

the upper inch of leaf mould, suggesting that the ticks do not seek protection from winter by descending to any depth in loose rock. Because of the presence of the cage, the ground surface was not protected by snow, with the result that it was exposed to a temperature of -40° F. However, temperature readings taken at a depth of 1 foot in the talus beneath the cage did not go below 32° F. The only adult found in its apparently natural site of hibernation was an unengorged female, located by accident in November under a small rock at ground level. Careful search during summer months in the areas where concentra-

tions of ticks had been liberated the previous spring has, however, revealed specimens among the decaying roots of bunch grass, *Agropyron* sp., substantiating the theory that adult aestivation and hibernation are spent at shallow levels.

In conclusion, it has been shown that a portion of these ticks are capable of living more than 12 months as unfed adults, passing the winter under the protection of snow. The disappearance of all the ticks in late spring is apparently due not to normal aging but to some form of diapause, the cause of which is not known.

RECORDS OF BEES FROM BRITISH COLUMBIA: BOMBIDAE¹

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This paper records 26 species, 14 named varieties, and 10 colour variants of *Bombus* and 4 species of *Psithyrus* from British Columbia. Of the 5326 specimens here recorded, 4641 belong to *Bombus*, and 685 to *Psithyrus*.

These records have been compiled from the collections in the Dominion Entomological Laboratory, Kamloops, B. C.; the University of British Columbia, Vancouver, B. C.; and the Provincial Museum, Victoria, B. C.; and from the Canadian National Collection, Ottawa, Canada, as well as from some records in publications by Franklin and Frison, and some unpublished notes by Frison. Almost all of the records obtained from the Canadian National Collection were from specimens determined by Frison.

These bumble bees were collected by 97 collectors during 50 years from 142 localities; except F. W. L. Sladen, E. R. Buckell, and G. J. Spencer, they paid little attention to taxonomy of bees, and their material was obtained in the course of general collecting. The localities are listed and their corresponding numbers placed on the accompanying map.

The collection points are mainly in

the southern half of the Province, and vast areas in the north have not yet been visited by collectors. This, of course, is due to the fact that there are no roads, railways, or other ready means of entering these areas.

There are no collection records from the Queen Charlotte Islands, but several species must occur there as they have been taken on the adjacent mainland and on islands off the Alaskan coast.

After the name of each species the number of localities in which it has been taken, the number of each sex, and the total number of specimens recorded are indicated, e.g.: (26: 80♂ 39♀ 83♂—202).

The author wishes to thank all those who have helped in the preparation of this paper, either by the loan of material or in providing species determination or locality records. Thanks are particularly due to Mr. K. V. Krombein, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, Washington, D. C., for the determination of material, and to Dr. O. Peck, Division of Entomology, Department of Agriculture, Ottawa, Canada, for the British Columbia records in the Canadian National Collection.

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² Retired November 1, 1949.

TABLE I

Localities from which Bombidae have been recorded in British Columbia. The numbers correspond to those on the accompanying map. (V. I.=Vancouver Island.)

1. Adams Lake	49. Hazelton	97. Penticton
2. Agassiz	50. Hedley	98. Pouce Coupe
3. Alberni, V. I.	51. Hope	99. Powell River
4. Alexis Creek	52. Hope Mountain	100. Premier Lake
5. Armstrong	53. Hudson Hope	101. Prince George
6. Arras	54. 100 Mile House	102. Prince Rupert
7. Ashcroft	55. Invermere	103. Quesnel
8. Aspen Grove	56. Inverness	104. Quick
9. Atlin	57. Jesmond	105. Radium
10. Barkerville	58. Jordan Meadows, V. I.	106. Revelstoke
11. Bella Coola	59. Kaleden	107. Rogers Pass
12. Boston Bar	60. Kamloops	108. Rolla
13. Boswell	61. Kaslo	109. Royal Oak, V. I.
14. Bridge Lake	62. Kelowna	110. Saanich, V. I.
15. Buccaneer Bay	63. Keremeos	111. Sahtlam, V. I.
16. Burns Lake	64. Kitchener	112. Shawnigan, V. I.
17. Canim Lake	65. Kitwanga	113. Salmon Arm
18. Carbonate	66. Ladysmith, V. I.	114. Salvus
19. Cedarvale	67. Langley	115. Savona
20. Celista	68. Lardo	116. Shuswap
21. Centurian	69. Lillooet	117. Sicamous
22. Chapmans	70. Lumby	118. Sidney, V. I.
23. Chase	71. Lytton	119. Smithers
24. Chilcotin	72. Macalister	120. Soda Creek
25. Chopaka	73. Manning Park	121. Sooke, V. I.
26. Clinton	74. Merritt	122. Stanley
27. Comox, V. I.	75. Metlakatla	123. Stikine
28. Copper Mountain	76. Midday Valley	124. Sugar Lake
29. Courtenay, V. I.	77. Milner	125. Summerland
30. Cowichan, V. I.	78. Minnie Lake	126. Terrace
31. Cranbrook	79. Mission	127. Tofino, V. I.
32. Crescent	80. Mount Arrowsmith, V. I.	128. Trinity Valley
33. Creston	81. Mount Cheam	129. Tye
34. Crows Nest	82. Mount McLean	130. Ucluelet, V. I.
35. Departure Bay, V. I.	83. Nanaimo, V. I.	131. Vancouver
36. Duncan, V. I.	84. Nelson	132. Vanderhoof
37. East Pine	85. Newcastle Is.	133. Vaseaux Lake
38. Fairview	86. Newgate	134. Vernon
39. Fernie	87. New Westminster	135. Victoria, V. I.
40. Field	88. Nicola	136. Walhachin
41. Fitzgerald, V. I.	89. Okanagan Falls	137. Wellington, V. I.
42. Forbidden Plateau, V. I.	90. Okanagan Mission	138. Westbank
43. Fort Steele	91. Oliver	139. Westholme, V. I.
44. Fraser Lake	92. Osoyoos	140. White Lake
45. Glacier	93. Oyama	141. Williams Lake
46. Golden	94. Pacific	142. Yale
47. Goldstream, V. I.	95. Peachland	
48. Hat Creek	96. Pender Harbour	

The Province of British Columbia, 355,855 square miles in area, is approximately the same size as the Pacific States of Washington, Oregon, and California. It is a land of mountains, valleys, and lakes, with a wide altitudinal range and extending over 11 degrees of latitude.

These topographical features have a marked influence on climatic conditions, and the vegetation varies from the humid luxuriance of the southern coastal region to the semi-arid, cactus, and sagebrush areas of the interior plateau. The close succession of markedly different geo-

graphical features has produced a wide variety of plant and animal associations, and many species of insects, including the bumble bee, are often confined to widely scattered but similar habitats.

MAIN GEOGRAPHICAL AREAS

For the purposes of this paper, the following are the main geographical areas of British Columbia, with a brief description of ecological conditions in each.

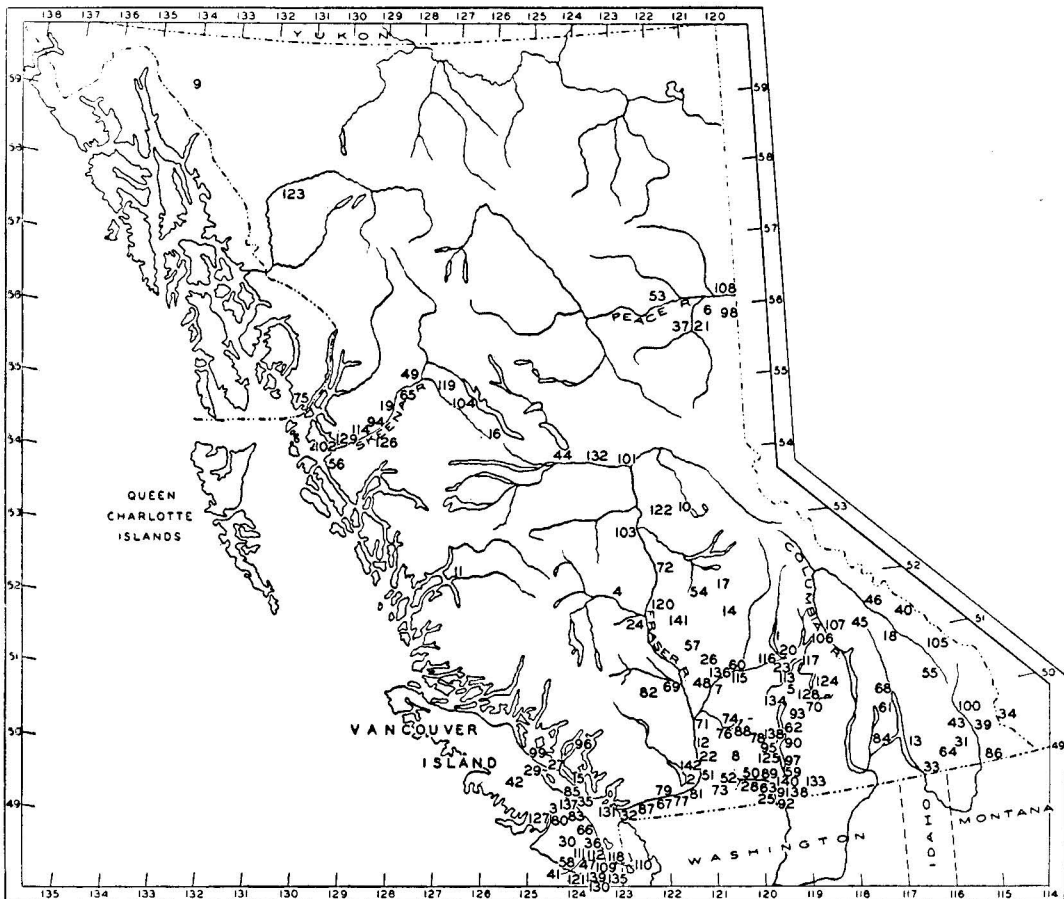


Fig. 1. Map of British Columbia showing the 142 localities mentioned in the text.

