THE ORTHOPTERA OF NOVA SCOTIA

by

V. R. Vickery

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INTRODUCTION

Orthoptera in Nova Scotia are not generally considered to be economic pests. However the records show that many infestations of economic proportions have occurred in the province. The present study was not initiated because of the economic status of the group but rather because of the interesting variation encountered in the relatively small number of species representing this Order.

This paper includes a brief resume of the classification of the Order Orthoptera and the Orthoptera found in Nova Scotia, including keys, illustrations, descriptions, range, habits, habitat and common synonyms. A check list is included as well as a glossary of terms.

Six species which were not previously recorded from Nova Scotia are included in this paper. This brings the total number to thirty-one definitely recorded species. Four other species, which may possibly also occur here are included in the keys but no descriptions are given. This makes up a total of thirty-five species in twenty genera, twelve subfamilies and four families. Full use has been made of previous work to make the list as complete as possible. The present study

has added three species and confirmed many of the species previously recorded as occurring in this province. Three more species are included on the authority of Dr. F. A. Urquhart, Head, Division of Zoology and Palaeontology, Royal Ontario Museum, Toronto.

Keys are given to separate all major and minor groups. These are supplemented by illustrations. Authors and dates are given, wherever known, for genera and species. The species are described, and the most important synonyms are given, as well as the original combination of the specific name. Body length is given in millimeters. Common names, range and notes on habits and habitat are given for most species. These latter notes have been drawn to some extent from Allard, 1911, Gooderham, 1916, Piers, 1918, and Blatchley, 1920, but also have been supplemented by personal observation. Notes on distribution and abundance in Nova Scotia are included, with collection data of specimens taken during this project. All specimens, of which data is listed, are in the Nova Scotia Agricultural College insect collection, unless otherwise stated.

The policy of dividing subfamilies into tribes has not been followed in this paper, as it is felt that due to the

relatively small number of species involved, the overall picture of the classification would become more obscure rather than clearer.

The work of Morgan Hebard has been followed in the classification given in this paper. His general classification of the larger groups of Orthoptera as applicable here is given below. It is taken from his "Dermaptera and Orthoptera of Illinois", 1934, and "Appalachian Mountains Orthoptera", 1945.

Order Orthoptera.

Family Blattidae.

Subfamily Pseudomopinae.

Subfamily Blattinae.

Family Acrididae.

Subfamily Tetriginae.

Subfamily Acridinae.

Subfamily Oedipodinae.

Subfamily Cyrtacanthacrinae.

Family Tettigoniidae.

Subfamily Phaneropterinae.

Subfamily Copiphorinae.

Subfamily Conocephalinae.

Subfamily Rhaphidophorinae.

Family Gryllidae.

Subfamily Gryllinae.

Subfamily Nemobiinae.

CONSIDERATION OF CLASSIFICATION OF ORTHOPTERA

Orthopteran classification has long been a confused picture. A multitude of names for the major classifications has arisen due to misapplication of many of the early type names. If the Law of Priority is applied, the name Orthoptera would be replaced by Dermaptera, which was proposed by DeGeer in 1773 to include all orthopteroid insects. When Linnaeus established orders in 1774, he probably included this group in his Coleoptera. Olivier, in 1789, proposed Orthoptera, and Latreille, in 1796, restricted its limits. In 1815, Kirby restricted DeGeer's Dermaptera to its present limits. The Saltatoria was proposed by Latreille in 1817, and this name has been used very loosely until relatively modern times.

Some authorities have divided the Orthoptera into several groups of ordinal rank; e.g., Essig, 1942, but Imms and many others feel this is unwarranted.

The order has been divided into suborders by many workers,

but others recognize only family groups. The terms Saltatoria, Gressoria, Acridoidea, Tettigoncidea, Cursoria, Blattariae, Dictuoptera, Blattodea, Neoblattariae, Blattoidae, and others have been applied to various groups by different authors. Rehn and Hebard, recognized as the modern authorities on Orthoptera in America, do not recognize these groups, but subdivide the order directly into families.

Family and subfamily names have undergone much change and revision due to misapplication of early type genera. This is largely due to the extremely brief and inadequate descriptions of American species by early European writers. One example of this is that the two families now known as Acrididae and Tettigoniidae, have both been known in the past as Locustidae. The name Blattidae has never been in doubt, as it is properly based on Linnaeus' genus Blatta, 1758. The name Gryllidae for the true crickets is now correctly applied, but was for many years very broadly used, as the original genus Gryllus of Linnaeus was of broader scope than the whole family Gryllidae of the present day.

The Acrididae is divided into subfamilies, and these have been badly confused. The Grouse locusts were known for years as Tettiginae. In late years, it was thought the genus

Acrydium Geoffroy, 1762, should take priority over Tettix Charpentier, 1841, so the subfamily name was changed to Acrydiinae. Then, in 1942, Roberts discovered that Geoffroy's genus should be applied to a group of slant-faced locusts, and the next available name was that of Tetrix Latreille, 1802, thus changing the family name to Tetriginae. Some workers elevate this group to family rank.

The subfamily Oedipedinae based on Oedipoda Serville, 1831, has remained largely unchanged.

The subfamily Acridinae, the slant-faced grasshoppers, has also been known as Tryxalinae and Truxalinae.

The Cyrtacanthacrinae has also been called Locustinae and Acridinae.

The family Tettigoniidae has also been called Locustidae, but Linnaeus' genus Locusta was based on a true locust. The present name is actually based on Linnaeus' genus Tettigonia. Kirby, 1910, called this family Phasgonuridae.

Many recent authors, including Rehn and Hebard, have given tribal names to groups of related genera, usually based

on an older single genus which has been subsequently divided.

PHYSICAL BACKGROUND

Nova Scotia lies between 43 degrees and 47 degrees north-latitude and 59 degrees and 67 degrees west-longitude, with the axis running in a northeast - southwest direction. It is about 340 miles long and averages 50 miles in width. It consists of a peninsula, joined to the mainland (New Brunswick) by the swampy isthmus of Chignecto, and Cape Breton Island, which is separated from the eastern end of the peninsula by the Strait of Canso. The island and the mainland are joined by a causeway which was completed in 1955. The province is divided into 18 counties, as shown on the map, Plate 1.

"Geologically the province is the up-tilted and eroded surface of an old Cretaceous peneplain. This dips below the surface of the Atlantic Ocean to produce the drowned and very irregular coastline, and raises gradually and evenly to the northward to attain in the highlands of northern Cape Breton and southern New Brunswick a height of 1200 feet. The weaker rocks and structures of the northern area have worn away so that the province, which is flat, sterile and poorly drained along the Atlantic Coast, becomes increasingly hilly and irregular inland." (Roland, 1944).

The southern half of the province is called the Atlantic Upland, indicated by the clear area on the map, Fig. 2a and is composed of rocks resistant to weathering, slates, quartzites and granites. It is not basically an upland but rises gently from sea-level to a height of 100 to 500 feet in the north. In the western half the three rock types appear in about equal proportions; i.e., the area comprising southern Yarmouth, Shelburne, Queens and Lunenburg Counties. In the eastern area granites and quartzites are predominant with slates nearly absent. Lakes, streams, bogs and barrens are very numerous in the Atlantic Upland area.

The true uplands are found in the northern half of Nova Scotia, as indicated by the shaded areas on the map, Fig. 2a. The North Mountain extends from Kings County, at a height of 600 feet, in a southwest direction to dip beneath the sea at the end of Digby Neck. It is composed largely of basalt or trap rock. The ranges of hills from Cumberland County to Cape Breton are composed of igneous rocks, syenites, diorites and granites. These hills rise to 1000 feet and are covered with forest, mostly deciduous. The broad plateaus of northern Cape Breton are up to 1200 feet high and are very poorly drained. The plateaus are covered with bogs and trees and have a more severe climate than the rest of the province.

The remaining area, which is vertically hatched on the map, Fig. 2a, is lowland which varies considerably. The Annapolis Valley is basically Triassic sandstone, while the northern and eastern lowlands have various mixtures of sandstones, shales, conglomerates, limestones and gypsum. In these areas deep valleys and rugged cliffs are found near the uplands and lakes and ponds are scarce.

The southwestern area has the longest frost-free period and the most foggy days, lower summer temperatures and higher minimum winter temperatures than the other regions. Cape Breton Island presents the other extreme, having a short growing season, very little fog and lower temperatures throughout the year.

Dice, 1943, divided North America into 'Biotic provinces'. The Canadian biotic province, in which Nova Scotia is situated, contains elements of both the Canadian and Alleghanian zones of previous authors. As flora and fauna of both these zones are represented in Nova Scotia, there would be little use in this paper in combining them.

Nova Scotia may be divided by its flora into four general regions, (Roland, 1944-45) as outlined on map, Fig. 2b:

1. predominantly Canadian; 2. predominantly Alleghanian; 3. a northern region which is partially Hudsonian in character; and 4. the southwestern region which bears flora typical of the coastal plains of more southerly areas. The peninsula is roughly divided into three areas. The Costal Plains region is made up of southwestern Yarmouth, Shelburne and Queens Counties. The remainder of the mainland is divided into regions by a line drawn roughly from Annapolis to Guysborough. The region to the north of the line is mainly deciduous, representative of the Alleghanian zone, while the poorly-drained area to the south of the line is representative of the Canadian zone. Thus, in Nova Scotia, there exists a curious reversal in that the southern elements are found in the north while the northern elements are found in the south.

The island of Cape Breton is considered separately. The Alleghanian zone extends into the northwestern part of Cape Breton Island and includes the Margaree Valley. The boggy plateaus of northern Cape Breton bear flora such as black spruce, fir, Ericaceous plants and sphagnum, typical of the more northern Hudsonian zone. The remainder of the island is similar to the Atlantic coast of the mainland and is classed as Canadian zone.

Considerable variation occurs in all of these regions, with small areas in each apparently typical of another region. This is due largely to drainage and elevation of the areas concerned.

Actually, as Ferguson, 1954, points out, "Nova Scotia lies within that zone where the northern hardwood forest of eastern North America and the southern edge of the northern coniferous forest meet and intermingle". The association of the different types of flora, Alleghanian, Canadian and Hudsonian is very close and it is rather surprising to discover that the floral zones are as distinct as the floral distribution shows them to be. The coastal plains flora is largely confined to the poorly drained areas in the southwest but representatives of this flora are also found in a few other poorly drained locations. Ferguson mentions the temptation to subdivide Nova Scotia into crudely defined zones based upon distribution of Lepidopterous species. He states that these zones coincide well with the geological divisions. Ferguson listed eight hundred thirty-two species of Macrolepidoptera so that his divisions are probably soundly based.

Piers, 1918, attempted to show correlation between the geologic divisions and the distribution of Orthoptera. This

was based upon only twenty-six species, and at that time much of the province had not been searched for insects. The known capture localities cannot be considered to be typical of the whole zones in which they were located. Unfortunately this situation still exists and no such correlation is considered feasible at this time. The present study is not sufficiently comprehensive and the record of previous captures is not complete. This latter fact is due largely to the loss by fire of the Nova Scotia Agricultural College insect collection and accompanying records in 1946. Further, some areas of the province, particularly the island of Cape Breton and the neighboring mainland counties, have been but little explored for insects.

ORTHOPTERA FOUND IN NOVA SCOTIA

LITERATURE ON N.S. SPECIES

F. Walker, 1869 - 1872, provided the first information on the Orthoptera of Nova Scotia. Some of the species he listed as present are now considered to be misidentifications, as they have not been taken since that time. These include Oedipoda (= Arphia) sulphurea (Fabr.), Oedipoda rugosa (= Hippiscus rugosus) Scudder, and Tetrix ornatus (Harris). The

last named was probably a misidentification of Tetrix arenosus angustus (Hancock), while the first two were misidentifications of Circotettix verruculatus (Kirby). The following species were recorded and subsequently confirmed; Tetrix subulatus (Linn.), Chorthippus longicornis (Latr.), Dissosteira carolina (Linn.), Melanoplus bivittatus (Say), M. femur-rubrum (DeGeer), Scudderia curvicauda (DeGeer), Conocephalus fasciatus (DeGeer) and Nemobius fasciatus (DeGeer).

S. Scudder, 1892, recorded Hippiscus apiculatus (Harris) from Nova Scotia but this species has not been found subsequent to that date. As Piers, 1918, states, the record was probably a mistake in Scudder's record.

Scudder, 1899, reported the presence of Orphulella speciosa (Scudd.) in N.S., from a collection by Piers. Piers, 1918, believed a mistake had occurred, and doubted the existance of this species in the province. However Urquhart, 1951, states that O. speciosa definitely is present, as he collected three specimens in 1949, at Bridgetown, Annapolis County.

C. B. Gooderham published a paper on the Acrididae of N.S. in 1916, and the next year published another on the Locustidae (Tettigoniidae). In the first paper, Tetrix ornatus

(Harris) was recorded, but this was revoked in the second paper as misidentification of T. arenosus angustus. Many of Gooderham's specimens of Orthoptera and the collections of others up to the year 1946 were housed in the insect collection of the N.S. Agricultural College, the largest collection east of Quebec. These were not available for this project as the collection was destroyed by fire in 1946.

H. Piers, 1918, published the most complete work on N.S. Orthoptera. He included twenty-eight species, two of which he considered to be hypothetical, Zubovskya glacialis (Scudd.) and Melanoplus fasciatus (F. Walker), and two of doubtful occurrence, Orphulella speciosa (Scudd.) and Hippiscus apiculatus (Harris). M. fasciatus was confirmed as present near Yarmouth by J. W. H. Rehn, 1939. Z. glacialis was confirmed by F. A. Urquhart, 1951, (collected by C. E. Atwood), and O. speciosa by Urquhart as stated previously. H. apiculatus is considered in error. Urquhart also added Nemobius cubensis palustris Blatchley as a result of collections made in 1949.

During the present study three species were found which had not previously been recorded in Nova Scotia. These are Melanoplus keeleri luridus (Dodge), Chorthophaga viridifasciata (DeGeer) and Neoconocephalus ensiger (Harris). Melanoplus fasciatus (Walker) had been found by Bayard Long, identified

by J. W. H. Rehn, near Yarmouth in southwestern Nova Scotia in 1920. This single female constituted the only record in the province. During 1953 this species was also found in Cumberland County, some two hundred miles distant from the original location.

In addition to the above, most other species previously recorded were again found. Exceptions to this include two small crickets Nemobius carolinus Scudd. and N. cubensis palustris Blatchley. No collections were made in the original capture area and these crickets are apparently not present in the areas where extensive collecting was carried out. Persistent efforts failed to produce a single specimen of Orphulella spp. or of Zubovskya glacialis (Scudd.).

It has not been possible, during the present study, to make collections in the eastern end of Nova Scotia or on Cape Breton Island.

CLASSIFICATION OF N.S. ORTHOPTERA

ORDER ORTHOPTERA

Within this order are found some of the most generallized insect types but a relatively great divergence of forms exists.

Wings are variable, often being vestigial or absent; where present, they consist of two pairs. The fore-wings, or tegmina, are thickened and parchment-like, but with distinct venation. The hind-wings are often fan-like, usually folded beneath the tegmina when at rest. Where wings are absent, the labium is cleft. Wingless forms do not bear stridulating organs, but nearly all winged males, except in the Family Blattidae, have some apparatus for producing sound.

The mouthparts of both adults and immature forms are typical of the biting, chewing type. Metamorphosis is gradual; normally four to six nymphal instars occur. Nearly all Orthoptera are phytophagous and some of them are of great economic importance.

Key to N.S. Families of Orthoptera.

1. Legs of equal or nearly equal size, hind femora not adapted for leaping; sound producing organs absent; ovipositor of females concealed; where present, tegmina and wings of nymphs in normal position. ------- Family Blattidae, p. 17.

Legs of unequal size, the hind femora thickened, swollen, longer than the others, adapted for leaping; sound-producing

organs usually present; ovipositor of female exserted and plainly visible; when present, wings and tegmina of last two instar nymphs in reversed position. ---------- 2.

2. Antennae much shorter than the body; tarsi three-jointed; stridulating organs, when present, on hind femora and lower borders of tegmina; ovipositor consists of two pairs of short plates diverging at the tips. ----- Family Acrididae, p. 20.

Antennae much longer than the body, tarsi three or four-jointed; stridulating organs, when present, on dorsal area of tegmina; ovipositor usually elongated. ---------- 3.

3. Tarsi four-jointed, tegmina with sides sloping; ovipositor usually flattened, sword-shaped; general color green or brown. ---------- Family Tettigoniidae, p. 67.

Tarsi three-jointed; tegmina flat above, with sides bent abruptly down; ovipositor nearly straight, or slightly upcurved, needle-like; general color brown to black.

---------- Family Gryllidae, p. 91.

FAMILY BLATTIDAE

The cockroaches comprise one of the oldest groups of

insects persisting to present times. Although they are primitively forest dwellers, they exist in Nova Scotia only as household pests. No members of this family are native in the province but are established adventives. Two species, in two subfamilies, are represented.

Key to N.S. Subfamilies (Genera, Species) of Blattidae.

Size small; structure delicate; general color light buff to brown; pronotum with a pair of wide, dark-brown, longitudinal stripes; wings well developed.

---------- Pseudomopinae (Blatella germanica), p. 18.

Size medium large; structure robust; general color dark-brown; pronotum without longitudinal stripes; wings reduced, moderately in male, greatly in female.

---------- Blattinae (Blatta orientalis), p. 19.

Subfamily Pseudomopinae.

Blatella Caudell, 1903.

1. Blatella germanica (Linnaeus), 1767.

Common names - 'German Cockroach', 'Croton Bug', and in Nova Scotia known locally as 'The Yankee Settler'.

Original combination - Blatta germanica.

Phyllodromia germanica. Piers, H., Trans. N.S. Inst. Sci. 9:209, (1896); Halifax.

Blatella germanica. Piers, H., Trans. N.S. Inst. Sci. 14:247-248, (1918); Hfx., Col. and Cumb. Cos.

Small species, body with sides slightly narrowing caudally in male, almost parallel in female; tegmina fully developed in both sexes, as long or slightly longer than the abdomen; yellowish-brown in color, female often darker; legs light; pronotum marked with two dark brown longitudinal stripes separated by a yellowish line; length of body, male 13, female 10.

