

as if the white wings were showing through. There are a number of dark speckles across each segment. The antennae cases are also green—legs white—proboscis (?) green. Some of the more backward larvae did not pupate until the end of July—not until several imagines from early pupae had emerged.

The first moth (a female) emerged on 25th July, the second (a male) on the 29th, and the third (a female) on the 31st. In all, 29 moths emerged—12 males and 17 females. In the wild state, the moth is sometimes found at rest on the trunks of trees, where it is a conspicuous object; but it is easily disturbed and has a tendency to fly upwards among the branches of the firs.

NOTES ON THE ECOLOGICAL DISTRIBUTION OF SOME ORTHOPTERA FROM THE CHILCOTIN DISTRICT OF BRITISH COLUMBIA

By E. R. Buckell

In British Columbia there are some species of Orthoptera which do not frequent the same type of habitat in different parts of the Province, and the following notes on ecological distribution apply only to the Chilcotin District, and mainly to the Riske Creek Range situated in the angle made by the junction of the Fraser and Chilcotin Rivers.

In dividing a number of species into "groups" or "associations of species" there are a number of plans which might be adopted. In the Chilcotin District, however, the topographical and floral characters lend themselves readily to the formation of four main divisions, populated by fairly distinct groups of species. These may conveniently be called the *campestrian*, *sylvan*, *semi-sylvan* and *hygrophilous* groups. The *campestrian* group may, furthermore, be sub-divided into *phytophilous*, *saxicolous* and *geophilous* species; and the *hygrophilous* group into *humicolous* and *paludicolous* species. These sub-divisions are added to further emphasize the various types of environment chosen by the *campestrian* and *hygrophilous* species for their normal habitat (i.e., the habitat in which they are found in greatest numbers). A short description of the district will further explain the choice of these headings.

The Riske Creek Range is an undulating, triangular, tableland, with an elevation ranging from 3,000 to 3,500 feet. It is bounded on two sides by the river valleys of the Fraser and Chilcotin Rivers, which are approximately 1,500 feet below the level of the main tableland.

The steep river valley slopes and the main tableland are open grass lands bounded on the north by forests of fir, spruce and pine. This open grass covered area contains about 300 square miles and forms the home of the *campestrian* species.

The lower slopes and benches of the river valleys are very much warmer than the upper tableland and are covered with tall bunch-grass and *Chrysothamnus* bushes, and are intersected by numerous ravines filled with rank herbage and small trees. It is here that we find the phytophilous campestrian species, whose habitat is a warm, dry location, plentifully covered with herbage such as the tall bunch-grass of the open slopes, or the tangled brush of the ravines. The colder and higher tableland above supports but little vegetation and has been so heavily overgrazed by cattle that we find nothing but a scant covering of low-growing grasses and small plants which soon dry up in the summer sun. This is the home of the geophilous campestrian species, whose favourite habitat is a bare, sunbaked ground devoid of all tall herbage.

The tableland is composed of a layer of lava rock overlying deep beds of silt and gravel. The rivers in cutting down through this volcanic rock into the softer layers below, have left in many places, precipitous cliffs along the upper edges of their valleys (locally known as "the rimrock"). At the base of these cliffs there is the usual talus of broken rock which reaches down on to the upper slopes of the valleys, forming a favourable habitat for certain species which I am calling the *saxicolous campestrian*.

The forests, bounding the open country on the north, are composed mainly of Douglas fir (*Pseudotsuga mucronata*), Engelmann spruce (*Picea engelmanni*) and Lodgepole pine (*Pinus murrayana*). There is very little undergrowth, the ground being covered with pine-grass. In these forests we find the sylvan species.

The semi-sylvan species are those which are found in the large natural clearings in the forest, where an abundance of tall herbage grows, and in the long grass beneath the aspen poplars which are always found fringing the edge of the forests and dividing them from the open grass-land. The species included under this heading naturally overlap the sylvan and geophilous campestrian species, but are never numerous away from their natural habitat.

Lastly, we have the hygrophilous group divided into the humicolous species inhabiting hay-fields, borders of streams, the thick herbage of "willow-bottoms," and the margins of lakes, and the paludicolous species frequenting marshes and bogs.

The following species were collected during the summer of 1920, and are arranged systematically with short notes on their Ecological Distribution.

Family LOCUSTIDAE

Anabrus longipes Caudell. *Semi-sylvan*. Found inhabiting open glades, Aspen groves on open mountain slopes, and in and around clumps of trees on certain portions of the open range.

Steiroxys (trilineata?) Thomas. A *semi-sylvan* species, fairly plentiful, found in similar locations to **Anabrus longipes**.

Cyphoderris monstrosus Uhler. *Sylvan*. A nocturnal species. May be found during the day time beneath logs and flat stones in the forests.

Family GRYLLIDAE

Gryllus abbreviatus Serville. A *saxicolous campestrian*. An uncommon insect in this locality found only in warm situations close to the Fraser River. Frequents rock-slides and stony ravines, where the males may be heard stridulating during the heat of the day.

Oecanthus quadripunctatus Beut. A *phytophilous campestrian*. Found occasionally among tall plants and rose bushes in dry, warm ravines in the river valleys.

