mained usually motionless when they could easily be made to jump into the beating net, which was held below the spot under investigation to catch the bark and any specimens which might fall with it. Without such use of a net the species would prove very difficult to capture. The insect is apparently wholly nocturnal and individuals probably seldom leave the tree trunks. This latter is indicated by the peculiar silvery general coloration of the insects, mottled and speckled with dark brown, which blends perfectly with the bark of the trees upon which they are found, but which would cause them to be conspicuous under many other environmental conditions."

Subfamily V. GRYLLINÆ.

The Ground and Field Crickets.

This subfamily comprises our most numerous and best known crickets. They are of small or medium size, usually robust and stubby in form and have the head large, vertical or nearly so, vertex broad, rounded into the face; antennæ long, setaceous; ocelli three, usually arranged in a very obtuse triangle; pronotum short, subquadrate, its front and hind margins truncate or nearly so; tegmina and wings variable in length; stridulating organ of male furnished with a speculum; fore tibiæ with a tympanum on one or both faces; femora unarmed, hind ones very stout; hind tibiæ armed above with two rows of spines, without serrations between them, and with six subapical spurs; joints of all the tarsi compressed; anal cerci long, tapering, bristly. Ovipositor variable in length, straight, slender, cylindrical, feebly lanceolate at apex.

About 20 genera of the subfamily are known, six of which are represented in the eastern United States. The principal literature treating of these is as follows: Saussure, 1874, 379, 1877, 226; Blatchley, 1892, 1900, 1903; Scudder, 1896a, 1896b, 1896c, 1901b, 1902a; Walker, E. M. 1904; Morse, 1905; Lutz, 1908; Hebard, 1913, 1913a, 1915, 1915c; R. & H., 1915c, 1916.

KEY TO EASTERN GENERA OF GRYLLINÆ.

a. Spines of hind tibiæ long, movable, pilose; last joint of maxillary palpi at least twice the length of the one preceding; basal joint of hind tarsi (in our species) unarmed above; smaller, length of body less than 12 mm.

b. Lower front angle of lateral lobes of pronotum rounded; tegmina of male with a tympanum; hind tibiæ armed above with four spines on each margin and with three subapical spurs on each side. I. NEMOBIUS, p. 671.

bb. Lower front angle of lateral lobes rectangular or acute; tegmina of male without a tympanum; hind tibiæ armed above with

three spines on each margin and with only two subapical spurs on inner side (Fig. 235, *c*.) II. HYGRONEMOBIUS, p. 688.

aa. Spines of hind tibiæ stout, immovable; last joint of maxillary palpi not more than one-third longer than the one preceding; basal joint of hind tarsi serrate above on both margins; larger, length of body rarely under 14 mm.

c. Ocelli arranged in a nearly transverse row; upper inner subapical spur of hind tibiæ as long as the middle inner one; ovipositor very short, scarcely visible. III. ANUROGRYLLUS, p. 690.

cc. Ocelli arranged in an obtuse triangle; upper inner spur of hind tibiæ shorter than the middle one; ovipositor at least half as long as hind femora.

d. Vertex between the antennæ scarcely wider than basal joint of antennæ; lower margin of lateral lobes very short, rounded into both front and hind margins. IV. GRYLLODES, p. 692.

dd. Vertex between the antennæ twice or more as wide as basal joint of antennæ; lower margin of lateral lobes elongate, nearly straight.

e. Hind tibiæ not more than two-thirds the length of hind femora, armed above with four or five spines on each margin; fore tibiæ in short-winged forms with a tympanum on outer side only. V. MIOGRYLLUS, p. 693.

ee. Hind tibiæ three-fourths or more the length of hind femora, armed above with five to eight spines on each margin; fore tibiæ with a tympanum on both outer and inner sides. VI. GRYLLUS, p. 696.

I. NEMOBIUS Serville 1839, 345. (Gr., "a grove-dweller.")

THE GROUND CRICKETS.

Size small, form compact; body and legs sparsely clothed with long bristle-like hairs; vertex rounded into the face; ocelli small, round, arranged in a triangle; eyes oval, prominent; disk of pronotum subquadrate, but slightly wider than head; lower margin of lateral lobes horizontal, its front and hind angles rounded; tegmina of male usually shorter than abdomen, their tips rounded or subtruncate, the tympanum with but a single oblique ulnar vein; tegmina of female with a few prominent longitudinal veins and numerous connecting cross-veinlets; wings variable in length, often absent; inner or hind face of fore tibiæ only with a tympanum; hind femora strongly swollen; basal joint of hind tarsi not sulcate above, armed only at apex with two small teeth and with a long spine on each side, the inner one the longer; cerci of both sexes very slender, tapering, half the length of hind femora clothed with short hairs and long bristles. Ovipositor variable as to species.

Of all the Gryllidæ which occur with us, these little brown ground crickets of the genus *Nemobius* 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. Even the tangled masses of sphagnum mosses and other semi-aquatic growth of fen and marsh furnish shelter and food to certain species which, in the ages of the past, have become adapted to a life of such surroundings.

They appear to be omnivorous, feeding upon carrion, cow dung and grasses with equal avidity. Though small in size, their enormous numbers, as well as 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, renders them particularly injurious. The aggregate damage which they cause to grass and kindred plants in the course of a single season must be great, and there is little doubt but that all species of the genus should be classed among those insects highly destructive to forage plants.

The small size, nearly uniform color and variability in length of tegmina, wings and ovipositor have led to many synonyms among the species of *Nemobius*. Up to 1900 but four species were known from the Eastern States. In that year I described three additional ones from Indiana, and a fourth in 1903. Hart, Walker, Caudell and Hebard have since described other forms. Hebard in his Revision (1913) placed several of the previously known forms as synonyms or varieties, and recognized 12 species and seven races or varieties from America north of Mexico. In the present work most of his conclusions have been adopted and the following key is based largely upon the one prepared by him.

a *b* *c*

Fig. 224. Color pattern of face and head of *Nemobius*. a, *grisens*, b, c, *ambitiosus*, × 4. (After Hebard.)

KEY TO EASTERN SPECIES OF NEMOBIUS.

a. Lower pair of apical spurs of hind tibiæ unequal in length, the inner one much the longer; apex of ovipositor with only the upper margin serrulate.

b. Ovipositor straight or nearly so, at least as long as, or barely shorter than hind femora (except in the race *funeralis*.)

c. Ovipositor distinctly longer than hind femora (except in races *socius* and *funeralis*); black markings of body not scattered in blotches and dashes to give a mottled appearance; wings often fully developed.

d. Face below the antennæ not a uniform shining piceous; general color without a grayish suffusion.

e. Ovipositor longer than hind femora; species of northern range.

f. Occiput with four dark stripes; general color rusty black to sooty brown; larger, length of body, males 7.5—10, females, 8—11 mm. 320. FASCIATUS.

ff. Occiput without evident black stripes; general color very dark; smaller, males, 6.7—8, females, 7.3—9 mm. 320a. ABORTIVUS.

ee. Ovipositor no longer than hind femora; species of southern range; color and size of *fasciatus*. 320b. SOCIUS.

dd. Face below the antennæ a uniform shining piceous (Fig. 224, *a*); general color with a grayish suffusion; lateral margins of dorsal field of male tegmina narrowly yellow.

g. Ovipositor much longer than hind femora; distribution northern. 321. GRISEUS.

gg. Ovipositor nearly one-third shorter than hind femora; distribution southern and southwestern. 321a. FUNERALIS.

cc. Ovipositor no longer than hind femora; black markings, especially in females, scattered to give a mottled appearance; brachypterous, wings absent.

h. Head without an ivory-white bar between the eyes; hind femora without two lengthwise fuscous stripes; general range northern. 322. MACULATUS.

hh. Head with a narrow white cross-bar between the eyes, this bordered above with a wider shining black one (Fig. 224, *b*); hind femora usually with two fuscous stripes; general range southern. 323. AMBITIOSUS.

bb. Ovipositor evidently but not strongly curved, about two-thirds as long as hind femora (Figs. 229, 231.)

i. Larger, length of body, male, rarely under 6 mm.; color not a uniform pitchy brown; habitat not confined to sphagnum bogs.

j. Pronotum and femora clay-yellow mottled with fuscous; wings absent; apex of ovipositor armed above with rather stout, very sharp teeth; general range northern. 324. VARIEGATUS.

jj. Pronotum and femora not distinctly mottled with fuscous; wings usually present and longer than abdomen; ovipositor armed with very fine, close-set teeth; general range southern.

k. Occiput without a narrow dark cross-line; tegmina of females as long as abdomen, their tips narrowly rounded; general color dark brown, not distinctly mottled. 325. CUBENSIS.

kk. Occiput with a narrow dark cross-bar behind the eyes; tegmina of female about three-fifths the length of abdomen, their tips subtruncate; general color paler brown mottled with fuscous. 325a. MORMONIUS.

ii. Smaller, length of body, male, rarely more than 5.8 mm.; general color uniform piceous (rarely, southern specimens, dull

yellow with only the tegmina piceous); habitat confined to sphagnum bogs. 326. PALUSTRIS.

aa. Lower pair of apical spurs of hind tibiæ equal in length; apex of ovipositor with both upper and lower margin serrulate, the teeth of the latter very fine and widely spaced (Figs. 233, 234.)

l. Last two joints of maxillary palpi not wholly white; general color pale brown; dorsal surface of abdomen of female dark brown with three rows of paler spots. 327. CAROLINUS.

ll. Last two joints of maxillary palpi pure bone-white; general color very dark brown; dorsal surface of female abdomen without pale spots. 328. CONFUSUS.

320. NEMOBIUS FASCIATUS (DeGeer), 1773, 522. Striped Ground Cricket.

Size large for the genus. General color dark reddish-brown to dusky black; head and pronotum usually darker than the other parts; occiput with four more or less distinct blackish stripes; tegmina in great part, lower part of lateral lobes and cheeks pale brownish-yellow; nymphs usually with a median dorsal dark stripe on abdomen and a broad dark band on lateral lobes. Pronotum about one-third wider than long, its bristly hairs very numerous. Tegmina dimorphic in length, nearly as long as hind femora and reaching nearly to tip of abdomen in both sexes (*fasciatus*), often one-half shorter and reaching only the middle of abdomen in female (*vittatus*). Wings also dimorphic, surpassing tip of ovipositor in macropterous female, represented by mere scales in brachypterous one. Ovipositor, rigid, straight, apical fourth very feebly sublanceolate at tip, with upper valves serrulate above. Length of body, ♂, 7.2—10.6, ♀, 8—11.5; of pronotum, ♂, 1.8—2.1, ♀, 1.7—2.4; of tegmina, ♂ and ♀, long form, 7—7.5, short form, ♂, 4.1—5.5, ♀, 3.7—6.1; of hind femora, ♂, 5.7—7.6, ♀, 6—8; of ovipositor, 6.8—9.4 mm. (Fig. 225.)

The long-winged or typical form of this ground cricket is much less common in Indiana than the short-winged one. I have taken it in the field on but two or three occasions, and then in small numbers on the stems of tall grasses about the margins of marshes. However, many have been taken from the walks and streets of Indianapolis, Fort Wayne and other cities and towns in the northern part of the State, but none, as yet, in the southern half, not even in Terre Haute, where I resided for seven years. Where the long-winged form breeds, and feeds by day is to me unknown. It appears to reach maturity about July 15th as, at times, in the first week in August, swarms composed of myriads have appeared about the lights of some of the cities. The newspapers the next day had a column or more devoted to the insects but nothing, except wild guesses, as to whence they came.

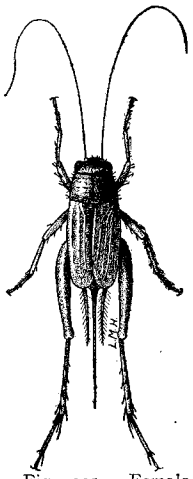

Fig. 225. Female. Short-winged form. (After Lugger.)

The short winged form (*vittatus*) begins to reach maturity in central Indiana about July 15th. Living specimens have been seen as late as December 1st. Although present in vast numbers, but little is known of its life habits. 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.

The known range of *N. fasciatus* is a very wide one, extending from Nova Scotia and New England, west to Manitoba, Wyoming and Utah, and south and southwest to Tennessee, central Georgia, Arkansas and New Mexico. West of Manitoba typical *fasciatus* is replaced by its northern race *abortivus* Caudell, and south of North Carolina and central Georgia by the southern race *socius* Scudder. It is recorded as common wherever found and in number of individuals is perhaps the most abundant of all our eastern Orthoptera.

