A MONOGRAPH OF THE WESTERN HEMISPHERE BUMBLEBEES (HYMENOPTERA: APIDAE; BOMBINAE)

I. The Genera Bombus and Megabombus Subgenus Bombias

H. E. MILLIRON
Entomology Research Institute
Canada Department of Agriculture
Ottawa, Canada

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INTRODUCTION

Scope of work. The present investigation, based on the writer's interest which was initiated in 1938, was interrupted between 1942 and 1946 because of World War II, resumed in late 1947 and continued since then except for several short periods. Since the beginning, approximately 140,000 specimens have been examined from various parts of the World though in particular from places in the Western Hemisphere; more than 85,000 specimens have been assembled for reference in Ottawa where the work is being completed. Some research was done in European, South American and North American museums, especially at the Carnegie Museum, Pittsburgh, Pa., U.S.A. Since early 1961, the work has continued at the Entomology Research Institute, Canada Department of Agriculture, Ottawa, Canada. I have been fortunate to have been able to perform field work, including collecting and biological studies, in South America, Mexico, the United States, and Canada.

With few exceptions, the types of all 103 taxa recognized as valid have been studied, as well as those of most synonyms. In the descriptions contained in this work the expression of coloration of taxa, in many instances, follows the standards and nomenclature set forth by Ridgway (1912).

SOURCES OF RECORDED MATERIAL

Much of the material supplied for this study was lent by various institutions and individuals of both hemispheres. The ecological data from these specimens have been scrutinized, compiled, and entered for each respective taxon, followed by a bracketed code in each case to indicate the source or origin. Except for some retentions, and/or exchanges, all these specimens now have been, or soon will be, returned. Specimens comprising my personal collection are included in the compilation of ecological data for each taxon. The following is an alphabetical list of codes of borrowed and personal material that has been of inestimable value in this investigation.

AMNH—The American Museum of Natural History, New York, N.Y., U.S.A.; **ANSP**—The Academy of Natural Sciences of Philadelphia, Philadelphia, Pa., U.S.A; **AR**—the late Brother Adrien Robert, University of Montreal, Montreal, Que., Can.; **BMNH**—British Museum (N.H.), London, Eng.; **CIS**—California Insect Survey, University of California, Berkeley, Calif., U.S.A.; **CL**—the late Dr. A. M. de Costa-Lima, Instituto Oswaldo Cruz, Rio de Janeiro, R.d.J., Bras.; **CL. ena**—the late Dr. A. M. de Costa-Lima, Escola National de Agronomia, Universidad Rural, R.d.J., Bras.; **CM**—Carnegie Museum, Pittsburgh, Pa., U.S.A.; **CNC**—Canadian National Collection (Entomology Research Institute), Ottawa, Ont., Can.; **CNHM**—Chicago Natural History Museum, Chicago, Ill., U.S.A.; **COL**—Ministerio de Agricultura, Centro Nacional de Investigaciones Agricolas Tibiatata, Bogotá, Cund., Col.; **CSC**—Prof. C. S. Carbonell, Facultad de Agronomia, Universidad de la Republica, Montevideo (Sayago), Mald., Urug.; **CU**—Cornell University, Ithaca, N.Y., U.S.A.; **Evans**—Dr. H. E. Evans, Museum of Comparative Zoology, Harvard University, Cambridge, Mass., U.S.A.; **HEM**—H. E. Milliron, Entomology Research Institute, Ottawa, Ont., Can.; **IBSA**—Secretário de Agricultura, Instituto Biologico, São Paulo, S.P., Bras.; **INHS**—Illinois Natural History Survey, Urbana, Ill.,

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U.S.A.; **INIA**—Instituto Nacional de Investigaciones Agricolas, Mexico, D.F., Mex.; **JSM**—Padre J. S. Moure, Museu Paranaense, Curitiba, Par., Bras.; **KL**—Karol Lenko, Instituto Biologico, São Paulo, S.P., Bras.; **KU**—The University of Kansas, Lawrence, Ks., U.S.A.; **MASS**—University of Massachusetts, Amherst, Mass., U.S.A.; **MCZ**—Museum of Comparative Zoology, Harvard University, Cambridge, Mass., U.S.A.; **MLF**—Miguel Lilo Foundation, Tucuman, Tuc., Arg.; **MNHN**—Muséum National d'Histoire Naturelle, Paris, Fr.; **NMW**—Naturhistorisch Museum, Wien, Aust.; **NRS**—Naturhistoriska Riksmuseet, Stockholm, Swed.; **NSM**—Museum of Natural History, Halifax, N.S., Can.; **PMNH**—Peabody Museum of Natural History, Yale University, New Haven, Conn., U.S.A.; **RRD**—the late Mr. R. R. Dreisbach, Midland, Mich., U.S.A.; **SADZ**—Secretario de Agricultura, Departmento de Zoologia, (Instituto Biologico), São Paulo, S.P., Bras.; **Seabra**—Dr. Campos Alberto Seabra, Rio de Janeiro, R. d. J., Bras.; **SD**—the late Prof. H. C. Severin, South Dakota State College, Brookings, S.D., U.S.A.; **SG**—Silveira Guido, Facultad de Agronomia, Universidad de la Republica, Montevideo (Sayago), Mald., Urug.; **UM**—Museum of Zoology, University of Michigan, Ann Arbor, Mich., U.S.A.; **UNMH**—Museo de Natural Historia, Montevideo, Mald., Urug.; **USNM**—United States National Museum (Smithsonian Institution), Washington, D.C., U.S.A.; **UZM**—Universitetetes Zoologiske Museum, Kjobenhavn, Den.; **v.d.V.**—Dr. J. van der Vecht, Rijksmuseum van Natuurlijke, Leiden, The Nethlds.; **ZMA**—Zoologisch Museum, Amsterdam, The Nethlds.; and, **ZMB**—Zoologisch Museum (Humboldt Universität), East Berlin, D.D.R.

CITING OF CERTAIN COLLECTORS

Those persons who have collected extensively, or rather so, the examined material pertaining to this revision are indicated only by their initials or initial (or modification thereof) as a part of the ecological data for a taxon; these collectors are as follows:

A. — Arnau
As. — Ares
A.A. — Ares
A.E.R.D. — Downe
A.F.P. — Prosen
A.M. — Maller
A.R. — Robert
A.R.B. — Brooks
A.T. — Twomey
A.Wk. — Willink
A.Wn. — Washburn

Bi. — Bridarolli
Bo. — Biezanko
By. — Bradley
B.A.G. — Gibbard
B.G. — Guevara
B.H. — Haig
B.M. — Malkin

C. — Cockerell
C.&P.V. — Vaurie
C.A.C.S. — Seabra
C.B. — Biezanko
C.C.L. — Loan
C.D.B. — Bird
C.D.F.M. — Miller
C.D.M. — Miller
C.E.L. — Lilly
C.H.M. — Mann
C.M. — Marin

D. — Darlington
D.B. — Bolinger
D.F. — Frechin
D.F.H. — Hardwick
D.J.&J.N.K. — Knull
D.K.D. — Duncan
D.O. — Olea
D.P.W. — Whillans
D.S.B. — Bullock

E.E.M. — MacDougall
E.E.S. — Sterns
E.F.C. — Cashman
E.H.N.S. — Smith
E.H.S. — Strickland
E.M. — Mason, Edith
E.O. — Osorno
E.R.B. — Buckell
E.R.T. — Tinkham

F. — Freeman
(F.) — Foerster
F.&L. — Freeman & Lewis
F.&P.R. — Rindge
F.C.S. — Sears
F.G.D. — DiLabio
F.G.W. — Werner
F.H.W.&(F.H.W.) — Walz
F.J. — Johansen
F.J.D. — Dyer
F.L.W. — Woytkowski

F.M.(&d.)O. — Oliveira
F.Ms. — Monros
F.Pn. — Plaumann
F.Po. — Pacheco
F.R. — Rindge
F.S. — Schade
F.S.L.W. — Williamson
F.Wi. — Woytkowski
F.W.L.S. — Sladen
F.W.P. — Pennell
F.Wr. — Werner

Gb. — Golbach
Gh. — Gertsch
G.A.H. — Hobbs
G.B. — Butler
G.B.F. — Fairchild
G.B.R. — Rich
G.D.B. — Butler
G.E.F. — Ferguson
G.E.S. — Shewell
G.F. — Ferguson
G.J.S. — Spencer
G.K.S. — Sweatman
G.L. — Lassmann
G.M.B. — Brandt
G.P.H. — Holland
G.S.W. — Walley

Hd. — Hayward
Hl. — Huckel
H.A.S. — Scullen
H.C.S. — Severin
H.E.V. — Evans
H.E.M. — Milliron
H.E.O. — Osorno
H.F.H. — Howden
H.G. — Gouvela
H.H. — Huckel
H.H.S. — Smith
H.J.H. — Huckel
H.K. — Kahl
H.O. — Osorno

J.A.M. — Monro
J.B.H. — Hartley
J.C.B. — Bradley
J.D.S. — Soper
J.E.B. — Brooks
J.E.H.M. — Martin
J.F. — Foerster
J.F.G.C. — Gates-Clarke
J.F.M. — McAlpine
J.F.Z. — Zikan
J.G.C. — Chillcott
J.M. — Moure
J.M.A. — Arnau
J.N.K. — Knull
J.R. — Ramdas
J.R.M. — McGillis
J.R.V. — Vockeroth
J.R.W.M. — McGillis
J.Sh. — Steinbach
J.Sp. — Soukup
J.S.M. — Moure
J.S.W. — Waterhouse
J.W.M. — MacSwain
J.Z. — Zikan

K.J.H. — Hayward
K.L. — Lenko

L.A.K. — Kelton
L.C.A. — Alvarenga
L.E.P. — Peña
L.P. — Peña
M. — Michener
Me. — Moure
Mr. — Michener
Ms. — Monros
M.A. — Alvarenga
M.A.E. — Evans
M.&M. — Moure & Michener
M.M.S. — Senkute
M.S. — Senkute
M.Z. — Zischka

N.L.H.K. — Krauss

O.P. — Peck

P.A.T. — Telles
P.B. — Bridarolli
P.&C.V. — Vaurie
P.D.A. — Ashlock
P.D.H. — Hurd
P.F.B. — Bruggemann
P.J.A. — Anduze
P.L. — Lopez
P.M.T. — Tashereau
P.R. — Rindge
P.R.E. — Ehrlich
P.F.W. — Fattig

R.A.M. — Morse
R.E.L. — Leech
R.Gg. — Glendenning
R.Gh. — Golbach
R.G.H. — Harris
R.H.W. — Washburn
R.&K.D. — Dreisbach
R., K.D. — Dreisbach
R.L. — Lambert
R.&R. — Rehn
R.R.D. — Dreisbach
R.S.B. — Bigelow
R.S.C. — Crassin
R.W.D. — Dawson
R.W.S. — Salt

Sh. — Steinbach
Sn. — Sladen
S.D.H. — Hicks

T.B.M. — Mitchell
T.D.A.C. — Cockerell
T.N.F. — Freeman
T.W. — Washburn

Wh. — Weyrauch
Wk. — Willink
W.B.S. — Schofield
W.C.M. — Clarke-McIntyre
W.D. — Downes
W.I.C. — Campbell
W.J.B. — Brown
W.P.C. — Cockerell
W.R.M. or W.R.M.M. — Mason
W.J.G. — Gertsch
W.W.G. — Gibson
W.W. — Weyrauch
W.W.Mn. — Mann
W.W.Ms. — Moss
W.W.P. — Perrett

Z. — Zischka
Z.M. — Müller

ACKNOWLEDGMENTS

The help and encouragement received during the course of this study have been most gratifying. Lack of space does not permit expression of appreciation to each of the many individuals involved in this respect, but to all who made available their collections I extend my sincere thanks, and especially so to Dr. R. W. Dawson, Pullman, Wash., U.S.A., for having in 1941 donated to the writer his large personal identified collection of nearly perfectly prepared material from many parts of the United States. Mention should also be made of the generosity of the late Professor H. C. Severin whose extensive private collection was supplied by him for my study. I am grateful to the staffs of all museums and/or institutes of Europe and North and South America for the loan of their pertinent material, and especially thankful to the Liguel Millo Foundation, Tucuman, Argentina, S.A., for the loan of its vast collection. Many other institutions on both South and North American continents cooperated by lending valuable specimens. In addition, over the years I have obtained numerous specimens by purchase, especially from South American collectors.

Generous thanks are due Mr. Patrick Burnside, currently a high school instructor at Dryden, Ont., for his excellent and devoted technical assistance for nearly two years; in addition to some other aspects of the work he is to be credited with completion of most wing drawings under my supervision. Most other drawings are by the writer, traced and inked by Mrs. Marian Platek, formerly with the bio-Graphic Unit, Scientific Information Section, Canada Department of Agriculture, Ottawa; some photographs and the diagrams were done by others of that Unit.

It is a pleasure to acknowledge the efforts and facilities of the Carnegie Museum, Pittsburgh, Pa., and the opportunity afforded by the Entomology Research Institute, Ottawa, to bring the present undertaking to completion.

PHYLOGENY OF BOMBINAE

For many years my contention has been that the true bumblebees constitute a heterogeneous assemblage of insects with similar appearance and habits. The evolution involved appears to have been such that the true or actual phylogeny of these bees is obscure and might never be perfectly understood. Although the origin of bumblebees is relatively recent, fossil records of them are meager. Scudder (1891) indexed several supposed bumblebee fossil records and gave literature references pertaining to each. Cockerell (1909*c*, *d*) studied most of the so-called bumblebees in amber and concluded that they could, at best, be regarded only as possible relatives or ancestral types; and he (1906*d*) found none in the fossil bed at Florrisant, Colo. Probably the only true fossil bumblebee yet known is that found near Spokane, Wash., in shale belonging to the Upper Miocene Epoch. This was recognized and named by Cockerell (1931*a*: 309) as *Bombus proavus*. It appears that bumblebees did not arise alone simply by what is known as orthogenetic evolution, but that other means such as divergence, parallelism, and convergence were also in operation.

Milliron (1961*a*) has inferred that the principles of convergent and parallel evolution must have been the most pertinent and effective types that brought about the various groups of these bees from different ancestral stocks; and, furthermore, that not all arose necessarily at the same time and place.

Numerous investigators have expressed evolutive opinions or schemes bearing on the phylogeny of bumblebees. If the student desires to review these ideas he should consult Bischoff (1935*b*), Buttel-Reepen (1903*a*, *b*; 1906), Cockerell (1908*b*), Franklin (1954), Friese (1900, Ann. k. k. naturh. Hofmus. XV: 240), Friese and Wagner (1910), Frison (1927*e*), Haas (1962), Krüger (1917), Kruseman (1960), Lutz (1916), Michener (1944), Plath (1927*d*, 1934), Reinig (1939*c*), Sladen (1912*b*), and Wheeler (1928). While most of these opinions have more or less affected my thinking, not one of them seems to have gained universal acceptance.

The first angiosperms are believed by some to have originated during the late Mesozoic or the early Cenozoic Era, possibly as long ago as 75 to 100 million years (*cf.* Buttel-Reepen 1915, table; Simpson 1953: 31). Since the Apoidea are largely dependent on this division of plants, the primitive apoids probably arose from primitive sphecoids and began adaptation to the then existing angiosperms as far back as 80 million or more years ago. If *B. proavus* is to be considered as the sole true fossil bumblebee, and it is correctly associated with geological time, then ancestral bumblebees occurred in the Tertiary Period (Miocene Epoch, or before) roughly 20 to 25 million years ago when it is believed that such flowering plants as linden, magnolia, and oleander were present. Cockerell (1909*c*), after studying the fossil bees in Baltic amber, described them as representing species which he assigned to *Chalcobombus, Protobombus,* and *Sophrobombus*, all of the Tertiary Oligocene Epoch, at least about 40 million years ago. As indicated before, he regarded these as "bombiform" and not genuine bumblebees as we know them. Cockerell (1906*d*: 41, 42) earlier had described from Scudder material the fossil monobasic genus *Calyptapis*, assigning it as a progenitor of certain present day anthophorids; subsequently he (1908*b*) studied material of the same species in better condition from the Miocene shale at Florrisant, Colo., and concluded that it was more bombiform than previously realized, and speculated that it could have been an ancestral form of our modern bumblebees. Despite the lack of any evidence that *Calyptapis* ever occurred outside the Western Hemisphere, Cockerell (*loc. cit., supra*) reasoned that if it was a bombid ancestor the existing records (all from Colorado) do not preclude the possible origin of bumblebees (also) in the Eastern Hemisphere.

It is unlikely that any taxonomist who has worked intimately with a sizeable group for years is finally without at least some kind of phylogenetic concept that either augments or serves as a basis for a present day sound and usable system of classification which, as a rule, is founded largely on fundamental structural features that are associated with homologous parts, and sometimes also on behavior patterns. With phylogeny, however, too heavy reliance on these approaches might be misleading in certain instances because we know of a multitude of morphological adaptations, as well as similarities (parallel adaptations) in color and behavior patterns, that have evolved in totally different or distantly related groups of organisms, particularly with reference to intrinsic environments. My phylogenetic thinking with regard to the bumblebees was revealed (1961*a*) and the resultant scheme of classification was greatly affected by it. The inference was that bumblebees comprise a "polyphyletic" group, as it was suggested they evolved from different ancestral stocks, or stems; and, at present all these species superficially appear to be homogeneous. It is believed this situation could have come about principally through the responses to two types of evolution, convergent and parallel. Extracted from Krüger

(1917) is a phylogenetic diagram (Fig. 1) at the group level; it is based on the presence or absence of a sharp tooth or stout spine-like condition at the distoposterior angle of the (especially female) mesobasitarsite. It is clear that two evolutionary trends are evident, and that this diagram somewhat resembles my own; however, I am of the opinion that the use of such a character to reflect a finer or more detailed phylogenetic chart for the true bumblebees does have its limitations.

With respect to phylogeny, little can be added to what has already been said (Milliron 1961*a*) apart from re-emphasizing the matter of considerable importance being placed on the male genitalia in this study, and especially on the form of the sagittae (*cf.* Fig. 4), which are structures that show progressive orthomorphous changes above the species (group) level, hence were judged useful in better understanding the phylogenetic aspect. Studies of the sagittae, of the wing venation in the disco-medial area in both sexes (Pls. IV–IX), the male antennae (length) and eyes, and of certain features associated with the mid- and hind legs in both sexes were undertaken. Using these features in a comparative study of material from both hemispheres, bumblebees as a whole seem to have evolved to the generic level chiefly by way of two evolutionary lines, with little branching. One of these I have called the Mendax Line, assigned its origin to the Eastern Hemisphere and, based on some of the characteristics of the present-day *mendax*, believe it was derived from a primitive anthophorid stem; the other I have called the Fraternus Line based on *fraternus*, a species which shows some xylocopid affinity, credit its origin to the Western Hemisphere, and believe it arose from the same stem that produced our modern Xylocopini (Figs. 2, 3). To the Mendax Line are assigned all species groups whose males have the sagittal heads more or less straight, flared or modifications thereof; to the Fraternus Line belong all species groups whose males have their sagittal heads more or less sickle shaped and strongly curved or bent inwardly.

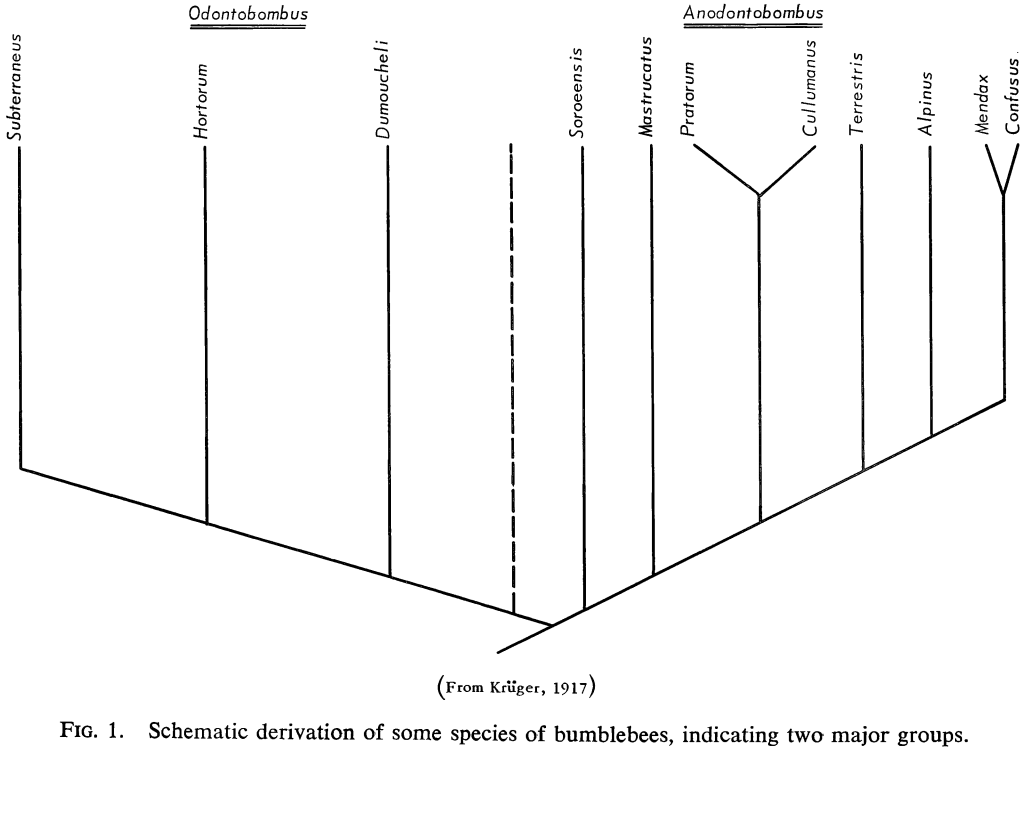

FIG. 1. Schematic derivation of some species of bumblebees, indicating two major groups.

