nemobius exiguus, Scudder, Boston Jour. Nat. Hist., VII, 1862, 429,
(Not *Acheta exigua*, Say.).

Nemobius fasciatus exiguus, Fernald, Orth. N. Eng., 1888, 16.

Also a very common species and found in company with the preceding, the habits of the two being essentially the same. From *vittatus* it may be known by its *much smaller* size, lighter color, and by the last two segments of the maxillary palpus being white. Moreover the ovipositor is much shorter, being only one-half to two-thirds the length of the hind femur, whereas in *vittatus* it is fully as long as that segment. A careful examination of a large number of specimens leads me to believe that these differences are constant, with no intermediate forms, hence the two species should be separated.

Length of body, male, 7 mm.; of female, 8 mm.; of hind femora, 6 mm.; of ovipositor, 3 to 4 mm.

9. NEMOBIUS FASCIATUS, DeGeer. The Long-winged Striped Cricket.

Nemobius fasciatus, Scudder, Bost. Jour. Nat. Hist., VII, 1862, 436.

Fernald, Orth. N. Eng., 1888, 16.

McNeill, Psyche, VI, 1891, 6.

This species has not been seen by the writer within the boundaries of the state; but Scudder, *loc. cit.*, says that it has been taken at Delphi, Indiana. From the two preceding species it may be known by the presence of the inner wings, which extend beyond the end of the ovipositor. McNeil, *loc. cit.*, records it as being common about the electric lights at Rock Island, Illinois.

V. ANAXIPHUS, Saussure (1874).

Our native species of this genus are very small crickets resembling those of *Nemobius* in form of body, breadth of head, etc.; but having the ovipositor very much compressed and curved strongly upwards as in many of the common species of *Locustidae* or katydids.

10. ANAXIPHUS PULICARUS, Saussure.

Anaxipha pulicaria, McNeill, Psyche VI, 1891, 6.

Head and pronotum brick red in color, sparsely clothed with long hairs; wing covers and legs very light brown; abdomen and ovipositor darker. Both sexes are wingless, but the wing covers of the male are well developed, fully covering the abdomen, while those of the female reach but little beyond its middle. The cerci are exceedingly long, tapering, and covered with fine yellow hairs. The hind femora of the males are proportionally much longer than those of the females as will be seen by the following measurements:

Length of body—male, 6.5 mm., female, 8 mm.; length of posterior femora—male, 6.5 mm., female, 6 mm.; length of ovipositor, 3.5 mm.; of antennæ of male, 32 mm.

This handsome little cricket was first taken in the state on Aug. 26, 1891, at Kewanna, Fulton county, where it occurred in small numbers among the sphagnum mosses growing in a tamarack swamp. On Sept. 6, it was found in Vigo county, 135 miles farther south, about the borders of a large pond. Here it was abundant in isolated spots on the leaves and stems of the arrow alum, *Peltandra undulata*, Raf. It is very active and difficult to capture, and, on account of its small size, is doubtless overlooked in many localities where it occurs in abundance. It is not described in any of the works to which I had access, and specimens were sent to Prof. Lawrence Bruner, Lincoln, Neb., who kindly identified them for me.

VI. PHYLLOSCIRTUS, Guerin. (1846).

The members of this genus are small crickets which have the head broader than the prothorax. They may be readily known from all other Gryllids by having the apical joint of the maxillary palpus flattened, oval, and much longer than the preceding joint which is triangular. The ovipositor is somewhat compressed and curved upwards.

11. PHYLLOSCIRTUS PULCHELLUS, Uhler. The Handsome Cricket.

Phyllopalpus pulchellus, Uhler, Proc. Ent. Soc. Phil., II, 1864, 544.

Phylloscirtus pulchellus, Riley, Stand. Nat. Hist., II, 1884, 183.

McNeill, Psyche, VI, 1891, 6.

This is the only species of the genus known to occur in the eastern United States, and is the most brightly colored of all our native crickets. In the living specimen the head and thorax are crimson, the wing covers a shining pitch black, while the thick hind femora are almost transparent but become white in alcohol. The wing covers reach the end of the abdomen, and the wings are almost as long. A single female specimen was taken on September 6th, from a leaf of the button bush, *Cephalanthus occidentalis*, L., near the border of a large pond in Vigo county. When discovered it was motionless, but was vibrating its large maxillary palpi in a very rapid and curious manner. It is a southern species but has been recorded from New York and Illinois, and probably occurs in low wet woods throughout the southern half of this state. According to Uhler, it is found most frequently "amongst the grass and low bushes near ditches where it jumps about with great rapidity."

Measurements: Length of body, 8.5 mm.; of ovipositor, 3.5 mm.; of posterior femora, 6 mm.; of antennæ, 18 mm.