Piers (1918, 331) says it is one of the most numerous species of Orthoptera in Nova Scotia, all the specimens noted, however, being the short-winged form.

"Around Halifax they begin to reach maturity about July 20, but the males do not commence stridulating till a fortnight later. At first a few are heard and only at night and so very faintly as to be all but inaudible except to a trained ear. In a few days they may be heard in daytime as well as at night and the notes become more noticeable. They are last heard at Halifax about Nov. 10, * * * some of them surviving as many as four ice-forming frosts, frozen ground and even evanescent snow falls.

"The stridulation or shrilling note of the male is produced by the insect lifting the wing-covers about 45° above the body, and then shuffling them very rapidly together so as to vibrate the resonant organ at their base; thus producing a trilling sound or tremolo, of a prolonged character, resembling the syllable *ple-e-e-e, ple-e-e-e, ple-e-e-e*, repeated at rather short intervals or sometimes continued for several seconds or even much longer. The sound has a peculiar silvery timbre, and when myriads are shrilling all over the fields at night, or on fine days in late autumn, when other sounds are hushed and the air filled with the mystic charm of the hour or season, it produces a peculiarly drowsy, ceaseless tremor, pulsation or 'shimmer' of sound which is very familiar and loved by all dwellers in the country. It is, however, ineffably associated with a sad feeling that summer is on the wane or past, for it is our most characteristic autumnal sound in grassy places, and is linked with the sight of golden-rods and purple asters and the odour of falling leaves."

Scudder (1868a) has set the note of the male to scale and says: "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."

Allard (1910) states that throughout October and early November "*N. f. vittatus* fairly swarms in the grass fields and pastures of much of New England," but he had never taken there the long-winged one. Around Washington, D. C. he found the two forms intermingling in some localities, and in others the long-winged one wholly absent. He adds:

"About Oxford, Mass., two singing forms of *N. f. vittatus* are very common. The stridulation of one of these is a very high pitched, prolonged trill, *ti-ti-ti-ti-ti-ti-ti-ti-ti-ti;* that of the other form is a very brief, shrill, intermittent *tiiii-tiiii-tiiii.* A considerably lower pitch quite sharply distinguishes the brief intermittent notes, *tiiii-tiiii,* from the prolonged trill. These two trilling forms of *vittatus* are quite definitely confined in separate colonies, and in different localities. The prolonged trilling form occupies almost exclusively the dry, grassy upland fields and pastures. In the damp and marshy low grounds in fields and pastures this form is replaced almost entirely by pure colonies of the intermittent trilling form. Only where the wet and dry conditions overlap is there a noticeable intermingling of the two forms. At Oxford this is the most abundant insect of late autumn, and continues to trill in the fields until overcome by the keen, freezing nights of November."

The known synonyms of *N. fasciatus* are *Acheta hospes* Fab. (1775, 281); *Acheta vittata* Harris (1835, 576), the short-winged form above mentioned; *Nemobius exiguus* Scudder (1862, 429) and *N. utahensis* Scudd. 1896a, 103). The *N. canus* Scudder of my former work (1903, 423) is also placed by Hebard as only a pale form of *N. fasciatus,* the true *N. canus* being a synonym of *N. f. socius* Scudd.

320a. NEMOBIUS FASCIATUS ABORTIVUS Caudell, 1904b, 248.

Smaller than typical *fasciatus.* Color darker, in some specimens almost black; tegmina transparent sooty brown, the main veins darker, the lateral or costal field blackish, not pale as in *fasciatus;* femora usually black; dorsum of abdomen dark brown. Tegmina shorter than hind femora. Ovipositor with apex enlarged for a shorter distance and serrate

as in *fasciatus*. Length of body, ♂, 6.7—8, ♀, 7.3—9; of tegmina, ♂, 4.3—5.8, ♀, 3.1—4.6; of hind femora, ♂, 4.9—5.5, ♀, 5.4—6.2; of ovipositor, 6.2—7.4 mm.

Moose Jaw, Assiniboia, Aug. 24 (*Caudell*). This small dark form of *N. fasciatus* is included in this work on the Ft. William, Ont., record of E. M. Walker (1911, 304) who states that: "The specimens were confined to a small sandy area thinly clothed with grass and weeds. They were very small and the stridulation was a low continuous trill differing from that of typical *fasciatus*. It is thus possible that this form is specifically distinct." He also states (1910, 354) that a series of *abortivus* from Aweme, "show great variation in color and length of tegmina and ovipositor. Some individuals approach *N. maculatus* Bl. from Indiana in all of these characters and are scarcely distinguishable except by the longer and more numerous hairs of the pronotum, but as a rule the ovipositor is distinctly longer than in *N. maculatus*."

Caudell's types were from Moose Jaw where he found them "hopping actively about in the grass in and along the borders of a draw or small hollow in the prairie." Hebard (1913, 429) gives the distribution as "the prairie region of Manitoba, Saskatchewan and Alberta and the adjacent portions of the United States. Only brachypterous individuals are known."

320b. NEMOBIUS FASCIATUS SOCIUS Scudder, 1877, 37.

Size and form of typical *fasciatus*. Color same as there, ranging from pale reddish (*canus* Scudder) to fuscous-brown, the dark stripes on occiput often wanting in very pale or very dark specimens. Differs from *fasciatus* only in having the ovipositor as short as or shorter than the hind femora. "Nearly allied to our common *N. vittatus* with which it agrees in size, although a little slenderer; tegmina, however, much longer and ovipositor proportionally a little shorter." (*Scudder.*)

Lake Okeechobee, Ft. Myers, Lakeland, Sarasota and Dunedin, Fla. (*W. S. B.*); Thomasville, Ga. (*Hebard*); Dallas, Tex. (*Boll.*) About Dunedin both adults and nymphs occur throughout the winter among the low grasses and beneath boards and logs along the borders of ponds and low marshy places in open pine woods. Recorded from numerous localities on the mainland of Florida but not as yet from the southern keys.

The range of this form, which is so close to *N. fasciatus* that it is hardly worthy a distinctive name, extends from North Carolina and Tennessee south throughout Florida, west to Brownsville, Texas and north to Arkansas and Oklahoma, where it merges into typical *fasciatus*. It appears to be nowhere so abundant as is *fasciatus vittatus* in the north and macropterous individuals are

said to be more numerous than short-winged ones, though this is not true in the series at hand from Florida.

Hebard has placed both the *N. canus* and the male of *N. aterimus* of Scudder (1896a, 103, 105) and also the *N. hastatus* Sauss. (1897, 221) as synonyms of *N. f. socius*. Of *canus*, described from Texas, Scudder states: "This is possibly only a geographic race of *fasciatus* remarkable for its cinerous aspect and the striped appearance of the female tegmina." A female cotype from Dallas, sent me by Scudder, has the ovipositor fully as long as in *fasciatus* and there is little doubt but that *fasciatus, vittatus, socius, canus* and *abortivus* should all be merged under DeGeer's name. The trinomial names are retained here only that the student may thus label his specimens if he so desire.

321. NEMOBIUS GRISEUS E. M. Walker, 1904, 182. Gray Ground Cricket.

Size rather small; form moderately slender. Dull reddish-brown covered with fine, short closely appressed gray or brown hairs; occiput dull yellow with three dark fuscous stripes; face piceous; maxillary palpi reddish-brown, the terminal segment fuscous; lateral lobes of pronotum dark brown their lower margin yellowish. Tegmina translucent, the dorsal field pale brownish-yellow, often with a few fuscous blotches near base, in male narrowly margined with pale yellow; lateral field in great part fuscous. Femora fuscous-brown with numerous small pale spots. Abdomen above with a median row of large fuscous spots. Disk of pronotum about one-fourth wider than long, sparsely clothed with long black bristles, its front half or more with a distinct impressed median line. Tegmina of male covering three-fourths or more of abdomen, in repose forming an oblong quadrangle with sides very feebly converging from base, their tips broadly rounded; of female more than half as long as hind femora with tips broadly obliquely rounded. Wings absent. Ovipositor stout, straight; apical sixth feebly swollen, finely serrulate above. Length of body, ♂, 6.8—8, ♀, 7.6—8.2; of pronotum, ♂, 1.4—1.8, ♀, 1.6—2.1; of tegmina, ♂, 4—4.9, ♀,, 2.8—3; of hind femora, ♂, 4.9—6, ♀, 5.7—6.9; of ovipositor, 7.2—8.9 mm. (Fig. 226.)

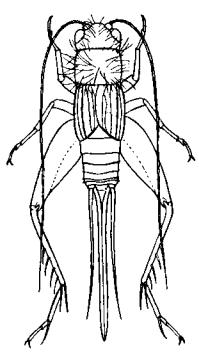

Fig. 226. Female, ×3. (After Hebard.)

Toronto, Ontario, Aug. 9—16 (*Walker*). Vigo and Crawford Counties, Ind., Sept. 4—Oct. 9, three males (*W. S. B.*). The Indiana specimens are in part treated by me (1900, 54; 1903, 425), upon the authority of Scudder, as *N. cubensis* Sauss. Hebard (1913, 434) has placed them as *griseus*. They differ from typical male Ontario *griseus* in being less gray and lacking the fuscous blotches on base of tegmina, in the distinct yellow discoidal veins of tegmina, and in the single Crawford County one being much larger, it furnishing all the maximum measurements for that sex above given.

As I have no Indiana female, I have adopted Hebard's conclusions. Those from Vigo County were taken from the sandy bed of the old canal five miles north of Terre Haute.

Of his types Walker (loc. cit.) wrote: "This is a well marked species, easily distinguished from *N. fasciatus* by its much smaller size, grayish coloration, more distinct dark markings and longer ovipositor. It occurs only on sandy soil where the vegetation is somewhat scanty. The pale colors render it very inconspicuous against the sand. The chirp of the male is a feeble continuous trill, more high pitched and much shorter than that of *fasciatus*."

N. griseus has been recorded only from central eastern Ontario, Maine, Massachusetts and the Indiana localities above given. A single long-winged female was taken by Walker. It is closely allied to *fasciatus*, its xerophytic habitats having produced slight color and structural changes which are probably sufficient to retain its specific standing.

321a. NEMOBIUS GRISEUS FUNERALIS Hart, 1906a, 159.

"Differs from *N. griseus* only in its darker coloration, more obscure color pattern and much shorter ovipositor, the latter being but little over three-fourths the length of caudal femur." (*Hebard.*) Length of body, ♂, 8.9, ♀, 7.9—9.2; of pronotum, ♂, 2, ♀, 1.7—1.9; of tegmina, ♂, 5.8, ♀, 2.7—3.8; of hind femora, ♂, 6.6, ♀, 5.6—6; of ovipositor, 4—4.4 mm.

Hart's unique female type was taken Dec. 26, at College Station, Tex. It is placed as a southern race of *griseus* by Hebard (1913, 437). R. & H. (1916, 288) have recorded a single female from Macon, Ga., and a male from Winslow, Ark.

322. NEMOBIUS MACULATUS Blatchley, 1900, 52. Larger Spotted Ground Cricket.

Size medium for the genus; form robust. Dark brown with a yellowish suffusion, more or less dotted with piceous, especially on occiput, cheeks, disk of pronotum and hind femora; occiput with a narrow median yellowish line and another about the eyes; maxillary palpi reddish-brown, apical half of terminal segment fuscous; tegmina of male with dorsal field translucent brown, the discoidal vein narrowly ivory-white; lateral field and upper two-thirds of lateral lobes in both sexes dark brown. Head rather large, as wide as pronotum. Disk of pronotum about two-fifths wider than long, feebly narrowing from base to apex, its front margin and lateral lobes sparingly beset with stiff black bristles. Tegmina of female less than half as long as hind femora, covering one-third of abdomen, their tips both of dorsal and costal fields obliquely subtruncate and meeting at an angle, the longitudinal veins prominent, cross veinlets feeble; those of male covering two-thirds of abdomen, their tips broadly obliquely rounded. Ovipositor straight, the apical sixth tapering evenly to the acute tip, finely and sharply serrulate above (Fig. 227.) Length of body, ♂,

6.5—8.4, ♀, 7.5—9; of pronotum, ♂, 1.8—2, ♀, 1.9—2.2; of tegmina, ♂, 3.5—4.3, ♀, 2—3.2; of hind femora, ♂, 5.2—6, ♀, 6.1—6.8; of ovipositor, 5—6.8 mm. (Fig. 228.)

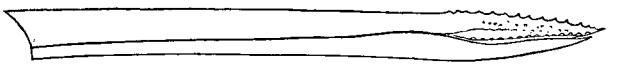

Fig. 227. Ovipositor of *N. maculatus*, × 12. (After Hebard.)