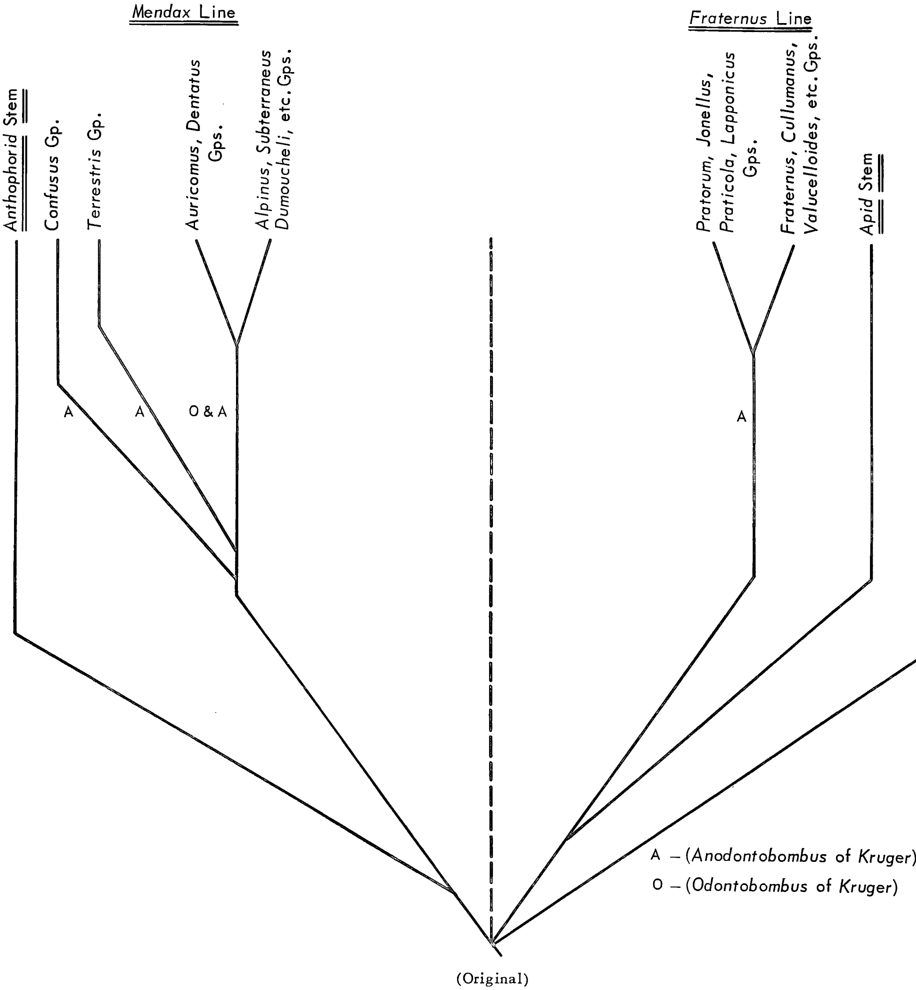

FIG. 2. Phylogenetic diagram of the major species groups of bumblebees, indicating the possible origins of the two principal lines of evolution.

It should be pointed out that while *Psithyrus* is regarded as being monophyletic, its origin, as well as that of the Confusus group (Eurasian) and of the Terrestris group, is not clear, but it is possible these three are branches of the Mendax Line, even though today they are structurally quite different from one another. Some time in the past, probably during at least a part of the Tertiary and parts of the Quarternary Pleistocene, it is likely that free passage and frequent exchange of these lines occurred between the hemispheres through the Bering Area, so that at present their descendent representatives are found in both hemispheres to which reference is made (Eastern, Western).

The supraspecific classification of the principal species groups of true bumblebees (chiefly of the Western Hemisphere) used in this work is shown in Fig. 2, while that of the generic and subgeneric divisions of the subfamily Bombinae is given in Fig. 3. As indicated above, this classification is based on my interpretation, through comparative study, of the significance of certain morphological features and was in no way derived from my limited biological studies. Any workable taxonomic arrangement based on reliable characters that can be used to assess natural relationships should conform, at least to some reasonable degree, to what is reflected by a classification received from intensive bionomical investigations, though minor modifications might be desirable in either scheme. From information supplied by the commendable biological works of Sladen (1899, 1912*b*) and Plath (1927*d*, 1934) diagrams were constructed as Figs. 13 and 14; though the nomenclature is not strictly comparable to that employed in the present revision it is quite evident in both cases that two major evolutionary trends are indicated for the true bumblebees, and concurrence with my own thinking.

As stated, the inquiline bumblebees apparently comprise a homogeneous group that appears to be of monophyletic origin. This conclusion was reached by taking into comparative account several features common to all species known to me. All males have membranous volsellae and squamae, short blocky heads, short antennal scapes, and relatively narrow hind tibiae; in all females the outer surface of the hind tibiae is convex and hairy, the mandibles are elongate, and the more or less carinate condition of the hypopygium is a characteristic feature. To me it is unthinkable that these inquilinous bees could have evolved from different ancestral stocks and still develop so many similar structural modifications. It has been suggested (Milliron 1961*a*) that possibly the group has been in existence from as early as the middle of

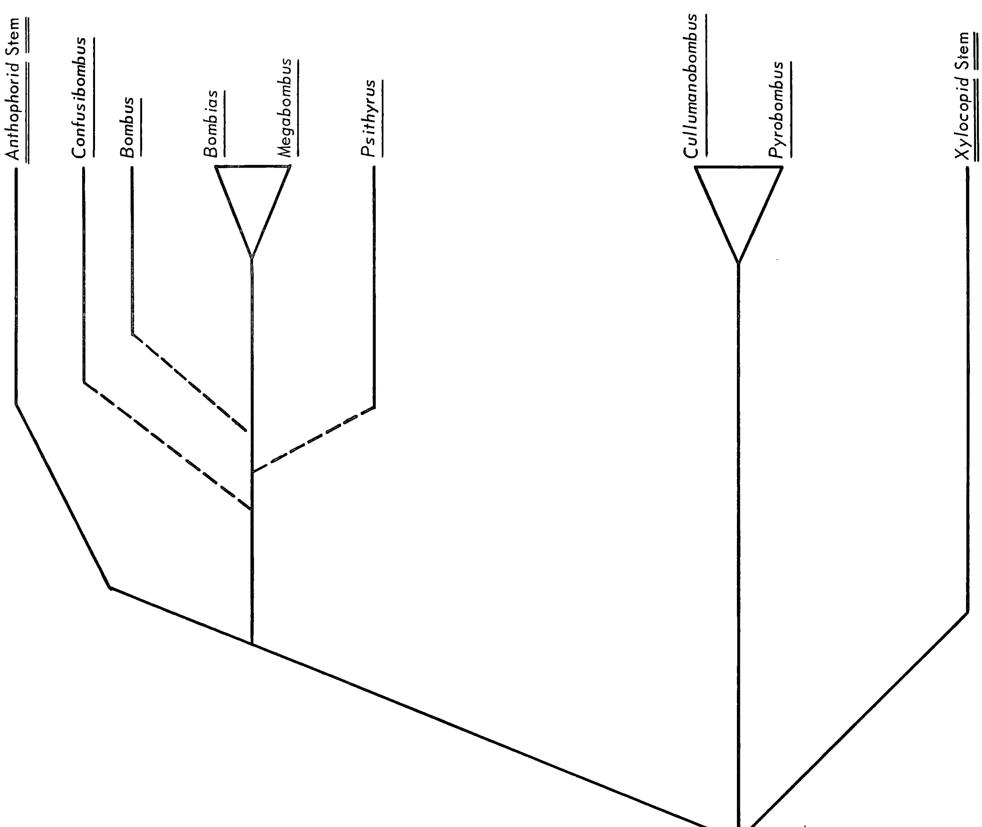

FIG. 3. Diagram illustrating the probable derivation of the genera and subgenera of the Western Hemisphere true bumblebees, including the inquiline genus *Psithyrus*; the genus *Confusibombus* is of the Eastern Hemisphere.

the Tertiary and since has evolved very slowly. The most primitive species could have evolved either directly from the Mendax Line, or from a branch thereof, possibly close to the advent of either the Confusus or Terrestris group of the true bumblebees, but it seems unlikely that this can ever be positively ascertained. At this point, it is interesting to note that among the specific derivatives of the Mendax Line it is not uncommon to encounter nests of true bumblebees that have been usurped, especially by queens of the same or of a related species. It is now known that this practice has become so well established within a species pair in the Alpinus group (Milliron and Oliver 1966) that this behavior can be regarded as quite akin to the inquilinism demonstrated by *Psithyrus*. Usurpation in the Terrestris group is well documented.

HORIZONTAL AND VERTICAL DISTRIBUTION OF SPECIES

Bumblebees occur at many places on the major land masses of the Northern Hemisphere and extend over most of South America to Terra del Fuego. While they are more prominent in areas with temperate climate some are to be found at certain parts of the arctic during summer, and one species (*transversalis*) has adapted itself to the South American subtropical and tropical areas in parts of Brazil, French and British Guiana, Venezuela, Colombia, Peru, Bolivia, and undoubtedly is present in parts of Ecuador though I have no records of the last mentioned country. Several other species are not uncommon in subtropical areas. They are absent from all of Africa, except along its northwest coast, nearly all of India except its northern highlands, and from Australia, though at one time it was believed that they had been successfully introduced into New South Wales (Olliff 1895: 67). New Zealand has no indigenous species, but does have some introduced ones (Dumbleton 1949; Gurr 1957; Montgomery 1951). They are not yet known to occur in New Guinea but are found in Sumatra, Java, Philippines (Luzon and Mindanao), Formosa, Japan, the larger islands of the Aleutians, San Miguel Island (off California), Vancouver and Triangle Islands (off British Columbia), the Canary Islands (off Spain), and on some of the larger islands in the Mediterranean. They are known to occur on Nova Zemlya, Iceland, coastal Greenland, and on several of the larger islands in the Canadian Northwest Territories. Of course they are present on most of the British Isles, but are absent from all the Caribbean and other islands in the Atlantic Ocean and Gulf of Mexico, as well as being absent from all islands of the Pacific Ocean not alluded to above, and those of the Indian Ocean.

Depending on the species, bumblebees have been taken from sea level to altitudes exceeding 14,000 ft in the Eastern Hemisphere (Western Himalayas) (Skorikov 1931). Wherever they exist at high elevations, it goes without saying that the snow line, at whatever altitude, and not necessarily temperature prevents them from extending their established range at least somewhat higher. In the Western Hemisphere these bees have been captured at altitudes over 12,000 ft in the Rocky Mountains and over 13,000 ft in the Andes Mountains.

Bumblebees which inhabit locations ranging from low to high altitudes in their distribution often exhibit a noticeable difference in length and texture of their pubescence within the same species. Generally speaking the pubescence on specimens taken at high altitudes is longer, finer, and looser (shaggier) than that on individuals captured at low altitudes, except that these differences might be apparent on individuals of these same species which also occur in high latitudes at low elevations. And, all the arctic and the single subantarctic (over most of the Chilean subregion) species have long, loose pubescence. Friese (1902), Vogt (1909, 1911), Franklin (1912), and others have noted or alluded to these differences. Coloration and melanism, as are apparently affected by geographic and climatic factors, are briefly discussed under "Color Development, etc.".

All the distributional maps in this work were finally constructed in the following manner. At first, each specimen at hand of all taxa had its place of capture indicated by a blue dot on the appropriate map. But in the cases of numerous species the results did not necessarily represent a truly accurate picture of relative abundance at given localities for several reasons. Records were so numerous in some species it was impossible to show distinct dots in a particular area, even though large, without complete mergence; in other cases, an entire nest from a microhabitat yielded hundreds of specimens. Moreover, in a given locality, especially a popular one for collecting, much depended on favorable conditions, the ability, activity and interest of the collector, as to how many specimens were obtained at a particular time and place. Any general scheme that would show together on the same map distribution and accurate relative abundance for each taxon was not without complications. Therefore, the procedure adopted was that of indicating only distribution, which was done by surrounding the entire dotted region with a blue line. The range was then slightly extended at most places to take into account probable additional distribution not yet recorded; this space was then completely covered (except sizeable lakes) with a standard zip-a-tone pattern. Future collecting will likely justify further extensions with respect to several taxa, and possibly some reductions in certain others. The maps should be consulted accordingly.

Ecological data indicate that most species have a discontinuous horizontal distribution, and some a disjunct range. The former pattern is not reflected in these maps because, in general, it is extremely complicated. Until such time when more intensive collecting has been accomplished, it would be unwise to attempt such refinement, as it would now serve no useful purpose.

EXTERNAL MORPHOLOGY OF BUMBLEBEES

Some species of bumblebees in the Western Hemisphere might have the queen no longer than 13 mm, the worker 7 mm, and the male 10 mm, whereas in the largest species the queen might measure as much as 32 mm, the worker 18 mm, and the male 17 mm. Generally, there is considerable size variation within the castes, so that the smallest species often produce individuals larger than given above, and the largest species have specimens that vary downward from the maxima. I have seen a few runty workers, e.g., those between 3.5 to 4 mm that belonged to a species usually having a range of 9–15 mm in that caste. In a number of species the size variation, especially in the queen and worker castes, might result in overlapping so that it is virtually impossible to draw any sharp line of distinction between them.

Franklin (1912: 204–235) has covered the external morphology of bumblebees very well and the student is referred to that work for additional information not contained herein because a great amount of unnecessary repetition would occur if this subject was treated in detail. Only those features which seem to have taxonomic value are referred to in this work, and generally in the sense of their constancy and reliability. **The Head.** This part (Pl. I, A–C) possesses several features that are significant to classification. The sulpture on the *vertex*, though somewhat variable, is useful, particularly the amount or extent of punctation within the imaginary space called the *ocellocular area.* With respect to the ocelli, which are quite constant within a caste in the species, they are valuable in that they show difference in size, and also their position in relation to one another, to the *compound* eye, and to the imaginary *supraorbital line*; two imaginary lines are here associated with them, the distance between lateral ocelli spoken of as the *interocellar line*, and the *ocellocular line* which is that distance between a lateral ocellus and the nearest point on the upper inner margin of a compound eye. The *preoccipital ridge* is sharper and better defined in some species than in others. Behind about the lower half of a compound eye is the

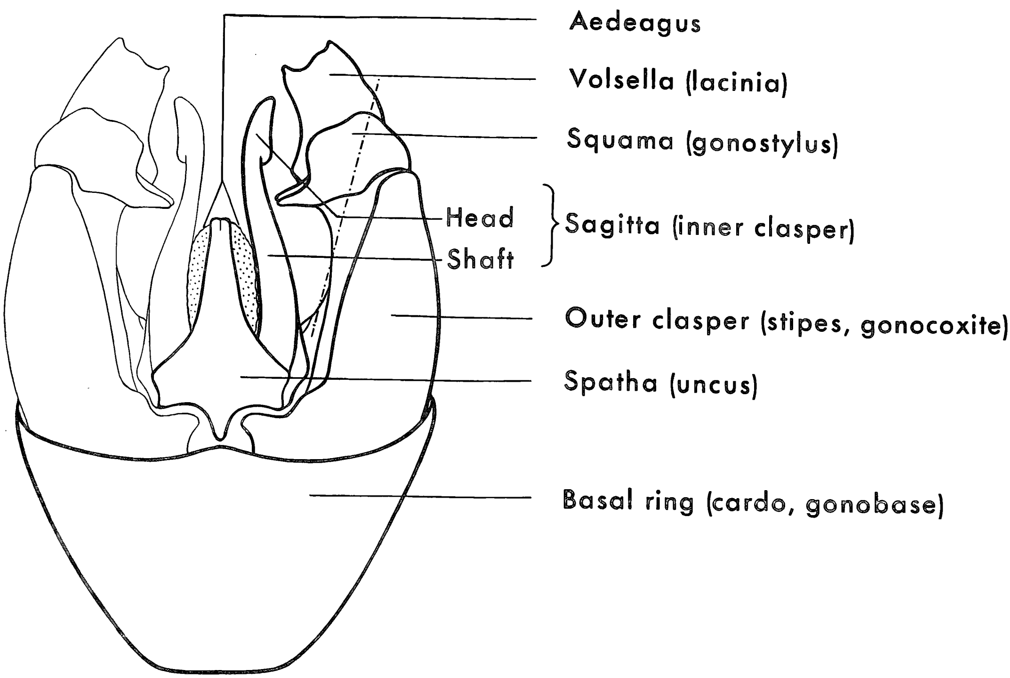

FIG. 4. Diagrammatic drawing of the bumblebee male genitalia (dorsal view) indicating nomenclature of the principal parts.

gena and the area above is referred to as the *temple*; the sculpture or punctations on these regions is only of limited value. A most important sclerite on the face is the *clypeus* which ordinarily does not vary widely within any caste; its shape, height and width, convexity, size and extent of punctations are useful in the differentiation of species. The *malar space* is the area between the bottom of a compound eye and the base of a mandible; among specimens of comparable size within the castes of a species it is subject, as a rule, to only slight variation when the length is measured against the width, contrary to the belief of some past investigators. It is an area that can be relied on, in part, for separating many taxa. In the female the labrum bears two more or less conical elevations each baso-sublaterally and separated by a concavity; each is called a *labral tubercle*, and the area between, the *intertubercular depression*. In the male the tubercle is more flattened, each less definitely separated from its counterpart, and each is called a *labral callosity*. The remainder of the upper lip consists of the *labral shelf*, referred to in many of the redescriptions. The size, shape, sculpture, and distance apart of the tubercles, and the shape of and pubescence on the shelf are often helpful in specific diagnoses. The outer surface of the *mandible* possesses several features that are rather specifically constant and are often an aid in separating closely related taxa, such as certain ones belonging to the Alpinus group. Krüger (1920: 331) was one of the first to draw attention to the value of the female mandible in the taxonomy of bumblebees. One of this structure taken from a queen *Megabombus* (*M.*) *p. pennsylvanicus* is diagrammed with the principal features labeled on Pl. I (E). The *antenna* (Pl. I, D) of either sex (female 12-segmented; male 13-segmented) is one of the most important appendages to examine in the identification of species; of particular value are the length

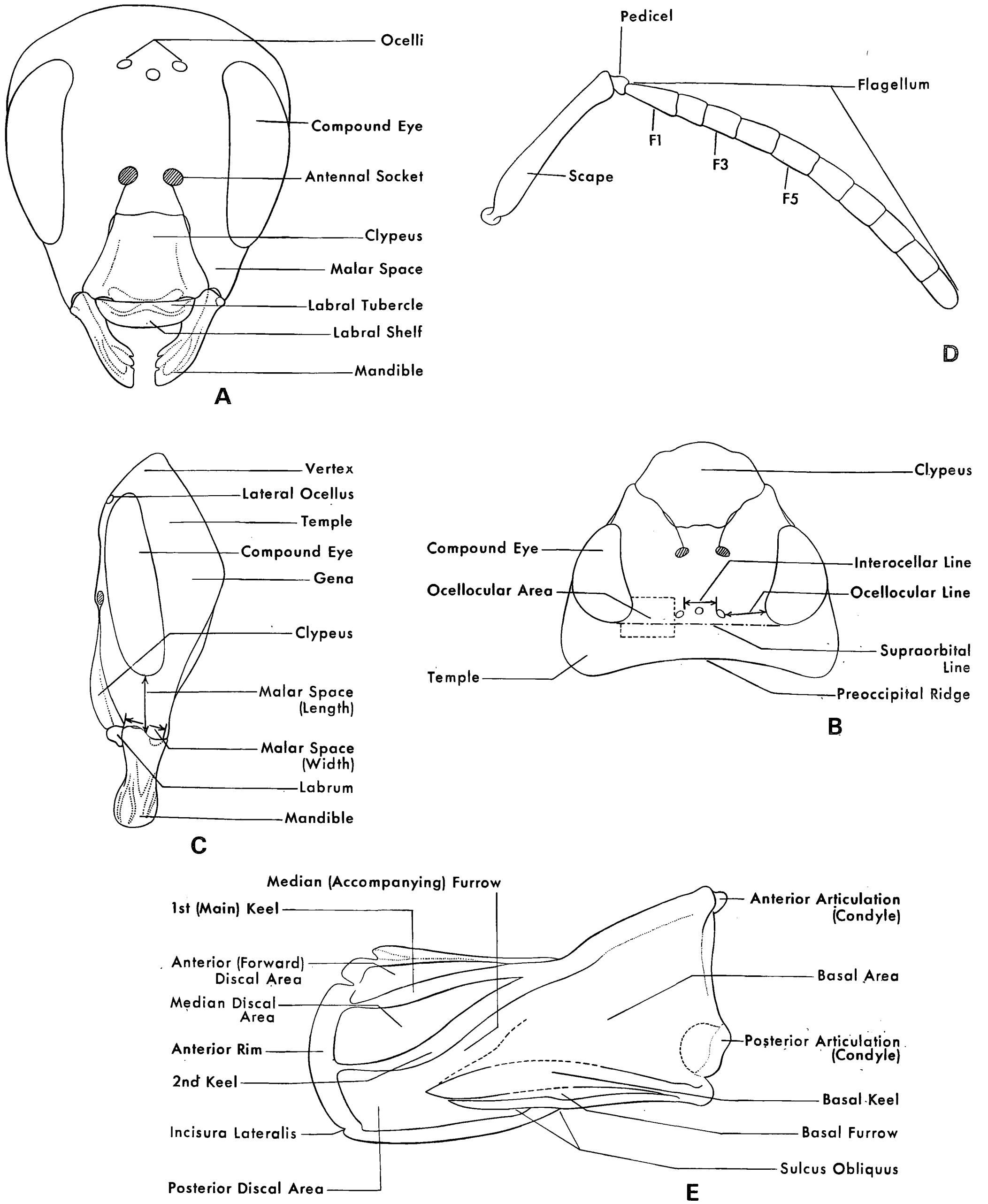

PLATE I. Cephalic morphological details, including antenna and mandible, based on *Megabombus p. pennsylvanicus*.