B. germanica is found only in buildings in Nova Scotia and is widely distributed all over the province. Presumably it was brought here by United Empire Loyalists during the American War of Independence, hence its local common name. The insect collection of the Nova Scotia Agricultural College, Truro contains the following series: 4 males and 9 females, Aug. 6, 1951, old Military Hospital, Debert, Colchester County.

Subfamily Blattinae.

Blatta Linnaeus, 1758.

2. Blatta orientalis Linnaeus, 1758.

Common name - 'Oriental Cockroach'.

Stylopyga orientalis. Piers, H., Trans. N.S. Inst. Sci. 9:210, (1896); Halifax.

Blatta orientalis. Piers, H., Trans. N.S. Inst. Sci. 14:250-251, (1918); Halifax.

Medium large species; male smaller than female; tegmina of neither sex reaching end of abdomen, covering three-quarters in male, rudimentary, covering one-third in female; dark brown in color; legs and underside lighter; pronotum uniform dark-brown; length of body, male 22, female 27.

This native of Asia is now found over most of America particularly in seaports. It is known from Halifax and Sydney and is almost certainly present in other seaport towns.

The present collection includes 5 specimens; 2 males, 2 females and 1 nymph, Halifax, June 18, 1955.

FAMILY ACRIDIDAE

The Acrididae are characterized by having long, stout, hind femora; tibiae armed with numerous spines; head vertical, with face often oblique; tarsi three-jointed.

This is the Family Locustidae of Comstock, but not of

other authors who applied that name to the Tettigoniidae. This family contains the most well known and the most destructive species of Orthoptera.

Key to N.S. Subfamilies of Acrididae.

1. Size very small; pronotum extending backward, tapering, to or beyond end of abdomen; tegmina represented by small, oval, lateral lobes (Figs. 3a and 3b). --- Tetriginae, p. 22.

Size larger; pronotum not extending backward over abdomen; tegmina usually well developed, but sometimes abbreviated or wanting. ---------- 2.

2. Prominent conical tubercle borne on the prosternum between the prothoracic legs (Figs. 10a and 10b).
---------- Cyrtacanthacrinae, p. 48.

No tubercle borne on the prosternum between the prothoracic legs. ---------- 3.

3. Face usually very oblique; median carina of pronotum never high and crest-like, or cut by more than one sulcus.
---------- Acridinae, p. 28.

Face nearly or quite vertical; median carina of pronotum usually cut by more than one sulcus (Fig. 7).

---------- Oedipodinae, p. 39.

Subfamily Tetriginae

This is the subfamily Acrydiinae of many authors. It is characterized by the backward extending pronotum, and the small size of the included species. Some workers have elevated this group to full family rank.

Key to N.S. Genera of Tetriginae.

Antennae 12 or 13 jointed; median carina of pronotum high and crest-like, arched longitudinally; upper lateral sinus of pronotum about half as deep as lower one (Fig. 3b).

---------- Nomotettix, p. 22.

Antennae 14 jointed; median carina of pronotum low and rather flat from lateral view; upper lateral sinus of pronotum nearly as deep as lower one (Fig. 3a). -------- Tetrix, p. 24.

Nomotettix Morse, 1894.

3. Nomotettix cristatus (Scudder), 1862.

Common name - 'Crested Grouse Locust'.

Original combination - Tettix cristatus.

Nomotettix cristatus. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:23, 27, (1917); Col. Co.

-- Piers, H., Trans. N.S. Inst. Sci. 14:254-257, (1918); Hfx. and Col. Cos.

-- Rehn, J. W. H., Can. Ent. 71:176, (1939); Col. Co.

Nomotettix sinuifrons Hancock, 1899, N. borealis Walker, 1909, Batrachidea carinata Scudder, and Batrachidea cristata Harris are synonyms.

This is one of the smallest of N.S. orthopterans; pronotum high and arched; body finely granulate, especially on pronotum; vertex projects beyond the eyes, front margin of pronotum extended over back of head; notches of lateral posterior pronotum as in key; pronotum reaching to apex of hind femora. Grayish-brown in color, slightly lighter beneath; two blackish spots on lateral areas of pronotal disc; length of body, male - 7.5 to 9, female - 8 to 9.5.

The native range of N. cristatus covers the eastern United States and southern Canada. It is rather widely distributed

in Nova Scotia where it is common in dry pastures. H. Piers, 1918, reported this species very rare at Halifax (a single specimen) and rather common around Truro. Urquhart collected N. cristatus in Nova Scotia in 1949, but specimens which he sent to the N.S. Agricultural College collection are from Woods I., P.E.I. The series in the collection includes 20 specimens from Nova Scotia: 2 males and 5 females, West Brook, Cumberland County, June 20, 1952 and June 29, 1953; 1 male, 1 female and 1 nymph, Sweet's Corner, Hants County, Aug. 18, 1952; 1 male, North Alton, Kings County, Aug. 8, 1952; 1 female, Centreville, Kings County, May 26, 1954; 1 nymph, New Ross, Lunenburg County, July 7, 1952; and 1 male and 6 nymphs, Truro, June 30, 1952.

Tetrix Latreille, 1802.

Key to N.S. Species of Tetrix.

Median carina of pronotum elevated more or less distinctly along entire length; dorsal part of pronotum high in middle, sloping on the sides; body very slender, especially males; front margin of vertex obtusely angulate viewed from above, median carina at most very slightly projecting (Fig. 4a); hind part of pronotum long, apex narrowly acute, surpassing hind femora in extended form (Fig. 3a) and reaching the ends in abbreviated form. ---------- T. subulatus, p. 25.

Median carina of pronotum indistinct, slightly elevated on anterior third; dorsal area of pronotum flat or nearly flat; body robust; front margin of vertex very slightly rounded, the median carina projecting (Fig. 4b); apex of pronotum reaching considerably beyond hind femora in extended form and only slightly beyond in abbreviated form.

---------- T. arenosus angustus, p. 26.

4. Tetrix subulatus (Linnaeus), 1761.

Common name - 'Granulated' or 'Slender Grouse Locust'.

Original combination - Gryllus subulatus.

Acrydium granulatum. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:23, 27, (1917); Col., Kings, Hants, Anna. and Yar. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:257-259, (1918); not at Halifax; as Gooderham above.

Acrydium subulatum. Rehn, J. W. H., Can. Ent. 71:176, (1939); Pict., Col. and Kings Cos.

Acrydium granulatum (Kirby), 1837, is the most common synonym and the names Tettix luggeri Hancock, 1897, Tettix morsei Hancock, 1899, Tettix granulatus, and Tettix brunneri Bolivar, 1877, are also synonymous.

Pronotum and legs finely granulated; easily recognized by the prominent angulate form of front margin of vertex. Color variable, grayish to reddish-brown, sometimes blackish, often with median white band along full length of pronotum; inner wings bluish or bottle-green. Length of body, male 8.5 to 13.5, female 11 to 15.3.

T. subulatus prefers sedgy meadow lands and swales on sandy soil which remains moist. General range is eastern and northern North America, north of 38 degrees Latitude. Gooderham, 1917, and Piers, 1918, reported this species to be rather common in the central and southwestern counties. It was collected by Urquhart in Nova Scotia in 1949 but specimens sent to the N.S.A.C. collection are from Ontario. There are 72 specimens in the N.S.A.C. collection, 30 males and 42 females: 23 males and 36 females, Kentville, Aug. 10, 1951; 3 males and 1 female, South Ohio, Yar. Co., Aug. 13, 1951, and 3 males and 1 female, same location, Apr. 24, 1952; 2 males, Truro, Apr. 5, 1953; and 2 females, Debert, Col. Co., Apr. 23 and May 6, 1952.

5. Tetrix arenosus angustus (Hancock), 1896.

Common name - 'Sanded Grouse Locust'.

Original combination - Tettix angustus.

?Tettix ornata Harris. Walker, F., Cat. Derm. Salt. Brit. Mus. 5:813, (1871); Nova Scotia.

Acrydium ornatum (Not of Say). Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:23, 27, (1917); Col., Kings, Hants, Anna. and Yar. Cos.

Acrydium arenosum angustum. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1917:35, (1918); Erratum of above.

-- Piers, H., Trans. N.S. Inst. Sci. 14:259-263; Not at Halifax; as Gooderham above.

This insect has been commonly called Acrydium arenosum angustum. Tettix obscurus Hancock, 1896, Tettix gibbosus Hancock, 1896, Tettix inflatus Hancock, 1896, Tettix decoratus Hancock, 1896, and Tettix fluctuosus Hancock, 1896, are synonyms.

Description as in key; pronotum narrow in front, nearly twice as broad at shoulders; lateral carinae close together anteriorly, becoming obsolete, reappearing twice as wide apart, diverge to shoulders, and converge to apex. Generally light brown in color, somewhat darker on pronotal disc; inner wings iridescent, veins dusky. Length of body to end of pronotum, male 8.9, female 10.

T. arenosus angustus is found near banks of streams

and boggy places. The race angustus occurs throughout the Alleghanian Division of the Transition Zone. This species has been found over the western part of the province. The present series includes 35 specimens, 18 males and 17 females, all but one from the same location, Debert, Colchester County; 7 males and 3 females, April 23, 11 males and 13 females, May 6, 1952, and a single female from Truro, June 30, 1952.

F. Walker in 1871, as reported by Piers, identified "Tettix ornata Harris" from the Redman collections of 1821. This single specimen is said to be correctly identified. This species has not been taken since and Piers has somewhat doubtfully referred the record to T. arenosus angustus. It is more likely that the identification should stand, but that the locality (stated merely as 'Nova Scotia') is not accurate. It should also be pointed out that Nova Scotia, in 1821, covered a much greater area than at present and it is possible that the specimen was taken at some point which was then Nova Scotia but which is now located far from the present boundary.

Subfamily Acridinae

This subfamily has been called by various names, such as Tryxalinae and Truxalinae, but it is correctly Acridinae,

based on the genus Acrida of Linnaeus. Acridinae should not be applied to the spur-throated locusts (Cyrtacanthacrinae). The face in this group is usually decidely oblique, meeting the vertex in an acute angle; lateral foveolae are well developed.

In Nova Scotia four species in three genera are known, and a fifth species probably occurs.

Key to N.S. Genera of Acridinae.

1. Lateral foveolae of vertex small and not visible from above (Fig.5a). ---------- Orphulella, p. 30.

Lateral foveolae of vertex plainly visible from above as linear depressions between the eyes and the apex (Fig. 5b). ---------- 2.

2. Median carina of pronotum low and cut somewhat behind the middle by the principal sulcus. ------Chorthippus, p. 33.

Median carina of pronotum rather high and sharp and cut somewhat in front of the middle by the principal sulcus. ---------- Stethophyma, p. 35.

Orphulella Giglio-Tos, 1894.

Key to N.S. Species of Orphulella.

Pronotum generally with lateral carinae little incurved, about equally separated in front and behind; vertex blunt, central depression extending close to apex; prozona usually slightly longer than metazona (Fig. 6); dorsal valve of aedeagus, in lateral view, more or less constricted at apex, almost pointed. ---------- O. speciosa, p. 30.

Pronotum generally with lateral carinae strongly incurved, more widely separated behind than in front; vertex rectangular to slightly acute, the central depression removed from apex one-third in male, to one-fourth in female, of width of apex; prozona and metazona nearly equal in length or metazona slightly longer; dorsal valve of aedeagus, in lateral view, more or less enlarged or knobbed at apex. ------- (O. pelidna), p. 32.

6. Orphulella speciosa (Scudder), 1862.

Common name - 'Pasture-Locust'.

Original combination - Stenobothrus speciosus.

Orphulella speciosa. Scudder, S., Can. Ent. 31:184, (1899); "Halifax, N. S., Piers".

-- Piers, H., Trans. N.S. Inst. Sci. 14:264-266, (1918); refuted record of Scudder, above.

S. aequalis Scudder, 1862, S. bilileatus Scudder, 1862, S. gracilis Scudder, 1872, Orphulella obliquata Scudder, 1899, O. picturata Scudder, 1899, and Orphula decora McNeill, 1897, are synonyms.

Face very oblique, vertex bluntly rounded, obtuse in female, right-angled in male; lateral foveolae not visible from above; pronotum as in key; tegmina usually reach ends of hind femora, but vary from 3 mm. shorter to 3 mm. longer in females, and 1.5 mm. shorter to 2 mm. longer in males. Color variable, four distinct variations occurring; (a) head, disc of pronotum and tegmina green, (b) head and disc of pronotum green, tegmina rose-red, (c) head and pronotum brown, tegmina rose-red, (d) head, pronotum, and tegmina brown; the green variation is the only one recorded from N.S.; dark line behind eye reaches pronotum along whitish lateral carina; tegmina with a few spots which are sometimes wanting; hind femora greenish or brownish, not banded; hind tibiae dull brown to yellow without a pale ring at the base. Length of body, male 13 - 14, female 16 - 21.

O. speciosa ranges over eastern and central North America. It is very numerous in New England, but scarce in Nova Scotia.

It prefers dry, sandy, or loamy soils, and grassy untilled fields, and is most active during hot weather. It is non-migratory and moves chiefly by leaping.

O. speciosa was reported from Nova Scotia by Scudder, 1899, from a collection by Piers, but was later rejected by Piers, 1918, as in error. Urquhart holds the belief that the error was made in determination, and that the species in question was actually O. pelidna. However, O. speciosa has been taken in Nova Scotia by Urquhart, at Bridgetown, Anna. Co., Aug. 14, 1949, the first definite record. A female specimen taken at Norton, New Brunswick, Aug. 9, 1949, and a damaged specimen from Antigonish, Aug. 7, 1949, are located in the N.S.A.C. insect collection.

7. Orphulella pelidna (Burmeister) 1838.

Common name - 'Spotted-winged Locust'.

Original combination - Gomphocerus pelidnus.

Stenobothrus maculipennis Scudder, 1862, S. propinquans Scudder, 1862, and Orphulella pratorum Scudder, 1899, are synonyms.

This species has not been recorded from Nova Scotia, but Urquhart believes that it almost certainly is present. As noted under O. speciosa, Urquhart believes Scudder's 1899 record should be applied to O. pelidna. There is no previous record of any attempt to search out this species in its normal habitat and it was not found during the present study.

Chorthippus Fieber, 1852.

8. Chorthippus longicornis (Latreille).

Common name - 'Short-winged Brown Locust'.

Stenobothrus curtipennis (Harris). Walker, F., Cat. Derm. Salt. Brit. Mus. 4:754, (1870); Nova Scotia.
-- Walker, F., Can. Ent. 4:31, (1872); Nova Scotia.
-- Piers, H., Trans. N.S. Inst. Sci. 9:213, (1896); Nova Scotia.

Chorthippus curtipennis. Gooderham, C. B., Proc. Ent. Soc. N. S. for 1916:25, 27, (1917); Col., Kings, Hants, Anna., Digby, Yar. and Queens Cos.
-- Piers, H., Trans. N.S. Inst. Sci. 14:266-269; Halifax.

Chorthippus longicornis. Rehn, J. W. H., Can. Ent. 71:176, (1939); Lunen., Shelb., Yar. and Digby Cos.

C. curtipennis (Harris), 1835, Stenobothrus longipennis Scudder, 1862, and S. coloradensis McNeill, 1897, are synonyms.

Foveolae of vertex plainly visible from above as linear depressions; median carina of pronotum not high or sharp, cut somewhat behind the middle, lateral carinae incurved; tegmina of male usually reaching end of abdomen, of female usually covering two-thirds of abdomen, but longer or shorter in each sex; wings slightly shorter than tegmina; hind femora rather slender. Color variable, green, greenish, olive gray, brownish to reddish; lateral carinae of pronotum whitish, with dark line from behind eye crossing it diagonally providing a dark line outside of anterior three-fifths and inside of posterior two-fifths. Body length, male 15, female 18.5.

This insect is common all over the northern United States and Canada in the Canadian and Transition Zones. It is very numerous in New England, and in Nova Scotia it is common throughout. It frequents damp places with thick grasses, dry meadows, and roadsides. It is not considered to be economically important.

The N.S.A.C. collection contains eleven specimens provided by Urquhart: 4 males, 1 female, Sable R., Shelb. Co., Aug. 8;

2 females, Southampton, Cumb. Co., July 25; 1 male, 2 females, N. E. Margaree, Inv. Co., July 26; and 1 male, Woods I., P.E.I., July 24, all in 1949. Since 1950 the following series has been collected and placed in the N.S.A.C. collection: 11 males, 20 females, Kings Co., July 20 - Sept. 10; 2 males, 2 females, Hants Co., Sept. 6 - Oct. 1; 3 males, 4 females, Anna. Co., Oct. 18; 7 males, 18 females, Yar. Co., Aug. 13 - Sept. 29; 1 male, 2 females, Cumb. Co., Aug. 26 - 30; and 1 male, 1 female, Pict. Co., Sept. 18.

Stethophyma Fischer, 1853.

Key to N.S. Species of Stethophyma.

Scapular area of tegmina with a pale yellow streak; intercalary veins of male tegmina with very obscure, low teeth; lateral carinae of pronotum cut by all three sulci in front of middle (Fig. 8a). ---------- S. lineata, p. 36.

Scapular area of tegmina without a pale yellow streak; intercalary veins of male tegmina with minute, sharp, elevated teeth; lateral carinae of pronotum cut only by first and third sulci (Fig. 8b). ---------- S. gracilis, p. 37.

9. Stethophyma lineata (Scudder), 1862.

Common name - 'Striped Sedge Locust'.

Original combination - Arcyptera lineata.

Mecostethus lineatus. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:25, 27, (1917); Kings and Yar. Cos. -- Piers, H., Trans. N.S. Inst. Sci. 14:269-271, (1918); Halifax Co.

Stethophyma lineatum. Rehn, J. W. H., Can. Ent. 71:176, (1939); Digby, Lunen. and Yar. Cos.

F. Walker's Stethophyma variegatus is probably a synonym.

Foveolae of vertex very shallow but visible from above; pronotum with three distinct carinae; the median rather high and sharp, plainly cut somewhat in front of the middle by principal sulcus; lateral carinae distinctly divergent behind; wings and tegmina well developed, surpassing ends of femora by about one-third the length of the tibia. Color generally brownish with yellow markings, tegmina with pale yellow streak; head and pronotum brown, pronotal disc lighter, underparts green; abdomen dark brown on top and sides, light green beneath; pale yellow line from eye across pronotum to join line on tegmina; hind femur olive on outer face, blackish near apex,

with three white spots midway, upper edge brownish, lower edge maroon with two black marks separated by yellow near apex; hind tibia buff, darker near base and apex. Body length, male 26, female 36.

