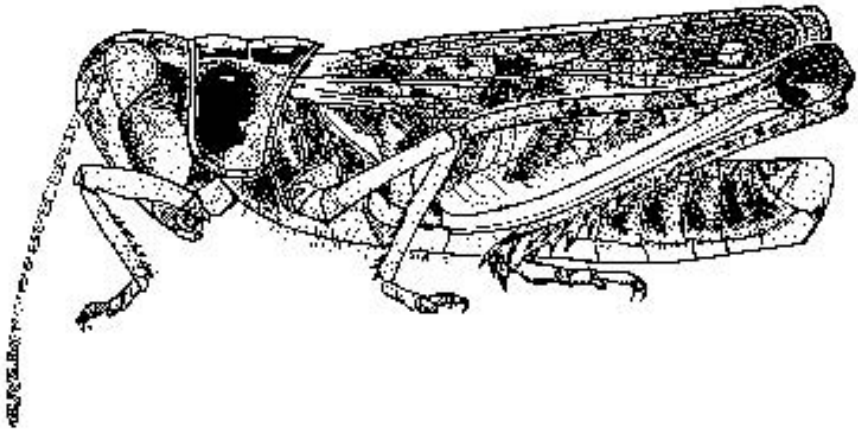

FRONTISPIECE. *Bruneria yukonensis* Vickery, the Yukon Grasshopper, the only species of Orthoptera endemic in the Yukon. Length about 2 cm.

Orthopteroid Insects (Orthoptera) of the Yukon

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Abstract. Seventeen species of Orthoptera occur in the Yukon. One species, *Bruneria yukonensis* Vickery, is endemic. Most species have affinity with Palaearctic relatives and some genera are Holarctic. The present occurrence of nearly all of the species has been strongly influenced by land bridges between Asia and North America and by Beringian refugia.

Resume. *Les insectes orthoptéroïdes (Orthoptera) du Yukon.* Dix-sept espèces d'orthoptères vivent au Yukon. Une espèce, *Bruneria yukonensis* Vickery, est endémique. La plupart des espèces ont des affinités avec la faune paléarctique et certains genres sont holarctiques. La répartition actuelle de presque toutes les espèces a été fortement influencée par la présence de voies terrestres entre l'Asie et l'Amérique du Nord et par l'existence de refuges béringiens.

Introduction

Seventeen species of Orthoptera have been recorded from the Yukon, 14 acridid grasshoppers (Acrididae) and 3 pygmy grasshoppers (Tetrigidae). One species of Orthoptera, *Bruneria yukonensis* (Frontispiece), is endemic in the Yukon. Representatives of the Orthoptera occur all over the world. Most species are primarily tropical or subtropical but some are adapted to temperate regions. Very few species are known from the arctic.

A single species of cockroach, *Blattella germanica* (Linn.), the common German Cockroach, also manages to survive in heated buildings and breeding is continuous. It could not survive without this protection. It has become established in many northern locations in buildings in Iceland, Greenland, Alaska (Pribilof Islands), in Canada at Alert, Ellesmere Island, as well as various other northern localities, including some in the Yukon. As it is only adventive it will not be discussed further in this paper.

The species of Acrididae in the subarctic have life cycles lasting one or 2 years or more. Those that are univoltine pass the winter in diapause in the egg stage; semivoltine species pass the first winter as eggs and the second as third- or fourth-instar nymphal hoppers, maturing in the following spring. Under northern conditions the eggs of some species may not hatch until the third spring season (see Kreasky 1960). The Tetrigidae have, so far as is known, univoltine cycles but winter as adults and produce a new generation that becomes adult before winter. This type of cycle is not confined to northern regions but also is common in temperate regions. In the tropics and subtropics breeding may be continuous, producing a number of generations each year, or may be interrupted by aestivation during hot or very dry conditions.

Materials and Methods

Specimens have been examined over a period of years from the following institutions: Canadian National Collection, Ottawa, Ontario (CNCI); Royal Ontario Museum, Toronto,

pp. 223–239 in H.V. Danks and J.A. Downes (Eds.), Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods), Ottawa. 1034 pp.

Ontario (ROME); Spencer Museum, University of British Columbia, Vancouver, British Columbia (SMDV); Academy of Natural Sciences, Philadelphia, Pennsylvania (ANSP); United States National Museum of Natural History, Washington, District of Columbia (USNM); Museum of Zoology, University of Michigan, Ann Arbor, Michigan (UMMZ); and Lyman Entomological Museum and Research Laboratory, McGill University, Ste-Anne-de-Bellevue, Quebec (LEMQ). Unfortunately very few data other than locality are available for most species. Very few labels have habitat data or elevations of collecting sites. The known favoured habitats of a species from other, more southern, localities are discussed under each species.

Comparative Distribution

The Yukon fauna comprises 17 species. Alaska also has 17, but shares only 15 with the Yukon. Twenty-two species are known from the western Northwest Territories but 5 occur only close to the borders of British Columbia and Alberta. Canada and adjacent states of the United States have 389 species but this total includes both Orthoptera and Grylloptera as recognized by Vickery and Kevan (1983, 1986). In the Yukon only 2 superfamilies occur, Acridoidea with one family, Acrididae, and Tetrigoidea with one family, Tetrigidae.

Species Found Close To But Not In The Yukon

A number of species of Orthoptera are known from northern British Columbia and do not occur in the Yukon though they may be found there at some later time. These include *Trimerotropis verruculata* (Kirby) (Acrididae: Locustinae) that is known from several localities on the Mackenzie River and around Great Bear Lake in the Northwest Territories as well as Coal River on the Liard River, not far south of the Yukon/British Columbia border. It would not be surprising to find this species at some southern Yukon localities.

Another locustine species, *Pardalophora apiculata* (Harris), likewise has not been found in the Yukon but it is well established in the Northwest Territories. As all records are from east of the Mackenzie River, or close to the border with Alberta, this species is not expected to migrate to the Yukon.

Melanoplus gordonae Vickery, described from near Fairbanks, Alaska, by Vickery (1969), is not known from the Yukon. Its range is thought to be very restricted, perhaps indicating a relict population that once was more widely distributed.

No species of the Order Grylloptera occurs in the Yukon but 2 species of so-called camel crickets (Rhaphidophoridae: Ceuthophilinae), *Pristoceutophilus celatus* (Scudder) and *Ceuthophilus alpinus* Scudder, are known from northern British Columbia. The localities where they were found are not near the Yukon border. A species of Tettigoniidae: Decticini, *Sphagniana sphagnorum* (Walker), occurs at Fort Smith in the Northwest Territories, but again this is not close to the Yukon (Vickery and Kevan 1983, 1986).