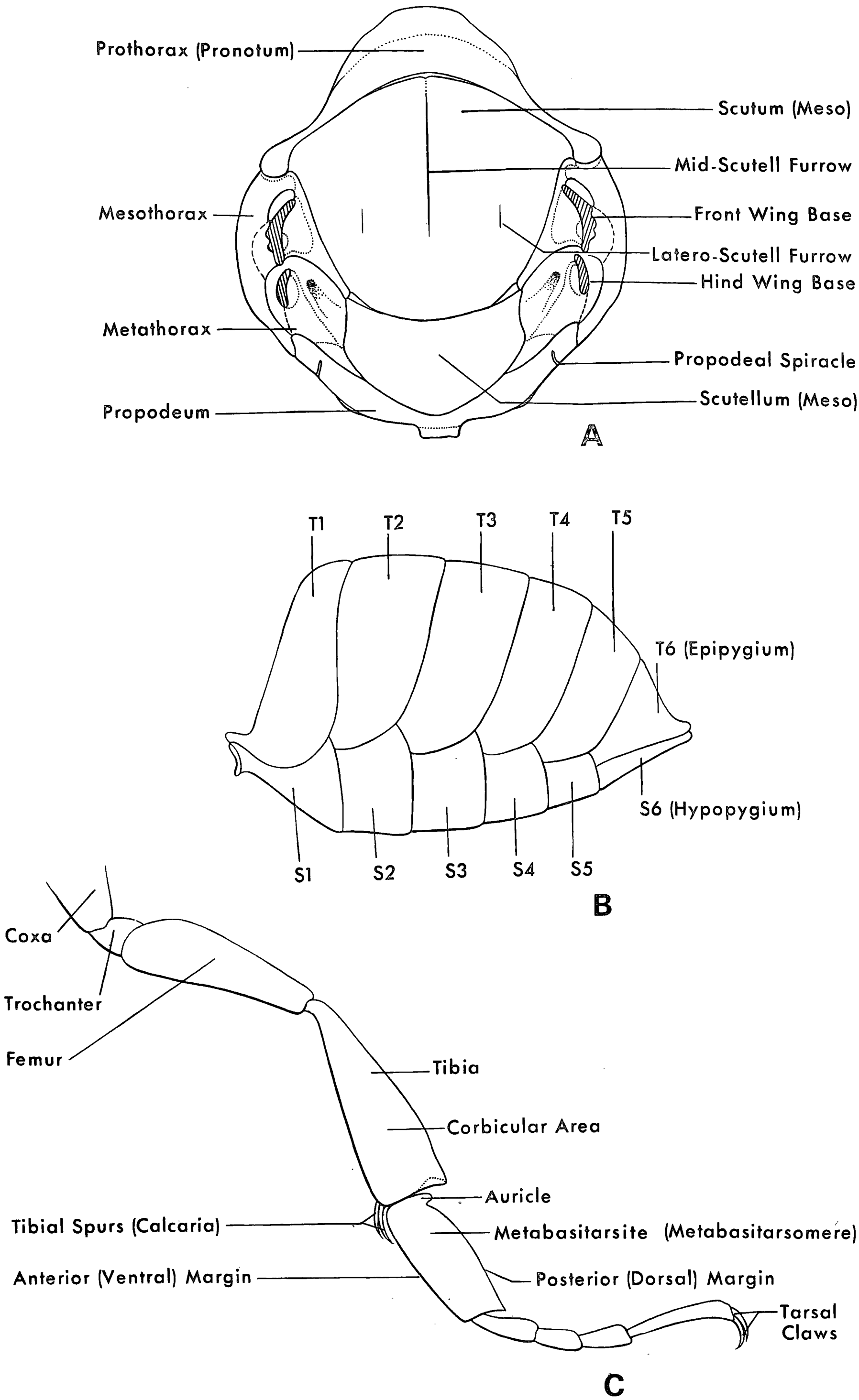

PLATE II. Morphological details of thorax, abdomen, and left hind leg, based on *Megabombus p. pennsylvanicus.*

SYMBOLS applying to the Comstock–Needham System or to the Cresson System. **A**—anal, vein or cell, either system; **B**—basal, vein in Cresson; **C**—costa, vein; costal, cell; costal, both vein and cell in Cresson; **Cu**—cubitus, vein; cubital, cell; cubital, vein in Cresson; **D**—discoidal, vein or cell in Cresson; **Ic**—Intercubital, vein in Cresson; **In**—incision in vannal area of hind wing; **M**—median, vein; median, cell; median, both vein and cell in Cresson; **Ma**—marginal, vein or cell in Cresson; **Ps**—pterostigma; stigma in Cresson; **Rc**—recurrent, vein in Cresson; **Sc**—subcosta, vein, either system; **Sd**—subdiscoidal, vein in Cresson; **Sm**—submedian, cell in Cresson; **Sma**—submarginal, cell in Cresson; **Tm**—transverse median, vein in Cresson; **Ts**—transector, neither system; **vf**—vannal furrow, in front wing; **vl**—vannal lobe, in hind wing.

EQUIVALENTS in the Cresson and Comstock–Needham Systems

Veins

Cresson (modified)	Comstock–Needham (Ross 1935)
A	A
B	M plus basal abscissa* Rs
C	C plus R_1 beyond pterostigma
Cu	Rs plus M, and M
D	1st and 2nd abscissae of Cu beyond cu-a
1st Ic	Rs abscissa after separating from M
2nd Ic	2 r-m
3rd Ic	3 r-m
M	Basal abscissa of combined M and Cu
Ma	2 r and 3 distal abscissae of Rs
1st Rc	1 m-cu
2nd Rc	2 m-cu
Sc	Sc plus unbranched R
Sd	3rd abscissa of Cu beyond cu-a
Tm	Cu-a (cu-a)

*Any discrete portion of a vein.

Cells

Cresson (modified)	Comstock–Needham (Ross 1935)
A	3 A
C	C
1st D	1 M
2nd D	2 Cu
3rd D	2 M
M	R
Ma	3 R_1
1st Sma	1 plus 2 R_1
2nd Sma	1 Rs
3rd Sma	2 Rs
Sm	1 Cu

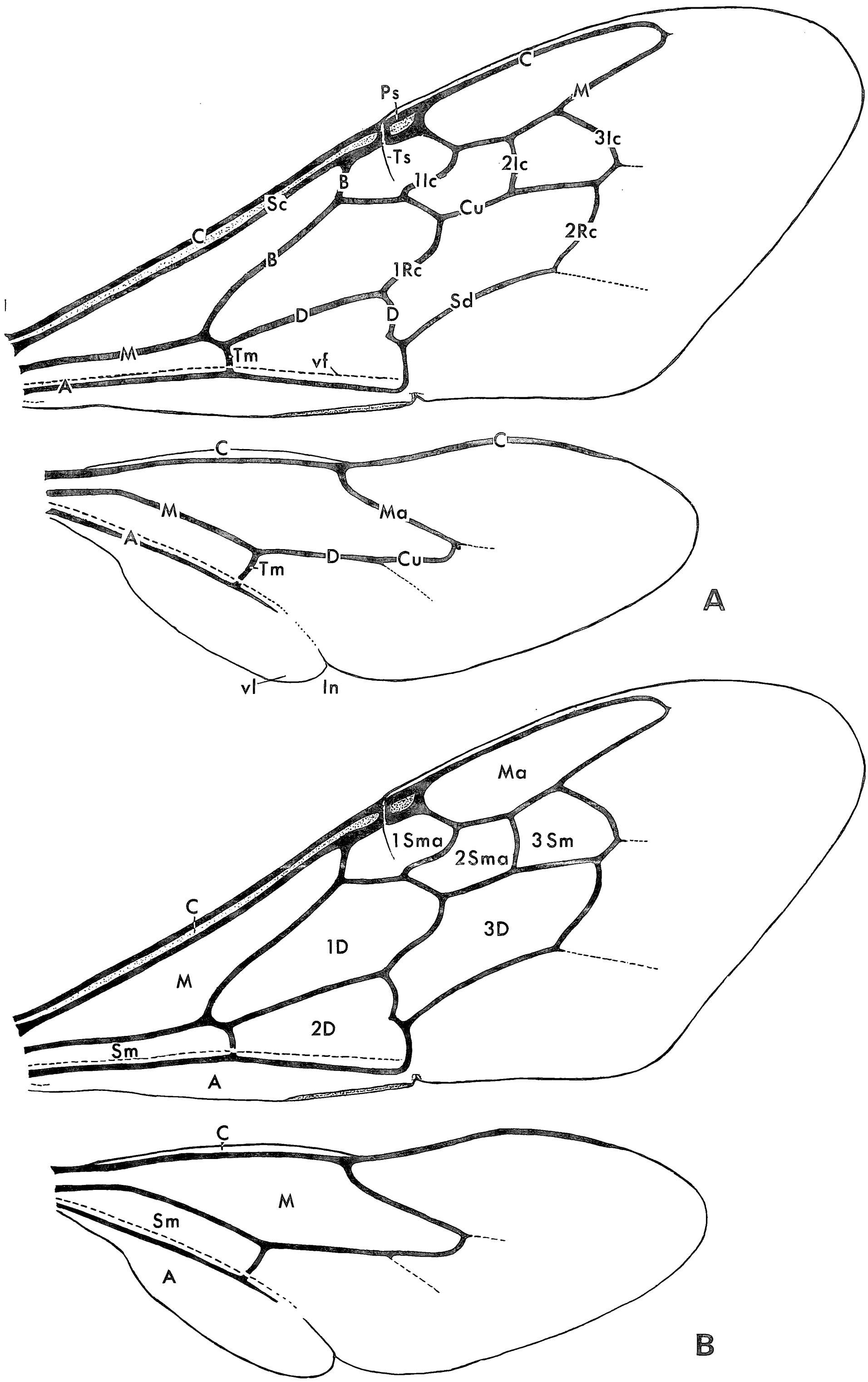

PLATE III. Right wings of *Megabombus p. pennsylvanicus*. *A, wing* venation; B, wing cells.

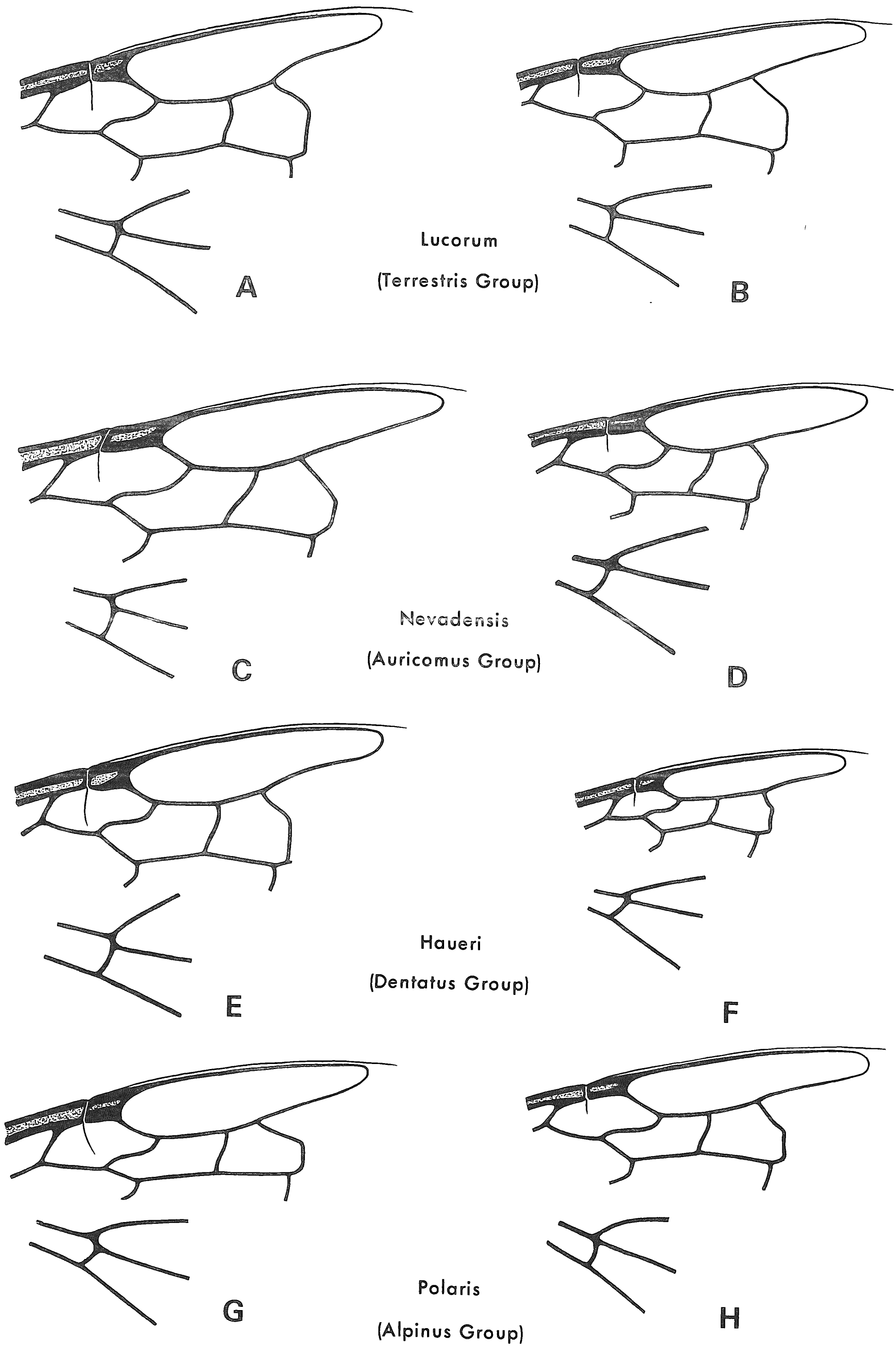

PLATE IV. Typical female (left) and male (right) front wing venation and cells in the submarginal and medial-discoidal areas of four bumblebee species groups.

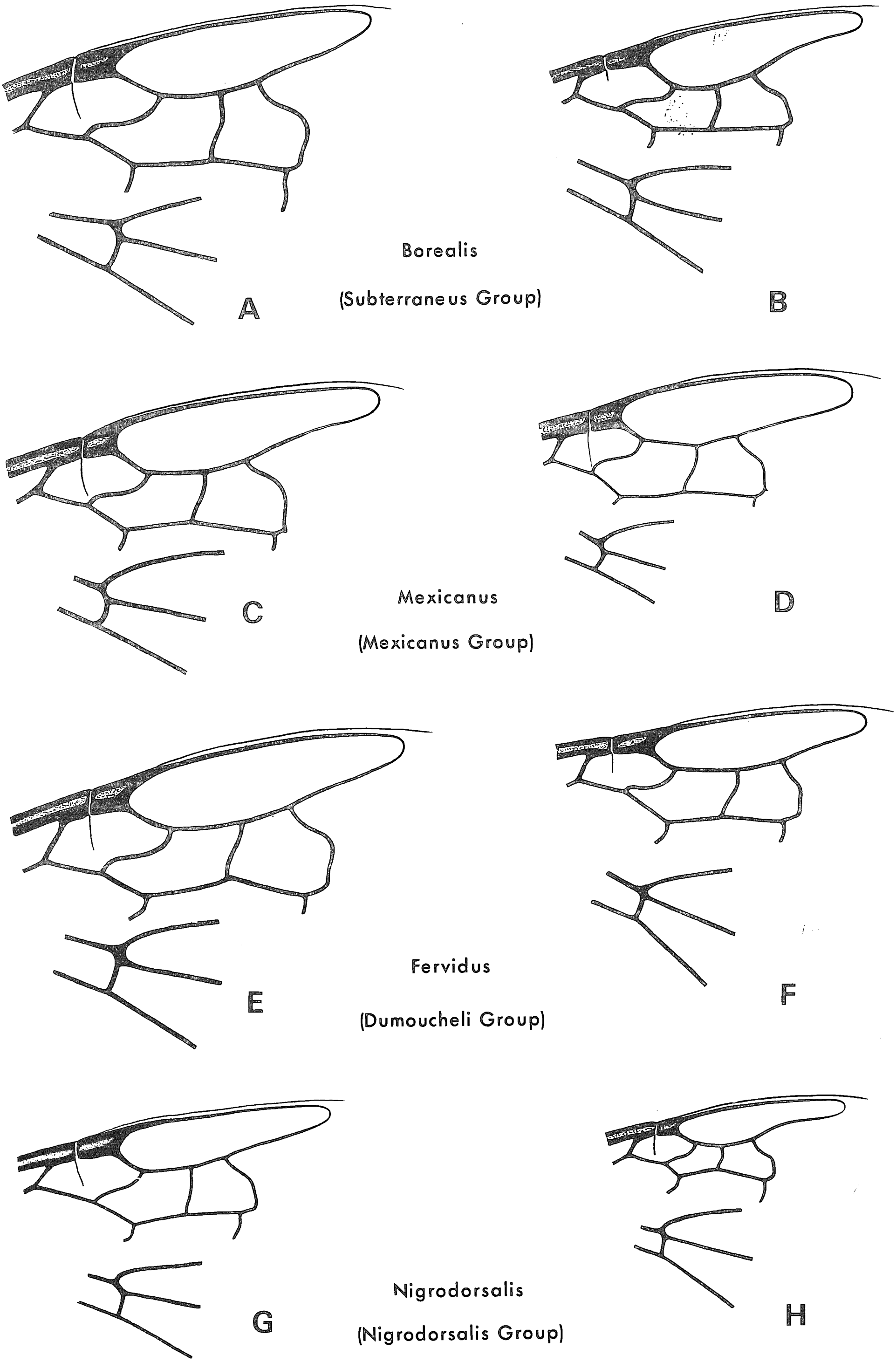

PLATE V. Typical female (left) and male (right) front wing venation and cells in the sub-marginal and medial-discoidal areas of four bumblebee species groups.