This handsome mottled species occurs sparingly throughout Indiana, frequenting for the most part low, dry open woods and borders of thickets. In Marion County I once found it quite frequent on October 6 amongst dead leaves and beneath logs where the ground ivy, *Nepeta glechoma* L., covered most of the earth. A week later, a heavy hoar-frost meanwhile intervening, not a specimen could be found.

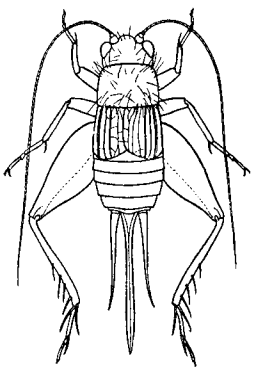

Fig. 228. Female, X 3. (After Hebard.)

From the short-winged form of *N. fasciatus* this species is readily distinguished by its average smaller size, shorter tegmina of female, shorter and straighter ovipositor, fewer hairs on head and pronotum and finer cross-veinlets of female tegmina. The serrulations of the ovipositor are sharper than in *fasciatus*. The two also differ in color, the ground of *maculatus* being paler and the piceous more generally sprinkled where in *fasciatus* it is in lengthwise bars.

The known range of *N. maculatus* extends from New Canaan, Conn. and Long Island, N. Y. west to northern Indiana and south and southwest to Maryland, Virginia, Raleigh, N. Car. and Rabun Co., Ga. It is not definitely recorded from any locality in Illinois or Michigan, though it doubtless occurs in the former and probably in the latter State. Walker's record (1904, 185) from Tobermory, Ont. is said by Hebard to be based upon a small *fasciatus*. It has been taken at several stations in Ohio and at Clarksville, Tenn. About Washington, D. C. it is said to be common, but Fox records only a single female from Tappahannock in his Virginia paper. No macropterous specimens are known.

323. NEMOBIUS AMBITIOSUS Scudder, 1877a, 81.

Size small; form compact, robust. Dark reddish-brown; males often with a yellowish and females with a grayish tinge. Head vertically compressed, the occiput very convex, reddish-brown, with a broad shining

black bar between the eyes; face also shining piceous, sharply separated from the black above by a narrow ivory-white bar (Fig. 224, *b*, *c*); last joint of maxillary palpi fuscous, the preceding one dull yellow. Tegmina of male piceous with the narrow margins (discoidal veins) and extreme tips pale yellow. Legs reddish-brown flecked with fuscous; outer face of hind femora with two fuscous stripes, the lower one the more distinct; basal third or more of dorsum of abdomen piceous, the remainder dark brown. Disk of pronotum subquadrate, very slightly wider than long. Tegmina of female often in great part buffy, flecked with darker brown, less than half as long as hind femora, the tips of dorsal field obliquely rounded; those of male covering three-fourths or more of abdomen, and forming an even oblong quadrangle with sides parallel and tips broadly rounded, wings absent. Ovipositor straight, its apex not thickened, finely serrulate above. Length of body, ♂, 5.9—7.8, ♀, 6—8.2; of pronotum, ♂, 1.2—1.9; ♀, 1.6—2.1; of tegmina, ♂, 3.2—4.5, ♀, 2.2—3.3; of hind femora, ♂, 4.8—6, ♀, 4.9—6.3; of ovipositor, 4—6 mm.

Ormond, Ft. Reed, Lake Istokpoga, Ft. Myers, Sarasota, Lakeland and Dunedin, Fla. (*W. S. B.*); Macon, Ga. (*Fox*). I first saw this handsome and well marked little cricket at Ormond in March 1899 where it was frequent among dead leaves and short grasses along the roadways, hedge-rows and borders of the pine woods. About Dunedin it is by far the most common of the three ground crickets there taken, both nymphs and adults occurring in numbers throughout the winter, especially among and beneath the dead leaves and other debris in dry sandy open oak and pine woods. The numerous records by other collectors show that it occurs in like situations throughout the mainland of the State, adults being found during every month of the year.

The known range of *ambitiosus* is limited, extending from eastern South Carolina and northern Georgia south to Homestead. Fla. Only the brachypterous form is known. Allard (1911a, 156) describes its habits and song in northern Georgia as follows: "This pretty *Nemobius* is the first species to appear at Thompson's Mills and dwells among leaves in deciduous woods. It is especially common on a warm, heavily wooded slope bordering a small brook just east of the settlement. The trill is very brief, high-pitched and shrill, *tiiiiiii-tiiiiii-tiiiiiii-tiiiiiii*. It is one of the commonest species of *Nemobius* in this vicinity and begins to stridulate as soon as spring opens in March and April. In April, 1910, very cold periods of weather with considerable sleet and snow completely silenced these hardy crickets. Notwithstanding this inclement weather these crickets were always in active stridulation as soon as the days became warmer."

324. NEMOBIUS VARIEGATUS (Bruner), 1893a, 32. Smaller Spotted Ground Cricket.

Size medium; form robust. Dull clay yellow, mottled with blackish-brown; face below the antennæ shining dark brown; occiput, disk of pronotum and femora mottled with fuscous; apical half of terminal segment of maxillary palpi brown; tegmina translucent brownish-yellow, the upper third of lateral field with a blackish bar; dorsal field in female often with black fleckings; the mottled appearance sometimes due, however, to the black of dorsal surface of abdomen shining through them. Head large, rounded, as wide as pronotum, both it and the latter with scattered long bristly black hairs. Pronotum nearly one-third wider than long, its apical two-thirds with a feebly impressed median line. Tegmina of male as long as hind femora, reaching tip of abdomen; those of female covering half the abdomen, their tips broadly obtusely rounded. Wings absent. Ovipositor dark brown, a little upcurved, moderately stout, the apical serrulated portion longer than usual, nearly one-fourth the entire length, the teeth rather stout with sharp tips (Fig. 229.) Length of body, ♂, 6.4—7.5, ♀, 6.6—9.4; of pronotum, ♂, 1.4—1.7, ♀, 1.9—2; of tegmina, ♂, 3.9—4.4, ♀, 2.8—3.7; of hind femora, ♂, 4.7—5.6, ♀, 6—6.7; of ovipositor, 3.4—4.1 mm.

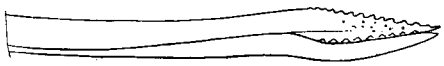

Fig. 229. Ovipositor of *N. variegatus*, × 14. (After Hebard.)

Marion, Vigo, Putnam and Knox counties, Ind., Oct. 1—27. In Indiana this prettily marked little species has been found to be rather common on the grass-covered banks of streams and along the fence rows of open woods in the counties mentioned and it probably occurs in like situations throughout the southern two-thirds of the State. In general appearance it is a diminutive form of *N. maculatus* above described, but its small size and short arcuate ovipositor at once distinguish it.

This is the *N. carolinus* Scudd. of my former works (1900, 1903), it having been so named for me by Scudder from specimens sent him for examination. As shown by me (1903, 427) it was also regarded as the species called *Cyrtoxyphus? variegatus* Bruner. Hebard has shown that the true *N. carolinus* is a different insect and has redescribed (1913, 452) the present species as *N. bruneri*, claiming (p. 455) that Bruner's name "was unidentifiable from the literature." In a previous letter (Jan. 16, 1913) he wrote: "This species must be called *Nemobius variegatus* (Bruner) as this is the earliest description and the type specimen is in my collection. Bruner called it a *Cyrtoxyphus* which caused it to be overlooked." While Bruner's mention of the species is admittedly very brief he said: "I have given it the name *variegatus* on account of its being variegated," and as it was the only variegated form of *Nemobius* at that time known I have restored his name.

The known range of *N. variegatus* extends from Maryland and Virginia west to northeastern Nebraska and south and southwest to Charlotte, N. Car. and Wichita, Kansas. It appears to be very late in reaching maturity, all of the Indiana specimens having been taken in October, and none of the adults recorded elsewhere from our territory earlier than Sept. 6. No macropterous individuals are known.

325. NEMOBIUS CUBENSIS Saussure, 1874, 384. Cuban Ground Cricket.

Size small and form slender for the genus. Dull brownish-yellow; occiput, pronotum and tegmina fuscous brown, often with small paler markings; dorsal surface of abdomen black; cerci brown. Head as wide as base of pronotum, compressed vertically. Disk of pronotum evidently but feebly narrowed from base to apex, about one-third wider than long, sparsely clothed with long black bristles. Tegmina in both sexes nearly or fully as long as abdomen, those of male forming in repose an oblong quadrangle with sides feebly converging from base, their tips rounded; of female slightly narrowed toward apex, their tips narrowly rounded. Wings usually fully developed, twice as long as tegmina and surpassing tip of ovipositor 2—3 mm.; sometimes absent. Ovipositor feebly curved, its apex sublanceolate with tips very finely serrulate above (Fig. 230.) Length of body, ♂, 5.7—7.2, ♀, 5.6—7.4; of pronotum, ♂, 1.2—1.7, ♀, 1.3—1.7; of tegmina, ♂, 3.9—4.8, ♀, 3—4.9; of hind femora, ♂, 4.2—5.6, ♀, 4.7—5.6; of ovipositor, 2.7—4 mm.

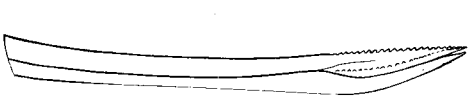

Fig. 230. Ovipositor of *N. cubensis*, × 17. (After Hebard.)

Ormond, LaBelle and Lake Okeechobee, Fla., Mch. 6—Apr. 13 (*W. S. B.*); Washington, D. C., Aug. 28 (*Caudell*). In Florida it has been recorded from numerous points throughout the mainland but not from the southern keys. The general distribuation in our territory is southern and submaritime, extending from Staten Island, N. Y. to Homestead, Fla. It was originally described from Cuba, Mexico and Brazil.

The long-winged or typical form of *cubensis* is more generally known than the short-winged one as most of the specimens in collections were taken at light. R. & H. (1912) found the brachypterous form in numbers March 17 in the high grass of the everglades at Homestead, Fla., and Hebard (1915b) records the short-winged form from bare muck in a red mangrove swamp at Cape Florida and Key Biscayne. Fox found a single female at Tappahannock, Va., on a road through a tidal marsh, so that the natural home of the species is probably in or among the tall grasses of marshes and tidal flats.

The *N. volaticus* Scudd. (1877, 36) and the female of *N. aterrimus* Scudd. (1896b, 432) are synonyms of *N. cubensis*.

325a. NEMOBIUS CUBENSIS MORMONIUS Scudder, 1896a, 106. Mormon Ground Cricket.

General color as in key but exceedingly variable; pronotum dull yellow usually distinctly blotched with fuscous; tegmina of female with the veins, a humeral stripe and costal margins pale. Last joint of maxillary palpus one-half longer than fourth. Ovipositor longer than head and pronotum together. Length of body, ♂ and ♀, 6.5—8; of tegmina, 3—4; of hind femora, 5—5.8; of ovipositor, 3.5—4 mm.

This western form is here included on the record given by Hebard of a single female taken by F. M. James at Biloxi, Miss. Its known range extends from that point to the Pacific coast, north to St. George, Utah (type locality) and south to the state of Tabasco, Mex. A macropterous female at hand from Yuma, Cal., is notably paler than *cubensis* but otherwise appears very similar. The great majority of known specimens are brachypterous.

Hebard (1913, 466) says that "in the desert regions of the southwestern United States this insect is but very occasionally met with in the short grasses growing near streams and other restricted damp areas but in the semi-arid mesquite region of Texas it is widely distributed in the short grasses. Still farther eastward it is found in the typical undergrowth of the long-leaf pine forests. The macropterous form is scarcely ever encountered except at light."

326. NEMOBIUS PALUSTRIS Blatchley, 1900, 53. Marsh Ground Cricket.

Size very small; the body of male especially short and broad; female more slender. Head, tegmina and body of most specimens a uniform dark piceous; disk of pronotum piceous or fuscous sprinkled with piceous; antennæ, legs and ovipositor fuscous; maxillary palpi yellowish except the apical joint which is wholly piceous. Disk of pronotum one-third broader than long, the sides subparallel, rather thickly beset with stiff black bristles, as are also the occiput and dorsal surface of fore and middle femora. Tegmina of female covering slightly more than half the abdomen, their tips broadly rounded; of male forming an elongate quadrangle with sides distinctly but feebly converging from base, the tips more narrowly rounded. Ovipositor distinctly though feebly arcuate, the apical fifth but little enlarged, above very finely and closely serrulate with dull, rasp-like teeth (Fig. 231.) Length of body, ♂, 5.2—6.2, ♀, 6—6.8; of pronotum, ♂, 1—1.5, ♀, 1.3—1.9; of tegmina, ♂, 3.7—4, ♀, 2.1—3.2; of hind femora, ♂, 3.9—5, ♀, 4—5.4; of ovipositor, 3.1—3.8 mm. (Fig. 232.)