Two members of the Order Notoptera, *Grylloblatta campodeiformis nahanni* Kamp and *G. c. athapasca* Kamp were described from northern British Columbia (Kamp 1979), the former from Mt. McDane in the Cassiar Range at 1747 m, the latter from Summit Lake, Mt. St. Paul, 1502 m, in Stone Mountain Provincial Park. Grylloblattids occur in isolated communities and, though possible, it is unlikely that these subspecies will eventually be found in the Yukon. It is more probable that any grylloblattid found north of the present provinces would prove to be a new species or subspecies. Grylloblattids are cold hardy but occur in rocky scree, often at considerable depth, or in caves and are seldom seen during

warm weather. So far as I know, no search has been made for grylloblattids in the Yukon. Storozhenko (1991) recorded new genera and species of Upper Permian grylloblattids and Storozhenko (1992) reported on fossil grylloblattids from Permian deposits near Archangel, Russia, but there are no records to date of fossil grylloblattids in Canada. Since the original discovery of this interesting group of insects in western Canada by Walker (1914), additional extant species, many in the genus *Galloisiana*, have been found in Kirin Province, northeastern China (Wang 1987*a*, *b*), Mjohiang Mountains, North Korea (Szeptycki 1987) and from "Lazourkij", Kieva River, Siberia (Storozhenko 1988).

Orthoptera of the Yukon

I have published data on some or all of the species of Orthoptera in the Yukon (Vickery 1964, 1967*a*, *b*, 1969, 1983, 1984; Vickery and Kevan 1983, 1986; Vickery and Scudder 1988). Three papers discussed origins and relationships to taxa of other regions (Vickery 1986, 1987, 1989).

The distribution patterns of species in the Yukon are subject to considerable distortion due to incomplete collecting. The terrain has dictated that nearly all collections have been made near highways, lakes or navigable rivers.

Family Acrididae

Subfamily Melanoplinae

Tribe Melanoplini

1. ***Melanoplus borealis borealis* (Fieber)**

A medium small species; tegmina usually short, not reaching apex of abdomen, macropterous forms occur rarely; male cercus upcurved, length little more than twice basal width (Fig. 2a); outer face of hind femora lacks cross bands.

Distribution: Very broad, from the northern tier of U.S. states northward to beyond timber line, including Alaska, Yukon and Northwest Territories (Vickery 1967*a*) (Fig. 3).

Yukon records: Found at many locations over most of the Yukon, including Kitwanga, Cabin Cr., Ross R., Pelly Crossing, Rancheria, South Macmillan R. and Canol Rd. (local regions nos. 1, 4, 8, 10, 11, 12, 13, 16, 17, 18, 19; see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV.

Biological information: It usually frequents damp cool situations where grass is luxuriant but also is found on cold sphagnum on arctic tundra (Vickery and Kevan 1983). It is agile and is not easily captured. It is primarily a grass feeder but will also eat forbs.

2. ***Melanoplus sanguinipes sanguinipes* (Fabricius)**

Male subgenital plate notched; male cercus broad, short and rounded apically (Fig. 2b); female cerci triangular, upper and lower margins concave; hind femur of both sexes with dark cross bands; hind tibia usually red.

Distribution: The distribution is greater than for *Melanoplus b. borealis*, as it extends farther southward in the United States but it does not extend as far northward as that species. It is quite common across the southern two-thirds of Alaska, western Northwest Territories and Yukon.

Yukon records: Local regions nos. 8, 12, 13, 16, 17 (see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV.

Biological information: This species is known as the worst grasshopper pest in Canada. Adults have long tegmina, fly readily and have the capacity to migrate over considerable distances. The habits are widely variable and it is very tolerant of conditions of temperature and humidity. It feeds preferentially on grasses but accepts other plants and is also omnivorous. The life cycle in the Yukon probably lasts 2 years.

3. ***Melanoplus bruneri* Scudder**

Larger than the last species and resembles it; male subgenital plate notched but differs in that it is extensively produced upward; male cercus large, subrectangular (Fig. 2c); upper margin of female cercus straight, not concave; hind femur banded; hind tibia pink to red, occasionally pale green to yellow.