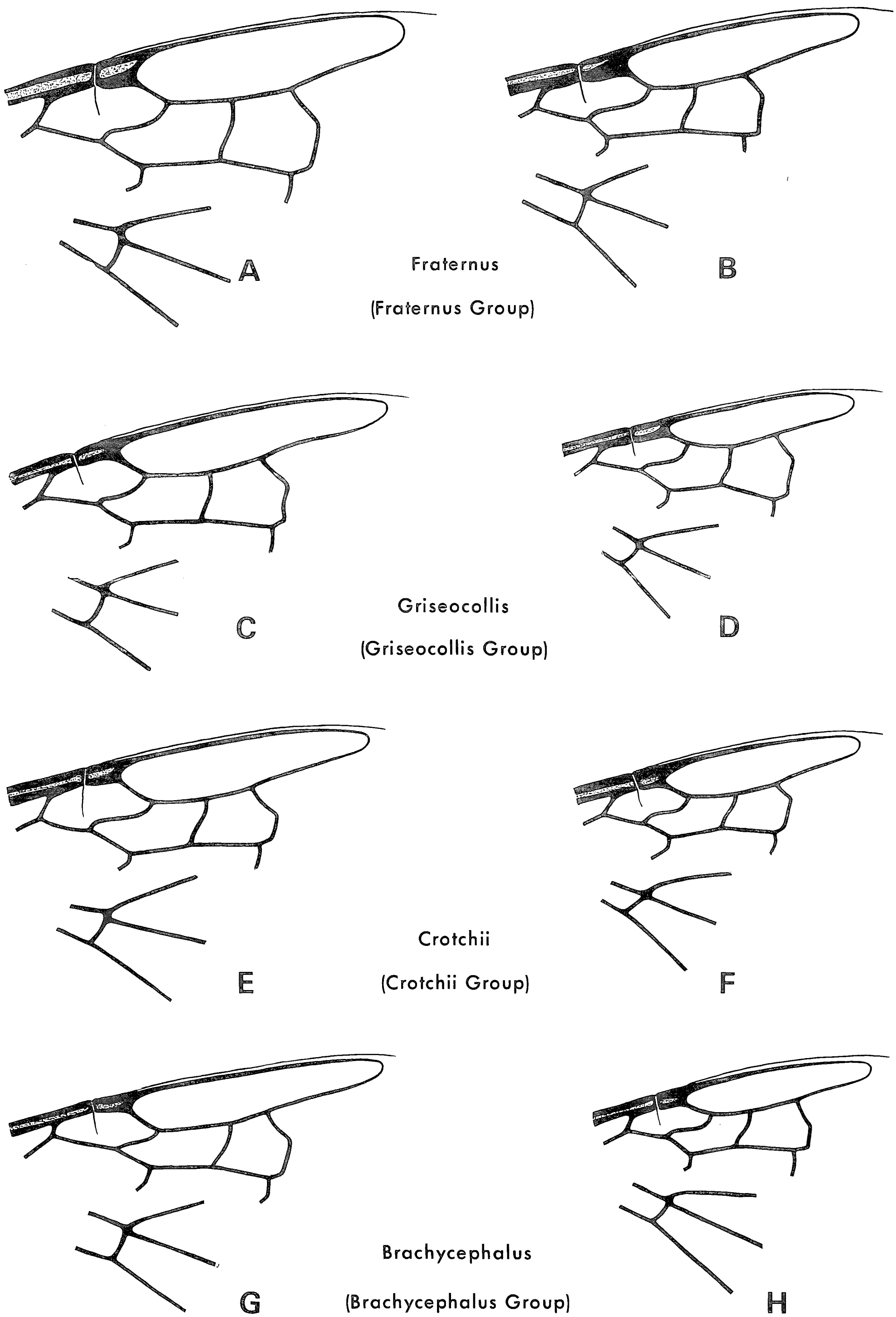

PLATE VI. Typical female (left) and male (right) front wing venation and cells in the submarginal and medial-discoidal areas of four bumblebee species groups.

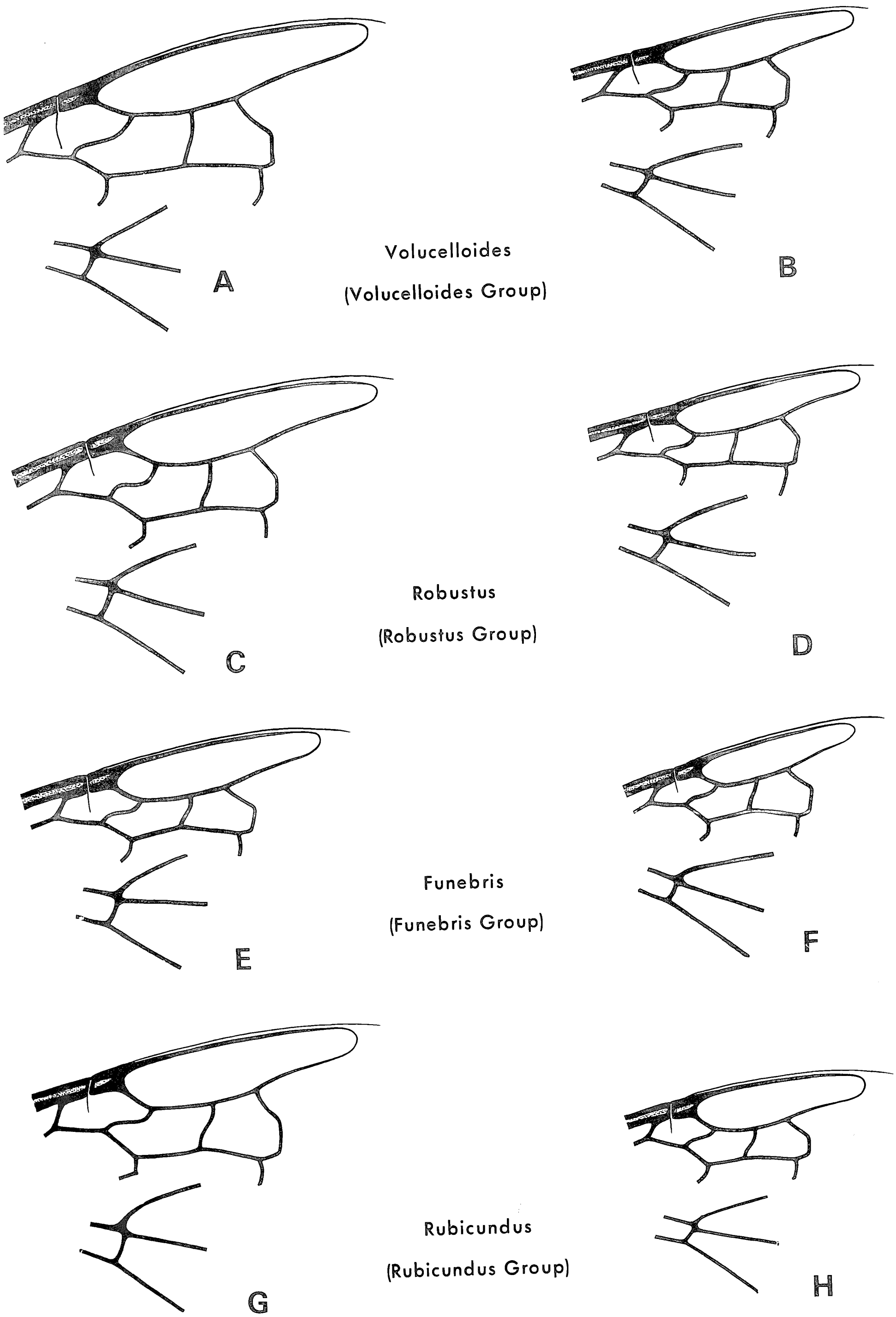

PLATE VII. Typical female (left) and male (right) front wing venation and cells in the submarginal and medial-discoidal areas of four bumblebee species groups.

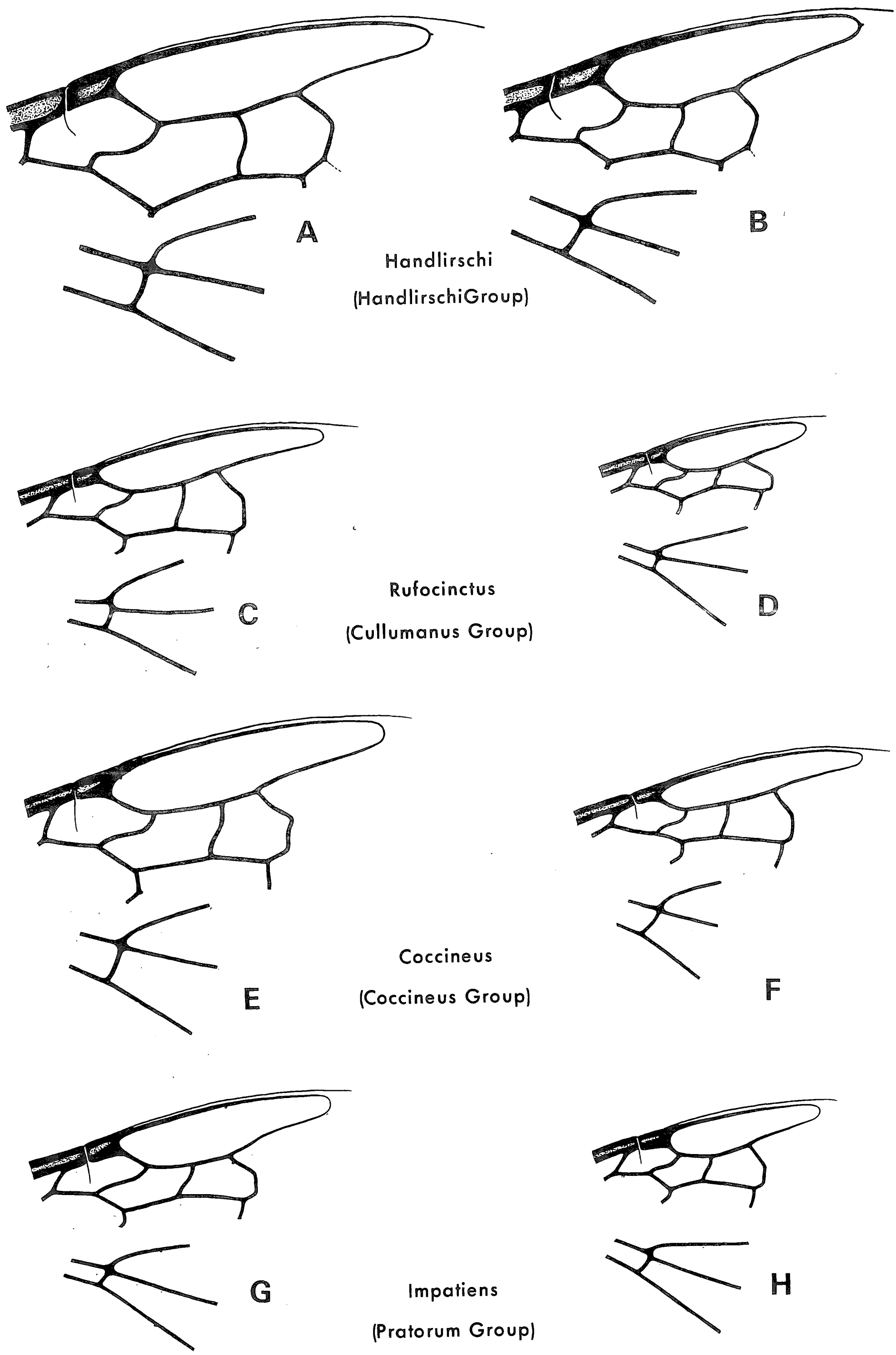

PLATE VIII. Typical female (left) and male (right) front wing venation and cells in the submarginal and medial-discoidal areas of four bumblebee species groups.

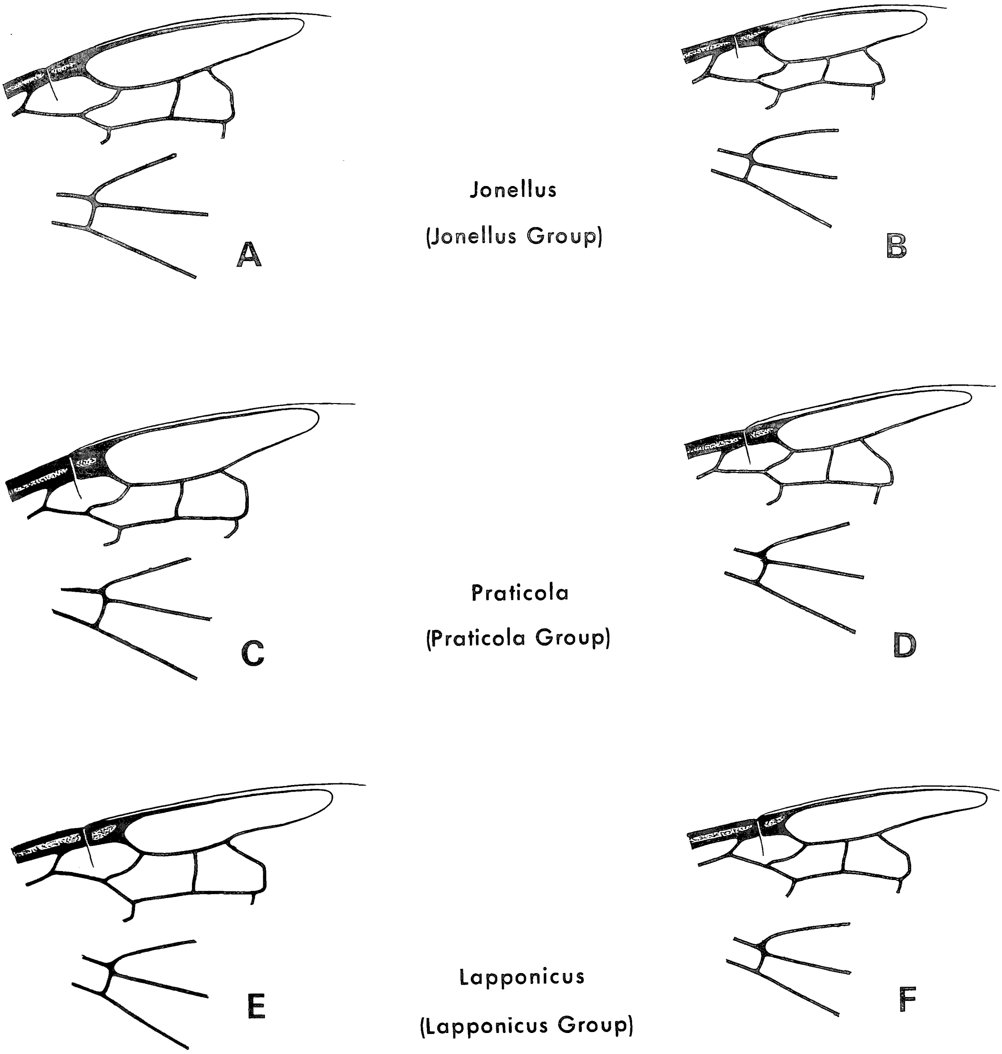

PLATE IX. Typical female (left) and male (right) front wing venation and cells in the submarginal and medial-discoidal areas of three bumblebee species groups.

of the scape with respect to that of the flagellum, and the relative lengths of especially the basal flagellar segments. Of course the shape or frontal outline of the head is perceptibly different, generally at the supraspecific level. **The Thorax.** This body region, exclusive of appendages (Pl. II, A), reveals few morphological features that are relied upon primarily because it is a region usually densely covered with pubescence, the coloration and character of which are often employed as aids to separate species. The approximate center of the *mesoscutum* is termed the *disc;* it is usually circular, bare, and smooth for the most part; its punctation is subject to some variation, but extent of coverage differs between species. The posterior extention of the *mid-scutell furrow* toward or onto the disc also differs, and the *latero-scutell furrow* is more obvious in some species than in others. The **legs**, especially certain parts of the middle and hind ones, have some features that to a degree lend themselves to classification and particularly as aids to identification; a left hind queen leg is figured and labeled (Pl. II, C). In this work the tibia and metabasitarsite are much relied upon: their shapes, margins, appearance of outer surfaces (including degree of flatness, concavity, or convexity), comparative lengths, and the character of the posterior fringes (corbicular and metabasitarsal) which, however, are often subject to color variation in a number of species. The **Wings** (Pl. III, A, B) of a queen are diagrammed and their veins (A) and cells (B) labeled, employing a slightly modified Cresson system; accompanying this plate is a defined list of abbreviations embodying all the Cresson and some of the Comstock–Needham terminologies in order that if a student desires to employ the latter he might do so more readily; some few abbreviations (e.g., *Ts.*, *vf.*, *vl.*, etc.) are not common to either. A brief explanation might be in order here with respect to the term "transector" which varies in length and in most cases does not completely bisect the first submarginal cell. It is more of the nature of a spurious vein rather than a true vein, but could be the vestige of one as MacGillivray (1906: 620) believed when he remarked "In certain genera of Apoidea, as *Bombus, Psithyrus,* and *Osmia*, and of Larridae, the base of the radial sector is preserved as a fine thread-like vein, frequently entirely colorless, while in some other genera only the transparent stubs remain". Franklin (1912: 227) termed this same feature a "veinlet". Included in the tabulation preceding the wing plates is also a list of abbreviations of the Cresson terminology for both veins and cells, and their equivalents in the Comstock–Needham system. In the present study two areas in the front wings of both queen and male of the true bumblebees received special consideration; they are (1) that region of the marginal and submarginal cells with their enclosing veins and (2) the venation comprising the distal end of the median, proximal third of the basal, all the transverse median, and the approximate middle third of the anal which receives the transverse median. These wing parts in typical species of the various species groups are illustrated (Pls. IV–IX), those of a female on the left and those of a male on the right. Some degree of intraspecific variability is detectable, but this has not been a disturbing factor since variation usually is not concurrently discernible in both wing areas of a specimen. Small as the differences in cell shapes and venation between groups might seem, they have been useful in the classification and identification of these bees. The **abdomen** (Pl. II, B) is illustrated in lateral view. Except for size and shape, the genitalia, and the character and color of the pubescence on the abdomen, this body region has few external diagnostic features to aid in identification. In the true bumblebees the specific characteristics found on the *epipygium* are often very helpful especially in the queen; these include the form of the disto-lateral ridges, the type of medial concavity (or convexity) and its sculpture, and the character of pubescence particularly with reference to length and density. In the genus *Psithyrus* it is the *hypopygium* of the female of most species that is similarly important. The *female genitalia* of both true and inquiline bumblebees show specific and apparently subspecific differences, but they have received little or no attention in the present work primarily because it was felt that detailed examination of these was unnecessary, and having done so would have considerably extended the scope and thereby the time of completion of this investigation. Nevertheless, it should be pointed out that certain structures associated with the base of the sting, as well as certain features of the sixth abdominal sternum (hypopygium), apparently can be valuable aids in both the classification and identification. This aspect of the study of bumblebees has received the attention of several workers including Cholodkvosky (1884), Franklin (1912: 221–223; 1913: pl. V, fig. 14; pl. XVIII, figs. 147, 151, 157; 1954: 48), Richards (1927*a*), Elfving (1960*a*), Moure and Sakagami (1962), Tkalcu (1962*c*), and more recently by Hazeltine and Chandler (1964). In my own work, great significance was placed on the *male genitalia* to help form a scheme of classification; moreover, they were repeatedly used in making or verifying identifications. This structure is shown (Fig. 4) diagrammatically and the principal parts labeled, the older terminology being preferred. With respect to phylogeny particular emphasis was placed on the shapes of the sagittal heads which seemed to be much more meaningful than other features of the male genitalia. In formulating classification and groupings other parts, such as shapes of the squamae and volsellae, were also used, and to some extent the seventh and eighth sterna which are, incidentally, reversed on the genitalic plates to more economically conserve space. Many features of these genitalia and their associated sterna are diagnostic and are extremely important to specific and subspecific identification.

HYBRIDISM

This term is used here to designate individuals that appear to be the result of natural specific and subspecific interbreeding. With respect to the interaction of subspecific allopatric or sympatric populations it might be safer to employ the term "secondary intergradation" as suggested by Mayr (1963: 369).[2] Vogt (1909) several times referred to hybridization to which he attached little significance. Very few bumblebee workers have recognized that this phenomenon might be responsible for some of the troublesome variability. Franklin (1912: 237) stated "On account of the difficulties met in arranging the species, some have been led to think that hybrids are common. The writer has never yet seen a single specimen of this family which, in his opinion, was a hybrid". Plath (1934: 25) followed suit. Wagner (1907) was one of the first to place any emphasis on the occurrence of hybrids, and the matter was further stressed in the work of Friese and Wagner (1910). The following is a translation of the discussion by Wagner (pp. 3–4) bearing on this subject:

"All things considered, it is hardly possible now to give a definite answer to the question; since the required pertinent material is lacking all we can offer at this time are some surmises. For my part, I believe that there are two causes which have been responsible for polychromism and polymorphism in bumblebees.

"First is the extensive crossing between different species. I have two bases for this assumption: The similarity in structure of the genitalia of the different species; and, the numerous observations on the copulation of bumblebees.

"The male genitalia of bumblebees throughout the genus *Bombus* show, as Radoszkowski (Bul. Soc. imp. Nat., Moscou, 1884; Hor. Soc. ent. Ross., 1888) had previously called to attention that only 'the branches of the forceps and their volsella' are subject to variation, and is of little importance.

"What is to prevent copulation, when the aggressive males of each species are unable to *unerringly* differentiate between *each and all* receptive queens? I placed in a terrarium, along with a queen of *Bombus terrestris*, several males of a different species; whereupon all of the

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[2]Mayr, E. 1963. Animal species and evolution. The Belknap Press, Harvard University.

latter, without exception, attempted to copulate with the queen which warded off their advances the queen remained on her side, *and* all the males *were* opposite her in the same fashion.

"The result of such a *possible* cross is exceptionally difficult to comprehend. However when we realize that the queens in the early part of the year show a very scanty array of different forms and color, compared to what is evident during the course of the summer we can, indeed, advance the opinion that the hybrid neither overwinters nor begets a future generation.