Fig. 231. Ovipositor of *N. palustris*, × 15. (After Hebard.)

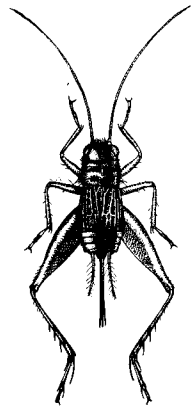

Fig. 232. Female. × 3. (Original.)

In Indiana this handsome little pitch brown cricket has been found only among the tamarack swamps and cranberry bogs of the northern counties, where it finds a congenial home in the midst of the dense, damp sphagnum mosses. Sometimes they are so plentiful that a half dozen or more are seen in an area a foot square. Like the other members of the genus they are very active, when disturbed leaping vigorously, a few inches at a time, and finally seeking safety by burrowing in the masses of mosses. It has been taken in Marshall, Fulton and Starke counties and probably occurs wherever peat bogs and sphagnum mosses are present.

The known range of this little marsh cricket extends from northern New England and Algonquin Park, Ontario, west to northern Indiana and south and southwest to Washington, D. C., Wilmington, N. Car. and Thomasville, Ga. Morse (1919a) says it is "locally common in sphagnum bogs at Orono, Me., in eastern Massachusetts and Connecticut." Walker (1904, 185) records the finding of a colony in a floating sphagnum bog at Algonquin Park, Ont. "They were present in numbers but were difficult to capture. By pressing the masses of sphagnum down under water it was often possible to bring the crickets to the surface. My attention was first called to them by the chirp of the male which is a continuous and rather feeble trill."

R. & H. (1911, 597) have described a form of *N. palustris* taken in a sphagnum bog at Thomasville, Ga. as a geographic race under the name of *N. p. aurantius*. Specimens at hand from the Davis and Hebard collections show it to differ only in having the ground color reddish-brown, the tegmina and upper surface of abdomen alone piceous-brown. In my opinion it is, as doubtfully suggested by Hebard (1913, 472), only a "mere color variety" of *palustris*.

327. NEMOBIUS CAROLINUS Scudder, 1877, 36. Carolina Ground Cricket.

Size medium; body slender. Antennæ, head, pronotum and femora brownish-yellow; maxillary palpi pale yellow throughout or with apical third of terminal joint fuscous. Tegmina brownish-yellow with a narrow piceous bar on upper third of lateral field and basal third of dorsal field often more or less piceous, male; dorsal field usually heavily shaded with blackish, female; upper surface of abdomen blackish, the exposed portion in female dark brown with four rows of small pale spots; lower surface brownish-yellow. Head prominent, as wide as base of pronotum, eyes

small, broadly ovate. Pronotum about one-third wider than long, its apex very slightly narrower than base, its sides and front margin with a few long bristly hairs. Tegmina of male translucent, delicate, covering three-fourths or more of abdomen, often reaching its tip; lateral field widened to embrace the sides of the broad abdomen; of female covering about two-thirds of abdomen, their tips obliquely subtruncate. Wings usually absent, rarely fully developed and much surpassing the abdomen. Ovipositor distinctly though feebly curved, the valves with apical fifth slightly sublanceolate and both upper and lower margins curved, the teeth of former stout, rather widely and irregularly spaced, those of lower minute, widely separated (Fig. 233.) Length of body, ♂, 7.4—8.5, ♀, 6.5—8.4; of pronotum, ♂ and ♀, 1.7—2; of tegmina, ♂, 5.5—6, ♀, 3—3.8; of hind femora, ♂, 5.5—6.4, ♀, 5—6.4; of ovipositor, 3—3.9 mm.

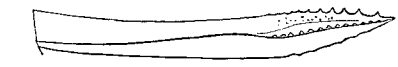

Fig. 233. Ovipositor of *N. carolinus*, × 13. (After Hebard.)

This species, the *N. exiguus* of my former work (1903, 426), occurs throughout Indiana where it is fully one-half as common as the short-winged form of *N. fasciatus*. It occurs most frequently among moist fallen leaves and beneath stones along fence rows and borders of thickets and streams. The long-winged form is very rare, two females, taken in Wells County by E. B. Williamson, being the only ones seen from the State.

Outside of Indiana specimens of *N. carolinus* are at hand from De Grassi Point, and Owen's Sound, Ont. (*Walker*); South Natick, Mass. (*Morse*); North Carolina (*Scudder*); North Madison, Conn. and Sanford, Lakeland, La Belle, Sarasota and Dunedin, Fla. (*W. S. B.*). About Dunedin it is very scarce in early spring but several long-winged females have been sent me which were taken at light in June. It is recorded from numerous localities from the southern mainland of Florida by R. & H., but the records from the northern part of the State are few. Near Miami, Hebard found it locally common "on sodden leaves under a labyrinth of roots in a dense red mangrove swamp."

The known range of *N. carolinus* is a wide one, extending from Truro, Nova Scotia and New England north and west to the Temagami District, Ont., Minnesota and Nebraska and south and southwest to southern Florida and central Texas. From Truro, N. S. but a single male is recorded, but in Ontario Walker (1904, 187, as *N. angusticollis*) found it, as it is in Indiana, next to *fasciatus* the most common *Nemobius* in the Province. There, he says:

"It frequents low grounds of almost any kind, but delights especially in low grassy borders of swampy woods or clearings in swamps. I have found it in abundance in sphagum moss when growing in such localities, but have not met with it in the open peat-bogs where *N. palustris* occurs.

It is also found beneath stones along the margins of lakes and streams. I first discovered this insect through its stridulation, which was a high-pitched continuous trill of considerable volume."

Allard (1916a) says that about Clarendon, Va., the tiny *Nemobius carolinus* is very common beneath the leaves and grass of the roadsides throughout the summer. Its stridulation is a weak, continuous trill indefinitely prolonged. They are persistent singers and may be heard throughout the night. In the coolness of the early morning they appear to be especially musical. They keep well concealed beneath the dead and matted herbage, and are exceedingly difficult to capture."

Owing to numerous wrong identifications by Scudder and the confusion by him of the species above described as *N. variegatus* with his *N. carolinus*, the synonyms of the latter are numerous. In addition to my *Nemobius exiguus* above cited, as placed by Hebard (1913, 473), are *N. septentrionalis* Prov. (1877, 24), *N. volaticus* Scudd., female (1877, 36), *N. affinis* Beut. (1894a, 249), *N. angusticollis* Walker (1904, 186) and *N. janus* Kirby (1906, 19). It has been recorded many times under these synonyms, especially that of *N. exiguus* Blatch., a name used by Say for a species of *Anaxipha* and wrongly applied by Scudder (1862, 429) to *Nemobius fasciatus* Say. Hebard in his Revision (1913) has given a detailed account of the synonymy of this and other species of *Nemobius*. Two races of *N. carolinus* are recognized by him, viz: *N. c. brevicaudus* Bruner (1904, 57) from Colorado and *N. c. neomexicanus* Scudd. (1896a, 100) from Texas, Arizona and New Mexico.

328. NEMOBIUS CONFUSUS Blatchley, 1903, 428.

Size rather small; form moderately robust. Head, pronotum and tegmina piceous, shining, last two segments of maxillary palpi ivory-white, the basal ones piceous; dorsal surface of abdomen dark brown; legs and under surface dull yellow. Pronotum about one-third wider than long, with a median impressed line on front half, its disk, as well as that of occiput and fore and middle femora, with scattered black bristly hairs. Tegmina of male translucent, covering end of abdomen, in repose forming an elongate quadrangle with margins subparallel; of female half as long as hind femora, their tips broadly slightly obliquely rounded. Ovipositor but little more than half as long as hind femora, dark brown in color, its apical third wider and a little upturned; armed both above and below, the upper teeth rather stout, sharp, and more than usually distant one from another, the lower ones very fine and also widely spaced (Fig. 234.) Length of body, ♂, 5.7—7, ♀, 6.8—7.3; of pronotum, ♂, 1.4—1.7, ♀, 1.4—1.9; of tegmina, ♂, 3.8—4.8, ♀, 2.8—3.1; of hind femora, ♂, 4.1—4.9, ♀, 4.8—5.3; of ovipositor, 2.5—3.1 mm.

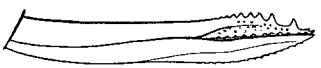

Fig. 234. Ovipositor of *N. confusus*, × 14. (After Hebard.)

Kosciusko, Knox and Posey counties, Ind., Aug. 17—Oct. 25 (*W. S. B.*); Cabin John Run, Md. (*Davis*). This sombre-hued little cricket was first found in Kosciusko Co. Aug. 26, 1902, in some low, damp woods bordering Tippecanoe Lake. Here it had its home among the fallen leaves and beneath small chunks and chips. From Posey County a single specimen was procured also from a tract of low woods and on Oct. 5, 1917, about twenty were taken from beneath dead leaves on the side of a thickly wooded little slope leading down to the margin of a cypress swamp in Knox County. It appears that I had no males in the type series of *confusus* taken at Tippecanoe Lake and unfortunately got hold of a male of *N. maculatus* in drawing up the original description, so that the characters therein pertaining to that sex are misleading.

Outside of Indiana *N. confusus* has been recorded from a number of stations in Maryland and Virginia, from Raleigh, N. Car. and from Rabun County and Buckhead, Ga. At Raleigh Brimley (1908, 21) found it "in damp places not far from water from mid-August to late November," while at Buckhead a nymph was taken by R. & H. from the undergrowth of mixed oak and pine forest. No macropterous specimens are known.

It seems that each of the different species of this genus taken in Indiana has its special abiding place, *fasciatus* and *carolinus* being the only ones which may be looked for anywhere in open fields and along roadways; *maculatus* occurs in open woods usually in dry situations; *griseus* in sandy districts; *variegatus* along the banks of streams and on gravelly hillsides; *palustris* nowhere except among the sphagnum mosses of dense swamps and bogs, while *confusus* likes best the shadows of dense woods which are low and moist. Each form has, therefore, its special habitat where the food on which it thrives is most abundant, and where, during the ages past, it has become so modified in organ and hue as to receive from man a distinctive specific name.

II HYGRONEMOBIUS Hebard, 1913a, 451. (Gr., "moist" + "grove-dweller.")

Small compact crickets closely allied to *Nemobius*[80] and having the body pubescent, sparsely clothed with hairs, head and pronotum similar to *Nemobius*, the lower front angles of lateral lobes rectangular and much sharper than the lower hind ones;

[80]Also very close to *Pseudonemobius* Sauss. (1877, 231, 234; 1878, 510), the differential characters given by Saussure in his key being almost exactly the same as those given by Hebard for the present genus.

tegmina of males short, lacking a tympanum; wings usually absent; inner or hind face of front tibiæ with a very small, scarcely evident tympanum; hind femora greatly dilated; hind tibiæ with upper margins each armed with three pairs of long, distant, movable spines and with five subapical spurs, two on inner and three on outer side, the usual lower inner one absent, the upper one as long as basal joint of tarsus.

Hebard (1915) recognizes five species of the genus, all tropical or subtropical in distribution. One of these occurs in Florida.

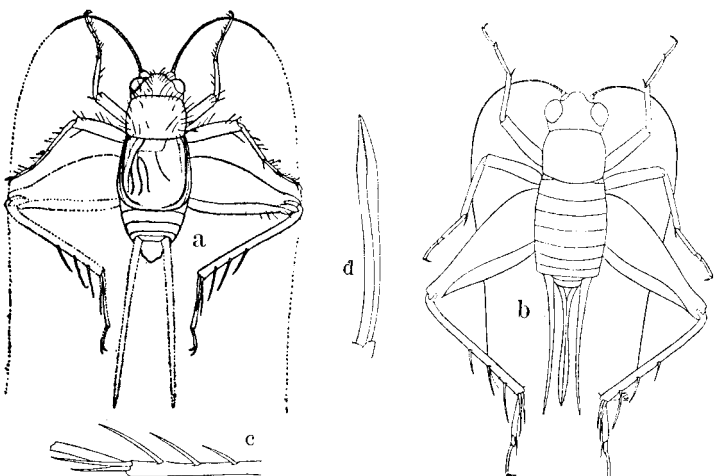

Fig. 235. *Hygronemobius alleni*, × 4. *a*, male; *b*, female; *c*, outline of hind tibia; *d*, of ovipositor. (After Hebard.)