Family ACRIDIDAE

Tettiginae

Acrydium granulatum Kirby. A *humicolous hygrophile*. Taken only in damp grass beneath willow and birch close to water. Both long and short-pronotumed forms were collected.

Acrydium brunneri Bol. A *humicolous hygrophile*. Observed only in one small area among fallen leaves and moss under birch and willow around an upland spring.

Tryxalinae

Amphitornus bicolor McNeill. A *phytophilous campestrian*. Inhabits the bunch-grass slopes of the river valleys. A few found on upper table-land in depressions where the herbage was fairly plentiful.

Chloealtis abdominalis Thomas. *Sylvan*. Very common. Frequenting open forests, especially where logging operations have been conducted leaving the ground strewn with dead limbs. Less plentiful in aspen groves in *semi-sylvan* locations.

Chloealtis conspersa Harris. *Sylvan*. Common. Inhabiting open forests in company with *C. abdominalis*.

Mecostethus gracilis Scudder. A *paludicolous hygrophile*. Collected in wet marshes and flooded areas in wild hay meadows. Flies actively about in the tops of tall grasses and rushes.

Chorthippus curtipennis Harris. A *humicolous hygrophile*. A very common species in long rank meadow grass and under aspens in damp locations. Extending in places into distinctly *sylvan* surroundings.

Platybothrus brunneus Thomas. A *geophilous campestrian*. Was found in great numbers over approximately 1,000 square miles of dry, bare, overgrazed range. The only *geophilous* species of this sub-family collected and, I believe, the first record of a **Tryxaline** occurring in injurious numbers in Canada.

Oedipodinae

Arphia pseudonietana Thomas. A *phytophilous campestrian*. Rarely seen. Taken in small numbers in hot, dry ravines, and among sage brush near the Fraser River.

Camnula pellucida Scudder. A *geophilous campestrian*. This common and destructive species was found everywhere on the open range land.

It is particularly fond of alkaline ground, especially for oviposition. A species with migratory tendencies and flies freely. This species migrated during August into sylvan, semi-sylvan and phytophilous locations in search of food, but returned to the range for oviposition.

Hippiscus sp. A *geophilous campestrian*. A typical geophilous campestrian distributed all over the open range and rarely extending into semi-sylvan or phytophilous surroundings.

Hippiscus (Xanthippus) latefasciatus Scudder. A *phytophilous campestrian*. This large brightly coloured insect is one of the earliest to appear in spring as it hibernates as a nymph. Commonly found on warm bunch-grass flats along the river valleys. Occasionally found on the upper range.

Pardalophora tuberculata Beauv. *Semi-sylvan*. A rare species, taken occasionally in dry mountain meadows.

Spharagemon aequale Say. A *phytophilous campestrian*. Collected only on lower bunch-grass flats close to the rivers, where, in company with **Metator pardalinus**, it did considerable damage to the grass.

Metator pardalinus Saussure. A *phytophilous campestrian*. Very common on lower bunch-grass flats in company with **Spharagemon aequale**. Rare on upper range. Both yellow and red winged forms were seen.

Circotettix carlinianus Thomas. A *geophilous campestrian*. Found only on the driest and barest parts of the upper range in small scattered colonies.

Circotettix lobatus Saussure. A *saxicolous campestrian*. Inhabits the steep rocky sides of ravines and the base of cliffs in warm locations on the river slopes.

Circotettix suffusus Scudder. A *sylvan* species. This species was most frequently found in the Chilcotin district in sylvan locations, but also inhabits semi-sylvan areas such as open clearings and road sides.

Trimerotropis vinculata Scudder. A *phytophilous campestrian*. Found locally on dry exposed areas on lower river benches.

Trimerotropis sp. A *geophilous campestrian*. A typical geophilous species found commonly on the open range of the tableland.

Acridinae

Melanoplus atlanis Riley. A *geophilous campestrian*. Frequents dry, sandy grass lands on sheltered parts of the range.

Melanoplus femur-rubrum DeGeer. A *humicolous hygrophile*. Restricted in the Chilcotin district to hay meadows and long rank grass; avoiding very dry areas.

Melanoplus bivittatus Say. Mainly a *semi-sylvan* species, adapted, however, to a wide variety of conditions. It was found wherever there was a thick growth of succulent vegetation, such as the borders of streams, and also out on the open range in depressions where there was a good covering of grass.

Melanoplus packardii Scudder. A *phytophilous campestrian*, with geophilous tendencies. Only collected in one locality. Found among bushes on a dry, stony bank near the Chilcotin River at Hanceville.

Melanoplus altitudinum Scudder. *Semi-sylvan*. Found only among the scrub along road sides and in aspen poplar groves.

Melanoplus minor Scudder. A *phytophilous campestrian*. Frequents dry ground among bushes and low scrub, on the lower river valley flats. Found sometimes in typical semi-sylvan surroundings.

Melanoplus bruneri Scudder. *Semi-sylvan*. Found most commonly in semi-sylvan locations, but extends into the geophilous campestrian area where the open range adjoins the forest.