VII. OROCHARIS, Uhler (1864).

The members of this genus have the head slightly narrower than the base of the pronotum; the maxillary palpi with the third segment longest, cylindrical; the apical one a little longer than the one preceding, enlarged gradually from the base, obliquely truncate. Both wing covers and wings are longer than the abdomen. The posterior femora are less thickened and the body less robust, longer, and flatter, than in the preceding or the following genus.

12. OROCHARIS SALTATOR, Uhler.

Orocharis saltator, Uhler, Proc. Ent. Sec. Phil., II., 1864, 545.

Riley, Stand. Nat. Hist., II, 1884, 182.

Apithes McNeillii, Blatchley, Canadian Entomologist, XXIV, 1892, 27.

General color, after immersion in alcohol, dull brownish yellow, the male the lighter. A dark brown stripe reaches from the eye along the side of head and prothorax to posterior border of pronotum. The wing covers each with a small brown spot at base: those of the female with many cross veinlets which are darker than those running lengthwise, giving the dorsal field a checkered appearance. In the male the vein separating the dorsal field of the wing cover from the lateral is yellow; in the female the yellow is broken by a number of oblong dark spots. All the femora are rather thickly marked with small, dark spots; those on the posterior pair

being arranged in regular rows. The wings extend 2.5 mm. beyond the tip of wing covers. Measurements: Female, length of body, 16 mm.; of wing covers, 14.5 mm.; of posterior femora, 9 mm.; of ovipositor, 12 mm. Male, length of body, 14 mm.; of wing covers, 12.5 mm.; of posterior femora 7.5 mm.

A single pair have been taken in Vigo county. The female was secured Oct. 21, 1891, from the lower leaves of a golden rod, *Solidago latifolia*, L., which grew in a thick, upland woods. The male was taken just a year later from the under surface of a leaf of prickly ash, *Nanthoxylum americanum*, Mill. It flew from one leaf to another and, before its capture, was thought to be a species of *Blattida*, so flat did its body appear.

Not having Mr. Uhler's paper when the female was taken it was sent to Mr. S. H. Scudder, of Cambridge, Mass., for identification. He returned it with the statement that it was, in his opinion, "an undescribed species of *Apithes*, allied to *A. azteca*, Sauss, and very different from *A. quadrata*, Scudder." On the strength of his statement, and prematurely on my part, it was described as new in the Canadian Entomologist, *loc. cit.* Having since secured Mr. Uhler's paper diagnosing the two genera, *Apithes* and *Orocharis*, a careful comparison with the descriptions therein proves it to belong to the latter genus; and, although differing somewhat in the details of color and measurement from Uhler's description of *saltator*, yet the differences are not sufficient, in my opinion, to make of it a distinct species. It has heretofore, been recorded, as far as I can ascertain, only from the southeastern United States.

VIII. APITHES—(HAPITHUS), Uhler (1864).

Thick bodied crickets resembling in general form the members of the genus *Gryllus* but having the head narrower than the posterior margin of the pronotum. The maxillary palpi with the apical segment as long as the 2d and 3d together. The wing covers do not reach the base of the abdomen and the wings are much shorter.

13. APITHES AGITATOR, Uhler.

Hapithus agitator, Uhler, Proc. Ent. Soc. Phil., II, 1864, 546.

Riley, Stand. Nat. Hist., II, 1884, 183, fig. 258.

A short, heavy-bodied cricket; dull reddish brown in color, with the vein, separating the dorsal field of the wing cover from the lateral, a yellowish white. The top of head and pronotum, and the surface of all the femora densely covered with brownish-yellow hairs. Measurements: Female, length of body, 11 mm.; of wing covers, 7.5 mm.; of posterior femo-

ra, 9 mm.; of ovipositor, 8 mm. Male, length of body, 10 mm.; of posterior femora, 8 mm.

A large number of specimens of this cricket were taken in two localities in Vigo county, Indiana, during the last half of September. The first ones discovered were on the slender twigs of some prickly ash shrubs which grew in a damp upland woods. The place was visited a number of times and the crickets were always found, perfectly motionless, and immediately above or below one of the thorns or prickles jutting forth from the twigs. The tips of the hind femora were raised so as to project above the body thus causing them to resemble the thorns; and the color of the insects corresponding closely to that of the bark, made them very difficult to discover even when in especial search of them. On every clump of prickly ash in the woods mentioned a number of specimens were secured but they could be found no where else thereabouts. The second locality where they were discovered was about the roots of a scarlet oak, *Quercus coccinea*, Wang, which grew on a sandy hillside. Here they were plentiful, and resting motionless in the depressions of the bark or beneath the leaves in the cavities formed by the roots of the tree.