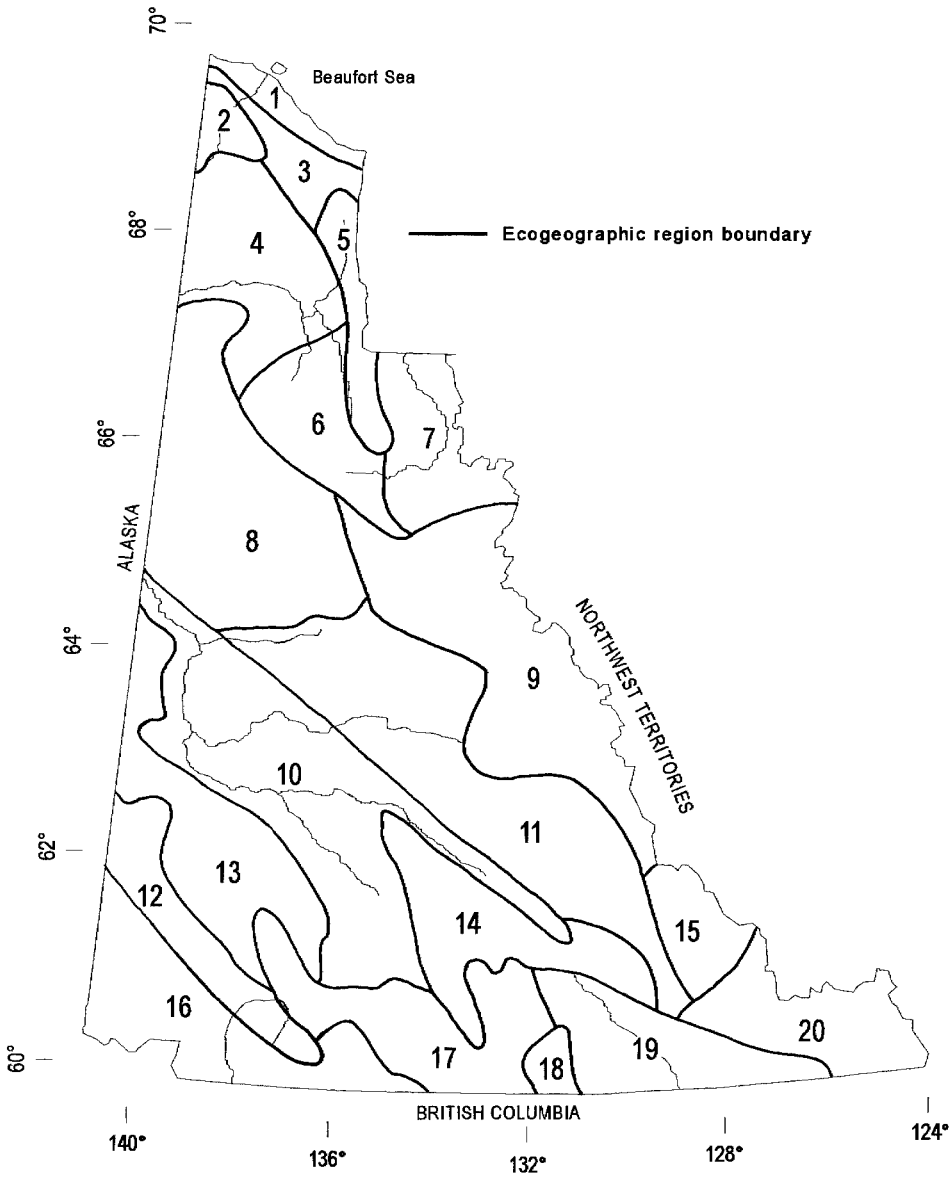

FIG. 1. Map of the Yukon, indicating ecogeographic regions (see Table 1): 1, Arctic Coastal Plain; 2, British Mountains; 3, Arctic Plateau; 4; Porcupine Plain; 5, Richardson Mountains; 6, Eagle Plain; 7, Peel Plain; 8, Ogilvie Mountains; 9, Wernecke/Selwyn Mountains; 10, Yukon/Tintina; 11, Eastern Plateaus; 12, Shakwak Trench; 13, Western Ranges; 14, Pelly Mountains; 15, Logan Mountains; 16, St. Elias/Coast Mountains; 17, Southern Lakes; 18, Cassiar Mountains; 19, Liard Plain; 20, Hyland/Liard Plateaus.

Distribution: The distribution is quite broad, from Quebec to British Columbia and northward to the lower two-thirds of Alaska and Northwest Territories and in the Yukon.
Yukon records: Local regions nos. 5, 8, 12, and 17 (see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV.

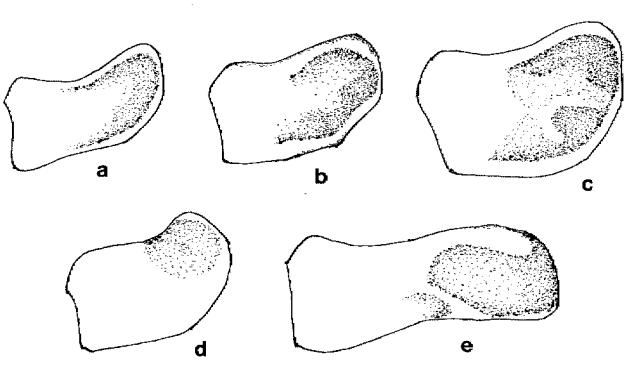

FIG. 2. Cerci of males, *Melanoplus* species: a, *M. b. borealis* (Fieber); b, *M. s. sanguinipes* (Fabricius); c, *M. bruneri* Scudder; d, *M. k. kennicottii* Scudder; e, *M. fasciatus* (F. Walker).

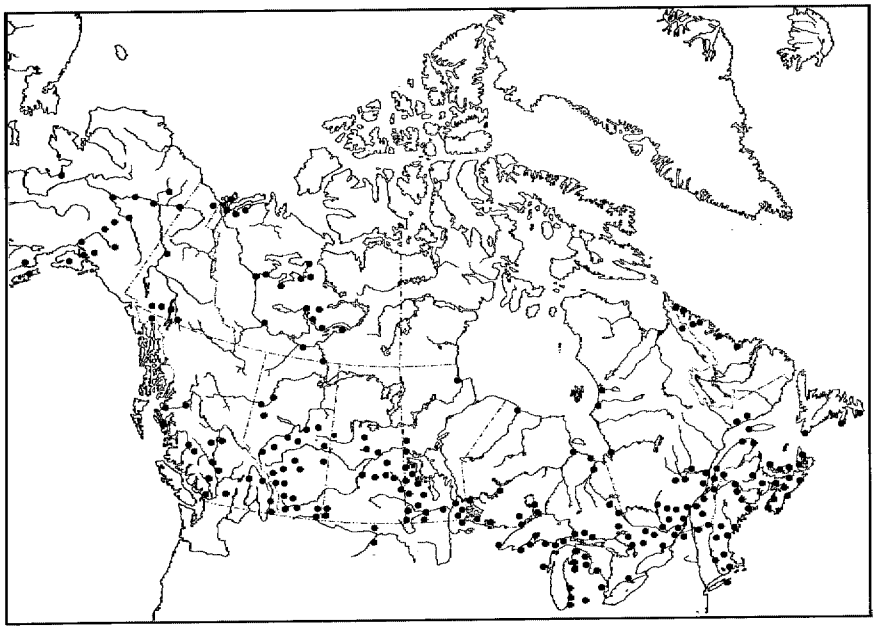

FIG. 3. Distribution of *Melanoplus borealis borealis* (Fieber) (1), a species with broad climate tolerance.

Biological information: This species occurs mainly in forested areas, grassy open slopes and rangeland where there are open grassy areas. It feeds upon both grasses and forbs but seems to prefer grasses. The life cycle requires 2 years in the Yukon.

4. ***Melanoplus kennicottii kennicottii*** **Scudder**

A small species (17 to 22 m); male subgenital plate triangular; male cercus large, rectangular, depressed dorsally at rounded apex (Fig. 2d); hind femur yellow beneath with cross bands obvious only on upper half of outer face; hind tibia blue or buff.

Distribution: Western and northwestern, from South Dakota, Montana and Wyoming through Saskatchewan, Alberta and northern British Columbia to Alaska, Yukon and Northwest Territories.
Yukon records: Found in local regions 4, 10, 12, 17, and 19 (see Fig. 1). Vickery (1967*a*) did not report this species from the Yukon but subsequent collections confirmed its presence there (Vickery and Kevan 1983, 1986). Specimens: LEMQ, ROME, SMDV.
Biological information: It prefers forbs but will eat grasses and sedges (Brooks 1958). It is generally known as a "scarce boreal species" (Hebard 1935). Adults have been collected only in July and August and it is not known whether the life cycle is univoltine or semivoltine.

5. ***Melanoplus fasciatus* (F. Walker)**
Easily distinguished by the short tegmina that covers only about 3/4 of abdomen in males, 2/3 in females; male cercus broad, strap-like (Fig. 2e); more robust than *M. b. borealis*, the other species with short tegmina; hind femora red beneath with conspicuous cross bands.
Distribution: Primarily northern, occurring in all Canadian provinces and Alaska, Yukon and Northwest Territories.
Yukon records: Known from local regions 4, 11, 12, 13, 17 and 19 (see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV, ANSP.
Biological information: It is found in association with heath plants in open areas in woods. It is univoltine in the south but it is probable that 2 years are required for completion of the life cycle in the northern range.