Melanoplus alpinus Scudder. A *sylvan* species. Found throughout the open pine forests, usually above 3,500 feet elevation.

Melanoplus infantilis Scudder. A *geophilous campestrian*. A typical geophilous species and the only *Melanoplus* found commonly on the open dry range. It chooses the barest of ground for its habitat, and never encroaches upon the semi-sylvan or phytophilous locations.

Melanoplus borealis Fieber. A *humicolous hygrophile*. An inhabitant of the tall rank vegetation beneath birch and willow on the borders of streams. A sluggish species, usually seen resting on the leaves of nettles and other tall plants. A richly coloured insect, probably due to its humid surroundings.

Melanoplus fasciatus Walker. *Sylvan*. A typical sylvan species found among low brush in the forest areas in the higher elevations. In addition to the species of *Melanoplus* enumerated above two species of wingless *Melanopoli* (genus and species not yet determined) were taken in considerable numbers. They were typically semi-sylvan in their choice of habitats. They were found in dry mountain meadows and in aspen groves on the mountain slopes.

TABLE OF THE "LOCUST ASSOCIATIONS" FOUND IN THE
CHILCOTIN DISTRICT OF BRITISH COLUMBIA

Group I. CAMPESTRIAN (Inhabiting Open Ground)

PHYTOPHILOUS Species.

Oecanthus quadripunctatus Beut.

Amphitornus bicolor McNeill.

Arphia pseudonietana Thomas.

Hippiscus (Xanthippus) latefasciatus Scudder.

Spharagemon aequale Say.

Metator pardalinus Saussure.

Trimerotropis vinculata Scudder.

Melanoplus packardii Scudder.

Melanoplus minor Scudder.

GEOPHILOUS Species.

- Platybothrus brunneus* Thomas.
Camnula pellucida Scudder.
Hippiscus sp.
Circotettix carlinianus Thomas.
Trimerotropis sp.
Melanoplus atlanis Riley.
Melanoplus infantilis Scudder.

SAXICOLOUS Species.

- Gryllus abbreviatus* Serville.
Circotettix lobatus Saussure.

Group II. SYLVAN (Inhabiting Forests)

- Cyphoderris monstrosus* Uhler.
Chloealtis abdominalis Thomas.
Chloealtis conspersa Harris.
Circotettix suffusus Scudder.
Melanoplus alpinus Scudder.
Melanoplus fasciatus Walker.

Group III. SEMI-SYLVAN (Inhabiting Borders of Forests, Poplar Groves, Open Glades, etc.)

- Anabrus longipes* Caudell.
Steiroxys (trilineata?) Thomas.
Pardalophora tuberculata Beauv.
Melanoplus bivittatus Say.
Melanoplus altitudinum Scudder.
Melanoplus bruneri Scudder.

Group IV. HYGROPHILOUS

HUMICOLOUS (Moisture-loving) Species.

- Acrydium granulatum* Kirby.
Acrydium brunneri Bol.
Chorthippus curtipennis Harris.
Melanoplus femur-rubrum DeGeer.
Melanoplus borealis Fieber.

PALUDICOLOUS (Marsh-loving) Species.

- Mecostethus gracilis* Scudder.

In conclusion it is worth mentioning the influence that man has had upon the distribution of some of the Orthoptera of the Chilcotin district. Before this country was settled, the whole of the tableland (geophilous campestrian location) was thickly covered with bunch-grass, and although undoubtedly somewhat colder than the river valley slopes (phytophilous campestrian location), I believe that the Orthopteran fauna was very similar in the two localities.

The use of this country as a cattle range has completely altered the condition of the tableland, or upper range, where the cattle have been allowed to graze unchecked. The bunch-grass has gone, and the range is bare and uncovered by any high growing plants. Species such as **Metator pardalinus**, **Spharagemon aequale** and **Amphitornus bicolor** no longer find the range to their liking and only a few of them can now be found in some of the depressions where there is an unusual abundance of grass.

These species are now confined to the river valley slopes which have been fenced as "winter ranges" and are not overgrazed by the cattle. The overgrazing of the range, while it has caused the decrease of some species, such as **Metator**, **Spharagemon** and **Amphitornus**, has undoubtedly created ideal conditions for other species, probably hitherto comparatively uncommon. Among these may be mentioned **Melanoplus infantilis**, **Camnula pellucida** and **Platybothrus brunneus**. The last species was extremely abundant, causing a serious outbreak over at least 1,000 square miles in the Chilcotin district alone, and as specimens were also secured from the Nicola Valley, it probably extended over 2,000 to 2,500 square miles of open cattle range in British Columbia. This sudden outbreak, in large numbers, of a species never before recorded from the Province, and rarely taken in Canada, is remarkable.

The following species from the above list are believed to be new records for the Province.

- Pardalophora tuberculata** Beauv.
- Mecostethus gracilis** Scudder.
- Platybothrus brunneus** Thomas.
- Melanoplus fasciatus** Walker.
- Melanoplus infantilis** Scudder.
- Melanoplus borealis** Fieber.
- Melanoplus minor** Scudder.
- Melanoplus altitudinum** Scudder.