**Southeastern British Columbia
(Area No. 1)**

This is a comparatively small, triangular region, of particular interest in that both the flora and fauna sometimes bear a closer relationship to those of Alberta and northwestern United States than to the remainder of the Province. Insects can enter this region from Alberta with little difficulty, through the low, dry Crows Nest Pass; from Montana and Idaho through the valley of the Kootenay River; and from northeastern Washington up the valley of the Columbia River.

This region is bounded on the east by the British Columbia-Alberta boundary, which is the summit of the main range of the Rocky Mountains; on the west by the almost impenetrable mass

of high, snow-capped, heavily timbered Selkirk Mountains; and on the south by the International Boundary between British Columbia and the northwestern states of Montana, Idaho, and Washington, which, of course, presents no physical barrier.

The following localities are included in this area: Carbonate, 18; Radium, 105; Invermere, 55; Premier Lake, 100; Fort Steele, 43; Crows Nest, 34; Fernie, 39; Cranbrook, 31; Newgate, 86; Kitchener, 64; Creston, 33; Boswell, 13; Kaslo, 61; Lardo, 68; Nelson, 84.

Southern Interior (Area No. 2)

For the purpose of this paper the southern interior extends from the International Boundary, bordering the

State of Washington, north to latitude 52° , and from the western boundary of southeastern British Columbia west to the eastern slopes of the Coast Mountains.

The eastern and western boundaries are excellent natural geographical barriers. The southern boundary presents more of a barrier to insects than is indicated by a glance at the map, for the eastern and western mountain masses form a definite bottleneck, through which the Okanagan and Similkameen rivers flow south in narrow, hot valleys.

Latitude 52° has been chosen as the boundary line between the southern and central interior regions. There are no very definite geographical barriers along latitude 52° , but the collection records of a number of species definitely show that at about this latitude there is a marked distributional change, probably because the mountainous terrain of the southern interior gives way at this point to an undulating plateau, from 2500 to 4000 feet in elevation.

The following localities are included in this area: Osoyoos, 92; Oliver, 91; Fairview, 38; White Lake, 140; Vaseaux Lake, 133; Okanagan Falls, 89; Kaleden, 59; Penticton, 97; Keremeos, 63; Chopaka, 25; Hedley, 50; Copper Mountain, 28; Summerland, 125; Peachland, 95; Westbank, 138; Kelowna, 62; Okanagan Mission, 90; Oyama, 93; Vernon, 134; Lumby, 70; Trinity Valley, 128; Sugar Lake, 124; Armstrong, 5; Field, 40; Golden, 46; Glacier, 45; Rogers Pass, 107; Revelstoke, 106; Sicamous, 117; Salmon Arm, 113; Celistia, 20; Adams Lake, 1; Chase, 23; Shuswap, 116; Kamloops, 60; Merritt, 74; Midday Valley, 76; Nicola, 88; Minnie Lake, 78; Aspen Grove, 8; Savona, 115; Walthachin, 136; Ashcroft, 7; Hat Creek, 48; Lytton, 71; Lillooet, 69; Mt. McLean, 82; Clinton, 26; Jesmond, 57; Bridge Lake, 14; Canim Lake, 17; 100 Mile House, 54; Williams Lake, 141; Soda Creek, 120; Chilcotin, 24; Alexis Creek, 4.

Central Interior (Area No. 3)

This region extends north from latitude 52° to latitude $55^\circ 30'$, and from the Alberta boundary and the Rocky

Mountains on the east to the Coast Mountains on the west. As in the southern interior region, the eastern and western boundaries are natural geographical barriers of high, unbroken mountain chains. The northern boundary presents no geographical features to limit the distribution of insects. It has been chosen only because it encloses the northernmost records found in the central interior region.

The following localities are included in this area: Macalister, 72; Quesnel, 103; Stanley, 122; Barkerville, 10; Prince George, 101; Vanderhoof, 132; Fraser Lake, 44; Burns Lake, 16; Quick, 104; Smithers, 119; Hazelton, 49; Kitwanga, 65; Cedarvale, 19; Pacific, 94; Terrace, 126; Salvus, 114; Tye, 129.

Northern Interior (Area No. 7)

This region extends north from latitude $55^\circ 30'$ to the Yukon boundary, latitude 60° , and from the Rocky Mountains on the east to the Coast Mountains (boundary of Alaskan panhandle) on the west. As in the southern and central interior regions, the mountains of the eastern and western boundaries are natural geographical barriers. The boundaries on the north and south present no obstacles to insect distribution.

This region is entirely without roads or railways and the only collection records are from Stikine, 123, and Atlin, 9, both in the extreme northwestern corner of British Columbia.

Northeastern British Columbia (Area No. 6)

This triangular area lies entirely to the east of the Rocky Mountains and is geographically part of the northwestern parkland area of Alberta. It is bounded on the west by the Rocky Mountains, which constitute its only natural geographical boundary. To the north, the Yukon boundary and to the east, the Alberta boundary present no hindrance to the spread of insects.

Collections have been made only in the southern tip of this region, close to the Peace River, and include the follow-

ing localities: Rolla, 108; Pouce Coupe, 98; Arras, 6; Centurian, 21; East Pine, 37; Hudson Hope, 53.

Mainland Coast (Area No. 4)

This region consists of precipitous mountains descending to the sea, and innumerable inlets and small islands. The only extensive area of agricultural land is situated in the extreme south, in the delta of the Fraser River; there is a much smaller area in the extreme north, at the mouth of the Skeena River. This region is sharply separated from the interior of the Province by the high, rugged Coast Mountains, the northern boundary being the southern tip of the Alaskan panhandle, and the southern boundary the British Columbia-Washington line, south of the Fraser River.

The following localities are included in this area: Boston Bar, 12; Chapmans, 22; Yale, 142; Hope, 51; Hope Mountains, 52; Agassiz, 2; Mt. Cheam, 81; Milner, 77; Langley, 67; Mission, 79; Crescent, 32; New Westminster, 87; Vancouver, 131; Bucaneer Bay, 15; Pender Harbour, 96; Powell River, 99; Newcastle I., 85; Inverness, 56; Prince Rupert, 102; Metlakatla, 75.

Vancouver Island (Area No. 5)

Bumble bees have been collected extensively on Vancouver Island. The records are from the southern end of the Island and for some distance up the east coast. The west coast and the northern half of the Island are areas of very heavy

rainfall and dense coniferous forests, and what small settlements there are consist mainly of coastal logging camps.

The following localities are included in this area: Victoria, 135; Westholme, 139; Ucluelet, 130; Sooke, 121; Goldstream, 47; Royal Oak, 109; Saanich, 110; Sidney, 118; Fitzgerald, 41; Shawnigan, 112; Duncan, 36; Jordan Meadows, 58; Sahtlam, 111; Cowichan, 30; Ladysmith, 66; Nanaimo, 83; Departure Bay, 35; Wellington, 137; Alberni, 3; Tofino, 127; Mt. Arrowsmith, 80; Comox, 27; Courtenay, 29; Forbidden Plateau, 42.

Table II gives the distribution and the altitude range of Bombidae in British Columbia; the species, which include the varieties and colour variants, are listed in order of abundance, *Psithyrus* spp. being listed separately from *Bombus* spp. In determining this order the number of localities in which a species had been taken (column 2) was given preference over the number of specimens recorded (column 3), as the writer believes this gives a much more reliable indication of the status of the species. The altitude range is the range in which the species is most commonly found and not necessarily its extreme limits. Further extensive collecting would undoubtedly result in some changes, but for the data on hand the table gives a very fair indication of the general prevalence, distribution, and altitude range of the species in the Province.

TABLE II
Distribution and altitude range of Bombidae in British Columbia.