The range is wide, Canadian, Transition, and northern part of Upper Austral Zones, in the northern United States and southern Canada, east of the prairie, east of longitude 100 degrees, and north of latitude 40 degrees. It frequents wet meadows from late July to near the end of October.

It is found in western Nova Scotia but it is rather rare in the rest of the province. Urquhart collected this species in western Nova Scotia; 8 males, 3 females, Sable R., Shelb. Co., Aug. 8, 1949; and 1 female, Grand Lake, Hfx. Co., July 26, 1949. These specimens are in the N.S.A.C. collection as are the following; 1 male, 2 females, Bridgetown, Anna. Co., Aug. 11, 1951; 1 female, Kentville, Kings Co., Sept. 10, 1951; 16 males, 6 females, S. Ohio, Yar. Co., Aug. 13, 1951; 1 male, same location, Sept. 10, 1951; and another male at the same location, Sept. 29, 1953.

10. Stethophyma gracilis (Scudder), 1862.
Common name - 'Graceful Sedge Locust'.
Original combination - Arcyptera gracilis.

Mecostethus gracilis. Piers, H., Trans. N.S. Inst. Sci. 9:215, (1896); Hfx. Co.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 25, 27, (1917); Col., Kings and Yar. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:271-272, (1918) Hfx. Co.

This handsome species resembles S. lineata, but the intercalary vein of the tegmina of male has sharp, elevated, minute, closely set teeth. It is more robust and squat than S. lineata. The pale yellow line of the tegmina is absent. The lower edge of the hind femora is a striking bright red. Body length, male 19-23, female 16.5-21.

The range is about the same as for S. lineata but slightly more northern. It is chiefly confined to the Canadian and Transition Zones. It is quite common in western Nova Scotia from early August to the end of September.

S. gracilis was not taken by Urquhart during his collecting tour of Nova Scotia in 1949. The following specimens are in the N.S.A.C. collection: 7 males, 3 females, Bridgetown, Anna. Co., Aug. 11, 1951; 2 males, Aug. 20, and 1 male, Aug. 27, 1951, at Kentville, Kings Co., 10 males, 2 females, Black Hole,

Kings Co.; Sept. 10, 1951; 1 male, Grafton, Kings Co., Sept. 11, 1952; and 3 males, Kingston, Kings Co., Aug. 10, 1955.

Subfamily Oedipodinae.

This subfamily is based on the type genus Oedipoda Serville, 1831. Its members are characterized by their large size; color dull brown, green or grayish; pronotum short; prosternum not bearing a spine or tubercle; face nearly vertical; median carina of pronotum raised as a crest and cut by one or more transverse sulci; wings usually brightly colored. Winter is passed in the egg stage. Males stridulate while in flight, by rubbing surface of tegmina on upper surface of hind wings.

Key to N.S. Genera of Oedipodinae.

1. Median carina of pronotum notched by only one sulcus (Fig. 7). ---------- 2.

Median carina of pronotum notched by two sulci, the front notch often less distinct than the hind one; hind wings with two or three radial veins greatly enlarged; hind wings yellow

with dark median transverse band widening behind.

---------- Circotettix, p. 46.

2. Disc of hind wing nearly transparent, but not distinctly bordered by black. ---------- 3.

Disc of hind wing opaque, black with yellow border; lateral carinae of pronotum extending only to principal sulcus; disc with few if any tubercles. -------- Dissosteira, p. 44.

3. Disc of pronotum roof-shaped, front margin angulate; hind wings transparent, yellowish at base, remaining two-thirds smoky, paler at apex, dark bar along middle of front margin.

---------- Chortophaga, p. 40.

Disc of pronotum flat, front margin truncate; median carina low, faintly notched by principal sulcus; hind wings transparent with dusky veins. ---------- Camnula, p. 42.

Chortophaga Saussure, 1884.

11. Chortophaga viridifasciata (DeGeer), 1773.

Common name - 'Northern Green-striped Locust'.

Original combination - Acrydium viridifasciata.

Gryllus virginianus Fabr., 1775, Locusta infuscata and L. radiata Harris, 1841, Tomonotus zimmermanni Saussure, 1861, and Stethophyma dorani Goding are synonyms.

Medium sized species, body slim; vertex horizontal and triangular, apex truncate; foveolae very shallow, elongate triangular; frontal costa prominent; joints of antennae short and slightly flattened; disc of pronotum roof-shaped, front margin angulate and projected forward, hind margin acute-angled; median carina not prominent, straight and faintly notched on anterior half; lateral carinae visible only on metazona; tegmina long and narrow, longer than abdomen with apical half membraneous.

Color dimorphic, either brown or green; green form with head, pronotum, basal part of tegmina and outer face of hind femora grass-green, with apical part of tegmina and narrow costal stripe pale brown, and abdomen reddish-brown; brown form with apical halves of tegmina darker; hind tibiae brown with white ring near the base. Body length, males 17-24; females 22-32.

This species is here recorded in Nova Scotia for the first time. It frequents sunny slopes in dry, grassy places.

It is widely distributed over North America east of the Rocky Mountains, south to Georgia, Oklahoma and Texas, and north to Nova Scotia, New England and Ontario. Blatchley, 1920, states that both color phases occur together in Indiana with green females and brown males predominant. Less than twenty percent of the females were brown and much less than twenty percent of the males were green. The series taken during the present study include four green females, three brown females and four brown males: 2 females, West Brook, Cumb. Co., June 23, 1951; same location, 2 males, 2 females, June 20, 1952; 2 males, 1 female, Rodney, Cumb. Co., June 21, 1952; and 2 females, West Brook, June 29, 1953.

Genus Camnula Stal, 1873.

12. Camnula pellucida (Scudder), 1862.

Common name - 'Clear-winged Locust' or 'Roadside Grasshopper'.

Original combination - Oedipoda pellucida.

Camnula pellucida. Piers, H., Trans. N.S. Inst. Sci. 9:214, (1896); Hfx. Co.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 26-27, (1917); Col., Kings, Hants, Anna., Digby, Yar., Queens, Vict., Inv. and Cumb. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:274-277, (1918); Hfx. Co.

-- Rehn, J. W. H., Can. Ent. 71:176, (1939); Col. and Lunen. Cos.

Stenobothrus obiona Thomas, 1871, Oedipoda atrox Scudder, 1872, and Camnula tricarinata Stal are synonyms.

Small species; head compressed, pronotum with disc flat and smooth, much wider behind, truncate in front, median carina low, of equal height throughout, faintly cut by one sulcus in front of the middle; sides of the pronotum deeper than long; tegmina narrow, reaching beyond abdomen. Color generally light brown; dark triangular spot behind eye and dark vertical spot on front half of lateral lobe of pronotum; tegmina smoky brown, light and dark patches on the sides, darker on dorsal surface with a yellowish stripe along humeral angle; inner wings transparent with dark veins; hind femora yellowish brown, darker at apices, and faintly marked with dark bars; tibiae yellowish-brown; abdomen yellowish beneath, sides darker. Body length, males 17 to 21, females approximately 27.

The range of C. pellucida includes the southern part of the Canadian Zone, the Transition, and upper part of the Upper

Austral Zones. It is common throughout southern Canada and northern and western United States. It is found in dry locations, and is common in fence rows and on roadsides. This species is often very injurious to vegetation.

Urquhart has provided the following specimens to the N.S.A.C. collection: 3 males, 4 females, Southampton, Cumb. Co., July 25, 1949; 1 female, Chester, Lunen. Co., July 29, 1949; and 3 males, 2 females, N.E. Margaree, Inv. Co., Aug. 26, 1949. Since then, collections have been made as follows: Truro, Col. Co., 1 female, July, 1949; Kentville, Kings Co., 16 males, 16 females, Aug. 13, 1951; and 1 male, 1 female, Freeport, Long Island, Digby Co., July 29, 1954.

Dissosteira Scudder, 1876.

13. Dissosteira carolina (Linnaeus), 1758.

Common name - 'Carolina Locust'.

Original combination - Gryllus (Locusta) carolina.

Dissosteira carolina. Piers, H., Trans. N.S. Inst. Sci. 9:214, (1896); Nova Scotia.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 26-27, (1917); Col., Kings, Anna., Digby, Yar., Queens, Lunen., Pict. and Cumb. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:278-281, (1918); Hfx. Co.

-- Rehn, J. W. H., Can. Ent. 71:176, (1939); Col., Kings, Hfx. and Yar. Cos.

Disc of pronotum with front margin nearly truncate and hind margin obtuse-angled; median carina high, cut before the middle by a deep narrow notch (Fig. 7), front lobe almost straight, hind one arched; lateral carinae rounded and extending about one-third their length beyond the abdomen. The color is variable, chocolate brown, brown-black, to gray, underside lighter; tegmina brown, clouded, and spotted with darker brown; hind wings dark-brown or black with a pale yellow outer border, the apex smoky with several darker spots; hind femora with inner face light, crossed by three blackish bands, the first nearly covering the basal half; hind tibiae dirty-yellowish. Body length, males 26 to 30, females 34 to 40.

D. carolina ranges throughout the Transition and Upper and Lower Austral Zones, as well as the southern part of the Canadian Zone. It is found from coast to coast in Canada and the United States. It frequents dry, sandy areas such as dusty roads.

Specimens in the N.S.A.C. collection collected by Urquhart in 1949 include: 2 males, Lunenburg, Aug. 2; 1 male, Grand Lake, Hfx. Co., July 26; and 1 male, Pictou, Aug. 22. Other specimens are as follows: Kentville and other Kings Co. points, 21 males, 11 females, July 25 - Sept. 7; 1 female, Bridgetown, Anna. Co., Aug. 11; 1 female Windsor, Hants Co., Oct. 1; 2 females, West R., Pict. Co., Sept. 18; 1 female, Southampton, Cumb. Co., Aug. 25, all in 1951; and 1 female, S. Ohio, Yar. Co., Aug. 21, 1954. Several of the Kings Co. specimens were found dead, clinging to tall grasses, the victims of a fungus disease.

Circotettix Scudder, 1876.

14. Circotettix verruculatus (Kirby), 1837.

Common name - 'Snapper' or 'Cracker Locust'.

Original combination - Locusta verruculata.

Oedipoda rugosa (not of Scudder). Walker, F., Cat. Derm. Salt. Brit. Mus. 4:731, (1870); Nova Scotia.

-- Walker, F., Can. Ent. 4:31, (1872); Nova Scotia.

Oedipoda sulphurea (not of Fabricius). Walker, F., Cat. Derm. Salt. Brit. Mus. 4:729-730, (1870); Nova Scotia.

-- Walker, F., Can. Ent. 4:31, (1872); Nova Scotia.

Circotettix verruculatus. Piers, H., Trans. N.S. Inst.

Sci. 9:214, (1896); Hfx. and Anna. Cos.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 26-27, (1917); Col., Kings, Hants, Yar. and Queens Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:281-285, (1918); Antig. and Hfx. Cos.

-- Rehn, J. W. H., Can. Ent. 71:177, (1939); Col., Hfx. and Lunen. Cos.

Locusta latipennis Harris, 1841, is a synonym.

Pronotum flattened on top, right angled to acute angled behind; median carina elevated in front and notched by two sulci before the middle, the front notch usually less distinct; wings and tegmina about as long as total body length; hind wings with three enlarged radial veins. The color is variable, usually blackish above, with underparts brown; tegmina grayish to brownish-gray, blotched with black; hind wings semitransparent, pale yellow on basal half, followed by a blackish band, then by a semi-clear area with blackish veins; some radial veins deep yellow at bases, costal margin dusky; hind femora grayish with four blackish bands; eyes black or black spotted with gray. Body length, males 24 to 25, females 25 to 28.

Its range is very wide and more northern than D. carolina. It is found in the Canadian and Transition Zones, and in elevated parts of the Upper Austral Zone. It prefers dry sandy areas.

Specimens collected by Urquhart include the following: 2 males, Sable R., Shelb. Co., Aug. 8, 1949; and 1 male, N.E. Margaree, Inv. Co., Aug. 26, 1949. Subsequent collections are: 1 female, Baddeck, Vict. Co., Aug. 5, 1951; 2 males, 1 female, N. Alton, Kings Co., Aug. 5, 1951; 3 males, 1 female, Kingston, Kings Co., Aug. 4, 1952; 1 male, Debert, Col. Co., Sept. 6, 1951; 1 male, Truro, Col. Co., Aug. 29, 1952; and 1 male, West Brook, Cumb. Co., Sept. 7, 1954.

Subfamily Crytacanthacrinae.

This subfamily is based upon the genus Crytacanthacris, and has been called Locustinae by some authors and Acridinae by others. It is characterized by the fact that all its members bear a prominent conical spine or tubercle between the prothoracic legs; pronotum generally short, disc not wrinkled or bearing tubercles, hind margin broadly rounded, never acute-angled; tegmina usually well developed; color variable.

Included in this subfamily are the most injurious species of Orthoptera. Winter is passed in the egg stage; nymphs hatch in early summer, and adults are present from July to the end of October. They stridulate only rarely, and then only while at rest, by rubbing the serrated, lower inner surface of the hind femora against veins on the outer surface of the tegmina.

Key to N.S. Genera of Crytacanthacrinae.

Tegmina wanting; space between mesosternal lobes distinctly broader than long, as broad or nearly as broad as the lobes themselves; prosternal spine short and conical.

---------- Zubovskya, p. 49.

Tegmina present, usually well developed, sometimes short, but never wanting; space between mesosternal lobes generally longer than broad (Fig. 9). ---------- Melanoplus, p. 51.

Zubovskya Dovnar-Zapolskij, 1933.

This genus is one of a group into which the old genus Podisma of Latreille, 1829, was recently divided. All Canadian species which were known under Podisma fall into the new genus Zubovskya.

15. Zubovskya glacialis (Scudder), 1863.

Common name - 'Wingless Mountain Locust'.

Original combination - Pezotettix glacialis.

Podisma glacialis. Piers, H., Trans. N.S. Inst. Sci. 14:286-288, (1918); (Hypothetical, not reported).

This insect was long known in North America as Podisma glacialis. Pezotettix borealis Glover is a synonym.

Wingless, medium to small species; prozona nearly twice as long as metazona, pronotum smooth, lateral carinae usually wanting, median carina evident, but low, cut by three transverse sulci in male, by hind one only in female; sulci deep on lateral lobes, front one short; prosternal spine short, stout, with bluntly rounded tip; interspace between mesosternal lobes of males as wide as the lobes, of female nearly twice as long; abdomen of female compressed, carinate, of male subcylindrical, upcurved; vertex between the eyes as broad in male, or twice as broad in female as first antennal joint; face distinctly but not strongly oblique; male supra-anal plate long, triangular, acute at tip, sides sinuous, median sulcus deep; furcula of male slender, subparallel; cerci stout, erect, feebly tapering above broad basal third, tips oblique; upper margin of subgenital plate broadly rounded, truncate, but with slight median

notch, tubercle below upper margin broad, prominent. Color dark, greenish above, greenish-yellow beneath, sparsely clothed with erect hairs; head greenish-yellow, often with dark streak on face; mouthparts pale; pronotum dark green, shining black stripe from eye to abdomen, faint on metazona and abdomen; inner and lower faces of hind femora coral red; hind tibiae bluish-green, spines black at tips, cerci black. Body length, male 15 - 17.5, female 19 - 28.

This species is mainly subalpine. It has been recorded from Quebec, Prince Edward Island, New England, New York and Pennsylvania. It was taken in Nova Scotia by Dr. C. E. Atwood (as reported by Urquhart in correspondence). It frequents patches of alders and dwarf birch in heavily wooded areas. In Ontario and Manitoba the race Z. g. canadensis is recorded, but specimens from the Maritime Provinces appear to be typical Z. glacialis. No specimens were captured during the present study.

Melanoplus Stal, 1873.

Key to N.S. Species of Melanoplus (Males).

1. Tegmina about the same length as the abdomen or slightly longer. ---------- 2.

Tegmina much shorter, covering two-thirds or more of the abdomen, lanceolate; cerci slightly expanded at base, middle little narrower than the base (Fig. 12e).

---------- M. fasciatus, p. 55.

2. Cerci either equal in breadth or tapering beyond the middle, tip slender or acuminate, never forked.

---------- 3.

Cerci with apex expanded, broader beyond the middle, tip spatulate, subspatulate or forked.

---------- 5.

3. Apex of subgenital plate elevated with small but distinct median notch (Fig. 11b); cerci short nearly equally broad throughout, not longer than twice middle breadth (Fig. 12b); prosternal tubercle conical, tapering (Fig. 10b).

---------- M. mexicanus, p. 57.

Apex of subgenital plate not notched (Fig. 11a); cerci at least three times as long as middle breadth, apical half may be tapering. ---------- 4.

4. Hind tibiae bright red; apical half of cerci much less

than half as broad as extreme base (Fig. 12d); prosternal tubercle cyclindrical, rounded at tip (Fig. 10a).

---------- M. femur-rubrum, p. 59.

Hind tibia pale red to yellowish; apical half of cerci distinctly more than half as broad as extreme base (Fig. 12a).

---------- M. borealis junius, p. 61.

5. Size large (more than 25mm.); cerci with apical half much enlarged but never distinctly forked (Fig. 12f); pronotum with light colored lateral stripes along margin of disc and continued along tegmina. ---------- M. bivittatus, p. 63.

Size smaller (less than 20 mm.); cerci distinctly forked (Fig. 12c), forks nearly equally distant.

---------- M. keeleri luridus, p. 66.

Key to N.S. Species of Melanoplus (Females).

1. Large, robust; hind femora 15 mm. or more (usually 17mm.); two distinct yellow stripes on head, pronotum and tegmina.

---------- M. bivittatus, p. 63.

Smaller; hind femora not over 15mm.; yellow stripes, as above, lacking. ---------- 2.

2. Dovetailing interspace between mesosternal lobes longitudinal or quadrate; tegmina usually passing hind femora; prozona not swollen. ---------- 3.