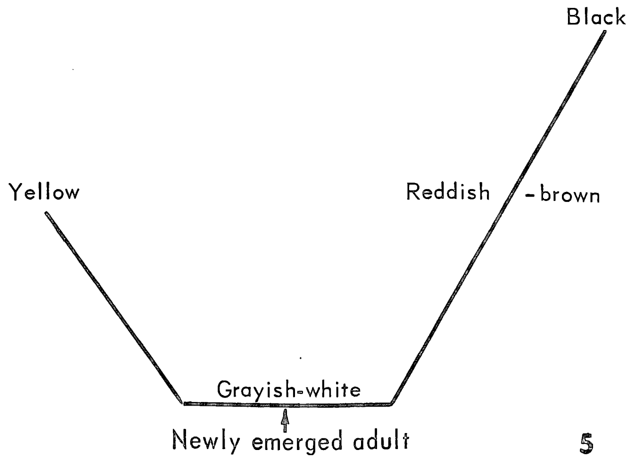
"Nevertheless, their occurrence, as well as that certain crossings have played a role in the formation of new species, can hardly be denied; a needed important aspect in the proper study of these hybrids would lead to clarifying some of the relationships between the existing true species which, however, is something that nobody has been willing to investigate, as far as I know". Italics not nomenclatorial are mine.

Under confinement, I have also observed courtship and attempted copulation by males of *Megabombus f. fervidus* with virgin queens of *M. p. pennsylvanicus*. The queens responded much the same as described by Wagner; copulation was not successful, and repeated attempts proved fatal, by stinging, to each of the three males used in this experiment (*cf.* Milliron 1967: 1331), despite the close similarity of the male genitalia of the two species involved.

It should be noted here that, on theoretical grounds, Bequaert and Plath (1925: 282) suggested hybridization as one of four possibilities causing color variation in bumblebees. For lack of more evidence, I do not contend that interspecific bumblebee hybrids are of common occurrence but specimens, believed to be such, have come to my attention, *viz.*, several males captured in the Churchill (Manitoba) area showing characteristics of both *Pyrobombus j. jonellus* and *P. f. frigidus*; also, a number of Pennsylvania and New York queens are at hand, each representing features of both *Pyrobombus bimaculatus* and *P. v. vagans*. Likewise, I possess a few Ohio queens that are difficult to place in either *P. perplexus* or *P. v. vagans*, and many workers have been seen that posed a similar problem. Numerous specimens (*e.g., Megabombus fervidus*, all castes), apparently representing subspecific intergrades, have been available for examination during the course of this study. These have been common enough to indicate, without doubt, that hybridization (or secondary intergradation) between allopatric and/or sympatric subspecies can be expected to occur locally, especially in certain areas of the species range. However, it should be emphasized that in many instances various localized environmental factors operating on populations of different species and subspecies occupying the same range might account for troublesome chromatic similarities or dissimilarities (*e.g.*, melanism) having no connection with interbreeding. Such situations render it impossible to be sure that true hybrids are involved in all cases. I have seen some 17 queens from Alberta that probably should be taken to be *Megabombus n. auricomus*; nearly one-half of these could be regarded as melanics of either *nevadensis* or of *auricomus*, while the remainder grade strikingly toward the latter subspecies.

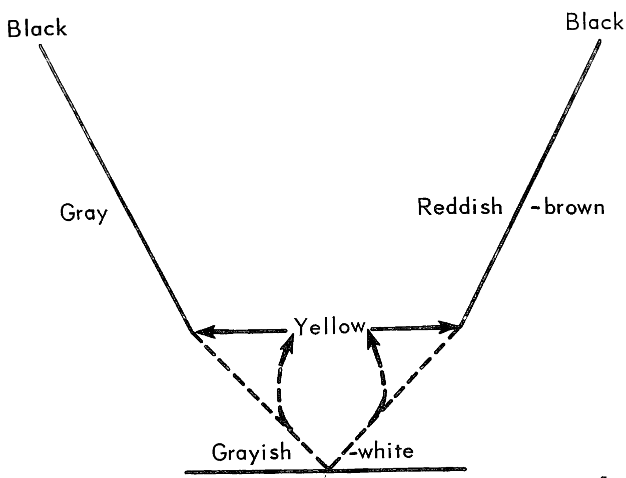
COLOR DEVELOPMENT, VARIATION, MELANISM, AND ABERRATIONS

Newly emerged imagines, known as callows, are clothed with whitish or grayish pubescence which is closely matted to the body, regardless of what color the different parts will ultimately be. Soon after emergence the legs are employed to loosen the pile, thus permitting it to become dried and fluffy. Within a matter of hours, chromatic changes begin to occur. These changes seem to pass through different developmental series. If we accept the belief of Friese and Wagner (1910: 16–17, 71–73), red is an intermediate phase in the change from the initial pale color to black, which is very commonly encountered in the pubescence of bumblebees. It might be assumed, therefore, that wherever red, of whatever extent and degree, is the final color the process was arrested at that point, and from some cause or causes, be they genetic or not. This is fine when we are dealing with species, normally



5

(From Babiy, 1925)



6

(After Babiy, 1925)

FIGS. 5–6. Sketch of one kind (Fig. 5) and of a second kind (Fig. 6) of progressive development to the final coloration of bumblebee pubescence.

black on various parts, especially the abdominal terga. We encounter individuals with varying amounts of red ranging from a few hairs intermixed with the black on some, to complete coverage on others. Aside from the purely genetic aspect of chromatic inheritance, the problem of color development apparently is complicated and not yet close to being properly understood. Sladen (1912*b*: 149) was of the opinion that individuals which never attained their full color brightness, were those that had been chilled and starved before leaving the nest.

Babiy (1925) published a thought-provoking paper in which he gave two diagrams (translated here as Figs. 5, 6) illustrating chromatic transitions from whitish grey to black and yellow (gold) depending on the developmental series. He discussed the hair structure, particularly with respect to the internal lumen and the protein plasma-like material contained therein. Reference was made to the solubility of this substance from yellow, red, and black pubescence in water (hot) and in xylol, certain concentrated hot concentrated mineral acids, h.c. nitric acid and in caustic ammonia, and to its insolubility in other chemicals. The use of aqueous solutions containing chlorine, when added to aqueous extracts from yellow pubescence, resulted in bleaching of color, just as hydrogen peroxide affects hair. The plasma-like substance was termed chromogen(s) associated with, or bėlonging to, one or more groups of the melanines. It was suggested that the color change in a particular developmental series might depend on the concentration of chromogen, or to a mixture, as to whether the final color was yellow, red, or black; and, that the arrest of further chromatic change at any point might be due to a deficiency of some agent involved, *e.g.*, tyrosine, the enzyme tyrosinase, etc. The Millon reaction was employed to determine the protein nature of the plasma-like substance within the central lumen of the hairs; this is the use of a reagent containing a mixture of mercurous nitrate and nitrite in nitric acid. If, by adding this reagent to a nitrogenous

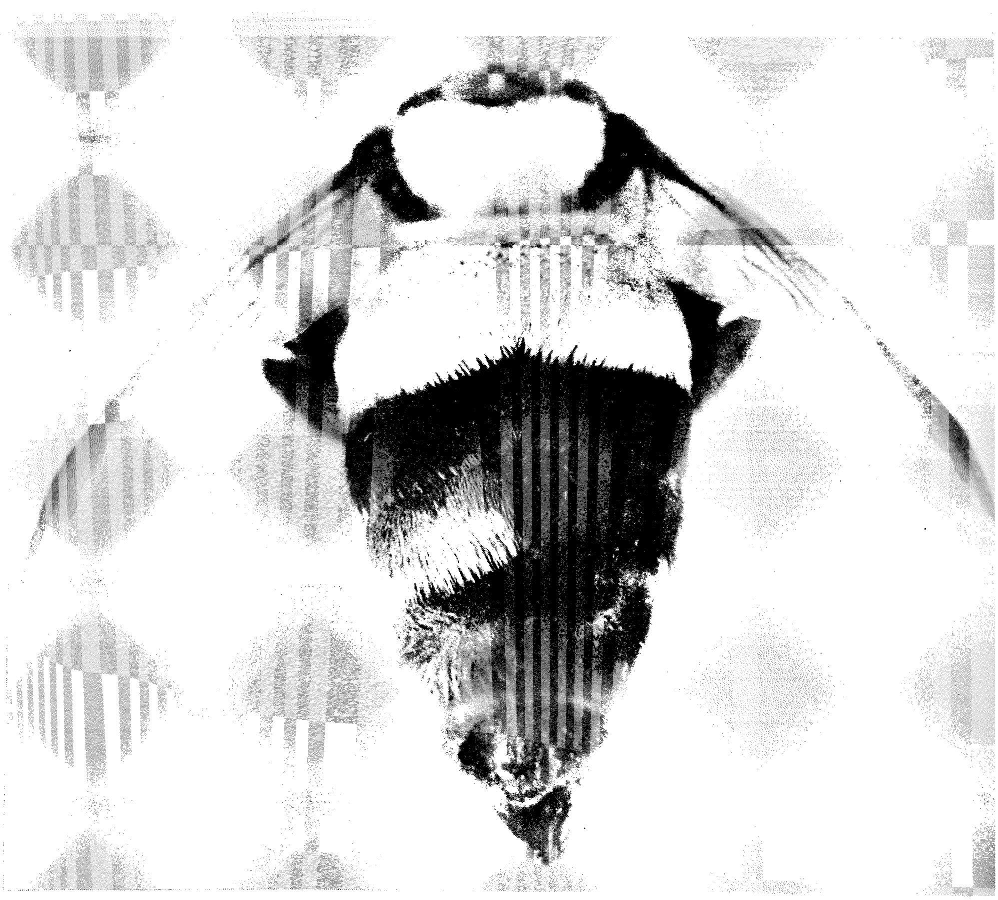


FIG. 7. Aberrant queen of *Pyrobombus (C.) fraternus*. (Photo courtesy Dr. K.W. Cooper, Riverside, Cal.)

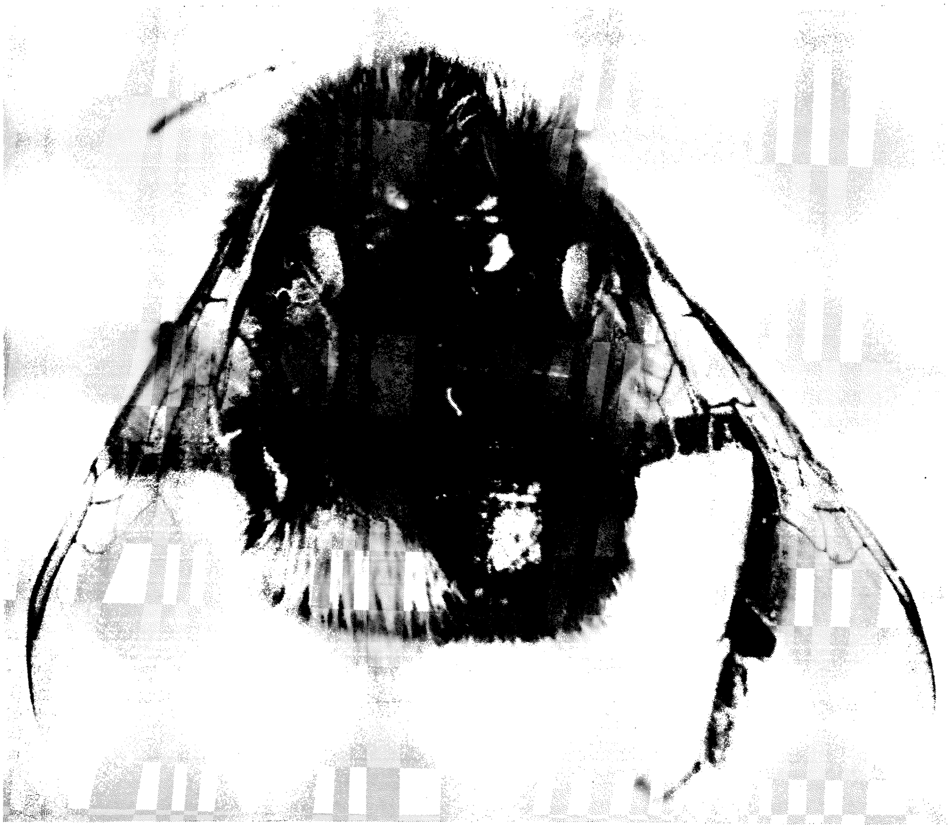


FIG. 8. Aberrant worker of *Bombus t. occidentalis.*

material and warmed, a yellow or white changing to red indicates protein. Babiy (*loc. cit.*) obtained this positive reaction with both the extract from yellow pubescence, and from the yellow hairs though more slowly. White pubescence also gave positive results.

The Millon reaction is reliable within limits; for example, a positive test is produced by any compound containing the hydroxy-phenyl group ($-C_6H_4OH$), and since the amino acid tyrosine is the sole one with this group, a positive test can only be gotten from proteins which yield this acid on hydrolysis. Gelatin and some of the protamines hydrolyzed do not produce tyrosine and therefore do not respond to the test. Conversely, certain non-nitrogenous compounds, *e.g.*, phenol salicylic acid and thymol, react positively to the Millon test, but beyond this these do not enter into any chromatic changes with which we are concerned here. Babiy (*loc. cit.*) undoubtedly was aware of this when he concluded that the positive Millon reaction indicated the presence of tyrosine, but since he could proceed in the desired research direction no further, using this reaction, he turned attention to the enzyme tyrosinase which oxidizes tyrosine to produce color. An ample supply was obtained in the juice from potatoes, and the investigation was continued by performing several trials using this enzyme on pubescence and to aqueous extract from yellow hair. Chromatic changes obtained formed a basis, at least in part, for the developmental series as diagrammed.

Babiy (*loc. cit.*) alluded to some of the critical factors that might affect chromatic changes in the pubescence of bumblebees, aside from the actual amounts of the principal compounds involved; these might be related to temperature, moisture, and oxygen, in view of the apparent occurrence of hydrolysis and oxidation reactions.

Most species of bumblebees are subject to color variation, some more so than others. Babiy (1925: 511) thought that his research on color development might open the door to some plausible explanation of this great degree of variability. Vogt (1909, 1911) emphasized at length the importance of environmental effects as the causes of chromatic variability. Reinig (1939*c*: 185) stated, "I have presently arrived at the conclusion that there is no principal distinction between individual and geographic variability", and at the same time disagreed with Vogt's rejection of any importance to the role of selection, saying that the latter's work pointed directly to the acceptance of an adaptation phenomenon, which the present writer believes might, to a large degree, be correct. Franklin (1912: 200–202) discussed the matter under the topic Climatic Variation, and tended to emphasize that the most variable species are those whose habitat extends over very diversified areas. With climate, food, parasites, etc. in mind, Bequaert and Plath (1925: 282–285) touched upon somatic variation under the influence of the environment, particularly with respect to some species which show red pile, to a lesser or greater extent on one or more of what are normally black abdominal terga. If this is a case of arrested development from whitish gray through red to black, the stoppage from going beyond red must take place at one time on any given individual irrespective of the extent involved; in other words, the arrestment is not likely to be progressive, say from the posterior margin of tergum 3 to the anterior margin of the sixth tergum, or *vice versa* on one and the same specimen over any length of time. Of course, if sufficient adult material is available, enough gradiants should be in evidence to permit one to decide, in general, the extremes of minimal and maximal arrestment on the combined terga subject to this effect.

Sichel (1865: 422; separate: 22) was one of the earliest to appreciate the degree of variability in bumblebees and the taxonomic problems posed by it. The French is so clear and concise it is here quoted without translation:

> "Depuis que la facilité des moyens de communication a augmentée la fréquence des voyages et des explorations zoologiques, la multiplication des genres et surtout des espèces a rendu leur étude de plus en plus difficile. Beaucoup d'espèces ont été décrites sous de noms differents; ces descriptions sont dispersées dans des monographies, des voyages, des publications périodiques, souvent rares dans les bibliothèques et d'un accès difficile. Ce qui augmente encore ces difficultés, c'est que les variétés, au premier coup d'oeil, diffèrent souvent tant des espèces typiques, qu'on ne peut les y rapporter qu'après les avoir étudiées sur de grandes séries d'individus receuillis dans les mêmes localités. Par ces raisons l'étude monographique des espèces grouppées par séries et surtout celle des faunes locales, acquiert de jour en jour une plus haute importance. Elle seule peut faire rentrer dans des limites rationelles le nombre des espèces qui nous débordent, et qui, en grande partie, ne sont basées que sur de simples variétés".

Melanism is commonly encountered in the study of bumblebees and has been referred to, in one way or another, by nearly all the principal taxonomic workers in this group of bees. Most such specimens seen by me were taken at low to high areas dominated by cool, moist atmosphere. Some examples are: The very dark form of *Pyrobombus* (*P.*) *sitkensis* occurring on Triangle Island in the Queen Charlotte Group; the darker (and average larger) forms of *P.* (*P.*) *lapponicus*, *Megabombus* (*M.*) *strenuus* and *M.* (*M.*) *polaris* inhabiting certain areas of the Northwest Territories; and the totally black *P.* (*C.*) *f. funebris* (♂s) from Peru. Vogt (1909, 1911) referred to melanism on several occasions, and specified certain areas (*e.g.*, Denmark, southern Scandinavia) as places where it is commonly encountered;

Sladen (1912*b*: 148) also remarked about it in a similar manner. True melanism was briefly alluded to by Babiy (1925) in the paper on color changes previously referred to; apparently it is brought about in most cases where inheritance is not involved, by the action of certain natural climatic factors of the environment. Of course, in the instance where the pubescence on any part of the body is normally and characteristically a dark color (*e.g.*, brown or black) then the exhibition of melanism must have been primarily due to genetic factors. Hoffer (1905) apparently was able to get of *agrorum* both the light and dark forms by changing external conditions, especially that of temperature. Sladen (1912*b*: 149) believed that specimens having their pubescence abnormally tinged with brown was due to prolonged chilling while in the pupal stage. When melanism is in evidence where normally the color is light (*e.g.*, yellow) it might be faintly expressed, with only a few black hairs intermixed, to a condition where black predominates or is complete.

Aberrations treated here refer to a kind of unusual chromatic deviation from the normal condition. This abnormality is more commonly detected on the abdominal dorsum and is usually expressed as one or more patches of lighter pubescence on one side, or on both, of the segment involved (Figs. 7, 8). Sometimes only a portion of the individual hairs are so affected, *e.g.*, the tips or the upper halves, which is the only type of this aberrancy I have seen on the thoracic region, as on *Pyrobombus* (*C.*) *f. funebris*, though it probably occurs on some others as well. Vogt (1909: 45, 46) mentioned having seen, in four different species (*soroeensis*, *terrestris*, *ruderatus*, *lapidarius*), individuals having patches of off-color pubescence on their abdomens. Franklin (1912: 236, 237) referred to these aberrations under "Freak Specimens", and stated that he possessed two queens of *bimaculatus* showing this phenomenon; since he remarked with respect to these, ". . . which have sported . . .", it is assumed that he might have also considered them as *sports*. I have examined a surprising number of these abnormal specimens in the course of this study; whatever be the cause(s) of this aberrancy is not clear to me. Sladen (1912*b*: 149) was of the opinion that it was "due to injury during the larval or pupal stages", but this is questionable.

CLEANING AND RESETTING OF MATTED ADULTS

Before absolute confidence can be placed in the identity of matted specimens it is often desirable to clean and reset them. The true color (except possibly black) of pubescence tightly stuck to the body usually is not apparent. Moreover, when such pubescence is mixed with dirt, gums, resins, nectar, honey, oils, etc., it is even more difficult to judge what is the actual coloration; sometimes the structural characters can also be hidden from clear view.

Figure 9 illustrates the same specimen before and after cleaning and resetting. Most successful restoration attempts require time, care, and patience. Before undertaking any method involving fluids that might obliterate data on labels it is safer to remove the labels before beginning. I never deal with more than one single specimen at a time (for reasons that will be obvious), therefore no confusion can result. It is recommended, to minimize breakage, that the specimen first be relaxed in an ordinary relaxer. Since the principal problem is selection of a suitable solvent, this step sometimes leads to shortening the cleaning process by indicating that water is all that is required besides alcohol. If this is so, it is possible to bypass the use of other solvents such as ether, chloroform, etc. and transfer the specimen to tepid water, then to 70% ethyl alcohol, and finally to 95% ethyl alcohol, for periods of 1 hour or more respectively. If it seems advisable to use any good detergent with gentle shaking to remove stubborn particles or material, the detergent should be added to the tepid water, in which case another water rinse should be interpolated in the

FIG. 9. The same queen specimen before (left) and after (right) cleaning and resetting; *festivus*.

technique before using the alcohol baths. I have found that a good detergent is the most reliable cleansing agent, even in instances where it is helpful to employ, sometime before the final soaking, a fine teasing needle to gently separate any hair masses which persist in sticking together. Where it is evident that water alone or water plus detergent proves ineffective in removing or dissolving foreign material, then it is recommended that ether, chloroform, or carbon tetrachloride be substituted (usually for longer periods) before treatment with alcohols. Considerable time is required to properly restore the original or natural condition of the pubescence, and for this reason it is not recommended that the use of hydrocarbon solvents referred to directly precede any attempt to restore natural appearance; these solvents volatize so rapidly from the surface of the specimen that trouble will be experienced by even the most rapid operator. Prepare several narrow, pointed pieces of white blotter paper about 1 to 2 in. long. A specimen freed of foreign substance (easily detected by the looseness of the pubescence) should then be removed from the 95% alcohol, placed on clean blotter paper (preferably white) and gently rolled over it, using a camel's-hair brush, until practically all the alcohol is absorbed and the wings and other appendages are completely freed. This, as well as separating the hairs permitting them to dry and assume their natural position and appearance, can be accomplished by carefully employing a fine jet of compressed air (or blowing) and more or less alternating by gently stroking with the pieces of pointed blotter paper and a camel's-hair brush; often a fine teasing needle, or pin, is useful. Before progressing very far it is advisable to remove, by absorption from the interior, as much as possible of the solutions which tend to appear from time to time especially from the mouth, behind the head, near the wing bases and coxae, and at the anal opening. When the specimen is nearly dry its appendages can be reset or fixed with bracer pins, and finally the pubescence fluffed into natural appearance. When completely dried the label(s) should be replaced; usually better contact with the pin results if the diameter of the original pin hole is reduced by pressure applied to it on one or both sides of the label, or a small amount of glue might be placed on or underneath where it is in contact with the pin. If a specimen dries completely with the pubescence still appressed to the body it is unlikely that any degree of desired improvement will be achieved. I have learned that at times during the endeavor to restore the fluffy condition of the pubescence the use of a stereomicroscope and good lighting is desirable when working over certain limited areas on a specimen offering difficulty.