Genera and species in order of abundance in collections	Localities	Total Specimens	Distribution by areas* in order of abundance in collections	Approximate altitude range: feet
Bombus				
<i>bifarius</i>	83	677	2, 1, 3, (4, 5), *7, 6	0-7000
<i>occidentalis</i>	77	430	(1, 2, 3), (4, 5), 7, 6	0-7000
<i>flavifrons</i>	74	400	(2, 3, 5), 4, 1, 7	0-7000
<i>mixtus</i>	64	445	(1, 2, 3, 4, 5), 7, 6	0-6000
<i>melanopygus</i>	56	353	(4, 5), (1, 2), 3, 6, 7	0-6000
<i>vagans</i>	49	398	(2, 3), 1, 7, 6, 4, 5	1000-4000
<i>californicus</i>	49	237	(2, 3, 4, 5), 1, 6	0-2000
<i>sitkensis</i>	42	344	(4, 5), (1, 2, 3)	0-6000
<i>appositus</i>	34	182	2, 1, 4	1000-2000
<i>centralis</i>	26	202	2, 1	1000-2000
<i>terricola</i>	23	191	3, 2, 6, 7, 4	2000-3000
<i>nevadensis</i>	21	71	2 north, 5, (1, 3), 6	0-2000
<i>rufocinctus</i>	20	98	2, 1, 5	2000-3000
<i>fervidus</i>	17	122	2	1000-2000
<i>ternarius</i>	11	243	3, 1, 2	1000-3000
<i>sylvicola</i>	7	153	2, 3, 1, 4	2000-7000
<i>griseocollis</i>	7	28	2 south	1000
<i>morrisoni</i>	7	12	2	1000-2000
<i>frigidus</i>	7	5	(1, 2), 5	1000-2000
<i>perplexus</i>	6	7	3, 4	0-2500
<i>huntii</i>	4	3	1	1000-3000
<i>kirbyellus</i>	2	29	3, 2 north	6000-9000
<i>hyperboreus</i>	2	3	2 north	3500-8000
<i>auricomus</i>	2	2	(5, 6)	0-1000
<i>vosnesenskii</i>	1	3	2	1000
<i>pleuralis</i>	1	3	2	1000
Total	26	—4641		
Psithyrus				
<i>insularis</i>	57	262	(1, 2, 3, 4, 5), 6, 7	0-5000
<i>suckleyi</i>	51	253	(1, 2, 3, 4, 5)	0-5000
<i>fernaldae</i>	21	80	(1, 2, 3, 4, 5, 7)	3000-7000
<i>ashtoni</i>	10	90	3, 2 north	3000-5000
Total	4	— 685		
Grand Total	30	142	5326	0-9000

* Brackets enclose the numbers for areas in which the species is equally abundant. See text.

Genus BOMBUS Latreille

Section *Boopobombus* Frison

Subgenus *Fraternobombus* Skorikov

No species of this subgenus have as yet been recorded from British Columbia.

Subgenus *Nevadensibombus* Skorikov

Bombus nevadensis Cresson (21: 1♂ 54♀ 16♂—71)

LOCALITIES—Invermere, Kaslo, Vernon, Trinity Valley, Salmon Arm, Chase, Kamloops, Nicola, Minnie Lake, Walhachin, Williams Lake, Chilcotin, Macalister, Quesnel, Rolla, Victoria, V. I., Sooke, V. I., Royal Oak, V. I., Sidney, V. I., Fitzgerald, V. I., Departure Bay, V. I.

The 71 specimens of *nevadensis* recorded from 21 localities indicate that

it is a fairly common bumble bee in British Columbia, and that it is widely dispersed in areas of temperate climate. It has been taken frequently on Vancouver Island and throughout the timbered regions of the interior, from the southeastern corner of the Province to the Peace River at latitude 56°, but not in the dry, hot sagebrush areas of the Okanagan Valley or in high mountain localities.

Bombus auricomus Robertson (2: 0♂ 2♀ 0♂—2)

LOCALITIES—Centurian, Aug. 4, 1921, 1♀. Departure Bay, V. I., May 24, 1925, 1♀.

This is apparently a rare species in British Columbia, and little is as yet known of its distribution. Centurian

is in the Peace River district north of latitude 56°, and Departure Bay on the southeast coast of Vancouver Island.

Subgenus **Separatobombus** Frison

Bombus griseocollis (DeGeer) (6: 1♂ 11♀ 6♂—18)

[= *B. separatus* Cresson]

LOCALITIES — Osoyoos, Oliver, Fairview, Vaseaux Lake, Okanagan Falls, Penticton.

Bombus griseocollis var. **mormonorum** Franklin (5: 3♂ 4♀ 3♂—10)

LOCALITIES — Osoyoos, Fairview, Okanagan Falls, Penticton, Vernon.

B. griseocollis and its variety *mormonorum* have been taken only in the Okanagan Valley, and, with the exception of the worker from Vernon, all were collected in the Upper Sonoran Zone, which extends up the Okanagan Valley as far as Penticton. It is probable that this species occurs also in the Similkameen River Valley from the Washington border to Keremeos. It has a wide range in the United States, and Scullen (1927) records it from Alaska.

Bombus morrisoni Cresson (7: 1♂ 4♀ 7♂—12)

LOCALITIES—White Lake, Kamloops, Nicola, Wadhachin, Ashcroft, Lillooet, Chilcotin.

B. morrisoni is one of the rarer species in British Columbia and has been taken only in hot, dry locations in the southern interior and at Chilcotin, where an extension of sagebrush dry-belt conditions extends up the valley of the Chilcotin River.

This bumble bee could easily be confused with *B. nevadensis* or *B. griseocollis* var. *mormonorum* in the field, as they are very similar in coloration. It is a large and handsome species with dense yellow pile covering the entire dorsum of the thorax, and the dorsum of the abdomen to the basal centre of segment four; the apex of the abdomen is black.

Subgenus **Cullumanobombus** Vogt

Bombus rufocinctus Cresson (10: 17♂ 6♀ 28♂—51)

LOCALITIES—Ferne, Kaslo, Kaleden, Okanagan Mission, Vernon, Lumby, Kamloops, Wadhachin, Hat Creek, Chilcotin.

Bombus rufocinctus var. **albertensis** Cockerell (5: 0♂ 4♀ 7♂—11)

LOCALITIES — Crows Nest, Oliver, Keremeos, Vernon, Chilcotin.

Bombus rufocinctus var. **prunellae** Cockerell & Porter (8: 3♂ 3♀ 6♂—12)

LOCALITIES — Vernon, Armstrong, Revelstoke, Kamloops, Merritt, Chilcotin, Saanich, V. I., Fitzgerald, V. I.

Bombus rufocinctus var. **iridis** Cockerell & Porter (1: unknown)

LOCALITY—Glacier (Frison unpublished notes).

All other bumble bee records from Glacier are by Sladen (17.V.1915), and it is assumed that he was the collector in this instance.

In addition to the three named varieties listed above, the Kamloops collection contains material of other colour variants described by Franklin (1913). These are listed below.

Colour variant 4. (4: 1♀ 8♂—9)

LOCALITIES — Crows Nest, Ferne, Vernon, Kamloops.

Colour variant 5. (1: 1♀ 0♂—1)

LOCALITY—Kaslo, July 30, 1906. 1♀.

Colour variant 6. (3: 0♀ 7♂—7)

LOCALITIES—Crows Nest, Ferne, Chilcotin.

Male colour variant 5. (1: 2♂—2)

LOCALITY—Vernon.

Male colour variant 8. (4: 5♂—5)

LOCALITIES—Kaleden, Summerland, Kamloops, Chilcotin.

B. rufocinctus, with the three varieties (*albertensis*, *prunellae*, and *iridis*) and the five colour variants here recorded, is represented by 98 specimens from 20 localities. They have been collected at widely separated points in the southeastern part of the Province, as well as throughout the southern interior north to Chilcotin, latitude 52°, and there are records of two queens from southern Vancouver Island. There are no records of *rufocinctus* from the central or northern interior or from the northeastern section of the Province. The collection records indicate that its extreme altitude limits are from sea level to 3000 feet, with an optimum altitude range from 2000 to 3000 feet. The varieties and colour variants collected to date appear to indicate no geographical preference, but variety *prunellae* is the only form of *rufocinctus* as yet recorded from Vancouver Island. It is extremely variable in colouration and the majority of specimens on hand show a lack of contrasting colours. In the field it is readily overlooked as a badly faded specimen of some common species, and it may be commoner than the number of records indicates. Further extensive collecting

is needed to determine accurately the distribution and altitude range of *rufocinctus* in British Columbia.

Section *Anodontobombus* Krüger

Subgenus *Alpinobombus* Krüger

Bombus hyperboreus Schönherr (2: 0♂ 3♀ 0♂—3)

[=*B. arcticus* Kirby]

(See Frison, 1919, p. 456)

LOCALITIES—Mt. McLean, July 12, 1926, 1♀, Chilcotin, July 14, 1921, 1♀; July 12, 1931, 1♀.

This species occurs in the northern regions of Europe and Asia and in Greenland and arctic Canada (Franklin, 1913; Frison, 1919, p. 456). It is indistinguishable from *B. kirbyellus* in the field.