Dovetailing interspace between mesosternal lobes subquadrate or distinctly transverse; tegmina not longer than hind femora; prozona swollen. ---------- 4.

3. Prosternal tubercle nearly cylindrical; tip bluntly rounded (Fig. 10a); cerci one and one-half to twice as long as greatest width, sharply pointed, somewhat acuminate, the converging sides slightly concave.

---------- M. femur-rubrum, p. 59.

Prosternal tubercle tapering, tip pointed (Fig. 10b); cerci short, only about one and one-third times as long as greatest width, rather blunt at tip, converging sides straight or convex. ---------- M. mexicanus, p. 57.

4. Tegmina about reaching end of hind femora.

---------- M. keeleri luridus, p. 66.

Tegmina shorter, covering only about one-half to two-thirds of the abdomen. (Some long-winged variants are exceptions). ---------- 5.

5. Dull grayish brown above, clay yellow below.

---------- M. fasciatus, p. 55.

Dull greenish yellow, tinged with fuscous.

--------- M. borealis junius, p. 61.

16. Melanoplus fasciatus (F. Walker), 1870.

Common name - 'Huckleberry Locust'.

Original combination - Caloptenus fasciatus.

Melanoplus fasciatus. Piers, H., Trans. N.S. Inst. Sci. 14:296-297, (1918); (Hypothetical; not reported).

-- Rehn, J. W. H., Can. Ent. 71:177, (1939); Yar. Co.

Melanoplus rectus Scudder, 1878, M. curtus Scudder, 1879, and M. baconi McNeill, 1899, are synonyms, and the Pezotettix borealis of some authors should also be referred to this species.

Size small, sexes nearly equal; robust; occiput elevated above pronotum; interocular space as broad in male, nearly twice as broad in female, as basal joint of antennae; frontal costa as broad as interocular space, feebly sulcate below ocellus in male, and slightly concave around it in female; pronotum expands feebly on metazona, disc rounded on prozona, flat on metazona, hind margin broadly rounded or obtuse-angled

median carina distinct only on metazona, faint on parts of prozona; tegmina usually covering two-thirds in female, or three-quarters in male, of abdomen; male cerci straight, four times as long as broad, middle third slightly narrowed, apical third concave with tip rounded and incurved; supra-anal plate broad, triangular, apex subacute, margins elevated, median ridges extending from base three-quarters of way to apex, uniting with a cross carina at apical third; furcula minute, widely separated, lying outside the median ridges; subgenital plate longer than broad, apical margin rounded, feebly elevated at middle. Color dull grayish-brown or reddish-brown above, clay yellow below; male darker than female; black band behind eye extending to metazona, bordered below by greenish-yellow; tegmina dull red-brown; hind femora dull yellowish-brown with two broad blackish bars; hind tibiae red to pale green, lighter ring near base, spines black. Body length, male 17-19.5, female 20-23.

This species ranges from northern Labrador to New Jersey and west nearly across the continent. It is primarily boreal, having its southern limit at 40 degrees north latitude. It is found in dry, open woods on sandy or rocky soil.

Piers, 1918, did not record this species; it was first

reported in Nova Scotia by Rehn, 1939, by a single female taken by Bayard Long in Yar. Co. on "bog barrens back of Goose Lake, Lower Argyle, Aug. 11, 1920". This remained the sole record until 1953 when I found a single male together with M. keeleri luridus and a few M. femur-rubrum on Oct. 27, while hunting deer at West Brook, Cumb. Co. The type of the locality is very different from the Argyle barrens, as it is on rather high ground, near the edge of a heavily forested area. The presence of blueberry bushes (Vaccinium spp.) is the only feature common to both sites.

17. Melanoplus mexicanus (Saussure), 1861.
Common name - 'Lesser Migratory Locust'.
Original combination - Pezotettix mexicanus.

Melanoplus atlanis (Riley). Scudder, S. H., 26 Ann. Rpt. Ent. Soc. Ont.:64, (1894); Nova Scotia.
-- Piers, H., Trans. N.S. Inst. Sci. 9:215, (1896); Hfx. Co. and Sable I.
-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 24, 27, (1917); Col., Cumb., Kings, Hants, Anna., Digby, Yar., Queens, Pict., Vict. and Inv. Cos.
-- Piers, H., Trans. N.S. Inst. Sci. 14:290-296, (1918); Hfx. Co.

Melanoplus mexicanus. Rehn, J. W. H., Can. Ent. 71:177, (1939); Col., Yar., Shelb. Cos., and Sable I.

Prosternal spine tapering, tip pointed; tegmina much longer than abdomen (one-quarter or more beyond the tip); apex of subgenital plate of male with small but distinct median notch; male cerci short and nearly equally broad throughout, rounded at ends, length less than or equal to twice middle breadth. Color similar to M. femur-rubrum, variable, upper parts dark grayish-brown; under surface of abdomen yellowish; face light green; mouthparts light; blackish band from behind eye to lateral part of prozona; tegmina grayish-brown, distinctly sprinkled with fuscous along median area; hind femora dirty yellowish-brown, or slightly reddish-yellow, with two oblique blackish bars across the upper and outer faces; hind tibiae dull burnt red. Body length, male 17-21, female, 16-27.

The range is very wide, from the Canadian to the upper part of the Lower Austral Zone, approximately the same as M. femur-rubrum. Urquhart collected this species in 1949 and specimens collected by him bearing the following data are in the N.S.A.C. insect collection: 4 males, 5 females, Sable R., Shelb. Co., Aug. 8; 2 males, Windsor. Hants Co., Aug. 13; and 2 males, 2 females, N.E. Margaree, Inv. Co., Aug. 26. Subsequent collections, all made during 1951, include: 1 male,

1 female, Kentville, Kings Co., July 17 and 21, and 37 others from Kings Co., July 10 to Oct. 18; 1 male, 3 females, Paradise, Anna. Co., Aug. 21; 3 males, 4 females, S. Ohio, Yar. Co., Aug. 13; 1 female, West R. Pict. Co., Aug. 21; and 1 male, West Brook, Cumb. Co., June 23.

This species, M. femur-rubrum, and Camnula pellucida are the most common species of Acrididae found in Nova Scotia.

18. Melanoplus femur-rubrum (DeGeer), 1773.

Common name - 'Red-legged Locust'.

Original combination - Acridium femur-rubrum.

Caloptenus femur-rubrum. Walker, F., Cat. Derm. Salt. Brit. Mus., 4:678, (1870); Nova Scotia.

-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.

Melanoplus femur-rubrum. Piers, H., Trans. N.S. Inst. Sci. 9:215, (1896); Halifax and Windsor, Hants Co.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916: 24-27, (1917); Col., Cumb., Kings, Hants, Anna., Digby, Yar., Queens, Pict., Vict. and Inv. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:297-301, (1918); Lunen. Co.

-- Rehn, J. W. H., Can. Ent. 71:177, (1939); Hfx. and Shelb. Cos.

Caloptenus devorator Scudder, 1875, Melanoplus interior Scudder, 1879, and Caloptenus sanguinolentus Provancher, 1873, are synonyms.

Prosternal spine nearly cylindrical, tip bluntly rounded; tegmina somewhat longer than abdomen; apex of male subgenital plate not notched; male cerci at least three times as long as middle breadth, apical half less than half as broad as its extreme base (broad and tapering). Color variable; usually brownish above; greenish-gray on front and sides of head and thorax; sides and underparts, dirty white or grayish-yellow line on side of thorax from insertion of tegmen to insertion of hind leg; broad black bar from behind eye extends on lateral part of pronotum; tegmina brown, usually spotted with fuscous along basal and median area; hind femora brown with two fuscous bars on upper edge, lower edge yellowish with pale red on outer part, joint black; hind tibiae bright red with black spines. Body length, male 16-23, female 18-28.

The range is very wide, from the Canadian to the Upper part of the Lower Austral Zone. It is very common in Nova Scotia, and is most numerous on dykes, dry meadows, etc.

Urquhart provided the following specimens from his

collections in Nova Scotia: 1 male, Chester, Lunen. Co., July 29; 1 male, Sable R., Shelb. Co., Aug. 8; 1 male, Pictou, Aug. 22; 3 males, N.E. Margaree, Inv. Co., Aug.26; and 1 female, Woods I., P.E.I., Aug. 24, 1949. Other specimens are as follows: 8 males, 3 females, S. Ohio, Yar Co., Sept. 28, 1951; 1 female, Bridgetown, Anna. Co., Aug. 11, 1951; 1 male, 1 female, Paradise, Anna. Co., Oct. 18, 1951; 1 male, 1 female, Kentville, Kings Co., Aug. 21, 1951 and 12 males, 16 females from Kings Co. points, July 16 to Oct. 11, 1951 and 1952; 1 male, 1 female, Windsor, Hants Co., Oct. 1, 1951; 1 male, 2 females, Rawdon, Hants Co., Sept. 18, 1952; 1 male, 1 female, Truro, Col. Co., Sept. 3, 1951; 1 female, West Brook, Cumb. Co., Sept. 7, 1954. This species was also taken at West Brook as late in the season as Oct. 27, 1953, but at present these specimens have evidently been mislaid.

19. Melanoplus borealis junius Dodge, 1876.

Common name - 'Northern Locust'.

Original combination - Pezotettix junius.

Melanoplus extremus (F. Walker). Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:24,27, (1917); Col. and Kings Cos.

-- Piers, H., Trans. N. S. Inst. Sci. 14:301-302;

reported N.S. specimens to be M. extremus junius (Dodge); Col. and Kings Cos.

For many years M. borealis (Fieb.), 1853, was known as Melanoplus extremus F. Walker, 1870. Pezotettix septrionalis Saussure, 1861, Caloptenus arcticus F. Walker, 1870, and Caloptenus parvus Provancher, 1876, are also synonyms. All specimens taken in Nova Scotia are M. borealis junius (Dodge), the short-winged form.

The short-winged form has the tegmina not reaching tips of hind femora, generally about 11 mm. long and reaching to the tip of the abdomen in males and covering one-half to three-quarters in the female; bluntly subacuminate at apex. The long-winged form has the tegmina surpassing the tips of the hind femora, generally considerably longer (up to 17 mm. long), rather broadly rounded at apex.

In the short-winged form the wings are much shorter that the tegmina and in the long-winged form they are very little shorter; apex of male subgenital plate without a median notch; male cerci short and broad, apical half distinctly more than half as broad as extreme base, gently curved, well rounded at tip; furcula parallel, tapering cylindrical spines, about half

as long as supra-anal plate. Color dark greenish-yellow; black bar behind eye extending on prozona; pronotum olive-brown above, greenish-yellow on sides; tegmina olive-brown, sometimes with a few dark spots on median area; hind femora yellowish, tinged with red-brown, lower face light orange; hind tibiae reddish or yellowish with black spines. Body length, male 16-24, female, 19-28.

The range includes much of Canada and the northern part of the United States. It is a boreal species confined to the Hudsonian, Canadian and Transition Zones. It is not common in Nova Scotia.

Urquhart took this species in Nova Scotia but the specimens he sent to the N.S.A.C. collection, all labelled Melanoplus borealis, were collected in Ontario. I have taken the following series: 3 males, 4 females, Kentville, July 10 - Aug. 6, 1951 and 1952; 8 males, 4 females, Aylesford Lake, Kings Co., July 8, 1952; 1 female, July 3, 1952, and 1 male, Aug. 11, 1954, at Woodville, Kings Co.; and 1 female, Truro, Aug. 10, 1952.

20. Melanoplus bivittatus (Say), 1825.
Common name - 'Two-striped Locust'.
Original combination - Gryllus bivittatus.

Caloptenus bivittatus. Walker, F., Cat. Derm. Salt. Brit. Mus. 4:678, (1870); Nova Scotia.

-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.

Melanoplus femoratus. Piers, H., Trans. N.S. Inst. Sci. 9:218, (1896); Hfx. Co.

Melanoplus bivittatus. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1916:24,27, (1917); Col., Kings, Hants, Anna., Yar., Queens, Vict. and Inv. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:303-307, (1918); Pict. and Lunen. Cos.

-- Rehn, J. W. H., Can. Ent. 71:177, (1939); Col., Hfx. and Yar. Cos.

Melanoplus femoratus (Burmeister), 1838, is the most common synonym. It has also been known by the combination Caloptenus femoratus, and Caloptenus bivittatus, and as the synonym Acridium milberti Serville, 1839.

Largest of genus in Nova Scotia; tegmina reach or slightly pass hind femora, sometimes slightly shorter in female; cerci of male large, wide, with apical half expanded but not forked, somewhat bootshaped with wide toe and distinct but small heel; furcula short, swollen, triangular. The red-legged phase is found in Nova Scotia. Color above bright apple-green, underparts

yellowish; distinct yellow line extends from upper part of eye along lateral angle of pronotum, and along anal vein of tegmen to its extremity; bordered below by a wider black band on head and pronotum, widest on prozona; diagonal yellow line extends from insertion of tegmen to insertion of hind leg; hind femora greenish-black on upper half of outer face to darker at tibial joint; outer face margined with yellow; hind tibiae poppy-red, dusky at base, spines black. Body length, male, 26.5-28, female, 31-35 (Some up to 40).

The range covers the area from the Northern Canadian Zone to the Upper Austral Zone, and from Atlantic to Pacific. This species is often destructive, causing damage to grasses and grain crops.

Urquhart provided specimens bearing the following data: 1 male, 2 females, Sable R., Shelb. Co., Aug. 8, 1949; 1 male, Chester, Lunen. Co., July 29, 1949. Other specimens include: Kentville, 1 male, July 17, 1 male, Aug. 17, 1 male, 1 female, Aug. 27, 1951; 3 males, 2 females, S. Ohio, Yar. Co., Aug. 13, 1951; 2 females, West R., Pict. Co.; 1 female, Black Hole, Kings Co., Sept. 10, 1951; and others including five pairs in copula, July - Aug., 1948 - 1952, from Kings Co. points.

21. Melanoplus keeleri luridus (Dodge), 1876.

Original combination - Caloptenus luridus.

Melanoplus luridus is now considered to be a variety of M. keeleri Thom., 1894. M. tenebrosus Scudder, 1879, and M. collinus Scudder, 1878, are synonyms.

Rather small in size, head not prominent; tegmina reaching or slightly surpassing tips of hind femora, narrow and gently tapering; prosternal spine short, conical, blunt and erect; male cerci distinctly forked, branches nearly equally distant; furcula minute triangular lobes. Color generally brownish fuscous and rusty brown; fuscous post-ocular band narrow and confined to prozona; hind femora with outer face yellowish-brown, dorsal area blackish-fuscous broken by three yellowish spots which suffuse the whole inner face; lower face bright orange; hind tibiae coral red with narrow fuscous basal annulus, tibial spines black on apical half. Body length, male, 19, female, 27.

The range covers the north-eastern part of the United States and north into Ontario. As it is present in Nova Scotia it undoubtedly occurs in New Brunswick although it has not been reported there. The collection of this species during

the present study constitutes the first record for Nova Scotia. Piers, 1918, indicated the possibility thet this species might be found in this province. The series of 18 specimens was collected at West Brook, Cumb. Co.: 3 males and 3 females, Oct. 27, 1953; 5 males and 7 females, Sept. 7, 1954. Collections made a few miles away from this location did not include this species so the distribution is apparently quite locallized.

FAMILY TETTIGONIIDAE

This is the Locustidae of earlier authors, an erroneous use of the name based upon misapplication of the genus Locusta of Linnaeus. It has also been called Phasgonuridae, and it is possible that this name will take precedence when the situation has been elucidated.

It is characterized by the long bristle-shaped antennae, much longer than the body; four-jointed tarsi; tegmina held sloping, meeting in an acute ridge over the body; ovipositor generally like a sword-shaped blade, tip not expanded; stridulating organs, when present, situated just behind the pronotum at base of the overlapping dorsal area of tegmina. Stridulation is brought about by parting the tegmina and bringing them together again, a vein of the upper surface of the tegmen

rasping against teeth of the organ. Winter is passed in the egg stage. The method of oviposition varies in the different groups.

Key to N.S. Subfamilies of Tettigoniidae.

1. Tegmina and wings present; general color green, rarely pale brown; fore tibiae always bearing auditory organ near proximal end. ---------- 2.

Tegmina and wings absent, or the former rudimentary; general color gray or brown; auditory organ lacking. ---------- 4.

2. Prosternal spines absent; vertex ending in a blunt spine or rounded, never projecting as a tubercle or cone; tegmina broad and leaf-shaped, shorter than wings; hind tibiae with an apical spur on each side. ---------- Phaneropterinae, p. 69.

Prosternal spines present (Fig. 19); vertex ending in a sharp, flat spine or produced into a projecting tubercle or cone; hind tibiae with no apical spines, or spine only on outer side. ---------- 3.

3. Vertex ending in a long, usually sharp cone (Fig. 18b); large, robust (24 mm. or more in length); front and middle femora spined beneath. ---------- Copiphorinae, p. 80.

Vertex ending in a rounded tubercle with concave sides (Fig. 18a); smaller, more slender (less than 24 mm. in length); front and middle femora without spines beneath.

---------- Conocephalinae, p. 82.

4. Pronotum short, not covering whole top of thorax; prosternal spines absent; eyes subrotund, situated partly above basal antennal joint; ovipositor nearly straight; tarsi compressed, joints not lobed.

---------- Rhaphidophorinae, p. 87.

Subfamily Phaneropterinae.

The members of this group live chiefly in bushes and small trees. They are solitary and slow moving, blending extremely well with their environment. Because of this some species which are quite numerous are seldom seen. Eggs are glued in double rows to the outer surface of slender twigs, or are inserted in the edges of leaves. The ovipositor is broad, curved, and obtuse at the apex. Stridulation notes

are harsh and rasping, and are heard chiefly at night.

Three species of Scudderia are found in Nova Scotia, and a fourth may be present. One species of the genus Amblycorypha may also be found eventually.

Key to N.S. Genera of Phaneropterinae.

Tegmina long and narrow, very little broader at the middle than at apex; fastigium of vertex horizontal or very feebly deflexed, little if any wider than basal joint of antennae (Fig. 17a); ovipositor short and broad, usually sharply curved upward, apical third finely crenate on both margins. ---------- Scudderia, p. 71.