LIFE HISTORIES, SELECTION OF NEST SITES, BROOD STRUCTURE, AND NUTRITIONAL BEHAVIOR

Much has been published in both hemispheres on the life histories of a number of species of bumblebees, so that herein only generalities will be stressed. Most species of the Temperate and Arctic regions usually do not, at the climax of development, produce very populous colonies, so that it is not always easy to locate even a prosperous colony, such as that of one of the more prolific species having in excess of more than 400 to 500 individuals. Medler (1959) reported the occurrence of a New Mexico nest of *Pyrobombus* (*P.*) *huntii* in which the production is said to have exceeded 1300. Some of the tropical species often produce a large number of offspring. Michener and LeBerge (1954) tallied more than 2100 individuals of all stages in a nest of *Megabombus* (*M.*) *medius* taken in the State of San Luis Potosi, Mexico; Rau (1941*a*), reporting on two nests of the same species, gave much lower figures in both cases, but this could have been due to ante-climaxal state of development. One of the most populous bumblebee colonies known was that developed by *Megabombus* (*M.*) *transversalis* (=*incarum*) in a Brasilian jungle; as detailed by Dias (1958*a*), it contained in all more than 3000. There is ample evidence to indicate that at least some of the tropical and subtropical species are perennial, which enables them to build large colonies. It would be difficult to determine exactly how many definable generations occur each year because under these

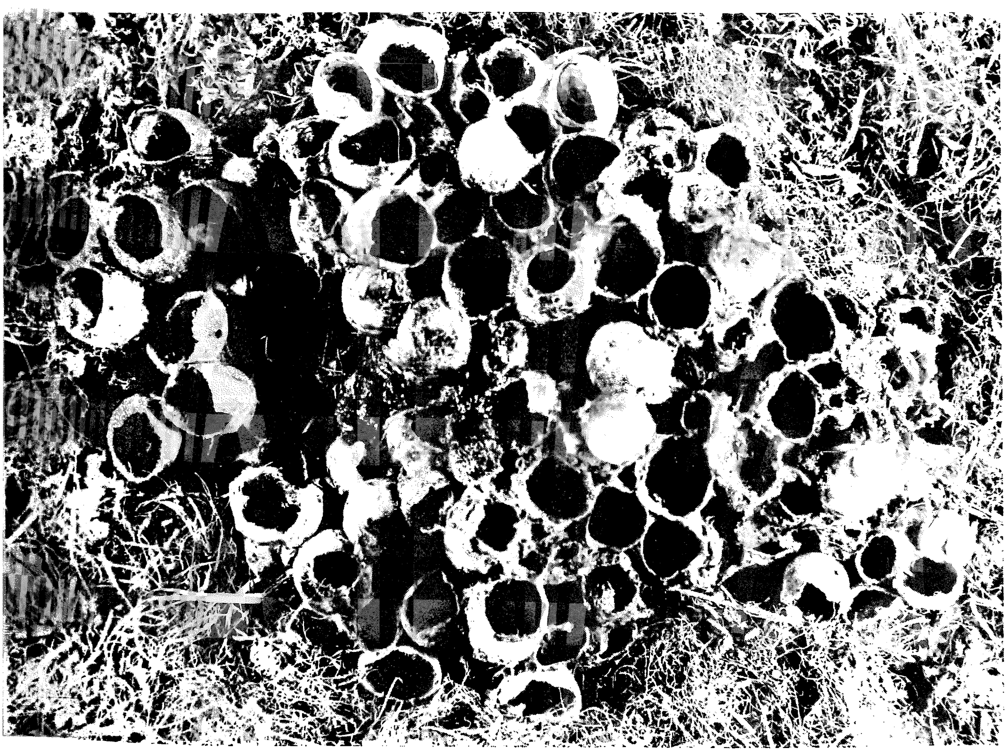


FIG. 10. Remains of *Pyrobombus (P.) sandersoni* nest near end of season.

FIG. 11. Laboratory colony of *Megabombus (M.) f. fervidus.*

conditions there must be considerable overlapping for various reasons, chief among which is queen supersedure by mated young queens. A nest (Fig. 12, 1–10) that appeared to be of this kind was that of *Megabombus* (*M.*) *atratus* taken from an irregular cavity of about 3-4 cu. ft in a roadside dirt bank near São Paulo, Brasil, by the writer with the help of Dr. Paulo Nogueira-Neto. The brood was oblong-oval, 17 cm long by 14 cm wide (Fig. 12, 2–3) and therefore occupied only a portion of the cavity floor. The brood was entirely covered with a conical canopy (Fig. 12, 1) which was approximately 18 cm high, and below was of the same shape as that of the nest base but large enough to entirely enclose it. Interiorly the canopy had several thin false walls projecting inwardly with uneven spacings between the walls. The apex of the canopy was secured to and supported by some of the numerous roots (mostly of grasses) that penetrated into the cavity from the roof as much as 25 cm. The canopy varied in color from dark grey to blackish brown; it consisted of soil and plant particles held together with wax and had two separate entrances near the base. A chemical analysis showed that wax and fats comprised about 39% of the materials used. The evidence indicated that a vacant bird nest served the satisfactory requirements, in this case, for the establishment of a colony, which evidently had been maintained continuously for at least 3 years. When this colony was taken on 15 November, 1955, more than 600 living offspring (eggs, all instars of larvae, pupae, adults) were recorded; many of the adults gained their freedom in the process because the physical conditions associated with this niche made it easy for them to escape. And still others, returning during our operations, were reluctant to approach within capture distance. Adults taken were 26 young queens, 129 workers, and 93 males. There were no callows among the queens and

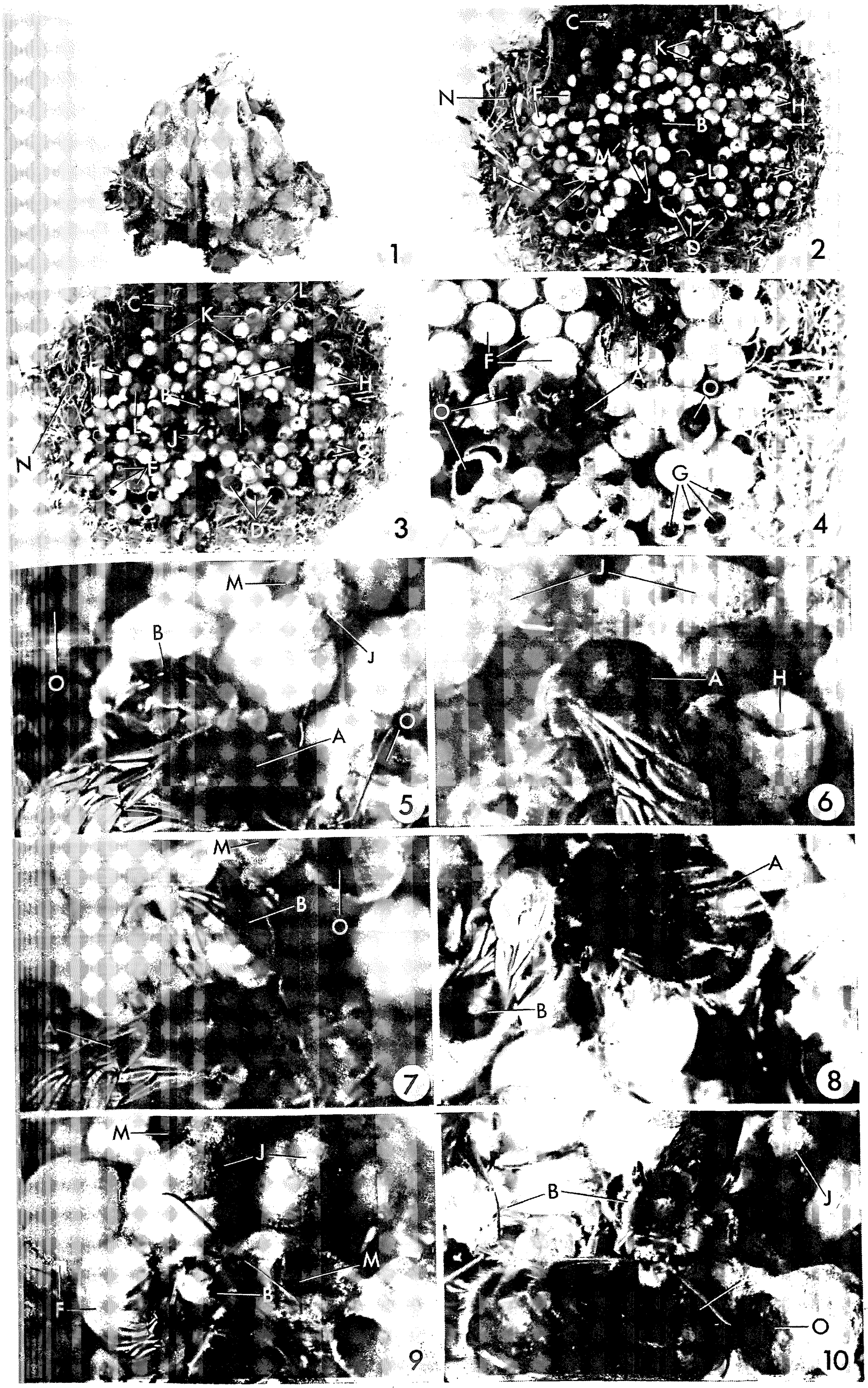


FIG. 12. Canopy (1), nest base, brood, and adult queens and males (2-10) of *Megabombus (M.) atratus*. (Photo courtesy Dr. Paulo Nogueira-Neto, São Paulo, Brasil.) **A**, queens; **B**, males, including callows; **C**, worker cells with pollen; **D**, empty queen cells; **E**, queen cells containing some pollen; **F**, cells containing male pupae; **G**, empty worker cells; **H**, cells containing worker pupae; **I**, cluster of closed worker cells with larvae; **J**, closed egg cells; **K**, worker cells with honey; **L**, pollen pockets; **M**, egg cell primed with pollen; **N**, nest base—soil particles mixed mostly with grass roots and rootlets; **O**, queen cells containing some honey.

no closed queen cells among the brood, which visibly consisted of the following cells: 121 open (queen, worker, male), 178 closed (worker, male), 32 closed egg (averaging slightly more than 5 eggs per cell), and several open egg cells primed with pollen. Visible also were some 64 old bases, mostly of worker cells, deep within the brood mass. During the ensuing 2 weeks numerous workers and males were reared from the closed brood cells. Without taking into consideration the accumulation of dead adults and dismembered body parts outside the base of the canopy it was estimated that possibly more than 800 progeny were associated with this nest when it was discovered.

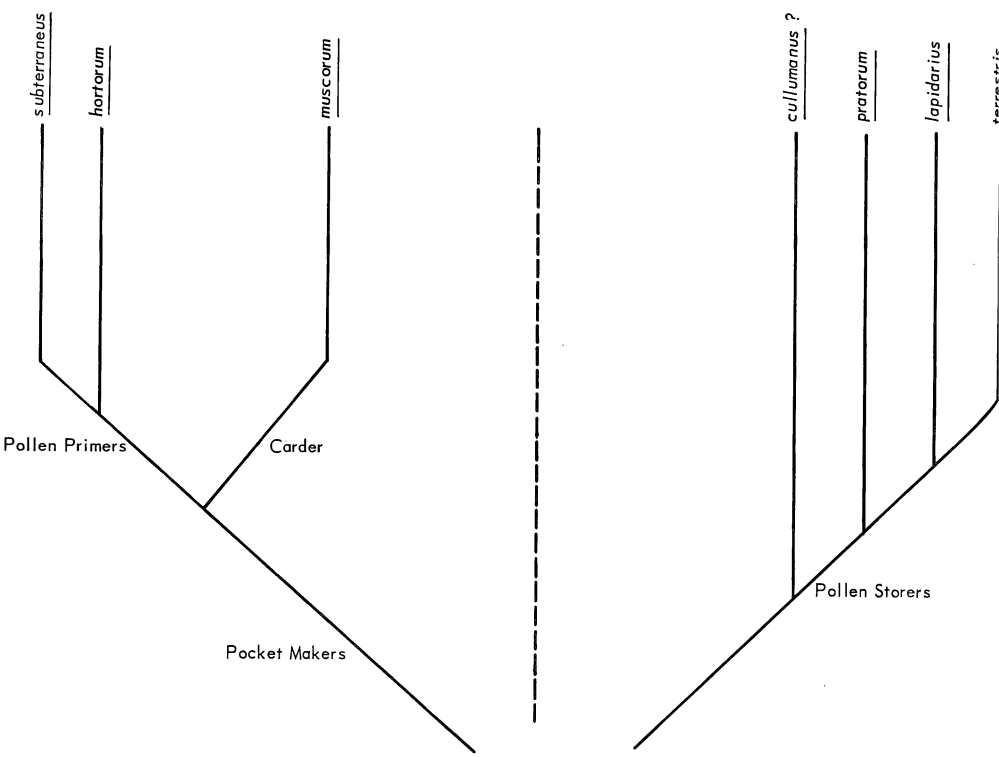
Most species of bumblebees require 3 to 5 days in the egg stage, 7 to 8 days in the larval stage, and 12–14 days in the pupal stage, or from about 3 weeks to 1 month to complete a cycle. Queens lay eggs in batches which produce more or less discrete broods. Usually the first brood is the most recognizable in its entirety because the production of the second batch of eggs is delayed by the brooding behavior of the lone queen; when, after the appearance of workers some of which assist in brooding and also perform other duties such as feeding larvae, the time interval between egg batches is shortened, frequently so much so after sufficient colony development that subsequent broods might not be easily defined due to overlapped adult emergence. According to Hobbs (Can. Ent., Vols. 96–98, 100, 1966–68) except for one species the queens of all species of bumblebees studied by him and coworkers laid but a single egg per cell of the first brood; in succeeding broods several eggs per cell were laid. The words "brood" and "generation" are often confounded or used synonymously. Wherever generation is employed in this work it refers to *all* the progeny of one set of parents (*e.g.*, the founding queen and one or more males) per colony, disregarding only any production of eggs by workers (Free and Butler 1959), even though in several species it is virtually impossible to draw a line of distinction between large workers and bonafide small queens. The term supersedure, as used here, is restricted to mean that a young fertile queen has taken over or replaced the mother queen and produces offspring which constitutes a succeeding generation. Several species need to be investigated with respect to how many generations they produce, or are capable of producing, annually, depending on environmental conditions and locations. Recently, Meidell (Norsk. ent. Tidsskr. 15: 31032, 1968) reported posthumously that *Pyrobombus* (*P.*) *jonellus* is capable of having two generations per season in Norway. I do not doubt this and suspect that the same behavior might apply to this species in at least part of its range in North America. Several years ago in late July I observed young queens of *P.* (*P.*) *bimaculatus* provisioning a nearly inactive parental nest, possibly with intent to start a second generation.

The sites selected for nesting vary widely between species and often even within the same species. Deserted nests of various mammals and birds, regardless of their locations, are frequently accepted by searching queens if favorable environmental conditions and space exist and there is ample material to protect the developing brood throughout the life of a colony. Such nests of mice, other rodents and birds are favorites. However, it should be remembered that searching queens might sometimes elect to nest in such places as haystacks, clumps of dried grasses, mosses, old stuffed furniture stored in barns or sheds, and in many similar situations not previously occupied by any form of vertebrate life. When suitable sites can be found on or near the surface of the ground certain species prefer to nest in them, while other species select underground niches. Runways to a nest might be virtually absent or be as long as possibly 2 to 3 ft for surface nests, whereas, they might extend 8 or more feet to an underground colony. The writer once took, near Felton, Dela., an underground nest of *Pyrobombus* (*P.*) *impatiens* having a runway of little more than

8 ft, but this species will occupy nest boxes above ground. A few additional examples are given to show that some, if not most, species will at times deviate from their preferences. *Megabombus* (*M.*) *pennsylvanicus*, which is usually a surface nester, accepted an abandoned squirrel nest in which to develop her colony 18½ ft above ground level (Milliron 1967), and in another instance I took a strong colony of this same species that occupied a mouse nest inside an open burlap bag partly filled with cracked corn and suspended on a post 7½ ft above the floor of an unused poultry house; another nest was located just beneath the surface near the top of a steep road bank. Nests of *M.* (*M.*) *fervidus*, also usually a surface inhabitant, I have obtained from a vacant bird house suspended 7 ft above ground (Milliron 1967), and Gibson (1930) found this species occupying an oriole nest; on one occasion I found a nest in a large hollow tree root a few inches beneath the soil surface. It has been noted that *Pyrobombus* (*P.*) *perplexus*, usually a subterranean nester, frequently develops colonies in the walls of buildings and even in bird houses. *P.* (*P.*) *bimaculatus* is much like *impatiens* in its nesting habit, but I have found a colony of it situated 2 ft above ground in a haystack. With possibly few exceptions, *e.g.*, *Bombus affinis*, it might be safely stated that most, if not all, so-called surface nesting species in our hemisphere will nest underground at varying depths or at places considerably above the surface. The published reports of finding bumblebee colonies in unexpected places or in unusual situations are too numerous to mention all here. I do not find it difficult to get the overwintered queens of several species to accept domiciles placed out of doors (*cf.*, Frison 1926*c*, 1927*a*; Fye and Medler 1954*c*; Hobbs *et al.* 1960), even those containing remains of the previous year's brood cells. A few spring collected queens of *bimaculatus*, *impatiens* and *p. pennsylvanicus* were induced to start nests indoors at Columbus, Ohio, in 1947. Some of my failures then were attributed to infertility or the use of carbon dioxide as a tranquilizer. Not all queens that successfully pass the winter are necessarily fertile (Milliron 1967), and I have noted that at least some of these search for nest sites almost as eagerly as do fertile queens. Colonies located ordinarily can be easily transferred to nest boxes of several designs, the exposed brood and adults of one of which is shown under an inner glass cover in Fig. 11.

It appears that vacated cells are never used for the reception of eggs. Soon after adults have emerged the caps (tops) are completely removed and the rims are variously chewed down and the empty cells prepared to store either pollen or nectar. Several such cells are shown in Fig. 10, which is what remained of the brood structure in a nest of *P.* (*P.*) *sandersoni* near the end of the season; note also that some four male cells still have their caps (tops) which appear whitish indicating that adults had not yet emerged.

Overwintered queens searching in spring and early summer for nest sites vary somewhat in their behavior depending on the species. At this time under favorable weather conditions they busy themselves during the day sipping the required amount of nectar and scrutinizing every conceivable niche that might provide suitable conditions for colony establishment; they seem to sense where might be located the site they seek. Some queens fly close to the ground in irregular serpentine flight patterns carefully surveying every square foot of an attractive area, be it in forests, meadows, refuse dumps, rock piles, etc.; others search just as diligently but fly on the average somewhat higher. Stumps, dead or hollow trees, brush lands, forest floors, grass clumps, stone walls, old buildings, etc. are only a few of the attractive places they inspect. On several occasions I have observed searching queens enter larger spider burrows, and in a few instances remain therein only momentarily before making a rapid exit indicating that possibly those burrows were inhabited. A suitable site is usually one which offers at least some protection from adverse weather, allows for brood expansion, and contains nest building materials. Rarely is brood directly exposed, even in subterranean nests; it is generally protected from excess moisture and low temperature by a canopy, the interior surface of which is plastered with wax usually mixed with fine organic or inorganic solid particles. After a searching queen has located a suitable place to construct a nest she crawls within the available nesting material and forms a cavity somewhat larger than her body, or accomplishes the same thing by pulling about and over her loose bits of nesting material. Leading into this cavity which is eventually enlarged to accommodate the first brood, is a passageway through which she exits and re-enters with loads of pollen and nectar. Either she concentrates on accumulating enough pollen to make a sizeable lump, or a waxen honey pot is formed, but both might be undertaken simultaneously. This requires several days under favorable conditions and might be delayed under adverse weather. When sufficient pollen (and also nectar) has been collected a shallow brooding groove is made across the lump, and with a mixture of wax and pollen first brood eggs cells are made at the sides of the groove above. Following the deposition of the first batch of eggs, brooding begins in earnest. There are slight deviations in the initial steps in establishing a colony depending on the species, and even within the same species. Usually the first workers to emerge average smaller, but soon these begin to perform various activities within the nest and some go to the field for provisions, as generally does the queen for a time until sufficient workers are produced. As the colony grows the canopy is often repaired and constantly enlarged to



(After Sladen, 1899, 1912b)

FIG. 13. Phylogenetic diagram showing possible evolutionary trends for a few Eastern Hemisphere bumblebee species based on nutritional behavior (from Sladen).