The collection of two queens of *hyperboreus* in 1926 and 1931 by the author at Chilcotin, elevation 3500 feet, is unusual, as one would not expect to find this bee at such a low elevation and in such a warm location. Further search on numerous occasions throughout the Chilcotin area, as well as on high mountains farther north, has not yielded any specimens of this species. The queen taken on Mt. McLean, although considerably farther south, was taken well above timber line, near permanent snow-fields, at an elevation of 7500 feet.

The determinations of the specimens have been confirmed by Dr. Krombein, of the United States National Museum. Further material must be collected before the abundance and distribution of *hyperboreus* in British Columbia can be determined.

Bombus kirbyellus Curtis (2: 6♂ 10♀ 13♂—29)

LOCALITIES—Chilcotin, Aug. 12, 1921, 1♀, Barkerville, June 29, 4♀; July 17, 6♂ 5♀ 13♂, 1948.

The record of *kirbyellus* from Chilcotin by the author was obtained in the same field as that in which *hyperboreus* was collected and is another record which is puzzling, as no further specimens have been found there. These specimens of *kirbyellus* and *hyperboreus* were taken during general collecting before the author became interested in bumble bees. Obtaining these in a general collection would indicate that both of them were fairly common species, but

repeated search at Chilcotin has not yielded any more specimens. It was not until 1948 that a small series of *kirbyellus* was obtained on Mount Murray, near Barkerville (lat. 53°), at an elevation of 6500 feet.

B. kirbyellus is said to be a strictly boreal species and has been taken at high elevations as far south as New Mexico. It very probably occurs on mountain tops above 7000 feet, in various parts of British Columbia, but the difficulty in reaching such elevations makes its collection difficult. It does not appear to occur on the summit of Mount Revelstoke, 6500 feet, where the author has frequently made collections. At the latitude of Revelstoke (51°), the elevation of 6500 feet may be too low.

As for *hyperboreus*, further extensive collecting is needed to determine accurately the distribution and altitude range of *kirbyellus* in British Columbia.

Subgenus *Terrestribombus* Vogt

Bombus occidentalis Greene (75: 152♂ 108♀ 132♂—392)

LOCALITIES—Carbonate, Radium, Invermere, Fort Steele, Crows Nest, Fernie, Cranbrook, Newgate, Kitchener, Kaslo, Oliver, Fairview, Okanagan Falls, Kaleden, Penticton, Keremeos, Hedley, Summerland, Kelowna, Okanagan Mission, Vernon, Sugar Lake, Armstrong, Field, Golden, Glacier, Rogers Pass, Revelstoke, Sicamous, Salmon Arm, Chase, Shuswap, Kamloops, Merritt, Nicola, Minnie Lake, Walhachin, Clinton, Chilcotin, Bella Coola, Burns Lake, Smithers, Hazelton, Kitwanga, Cedarvale, Terrace, Salys, Tyee, Prince Rupert, Lillooet, Mt. McLean, Lytton, Boston Bar, Yale, Hope, Hope Mts., Agassiz, Mt. Cheam, Milner, Vancouver, Buccaneer Bay, Newcastle I., Victoria, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Duncan, V. I., Ladysmith, V. I., Nanaimo, V. I., Departure Bay, V. I., Wellington, V. I., Alberni, V. I., Mt. Arrowsmith, V. I., Comox, V. I.

Bombus occidentalis var. *proximus* Cresson (8: 9♂ 3♀ 1♂—13)

LOCALITIES—Kaslo, Penticton, Vernon, Lytton, Hazelton, Atlin, Agassiz, Vancouver.

Bombus occidentalis var. *nigroscutatus* Franklin (1: 0♂ 0♀ 1♂—1)

LOCALITY—Kaslo, July 1, 1905, 1♀.

The following male colour variants of Franklin (1913) have been taken in British Columbia.

Male colour variant 3. (9: 11♂—11)

LOCALITIES—Fairview, Kaleden, Penticton, Westbank, Kamloops, Nicola, Tyee, Vancouver, Saanich, V. I.

Male colour variant 5. (5: 6♂—6)

LOCALITIES—Vernon. Kamloops, Smithers, Terrace, Tye.

Male colour variant 7. (1: 1♂—1)

LOCALITY—Hazelton, Aug. 20, 1947, 1♂.

Male colour variant 8. (4: 4♂—4)

LOCALITIES—Kaslo, Kaleden, Chase, Walhachin.

Male colour variant 9. (2: 2♂—2)

LOCALITIES—Kaslo, Sept. 2, 1906. Salvus, Aug. 17, 1946.

B. occidentalis is a very common bumble bee in British Columbia and is exceeded in numbers only by *B. bifarius* Cresson. With its varieties and colour variants it has been taken in 77 localities, and as far north as collections have been made. As it is recorded from Alaska, Yukon and Northwest Territories, it is no doubt distributed throughout the Province. It appears to be equally at home in the dry interior valleys, on the sea coast, and in mountain meadows up to elevations of 6500 feet. It is a very abundant species in late summer along the Skeena River from Hazelton to Prince Rupert, where it may be found visiting the flowers of fire-weed, *Epilobium* sp.

The varieties *proximus* and *nigroscutatus* are rare, but males often show some variation, and 5 of Franklin's 9 male colour variants were found among the material on hand. Franklin (1913) records that this is one of the most variable of North American bumble bees, but the material from British Columbia does not appear variable, except the males to some extent. Out of 273 ♀♀ all were typical specimens of *occidentalis* except for 3♀ 1♂ of var. *proximus* and 1♂ of var. *nigroscutatus*, and the latter specimen was not at all definitely marked.

The writer has examined a very brilliantly marked worker color variant from Aklavik, at the mouth of the Mackenzie River, Northwest Territories, collected by Mr. A. G. Dustan (11.VII.1946), in which the anterior part of the dorsum of the thorax was bright lemon yellow, the remainder entirely black; segment one of the abdomen entirely black; segment two, bright lemon yellow; segment three, black; segments four to six, clothed with long, pure white pile. A queen from Valdez,

Alaska, collected by Mr. J. D. Gregson (15.VII.1948) also shows a brightly contrasting colouration, having the dorsum of the thorax, except for the interalar band, bright lemon yellow; abdominal segments one and two, black; segment three, lemon yellow; segment four, black; and segments five and six, with short, ferruginous-white pile—in some respects resembling var. *nigroscutatus*. It may be that colour variants of *occidentalis* are not uncommon in arctic America.

Bombus terricola Kirby (23: 75♂ 58♀ 58♂—191)

LOCALITIES—Vernon, Salmon Arm, Kamloops, Minnie Lake, Savona, Walhachin, Bridge Lake, Canim Lake, 100 Mile House, Williams Lake, Chilcotin, Quesnel, Prince George, Burns Lake, Quick, Smithers, Hazelton, Kitwanga, Cedarvale, Terrace, Rolla, Pouce Coupe, Vancouver.

B. terricola is the commonest of all the bumble bees in the central interior. It is particularly common from Williams Lake north to Prince George, and west through the Nechako and Bulkley valleys to Hazelton, and in diminishing numbers along the Skeena River to Terrace. It has not been recorded from the canyon of the Skeena or from the coast at Prince Rupert. Its range probably extends well beyond these areas into the northern interior, as it has been taken in the northeastern section of the Province, at Rolla and Pouce Coupe in the Peace River district, considerably north of latitude 56°. The altitude range of the localities listed above is from sea level to 3500 feet, but its habitat of maximum abundance, lying between latitudes 53° and 55°, has only an altitude range of 2000 to 3000 feet. To the south of Williams Lake, latitude 52°, it rapidly becomes less abundant, and is a distinctly uncommon species throughout the southern interior. It has not been recorded from southeastern British Columbia or from the southern Okanagan valley. There is one record of its capture on the coast at Vancouver, but there are no records from Vancouver Island.

This is a very distinctive species, readily identified in the field, and its relative abundance and scarcity north and south of latitude 52° is very striking. The series of 191 specimens from

23 localities shows a remarkably uniform colouration. Franklin (1913) records that the scutellum may be more or less yellowish and occasionally entirely yellow. In this series very few show any yellow hairs on the scutellum, and only one has the scutellum entirely yellow: a queen from the northernmost locality, Rolla.

This is a bumble bee of considerable economic importance in the central interior, where an alsike clover seed industry is rapidly developing. When these alsike fields are in flower *terricola* may be seen in great numbers working on the blooms in association with smaller numbers of *flavifrons*, *occidentalis*, and *melanopygus*.

B. terricola is closely related to *B. terrestris* L., which ranges throughout the greater part of Europe and Siberia. Franklin (1913) records *B. terrestris* var. *moderatus* Cresson from several localities in Alaska and considers that it probably occurs also in Yukon Territory. It is therefore possible that *terrestris* s. lat. may be found in the extreme northwestern corner of British Columbia.