Tribe Podismini

6. ***Bohemanella frigida frigida* (Boheman)**
Small species (18 to 27 mm), tegmina short, reaching middle of hind femora; male cercus slightly upcurved apically; male subgenital plate conical and produced; hind femur banded; hind tibia red with black basal ring.
Distribution: This species is Holarctic. The Nearctic distribution is shown in Fig. 4. It also occurs in northern Russia and in Lapland.
Yukon records: In the Yukon it is known only from foothills of the Richardson Mts. at km 404 Dempster Hwy., and on the Alaska-Yukon border at 69°20′N (local regions nos. 2 and 4, see Fig. 1). Specimens: CNCI, ROME. LEMQ has specimens from Canoe L. (68°13′N), Northwest Territories, but none from the Yukon.
Biological information: In northern Russia and Lapland there is a single annual generation (Vickery 1984).
Taxonomic notes: Formerly called *Melanoplus frigidus*, placed in *Bohemanella* by Vickery (1987).

Subfamily Locustinae

Tribe Parapleurini

7. ***Stethophyma lineatum* (Scudder)**
Large species, males about 26 mm, females about 36 mm; pronotum with 3 carinae, middle one elevated, sharp, cut before middle by principal sulcus; tegmina and wings long; pale yellow line extends from behind eye across pronotum and along tegminal margin.
Distribution: The distribution of this species is very broad. It occurs in all Canadian provinces, Alaska, Yukon and Northwest Territories (Fig. 5).
Yukon records: Vickery (1967*a*) did not record the species from the Yukon, but subsequently (Vickery 1983, 1984) reported one male from Halfway Lks., Elsa, local region 11, see Fig. 1 (specimen in SMDV). It is quite rare north of 60°N, with single records from Alaska (Beaver, in USNM) and the Northwest Territories (Outpost Is., Great Slave L., in ROME) both recorded by Vickery (1967*a*).

Tribe Locustini

8. ***Arphia conspersa* Scudder**
Size medium, males 19–21 mm, females 22–28 mm; frontal costa strongly narrowed above median ocellus, less than half as wide as below sulcus; light brown to blackish brown, usually with pale mid-dorsal line along tegmina when at rest; hindwing disk usually yellow, sometimes pink, with black spur extending almost to wing base; hind tibia pale greenish brown with dark apex and dark ring at apical third.
Distribution: The distribution is broad, from western Ontario and Minnesota to British Columbia and northward to the Northwest Territories, Yukon and Alaska (Fig. 6).

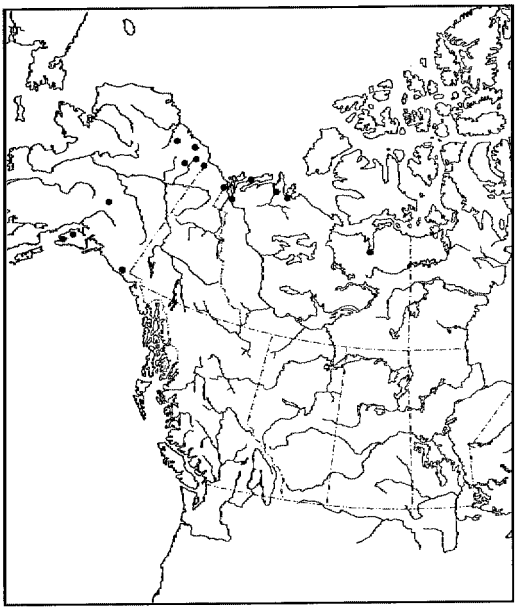

FIG. 4. Nearctic distribution of *Bohemanella frigida* (Boheman) (6), an arctic species.

Yukon records: Found from the British Columbia border northward to Dawson; Ross R. (61°56′N 132°30′W); Whitehorse, Dawson and Klondike Valley near Dawson (local regions 10, 11, 12, 13, 16 and 17, see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV and ANSP.
Biological information: This species shows a definite preference for arid conditions, generally on sandy or gravelly soils. It is a mixed feeder but prefers grasses and sedges.

9. ***Xanthippus brooksi* Vickery**
Large species, males about 23 mm, females about 37 mm; head and prozona of pronotum very rugose, median carina of pronotum cut near middle by 2 sulci, first usually slightly impressed; hindwing pale yellow with black cross band, this not reaching anal angle; hind femur red on ventral inner flange to pale pre-apical ring; hind tibia yellowish at base, pink on apical half.
Distribution: Distribution is quite small. Outside the Yukon it is known only from the type locality, Reindeer Depot, Northwest Territories.
Yukon records: Lapie R.; Tenas Cr.; Sheep Creek Rd., W side Slim's R. delta, km 1706 Alaska Hwy.; and Dempster Hwy., 48 km E Old Crow (local regions 4, 14 and 16, see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV, and USNM.
Biological information: The habitat is not well known but it has been found in grassy places on tundra. The life cycle is thought to be semivoltine. Adults were found in the Yukon in June.
Taxonomic notes: First described as *Xanthippus corallipes brooksi* (Vickery 1969) but was ranked as a species by Otte (1984).

10. ***Camnula pellucida* Scudder**
Small species, males 17–21 mm, females 19.5–28.5 mm; pronotal disk flat, smooth, widest posteriorly; median carina very low; light brown; tegmina smoky brown with yellowish stripe along humeral angle; hindwings transparent with dark veins; hind femur and tibia yellowish brown.
Distribution: This species is one of the most widespread of North American grasshoppers. It was first recorded north of 60°N by Vickery (1967*a*).
Yukon records: Found in many localities but none north of Dawson and Halfway Lks., Elsa (local regions 11, 12, 16 and 17, see Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV.
Biological information: C. pellucida is one of the most serious pest species in North America.

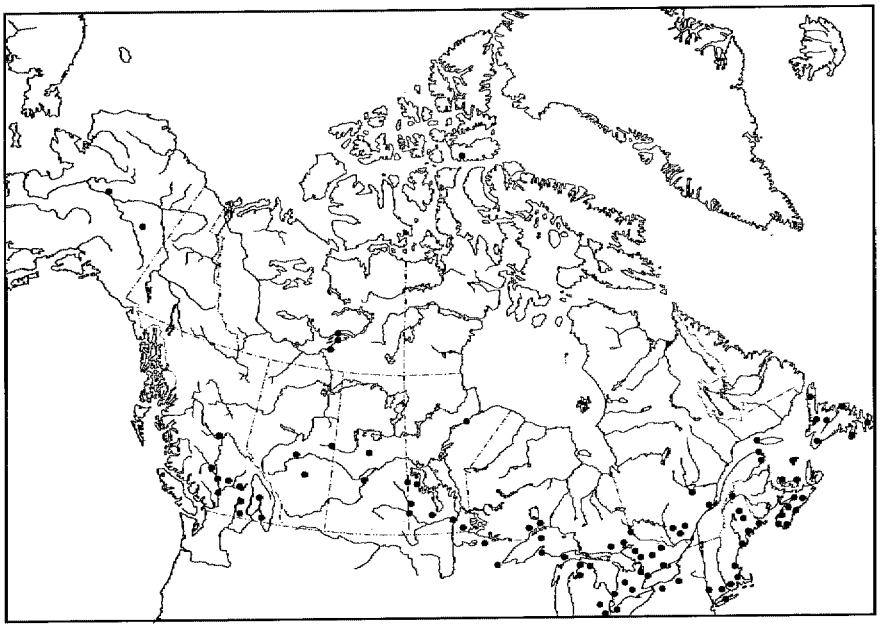

FIG. 5. Distribution of *Stethophyma lineatum* (Scudder) (7), indicating pre-Pleistocene immigration and subsequent range increase. The most northern records in Alaska and the Northwest Territories may be of accidental adventive specimens; that from Resolute Bay undoubtedly was an adventive specimen.