329. HYGRONEMOBIUS ALLENI (Morse), 1905, 21. Allen's Ground Cricket.

Body short, stout, somewhat depressed. Beneath brown; above fuscous finely maculate with brown; maxillary palpi dark; hind femora with three transverse fuscous bars on apical three-fifths, the base brown with numerous narrow oblique fuscous stripes. Antennæ about three times as long as body, very slender. Tegmina of male covering two-thirds of abdomen, their tips subtruncate; of female minute, lateral pads almost concealed by pronotum. Wings absent. Ovipositor compressed, feebly curved, the tip slightly lanceolate and very finely crenulate above. Other characters as above given. Length of body, ♂, 5—6, ♀, 6; of hind femora, ♂, 4.5, ♀, 5; of ovipositor, 4 mm. (Fig. 235.)

Miami, Fla. (*Hebard*). This little cricket is a submaritime species known from the United States only from a series taken at Miami, Fla. by Hebard who says (1915, 195): "They were found March 15 on the black soil and among drift in a mangrove swamp which at high tide was under more than a foot of water. The series was taken when the tide was out. At the time the weather was cool and the individuals were not rapid in their movements

but were difficult to capture owing to the environment, their sombre coloration and their habit of hiding under the drift or the sodden mangrove leaves."

Morse's types were taken July 13 at Moraine Cay, Bahama Islands by Dr. G. M. Allen who furnished Morse the following notes regarding its habits:

"This interesting little cricket was found abundantly along the edge of a mangrove swamp that extended for some distance out from the shore. On approaching this swamp from the landward side my attention was attracted by a faint but continuous cricket-like note which seemed to come from all about me. After a careful search among the black roots of the mangroves and the water-soaked leaves at their bases, I found numbers of the little insects. They were extremely quick and agile, and although it was easy enough to see them as they leaped aside at my approach, they immediately became invisible on alighting, so closely did they harmonize in color with the dark sticks and leaves. In this thick undergrowth the use of a net was practically out of the question, even if I could have been quick enough to sweep up the active little creatures. I found, however, that I could easily drive two or three at a time onto a sheet of newspaper that I spread on the sodden surface of the swamp, and with a slow but steady motion a wide-mouthed bottle could be brought above a resting insect and clapped over him before he could escape."

III. ANUROGRYLLUS Saussure, 1877, 283. (Gr., "without" + "tail" + "cricket.")

Robust crickets of medium or large size, in our species having the body sparsely and finely pubescent; head subglobose, vertical, the occiput very convex; eyes rather small, situated each side of antennal pits; ocelli small, the median one narrowly elliptical; disk of pronotum slightly narrower than head, subquadrate, rounded into the lateral lobes, the latter with lower margin oblique, its front angle obtuse, hind one rounded; tegmina about as long as abdomen and furnished with a tympanum, male; wings variable in length; front tibiæ with an oblong-oval tympanum on outer face; hind femora strongly dilated, longer than the combined tibiæ and tarsi; hind tibiæ armed with two rows of stout, immovable spines and three pairs of subapical spurs; anal cerci long, very slender, feebly tapering. Other characters as given in generic key. One widely distributed tropical species occurs in the southern states.

330. ANUROGRYLLUS MUTICUS (DeGeer), 1773, 520. Short-tailed Cricket.

Size medium, form robust. Nearly uniform pale brownish-yellow; occiput often tinged with fuscous; tegmina in part dusky; lower front angle of pronotum often very pale. Disk of pronotum subquadrate, wider than long, with an impressed median line, feebly narrowed in front, male,

sides subparallel, female. Tegmina of female covering one-half to two-thirds of abdomen. Wings usually absent, male, often exceeding the abdomen, female. Ovipositor not visible. Other characters as above given. Length of body, ♂, 12—16, ♀, 17; of pronotum, ♂ and ♀, 3.5; of tegmina, ♂, 12—17, ♀, 11.5; of hind femora, ♂ and ♀, 10.8—11.2 mm.

Tappahannock, Va., June 9 (*Fox*). A tropical or subtropical form occurring in the United States mainly along the Atlantic coast from New Jersey south and southwest to southern Florida, Louisiana and Victoria, Texas, and also in the West Indies, Mexico, Columbia and Guiana. In Florida it has been recorded from Jacksonville, Lawtey, Gulf Hammock, DeLand and Miami. At the latter place Hebard trapped a single male in a molasses jar.

Caudell (1904g) records that as early as 1887 they were reported as doing much damage about Jena, La., to cotton, sweet and Irish potatoes, peas, strawberries and tobacco, his correspondent writing that "their holes in the ground are scattered promiscously from a few inches to several feet apart, the burrows being seldom over a foot deep in the uplands but much deeper in the swamps where the subsoil was softer. The insects are seldom visible in day and do their cutting at night, taking all they want down in the ground, where they eat as they please or feed their young ones. They appear to go in colonies and we find that rapid cultivation, large flocks of poultry and numerous birds are necessary to keep them in check." In 1903 specimens were sent in to Washington from Beech Island, S. Car. which had been taken in cotton fields where they burrow to a depth of 18 inches, lining the holes with shreds of cotton leaves and in so doing destroying the young cotton for several feet in the row. The young were found in these burrows in June.

Manee (1908, 461) states that at Southern Pines, N. Car. the "mounds" of this cricket are very common and are "built near some small weed, whose leaves furnish the wide but shallow horizontal chamber," the latter connecting with one or more perpendicular or oblique tunnels which serve as 'retreat shafts' when the insect is disturbed." This is probably the species mentioned by Scudder (1894c) under the name *Gryllodes* sp. as taken by Maynard near Jacksonville, Fla. in similar burrows.

At Clarendon, Va. Allard (1916a) found *A. muticus* in numbers in early June in a pine grove where they occurred upon the trunks of the pines from one to eight feet above the ground. The males stridulated only on warm evenings, beginning about sundown and continuing in the early part of the night. "The trill is loud, continuous, high-pitched, much resembling that of an

Occanthus." Fox (1917) reports that about Tappahannock, Va. they are "frequent in fields and pastures and along fence rows, nocturnal in habits, singing at or close to the mouth of the burrow."

The following names are now regarded as synonyms of *A. muticus*: *Acheta guadeloupensis* Fab. (1793, 32); *Gryllus angustulus* F. Walker (1869, 27) and *Gryllodes clarazianus* and *G. caribeus* Sauss. (1874, 412, 413).

IV. GRYLLODES Saussure, 1874, 409. (Gr., "a leaper.")

Medium sized crickets of slender form having the head short, occiput not strongly convex; antennæ very slender, twice as long as body, the basal joint large, compressed, as wide or wider than the inter-antennal protuberance; pronotum short, transverse, about one-half wider than long, hind margin of lateral lobes very oblique; tegmina variable in length, in our species much shorter than abdomen, the mediastinal vein undivided, female, one-branched, male; front tibiæ without a tympanum on inner face; hind tibiæ with five or six spines on each margin, the inner middle and lower subapical spurs subequal; ovipositor straight, very slender, longer than hind femora.

Kirby (1906, 40) recognized 56 species as belonging to the genus, most of them tropical in distribution. Only one has become established in the eastern United States.

331. GRYLLODES SIGILLATUS (F. Walker), 1869, 46. Decorated Cricket.

Form depressed, slender, pubescent. General color pale brownish-yellow mottled and banded with dark brown; head with a cross-bar between the eyes, another, less distinct, at hind border of occiput, and a vertical stripe between the antennæ, dark brown; pronotum with a basal and median brown cross-bar, the former curving forward onto lateral lobes, the latter interrupted; tegmina pale brown; legs mottled with dark brown; abdomen in great part brown mottled with yellow. Head obliquely depressed. Tegmina of male covering half the abdomen, the stridulating organ large, tips broadly rounded; of female very short lateral pads, with tips of both dorsal and costal field obliquely truncate. Wings absent. Legs slender. Length of body, ♂, 14—16, ♀, 15—21; of pronotum, ♂ and ♀, 3—3.5; of tegmina, ♂, 5—6, ♀, 1.7—2.3; of hind femora, ♂, 9.5—10, ♀, 11—13; of ovipositor, 12—16 mm.

Miama and Big Pine Key, Fla., Sept. 25—Oct. 4 (*Davis*); Dunedin, Fla., Jan. 27, nymph (*W. S. B.*) Recorded also from numerous stations in southern Florida and on the keys, Lakeland being the most northern. The first record for the United States was that of R. & H. (1905) from Miami, where Hebard found them in numbers in February beneath bricks and between stones. "The

males emit a shrill sound easily distinguished from that of *Gryllus luctuosus* by its higher pitch and the longer duration of the stridulation. When exposed it waves its long slender antennæ about continually." Later (1914c) they state that "at Key West in July it was everywhere common about the town and that, with the aid of a flash-light, individuals were easily taken when carefully approached and suddenly seized; this was apparently due to the insects being blinded by the light for they are certainly the most active gryllid found within the United States."

Davis (1914) records them as occurring in a house on Big Pine Key where "they were reported as doing some damage by eating clothing, etc. At night when the lights were out they would come out of their hiding and the males would sing their cheerful and very energetic song."

The species is tropical and practically cosmopolitan, Walker's type coming from Australia. It is said to be very common in Cuba and the Bahamas. Caudell (Psyche, 1908, 96) has recorded it as appearing in countless numbers in the hot-houses of the U. S. Department of Agriculture at Washington, D. C., where they did considerable damage to various seedlings which they cut off near the ground. The *Gryllus pustulipes* F. Walker (1869, 51), the *Gryllodes poeyi* Sauss. (1874, 420) and the *Miogryllus transversalis* Scudd. (1901b, 257) are synonyms of *G. sigillatus*.

V. MIOGRYLLUS Saussure, 1877, 194. (Gr., "less" + "cricket.")

Crickets of small or medium size, the species differing from those of *Gryllus* in the usual absence or extremely inconspicuous nature of the tympanum on inner side of fore tibiæ; simple or one-branched mediastinal nerve of the tegmina; strictly longitudinal course of the veins on the dorsal field of the female tegmina; shortness of the hind tibiæ which are only two-thirds as long as the hind femora and armed above on each side with only four or five spines, and in the usual striped or banded summit of the head.

The tegmina and wings vary much in length in the same species but the short-winged forms are by far the more common. In macropterous individuals the wings are two and one-half or more times the length of tegmina, while in brachypterous ones they are represented by mere pads. One of the five species recognized by Hebard (1915c) occurs in the Eastern States.

332. MIOGRYLLUS VERTICALIS (Serville), 1839, 343.

Size large for the genus but smaller than most forms of *Gryllus;* form robust. Color exceedingly variable, ranging from dark brown to almost wholly black; head usually shining black with a narrow yellow stripe

above each eye and two shorter ones on middle of occiput; palpi yellowish, the apical joint dusky; antennæ dark brown, paler at base; pronotum blackish, mottled with paler; lateral lobes piceous above, the lower third or more dull yellow; tegmina reddish-brown to fuscous, the lateral field darker; abdomen dark brown, often with a narrow paler median line. Head large, strongly convex, wider than front margin of pronotum. Last joint of maxillary palpi obliquely truncate. Pronotum two-thirds or more wider than long, its sides subparallel, front margin feebly concave, hind one truncate. Tegmina of female usually but little longer than pronotum, scarcely attingent, covering about one-third of abdomen, the inner apical margin of dorsal field obliquely rounded. Tegmina of male covering three-fourths or more of abdomen, broadly overlapping, their tips rounded. Hind femora very stout. Tympanum on outer face of fore tibiæ elongate-oval, nearly one-fourth the length of tibiæ; in the rare long-winged form present and nearly as large on both faces. Ovipositor straight, as long as hind femora, its tip feebly enlarged. Length of body, ♂, 10—16, ♀, 11—17; of pronotum, ♂, 1.9—3.1, ♀, 2.1—3.2; of tegmina, ♂, 3.6—7.6, ♀, 2.2—4; of hind femora, ♂, 6.8—10.4, ♀, 7.4—11; of ovipositor, 7.2—12 mm. (Fig. 236.)

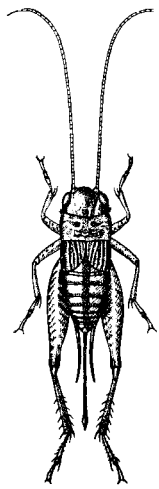

Fig. 236. Female. × 1.3. (Original.)