Subgenus **Protobombus** Vogt

Bombus ternarius Say (11: 56♂ 47♀ 140♀—243)

LOCALITIES—Crows Nest, Fernie, Golden, Chilcotin, Quesnel, Barkerville, Prince George, Vanderhoof, Fraser Lake, Burns Lake, Smithers.

This bumble bee is fairly common in the central plateau region of British Columbia from Chilcotin (latitude 52°), north to Prince George and northwest through the Nechako and Bulkley river valleys to Smithers (latitude 55°); it has been taken also in the Rocky Mountains at Crows Nest, Fernie, and Golden. It appears to be absent from the southern interior and coastal regions.

B. ternarius cannot be distinguished in the field from typical specimens of *bifarius* Cresson, and both occur together in the same rather restricted locations, where their queens may be seen in considerable numbers visiting dandelion flowers in June. *B. ternarius* is readily distinguished from *bifarius* on close examination by its having corbicular hairs black rather than bright ferruginous.

When freshly emerged this is a very pretty species; but, as in typical specimens of *bifarius*, the bright salmon-red colour of the second and third abdominal segments soon fades and becomes yellowish.

Bombus huntii Greene (4: 0♂ 1♀ 2♀—3)

LOCALITIES—Crows Nest, Aug. 11, 1927, 1♀ 1♀, Fernie, July 27, 1946, 1♀, Vancouver I.; Fort McLeod; Franklin (1913).

B. huntii is a mountain form, and the only material seen by the author was collected in the Crows Nest Pass through the main range of the Rocky Mountains. Scullen (1927, 1930) records it as a very common species in the mountains of eastern Oregon. Franklin (1913) records *huntii* from Vancouver Island and from Fort McLeod, which is at latitude 55°, but does not give any data on the material collected. It may occur in fair numbers at moderate elevations in the Rocky Mountain regions of British Columbia.

Bombus vosnesenskii Radoszkowski (1: 1♂ 0♀ 2♀—3)

LOCALITY—Osoyoos, July 20, 1925, 1♂ 2♀.

This bumble bee is very rare in British Columbia. Scullen (1927) gives its range as "British Columbia to Southern California and east to Nevada" and states that it is by far the most common species in the lower altitudes of western Oregon; and Frison (1923) records it from Montana.

Osoyoos (elevation 913 ft.) is at the extreme southern end of the Okanagan Valley and on the border between British Columbia and the State of Washington. It is unlikely that *vosnesenskii* will be found much farther north but it may occur at Victoria, on the extreme southern tip of Vancouver Island, as it is considered by Franklin to belong to the Pacific Coast portion of the Transition Zone.

This is a species that might be confused with typical specimens of *californicus* in the field.

Bombus bifarius Cresson (32: 36♂ 64♀ 38♀—138)

[=*B. edwardsii* Cresson]
(Franklin, 1913, p. 328)

LOCALITIES—Fort Steele, Crows Nest, Okanagan Mission, Vernon, Field, Golden, Kamloops, Merritt, Nicola, Minnie Lake, Walthachin, Hat Creek, Clinton, Jesmond, 100 Mile House, Chilcotin, Alexis Creek, Soda

Creek, Quesnel, Prince George, Vanderhoof, Fraser Lake, Burns Lake, Quick, Smithers, Kitwanga, Agassiz, Vancouver, Victoria, V. I., Saanich, V. I., Fitzgerald, V. I., Alberni, V. I.

Bombus bifarius var. **vancouverensis** Cresson (38: 15♂ 69♀ 26♂—110)
[=B. *edwardsii* var. *vancouverensis* Cresson]
(Franklin, 1913)

LOCALITIES — Invermere, Kaslo, Fairview, Okanagan Falls, Penticton, Keremeos, Kelowna, Okanagan Mission, Vernon, Golden, Revelstoke, Salmon Arm, Celista, Shuswap, Kamloops, Nicola, Minnie Lake, Clinton, Lillooet, Hazelton, Boston Bar, Buccaneer Bay, Pender Harbour, Victoria, V. I., Westholme, V. I., Goldstream, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Shownigan, V. I., Duncan, V. I., Jordan Meadows, V. I., Sahtlam, V. I., Courtenay, V. I., Nanaimo, V. I., Departure Bay, V. I., Alberni, V. I.

Bombus bifarius var. **nearcticus** Handlirsch (55: 150♂ 95♀ 184♂—429)
[=B. *edwardsii* var. *nearcticus* Handl.]
(Franklin, 1913)

LOCALITIES — Radium, Invermere, Premier Lake, Fort Steele, Crows Nest, Fernie, Cranbrook, Creston, Kaslo, Nelson, Oliver, Fairview, Vaseaux Lake, Okanagan Falls, Kaleden, Penticton, Keremeos, Hedley, Copper Mountain, Summerland, Peachland, Kelowna, Okanagan Mission, Vernon, Armstrong, Golden, Glacier, Revelstoke, Sicamous, Salmon Arm, Celista, Adams Lake, Kamloops, Merritt, Nicola, Minnie Lake, Clinton, Burns Lake, Quick, Smithers, Hazelton, Kitwanga, Atlin, Lillooet, Mt. McLean, Lytton, Boston Bar, Yale, Hope Mts., Agassiz, Victoria, V. I., Duncan, V. I., Alberni, V. I., Mt. Arrowsmith, V. I.

B. bifarius Cresson, with its two varieties, *vancouverensis* and *nearcticus*, is by far the commonest bumble bee in British Columbia, and this paper records 677 specimens from 83 localities, with an altitude range from sea level to at least 7000 feet in the southern interior. It undoubtedly occurs everywhere in the Province as far north as, or well beyond, latitude 55°.

B. bifarius has two very distinct and constant colour varieties, *bifarius* Cresson and *nearcticus* Handlirsch, and a third, *vancouverensis* Cresson, definitely intermediate in colouration between the other two. The distribution of these three forms in the Province is also sharply defined.

In the southern interior, south of latitude 51°, var. *nearcticus* is the dominant form and occurs in far greater

numbers than the other varieties in their respective areas. Only a very light, but widespread, scattering of the other two forms is found in the southern interior. In var. *nearcticus* the pile of the thorax, other than the black interalar band, is pure white or nearly so, and the dorsum of the abdomen is black and white, with no trace of ferruginous markings. In the male the light pile is pale yellow. There is no other bee recorded from British Columbia that is likely to be confused with *nearcticus*.

In the central interior, north of latitude 51°, var. *bifarius* (described by Franklin, 1913, as *edwardsii* Cresson; see Frison, 1923, p. 317) is the dominant colour form, and only a very light scattering of *nearcticus*, and still less of *vancouverensis*, is found in this area. The colouration of var. *bifarius* is such a striking contrast to that of *nearcticus* that it is difficult to realize that they belong to the same species. In var. *bifarius* the light pile of the thorax is bright lemon yellow instead of white as in *nearcticus* and *vancouverensis*, and segments two and three of the abdomen are rich salmon-red. In the field, var. *bifarius* is readily confused with *B. ternarius*, which has an identical colour pattern, but black corbicular hairs, whereas those of *bifarius* are ferruginous.

On Vancouver Island and on the coastal areas of the mainland, var. *vancouverensis* is the dominant form. In the northern interior, where var. *bifarius* is dominant, *vancouverensis* appears to be very scarce; but it is not at all unusual to find occasional specimens throughout the range of *nearcticus* in the southern interior. Both var. *bifarius* and var. *nearcticus* are found also, in small numbers, on Vancouver Island and on the adjoining mainland, but these areas are mainly populated by var. *vancouverensis*. It is remarkable how these three colour forms of one species occur so constantly in separate geographic areas with so little intermingling.

B. bifarius var. *vancouverensis* is a strikingly handsome bee, with its sharply contrasting patchwork of white, black, and red. It is definitely inter-

mediate between the other two forms, having the light pile of the thorax pure white as in *nearcticus*; and abdominal segments two and three with salmon-red pile, sometimes completely so, as in var. *bifarius*, or in varying amounts.

Considerable confusion, both in literature and named specimens in collections, has resulted from Franklin's (1913) placing *B. bifarius* Cresson as a synonym of *edwardsii*, and describing the real *edwardsii* under the name of *fernaldae* Franklin (see Frison, 1923, p. 317).

Bombus sylvicola Kirby (7: 107♂ 32♀ 14♂—153)

LOCALITIES — Kaslo, Revelstoke, Kamloops, Walhachin, Barkerville, Vanderhoof, Mt. Cheam.

B. sylvicola is the most difficult of all British Columbia bumble bees to determine with certainty, some specimens being very difficult to separate from *B. melanopygus*. Typical specimens of *sylvicola*, in which there is no admixture of black hairs with the yellow pile of the anterior portion of the thorax, are easily distinguished. But in material from British Columbia there seems to be every gradation up to a condition almost comparable to that of typical specimens of *melanopygus*.