Subfamily Gomphocerinae

Tribe Chrysochraontini

11. ***Chloealtis abdominalis* (Thomas)**

Small species, males 18–19 mm, females 23–28 mm; tegmina short, apices pointed, especially in females; greyish brown, sides of pronotum darker above; hind femur red beneath; hind tibia brown, darker toward apex.

Distribution: Distribution is wide, from eastern Quebec to the Pacific coast and northward to Alaska, Yukon and the Northwest Territories.

Yukon records: Found only in the southwest: Whitehorse, Carcross, Dezadeash L. and Snag (local regions nos. 10, 13, 16 and 17, see Fig. 1). Specimens: CNCI, ROME.

Biological information: So far as is known there is a single generation per year. It is seldom found to be numerous at any locality.

Taxonomic notes: Formerly *Neopodismopsis abdominalis* and was so recorded by Vickery (1967*a*).

Tribe Gomphocerini

12. ***Chorthippus curtipennis curtipennis* (Harris)**

Small species, males 12.5–16.5 mm, females 16–22 mm; lateral foveolae of vertex distinct, narrow, visible from above; tegmina short, in males reaching nearly to apex of abdomen, in females reaching only to 5th abdominal segment; brown with black near pronotal carinae and on abdomen; hind femur yellowish brown; hind tibia pale yellow.

Distribution: Nearctic. One of the most widely distributed Nearctic grasshoppers, occurring in the United States, in all Canadian provinces, Northwest Territories, Yukon and Alaska.

Yukon records: Found from southwest to far north but, so far, has not been collected in southeastern localities (see local regions 1, 4, 8, 10, 13, 16 and 17, Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV.

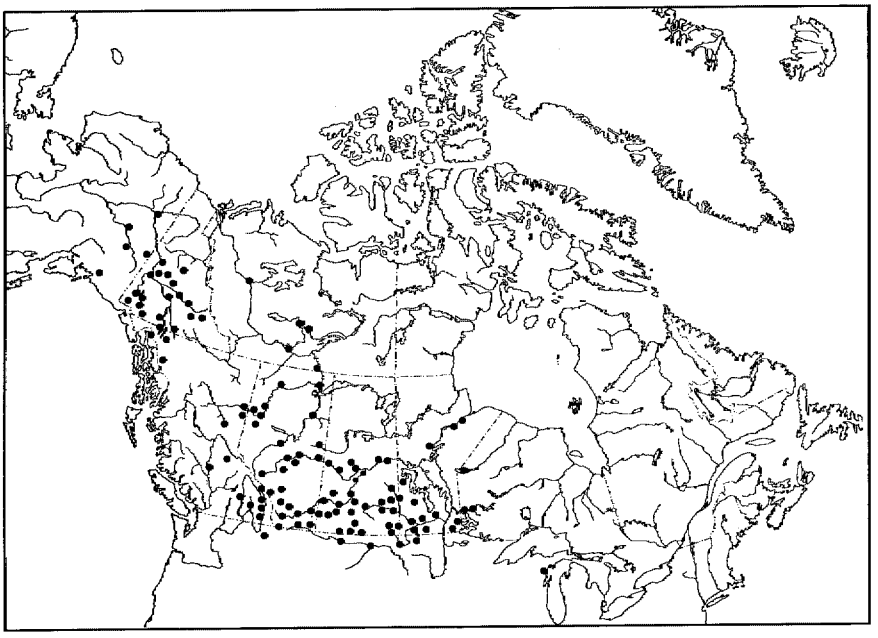

FIG. 6. Distribution of *Arphia conspersa* Scudder (8), a species that probably survived in a southern refugium and subsequently increased its range.

Biological information: Usually found in open areas and feeds on many grass species.The life cycle may require 3 or more years as it does in high elevations in Wyoming (Kreasky 1960). High-elevation and high-latitude responses are similar.
Taxonomic notes: Prior to 1964 this species was thought to be Holarctic and was known as *C. longicornis* Latreille. The correct identity was established by Vickery (1964).

13. ***Bruneria yukonensis* Vickery**
Small species, both sexes 18–25 mm; head small in proportion to body (Frontispiece); pronotum very little longer than head; tegmina reaching nearly to apex of abdomen; usually very dark, some specimens with yellowish median dorsal longitudinal line; tegmina shining, conspicuously spotted; hind femur with 3 oblique dark bands on outer face; hind tibia pale with apical third darker.
Distribution: This species is endemic to the Yukon.
Yukon records: Known from the type locality, shore of L. Laberge; Sheep Mt., Kluane National Park; Aishihik R.; and Sulphur L. (local regions 10 and 12, Fig. 1). Specimens: LEMQ, ROME, SMDV. The collection data for the male holotype are as follows: "Yukon, Lake Laberge shore, 62° N′; 135° W., 23-VIII-1961, D. Marsh". A second label has additional data: "W. shore of lake; deep creek, no trees, grassy slope burned out by sun". (Holotype in LEMQ, also Allotype and one female Paratype).
Biological information: The life cycle is not known. Adults were collected from late July to late August.
Taxonomic notes: Otte (1981) placed *yukonensis* in the Old World genus *Stenobothrus* but later (Otte 1995) he reverted to *Bruneria*.

14. ***Aeropedellus arcticus* Hebard**
Small species, about 12–19 mm; male antennae strongly clavate, black, enlarged and thickened apically; males usually blackish green, females variable, head and pronotum often with conspicuous black, creamy white and green pattern.
Distribution: Known only from the northern parts of Alaska, Yukon and Northwest Territories. This is the only grasshopper species known to occur north of the Canadian mainland and it is the only

species restricted to the arctic. All other Nearctic species, even those that occur in arctic localities, occur also in subarctic localities.
Yukon records: Firth R., British Mts.; km 410 Dempster Hwy.; and Herschel Is. (local regions 1, 4, 5, 6 and 10, Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV, ANSP.
Biological information: It is found on open tundra but nothing is known of the habits or life cycle. A related species occurring farther south, *Aeropedellus clavatus* (Thomas), is a grass feeder.
Taxonomic notes: Aeropedellus arcticus was described as a subspecies of the Palaearctic *Aeropedellus variegatus* but was ranked as a species by Vickery (1967*a*).