Southern third of Indiana, April 18—July 10; Dunedin and Lake Okeechobee, Fla. Dec. 3—Mch. 2 (*W. S. B.*); Mobile, Ala., Sept. 14 (*Loding*). In southern Indiana this species, resembling in general appearance a large *Nemobius*, has been taken in Franklin, Clark, Posey, Knox, Gibson and Crawford counties, where it occurs on dry wooded hillsides beneath flat stones and logs. It seems to like best places devoid of grass and other vegetation. In that region it probably reaches maturity about the middle of June, as it seems to be most abundant by the last of that month, when quite a number of specimens were taken in the vicinity of Wyandotte Cave.

The Florida specimens above mentioned were nymphs and were taken beneath boards along the margins of ponds and lakes. Elsewhere in that State it has been recorded from a number of stations between Jacksonville and Homestead and also from Key West.

This species is the *Miogryllus saussurei* Scudd. (1877, 35) of most American authors, myself included (1903, 442). Hebard (1915c) has placed *saussurei* as a synonym of *Gryllus verticalis*, which was based on a long-winged female from Cayenne, French Guiana. This was done without seeing Serville's type and the placement is therefore open to question, though, judging from

Serville's description, probably correct. Other synonyms of *verticalis* as given by Hebard are *Gryllus laplatæ* Sauss. (1874, 408) from Buenos Aires, *Gryllodes guyennensis* Sauss. (1877, 384) from Surinam and *Miogryllus oklahomæ* Caudell (1902, 90) from Perkins, Okla., the last named synonym being based upon an almost uniform black color variety.

If these synonyms of *M. verticalis* are correct the range of the species embraces most of the American continent. In the United States its known range extends from Staten Island, N. Y. west to Nebraska, Kansas and Oklahoma and south and southwest to Key West, Fla. and southern Texas. But one macropterous individual, a female taken by Brimley at Raleigh, N. Car., is recorded from this country and but three others besides the type have been noted elsewhere.

Davis (1909b) notes the habits of *M. verticalis* as follows: "At Lakehurst, N. Jer. it is found under dead leaves and other objects lying on the ground. My attention was first called to the insect by hearing the males stridulating at night. Their song is a slow, *zee,* repeated at intervals of several seconds. Later the females were also found. At Lakehurst and on Staten Island, several individuals were taken on sandy ground. It reaches maturity in June. Individuals of this species of cricket differ markedly in the development of the hearing organ on the inner side of the fore tibiæ. In two of the examples collected this organ is totally absent, in four it is slightly developed, and in one it is slightly developed on the inner surface of the right tibia, but absent on the same surface of the left leg."

Allard (1911a) describes its habits at Thompson's Mills, Ga., in part as follows: "It is a ground-dwelling species and keeps itself well concealed beneath the matted leaves and grass of gardens and orchards. Its notes are very brief, high-pitched musical trills, *tzeee-tzeee-tzeee,* with brief intermissions. One individual delivered from 38 to 39 trills in a minute. This cricket may be heard in stridulation very early in the morning and more or less throughout the day and at night. It is rather difficult to locate and capture one by its notes, for these are quickly silenced by one's approach. This cricket is very lively, and if uncovered leaps about vigorously. Its light brown coloration makes it very inconspicuous among the similarly colored leaves and soil."

Isely (1905, 248) says that the black form, *M. oklahomæ* Caud. is the first cricket to reach maturity at Wichita, Kansas, adults being taken on May 22. "In a few days they became very

numerous and the males' stridulation could be heard on all sides in the afternoon and evening. They were especially abundant in thick short dead grass on a hillside." He found some in small perpendicular burrows from one to two inches deep, and others beneath stones. No specimens were taken after June 23, though specimens of the pale form *M. saussurei* were found on August 8.

VI. Gryllus Linnæus, 1758, 425. (L., "cricket.")

The Field and House Crickets.

"The voice of the crickets, heard at noon from deep in the grass, allies day to night. It is a midnight sound heard at noon, a midday sound heard at midnight."—*Thoreau.*

This, the typical genus of the family Gryllidæ, comprises crickets of medium or large size and robust form, having the head large, subglobose, usually slightly broader than pronotum; eyes rounded, prominent; antennæ very slender, setaceous, longer than the body; pronotum broader than long, its disk rounded into the lateral lobes, which are longer than deep, with lower margin oblique or feebly curved, the front and hind angles rounded; tegmina and wings variable in length, the former with large shrilling organ in male; hind femora very much enlarged, shorter than tibiæ and tarsi united; hind tibiæ armed above on each side with five to eight large stout movable spines and at apex with three pairs of unequal spurs; basal segment of hind tarsi stout, armed above with a row of short spines on each margin, its apex terminating in two stout spurs, the inner one the longer; second joint very small, compressed; apical segment slender, about half as long as the basal one; anal cerci nearly as long as hind femora, slender, bristly, tapering; ovipositor as long as or longer than the hind femora, variable in length in the different forms, its extreme apex feebly enlarged, not serrulate.

To this genus belong those dark colored thick-bodied insects known as house and field crickets. The latter are the best known examples of the family Gryllidæ and in Indiana are abundant from June 1st 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.

Regarding the general habits of the field crickets Bruner (1886, 194) has written: "Usually most of our North American Grylli live singly or in pairs in burrows which they dig for themselves. These are used as retreats during the day time and serve as shelter from ordinary inclemencies of weather. These

burrows are generally forsaken about mid-summer for some sort of above-ground shelter. From this time on, until fall, they appear to be more social and live in colonies under various sorts of rubbish. Grain shocks are a favorite haunt for them and since twine has been used for binding, the crickets have been quite troublesome by cutting the bands. During late summer and fall the females commence preparations for the continuance of their kind, by thrusting their long, slender ovipositors into the loose soil and dropping their eggs. These sometimes hatch the same year, but, as a rule, lie over until the following spring. The young generally live above ground, where they hide among fallen leaves, grasses and other debris, though sometimes they also creep into chinks and crevices in the earth."

The remarks of Bruner apply in Indiana mostly to the form *luctuosus,* one of our largest and only social field cricket. Here the young of *G. pennsylvanicus* and *vernalis* are, for the most part, hatched in autumn and survive the winter in the nymph stages, while *G. domesticus,* the house cricket, passes the winter either as adult or nymph.

The synonymy of the American forms of this genus is greatly confused, due largely to the fact that foreign writers have attempted to monograph the genus with but a limited number of specimens at hand; and again to the fact that the different forms, especially the males, are very difficult to separate.

Lutz (1908) after studying carefully the variations in length of tegmina, wings and ovipositor of a large number of forms of *Gryllus* from all parts of the world concluded that "species in an any way natural sense do not exist in the genus." R. & H. (1915c) came to about the same conclusion regarding the native American forms, placing them all under the one name, *Gryllus assimilis* Fab. (1775, 280) described from Jamaica, qualifying this placement, however, by stating (p. 299): "We have found that in general certain types do predominate over certain regions. These constitute the bases of many of the supposed species but in our opinion should be characterized by symbols rather than varietal names, owing to their complexity and the evident fact that none of these are distinct, either specifically or as geographic races, and really show only the various phases resultant from varied environmental conditions."

There is no doubt but that the different forms of native *Gryllus* intergrade and merge, just as do those of *Nomotettix cristatus, Nemobius fasciatus* and numerous other forms of Orthoptera for

which varietal or racial names have been retained by recent American authors. Since the characters of all such races, varieties, or even species, for that matter, are resultant in great part from "variable environment," and since the grouping or placing of any series of closely related forms is largely a matter of personal opinion or viewpoint of the worker, and as names are more readily grasped and remembered than symbols, I have retained the older names of the more distinct forms of *Gryllus* as trinomials. The student may either use them as such and call them variants, varieties or forms of *assimilis*, or discard them altogether and lump his native field crickets under the one name *Gryllus assimilis* as R. & H. and Morse have done, a procedure which Piers (1918, 338) terms a "simple solution of the Gordian knot."

KEY TO EASTERN SPECIES AND VARIETIES OF GRYLLUS.

a. Black species, the tegmina and parts of the body sometimes dull yellowish or reddish-brown; head never with distinct blackish crossbars; first joint of antennæ not projecting beyond front of head. (ASSIMILIS[81]).

b. Hind femora wholly or in great part pale reddish-brown; tegmina, cerci and legs usually wholly or in great part dull reddish-brown.

c. Larger, length of body, male and female, 20 or more mm.; hind tibiæ with seven or eight spines on each upper margin. 333a. FIRMUS.

cc. Smaller, less than 16 mm.; hind tibiæ with only five or six spines on each margin. 333b. SCUDDERIANUS.

bb. Hind femora black or fuscous with only the basal third reddish-brown beneath; tegmina and legs rarely reddish-brown.

d. Ovipositor nearly or fully half as long again as hind femora, 16 or more mm. in length; head of male swollen, distinctly wider than front of pronotum. 333c. LUCTUOSUS.

dd. Ovipositor less than half as long again as hind femora, rarely over 14 mm. in length; head of male but little if any wider than front of pronotum.

e. Color in fresh specimens not shining black, but with a very fine grayish pubescence or "bloom:" tegmina of female with their inner edges either overlapping or attingent their full length; length of ovipositor 13—14 mm. 333d. PENNSYLVANICUS.

ee. Color shining black, tegmina rarely piceous or dull brownish-yellow; tegmina of female with the basal halves overlapping or attingent, the apical halves (always in *vernalis*,

[81]The typical form of *Gryllus assimilis* is subtropical and occurs in the United States only along the coast of Southern California. The form *integer* Scudder (1901a, 268) has been recorded by Caudell from near Washington ,D. C., and by Kostir (on Caudell's determination) from Cedar Point, Ohio. As Scudder described it from the Pacific States and R. & H. (1915c) restrict its range to the mountains of the arid portions of the southwestern United States and California, it is not included in the key. It is distinguished from *pennsylvanicus* by Scudder by having the pronotum nearly twice as broad as long.

rarely in *neglectus*) separated by a wide V-shaped notch, (Fig. 238.)

f. Ovipositor scarcely if any longer than hind femora; tegmina of female strongly reticulate. 333e. VERNALIS.

ff. Ovipositor nearly one-third longer than hind femora; tegmina of female less strongly reticulate. 333f. NEGLECTUS.

aa. Straw-colored species; head with distinct dark brown or blackish cross-bars; first joint of antennæ projecting slightly beyond front of head. 334. DOMESTICUS.

333a. GRYLLUS ASSIMILIS FIRMUS Scudder, 1902a, 295.

Size very large for the genus; form robust. Color largely piceous, head and pronotum black or piceous; mouth parts and lower half of lateral lobes reddish-brown; tegmina a nearly uniform dull reddish-brown, often with a narrow pale humeral stripe; femora dark reddish-brown, usually more or less tinged with fuscous. Head large, tumid, vertex prominent. Disk of pronotum one-half wider than long, hind margin slightly convex, median impressed line faint, lower margin of lateral lobes almost straight, its front angle evident, obtuse. Tegmina covering three-fourths or more of abdomen, female, as long as abdomen, male, their tips narrowly rounded. Wings usually shorter than tegmina, sometimes exceeding the abdomen. Inner apical spur of basal segment of hind tarsi very short, two-thirds as long as last segment. Ovipositor one-third or more longer than hind femora. Length of body, ♂ and ♀, 20—29; of pronotum, ♂, 4—5.2, ♀, 4.5—5.5; of tegmina, ♂, 14—17, ♀, 12—13; of hind femora, ♂, 14—16, ♀, 14—17; of ovipositor, 19—23 mm.

Gainesville, Dunedin and Ft. Myers, Fla. Oct. 11—Feb. 24 (*W. S. B.*); Agricultural College, Miss., Dec. (*Weed*). About Dunedin this large field cricket occurs sparingly throughout the winter beneath cover in old orange groves, gardens and dry sandy fields. Under the names *firmus* and *scudderianus* it has been recorded by other collectors from numerous stations throughout the mainland and southern keys of Florida. At Key West "they were found in and near their holes situated in the short heavy grasses growing on the scant soil near depressions." R. & H. (1914c, 411) speak of the song of *G. firmus* as a "loud, sharp, vigorous chirping," and of that of *G. luctuosus* (*rubens*) as a "slower stridulation noticeably different from the hearty chirp of *G. firmus*."

One of Scudder's types of *G. a firmus* was from Brookville, Ind. and the form ranges from that place and from southwestern Ohio (*Kostir*) southeastward and south to North Carolina, Key West and Texas. It merges gradually into the smaller *scudderianus* Sauss., from which it is mainly distinguished by the characters given in key. Scudder states that about one-third of his individuals of *firmus* were macropterous, but only short-winged specimens have been seen by me.