The material collected from Kaslo, Revelstoke, Barkerville, and Mt. Cheam was taken at an elevation of 6000 feet or over, whereas that from Kamloops, Walhachin, and Vanderhoof was from much lower elevations. The optimum altitude range for *sylvicola* is apparently from 6000 to 8000 feet. Though the localities where *sylvicola* has been collected are few, they are well distributed over the Province: Kaslo being in the southeastern corner; Revelstoke, Kamloops, and Walhachin in the southern interior; Barkerville and Vanderhoof in the central interior, and Mt. Cheam in the coastal area. Further collecting of this species is needed before any really satisfactory statement can be made as to its distribution and altitude range in British Columbia.

Mountain bumble bees have a short life, and are subjected to such violent winds and storms that they very quickly become faded and battered. It is very difficult to find time to visit such loca-

tions on a sufficient number of good collecting days to secure first the queens, then the workers, and lastly the males.

Bombus melanopygus Nylander (56: 116♂ 111♀ 126♂—353)

LOCALITIES—Radium, Invermere, Crows Nest, Boswell, Kaslo, Osoyoos, Vaseaux Lake, Okanagan Falls, Penticton, Copper Mountain, Summerland, Okanagan Mission, Vernon, Field, Golden, Glacier, Rogers Pass, Revelstoke, Sicamous, Salmon Arm, Celista, Merritt, Nicola, Clinton, Jesmond, Quesnel, Stanley, Barkerville, Salvus, Prince Rupert, Metlakatla, Rolla, Lillooet, Hope Mts., Manning Park, Agassiz, Mt. Cheam, Milner, New Westminster, Vancouver, Buccaneer Bay, Pender Harbour, Newcastle I., Victoria, V. I., Ucluelet, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Duncan, V. I., Cowichan Lake, V. I., Ladysmith, V. I., Nanaimo, V. I., Departure Bay, V. I., Tofino, V. I., Mt. Arrowsmith, V. I.

The 353 records of *B. melanopygus* from 56 localities indicate that this is a very common species, with a Province-wide distribution. It has a wide altitude range: from sea level to 8000 feet, with an optimum range of 0-6000 feet. It is particularly common on Vancouver Island, and on the coast of the mainland, and in the mountain meadows of the interior, where this species is readily confused with the strictly boreal species *B. sylvicola*. *B. melanopygus* occurs as far north as collecting has been done in British Columbia, and Franklin (1913) mentions that it is the commonest species in Alaska.

It is a strikingly handsome species which few entomologists would refrain from taking; this may account in some measure for the number of specimens in collections.

Bombus centralis Cresson (26: 80♂ 39♀ 83♀—202)

LOCALITIES—Invermere, Fernie, Kaslo, Osoyoos, Oliver, Fairview, Vaseaux Lake, Okanagan Falls, Kaleden, Penticton, Keremeos, Chopaka, Summerland, Peachland, Westbank, Kelowna, Vernon, Field, Salmon Arm, Kamloops, Merritt, Nicola, Minnie Lake, Walhachin, Chilcotin, Lillooet.

B. centralis has been recorded from 26 localities in the southern interior and southeastern regions of British Columbia. It occurs sparingly north to Chilcotin, latitude 52°, but does not appear to be present on Vancouver Island or the mainland coast.

In the field it closely resembles *B. flavifrons* but has a far more restricted range, occurring only in valleys with an altitude range of 1000 to 2000 feet.

Bombus flavifrons Cresson (66: 128♂ 79♀ 141♀—348)

LOCALITIES—Radium, Crows Nest, Fernie, Cranbrook, Kaslo, Oliver, Fairview, Okanagan Falls, Kaledon, Penticton, Summerland, Vernon, Field, Golden, Glacier, Revelstoke, Sicamous, Salmon Arm, Chase, Kamloops, Midday Valley, Nicola, Minnie Lake, Walhachin, Hat Creek, Bridge Lake, Canim Lake, Chilcotin, Quesnel, Barkerville, Prince George, Vanderhoof, Fraser Lake, Burns Lake, Quick, Smithers, Hazelton, Kitwanga, Cedarvale, Salvus, Metlakatla, Atlin, Lillooet, Mt. McLean, Lytton, Hope Mts., Agassiz, Milner, Vancouver, Buccaneer Bay, Powell River, Victoria, V. I., Royal Oak, V. I., Ucluelet, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Shawnigan, V. I., Sahtlam, V. I., Cowichan, V. I., Nanaimo, V. I., Departure Bay, V. I., Wellington, V. I., Alberni, V. I., Mt. Arrowsmith, V. I., Courtenay, V. I.

Bombus flavifrons var. **dimidiatus** Ashmead (20: 14♂ 7♀ 25♀—46)

LOCALITIES—Invermere, Kaslo, Glacier, Hazelton, Inverness, Metlakatla, Centurian, Lytton, Hope, Hope Mts., Agassiz, Mt. Cheam, Crescent, Vancouver, Buccaneer Bay, Victoria, V. I., Westholme, V. I., Sidney, V. I., Fitzgerald, V. I., Tofino, V. I.

Bombus flavifrons var. **ambiguus** Franklin (3: 0♂ 0♀ 6♀—6)

LOCALITIES—Agassiz, Vancouver, Nanaimo, V. I.

B. flavifrons is one of the commonest species in the Province, and with its varieties, *dimidiatus* and *ambiguus*, has been represented by 400 specimens from 74 localities; only *B. bifarius* and *B. occidentalis* exceed it in numbers. It appears to be equally at home at sea level, in hot, dry locations, and in mountains up to 7000 feet. The typical form, *flavifrons* Cresson, is represented by 348 specimens from 66 localities; var. *dimidiatus*, by 46 specimens from 20 localities; and *ambiguus*, by 6 specimens from 3 localities. Both *dimidiatus* and *ambiguus* are readily confused with *B. sitkensis* and *B. mixtus* in the field, and are therefore hard to collect.

B. flavifrons has been observed to be of considerable economic importance in aiding in the pollination of alsike clover,

in association with *B. terricola* and *B. melanopygus*.

Bombus pleuralis Nylander (1: 0♂ 2♀ 0♀—2)
LOCALITY—Vernon, May 15, 1920, 2♀.

Frison (1926, p. 135) gives the above record from Vernon, and also records this species as collected by Dyar and Caudell at Laggan, British Columbia; however, Laggan, now called Lake Louise, is in Alberta.

Bombus pleuralis var. **clarus** Frison (1: 0♂ 1♀ 0♀—1)

LOCALITY—Vernon, May 15, 1920, 1♀.

Frison (1926, p. 139) records this variety also from Laggan, British Columbia; this, as noted above, should be an Alberta record.

Except for these three queens, two being typical specimens of *pleuralis* and one a specimen of var. *clarus*, nothing is known of this species in British Columbia. Franklin (1912) records it only from Alaska.

Bombus sitkensis Nylander (42: 133♂ 67♀ 144♀—344)

LOCALITIES—Radium, Invermere, Fernie, Kaslo, Summerland, Vernon, Field, Golden, Revelstoke, Salmon Arm, Kamloops, Quesnel, Barkerville, Burns Lake, Smithers, Cedarvale, Salvus, Tyee, Prince Rupert, Inverness, Metlakatla, Boston Bar, Yale, Agassiz, Mt. Cheam, Hope Mts., Manning Park, Vancouver, Buccaneer Bay, Pender Harbour Newcastle I., Victoria, V. I., Ucluelet, V. I., Royal Oak, V. I., Sidney, V. I., Jordan Meadows, V. I., Nanaimo, V. I., Departure Bay, V. I., Alberni, V. I., Tofino, V. I., Comox, V. I., Courtenay, V. I.

B. sitkensis is a common species, easily confused with *B. mixtus* in the field. It has a Province-wide distribution and a wide altitude range. It is particularly common on Vancouver Island and the mainland coast and occurs in all sections of the Province where relatively cool, timbered areas occur. It is not found in any numbers in the arid, dry-belt regions of the southern interior. It is a common bumble bee in mountain meadows up to 7000 feet, and its optimum altitude range is from sea level to 6000 feet.

Bombus mixtus Cresson (64: 105♂ 130♀ 210♀—445)

LOCALITIES—Radium, Invermere, Crows Nest, Fernie, Cranbrook, Kaslo, Okanagan Falls, Penticton, Hedley, Copper Mountain, Summerland, Peachland, Okanagan Mission, Vernon, Field, Golden, Glacier, Revelstoke, Sicamous, Salmon Arm, Celista,

Adams Lake, Kamloops, Midday Valley, Nicola, Minnie Lake, Bridge Lake, Canim Lake, Chilcotin, Quesnel, Stanley, Barkerville, Prince George, Burns Lake, Smithers, Hazelton, Cedarvale, Salvus, Tye, Prince Rupert, Metlakatla, Atlin, Rolla, Lillooet, Mt. McLean, Lytton, Yale, Hope Mts., Agassiz, Milner, Mission, Vancouver, Buccaneer Bay, Victoria, V. I., Westholme, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Ladysmith, V. I., Nanaimo, V. I., Departure Bay, V. I., Alberni, V. I., Courtenay, V. I.