Tegmina broad, distinctly wider at middle than at extreme apex; fastigium of vertex deflexed to nearly same plane as frontal fastigium, obtuse, usually twice or more than twice as wide as basal antennal joint (Fig. 17b); ovipositor long, gradually curved, usually strongly serrate on both edges, apex rounded. ---------- Amblycorypha, p. 80.

Scudderia Stal, 1873.

Key to N.S. Species of Scudderia (Males).

1. Notch of supra-anal spine (decurved, dorsal abdominal process) with a small median tooth or projection; lateral flanges strongly compressed (Fig. 15a, 16a).

---------- S. texensis, p. 73.

Notch of supra-anal spine without median tooth.

---------- 2.

2. Notch of supra-anal spine rather shallow and V-shaped, the branches of the fork not swollen. ---------- 3.

Notch of supra-anal spine very deep, well rounded or U-shaped, each branch of fork much swollen (Fig. 15d, 16d).

---------- S. furcata, p. 78.

3. Ends of branches of supra-anal spine gently tapering (Fig. 15b, 16b); tegmina broad (over 8mm.), and short, not more than four times as long as wide.

---------- S. pistillata, p. 73.

Ends of branches of supra-anal spine subequal in width when viewed from above (Fig. 15c, 16c); tegmina narrower (under 8 mm.), and longer, nearly five times as long as broad.

---------- S. curvicauda borealis, p. 76.

Key to N. S. Species of Scudderia (Females).

1. Disc of pronotum with sides nearly parallel (Fig. 13a, also see Fig. 14d). ---------- S. furcata, p. 78.

Disc of pronotum with sides distinctly widening posteriorly (Fig. 13b). ---------- 2.

2. Ovipositor suddenly and strongly bent upward, its base distinctly broader than the middle (Fig. 14a).

---------- S. texensis, p. 73.

Ovipositor less suddenly bent upward, and not wider at base than at middle. ---------- 3.

3. Tegmina relatively broad, over 8 mm., proportion - width:length - 1:3; eyes small (Fig. 14b).

---------- S. pistillata, p. 73.

Tegmina relatively narrow, under 8 mm.; proportion-width: length - 1:4½; eyes large (Fig. 14c).

---------- S. curvicauda borealis, p. 76.

22. Scudderia texensis Saussure and Pictet, 1897.

Common name - 'Texan Bush-katydid'.

Prior to 1898, this insect, according to Blatchley, 1920, was confused with S. curvicauda. Its name does not suit its extremely wide distribution.

This species has not been recorded from Nova Scotia, but may occur in this province. If so, it is undoubtedly rare and with distribution closely confined to small areas.

23. Scudderia pistillata Brunner, 1878.

Common name - 'Broad-winged Bush-katydid'.

?Phaneroptera curvicauda (Not of DeGeer). Walker, F., Cat. Derm. Salt. Brit. Mus. 2:335, (1869); United States.

-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.

Scudderia pistillata. Piers, H., Trans. N.S. Inst. Sci.

9:211, (1896); Hfx. and Anna. Cos.

-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1917: 26-28, 36, (1918); Col., Hants, Digby and Yar. Cos.

-- Rehn, J. W. H., Can. Ent. 71:177, (1939); Kings Co.

Disc of pronotum distinctly broader posteriorly than anteriorly; tegmina broad and leaf-like, only three times as long as broad; supra-anal spine of male forked, the apical notch acute and shallow without a median tooth, and narrower than the upturned sub-anal spine; lateral flanges of notch subtriangular and distinctly tapering toward their ends, viewed from above; undersides of processes bearing small vertical longitudinal flanges or keels; hind femur of male 21 mm., of female 20 mm. Color, pale apple-green above, whitish green below; antennae brownish, greenish basally; vertex of head white; dorso-lateral angle of pronotum with cream stripe; abdomen green; annular stripes of brighter on darker green on posterior margins of abdominal segments; two longitudinal raised white lines on ventral abdominal surface. Body length, male 19-23.5, female 19-22.

The range includes the area from the southern part of the Canadian Zone to the northern part of the Upper Austral Zone, northern United States and southern Canada, east of the prairie.

This species is very common in Nova Scotia, much the most numerous of any species of Scudderia.

One specimen collected by Urquhart, a male, Sable R., Shelb. Co., Aug. 8, 1949, is in the N.S.A.C. collection. All other specimens, with one exception are from Kings Co.: Kentville - 1 male, July 14, 1949; 2 males, 1 female nymph, July 25, 1952; 1 male, Aug. 1, 1948; 1 male, Aug. 1, 1953; 1 male, Aug. 13, 1954; 2 males, Aug. 13, 1953; 1 female nymph, Aug. 13, 1954; 2 males, Aug. 26, 1952; 2 males, Aug. 27, 1952; and 1 male, Sept. 10, 1951; 2 males, Waterville, Kings Co., Sept. 9, 1951; 13 males, 1 female, Berwick, Kings Co., Aug. 28, 1952; 7 males, 2 females, Berwick, Sept. 11, 1952; 6 males, 1 female, Millville, Kings Co., Aug. 10, 1955; and 1 male, Truro, Col. Co., Aug. 19, 1949.

S. pistillata is common on bushes, mainly alders, in swampy locations. The loud stridulations of the males at dusk and after dark, on August nights, is a familiar sound in Nova Scotia. During the day males sometimes produce a short sharp 'zik' sound, but at night they call frequently producing a series of irregularly timed 'zik' sounds, followed by a long, drawn out 'cr-r-r-r-r-r-rick, cr-r-r-r--r-rick', which is repeated several times. These nocturnal stridulations are

described by Piers as "rasping, ear-piercing notes".

24. Scudderia curvicauda borealis Rehn and Hebard, 1914.
Common name - 'Curve-tailed Bush-katydid'.

Scudderia curvicauda borealis. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1917:28, 29, (1918); Kings, Anna. and Yar. Cos.
-- Piers, H., Trans. N.S. Inst. Sci. 14:317-320, (1918); as Gooderham above.
-- Rehn, J. W. H., Can. Ent. 71:178, (1939); Shelb. Co.

Phaneroptera curvicauda Burm., 1838, and P. angustifolia Harris, 1841, are a combination and a synonym of S. curvicauda (DeGeer), 1773. Blatchley, 1893, misidentified this species as Scudderia furculata. Rehn and Hebard (1914) established the race S. c. borealis for small northern individuals.

This species somewhat resembles S. pistillata, but is distinguished by features as given in the keys; narrow tegmina, larger eyes, somewhat longer hind femora (20 to 22.5 mm. as compared with 20 to 21 mm. in S. pistillata); smaller tympanal area on male tegmina, and subequal width of branches of fork of male supra-anal spines. Color generally uniform green;

lateral angles of pronotum weakly outlined in brownish-white. Body length, male 18-22, female, 18-20.

The race S. c. borealis R. and H., 1914, is generally considered to be represented in Nova Scotia, rather than typical S. c. curvicauda. The race S. c. borealis is typically northern in distribution, found in the Canadian Zone. It is smaller and more compact than typical curvicauda. Blatchley, 1920, doubts the justification of recognizing the race borealis solely on the basis of the smaller size and broad, short tegmina, but despite this the use of the racial name has become widespread.

Scudder, 1893, reports this species more noisy by night than by day, the note of daylight hours being 'bzrwi' lasting for one-third of a second. At night the note sounds like 'tchw' and is given about eight times in quick succession.

This species is not nearly as common as S. pistillata but appears to be widely distributed in Nova Scotia.

Urquhart collected one male and one female at Sable R., Shelb. Co., Aug. 8, 1949. Other specimens at hand are as

follows: 2 males, Kentville, Kings Co., Aug. 5, 1949; 2 females, Kentville, Aug. 31, 1948; 1 male, Waterville, Kings Co., Aug. 9, 1951; 1 female, Canard, Kings Co., Sept. 4, 1953; 1 female, Stellarton, Pict. Co., Oct. 12, 1950.

25. Scudderia furcata Brunner, 1878.

Common name - 'Fork-tailed Bush-katydid'.

?Phylloptera myrtifolia (not of Serville). Walker, F., Cat. Derm. Salt. Brit. Mus. 2:376, (1869); Canada.
-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.
Scudderia furcata. Gooderham, C. B., Proc. Ent. Soc. for 1917:28, 30, (1918); Hfx. Co. (Piers).
-- Piers, H., Trans. N.S. Inst. Sci. 14:320-323, (1918); Hfx. Co.

This species was misidentified by Blatchley, 1893, as S. angustifolia and by Riley, 1874, as Phaneroptera curvicauda, according to Blatchley, 1920. Blatchley also considers Scudderia fasciata Beutenmuller, 1894, to be a synonym, but Hebard, 1945, considers this as a distinct species.

Disc of pronotum with sides nearly parallel; tegmina narrow, proportions width to length, 1:4½ in males; 1:4 5/8

in females; supra-anal spine of male deeply forked, apical notch deep and U-shaped, without a median tooth, lateral processes decidely swollen, broadest at the base; and not much longer than broad; hind femora 17.5 to 22 mm. Color dark leaf-green, occasionally more or less suffused with brown; head and pronotum paler, lateral outlines of pronotum not outlined with yellowish. Body length, male, 14-18, female, 18-22.

S. furcata, according to Allard, 1911, calls less often at night than during the afternoons. It calls only at long and irregular intervals, and then produces a single keen 'zeep', or three slowly in succession, 'zeep-zeep-zeep'.

This species is of more generally southern distribution than the other species common to Nova Scotia. It is found in southern Canada and in most of the United States, east of the prairie, from Nova Scotia to Florida and west to Texas, Nebraska, South Dakota, and Ontario.

S. furcata is rather scarce in Nova Scotia but is found around Minas Basin. Urquhart presumably collected this species here but the specimens he sent to the collection were taken in Ontario. We have the following series: 1 male, Berwick,

Kings Co., Sept. 18, 1952; from Kentville, 1 male Aug., 1949, 1 male, 2 females, Aug. 24, 1948, 1 male, Aug. 26, 1952, 1 male, Oct. 10, 1948, 1 male, Oct. 14, 1946; 2 males, Rawdon, Hants Co., Sept. 18, 1952; 1 male, Onslow, Col. Co., Oct. 2, 1951.

Amblycorpha Stal, 1873.

26. Amblycorypha oblongifolia (DeGeer), 1773.
Common name - 'Oblong-winged katydid'.
Original combination - Locusta oblongifolia.

Amblycorypha scudderae Bruner, 1891, and A. sausseri Bruner, 1886, are synonyms.

This species has not been recorded from Nova Scotia, but may occur. It was not taken during the present study.

Subfamily Copiphorinae.

This subfamily contains rather large elongate species; vertex of the head terminating in a spine, often with a ventral tooth-like projection; antennae long; ovipositor long, straight, slender and sharp-pointed. The males stridulate like the katydids. The eggs are laid in plant material.

Neoconocephalus Karney, 1907.

27. Neoconocephalus ensiger (Harris), 1841.
Common name - 'The Sword-bearer'.
Original combination - Conocephalus ensiger.

Conocephalus attenuatus Scudder, 1872, is a synonym.

Generally elongated, slender; fastigium slender, slightly constricted in front of the eyes, narrowed from the middle forward, tooth projecting downward from front of base; pronotum with lateral carinae feebly divergent, disc finely punctate; humeral sinus shallow, very broadly rounded; tegmina narrow and much longer than the body; stridulating vein of male long and feebly swollen; female ovipositor long, straight and pointed. Color grass green (usually fading to dull yellow on drying); margins and tip of lower face of fastigium black, the tooth green; lateral carinae of pronotum often yellowish; tarsi, hind tibiae and tip of ovipositor somewhat infuscated. Body length, male, 24-26, female, 28-30.

N. ensiger stridulates only at night or during cloudy weather. Allard, 1911, reports this call as consisting of an intermittent but brisk 'tsip-tsip-tsip-tsip', which continues

indefinitely and lacks the harshness characteristic of Scudderia spp. Scudder, as reported by Lugger, 1897, found the call to be a note like 'brw' followed by a pause, then a sound like 'chwi' repeated about five times a second for an unlimited time. No opportunity to study the stridulation of this species was encountered during the present study.

This species has a very wide distribution, from N. S., Maine, S. Ontario, N. Dakota and south and south-west to N. Carolina, Tennessee, Kansas and New Mexico. It frequents tall grasses along ditches, fields, roadsides, etc. The present record is the first record of occurrence of this species in Nova Scotia. It is very locallized in distribution, having been taken at only one site. This is near the R.C.A.F. Station, Greenwood, N. S., and the possibility that it was introduced by aircraft is not precluded. Three specimens are on hand, all males taken at Millville, Kings Co., one on Aug. 13, 1954 and the other two on Aug. 19, 1954.

Subfamily Conocephalinae.

Members of this subfamily are very similar to the Copiphorinae but are considerably smaller; vertex of the head terminating in a tubercle, usually blunt. The males stridulate

but the notes are very soft and low and are heard only during the day. The eggs are deposited between the stems and root-leaves of grass or in the pith of twigs, etc.

Conocephalus Thunberg, 1815.

Key to U.S. Species of Conocephalus.

Tegmina always fully developed, longer than abdomen, exceeding wings by 2 to 3 mm.; form very slender; distal portion of male cerci slender, not depressed on inner side (Fig. 21a); ovipositor narrower and shorter (7-9 mm. in length) (Fig. 20). ---------- C. fasciatus, p. 83.

Tegmina and wings abbreviated, shorter than abdomen, very rarely fully developed; form quite robust; distal portion of male cerci short, quite stout, strongly depressed on the inner side (Fig. 21b); ovipositor heavier and longer (9-14 mm. in length). ---------- C. brevipennis, p. 86.

28. Conocephalus fasciatus (DeGeer), 1773.

Common name - 'Slender Meadow Grasshopper'.

Original combination - Locusta fasciatum.

Xiphidium fasciatum. Walker, F., Cat. Derm. Salt. Brit. Mus. 2:270, (1869); Nova Scotia.

-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.

-- Piers, H., Trans. N.S. Inst. Sci. 9:213, (1896); Hfx. and Hants Cos.

Conocephalus fasciatus. Gooderham, C.B., Proc. Ent. Soc. N.S. for 1917:24, 25, (1918); Col., Kings and Yar. Cos.

-- Piers, H., Trans. N.S. Inst. Sci. 14:324-325, (1918); Hfx., Col., Hants, Kings and Yar. Cos.

-- Rehn, J. W. H., Can. Ent. 71:178, (1939); Col., Kings, Digby, Yar. and Lunen. Cos.

This species was long known as Xiphidium fasciatum (correctly spelled Xiphidion). Orchelimum gracile is considered by Rehn and Hebard to be a synonym.

Very slender, delicate species; vertex of head extends forward and slightly upward as a rounded tubercle with concave sides; antennae long; prosternal spines short and weak; tegmina narrow, straight, and extending well beyond abdomen; wings slightly longer than tegmina; ovipositor slender, straight, and about two-thirds as long as the hind femora; hind legs long and slender, femora and tibiae about equal in length.

Color is a translucent light apple-green, finely sprinkled with brown on face, sides of head, pronotum, and legs, those on hind femora being arranged in longitudinal lines; dark brown dorsal stripe extends from vertex to end of abdomen, narrow on head, wider on abdomen; sides of abdomen brown; tegmina greenish-white to yellowish, with a brown-red blotch on the lateral basal part, this color extending to veins; hind femora green with apical third fawn; hind tibiae light fawn; spines tipped with black; ovipositor green with dorsal area and tip fawn. Body length, male 12-13.5, female 12-14.5.

The stridulations of C. fasciatus, according to Allard, 1911, are faint, ataccato lisps preceeding a long drawn out note, like 'Tip-tip-tip-tseeeeeee'. The preceeding lisps usually number from three to six, and are so faint that they may be easily missed. The stridulations of this species in Nova Scotia conform very well to this description.

The range is very wide, all over the United States and southeastern Canada from the Rocky Mountains east to the Atlantic, and south to Mexico. It is very common all over Nova Scotia. It prefers tangles of weeds and grasses bordering fields and often is found in large numbers. Urquhart collected C. fasciatus in Nova Scotia and provided specimens as follows:

4 males, 2 females, Sable R., Shelb. Co., Aug. 8; 2 males, 1 female, N.E. Margaree, Inv. Co., Aug. 26; 1 female, Southampton, Cumb. Co., July 25; 1 female, Woods I., P.E.I., Aug. 24, 1949. We also have: 8 males, 6 females, S. Ohio, Yar. Co., Aug. 13, 1951; 1 male Bridgetown, Anna. Co., Aug. 11, 1951; 2 females, Paradise, Anna. Co., Sept. 10, 1951; 4 males, 2 females, Black Hole, Kings Co., Sept. 10, 1951; 3 males, 7 females, Kentville, Aug. 13 - Sept. 22, 1951 - 1952; 2 males, 1 female, Brooklyn, Hants Co., Sept. 6, 1951; 3 males, Rawdon, Hants Co., Sept. 18, 1951; 1 male, 1 female, West River, Pict. Co., Sept. 18, 1951; 1 male, South Brook, Cumb. Co., Sept. 7, 1954; and 6 males, 3 females, Springhill, Cumb. Co., Aug. 26, 1951.

29. Conocephalus brevipennis (Scudder), 1862.
Common name - 'Short-winged Grasshopper'.
Original combination - Xiphidium brevipenne.

Xiphidium ensifer Scudder, 1862, and X. gossypii Scudder, 1875, are synonyms.

This species, which may be distinguished from C. fasciatus by the key and illustrations, has not been recorded from Nova Scotia, but may be present.

Subfamily Rhaphidophorinae.

This subfamily, formerly called Stenopelmatinae, is characterized by the absence of wings; males do not stridulate; pronotum short, not covering whole dorsal thoracic area; prosternal spines absent; ovipositor nearly straight; stout insects with arched back and large head which is bent downward between the fore-legs. They are nocturnal, living in caves, or hiding under stones, logs, etc., in damp woods or along brooks. Occasionally they are found in damp cellars. They are omnivorous feeders, but do not injure cultivated crops. The eggs are laid in the soil in the fall and hatch during the spring. Only one genus, Ceuthophilus, is found in Nova Scotia.

Ceuthophilus Scudder, 1862.

Key to N.S. Species of Ceuthophilus (Males).