Suborder Tetrigodea

Family Tetrigidae

Subfamily Tetriginae

Tribe Tetrigini

15. ***Tetrix subulata* (Linnaeus)**

Very slender; small, pronotal length males 10.0–10.5, females 12.0–12.5; facial angle rectangulate in dorsal view, carina not projecting; middle femur slender; greyish to reddish brown or darker, often with median longitudinal whitish band.
Distribution: Distribution is Holarctic, extending across Europe and Asia and the northern two-thirds of North America (Fig. 7).
Yukon records: Found nearly throughout the Yukon (local regions 4, 5, 6, 8, 10, 12, 17, 18 and 19, Fig. 1). Specimens: CNCI, LEMQ, ROME, SMDV, ANSP and UMMZ.
Biological information: Moist locations are preferred but the species is found in a broad range of habitats. The food is mosses or algae. The cycle is univoltine and winter is passed in the adult stage. Adults occur only in spring (overwintered) and fall (adults of the next generation).
Taxonomic notes: Also known in some early records as *Acrydium granulatum, Tetrix granulatum* or *Tetrix granulata*.

16. ***Tetrix brunnerii* (Bolívar)**

Larger than *Tetrix subulata* and more robust, pronotal length males 8.5–11.8 mm, females 9.5–13.5 mm; angle of vertex nearly rectangulate in dorsal view, not rectangulate in lateral view; pronotum low but with definite hump on median carina; middle femur broad, only about 3 times longer than wide; colour variable, blackish to buffy grey or yellowish, often with pale dorsal stripe or with triangular or irregular blotches on pronotum.
Distribution: The known distribution is Nearctic, nearly the same as *Tetrix subulata* (Fig. 7). It may be Holarctic. *Tetrix brunnerii* is found in most of Canada and is widely distributed in the Yukon, Northwest Territories and Alaska.
Yukon records: In the Yukon it is found in local regions 4, 8, 10, 11, 16 and 19 (Fig. 1). Specimens: CNCI, LEMQ, SMDV.
Biological information: It is usually found in meadows or bogs, often in forested areas. So far as is known the life cycle is univoltine and similar to that of *Tetrix subulata*.
Taxonomic notes: Tetrix ussuriensis Bei-Bienko, a Palaearctic sister species, occurs in Far-Eastern Russia and Manchuria (Bei-Bienko and Mishchenko 1963; Mishchenko 1965).

17. ***Tetrix ornata ornata* (Say)**

Small, slender species, pronotal length males 8–10 mm, females 9–10.5 mm; vertex arcuate in dorsal view, median carina projecting forward; pronotum tent-like in cross-section and arched in outline, median carina complete and continuous; colour variable, brownish, greyish or black, often with conspicuous white line or paired spots dorsally.
Distribution: Widespread in Canada and extends into the southern Northwest Territories and Yukon.
Yukon records: The only recorded Yukon localities are Snag and Dawson (local regions 8 and 13, Fig. 1). Specimens: CNCI.
Biological information: The life cycle is much the same as for other tetrigids, wintering as adults, then producing another generation that matures before the following winter.
Taxonomic notes: Early records have listed this species as *Tetrix ornata hancocki* and *Acrydium ornatum*.

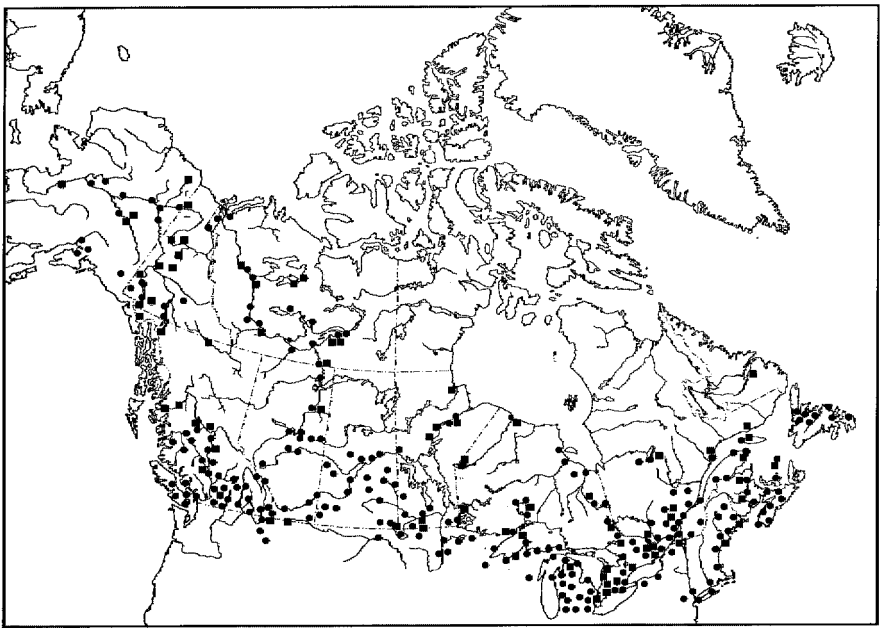

FIG. 7. Distribution of 2 tetrigid species, one Holarctic (*Tetrix subulata* (Linnaeus) (15), circles) and one with a Palaearctic sister species (*Tetrix brunnerii* (Bolivar) (16), squares).

Distribution of Species in the Yukon

The distribution of Orthoptera in the Yukon is summarized by ecogeographic region in Table 1. The Southern Lakes region (region 17) in south-central Yukon (Fig. 1) has the greatest number of species, 10, and regions 10 and 12 each have 9 species. The species that occurs in the greatest number of regions is *Melanoplus borealis* (1), followed by the tetrigids *Tetrix subulata* (15) and *T. brunnerii* (16). The third species of *Tetrix, T. ornata* (17), is known only from Dawson and Snag. *Melanoplus borealis* and *M. fasciatus* (5) occur in more regions than other species of the genus *Melanoplus*. Two other widespread species are *Arphia conspersa* (8) and *Chorthippus curtipennis* (12). The latter species is very widespread over North America and is able to occupy a number of ecological niches (Vickery and Scudder 1988). It probably occurs in many locations in the Yukon and additional collecting will no doubt add many more records. *Arphia conspersa* is quite common in the southern half of the Yukon but has not extended its range beyond 64° North.

Probable Ancestry and Development of Yukon Orthoptera

The orthopteroid fauna of the Yukon, though small, can be divided into 2 sections: first, those with speciation and radiation in the Nearctic and, second, Palaearctic migrants.