B. mixtus is very common in British Columbia, and 445 specimens are here recorded from 64 localities. It is very evenly distributed over the Province. The northernmost record for British Columbia is Atlin, latitude 59°.

It prefers cool, wooded situations, and is equally at home on the coast or in the mountains of the interior; it is not found in any numbers in the dry-belt regions of the southern interior. Together with *B. sithkensis*, which it closely resembles, it is one of the commonest bumble bees in Vancouver. It has a wide altitude range, from sea level to at least 8000 feet in the mountains of the southern interior; its optimum range is from sea level to 6000 feet.

Bombus frigidus F. Smith (7: 2♂ 1♀ 2♂—5)

LOCALITIES — Invermere, Crows Nest, Kaslo, Kamloops, 100 Mile House, Chilcotin, Victoria, V. I.

This species is evidently rare in British Columbia, but the locality records show it to be widely distributed throughout the southern portion of the Province, including Vancouver Island. It is one of several bumble bees that cannot be distinguished in the field from some common species; this may account for the small number of specimens in the collections studied.

Bombus perplexus Cresson (6: 3♂ 1♀ 3♂—7)

LOCALITIES — Prince George, Burns Lake, Smithers, Salvus, Prince Rupert, Buccaneer Bay.

The locality records of *perplexus* indicate that it does not occur in the southern interior of the Province, but it is found in the central interior; in the Nechako, Bulkley, and Skeena river valleys, between Prince George and Prince Rupert; there is also one record from Buccaneer Bay, north of Vancouver.

B. perplexus cannot be distinguished from *B. vagans* in the field, and as

vagans is particularly common in the territory where *perplexus* is found it is difficult to obtain a good series of the latter without killing large numbers of the former—something one dislikes to do.

Careful examination of several hundred specimens of *vagans* from all sections of the Province has revealed no specimens of *perplexus* except from the localities recorded above.

Bombus vagans F. Smith (47: 129♂ 82♀ 187♀—398)

LOCALITIES — Invermere, Fort Steele, Crows Nest, Creston, Kaslo, Lardo, Oliver, Westbank, Penticton, Summerland, Kelowna, Okanagan Mission, Vernon, Sugar Lake, Armstrong, Golden, Glacier, Revelstoke, Sicamous, Salmon Arm, Adams Lake, Shuswap, Kamloops, Merritt, Nicola, Minnie Lake, Canim Lake, Chilcotin, Quesnel, Stanley, Barkerville, Prince George, Fraser Lake, Burns Lake, Smithers, Hazelton, Kitwanga, Cedarvale, Terrace, Salvus, Metlakatla, Rolla, Hudson Hope, Hope Mts., Agassiz, Vancouver, Victoria, V. I.

B. vagans is one of the commonest species of bumble bees in the interior of British Columbia, and 398 specimens are here recorded from 49 localities. It prefers comparatively cool, timbered locations of moderate rainfall, and has not been taken in any numbers in the hot, arid regions of the southern Okanagan Valley or in extreme southeastern British Columbia. It is rare also in regions of heavy rainfall such as Vancouver Island and the mainland coast. It is found in maximum numbers from Vernon, in the North Okanagan Valley, northward through the southern and central interior regions, and is particularly abundant in the Nechako and Bulkley valleys from Prince George west to Terrace. It has also been taken at Rolla and Hudson Hope on the Peace River in northeastern British Columbia. Its abundance and distribution in the northern interior of the Province are unknown, and there appear to be no records of *vagans* from Alaska or Yukon Territory. Its optimum altitude range in British Columbia is from 1000 to 4000 feet.

Section *Odontobombus* Krüger

Subgenus *Subterraneobombus* Vogt

Bombus appositus Cresson (34: 88♂ 57♀ 37♀—182)

LOCALITIES — Invermere, Crows Nest, Cranbrook, Newgate, Kaslo, Nelson, Okanagan Falls, Penticton, Keremeos, Hedley, Summerland, Vernon, Glacier, Armstrong, Salmon Arm, Chase, Shuswap, Kamloops, Nicola, Minnie Lake, Walhachin, Hat Creek, Clinton, 100 Mile House, Chilcotin, Quesnel, Lillooet, Mt. McLean, Lytton, Chapman, Yale, Hope, Agassiz, Vancouver.

The records of 182 specimens from 34 localities indicate that this is a fairly common species in the valleys of south-eastern British Columbia and the southern interior. It occurs sparingly on the coast, and has not as yet been recorded from Vancouver Island. It is rare in the central interior but has been taken occasionally as far north as Quesnel (latitude 53°).

B. appositus is partial to dry open areas, where it may often be seen visiting thistles in company with *B. fervidus*, which it closely resembles in appearance, habits, and distribution.

Subgenus **Fervidobombus** Skorikov

Bombus fervidus (Fabricius) (16: 16♂ 39♀ 56♀—111)

LOCALITIES—Osoyoos, Oliver, Fairview, Kaleden, Penticton, Summerland, Peachland, Okanagan Mission, Vernon, Salmon Arm, Kamloops, Nicola, Minnie Lake, Walhachin, Ashcroft, Williams Lake.

Bombus fervidus var. **dorsalis** Cresson (7: 5♂ 4♀ 2♀—11)

LOCALITIES—Kaleden, Penticton, Salmon Arm, Kamloops, Nicola, Walhachin, Chilcotin.

B. fervidus, as well as its variety *dorsalis*, closely resembles *appositus*, but is less common. The records of the 111 specimens from 16 localities indicate that it is confined to the warm valleys of the southern interior. It has not been taken in southeastern British Columbia or to the west of the Coast Mountains. With the exception of two specimens from Chilcotin and Williams Lake (latitude 52°), all the records are from south of latitude 51°.

Bequaert (1932) gives some interesting notes of this species building their cells and rearing their broods in old birds' nests in trees.

When collecting insects in the Okanagan Valley in 1919, near the present townsite of Oliver, the author on several occasions placed his finger in the nests of the western marsh wren, *Telmatorhynchus palustris plesius* (Oberhol-

ser), to see whether they contained eggs, and was startled to have the nest vibrate violently and emit angry bumble bees. As he was not particularly interested in bees at that time, he did not determine the species. As *fervidus* is common in this district, it may have been this species that was making use of the wrens' nests. These little birds have the curious habit of building several spare nests, hanging them high up in the cat-tails; and these nests were evidently used by the bumble bees.

Bombus californicus F. Smith (24: 9♂ 23♀ 20♀—52)

LOCALITIES — Invermere, Creston, Penticton, Peachland, Westbank, Vernon, Armstrong, Salmon Arm, Chilcotin, Lytton, Hope, Agassiz, Langley, Crescent, Vancouver, Victoria, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Shawnigan, V. I., Nanaimo, V. I., Departure Bay, V. I., Alberni, V. I., Comox, V. I.

Bombus californicus var. **dubius** Cresson (9: 4♂ 8♀ 2♀—14)

LOCALITIES—Creston, Okanagan Falls, Westbank, Vernon, Agassiz, Vancouver, Victoria, V. I., Saanich, V. I., Nanaimo, V. I.

Bombus californicus var. **consanguineus** Handlirsch (35: 37♂ 71♀ 63♀—171)

LOCALITIES—Crows Nest, Fernie, Oliver, Fairview, Okanagan Falls, Kaleden, Penticton, Keremeos, Summerland, Vernon, Salmon Arm, Adams Lake, Kamloops, Walhachin, Clinton, Canim Lake, Chilcotin, Quesnel, Prince George, Quick, Smithers, Rolla, Arras, Centurian, East Pine, Agassiz, Mt. Cheam, Crescent, Vancouver, Victoria, V. I., Royal Oak, V. I., Saanich, V. I., Sidney, V. I., Fitzgerald, V. I., Wellington, V. I.

B. californicus, with its varieties *dubius* Cresson and *consanguineus* Handlirsch, is represented by 237 specimens from 49 localities. It is not a mountain bumble bee, but extends in the valleys over a wide area of the Province at an altitude range of 0-2000 feet.

B. californicus F. Smith, with the scutellum black, is represented by 52 specimens from 24 localities, and reaches its maximum abundance on Vancouver Island and the coast of the mainland. The variety *consanguineus*, with the scutellum yellow, is represented by 171 specimens from 35 localities and is the commonest of the three forms in British Columbia, ranging north to the central interior and Peace River district. The

variety *dubius*, with an admixture of black and yellow pile on the scutellum, is represented by 14 specimens from 9 localities. Though these definitely have some yellow pile, in varying amounts, mixed with the black on the scutellum, they are, in general, far more like the typical form than like var. *consanguineus*.

This is a fairly distinctive species in the field although the queens resemble those of *Psithyrus insularis*, but far more active.

Genus *PSITHYRUS* Tepeletier

This genus contains a small number of inquiline, or "guest," bumble bees, without workers; the females utilize the nests of true bumble bees, their young being raised by the host workers.