Hind margin of terminal dorsal segment of abdomen distinctly obtusely notched (Fig. 22a); hind tibiae distinctly bowed or curved on basal third. -------- C. maculatus, p. 88.

Hind margin of terminal dorsal segment of abdomen entire, rounded (Fig. 22b); hind tibiae straight.

---------- C. brevipes, p. 90.

Key to N.S. Species of Ceuthophilus (Females).

Carina of lower front surface of hind femur with many teeth; lower front margins of pronotum broadly bordered with brownish; general color dark; hind tibiae darkened between spur bases; ovipositor 6.5 to 7.5 mm. in length.

---------- C. brevipes, p. 90.

Carina of lower front surface of hind femur with few teeth; lower front margins of pronotum pale; hind tibiae normally with a single subdistal ventral spur; ovipositor 6.8 to 9.5 mm. long. ---------- C. maculatus, p. 88.

30. Ceuthophilus maculatus (Harris), 1841.
Common name - 'Spotted Camel Cricket'.
Original combination - Rhaphidophora maculata.

Ceuthophilus maculatus. Walker, F., Cat. Derm. Salt. Brit. Mus. 1:201, (1872); Nova Scotia. (Generic name incorrectly spelled as"Onthophilus").
-- Gooderham, C. B., Proc. Ent. Soc. N.S. for 1917: 31-32, (1918); Col. Co.
-- Piers, H., Trans. N.S. Inst. Sci. 14:326-327, (1918); Col. and Anna. Cos.

Ceuthophilus latebricola, and C. bicolor Scudder, 1894, are synonyms.

Body stout, back arched; antennae long; hind margin of terminal dorsal abdominal segment notched; fore femora often one-third or more longer than pronotum; hind femora broad; hind tibiae and hind femora of about equal length; lower carina of hind femur with 8 to 15 unequal rather coarse spines. Color is blackish-brown above, often with a lighter stripe on the dorsal part of the thorax; yellowish-brown beneath; dorsal part of abdomen often bears a number of small yellow dots; legs pale reddish-brown, the hind femora with brown bars. Body length, male 14, female 16.

The range extends from the southern Canadian Zone to the northern half of the Upper Austral Zone. It is common in New England, but somewhat rare in Nova Scotia. It is found from the middle of July to September under stones, beneath logs, and in hollow trees in dry open woods.

There is a single male specimen in the N.S.A.C. insect collection taken at Truro, Sept. 10, 1951.

31. Ceuthophilus brevipes Scudder, 1862.

Common name - 'Woodland Stone Cricket'.

Ceuthophilus terrestris. Gooderham, C. B., Proc. Ent. Soc. N.S. for 1917:33, (1918); Col. Co.

-- Piers, H., Trans. N.S. Inst. Sci. 14:327-328, (1918); Col. Co.

Ceuthophilus terrestris Scudder, 1894, is the common synonym, under which most Canadian records are placed.

Body stout; back arched; antennae long; hind margin of terminal dorsal abdominal segment not notched, but obtusely rounded; fore femora at least one-third longer than pronotum; hind femora broad and distinctly shorter than hind tibiae; outer lower carina with about 25 crowded, minute teeth; hind tibiae straight in both male and female. Reddish-brown in color; abdomen mottled with pale spots; often a light stripe on the dorsal part of the pronotum bordered by darker blotches; legs lighter, hind femora with obscure dark bars. Body length, male 13-14, female 14-15.

The range includes the eastern part of the Canadian and Transition Zones, in the northern United States and eastern

Canada. It is usually found in similar locations as C. maculatus but most of the specimens on hand were taken in damp cellars.

The series includes: 1 male nymph, Clarence, Anna. Co., June 9, 1947; Kentville, 2 male nymphs, June 26, 1952, 2 male nymphs, June 30, 1952, 2 females, Sept. 10, 1948; 1 male, 3 females, Debert, Col. Co., Aug. 12, 1951; and 1 female, Abercrombie, Pict. Co., Sept. 22, 1952.

FAMILY GRYLLIDAE.

This family includes the true crickets. The bristle-shaped antennae are much longer than the body; tegmina flat above, bent abruptly downward at the sides; hind femora stout, tarsi three-jointed; ovipositor usually protuding, straight or upturned, needle-like, with the tip often enlarged; stridulating organ, when present, is near base of tegmina, and is large, extending across the proximal portion of both anal and median areas of the tegmina; hind wings are of little use in flight.

In this family eggs are laid on the ground, singly, or in masses in burrows, or in plants. Winter is passed in the egg stage. Many species are grass feeders and do considerable damage.

Key to N.S. Subfamilies (and Genera) of Gryllidae.

Species small (body length less than 12 mm.); last joint of maxillary palpi double the length of the preceeding one; hind tibiae with long, moveable, pilose spines; first joint of hind tarsi without teeth or with one row of small teeth.

---------- Nemobiinae, Nemobius, p. 96.

Species large (body length more than 12 mm.); last joint of maxillary palpi little if any longer than the preceeding one; hind tibiae with strong, immoveable spines; first joint of hind tarsi grooved above, with two rows of teeth.

---------- Gryllinae, Acheta, p. 92.

Subfamily Gryllinae.

This subfamily contains crickets of medium to large size; robust; head large; eyes prominent; pronotum broader than long; hind tibiae armed above on each side with five to eight stout spines and three pairs of unequal apical spurs; ovipositor as long or longer than hind femora, apex enlarged but not serrulate.

Acheta Fabricius, 1775.

Uvarov, 1935, erected the genus Gryllulus to define the limits of a group of species originally described under Linnaeus' genus Gryllus, 1758. Roberts, 1941, pointed out that the name Acheta was available and had priority over Gryllulus and this name, Acheta, was established by Gurney, 1950. The common North American species fomerly under Gryllus fall within this genus.

32. Acheta assimilis luctuosus (Serville), 1839.
Common name - 'Common Field Cricket'.
Original combination - Gryllus luctuosus.

Acheta abbreviata (Not of Serville). Piers, H., Trans. N.S. Inst. Sci. 8:410, (1894); Windsor, Hants Co., N.S.
Gryllus pennsylvanicus form neglectus. Piers, H., Trans. N.S. Inst. Sci. 9:210, (1896); Hfx. and Hants Cos. -- Piers, H., Trans. N.S. Inst. Sci. 14:341-354, (1918); Hfx., Pict., Hants and Kings Cos.

McNeill's Gryllus vernalis, 1891, G. pennsylvanicus, and G. abbreviatus are all referred to A. a. luctuosus. Scudder's G. rubens is also a synonym. Rehn and Hebard, 1915, concluded

that the many listed species and forms of Gryllus should all be placed under A. assimilis, and the old species names are retained to some extent as trinomials.

Size small to medium; width of abdomen about one-third body length; head nearly same in width as pronotum; pronotum half again as wide as long, little if any narrower behind, front margin slightly concave, hind margin slightly convex; tegmina of female usually cover three-fifths to four-fifths of the abdomen, never longer than the abdomen; tegmina in male usually nearly covering abdomen, and rarely are slightly longer; inner edges of tegmina overlap for entire length in male, but may be somewhat separated in female at the ends to form an inverted V-shaped notch. Color generally black, often with fine gray pubescence on the pronotum, femora and some other parts; head shining black; tegmina shining black to dull gray-brown with brown veins; lateral edges of tegmina with a light colored line; ovipositor brownish; femora with brownish areas on inner and outer faces. Body length, male 15-21, female 14.5-23.5.

Allard, 1911, made the observation that this species stridulates incessantly in sunshine, emitting a brief, intermittent, musical 'chirp, chirp, chirp'. This is certainly

true of specimens in Nova Scotia with stridulation ceasing rather abruptly when the sun is suddenly obscured by heavy cloud.

Range is very wide, all over eastern United States and Canada. This species is very numerous in Nova Scotia, congregating in large numbers in thick grass, under stones, boards, etc., coming out to sun themselves during hot, sunny afternoons. The eggs are laid in the fall in the soil in irregular masses, and hatch the following July. Adults appear in August and do not survive the winter.

Urquhart has provided the following specimens (labelled Gryllulus a. luctuosus), taken in 1949: Windsor, Hants Co., 1 male, Aug. 13; Pictou, 2 males, 2 females, Aug. 22. In addition to these specimens the following are on hand: Paradise, Anna. Co., 1 male, 1 female, Sept. 21, 1951; Kentville, Kings Co., 1 male, 1 female, Sept. 10, 1951, and 2 males, 7 females, Sept. 10, 1948; Black Hole, Kings Co., 1 male, 1 female, Sept. 10, 1951; North Alton, Kings Co., 1 male, 1 female, Sept. 5, 1951; Wolfville, Kings Co., 4 males, 6 females, Aug. 2, 1951; Kings Co., 3 males, 5 females, Sept., 1946; Debert, Col. Co., 1 male, 2 females, Sept. 26, 1952; West R., Pict. Co., 2 females, Sept. 18, 1951.

Subfamily Nemobiinae.

Small, compact species; body and legs usually covered with long hairs; ocelli small, round, and arranged in a triangle; eyes oval, prominent; pronotum slightly broader than head; tegmina of males usually shorter than abdomen, tips rounded or subtruncate; tegmina of females with few prominent longitudinal veins and numerous small cross veins; hind wings variable, often absent; hind femora swollen; cerci of both sexes slender, tapering, hairy, and about half as long as the femora; ovipositor variable.

These crickets are gregarious, and unlike the Gryllinae, feed during daylight. They are omnivorous, and according to Blatchley (1920) feed "upon carrion, cow dung, and grasses with equal avidity". As they are usually very numerous they may cause considerable damage to grasses.

Nemobius Serville, 1839.

Key to N.S. Species of Nemobius.

1. Lower pair of apical spurs of hind tibiae unequal in length, the inner one much longer; apex of ovipositor of female

with only upper margin more or less finely serrulate.
---------- 2.

Lower pair of apical spurs of hind tibiae equal in length; apex of ovipositor of female with both upper and lower margins serrulate, teeth of lower margin very fine and widely spaced, teeth of upper margin very coarse (Fig. 23c); general color pale brown; last two joints of maxillary palpi partially but not wholly white. ---------- N. carolinus, p. 101.

2. Ovipositor straight, or nearly so, nearly as long or longer than hind femora, teeth of upper margin fairly coarse (Fig. 23a); occiput with four dark longitudinal stripes; general color black, to sooty-brown; males 7.5-10 mm., females 8-11 mm. in body length. ---------- N. fasciatus, p. 98.
(Ovipositor longer than hind femora - N. f. fasciatus).
(Ovipositor no longer or shorter than the hind femora - N. f. socius).

Ovipositor evidently but not strongly curved, about two-thirds as long as hind femora; wings usually present and usually longer than abdomen; ovipositor armed with fine, close-set teeth (Fig. 23b); general color dark brown to uniform piceous; body length of male rarely more than 6 mm.; habitat sphagnum

bogs. ---------- N. cubensis palustris, p. 102.

33. Nemobius fasciatus socius Scudder, 1877.

Common name - 'Striped Ground Cricket'.

Original combination - Nemobius socius.

Nemobius vittatus. Walker, F., Cat. Derm. Salt. Brit. Mus. 1:57, 114, (1869); Nova Scotia.

-- Walker, F., Can. Ent. 4:30, (1872); Nova Scotia.

Acheta vittata. Piers, H., Trans. N.S. Inst. Sci. 8:410, (1894); Windsor, N.S.

Nemobius fasciatus vittatus. Piers, H., Trans. N.S. Inst. Sci. 9:210, (1896); Hfx. and Hants Cos.

Nemobius fasciatus. Piers, H., Trans. N.S. Inst. Sci. 14:330-335, (1918); Col., Pict., Hants and Hfx. Cos.

Nemobius canus Scudder, 1826, and N. hastatus Saussure, 1897, are synonyms. Blatchley, 1920, believes all the races of N. fasciatus should be combined under the original name, N. fasciatus (DeGeer), 1773, (original combination - Gryllus fasciatus).

Size small; head and pronotum hairy; ovipositor straight; about the same length as the hind femur or somewhat shorter;

tegmina of females cover about one-half of the abdomen, of males cover about two-thirds of abdomen, cross-veins prominent; wings may be wanting in abbreviated form, (formerly known as vittatus, but not now recognized as a distinct race), or more than twice the length of the tegmina extending to nearly apex of ovipositor in long-winged specimens. Color black to sooty-brown, tegmina and legs somewhat paler; occiput with three dark longitudinal stripes, obscure in dark specimens; ovipositor blackish. Body length as in key.

The races fasciatus and socius are considered distinct ecological races, although morphologically they are extremely difficult if not impossible to determine with any certainty. Ovipositor length (see key) is not considered reliable, but if it is, then both races are found in Nova Scotia. N. f. fasciatus (DeGeer), 1773, is found in grassy fields and pastures, and stridulates incessantly during sunny periods. Its trill is, according to Allard, 1911, a very high and indefinitely prolonged 'ti-ti-ti-ti-ti-ti'. N. f. socius is found in swampy locations and its call is a brief and shrill 'tiiii-tiiii-tiiii'. Urquhart, in personal correspondence, has expressed the opinion that the difference is likely due to the nature of the tegmina under different conditions of humidity; that is, rearing specimens from either habitat under conditions of the other

habitat would produce individuals normally found in the type of habitat in which they are reared. If this is true, then the basis for erecting these trinominal forms is unsound.

This species ranges from the Southern Canadian Zone to the northern part of the Upper Austral Zone in eastern North America. Many Nova Scotia specimens are of the abbreviated form. N. fasciatus is one of the most numerous of Nova Scotia species of Orthoptera.

The following were collected by Urquhart in 1949: Sable R., Shelb. Co., 2 males, 4 females, Aug. 8; Chester, Lunen. Co., 1 male, July 29; N. E. Margaree, Inv. Co., 1 male, Aug. 26. The collection at hand also contains the following: S. Ohio, Yar. Co., 4 males, 7 females, Aug. 13, 1951, 3 males, 4 females, Sept. 28, 1951, 1 female, Aug. 26, 1954; Kingston, Kings Co., 2 males, 6 females, Aug. 10, 1955; Kentville, 3 females, Aug. 21, 1951; Black Hole, Kings Co., 2 males, Sept. 10, 1951; Wolfville, Kings Co., 1 male, 1 female, Sept. 2, 1951; Sweet's Corner, Hants Co., 6 males, 2 females, Aug. 17, 1955; St. Croix, Hants Co., 2 males, 2 females, Aug. 17, 1955; West R., Pict. Co., 2 females, Sept. 18, 1951; Springhill, Cumb. Co., 3 males, 1 female, Aug. 26, 1951.

34. Nemobius carolinus Scudder, 1877.

Common name - 'Carolina Ground Cricket'.

Nemobius carolinus. Piers, H., Trans. N.S. Inst. Sci. 14:335-336, (1918); Col. Co.

Cyrtoxiphus variegatus Bruner, 1893, Nemobius septrionalis Provancher, 1877, N. volaticus Scudder, 1877, N. augusticollis Walker, 1904, and N. janus Kirby, 1906, are synonyms. The N. exiguus listed by Blatchley, 1903, should be referred to this species.

Resembles N. fasciatus, but is smaller; tegmina of male reach about the tip of the abdomen, of female cover about one-half of abdomen; hind wings wanting; ovipositor distinctly shorter than the hind femora and a little up-curved; teeth of ovipositor, very coarse on upper side, very fine and widely spaced on under side. Color generally pale brown; head dark brown with yellow markings on vertex; antennae dark brown on three basal joints and on distal third, middle light brown; disc of pronotum mottled with light and dark brown spots, lateral lobes dark brown, sparsely clothed with coarse dark hairs; femora light brown with transverse darker markings on outer face; tibiae light brown and thickly clothed with fine dark

hairs, bases of spines dark brown; terminal yellowish. Body length, male 8.5, female 7.

Range is wide over eastern Canada and United States. Nova Scotia probably marks the northern limit. Its distribution extends south to Florida and Texas. It is found on grassy, sunny banks of streams, and about fences. Its trill is weak, and continuous, indefinitely prolonged.

Judging from the keys and descriptions of N. carolinus given by Piers, 1918, he may have actually referred to N. cubensis palustris, and not N. carolinus. This, if true, would invalidate his record of the species in Nova Scotia, but this is doubtful, as Urquhart found it to be present in considerable numbers in 1949. There are no specimens from Nova Scotia in the collection. Urquhart collected this species at Chester, Lunen. Co., July 20, 1949, and at Sable R., Shelb. Co., Aug. 8, 1949.

35. Nemobius cubensis palustris Blatchley, 1900.
Common name - 'Marsh Ground Cricket'.
Original combination - Nemobius palustris.

Nemobius aterrimus Scudder, 1896, is a synonym.

Very small slender species, males shorter and broader than females; pronotal disc one-third broader than long, thickly covered with stiff, black bristles; occiput, and dorsal parts of the fore and middle femora also hairy; tegmina of male forming elongate quadrangle with sides feebly converging from base; tips narrowly rounded; tegmina of female covering slightly over one-half of the abdomen, tips broadly rounded; ovipositor distinctly but feebly upcurved, apex feebly enlarged, teeth of upper edge very fine and closely set. Color generally uniform dark pisceous; maxillary palpi lighter except for apical joint. Body length, males 5.2-6.2, females 6-6.8.

This species is found in and around sphagnum mosses, peat bogs, tamarack swamps, and cranberry bogs all along the Atlantic coast of the United States and the Maritime provinces. Its call, according to Allard, 1911, is a faint quavering, high-pitched trill.

There are two males in the M.S.A.C. collection, both taken by Urquhart at Sable R., Shelb. Co., Aug. 8, 1949.

GLOSSARY OF TERMS

1. acuminate - tapering to a point.
2. apical - farthest from the body or base.
3. attenuate - slender and tapering.
4. carinate - keel-like.
5. cerci - appendages of last abdominal segment.
6. crenate - scalloped, with rounded teeth.
7. decurved - bent downward.
8. deflexed - abruptly bent downward.
9. fastigium - top of head.
10. foveolae - pits or grooves in the lateral margins of the fastigium.
11. furcula - processes of last abdominal segment of male.
12. fuscous - dark brown, approaching black.
13. intercalary vein - short, undivided vein above the media.
14. lanceolate - lance-shaped.
15. metazona - posterior portion of pronotal disc.
16. piceous - pitchy black.
17. pilose - having long sparse hairs.