Genera and Species that Evolved in the Nearctic. This group includes elements of 3 subfamilies of Acrididae: Locustinae [Oedipodinae], Gomphocerinae and Melanoplinae.

TABLE 1. Distribution of Yukon acridid and tetrigid species by ecogeographic region (see Fig. 1).

Species	Yukon ecogeographic region
Acrididae	
Melanoplinae	
1. *Melanoplus borealis borealis* (Fieber)	1, 4, 8, 10, 11, 12, 13, 16, 17, 19
2. *Melanoplus sanguinipes sanguinipes* (Fabricius)	8, 12, 13, 16, 17
3. *Melanoplus bruneri* Scudder	5, 8, 12, 17
4. *Melanoplus kennicottii kennicottii* Scudder	4, 10, 12, 17, 19
5. *Melanoplus fasciatus* (F. Walker)	4, 11, 12, 13, 17, 19
6. *Bohemanella frigida frigida* (Boheman)	2, 4
Locustinae	
7. *Stethophyma lineatum* (Scudder)	11
8. *Arphia conspersa* Scudder	10, 11, 12, 16, 17
9. *Xanthippus brooksi* Vickery	4, 14, 16
10. *Camnula pellucida* Scudder	11, 12, 16, 17
Gomphocerinae	
11. *Chloealtis abdominalis* (Thomas)	10, 13, 16, 17
12. *Chorthippus curtipennis curtipennis* (Harris)	1, 4, 8, 10, 13, 16, 17
13. *Bruneria yukonensis* Vickery	10, 12
14. *Aeropedellus arcticus* Hebard	1, 4, 5, 6, 10
Tetrigidae	
Tetriginae	
15. *Tetrix subulata* (Linnaeus)	4, 5, 6, 8, 10, 12, 17, 18, 19
16. *Tetrix brunnerii* (Bolivar)	4, 8, 10, 11, 16, 19
17. *Tetrix ornata ornata* (Say)	8, 13

Locustinae. The Subfamily Locustinae evolved 100 to 180 ma B.P. (Vickery 1987, 1989) while Eurasia, Africa and North America had still not separated from the rest of Pangaea. It is represented in Eurasia and North America and also occurs widely in the Ethiopian Region. Evolution and differentiation may not have been well advanced when the continents began to assume their present forms following the breakup of Pangaea. After the separation of Europe and North America, the Tribe Locustini continued to evolve and disperse from subcentres in each continent. Rehn (1958) postulated such a centre in the southwestern part of North America for the Melanoplini. Presumably other groups would also speciate and radiate from this or other centres.

The genera found in the Yukon, *Arphia, Xanthippus* and *Camnula,* are distinctively Nearctic, though relationship with Palaearctic genera is evident. There is only one Holarctic genus, *Stethophyma. Arphia,* as well as *Trimerotropis* and others, have penetrated into the tropics and now occur also in the Neotropical Region. The southward extension of range probably occurred after the American continents that had been separated for millions of years, following the breakup of Pangaea, became rejoined, probably less than 30 ma B.P. (Vickery 1987). *Trimerotropis* has not been recorded from the Yukon, but one species, *T. verruculata* (Kirby), is known from the Northwest Territories in several localities along the Mackenzie River.

It is probable that segments of the genera *Camnula* and *Xanthippus* survived in Beringian refugia, while other segments remained south of the ice sheet. The northern species of these genera exhibit a high degree of cold hardiness. *Xanthippus brooksi* (9) appears to be derived from Beringian elements. Its closest relative is *X. buckelli* Hebard, in southern British Columbia, but a significant geographical gap exists between the 2 species.

Xanthippus buckelli is considered by Otte (1984) to be merely an ecophene population of a widely variable species, *X. corallipes* Haldeman.

The genus *Arphia* probably survived south of the glacial incursions and later moved northward, with one species, *A. conspersa* (8), reaching the lower half of the Yukon and adjacent Alaska and Northwest Territories. This species has not become established in eastern Canada. *A. conspersa* is alate and might have been expected to have spread eastward as well as northward or southward. Its preference for arid conditions may have been the limiting factor. It is tolerant of cold which may suggest Beringian survival but, if so, it must also have survived south of the glacial ice.

Melanoplinae. The Subfamily Melanoplinae is represented in the Yukon by 5 species of *Melanoplus* (Melanoplini) and one species of *Bohemanella* (Podismini).

The Tribe Melanoplini has evolved in a Nearctic centre of radiation in the southwest area of the continent (Rehn 1958), probably from ancestors that had dispersed widely over Europe and North America before these continents separated. The same ancestors probably gave rise in the Old World to the Subfamily Catantopinae. The genus *Melanoplus* is represented in the Yukon by 5 species, *M. borealis*, *M. sanguinipes*, *M. bruneri*, *M. kennicottii*, and *M. fasciatus* (1–5). The distribution and cold hardiness of these species indicate that they may have survived glaciation in a Beringian refugium and moved southward when the ice receded but they also could have survived south of the ice and later extended their ranges northward to occupy the territory where they now occur. The latter 3 species are now found mainly in northern regions but the first 2 are much more widespread. Most other species of *Melanoplus* are less tolerant of cold and undoubtedly survived glaciation south of the ice sheet.

Bohemanella frigida (6), the sole member of the Podismini found in the Yukon, has more recently occupied northern North America and is discussed under Palaearctic immigrants. There are several subspecies in Asia (Bei-Bienko and Mishchenko 1963). The Asian subspecies nearest to Alaska is *B. frigida kamchatkiae* (Sjöstedt). It differs from *B. f. frigida* mainly in having smaller eyes and the mesosternal interspace is slightly wider. I have not been able to examine specimens but the northern Nearctic specimens appear to be closer to *B.f. frigida*.

Migration from the Palaearctic Region. Many orthopteroid taxa apparently evolved in the Asian 'Angaran' centre in the Palaearctic region (Rehn 1954, 1958). Migration of taxa to the Nearctic must have occurred several times, these taxa subsequently extending their range and occupying areas of the Nearctic region. Knowledge of the taxa involved and the time(s) of penetration to the Nearctic are not definitely known, due to lack of fossil and other surviving records. Vickery (1989) summarized the current knowledge of orthopteroid fossil records in Canada. Old World–New World relationships provide good evidence for use of a Beringian land bridge and possible survival of some taxa in a Beringian refugium.

In general the orthopteroids of the eastern Palaearctic are not well known and it is not known whether some of the relatives of the Nearctic immigrants have survived there.