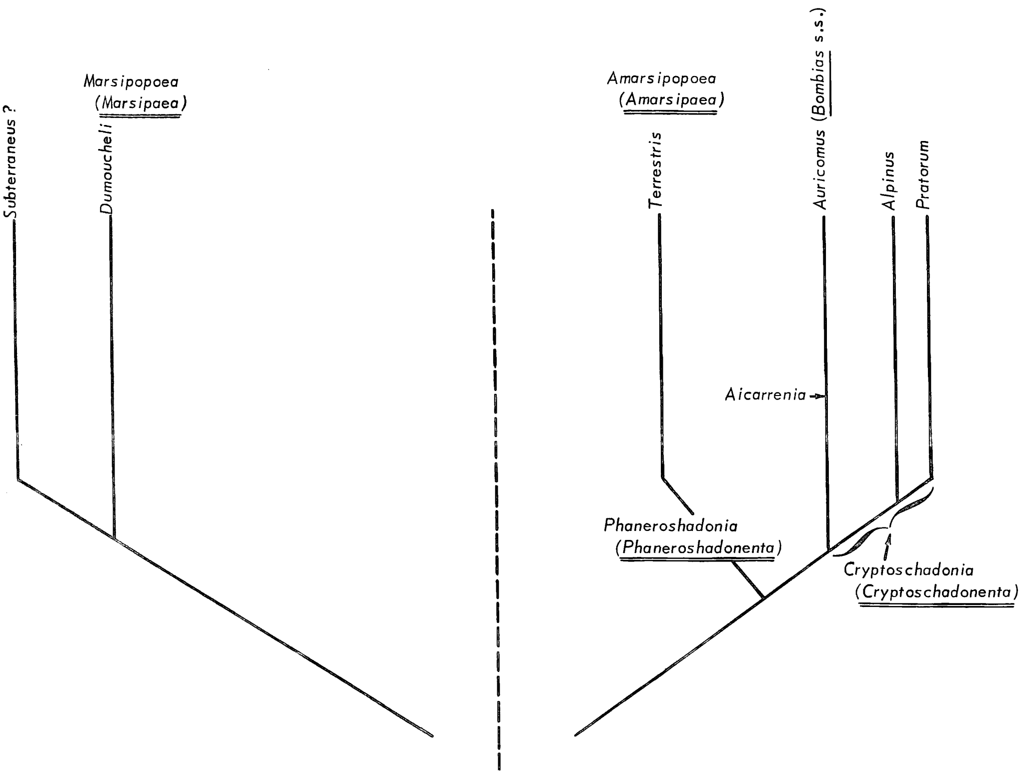


FIG. 14. Phylogenetic diagram showing possible evolutionary trends of certain Western Hemisphere bumblebee species groups based on nutritional behavior (from Plath).

accommodate the size of the expanding subsequent broods, each occurring above and to the side of the preceding in such a manner as not to interefere with feeding and emergence. Later in the season the old cells of the first broods are usually lowermost and often completely hidden, especially if they are not used for storage. Except for the cells spun by full-grown larvae, wax is widely utilized within the nest to reinforce the canopy, construct honey pots, and form egg and larval cells; it is a rather soft salve-like substance produced by the females (especially queen and larger workers) from glands situated more or less intersegmentally at the bases of abdominal segments 3–6. Most of it is secreted dorsally at the bases of segments 4 and 5, and some ventrally, especially at the bases of segments 3 and 6.

Bumblebees are referred to as species that are pocket makers and those that are pollen storers. Both Sladen (1912*b*: 152) and Plath (1927*d*; 1934: 131) have assigned the biologically known species to either of these groups. The substance of their schemes is diagrammed in Figs. 13 and 14. Pollen primers is another term that has been applied to some species in a rather restricted way, but it is doubtful if it should be so employed (*cf.* Plath 1934: 124–126). If the biologies of a number of species, which have been amply investigated, are taken into consideration there is indication suggesting the distinguishable groups as merely pocket makers and non-pocket makers. Most, if not all, species will resort to pollen priming, especially in egg cells, at some period in colony development; some do this regularly, others irregularly or sporadically. Likewise, most species do store surpluses of both pollen and nectar, some moreso than others. Usually vacated cells, to which wax might b added around the rims for increased capacity are used; when these are elevate considerably above adjacent cells they are commonly called wax cylinders, forme for storage of surplus pollen; *e.g.*, in prosperous *Bombus affinis* and *B. terricol* colonies sometimes two or more of such cylinders might extend upwards as muc as 2 or 3 in. and be filled with pollen. While this method of storing pollen i cylinders is commonly associated with species of *Bombus*, it or something simila might be rarely found in others; *e.g.*, *Megabombus f. fervidus* (*vide* Plath 1934: 16 125) but I have not seen anything comparable to a true wax cylinder in any one o the several nests of this species studied. The larvae of some species are nourished for the most part, almost exclusively on pollen with very little nectar mixed with it Thus, in the pocket-making species the bulk of pollen, gathered as pellets (two pe load), brought to the nests is deposited in pockets made at the sides of larva clumps and is, therefore, made directly available to the larvae; after growing to a size when the larvae are segregated into separate cells the pockets are formed on them. In such species the brood larvae might occasionally be fed collectively when small, or individually when small to larger, by a mixture of pollen and nectar regurgitated into cells by the adults, usually through holes that are quickly sealed again by most species, insuring that larvae are in closed cells. The latter is the usually employed method by the non-pocket-making species for feeding brood larvae, and also by the pocket makers for nourishing larvae that are destined to become the sexuals. It is characteristic for many larvae belonging to species of the genus *Bombus* to be variously exposed or partly uncovered much of the time during their development, especially the later growth period when greater quantities of food are required more frequently. Though pollen appears to be the principal food ingredient used by larval bumblebees, nectar is very important to colony development. In most species the latter forms a part of the larval nourishment, it is consumed in quantities by adults, and is sometimes utilized in small amounts as an adhesive. Nectar-collected supplies might be used immediately or they might be stored temporarily in waxen cells (pots) or for longer periods in vacated brood cells. Relatively small quantities of the total amount collected are ever converted to honey as such, but when this does occur (more obviously in some species) the honey, which usually has a rather strong taste, is always found in the sturdier vacated cells, some of which might be completely capped over with wax. Presumably this conversion provides a source of reserve food supply during long periods of inclement weather later in the season.

Floral Visitations

Although many species of bumblebees have shown a definite preference for a specific, or closely related flower, *e.g.*, *M. borealis* (Kby). for red clover, no particular species is strictly oligolectic. And, this preference might be altered from one location to another in the species distributional range, depending upon the availability of the preferred flower(s). When the foraging behavior of all bumblebees is better understood throughout the active season, probably most if not all the species will prove to be polylectic.

The floral visitations, as far as they are known to me, are herein summarized to genus for each taxon; these records were compiled from data on specimen labels and from reliable published information.

Economic Importance of Bumblebees

As Franklin (1912: 202) aptly stated, "Taking the world as a whole, probably the species of no other genus surpass those of the genus *Bombus* in their importance as pollen carrying agents, unless it be the species of *Apis*". Of course, he was referring to their importance as pollinators. The classical example, in this respect, is the successful introduction of a few species from England into New Zealand during 1885–86 for improving the yield of clover seed which subsequently increased to an encouraging extent.

Many papers dealing with the economic value of bumblebees have appeared, and numerous ones have detailed ways and means of increasing the population of these insects, particularly in conjunction with pollination studies. Numerous species are sufficiently abundant, usually each year, in most agricultural and forested areas to be of significance in the production of seeds of a long list of leguminous crops, those of ornamentals, and many kinds of fruits, including those of brambles, trees and ericaceous shrubs, and even cotton. Locally, in some years, bumblebees are noticeably scarce and a measurable reduction in production of a particular crop is noted.

Subfamily Bombinae

The subfamily Bombinae is here interpreted as including a group of social bees and a closely related group of inquiline bees of the family Apidae. The tribe Bombini of this subfamily differs from other Apidae except the Euglossini, in the structure of the female hind tibia, which has two apical spurs (calcaria) and a distinct corbicula on the outer surface. The clypeus in Bombinae is always more or less convex, often noticeably protuberant; the malar space is prominent, rarely otherwise; the first submarginal cell (first cubital, R plus first R_1, or first R_1, depending on the system) always has a complete or incomplete transection; the males have a volsella and squama that protrude, at least noticeably, beyond that part indicated as outer clasper (see Fig. 4).

The bumblebees (strictly social) belong to the tribe Bombini which, as regards the Western Hemisphere, consists of three genera, *Bombus* Latr., *Megabombus* D.T., and *Pyrobombus* D.T.; the inquiline bumblebees belong to the tribe Psithyrini, represented by a single monophyletic genus, *Psithyrus* Lep.

Key to Tribes of Bombinae

1. Antennae 12-segmented; abdomen 6-segmented (6 terga, 6 sterna visible), terminally pointed (FEMALES) 2
   Antennae 13-segmented; abdomen 7-segmented (7 terga, 6 sterna visible), terminally rounded (MALES) 3*
2. Hind tibial outer surface flat or concave (sometimes narrowly convex mid-longitudinally), devoid of conspicuous hairs except at base and borders; labrum rectangular; mandibles strongly arched mesad, closely overlapped when retracted, outer surface of each with 3 arcuate, convex keels, distinctly separated basal area between second and third; hypopygium never carinate latero-posteriorly (or submarginally); commonly known here as bumblebees .... Bombini (p. 43)
   Hind tibial outer surface evenly, strongly convex, covered with hairs; labrum triangular; mandibles somewhat elongate, tapered distally, not strongly arched mesad, incapable of being closely overlapped when retracted, outer surface of each with two rather wide, flattened keels attaining margin (first keel evident only on basal half of mandible, not extending to margin), anterior and median discal areas confluent distally; hypopygium characteristically carinate latero-posteriorly (or submarginally), commonly known here as inquiline bumblebees .... Psithyrini

*If the antennae are missing or the abdominal terga are obscured, the sex can be ascertained by noting the bifid tarsal claws, the inner tooth of which in the female is at most approximately 1/2 the length of the outer tooth and is curved inwardly; whereas that in the male is always at least 3/4 as long as the outer tooth or equal or subequal to it and shows little tendency to diverge. This character, slightly expanded here, should be credited to B.D. Walsh through Cresson (1863*a*: 84).

3. Head short, blocky (usually about as broad as high), rather coarsely punctate, with dense coarse hairs of about equal length on face and vertex; scape short, usually only ¼ to ⅓ length of flagellum which never has median segments noticeably arcuate beneath; hind tibia usually almost completely covered with hairs on convex outer surface, narrow, not greatly expanded toward apex which is fringed with dense, fine plumose very short hairs, angulate or subangulate dorso-posteriorly, posterior and anterior fringes not markedly different; second abdominal sternum usually with conspicuous transverse median elevation; hypopygium never strongly carinate along apical margin; volsella and squama membranous .... Psithyrini

Head longer, usually triangular to somewhat subspherical, with finer less dense punctation most noticeable on face, vertex; pubescence usually fine, variable in length; scape generally ⅓ to ½ as long as flagellum; hind tibia usually widened distally, outer surface variable in degree of convexity, amount and character of pubescence (distal third usually smooth, shining, less hairy), anterior and posterior fringes different in length; second abdominal sternum without transverse median elevation; hypopygium often strongly carinate along apical margin; volsella and squama corneous .... Bombini (p. 43)

GENERAL SYNOPSIS

BOMBINI

Genus **_Bombus_** **Latr.**

Terrestris Group
- *affinis* Cr.
- *lucorum lucorum* (L.)
- *lucorum patagiatus* Nyl.
- *terricola terricola* Kby.
- *terricola occidentalis* Grne.

Genus **_Megabombus_** **D.T.**

Subgenus *Bombias* Robt.

Auricomus Group
- *nevadensis nevadensis* (Cr.)
- *nevadensis auricomus* (Robt.)

Subgenus *Megabombus* D.T.

Alpinus Group
- *balteatus* (Dahlb.)
- *hyperboreus* (Schönh.)
- *kirbyellus* (Curt.)
- *polaris* (Curt.)
- *strenuus* (Cr.)

Subterraneus Group
- *appositus* (Cr.)
- *borealis* (Kby.)

Dumoucheli Group
- *atratus* (Fkln.)
- *bellicosus* (Sm.)
- *brasiliensis* (Lep.)
- *fervidus fervidus* (F.)
- *fervidus californicus* (Sm.)
- *fervidus sonomae* (How.)
- *dahlbomii* (Guer.)
- *diligens* (Sm.)
- *excellens* (Sm.)

medius (Cr.)
morio (Swed.)
opifex (Sm.)
pennsylvanicus pennsylvanicus (De G.)
pennsylvanicus sonorus (Say)
pullatus (Fkln.)
rubriventris (Lep.)
steindachneri (Handl.)

Nigrodorsalis Group
nigrodorsalis nigrodorsalis (Fkln.)
nigrodorsalis montezumae (Ckll.)
digressus Mlrn.
trinominatus (D.T.)

Mexicanus Group
brevivillus (Fkln.)
mexicanus (Cr.)
transversalis (Oliv.)

Genus *Pyrobombus* D.T.

Subgenus *Cullumanobombus* Vogt

Fraternus Group
fraternus (Sm.)

Griseocollis Group
griseocollis (De G.)
morrisoni (Cr.)

Crotchii Group
crotchii (Cr.)

Brachycephalus Group
brachycephalus (Handl.)

Volucelloides Group
volucelloides (Grib.)
melaleucus (Handl.)

Robustus Group
butteli (Fr.)
ecuadorius (Méun.)
hortulanus (Fr.)
robustus (Sm.)
tucumanus (Vach.)
vogti (Fr.)

Funebris Group
funebris funebris (Sm.)
funebris rohweri (Fris.)

Dentatus Group
haueri (Handl.)

Rubicundus Group
rubicundus (Sm.)

Handlirschi Group
handlirschi (Fr.)

Cullumanus Group
rufocinctus (Cr.)

Coccineus Group
baeri (Fr.)
coccineus (Fr.)

Subgenus *Pyrobombus* D.T.
Pratorum Group
alboniger (Fkln.)
bifarius bifarius (Cr.)
bifarius nearcticus (Handl.)
ephippiatus ephippiatus (Say)
ephippiatus formosus (Sm.)
ephippiatus vauflavus (Ckll.)
huntii (Grne.)
impatiens (Cr.)
schneideri (Fr.)
ternarius (Say)
vosnesenskii (Rad.)
wilmattae (Ckll.)

Jonellus Group
carriei (Grne.)
frigidus frigidus (Sm.)
frigidus couperi (Cr.)
jonellus jonellus (Kby.)
sandersoni (Fkln.)

Praticola Group
vagans vagans (Sm.)
vagans bolsteri (Fkln.)
vagans cockerelli (Fkln.)
praticola praticola (Kby.)
praticola flavifrons (Cr.)
bimaculatus (Cr.)
centralis (Cr.)
caliginosus (Fris.)
vandykei (Fris.)
cascadensis Mlrn.
edwardsii (Cr.)
sitkensis (Nyl.)
perplexus (Cr.)

Lapponicus Group
lapponicus sylvicola (Kby.)
lapponicus gelidus (Cr.)
melanopygus (Nyl.)

INFRATRIBAL AND SUPRAGENERIC NOMENCLATURE IN BOMBINAE

In the works of Krüger (1917, 1920), Frison (1927e), and Skorikov (1937*b*) suprageneric, infratribal nomenclature was proposed for categories of genera and species believed to be related and of common descent. This nomenclature mostly consists of sectional names which have no place in generic synonymy, and is dealt with as follows:

BOOPOBOMBUS Fris., 1927e, p. 62, is synonymous with part of *ANODONTO-*BOMBUS Krüg., 1917, p. 61, and refers to species of the subgenus *Bombias* Robt., 1903, p. 176, (genus *Megabombus* D.T., 1880, p. 40) and to those species of the subgenus *Cullumanobombus* Vogt, 1911, p. 57, (genus *Pyrobombus* D.T., 1880, p. 40). ODONTOBOMBUS Krüg., 1917, p. 61, is equivalent to the subgenus *Megabombus* D.T. ANODONTOBOMBUS Krüg. is, for the most part, synonymous with the subgenus *Pyrobombus* D.T.

Serie BOMBI CAPULIGERI Skor., 1937*b*, p. 53, is associated with all species of the genus *Megabombus* D.T., and serie BOMBI UNCINIGERI Skor., 1937*b*, p. 59, encompasses all species of the genus *Pyrobombus* D.T.

Krüger (1917, p. 65, footnote) questionably used "Untergattung" in referring to Sulcobombus, and throughout his works (1917, 1920) it is not clear that he, or Vogt (*in litt.*, Krüg. 1920, p. 362, footnote), meant to employ the terms Sulcobombus and Uncobombus in a generic or subgeneric sense. I am, therefore, at present inclined to regard both as either sectional or subsectional names, SULCOBOMBUS Krüg., 1917, p. 65 (footnote), being equivalent to either or both *Confusibombus* Ball, 1914, p. 78, and *Megabombus* D.T.; UNCOBOMBUS (Vogt) Krüg., 1920, p. 362 (footnote), corresponds to species of the genus *Pyrobombus* D.T. treated herein.

It should be noted that at least some of the sectional (or subsectional) names referred to above are applicable only to heterogeneous groupings and are rejected on this account; the remaining names are unacceptable because they are unnecessary and do not appreciably add to the understanding of the phylogenetic classification of the bumblebees.

Tribe **Bombini**

Key to Genera and Subgenera

1. Transverse median (cu-a) vein of front wing arising from median (media-cubitus) vein either before or at origin of basal (median) vein, or very near extreme mesal apex of first discoidal (median) cell, at most very short distance from base of discoidal (cubitus) vein, forming inner angle of 90° or less and outer angle of 90° or more with the latter (Pl. IV, C-F; VI; VII; VIII, A-F), then joining anal vein not beyond mesal apex of first discoidal cell; submedian cell (cubital) distally little wider than second discoidal (cubital 1a) cell proximally; ocelli medium to large, distinctly anteriad of supraorbital line (except in the Cullumanus group female, which has very short malar space), lateral ones closer to compound eyes than to each other 2

   Transverse median vein of front wing arising from discoidal vein distad of extreme mesal apex of first discoidal cell, or origin of basal vein, forming inner angle of 90° or more, outer angle of 90° or less (Pl. IV, A-B, G-H; V; VIII, G-H; IX) then joining anal vein near or beyond mesal apex of first discoidal cell; submedian cell distally noticeably wider than second discoidal cell proximally; ocelli medium to small, near or adjacent to supraorbital line, lateral ones usually at least as far from compound eyes as from each other (except in Nigrodorsalis group female, which has short vertex, ocelli situated little more forward, and lateral ocelli somewhat closer to compound eyes; then disto-posterior angle of mesobasitarsite spinate) 3

2. Transverse median vein in front wing arising before or at origin of basal vein, forming obtuse outer angle with discoidal; F1 (female) about 3 times as long as distal width, exceeding F2 plus F3 in length; malar space moderately long; F1 (male) greatly exceeding F3, about equal to F2 plus F3; compound eyes (male) usually bulging; sagitta straight (Pl. XI) .... *Megabombus*, subg. *Bombias* (p. 73)

   Transverse median of front wing arising from discoidal vein, at most very short distance from base, forming with it outer angle of 90°; F1 (female) not more than 2 times as long as distal width, not exceeding F2 plus F3 in length; F1 (male) usually never longer than F3, never equal to F2 plus F3; compound eyes (male) slightly swollen to bulging; sagitta (Pls. XVI–XVII, XIX–XX) with entire head (or only tip, Dentatus group, Pl. XVIII) hooked mesad (or if lanceolate, mesal apical margin with spine-like projection, as in the Rubicundus group, Pl. XIX) .... *Pyrobombus*, subg. *Cullumanobombus*

3. Transverse median vein in front wing arising considerable distance from base of discoidal vein, forming outer angle near 90° (or disto-posterior angle of mesobasitarsite sharply acute or spinate, Nigrodorsalis group female); malar space usually rather long; frontal outline of head distinctly higher than wide; disto-posterior angle female mesobasitarsite usually sharp or spinate; male flagellum 3 times or more length of scape, F1 shorter than F3, median segments often elongate, arcuate beneath; sagitta straight (some diverge distally), head usually expanded (Pls. XII-XV), extreme tip sometimes slightly convergent (as in Subterraneus and Alpinus groups, Pl. XII) .... *Megabombus*, subg. *Megabombus*

   Not as above; transverse median vein arising from discoidal very near or just beyond base 4

4. Frontal outline of head rounded, about as high as wide; malar space less than greatest distance between and including mandibular articulations; mandible (female) distinctly 4-toothed; male not markedly dimorphic, outer surface of tibiae smooth, mostly hairless except at margins; sagittal heads opposing, semi-cupped structures, each divergent (Pl. X) .... *Bombus* (p. 44)

   Frontal outline of head triangular or subtriangular, usually somewhat higher than wide; malar space at least as long as distance between and including mandibular articulations; males markedly dimorphic, tibia (most species) with at least scattered hairs over proximal half of outer surface; sagittal head always hooked mesad (Pls. XXI-XXIV) .... *Pyrobombus*, subg. *Pyrobombus*

Genus *Bombus* Latr., 1802, p. 385

Type: *Apis terrestris* L., 1758, p. 578. Monobasic

[*Bremus* Jur. (Panz.), 1801*a*, p. 164. Type: (*Apis*) *Bombus terrestris* (L.), 1758 p. 578; designated by M. & D., 1914 (1915), p. 428.] Generic name invalidated, Int. Com. Zool. Nomen., Opin. 135, 1939.