Of all the males taken, over thirty in number, there was not one with perfect wing covers, and, in almost every instance, the wing covers as well as the rudimentary wings were wholly absent; while every female had both pairs unharmed. I at first ascribed this wing mutilation to the males fighting among themselves, but finally discovered a female in the act of devouring the wings of a male. Why this curious habit on the part of the one sex? Possibly the females require a wing diet to requite them for their bestowed affections, or, perchance, they are a jealous set, and, having once gained the affections of a male, devour his wing covers to keep him from calling other females about him. *Quien sabe?*

Agitator is said to be common in the middle and southeastern states. The eggs of the female are there deposited in twigs of the white elm, *Ulmus Americana*, L., and the insects are very active at night, running and jumping about on the trunks of various trees.

IX. ECANTHUS, Serville (1831).

From the other *Gryllidæ* of the state the members of this genus may be known by their slender hind femora, their narrow, elongated prothorax, and their whitish or greenish-white color. The wing covers of the females are wrapped closely about the body, while those of the male are much

firmer in texture, broadly spread out, and very transparent; causing such a difference of appearance between the two sexes that tyro collectors often take them for widely different insects. Three species have, so far, been collected in the state, and two others very likely occur, but have not yet been taken.

14. *ECANTHUS NIVEUS*, DeGeer. The White Climbing Cricket.

- Ecantus niveus*, Harris, Ins. Inj. Veg., 1862, 153, figs. 71, 72, (In part).
 Fitch, Third Rep. Nox. Ins., N. Y., 1856, 86.
 Scudder, Bost. Journ. Nat. Hist., VII, 1862, 431.
 Rathvon, U. S. Agr. Rep., 1862, 381, figs. 17, 18.
 Thomas, Trans. Ill. St. Ag. Soc., V, 1865, 444.
 Walsh, Prac. Entom., I, 1866, 126; II, 1867, 54, 94.
 Scudder, Dist. Ins. in N. H., 1874, 365, (Note of, set to music).
 Glover, U. S. Ag. Rep., 1874, 143, fig. 16.
 Packard, Guide Stud. Ins., 1883, 564, figs. 561, 562.
 Id., Rep U. S. Ent. Conn., V, 1890, 230, 591, figs. 75, 76.
 Fernald, Orth. N. Eng., 1888, 17, figs. 7, 8, 9.
 Comstock, Intr. Ent., I, 1888, 122, figs. 109, 110.
 Murtfeldt, Insect Life, II, 1889, 130, (Carnivorous habits of).
 McNeill, Psyche, VI, 1891, 6.

Both sexes of this species are in color ivory white, more or less tinged with a delicate green, especially in the female. The top of head and basal joint of antennæ are usually suffused with ochre yellow, while on the lower face of each of the two basal joints of the antennæ is a small black spot. The ovipositor of the female is short, perfectly straight and usually tipped with black. The maxillary palpi are longer in this than in any other species of the genus and the wing covers of the male are broader in proportion to their length than in any other except *O. latipennis*, Riley.

Measurements: Male, length of body, 13 mm.; of wing covers, 13.5 mm.; width of wing covers, 6.5 mm. Female, length of body, 14.5 mm.; of wing covers, 14 mm.; of ovipositor, 5.5 mm.

The white climbing cricket is very common throughout the state, and mature specimens are to be found in numbers about grape vines, shrubbery, etc., from August 1st till November. In my experience the females appear more plentiful than the males, the latter being more often heard than seen.

During the day they keep themselves hidden among the foliage and flowers of various plants, but as night approaches they come forth and the male begins his incessant, shrill, chirping note, which he continues with little or no intermission till the approach of morning warns him to desist. Prof. McNeill, in *Psyche*, *loc. cit.*, has given an excellent description of the songs of the different species of *Oecanthus*. "That of *niveus*," he says, "is the well known *t-r-r—r-e-e: t-r-r—r-e-e*, repeated without pause or variation about seventy times in a minute. It is heard only at night and occasionally on cloudy days, but in the latter case it is only an isolated song, and never the full chorus of the night-song produced by many wings whose vibrations in exact unison produces that characteristic 'rhythmic beat,' as Burroughs has happily phrased it."

The females of *niveus* do much harm by ovipositing in the tender canes or shoots of various plants, as the raspberry, grape, plum, peach, etc.; no less than 321 eggs, by actual count, having been found in a raspberry cane 22 inches in length. The eggs are laid in autumn and at first the injury is shown only by a slight roughness of the bark, but afterwards the cane or branch frequently dies above the puncture, or is so much injured as to be broken off by the first high wind. If the injured and broken canes containing the eggs be collected and burned in early spring the number of insects for that season will be materially lessened.