Specimens of *Psithyrus* spp. are easy to collect, as they are sleepy and sluggish in their movements and often congregate in large numbers on flower heads of thistle, aster, and other attractive plants. This is particularly the case of males in late summer.

Psithyrus spp. may be readily distinguished from *Bombus* spp. by the absence of corbiculae, or pollen baskets, in the queens, and by the black, hairy faces of the males, the males of *Bombus* spp. having a conspicuous amount of yellow pile.

Seven species are known from America north of Mexico; and four of these, *insularis*, *ashtoni*, *suckleyi*, and *fernaldae*, are recorded from British Columbia. Of the remaining three species, *crawfordi*, described from Oregon, may well occur here; but *variabilis* is more southern in distribution and is less likely to be found. *P. laboriosus* has not as yet been recorded from British Columbia, but from its distribution in the U. S. it should be found here.

The species of *Psithyrus* closely resemble one another in size and in their black and yellow colouration, and in the field it is difficult to distinguish them. As *insularis* and *suckleyi* are exceedingly common and *ashtoni* and *fernaldae* are comparatively rare in British Columbia, it is difficult to secure good series of the latter two without collecting all specimens of *Psithyrus* seen.

Subgenus *Laboriopsithyrus* Frison

Psithyrus insularis (F. Smith) (56: 131♂ 131♀—262)

LOCALITIES — Carbonate, Radium, Invermere, Crows Nest, Fernie, Newgate, Kaslo, Osoyoos, Fairview, Okanagan Falls, Penticton, Hedley, Summerland, Okanagan Mission, Oyama, Vernon, Field, Golden, Glacier, Revelstoke, Sicamous, Salmon Arm, Kamloops, Merritt, Nicola, Aspen Grove, Walhachin, Hat Creek, Jesmond, Chilcotin, Quesnel, Stanley, Prince George, Vanderhoof, Burns Lake, Smithers, Kitwanga, Salvus, Lillooet, Lytton, Boston Bar, Hope, Hope Mts., Agassiz, Vancouver, Buccaneer Bay, Newcastle I., Victoria, V. I., Sidney, V. I., Fitzgerald, V. I., Duncan, V. I., Nanaimo, V. I., Departure Bay, V. I., Wellington, V. I., Mt. Arrow-smith, V. I., Forbidden Plateau, V. I.

This appears to be the only species of *Psithyrus* of which there are definite records of occurrence in the nests of *Bombus* spp. in British Columbia.

Frison (1921) records that Sladen (1915) found *P. insularis* in a nest of *B. flavifrons* at Agassiz on July 7, 1914. The author also received a queen of *insularis* and four workers of *B. mixtus* taken from a nest in a compost pile by H. B. Leech at Vernon on June 2, 1946. Mr. Leech stated that there was no sign of the *mixtus* queen which had evidently been killed or driven away by the *Psithyrus* sp.

This is the commonest species of *Psithyrus* in British Columbia, and this paper records 262 specimens from 56 localities widely and evenly distributed in the Province, at least as far north as latitude 56°, and with a considerable altitude range.

Subgenus *Ashtonipsithyrus* Frison

Psithyrus ashtoni (Cresson) (10: 75♂ 15♀—90)

LOCALITIES — Chilcotin, Quesnel, Barkerville, Prince George, Vanderhoof, Fraser Lake, Burns Lake, Quick, Smithers, Lillooet.

This is one of the rare species in British Columbia; and of the 10 localities recorded above, 9 are situated in the northern half of the Province, north of latitude 52°. The specimen from Lillooet, a little south of latitude 51°, was probably taken on Mt. McLean (altitude, 7600 ft.).

Psithyrus suckleyi (Greene) (51: 168♂ 85♀—253)

LOCALITIES — Carbonate, Invermere, Cranbrook, Kaslo, Nelson, Osoyoos, Oliver, Kaleden, Penticton, Keremeos, Peachland, Westbank.

Okanagan Mission, Vernon, Golden, Revelstoke, Sicamous, Salmon Arm, Adams Lake, Kamloops, Merritt, Nicola, Jesmond, Chilcotin, Quesnel, Prince George, Vanderhoof, Burns Lake, Smithers, Hazelton, Kitwanga, Cedarvale, Pacific Terrace, Tye, Lillooet, Lytton, Boston Bar, Yale, Hope Mts., Manning Park, Agassiz, Mt. Cheam, Vancouver, Buccaneer Bay, Victoria, V. I., Royal Oak, V. I., Duncan, V. I., Sahtlam, V. I., Ladysmith, V. I., Departure Bay, V. I.

P. suckleyi is similar to *insularis* in having a Province-wide distribution and a considerable altitude range. It is a common species, and the 253 specimens recorded were collected from 51 localities, ranging from latitude 49° to north of latitude 55° and from the Alberta border to Vancouver Island.

Subgenus **Fernaldaepsithyrus** Frison

Psithyrus fernaldae Franklin (20: 63♂ 15♀—78)

LOCALITIES — Invermere, Kaslo, Summerland, Vernon, Field, Revelstoke, Hat Creek, Jesmond, Chilcotin, Barkerville, Metlakatla, Stikine, Hope Mts., Manning Park, Agassiz, Mt. Cheam, Vancouver, Newcastle I., Departure Bay, V. I., Nanaimo, V. I.

P. fernaldae is a comparatively rare species but is more widely distributed than *ashtoni*, and the 80 specimens recorded were collected in 21 localities from latitude 50° to the Yukon boundary. The Kamloops collection also contains 7 males collected on July 15,

1948, at Valdez, Alaska, by J. D. Gregson. It has been taken at several points at sea level on the coast, but the specimens from the interior are mainly from mountain locations as high as 7000 ft. Further collecting is needed to determine its distribution and altitude range in British Columbia.

The Canadian National Collection, at Ottawa, contains 2 males of *fernaldae* var. *wheeleri* Bequaert and Plath, collected at Revelstoke on August 12, 1923, by P. N. Vroom. These were evidently mislabelled, as a check with specimens of *fernaldis* s. str. and a comparison with the type of *wheeleri* kindly undertaken by Dr. J. Bequaert, Museum of Comparative Zoology, Cambridge, Mass., clearly reveal that these two males are typical specimens of *fernaldae* and not of var. *wheeleri*.

In some unpublished notes, kindly loaned by Dr. H. H. Ross, Illinois State Natural History Survey, Frison also records var. *wheeleri* from Vancouver, B. C. But the writer has not obtained any data on this record, and as it might have been in error as in the case of the Revelstoke material, var. *wheeleri* is not being recorded here as occurring in British Columbia. It may, however, be found in the Province, as it occurs in both Oregon and California.

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AN UNUSUAL CUTWORM OUTBREAK¹

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Early in August, 1948, a report was received at the Dominion Entomological Laboratory, Agassiz, B. C., of a serious cutworm outbreak on Nicomen Island. This island, composed entirely of alluvial land, lies on the north side of the Fraser River east of Mission and is some 7 miles long. It was almost entirely covered with water to a depth of many feet during the disastrous flood in June, 1948, and all crops were destroyed.

Investigation showed a large, striped, greenish caterpillar to be present in epidemic numbers, feeding on the scanty vegetation that was then springing up as the land dried. The larvae were in various instars, but the majority were fully fed.

As the insect was not recognized, material was collected for rearing. The adults emerged throughout September, 1948 and were identified as *Dargida procincta* (Grote).

Search of literature showed no record of this insect as a pest in British Columbia, but W. Downes, lately in charge of the Dominion Entomological Laboratory at Victoria, has since informed me that, in 1928, a serious outbreak occurred in the Alberni, Comox, and Cumberland areas, where, chiefly on bottom lands, clover, alfalfa, young oats and couch grass were severely injured. J. R. J. Llewellyn Jones of Cobble Hill, Vancouver Island, also told me that he captures an occasional adult in most years.

Later in August, outbreaks were also reported in the Glendale, Matsqui, and

Hatzic areas, where similar flood conditions had obtained. The total area covered by the outbreak of this uncommon species was therefore some 200 square miles.

The larvae were found to feed on a variety of plants, chiefly grasses, oats, and corn; but the new growth of dandelion, plantain, and other weeds that had survived a three-week submergence were fed upon until the newly sown grain crops came through the mud. In some fields 25 per cent of the oat and corn seedlings were devoured. Feeding was general during daylight hours, this species having somewhat the habits and appearance of an armyworm.

A 3 per cent D.D.T. dust proved an effective and practical control.

Two interesting facts concerning the life-history of this species were noted. The first is the sudden and unexplained appearance of the larvae in numbers sufficiently large to give rise to an epidemic, for this species is seldom seen in an average year. The second is the complete confinement of the outbreak to flooded lands. It was particularly noticeable on Nicomen Island that even small ridges above flood level were not infested. In the latter connection it is interesting to refer to the observations made by Professor Spencer (1947), when it was noted that the moths of this species oviposited only in soil being soaked by a garden hose and were uninterested in the garden beds not being watered. Evidently only water-soaked land is chosen by the adults for egg-laying.

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¹ Contribution No. 2622A, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.