333b. GRYLLUS ASSIMILIS SCUDDERIANUS Saussure, 1874, 402. Scudder's Field Cricket.

Size small to medium; form rather slender. Color much as in *firmus*, tegmina usually paler reddish-brown; hind femora sometimes with apical half of inner and outer faces blackish; abdomen shining black. Head but little if any wider than pronotum, the latter with hind margin truncate, lower margin of lateral lobes shorter and more curved than in *firmus*. Tegmina covering about two-thirds of abdomen, female, or more, male. Wings very narrow, shorter than tegmina. Hind femora proportionally slender. Hind tibiæ with dorsal and median inner apical spurs subequal in length. Inner terminal spur of basal segment of hind tarsi slender, only half the length of last segment. Ovipositor longer than body, one-half longer than hind femora. Length of body, ♂ and ♀, 14—15; of pronotum, 3.5—4; of tegmina, ♂, 8—9, ♀, 7—8; of hind femora, ♂, 9—10, ♀, 10.5—11.5; of ovipositor, 14.5—16.5 mm.

Lake, Marshall, Fulton and Vigo counties, Ind. (*W. S. B.*). This is the *G. arenaceus* of my former work (1903, 443). It is rather plentiful in the sand dune region of northern Indiana, where it occurs in September and October beneath cover in dry bare sandy places. The reddish-brown hue of tegmina, legs and cerci usually contrasts strongly with the deep black of pronotum and abdomen. R. & H. (1915c) have made *firmus* a synonym of *scudderianus*, but as Saussure gives the measurements of the latter as length of body 14, hind femora 9 and ovipositor 14.5 mm., I believe that his name does not rightfully belong to as large a varient as *firmus*, though the two forms probably merge, through *G. rubens* Scudd. (1902a, 295) which R. & H. also place under *scudderianus*.

The range of the form *scudderianus* is open to question. Saussure's types were from "l' Amerique Septentrionale" without more definite locality. Scudder considered it a form of *abbreviatus*, i e., *luctuosus*. If *rubens* be taken as a connecting link overlapping *scudderianus* in the north and *firmus* in the south, the distribution of *scudderianus*, sensu strictu, may be said to be limited to the sandy districts of the northern and eastern states. As *arenaceus* it has been recorded by Kostir from Cedar Point, Ohio, and reported by Hubbell (Ms.) from Cheboygan Co., Mich.

333c. GRYLLUS ASSIMILIS LUCTUOSUS Serville, 1839, 335. Common Field Cricket.

Size medium to large for the genus; form very robust. Black, often tinged with rusty brown; head and pronotum shining black; tegmina usually a dark reddish- or fuscous-brown, sometimes pale brownish-yellow; hind femora black or dark reddish-brown, the basal third of under

and inner sides almost always brick-red, more prominently so in male. Pronotum one-half or more wider than long. Tegmina usually covering three-fourths or more of abdomen, female, all of abdomen, male; sometimes shorter in latter sex. Wings either reduced to mere pads (*abbreviatus*) or fully developed and reaching middle of ovipositor. Hind femora very stout. Hind tibiæ usually armed with six spines on outer margin, their upper and middle inner spurs slender and subequal. Length of body, ♂, 18—20, ♀, 18—22; of pronotum, ♂ and ♀, 4.5—5; of tegmina, ♂, 12—14, ♀, 11—13; of hind femora, ♂, 11—13, ♀, 10.5—13.5; of ovipositor, 17—21 mm.

In late summer and early autumn this is the most common field cricket in Indiana. Here it is represented during winter by the eggs alone. In southern Indiana these hatch in late May or early June and the mature males appear about July 1st, but in the central and northern parts of the State the first males appear about a month later. This large field cricket is, in habits, nocturnal, omnivorous, and a cannibal. Avoiding the light of day, it ventures forth, as soon as darkness has fallen, in search of food, and all appears to be fish which comes to its net. Of fruit, vegetables, grass and carrion, it 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 40 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.

This is the *G. abbreviatus* Serv. of most authors, including myself (1903, 435). Serville described two forms, *luctuosus* on page 335 and *abbreviatus* on page 336. The latter is now considered only the short-winged form of *luctuosus*, though McNeill (1891, 5) says it is his opinion that *abbreviatus* is distinct and that *luctuosus* is probably the long-winged form of *pennsylvanicus* Burm. The short-winged form (of *luctuosus*) is by far the more common in Indiana, only a few long-winged individuals having been noted.

The range of *G. a. luctuosus*, including the short-winged *abbreviatus*, is a wide one, extending from New England and Ontario west to Manitoba and Colorado, and south to southern Florida, Louisiana and Texas. In Florida it has been taken by me at Sanford, Key West, LaBelle, Ft. Myers and Dunedin, and recorded by others, mostly under the name *G. rubens* Scudd., from numerous other points, both on the mainland and keys. About

Dunedin it is the most common field cricket noted, both adults and nymphs occurring throughout the winter, the long-winged forms, there frequent, being often attracted to light. Hebard captured them in numbers on Feb. 9 beneath boards and stones along the main street of Miami, where "after dark they were stridulating at a great rate."

In Ontario Walker (1904, 250) says that adults begin to appear about the second week in August and in September and October become very numerous and congregate in large numbers under every chunk, log or board, under the loose bark of old logs or in burrows in the sand. Late in the season they may be seen by hundreds sunning themselves on fences close to the ground.

About Moline, Ill., according to McNeill (1891), "the eggs of *abbreviatus* hatch in July and the first adults appear as early as the second week in August. During every stage of life they are social, feeding together, seeking shelter in company and when egg laying time comes, in October, the females collect by hundreds in some suitable locality, an abandoned or little used roadway suits them well, and each lays several hundred eggs in an irregular mass. After this duty is performed their business on this planet seems to be finished and they succumb to the cold, none surviving the winter. The eggs do not hatch until the following July, or if in rare cases they do they probably perish with cold."

Allard (1911a, 157) says that about Washington *abbreviatus* "not infrequently takes up its quarters in the house, announcing its presence by its stridulations which are intermittent chirps, possibly louder than the chirp of *G. pennsylvanicus.*"

333d. GRYLLUS ASSIMILIS PENNSYLVANICUS Burmeister, 1838, 734. Pennsylvania Field Cricket.

Size medium; form broad. Head of male not so swollen as in *abbreviatus*, slightly wider than pronotum. Pronotum proportionally a little wider and shorter, the length contained in breadth nearly 1.6 times; hind margin slightly sinuate, median impressed line plainly visible on anterior half. Tegmina varying in color from deep black to smoky or grayish-brown, rarely a dull reddish-brown, often with a yellowish-brown line along the humeral angles, their inner edges straight, overlapping or attingent their full length; those of female reaching nearly to tip of abdomen in short-winged form, slightly exceeding the tip in long-winged form; those of male reaching tip of abdomen in both forms. Wings either narrow and shorter than tegmina or extending considerably beyond tegmina in the form of tail-like projections. Pronotum, legs and under side of body in freshly matured specimens with a minute grayish pubescence or "bloom" which becomes abraded with age, leaving these parts shining black. Hind femora short, stout, its average length contained in that of ovipositor 1.1

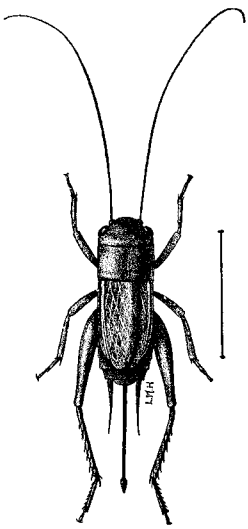

Fig. 237. Short-winged female. (After Lugger.)

times. Length of body, ♂ and ♀, 17—17.5; of pronotum, ♂, 3—3.5, ♀, 3.5—4.2; of tegmina, ♂, 11.5, ♀, short-winged form, 10, long-winged form, 12.4; of hind femora, ♂, 10—12.2, ♀, 10.5—12.4; of ovipositor, 13—14 mm. Width of pronotum, ♂ and ♀, 6.3 mm. (Fig. 237.)

From *luctuosus* this form may be distinguished by the shorter body, less swollen head of male and especially by the short ovipositor, which in Indiana specimens ranges between 13 and 14 mm. in length. The main distinguishing characters between *pennsylvanicus* and *vernalis* are set out under the latter form. Another, very noticeable in the field in spring, is the dull grayish tinge of fresh specimens of *pennsylvanicus*, especially on the legs and pronotum, the whole body of *vernalis* being shining black.

In Indiana *pennsylvanicus* is also everywhere a common cricket and for the most part survives the winter in the nymph stage, the young, on the approach of cold weather, making for themselves cone-shaped cavities an inch or two across the top and about as deep, in the mold beneath decaying logs and rubbish. Sometimes the margins of these burrows are surrounded by fragments of grass stems and pieces of decaying leaves. In warm, sheltered localities, some individuals evidently reach maturity in late autumn or early winter; a full grown, freshly moulted female having been taken in a greenhouse in Marion County, on December 14th. The males begin to pass their final moult in central Indiana about May 15th, and from then on through June and July the open woods pastures and the angles of old rail fences echo with the music of their song. The young hatch in July and August, and after the second or third moult form their winter abiding places, while the adults perish with the coming of the hoar frost. The long winged form is much less common than the short winged and is seldom met with in the field; but may often be found about electric and other lights during the summer nights. However, on two occasions in June, I have taken a long winged male in company with two short winged females beneath logs.

The range of the form or variant *G. a. pennsylvanicus* is even wider than that of *luctuosus* extending from Prince Edward Is-

land, Nova Scotia and New England west to British Columbia and California and south and southwest to southern Florida, eastern Texas and New Mexico. R. & H. (1915c, 302) say that "it is the dominant variant of the species in the well watered regions of temperate North America."

In Florida I have taken *pennsylvanicus* at Ormond, Sanford, LaBelle, Sarasota and Dunedin. Elsewhere in the State it is recorded definitely only from Orange City Junction by Caudell (1905) and Miami by Hebard (1915b). About Ormond it was the only field cricket noted in March and April, while around Dunedin both adults and nymphs are fairly plentiful from December to April.

Of *pennsylvanicus* in Ontario Walker says (1904, 251): "The chirp of the adult is first heard about the third week in May, the last toward the end of July. They are numerous about midsummer, when the fields and pastures resound with their song. They are very difficult to obtain, for they are not gregarious like *abbreviatus*, but usually occur in pairs hidden in the rubbish under some thick tuft of grass or weeds or under the edge of a stone. It requires the utmost care and patience to trace the song to its source, but if this is done successfully one is often rewarded by finding the female as well as the male." Of its habits in the south Allard (1911c, 147) says:

"Careful studies of a number of musical insects have shown the writer that very marked differences of stridulation may characterize certain species in different parts of their range. This has been found especially true of *Gryllus pennsylvanicus*. The sprightly intermittent chirps of the New England individuals no more resemble the weak, continuous *Oecanthus*- like trill of the northern Georgia individuals than the notes of *Oecanthus niveus* resemble the very dissimilar trill of *Oecanthus latipennis*. Not only is the stridulation very dissimilar, but the general habits are unlike. In New England *Gryllus pennsylvanicus* fairly swarms in grass fields and pastures during autumn, chirping everywhere in plain sight. In northern Georgia this cricket becomes exceedingly abundant in March, April and May. In this region it is very shy and secluded in its habits, stridulating beneath matted leaves, clods of earth, and grass in fields, and oftentimes in deep burrows in pastures. It is rarely seen unless deliberately uncovered and unearthed. By midsummer its stridulations are rarely heard."

333e. GRYLLUS ASSIMILIS VERNALIS nomen. nov.[82] Spring Field Cricket.

Size small for the genus. Female short-bodied, robust, male more slender. Nearly uniform black, shining; tegmina of female sometimes with a reddish-brown tinge at base and along humeral angle; hind femora with lower and inner sides of basal third feebly or not at all tinged with

[82]To replace the name *Gryllus americanus* of my former work (1903, 433) which was preoccupied by the *G. americanus* Drury (1773, 121.)

reddish-brown, never with the large reddish-brown spot so common in *G. luctuosus* and *pennsylvanicus;* cerci and hind tibiæ dark chestnut brown. Head no broader than pronotum; vertex prominent, straight, declivent. Disk of pronotum about one-third wider than long, median impressed line very distinct on apical three-fourths, front margin truncate, hind one slightly sinuate. Tegmina of female covering two-thirds of abdomen, overlapping or attingent only on their basal halves, the apical halves with inner margin obliquely rounded and therefore, in repose, widely separated, Fig. 238. Tegmina of male usually covering three-fourths of abdomen, rarely reaching its tip. Wings represented by narrow thin scales. Hind femora short, stout. Hind tibiæ armed above on each margin with five or six spines. Inner subapical spines of basal joint of hind tarsus slender, but little more than one-third the length of apical segment. Length of body, ♂, 13—14, ♀, 15—16.5; of pronotum, ♂, 3.5, ♀, 4.2; of tegmina, ♂, 7—8, ♀, 7.5—8; of hind femora, ♂, 10, ♀, 11; of ovipositor, 10.5—11.5 mm. Width of pronotum, ♂, 5, ♀, 5.6 mm. (Fig. 238.)