18. prozona - anterior portion of pronotal disc.
19. punctate - with numerous small surface pits.
20. quadrate - nearly square.
21. serrate - saw-toothed.
22. sinous - curving and recurving.
23. spatulate - flattened, clubshaped, apex rounded.
24. subacuminate - tapering almost to a point.
25. sub-anal spine - ventral upcurved anal process of male Scudderia spp.
26. subequal - similar, but not quite equal in size or form.
27. subrotund - not quite round.
28. subquadrate - not quite square.
29. subspatulate - nearly flattened, clubshaped.
30. sulcate (fastigium) - grooved.
31. supra-anal spine - dorsal decurved anal process of male Scudderia spp.
32. truncate - cut off squarely at tip.

CHECK LIST - ORTHOPTERA OF NOVA SCOTIA

(Systematic arrangement after Hebard).

ORDER ORTHOPTERA

FAMILY BLATTIDAE

Subfamily Pseudomopinae

Blatella Caudell, 1903.

1. *germanica* (Linnaeus), 1767.

Subfamily Blattinae

Blatta Linnaeus, 1758.

2. *orientalis* Linnaeus, 1758.

FAMILY ACRIDIDAE

Subfamily Tetriginae

Nomotettix Morse, 1894.

3. *cristatus* (Scudder), 1862.

Tetrix Latreille, 1802.

4. *subulatus* (Linnaeus), 1761.

5. *arenosus angustus* (Hancock), 1896.

Subfamily Acridinae

Orphulella Giglio-Tos, 1894.

6. *speciosa* (Scudder), 1862.

#7. *pelidna* (Burmeister), 1838.

Chorthippus Fieber, 1852.

8. *longicornis* (Latreille).

Stethophyma Fischer, 1853.

9. lineata (Scudder), 1862.

10. gracilis (Scudder), 1862.

Subfamily Oedipodinae

Chorthophaga Saussure, 1884.

11. viridifasciata (DeGeer), 1773.

Camnula Stal, 1873.

12. pellucida (Scudder), 1862.

Dissosteira Scudder, 1876.

13. carolina (Linnaeus), 1758.

Circotettix Scudder, 1876.

14. verruculatus (Kirby), 1837.

Subfamily Cyrtacanthacrinae

Zubovskya Dovnar-Zapolskij, 1933.

15. glacialis (Scudder), 1863.

Melanoplus Stal, 1873.

16. fasciatus (Walker), 1870.

17. mexicanus (Saussure), 1861.

18. femur-rubrum (DeGeer), 1773.

19. borealis junius (Dodge), 1876.

20. bivittatus (Say), 1825.

21. keeleri luridus (Dodge), 1876.

FAMILY TETTIGONIIDAE

Subfamily Phaneropterinae

Scudderia Stal, 1873.

#22. texensis Saussure & Pictet, 1897.

23. pistillata Brunner, 1878.

24. curvicauda borealis Rehn & Hebard, 1914.

25. furcata Brunner, 1878.

Amblycorypha Stal, 1873.

#26. oblongifolia (DeGeer), 1773.

Subfamily Copiphorinae

Neoconocephalus Karney, 1907.

27. ensiger (Harris), 1841.

Subfamily Conocephalinae

Conocephalus Thunburg, 1815.

28. fasciatus (DeGeer), 1773.

#29. brevipennis (Scudder), 1862.

Subfamily Rhaphidophorinae

Ceuthophilus Scudder, 1862.

30. maculatus (Harris), 1841.

31. brevipes Scudder, 1862.

FAMILY GRYLLIDAE

Subfamily Gryllinae

Acheta Fabricius, 1775.

32. assimilis luctuosus (Serville), 1839.

Subfamily Nemobiinae

Nemobius Serville, 1839.

33. fasciatus socius Scudder, 1877.

34. carolinus Scudder, 1877.

35. cubensis palustris Blatchley, 1900.

Species not recorded from Nova Scotia but which may be present. All other species have been definitely recorded.

ACKNOWLEDGEMENT

The assistance of the following people is gratefully acknowledged: Dr. E. M. DuPorte, Entomology Department, Macdonald College, for assistance and advice; Dr. F. A. Urquhart, Head, Division of Zoology and Palaeontology, Royal Ontario Museum, Toronto, for specimens and records and allowing the inclusion of unpublished records on three species previously unrecorded; Mr. M. E. Neary, Provincial Entomologist, Nova Scotia Department of Agriculture and Marketing, for permitting the use of facilities of the Nova Scotia Agricultural College insect collection; and the following who have made collections of Orthoptera while employed at various times as student assistants by the Entomology Division, Nova Scotia Department of Agriculture and Marketing, W. V. Potter, R. E. Morehouse, D. C. Eidt, P. M. Grainger, R. L. Horsburgh, J. R. Rainforth and G. D. Rafuse.

BIBLIOGRAPHY

Allard, H. A.
1910. Some New England Orthoptera observed in late October.
Ent. News 21:352-357.

1911. The musical habits of some New England Orthoptera in September.
Ent. News 22:28-39.

Blatchley, W. S.
1894. Some Indiana Acrididae III.
Canad. Ent. 26:220-221.

1898. Some Indiana Acrididae IV.
Canad. Ent. 30:54-64.

1900. On the species of Nemobius known to occur in Indiana.
Psyche 9:51-54.

1903. The Orthoptera of Indiana.
27th Ann. Rpt. Dept. Geol. Nat. Res. Ind. 1902. pp. 1-471.

1920. Orthoptera of Northeastern America.
Nature Publ. Co., Indianapolis, Ind., U.S.A.
pp. 1-784, 246 figures.

Brunner de Wattenwyl.
1893. Revision du Systeme des Orthopteres, et Descriptiones des Especies Rapportees.
Ann. Mus. Civ. Stor. Nat., 1-230 Geneva.

Caudell, A. N.
1907. Book Notice. Kirby's Catalogue of Orthoptera - Vol. II.
Canad. Ent. 39:287-292.

Caudell, A. N.
1910. In N. Banks', Family Distribution and Faunal Areas.
Proc. Ent. Soc. Wash. 12:95-97.

1911. Some remarks on Kirby's Synonymic Catalogue of Orthoptera, Vol. III, with additional notes on Vols. I and II.
Ent. News 22:158-167.

1927. Problems in Taxonomy.
Proc. Ent. Soc. Wash. 29:129-132.

1928. On the systematic position of the Orthopterous Genera Cnemotettix Caudell and Phoberopus Saussure and Pictet.
Proc. Ent. Soc. Wash. 30:103-105.

Comstock, J. H.
1924. An Introduction to Entomology.
9th Edition Revised, 1948.
Comstock Publ. Co., Ithaca, N.Y.

Criddle, N.
1918. The egg-laying habits of some of the Acrididae (Orthoptera).
Canad. Ent. 50:145-151.

Dice, L. R.
1943. The Biotic Provinces of North America.
Univ. Mich. Press, Ann Arbor, Mich.

Ferguson, D. C.
1954. The Lepidoptera of Nova Scotia.
Proc. N.S. Inst. Sci. Vol. 23, part 3:161-375.

Fulton, B. B.
1931. A study of the genus Nemobius (Orthoptera: Gryllidae).
Ann. Ent. Soc. Amer. 24:205-237.

Gooderham, C. B.
1917. The Acrididae of Nova Scotia.
Proc. Ent. Soc. N.S. 1916 (2) Jan. 1917:21-30.

Goodenham, C. B.
1917. The Locustidae of Nova Scotia.
Proc. Ent. Soc. N.S. 1917:23-36.

Gurney, A. B.
1940. A revision of the grasshoppers of the genus Orphulella Giglio-Tos from America, north of Mexico. (Orthoptera:Acrididae).
Ent. Amer. 20(3):85-157.

1950. The Linnaean subgeneric names of Gryllus (Orthoptera).
Jour. Wash. Acad. Sci. 40(12):409-413.

Hancock, J. L.
1918. A new genus and two new species of Tettigids (Orthoptera), with a note on Nomotettix borealis Walker.
Ent. News. 29:346.

Hebard, M.
1915. Records of Orthoptera from Newfoundland.
Ent. News. 26:306.

1919. New Genera and Species of Melanopli found within the United States (Orthoptera:Acrididae) Pt. II.
Trans. Amer. Ent. Soc. 45:257-297.

1926. A Key to the North American Genera of the Acridinae which occur north of Mexico. (Orthoptera:Acrididae).
Trans. Amer. Ent. Soc. 52:47-59.

1929. The Orthoptera of Colorado.
Proc. Acad. Nat. Sci. Phila. 81:303-425.

1932. The Orthoptera of Minnesota.
Univ. Minn. Agr. Exp. Sta. Tech. Bull. 85:1-60.

Hebard, M.
1934. Studies in the Orthoptera which occur in North America north of the Mexico boundary. Trans. Amer. Ent. Soc. 60(1):31-56.

1934. The Dermaptera and Orthoptera of Illinois. Bull. Ill. Nat. Hist. Survey. Vol. 20, Article 3:125-279.

1934. The importance of considering the season of appearance in collecting species of Orthoptera. Ent. News 45:179-180.

1935. Notes on Acrydium and the actual status of three supposedly American species (Orthoptera, Arididae, Acrydiinae). Ent. News 46:231-235.

1935. Studies in the Orthoptera of Arizona, Part II, A list of the Dermaptera and Orthoptera of Arizona with new records and corrections of the literature subsequent to 1900. Trans. Amer. Ent. Soc. 61:273-316.

1936. Notes on the North American Orthoptera of the Arctic Alpine Zone. Ent. News 47:13-15.

1937. Where and when to find the Orthoptera of Pennsylvania, with notes on the species which in distribution reach nearest this state. Ent. News 48:219-225; 274-280.

1945. The Orthoptera of the Appalachian Mountains in the vicinity of Hot Springs, Virginia, and notes on other Appalachian species and recent extensions of the known range of still other southeastern species. Trans. Amer. Ent. Soc. 71:77-97.

Henneguy, L. F.
1904. Les Insectes.
Masson et Cie., Paris. pp. 20-25.

Lugger, O.
1897. The Orthoptera of Minnesota.
Univ. of Minn., Agr. Exp. Sta. Bull. 55(91-386).

Matheson, R.
1944. Entomology for Introductory Courses.
Comstock Publ. Co., Inc., Ithaca, N.Y.

Morse, A. P.
1899. New North American Tettiginae.
Jour. N.Y. Ent. Soc. 7:200.

1919. A list of the Orthoptera of New England.
Psyche 26(2):21-39.

Packard, A. S.
1901. Occurrences of Melanoplus extremus in Northern Labrador.
Psyche 9:191.

Pettit, R. H. and McDaniel, E.
1918. Key to Orthoptera of Michigan with Annotations.
Michigan Agr. Coll., Exp. Sta. Special Bull.
No. 83.

Piers, H.
1918. The Orthoptera of Nova Scotia; with descriptions of the species and notes on their occurrence and habits.
Trans. N.S. Inst. Sci., 14(3):201-354.

McAtee, W. L. and A. N. Caudell.
1917. First list of the Dermaptera and Orthoptera of Plummers Island, Maryland and vicinity.
Proc. Ent. Soc. Wash. 19:100-122.

McNeill, J.
1893. A list of the Orthoptera of Illinois.
Psyche 6, no. 177:73-78.

Rehn, J. A. G.
1901. The Linnaean Genus Gryllus.
Canad. Ent. 33:118-121.

1902. Nomenclatural notes on two Genera of Orthoptera.
Ent. News 13:101-102.

1904a. Notes on the Orthoptera of the Keweenaw Bay Region of Baraga County, Michigan.
Ent. News 15:229-237.

1904b. Notes and records of New Jersey Orthoptera.
Ent. News 15:325-332.

1910a. Records of Orthoptera from Western Canada.
Ent. News 21:23-27.

1910b. Random notes on North American Orthoptera.
Trans. Ent. Soc. Amer. 27:331-337.

Rehn, J. A. G. and Hebard, M.
1911. Orthoptera found about Aweme, Manitoba.
Ent. News 22:5-10.

1914. Studies in American Tettigoniidae: Parts I, II, & III.
Trans. Amer. Ent. Soc. 40:271-344; 365-413.

1915a. Studies in American Tettigoniidae.
I. A synopsis of the species of the genus Orchelimum.
II. A synopsis of the species of the genus Conocephalus found in N. America, north of Mexico.
Trans. Amer. Ent. Soc. 41:11-83.

Rehn, J. A. G. and Hebard, M.
1915b. Studies in American Tettigoniidae (Orthoptera). V. A synopsis of the species of the genus Conocephalus (Xiphidium of authors) found in North America, north of Mexico.
Trans. Amer. Ent. Soc. 41:155-224.

Rehn, James A. G. and Rehn, John W. H.
1936. On new or redefined genera of Nearctic Melanopli (Orthoptera:Acridiae, Cyrtacanthacrinae).
Trans. Amer. Ent. Soc. 62:1-30.

Rehn, John W. H.
1939. Notes on the Orthoptera of Nova Scotia and Newfoundland.
Canad. Ent. 71:175-178.

Roberts, H. R.
1941. Nomenclature in the Orthoptera concerning genotype designations.
Trans. Amer. Ent. Soc. 57:1-34.

Roland, A. E.
1944-45. The Flora of Nova Scotia.
Proc. N.S. Inst. Sci., 21(3):1-552.

Scudder, S. H.
1880. A few notes on North American Acridii.
Canad. Ent. 12:75-76.

1896a. North American species of Hemobius.
Jour. N.Y. Ent. Soc. 4:99-107.

1896b. The species of Hemobius found in North America.
Psyche 7:431-434.

1897. Guide to the genera and classification of the North American Orthoptera found north of Mexico.
Edward N. Wheeler, Cambridge, Mass.

1898. A preliminary classification of the Tryxalinae of the United States and Canada.
Psyche 8:231-239.

Scudder, S. H.
1899. The North American species of Orphulella. Canad. Ent. 31:177-188.

1900. The species of Circotettix, a North American genus of Oedipodinae. Psyche 9:135-141.

1900. A list of the Orthoptera of New England. Psyche 9:99-106.

1900. Catalog of the described Orthoptera of the United States and Canada. Proc. Davenport Acad. Nat. Sci. 8:1-101.

1901. Alphabetical index to North American Orthoptera described in the Eighteenth and Nineteenth Centuries. Occasional Papers of the Boston Society of Natural History V. Boston, Mass.

1902. The species of Gryllus found in the United States east of the Sierra Nevadas. Psyche 9:291-296.

Urquhart, F. A.
1949. List of N.S. Orthoptera, collected and determined by F. A. Urquhart, and now in N.S. Agr. College, Truro, Insect Collection. (Unpublished).

1951. Personal correspondence. (Unpublished).

Uvarov, B. P.
1942. New and less known Palaearctic Orthoptera. Trans. Amer. Ent. Soc. 67:303-361.

Walden, B. H.
1911. The Euplexoptera and Orthoptera of Connecticut. State Geol. & Nat. Hist. Surv. Conn. Bull. No. 16, pp. 39-169.

Walker, E. M.
1902. A preliminary list of the Acrididae of Ontario.
Canad. Ent. 34:251-258.

1903. The genus Podisma in Eastern North America.
Canad. Ent. 35:295-302.

1904a. The Crickets of Ontario.
Canad. Ent. 36:142-144; 249-255.

1904b. Notes on the Locustidae of Ontario.
Canad. Ent. 36:325-330; 337-341.

1905. Notes on the Locustidae of Ontario.
Canad. Ent. 37:34-38; 113-119.

1909. On the Orthoptera of Northern Ontario.
Canad. Ent. 41:137-144; 173-178; 205-212.

1910. The Orthoptera of Western Canada.
Canad. Ent. 41:269-276; 293-300; 333-340;
351-356.

1915. Notes on a collection of Orthoptera from
Prince Edward Island and the Magdalen Islands,
Quebec.
Canad. Ent. 47:339-344.

Walker, F.
1872. Hemiptera, Heteroptera and Dermaptera (Orthoptera)
of America to the north of the United States.
Canad. Ent. 4:29-31.

ADDENDA

Melanoplus keeleri luridus (Dodge) was found to be fairly common on blueberry barrens near New Canaan, Cumb. Co., N.S., eight to ten miles from the original location of capture; 4 females, Aug. 27, 1956 and 3 males, Oct. 26, 1956, from this location have been placed in the Nova Scotia Agricultural College insect collection.

Melanoplus fasciatus (F. Walker) was found in company with M. keeleri luridus at New Canaan, Cumb. Co.; 1 male and 3 females, Aug. 9, 1956 and 6 females, Aug. 27, 1956. This species was also taken at Lower Argyle, Yarmouth Co., the site of Bayard Long's original first record of the species in the province. It was not taken in the bog area as Rehn (1939) reported of Long's record but only on high ground. M. borealis junius (Dodge) was found numerous in the lower boggy areas. Females of M. fasciatus and M. borealis junius are very difficult to separate by morphological features and there is a possibility that Rehn (1939) may have referred to M. borealis junius as this record was a single female. The present series of M. fasciatus now contains the following specimens: 1 male, 5 females, Lower Argyle, Yar. Co., N.S., Sept. 18, 1956.

Plate I

Map of the Province of Nova Scotia showing geographical position and division into counties.