Niveus, however, in part if not wholly, offsets this injurious habit by its carnivorous propensities, as the young, which are hatched in June, feed for some time upon the various species of aphides or plant lice which infest the shrubbery they frequent. Mr. B. D. Walsh, in the *Practical Entomologist*, *loc. cit.*, was the first entomologist to call attention to this carnivorous habit, but it seems little attention was given to the matter. Recently, however, it has come up again, and in *Insect Life*, for November, 1891, Miss Mary E. Murtfeldt, of St. Louis, Mo., has given a most interesting account of some experiments and observations concerning it which were made by her. From this article the following extract is taken: "Some leaves of plum infested with a delicate species of yellow aphid were put into a jar with the young of *Oecanthus niveus*, but attracted no immediate attention. As twilight deepened, however, the crickets awakened to greater activity. By holding the jar against the light of the window, or bringing it suddenly into the lamp light, the little nocturnal hunters might be seen hurrying with a furtive, darting movement over the leaves and stems, the head bent down, the antennæ stretched forward, and every sense apparently

on the alert. Then the aphides provided for their food would be caught up one after another with eagerness and devoured with violent action of the mouth parts, the antennæ meanwhile playing up and down in evident expression of satisfaction. Unless I had provided very liberally not an aphid would be found in the jar the next morning and the sluggish crickets would have every appearance of plethora."

15. *ECANTHUS FASCIATUS*, Fitch. The Striped Tree Cricket.

Ecanthus fasciatus, Fitch, Third Rep. Nox. Ins., N. Y., 1856, 96.

McNeill, Psyche, VI, 1891, 6.

Ecanthus niveus, Harris, Ins. Inj. to Veg., 1862, 154, (In part).

Rathvon, U. S. Ag. Rep., 1862, 381.

In its general form this insect resembles the preceding, but it is always darker in color, varying from a deep black to ivory white with fuscous markings. Most specimens, however, are greenish white with three black stripes on the head and pronotum and a broad dusky line along the center of the abdomen beneath. The wing covers of the male are less broad in proportion to their length than in *niveus*; while the ovipositor is longer and more distinctly turned upwards at the end than in that species.

Measurements: Male—Length of body, 14 mm.; of wing covers, 11.5 mm.; width of wing covers, 5.5 mm. Female—Length of ovipositor, 6.5 mm.

In Indiana this species is fully as common if not more so than *O. niveus*. It is more frequently found on wild plants than that species, being, in autumn, an abundant visitor of sun-flowers and golden rods. Mature specimens were taken in Putnam county, as early as August 9th.

16. *ECANTHUS ANGUSTIPENNIS*, Fitch. The Narrow-winged Tree Cricket.

Ecanthus angustipennis, Fitch, Third Rep. Nox. Ins., N. Y., 1856, 95.

McNeill, Psyche, VI, 1891, 8.

This species is readily distinguished by the narrowness of the wing covers of the male, their breadth being just about one third their length. The wings are longer than in either of the two preceding, extending in one specimen at hand, 9 mm. beyond the wing covers. The head and prothorax are less prominent, and the latter is much narrowed anteriorly. The general color is an ivory white, rather deeply tinged with greenish.

Measurements: Male—Length of body, 13 mm.; of wing covers, 11.5 mm. width of wing covers, 4 mm.

Angustipennis probably occurs in all parts of the state but is much less

common than either *niveus* or *fasciatus*. A fully developed male was taken from a leaf of an iron weed, *Vernonia fasciculata* Michx., on August 11th.



This completes the list of *Gryllidæ* so far known to have been taken in the state. Other species undoubtedly occur, and it was a desire to awaken an interest in the family and so lead, if possible, to their discovery, which, in the main, prompted the preparation of the present paper.

The species most likely to occur, but which have not, as yet, been noted are: *Tridactylus terminalis*, Uhler; *Tridactylus minutus*, Scudder; *Ecanthus latipennis*, Riley; *Ecanthus bipunctatus*, De Geer, and one or two species of *Myrmecophila*, which are the smallest crickets known. They resemble closely the young of cockroaches and inhabit the nests of ants. The writer will be pleased to receive specimens of *Gryllidæ* and other *Orthoptera* from any part of the state, and will return the names of those sent to all who may so desire.

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ENTOMOLOGIZING IN MEXICO. By W. S. BLATCHLEY.

THE OUTLOOK IN THE WARFARE AGAINST INFECTION. By THEODORE POTTER.

OUR PRESENT KNOWLEDGE CONCERNING THE GREEN TRITON, *DIEMYCTYLUS VIRIDESCENS*. By O. P. HAY.

The green triton, or newt, *Diemyctylus viridescens*, has been before this academy for discussion at a previous meeting. Since that time there have been some accessions to our knowledge regarding it. This pretty and harmless newt probably inhabits all parts of the state, but I have not found it abundant anywhere, though no doubt it is plentiful in suitable localities.