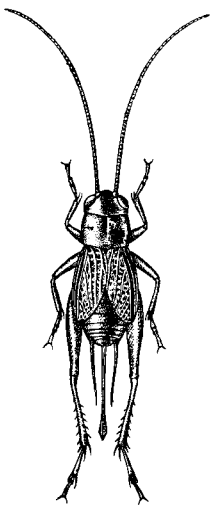

Fig. 238. *Gryllus vernalis* nom. nov. Female × 1.2. (Original.)

This shining black field cricket has been taken in Crawford, Posey, Vigo, Putnam, Marion, Marshall, Wells and Lake Counties, Indiana, and probably occurs throughout the State. It is here the first species of Gryllus to become mature in the spring, the note of the male—the first Orthopteran song of the season—having been heard on a number of occasions in the central counties as early as May 5th. The young of this species, as well as of *G. pennsylvanicus,* survive the winter as nymphs. In September and October, after passing the second or third moult, they seek the shelter of loose bark on log or stump, or crawl beneath chunk or rail where they form for themselves small, inverted cone-shaped burrows in the earth, in which they abide until spring. Those which attempt to pass the winter with only a shelter of bark above them almost always succumb to the changing temperatures of that season, but those which choose more wisely a burrowing place beneath some half buried log or chunk for the most part survive. The temperature of their hibernaculum is much more equable, and the insects becoming sluggish in late autumn remain so until called into new activity by the sunshine of spring, unless, meanwhile, they fall a prey to some shrew, mouse or other active winter insectivorous mammal. They emerge from their hiding places about April 1st, and after changing their garb two or three times,

reach the mating stage in early May, when the males begin to greet the passer-by with their merry chirp.

Neither this species nor *pennsylvanicus* are social crickets. Sometimes two or three of the young have adjacent burrows beneath the same chunk, but more often both they and the adults are solitary. The eggs are laid in June and July, and the newly hatched young are to be found in numbers during July and August.

Caudell (1907d, 292) has stated that this form is the same as *G. nigra* Harris (1841, 123), but that form was regarded both by Uhler (1862, 152) and Scudder as a synonym of *pennsylvanicus* which Harris did not mention. Moreover, the type of Harris is destroyed and his original description is so short and incomplete that no one can tell what species he had in hand.[83] I therefore have retained this as a middle-western variant or form of *G. assimilis*.

From *pennsylvanicus*, with which form *vernalis* was confused until 1903, the latter may be readily separated by its smaller size, narrower pronotum, more uniform shining black color, shorter ovipositor, and the shape, and position, when at rest, of the female tegmina. The reticulation of the dorsal field of these tegmina is more noticeable in *vernalis* than in *pennsylvanicus*, the main diagonal nerves being closer together and the cross nervules more elevated and prominent. Moreover, *vernalis* reaches maturity in the spring about a fortnight the sooner.

Outside of Indiana, *vernalis* (as *G. americanus*) has been recorded from Illinois and Texas by Hart (1906, 91; 1906a, 160) and from Franklin County, Ohio by Mead (1904, 110). Hart mentions it as "undersized, tegmina wholly black, usually divergent in female, peculiarly crinkled," and (1906a) says: "From what I have seen of this in Illinois I should think it was clearly distinct."

333f. GRYLLUS ASSIMILIS NEGLECTUS Scudder, 1862, 428. Neglected Field Cricket.

Size small to medium for the genus. Nearly a uniform piceous-black; tegmina sometimes black, frequently a light ochraceous brown. Pronotum about one-half wider than long. Tegmina of females covering two-thirds or more of abdomen, those of male reaching to its extremity. Ovipositor about one-third longer than hind femora. Other characters as given in key. Length of body, ♂, 15.5—21, ♀, 18—23; of pronotum, ♂, 3.2—3.4, ♀, 3.3—4; of tegmina, ♂, 9—11, ♀, 7.5—10.5; of hind femora, ♂, 9.4—10.8, ♀, 9.4—11.5; of ovipositor, 12.5—15 mm.

[83] It was as follows: "We have another species with very short or abortive wings; it is entirely of a black color and measures six-tenths of an inch in length from the head to the end of the body. It may be called *Acheta nigra*, the black cricket."

This form or variant is, according to Scudder, (loc. cit.) the most common one in New England. R. & H. (1915c, 302) state that it is "found in the northeastern part of the distribution of *G. assimilis,* ranging southward in the high Appalachians to northern Georgia and is known from the Piedmont plateau only in Pennsylvania." To this form Piers (1918, 343) refers the only form of *Gryllus* found in Nova Scotia and says (p. 352):

"In the vicinity of Halifax it is usually found on dry, sloping banks, with scant vegetation and therefore somewhat earthy and having some flattish stones scattered about, on country roadsides, the borders of fields, and similar places. It does not seem to congregate in numbers but is usually met with in pairs, a male and a female, under small stones, and when the stone is lifted it runs rapidly about, this way and that, in a bewildered manner, looking for a hiding place or its little burrow. Its leaping power is plainly not so great as that of *Nemobius*, and it makes but short jumps, and prefers if possible to find a place of concealment by running away. Its timidity and secretive nature cause it to be seldom seen about Halifax; but its notes draw attention to its hiding-place beneath a stone or piece of rubbish, where it can easily be captured.

"The eggs are deposited in loose soil in the latter part of the autumn and hatch the following year, possibly early in June or thereabouts. Its notes or shrilling are apparently first heard near Halifax about August 2 and are frequently heard during both day and night in suitable places; but by October the number is much lessened in daytime and few or none shrill at night. The note is considerably louder, and is a shorter, slower-timed, and more distinct and noticeable trill than that of *Nemobius fasciatus.* It sounds like the trilled syllable *plee-e-e.* After each such trill it is silent for a moment and then calls again, thus: *plee-e-e; plee-e-e;* and so on. These notes sound out distinctly louder and more staccato from the omnipresent undertone and lower-toned tremolo resultant from the intermingled shrilling of countless numbers of *Nemobius* on all sides. When both species call more faintly at the beginning of the season, it is much more difficult to differentiate between the two."

This form occurs at high altitudes and has a more northern range than *G. a vernalis.* It averages larger in size, has the ovipositor longer in comparison with the hind femora, the veins of female tegmina less reticulate and matures at a much later date.

334. GRYLLUS DOMESTICUS Linnæus, 1758, 428. House Cricket.

Size medium; form slender. Pale yellowish-brown or straw color; head with a dark reddish-brown bar on occiput just in front of pronotum; another between the upper portions of eyes; a third between the bases of antennæ and a fourth across the labrum, the lower two sometimes united. Pronotum with four or five irregular shaped spots of reddish-brown on dorsal surface, and a narrow bar of the same color each side; its hind margin slightly convex. Tegmina reaching nearly or quite to end of abdomen; sometimes with a reddish-brown spot on basal third. Inner wings either short and covered by, or extending considerably beyond, the tegmina. Hind femora short, rather slender. Ovipositor one-fifth longer than hind

femora, pale brown except the tip, which is darker. Length of body, ♂, 16.5, ♀, 15; of pronotum, ♂ and ♀, 3.5; of tegmina, 11; of hind femora, 10; of ovipositor, 12 mm. (Fig. 239.)

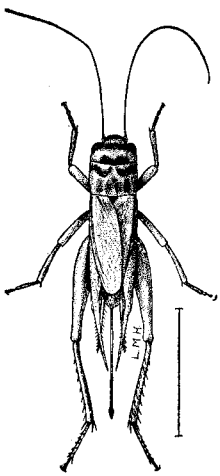

Fig. 239. Female. (After Lugger.)

The "house cricket" or "cricket of the hearth" appears to be scarce in Indiana. Until January 1, 1903, I had in my collection but three specimens, two long-winged males and a short-winged female, taken from beneath rubbish in a gravel pit near West Terre Haute, Vigo County, in October, 1894. On the later date mentioned I secured a dozen or more adults and nymphs in a greenhouse just north of the city of Indianapolis. The proprietor informed me that the males utter their call note throughout the winter and that the insect is seemingly most abundant at that season. It has also been noted near Bainbridge, Putnam County by J. S. Michaels.

This is an Old World cricket and probably occurs sparingly in most of the states east of the Rocky Mountains, though recorded from the south only from "Carolina," Georgia, Alabama and Texas. Scudder states that he has seen no short-winged specimens from the United States, though they are common in Europe. It is probable that in many instances the so-called "house-crickets" of the present country homes are field crickets, especially *G. luctuosus*, which have striven to prolong their existence by seeking shelter within the domiciles of man. Marlatt (1896, 52) has given the following pleasing account of the habits of this house cricket:

"In Europe, and in some parts of the United States, no insect inhabitants of dwellings are better known than these domestic or house crickets, not so much from observation of the insects themselves as from familiarity with their vibrant, shrilling song notes. These notes, while thoroughly inharmonious in themselves, are, partly from the difficulty in locating the songster, often given a superstitious significance and taken, according to the mood of the listener, to be either a harbinger of good and indicative of cheerfulness and plenty, or to give rise to melancholy and to betoken misfortune. The former idea prevails, however, and Cowper expresses the common belief that the—

> 'Sounds inharmonious in themselves and harsh,
> Yet heard in scenes where peace forever reigns,
> And only there, please highly for their sake.'

"The house cricket usually occurs on the ground floor of dwellings and evinces its liking for warmth by often occurring in the vicinity of fire-

places, concealing itself between the bricks of chimneys or behind baseboards, frequently burrowing into the mortar of walls. It is particularly apt to abound in bakehouses. It is rarely very abundant but at times multiplies excessively and becomes a very serious nuisance. During cold weather or in cold rooms in winter, it remains torpid, but under the influence of warmth it becomes active and musical. It is easily kept in captivity as a pet, and will reward the possessor by furnishing an abundance of its peculiar melody, and in Spain it is often kept, it is reported, in cages, as we do singing birds. It is in the main nocturnal in its habits, coming out in the dusk of the evening and roaming about the house for whatever food materials it may discover. It feeds readily on bread crumbs or almost any food product to which it can get access, and is particularly attracted to liquids, in its eagerness to get at which it often meets death by drowning. It is a very pugnacious insect and will bite vigorously if captured, and is often predaceous or carnivorous, like most of its outdoor allies It is supposed to feed on various other house insects, such as the cockroach and is also probably canibalistic. A pair of native species kept in a cage by the writer, for a short period manifested the greatest friendliness, but the male shortly afterwards made a very substantial meal of his companion.

"These Crickets, in common with most other Orthoptera, will occasionally in pure wantonness seemingly, cut and injure fabrics, and are particularly apt to cut into wet clothing, evidently from their liking for moisture. Any of the common field grasshoppers or crickets, entering houses, are apt to try their sharp jaws on curtains, garments, etc., and Dr. J. A. Lintner records the case of a suit of clothing just from the tailor which was completely ruined in a night by common black field crickets (*Gryllus luctuosus*), which had entered an open window in some numbers. There is a popular superstition also to the effect that if a cricket be killed its relatives will promptly cut the garments of the offender.

"The house cricket may be readily destroyed by taking advantage of its liking for liquids, and any vessel containing beer or other liquid placed about will usually result in crickets being collected and drowned in numbers. It may also be destroyed by the distribution of uncooked vegetables, such as ground up carrots or potatoes, strongly poisoned with arsenic. In the use of poisoned baits in dwellings great care, however, should always be exercised."

Walker (1904, 252) records the taking of all stages of *G. domesticus* in late autumn in the basement of the General Hospital at Toronto, Ontario. They were "lurking in the chinks between the bricks of the wall and positively swarmed under loose bricks close to the furnace. Morse does not mention it from New England (1919a) though R. & H. (1915c) state that it has been recorded from Connecticut.

Subfamily VI. OECANTHINÆ.

The White Tree Crickets.

Slender bodied crickets of a pale color having the head elongate, horizontal or nearly so; vertex declivent, passing gradually