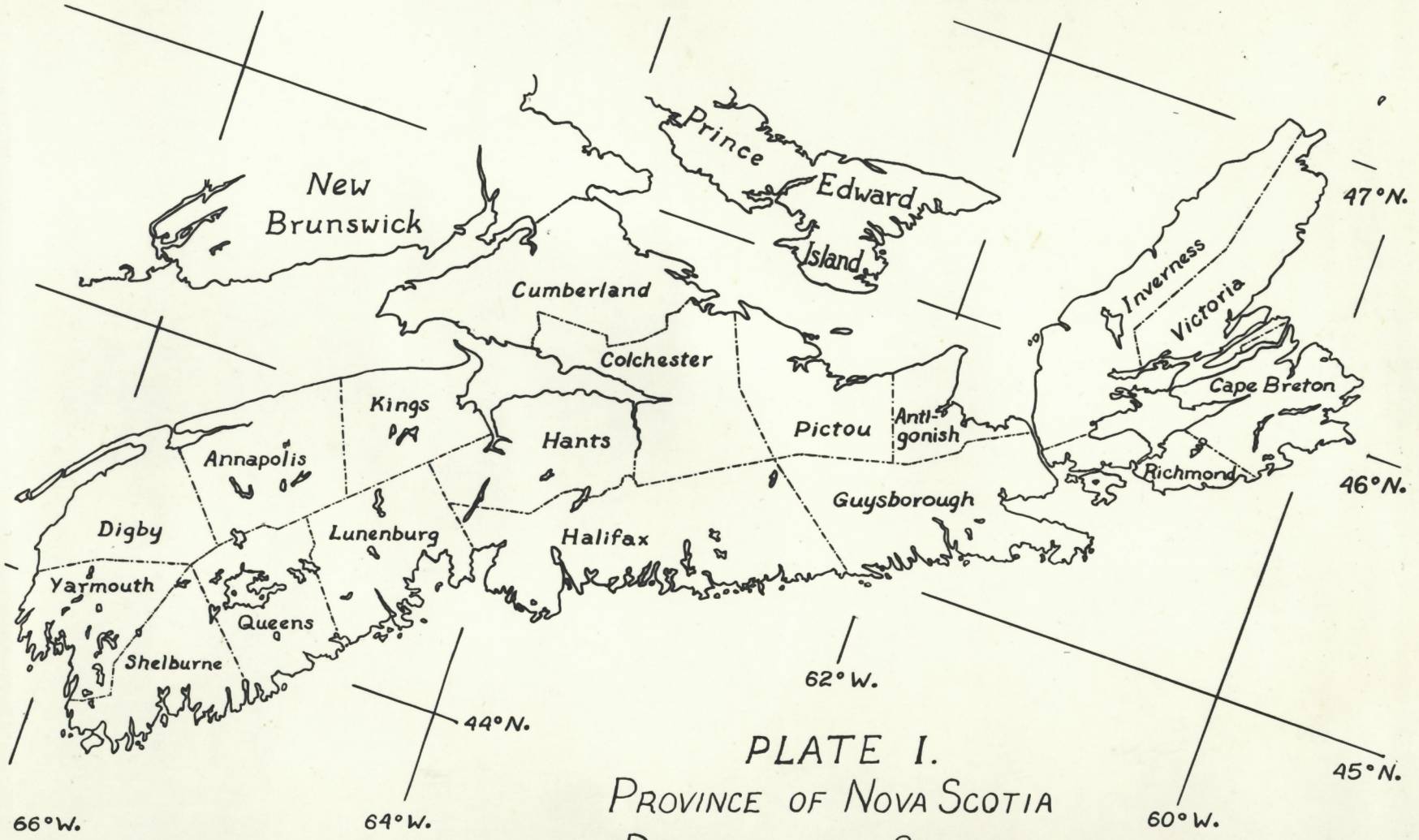


PLATE I.

PROVINCE OF NOVA SCOTIA

POSITION AND COUNTIES

Plate II

Figure 2a - Physiographic regions of Nova Scotia and adjacent areas: dark, shaded areas indicate true uplands; vertically hatched areas represent lowlands which vary considerably in basic structure; and the clear unshaded area indicates the so-called Atlantic Upland which is basically composed of rocks which are resistant to weathering and is poorly drained.

Figure 2b. - Floral regions of Nova Scotia and adjacent areas: 1, predominantly Canadian; 2, predominantly Alleghanian; 3, predominantly Hudsonian; and 4, coastal plains region.

PLATE II.

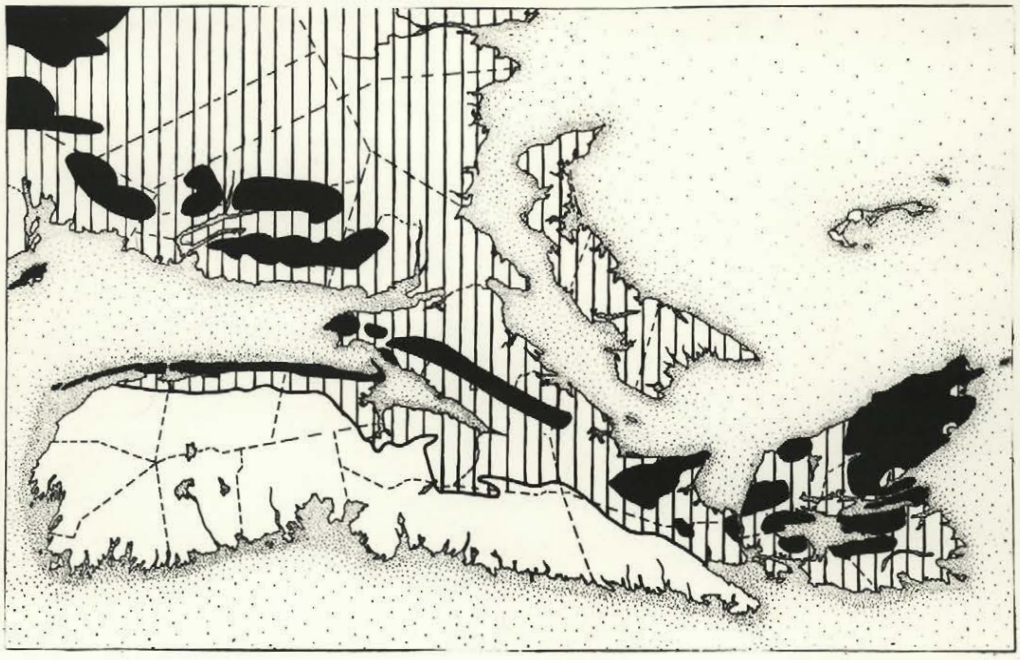


Fig. 2a. Physiographic Regions.

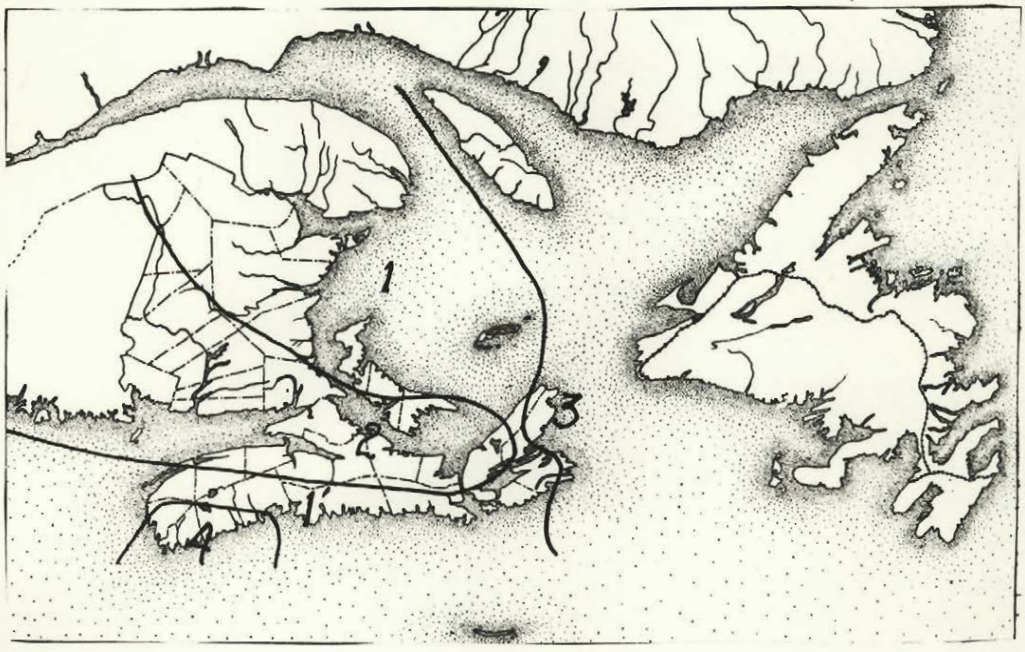


Fig. 2b. Floral Regions.

Plate III

Fig. 3a. - Pronotum of *Tetrix subulatus*, lateral aspect.

Fig. 3b. - Same of *Nomotettix cristatus*.

Fig. 4a. - Head of *Tetrix subulatus*, dorsal aspect.

Fig. 4b. - Same of *Tetrix arenosus angustus*.

Fig. 5a. - Head of *Orphulella speciosa*, dorsal aspect.

Fig. 5b. - Same of *Chorthippus longicornis*.

Fig. 6. - Pronotum of *Dissosteira carolina*, dorsal aspect.

Fig. 7. - Pronotum of *Orphulella speciosa*, dorsal aspect.

Fig. 8a. - Pronotum of *Stethophyma lineata*, dorsal aspect.

Fig. 8b. - Same of *S. gracilis*.

Fig. 9. - Mesosternal lobes of *Melanoplus bivittatus*, ventral aspect.

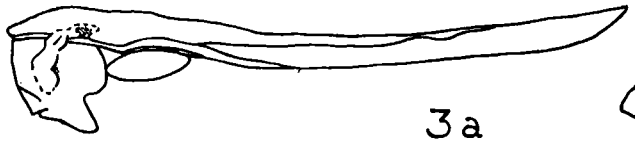
Fig. 10a.- Prosternal tubercle of *Melanoplus femur-rubrum*, lateral aspect.

Fig. 10b.- Same of *M. mexicanus*.

Fig. 11a.- Subgenital plate of *Melanoplus femur-rubrum*, posterior aspect.

Fig. 11b.- Same of *M. mexicanus*.

PLATE III.



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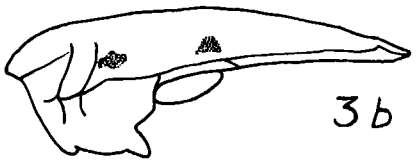

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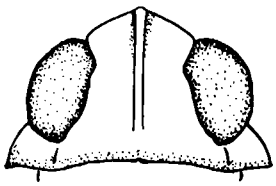

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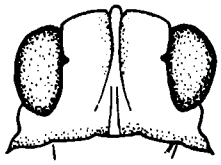

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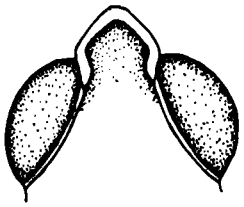

5a

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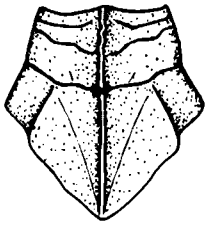

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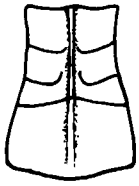

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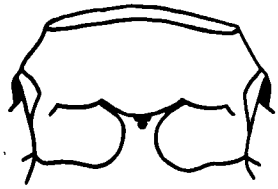
8a

8b



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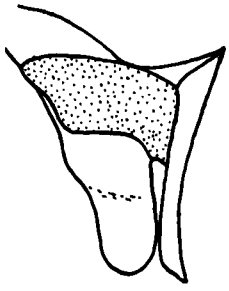

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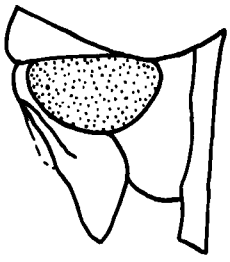

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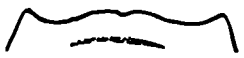


11a

11b

Plate IV

Fig. 12a. - Left cercus of Melanoplus borealis junius, male, lateral aspect.

Fig. 12b. - Same of M. mexicanus.

Fig. 12c. - Same of M. keeleri luridus.

Fig. 12d. - Same of M. femur-rubrum.

Fig. 12e. - Same of M. fasciatus.

Fig. 12f. - Same of M. bivittatus.

Fig. 13a. - Pronotum of Scudderia furcata, female, dorsal aspect.

Fig. 13b. - Same of S. pistillata.

Fig. 14a. - Ovipositor of Scudderia texensis, female, lateral aspect.

Fig. 14b. - Same of S. pistillata.

Fig. 14c. - Same of S. curvicauda borealis.

Fig. 14d. - Same of S. furcata.

Fig. 15a. - Supra-anal spine of Scudderia texensis, male, dorsal aspect.

Fig. 15b. - Same of S. pistillata.

Fig. 15c. - Same of S. curvicauda borealis.

Fig. 15d. - Same of S. furcata.

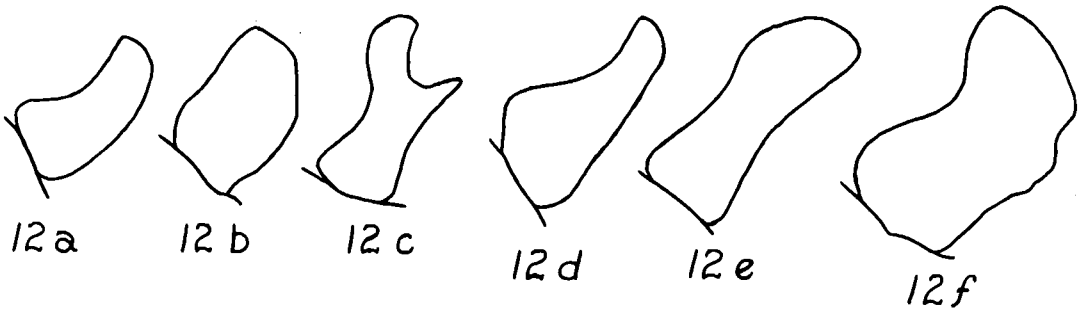
Fig. 16a. - Extremity of abdomen of Scudderia texensis, male, lateral aspect.

Fig. 16b. - Same of S. pistillata.

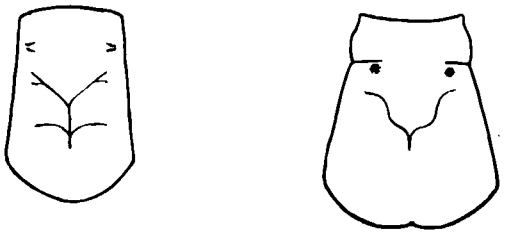
Fig. 16c. - Same of S. curvicauda borealis.

Fig. 16d. - Same of S. furcata.

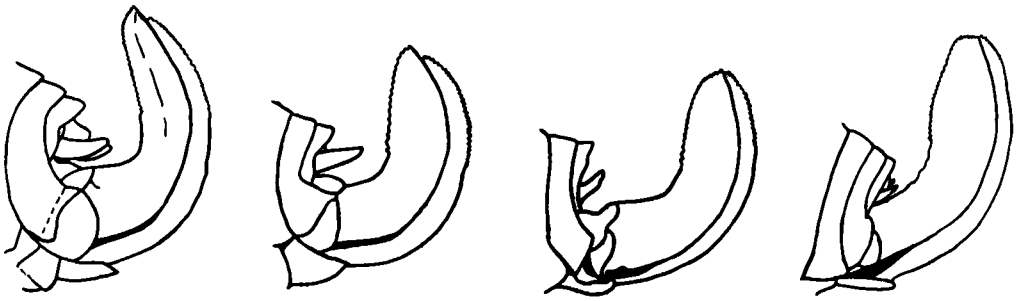
PLATE IV.



12 a 12 b 12 c 12 d 12 e 12 f

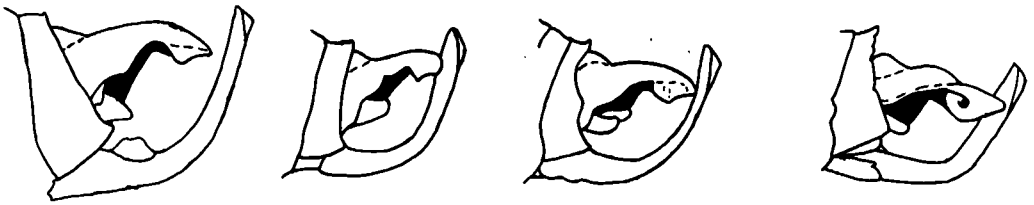


13 a 13 b



14 a 14 b 14 c 14 d

15 a 15 b 15 c 15 d



16 a 16 b 16 c 16 d

Plate V

Fig. 17a. - Frontal fastigium of Scudderia furcata, anterior aspect.

Fig. 17b. - Same of Amblycorypha oblongifolia.

Fig. 18a. - Same of Conocephalus fasciatus.

Fig. 18b. - Same of Neoconocephalus ensiger.

Fig. 19. - Prosternal spines of Conocephalus fasciatus, female, anterior aspect, head removed.

Fig. 20. - Ovipositor of Conocephalus fasciatus, female, lateral aspect.

Fig. 21a. - Left cercus of C. fasciatus, male, dorsal aspect.

Fig. 21b. - Same of C. brevipennis.

Fig. 22a. - Posterior part of abdomen of Ceuthophilus maculatus, male, dorsal aspect.

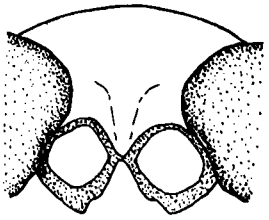
Fig. 22b. - Same of C. brevipes.

Fig. 23a. - Tip of ovipositor of Hemobius fasciatus socius, female, lateral aspect.

Fig. 23b. - Same of H. cubensis palustris.

Fig. 23c. - Same of H. carolinus.

PLATE V.



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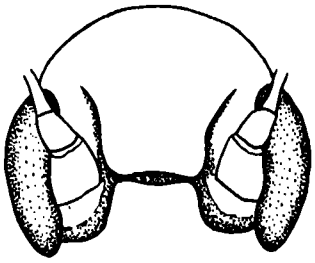
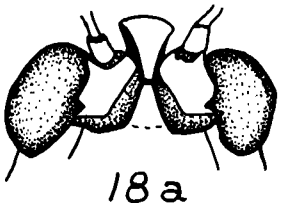


17 b



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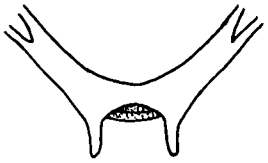

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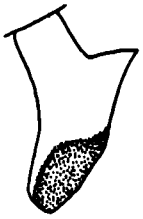

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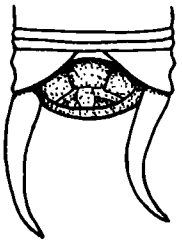
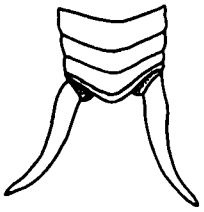


22 a

23 a



22 b

23 b

23 c