Holarctic Genera. The genus *Tetrix* is truly Holarctic. One species of these pygmy grasshoppers, *T. subulata* (15), is relatively common in both Palaearctic and Nearctic regions. Another Nearctic species, *T. brunnerii* (16), is closely related to the Palaearctic '*Clinotettix*' (or *Tetrix*) *ussuriensis* Bei-Bienko. It is probable that the latter species should be transferred to *Tetrix*. In the past the 2 species were thought to be conspecific by some authors. The third Nearctic species, *T. ornata* (17), is not closely related to the other 2 and does not have a

Palaearctic counterpart. The lack of close relationship between the 2 groups of *Tetrix* lends support to the premise that there were at least 2 migrations from Palaearctic to Nearctic, an early entry that then speciated and radiated in North America, producing *T. ornata* and other species such as *T. arenosa angusta* (Hancock), followed later by *T. subulata* and *T. brunnerii*. The earlier immigrants were pushed southward by subsequent glaciation, eventually moving northward again to occupy their present ranges. The later immigrants may have survived in a Beringian refugium.

Stethophyma, the only Holarctic genus in the Locustinae, must have extended its range from the Palaearctic to the Nearctic much later than the other genera. In the Palaearctic there is a single widespread species, *S. grossum* (Linnaeus), but in the Nearctic dispersal and speciation has produced 3 species, *S. lineatum* (7), *S. gracile* (Scudder) and *S. celatum* Otte. Although the greater number of species in the Nearctic region might be thought to indicate that migration of this genus was from Nearctic to Palaearctic, this is not so. The species in the Nearctic are the only North American representatives of the Tribe Parapleurini but the tribe has many genera and species in the Palaearctic region. In contrast to the ancient entry of other species of the Subfamily Locustinae, *Stethophyma* is a recent immigrant, probably entering North America prior to the last glacial period. The present distribution of *S. lineatum*, the most northerly distributed species is, with a few exceptions, confined to latitudes south of 55°N, indicating a lower level of cold hardiness than other subarctic species. There is only a single record of this species from the Yukon, Halfway Lakes, Elsa, a fairly warm lowland area similar to the southern Northwest Territories where *S. lineatum* also is found. An Alaskan record may have been based upon an accidental adventive specimen. Another specimen taken at Resolute Bay, Cornwallis Island (Fig. 5), undoubtedly was an accidental introduction by aircraft and captured during the same season.

Some members of the Subfamily Gomphocerinae are relatively recent migrants. The genus *Aeropedellus* is Holarctic. It is probably derived from the Palaearctic *Gomphocerus* or from a lineage from which both genera evolved. For some time it was thought that *A. variegatus* was Holarctic, with Nearctic and Palaearctic subspecies. *A. arcticus* (14) was described by Hebard (1935) as *A. variegatus arcticus* but subsequently was shown to be specifically distinct from *A. variegatus* (Vickery 1967*a*). *A. arcticus* is very cold hardy and is the only orthopteroid species found north of the arctic mainland, on Herschel Island. Confinement to the extreme north indicates relatively recent immigration and lack of subsequent range extension. *A. variegatus* has several subspecies but *A. arcticus* has none. Another species of *Aeropedellus*, *A. clavatus* (Thomas) occurs in southwestern Canada and the northwestern United States. The ancestors of the Nearctic species apparently crossed from Palaearctic to Nearctic at least twice, the later immigration of the parental stock of *A. arcticus* and a much earlier introduction that produced *A. clavatus*. The present distribution of the latter appears to be typical of species that survived south of the last glacial incursion.

Chorthippus, another gomphocerine genus, also is Holarctic. It has many Palaearctic species but only one Nearctic representative. For a period of time in this century the North American species was called *C. longicornis* (Latreille) and was considered to be Holarctic. Subsequently this was shown to be in error and the Nearctic species to be a valid species, *C. curtipennis* (12) (Vickery 1964; Reynolds 1980). The parent stock that probably gave rise to *C. curtipennis* was ancestral also to the Palaearctic *C. montanus* (Charpentier) and *C. parallelus* (Zetterstedt). This stock entered North America more than once (Vickery 1967*b*, 1989). The earlier population was pushed southward by the ice of a later glaciation and was obliterated in all areas except for a segment that survived on the coast of northern

California. A later incursion undoubtedly survived in a Beringian refugium, or there and also south of the advancing ice, and subsequently has become the most widespread species of Nearctic Orthoptera. Where the 2 populations finally met they were able to interbreed in a zone that now occurs over a broad area of western North America. The California population was described as *Chorthippus curtipennis californicus* by Vickery (1967*b*).

The single species of *Bohemanella*, *B. frigida* (6), occurs in the Nearctic region only in the northern part of Alaska, Yukon and the northwestern Northwest Territories. Until recently, *B. frigida* was placed in the genus *Melanoplus* (Melanoplini), but has now been shown to be a podismine (Vickery 1987). Formerly the species was thought to have migrated from the Nearctic to the Palaearctic region, the reverse direction of any other orthopteroid species. This anomalous situation was resolved by the placement of *frigida* in the genus *Bohemanella* in the Podismini.

Non-Holarctic Genera. Several genera are restricted to the Nearctic but have related genera in the Palaearctic. The genus *Bruneria* is related to the Palaearctic *Stenobothrus.* The parental stocks of these and other gomphocerine genera migrated to the Nearctic via Beringia.

These Nearctic genera have Palaearctic counterparts. *Chloealtis* (Tribe Chrysochraontini) is related to *Chrysochraon* Fischer, *Podismopsis* Zubovskii, *Euthystira* Fieber, and *Mongolotettix* Rehn (Rehn 1958). The wide distribution of *Chloealtis* indicates early immigration, probably the earliest of any gomphocerine stock. The relationship between *Bruneria* and *Stenobothrus* is closer and indicates later immigration.

Discussion and Conclusions

The series of Beringian land bridges prior to and during periods of glaciation and Beringian refugia appear to have been important factors that determined the presence of most of the orthopteran species now found in the Yukon. Nearly half of the species or their parental stocks are considered to have entered the Nearctic region via a Bering bridge (44%), some perhaps in pre-glacial times, and at least part of the populations of another 39% may have survived in Beringian refugia. It is unfortunate that no fossil orthopteroids, that might confirm these indications, have been found in the region (Vickery 1989).

Species that developed from migrants from the Palaearctic region include: *Bohemanella frigida, Stethophyma lineatum, Chloealtis abdominalis, Chorthippus curtipennis, Bruneria yukonensis, Aeropedellus arcticus, Tetrix subulata, T. brunnerii* and *T. ornata* (6, 7, 11–17). *Bruneria yukonensis* Vickery (Frontispiece) is endemic in the Yukon.

Species that may have had at least part of their populations surviving in a Beringian refugium include: *Melanoplus borealis, M. sanguinipes, M. kennicottii, M. fasciatus, Xanthippus brooksi* and *Camnula pellucida* (1, 2, 4, 5, 9, 10).

Only one locustine species, *Arphia conspersa* (8), has had no discernible involvement with Beringia.

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