Leucobombus D.T., 1880, p. 40. Type: (*Apis*) *Bombus terrestris* (L.), 1758, p. 578; designated by Sandhouse, 1943, p. 564.

Terrestribombus Vogt, 1911, p. 55. Type: [*Bremus*] *Bombus terrestris* (L.), 1758, p. 578; designated by Frison, 1927*e*, p. 67, (absolute tautonomy).

TERRESTRIS GROUP

KEY TO SPECIES

Females

1. Metabasitarsite evenly arched along posterior margin from auricle to apex, widest at or near middle, about as strongly arcuate proximally as distally; clypeus medially evenly convex; smooth, polished ocellar one-half of ocellocular area narrowly extended diagonally forward toward upper inner eye margin; thoracic pleura black below, at least near leg bases, rarely not 2

   Metabasitarsal posterior margin more strongly arcuate proximally than distally; clypeus not evenly convex, transversely depressed below, less punctate medially than elsewhere, coarsely sculptured at latero-ventral corners; smooth, polished ocellar one-half of ocellocular area not noticeably projecting diagonally from ocelli toward upper inner eye margin; thoracic pleura yellow to leg bases; worker usually with well-defined or indistinct moderately wide interalar black band, basal half of abdominal T2 rufous, these latter features usually absent in queen .... *affinis* Cr. (p. 67)

2. F1 about equal to F3; metabasitarsite evenly, not strongly arcuate along posterior margin, little more than twice as long as greatest width, distal and proximal (just beyond auricle) widths about equal; punctation on clypeus somewhat coarse, dense, rather uneven; light pubescence always citron yellow or paler, this normally

on thoracic dorsum anterior to tegulae, over all abdominal T2 (sometimes advanced on T1, present irregularly on T3), with white on T4 distally (or more), T5, sides of T6, remainder of body usually entirely black; rarely scutellum pale, resulting in evidence of distinct interalar black band .... *lucorum* (L.) (p. 45)

F1 little longer than F3; metabasitarsite with posterior margin more strongly arcuate, not more than about twice as long as greatest width; color pattern not as above .... *terricola* Kby. (p. 52)

Males

1. F1 plus F2 distinctly shorter than F3 plus F4; metabasitarsite evenly strongly arcuate along posterior margin from base to apex, distinctly longer than succeeding segments combined, outer surface about equally convex longitudinally from base to apex; abdominal T1 yellow, T2 usually yellow with rufous or rufescent tinge; genitalia (Pl. X) .... *affinis* Cr. (p. 67)

   F1 plus F2 subequal or equal to F3 plus F4; metabasitarsite less strongly arcuate along posterior margin, usually attenuate at basal half; abdominal T1 most often entirely black or predominantly so 2

2. Metabasitarsite approximately equally wide from middle to apex, disto-posterior angle rather sharp, posterior fringe fine, long basally, progressively shorter distally; hind tibial disto-posterior angle often sharp; light body pubescence citron yellow or paler, covering abdominal T2 entirely; abdominal T1 and T3 (usually both) entirely black, T4 distally (more or less), T7 white; genitalia (Pl. X) .... *lucorum* (L.) (p. 45)

   Metabasitarsite usually distinctly narrower distally, base considerably attenuated, posterior fringe shorter than above, with few longer hairs near base; genitalia (Pl. X) .... *terricola* Kby. (p. 52)

Bombus lucorum (L.)

Key to Subspecies

Females

Thoracic dorsum anterior to tegulae, abdominal T2 (sometimes encroaching on T1, present irregularly on T3) citron yellow; T4 (distally or more), T5, sides of T6 white; scutellum rarely with pale pubescence; remainder black .... *l. lucorum* (L.) (p. 45)

Thoracic dorsum anterior to tegulae, scutellum rarely, abdominal T2 (sometimes distally on T1, irregularly on T3), T4 (varying amount), T5, sides of T6 white; remainder black .... *l. patagiatus* Nyl. (p. 51)

Males

Thoracic dorsum anterior to tegulae, frequently on scutellar posterior margin especially, abdominal T2 (frequently distally on T1, sometimes irregularly on T3) pale to drab yellow; T4 (sometimes along postero-lateral margin), T5-7 white .... *l. lucorum* (L.) (p. 45)

Color as above, except pale or drab yellow entirely replaced by white .... *l. patagiatus* Nyl. (p. 51)

Bombus lucorum lucorum (L.)

Apis lucorum L., 1761, p. 425, (re: nominate ssp. only): *Bombus lucorum* v. *moderatus*, Slad., 1919*b*, p. 31G; Beq., 1920*a*, p. 293, [n. syn.]: *Bombus moderatus* Cr., 1863*a*, p. 109, (*pro modestus* Cr., 1863*a*, p. 99, ♀, *nec* Eversm., *nec* Sm., *cf. seq.*), [n. syn.]: *Bombus modestus* Cr., 1863*a*, p. 99, (♀, not ♀), (*nec* Eversm., 1852, p. 134; *nec* Sm., 1861, p. 153), [n. syn.]: *Bombus terrestris* v. *lucorum*, Schmied., 1878, p. 361, (*nec Apis terrestris* L., 1758, p. 578), [n. syn.]: *Bombus terrestris* v. *moderatus*, F. & G., 1908, p. 111, (*nec A. terrestris* L., 1758, p. 578), [n. syn.]: *Bombus terrestris* v. *schmiedeknechti* Verh., 1892, p. 205, (*nec A. terrestris* L., 1758, p. 578), [n. syn.]: *Bombus terricola*, Handl., 1888*a*, p. 234 (p.p.), (*nec* Kby., 1837, p. 273), [n. syn.]: *Bombus terricola* v. *modestus*, Fr., 1902, p. 487, (*nec* Kby., 1837, p. 273), [n. syn.]: *Bombus* (Terrestris group), Rad., 1884, p. 80 (p.p.): *Bombus* (*B.*) *moderatus*, Brs., 1951, p. 1250, *In* Muesebeck *et al.*, [n. syn.]: *Bombus* (*B.*) *terrestris* v. *moderatus*, Fkln., 1912, p. 262, (*nec A. terrestris* L., 1758, p. 578), [n. syn.]: *Bombus* (Terrestris group), Fkln., 1912, p. 261, (p.p.); Mlrn., 1961*a*, p. 55, (p.p.): *Bremus moderatus*, Fris., 1924, p. 293, [n. syn.]: *Bremus* (*Terrestribombus*) *moderatus*, Fris., 1927*e*, p. 67, [n. syn.]: *Terrestribombus lucorum*, Skor., 1922*a*, pp. 77, 99, (text); p. 155, (list): *Terrestribombus lucorum* f. *magnus* Vogt, 1911, p. 56, [n. syn.]: *Terrestribombus moderatus*, Skor., 1922*a*, p. 155, (list), [n. syn.]. *Bombus l. jacobsoni* Skorv., 1912*b*, p. 610, [n. syn.).

DESCRIPTION. **Queen.** Length, 18–20 mm; thoracic width, 9–10 mm; abdominal T2 width, 10–11 mm. *Head:* Frontal outline trapezoidal, slightly wider than high above labrum; ocelli touching supraorbital line, moderate in size, lateral ones about as far apart as each is from a compound eye, together forming a weak arc; vertex smooth and distinctly concave posteriad of ocelli, ocular half of ocellocular space with stronger and more widely separated punctures mesally; clypeus evenly and strongly convex, rather uniformly and strongly punctate, more densely so ventrolaterally; malar space weakly irregularly convex, minutely sculptured, distinctly shorter than distance between (and including) articulations; anterior surfaces of labral tubercles well-defined triangulate, densely sculptured, depression between not deep and sharp, ventral surfaces concave and less distinctly sculptured, labral shelf arcuate, rather wide, extended to just within each tubercle; mandible with conspicuous sulcus obliquus, prominent incisura lateralis, its dorsal and median principal carinae of similar width, gradually attenuated distally, latter weakly and evenly arched but not strongly united basally with former; flagellum approximately 1⅗ longer than scape, F1 a little less than twice its distal width, distinctly longer than F2 but very little more than F3; mesoscutum sparsely punctate over considerable area behind median stria; triangular area on mid-distal margin of especially abdominal T2 and T3 noticeably impunctate; hypopygium without sharp median carina; outer surface of hind tibia weakly granulose to glabrous; metabasitarsite with posterior margin evenly and strongly arcuate, outer surface weakly concave, only slightly alutaceous; body pubescence not compact, of moderate length, rather even, medium coarse, denser over most of thoracic dorsum. *Color*: Head black; thorax above anteriad of tegulae vivid deep yellow, extending onto upper one-third of pleura, remainder of thorax black; abdominal T2 vivid yellow (sometimes conspicuous small white patches laterally) except few black hairs narrowly along distal margin, T4 on its distal third and all T5 white, remainder of abdomen black; legs black except most of pubescence at tips of basal segments and beyond with ferruginous tinge; wing membrane lightly stained with brown, venation dark.

Worker. Length, 9–15 mm; thoracic width, 6–9 mm; abdominal T2 width, 5–9 mm. Structurally similar to the queen except the flagellum is shorter in relation to scape (only about 1½ times longer) and F1 is somewhat longer in relation to F3. Color of pubescence as in the queen except rather paler yellow, and the lateroapical margins of distal abdominal sterna have pale or whitish hair; wing membrane somewhat less deeply stained.

Male. Length, 13–16 mm; thoracic width, 9–10 mm; abdominal T2 width, 8–9 mm. *Head:* Frontal outline trapezoidal, distinctly wider than high above labrum; ocelli small, on supraorbital line, situated in near straight line; vertex smooth and concave laterad and posteriad of ocelli, ocular half of ocellocular space with rather sparse but distinct punctures; front of head thickly pubescent, clypeus rather densely and evenly punctate; labrum irregularly sculptured, transversely convex except laterocentrally slightly concave; malar space about equal to width between (and including) articulations, weakly convex and rather densely covered with small punctures; flagellum little more than twice scape, F1 less than twice its distal width, distinctly longer than F2 and only slightly shorter than F3; outer surface of hind tibia mid-longitudinally convex, weakly and finely granulose; metabasitarsite narrower at base than at apex, its outer surface rather broadly and deeply concave, its posterior margin arcuate proximally, weakly so beyond; last exposed abdominal sternum with deep transverse concavity, its distal margin feebly emarginate medially. Genitalia, seventh and eighth abdominal sterna (Pl. X). *Color:* Triangular area on vertex with noticeable admixture of yellow, otherwise head black; thoracic dorsum anteriad of tegulae and upper portion of mesopleura yellow, remainder of thorax black; abdominal T1 black except noticeable admixture of yellowish hairs, T2 all yellow except narrowly black medially along its posterior margin, distal one-third of T4 and all of T5–T7 white, remainder of abdomen above and beneath black except lateral and posterior margins of distal sterna pale or whitish; legs black except hind tibial fringes pale-tipped and tarsal pubescence noticeably ferruginous; wing color similar to that of worker.

Redescribed from hypotypes. **Queen**, Rampart House, Yukon Territory, 23-V-1951, C.C. Loan; **worker**, Fort McPherson, Northwest Territories, 9-VII-1957, R. Hurley; **male**, Nabesna Road, Alaska, 7-VIII-56. Hypotypes in the Canadian National Collection, Ottawa.

TYPE. Male in the Linnean Collection, Burlington House, London. I saw this specimen but did not examine it closely. There seems to be some question as to the correct identity, that is, whether it actually represents *terrestris* or *lucorum*. However, until such time as this is resolved I choose to accept it as the type of *Apis lucorum* Linné.

TYPE LOCALITY. Presumably Sweden. Number of specimens at hand: 606. In flight: from early May to September, the males first making their appearance some time during the second half of July. Distribution: (vertical), from sea level to 4000 ft; (horizontal), Alaska southward to parts of southern British Columbia and Alberta, and eastward through Yukon Territory and Northwest Territories. Floral visitations: *Petasites* is the only available botanical record for this taxon under the name *lucorum* in the Western Hemisphere.

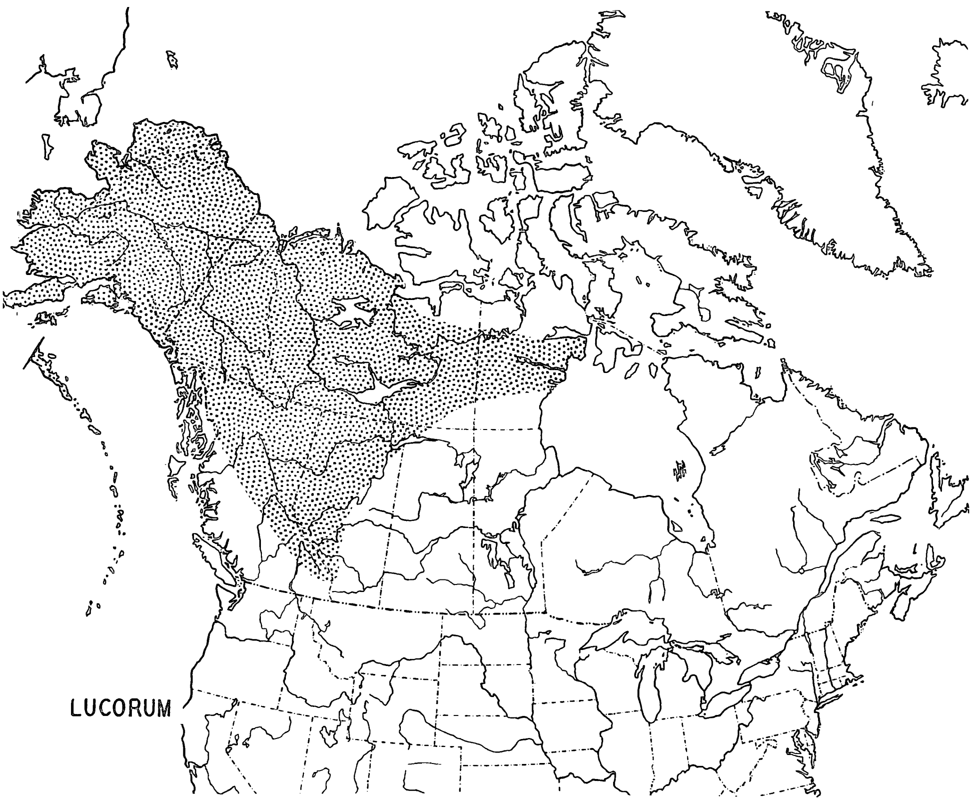
VARIATION. Little significant structural variation is evident in this species. Chromatically, however, the following should be noted. *Queen and worker*: Pattern rather stable except sometimes the yellow is pale or fulvous, or it may be present in varying amounts beyond that described; yellow may appear over all the mesothoracic pleura; or, yellow may be present on the scutellum in varying amounts, on abdominal T1, and to a lesser degree on T3. Often the distal abdominal sterna have noticeably pale or whitish pubescence, especially laterally along their apices or at their sides; also, T6 may have white pubescence at its sides. This condition represents the atypical paler individuals. Freakish variants, especially with respect to the abdominal pattern also are rather common. *Male*: Much more tendency to vary in the same direction is apparent, so that often specimens have some intermixture of yellow on the face, and all the thoracic pleura may be yellow except usually beneath the wing bases or on the metapleura; much yellow may occur on the scutellum; all of abdominal T1 may be yellow, but rarely is there any admixture of this color on T3.

I have observed in Eastern Hemisphere material this same kind and degree of variations as described above for specimens from the Western Hemisphere.

COMMENTS. This widely distributed species continues into Siberia and appears to be locally common at many places across the northern part of Eurasia to the British Isles, and also occurs at higher elevations in south-central Europe and in parts of the Middle East. Abroad, numerous names have been applied to its various component populations, some of which apparently do represent good subspecies. Our form in the Western Hemisphere does not differ in any significant respect from that which occurs across northern Eurasia to Sweden and England.

Lighter specimens of *lucorum* bear a close superficial resemblance to *terricola* (subspecies *occidentalis* Greene) which appears to have evolved from it. In areas where these two are allopatric there does not, however, appear to be hybridization; at least, this phenomenon has not been detected among the material studied.

The subspecies is boreal, and nearly circumpolar, being absent in all Canadiar arctic islands, Greenland, and Iceland. It does not occur in northern Canada east oi Hudson Bay.



MAP 1

CANADA

QUEENS

Alberta: 5 Banff, 21-V-1915, F.W.L.S. [CNC]; 1 Maligne Lake, 1-3 J[ul]y '15, E.L. Diver, (Cornell U[niversity], Lot 619, sub. 251) [CU]. **Northwest Territories:** 1 Aklavik, 12-VI-1956, R.E.L.; 2 Aklavik, 13-VI-1956, R.E.L.; 1 Aklavik, 22-VI-1956, E.F.C.; 1 Cameron Bay (Great Bear Lake), 12-VII-1937, T.N.F.; 1 Cameron Bay (Great Bear Lake), 22-VII-1937, T.N.F.; 1 F[or]t McPherson, 27-VI-1957, S.D.H.; 2 Norman Wells, 9-VI-1949, S.D.H.; 1 Norman Wells, 22-VI-1949, W.R.M.M.; 1 Norman Wells, 30-VI-1949, W.R.M.M.; 1 Norman Wells, 12-V-1953, J.S.W.; 1 Norman Wells, 16-V-1953, C.D.B.; 3 Norman Wells, 18-V-1953, C.D.B.; 6 Norman Wells, 18-V-1953, J.S.W.; 4 Norman Wells, 19-V-1953, C.D.B.; 3 Norman Wells, 20-V-1953, C.D.B.; 2 Norman Wells, 24-V-1953, J.S.W.; 1 Norman Wells, 27-V-1953, C.D.B.; 1 Norman Wells, 27-V-1953, J.S.W.; 1 Reindeer Depot (Mackenzie Delta), 23-VI-1948, W.J.B.; 1 Reindeer Depot (Mackenzie Delta), 2-VII-1948, J.R.V.; 1 Reindeer Depot (Mackenzie Delta), 8-VII-1948, J.R.V.; 2 Sawmill Bay, 17-VI-1948, D.F.H.; 3 Sawmill Bay, 20-VI-1948, D.F.H.; 1 Sawmill Bay, 21-VI-1948, D.F.H.; 1 Yellowknife, 24-VI-1949, R.R. Hall [all, CNC]. **Yukon Territory:** I Firth River, 14-VII-1956, E.F.C.; 1 Rampart House, 18-V-1951, J.E.H.M.; 2 Rampart House, 19-V-1951, J.E.H.M.; 1 Rampart House, 20-V-1951, C.C.L.; 2 Rampart House, 20-V-1951, J.E.H.M.; 7 Rampart House, 21-V-1951, J.E.H.M.; 6 Rampart House, 22-V-1951, J.E.H.M.; 3 Rampart House, 23-V-1951, C.C.L.; 2 Rampart House, 26-V-1951, C.C. Loan; 5 Rampart House, 26-V-1951, J.E.H.M.; 2 Rampart House, 28-V-1951, C.C.L.; 1 Rampart House, 28-V-1951, J.E.H.M.; 5 Rampart House, 19-VI-1951, C.C.L.; 1 Rampart House, 7-VII-1951, C.C.L. [all, CNC]. **Locality indeterminate:** 1 Fort Cudaley [? Cudahy], 25-VIII-96, W. O'Isilvie; 1 Outpost, 26-VII-45 [all, CNC].

UNITED STATES

QUEENS

Alaska: 1 Alitak, V-26-33, (Acc. 3313); 1 Kodiak, 7-23-15, (Acc. 4859) [all, AMNH]; 2 Napaskiak, June 15, '16, on *Petasites* [MCZ]; 1 Nulato, VII-25-1916 [AMNH]; 1 Richard[son] H[igh]w[a]y (mile 250), 26-V-1951, W.R.M.; 1 Richard[son] H[igh]w[a]y (mile 213), 17-VI-1951, W.R.M. [all, CNC]; 1 Umiat, 21-VI-47, C. Schultz [HEM].

CANADA

WORKERS

Alberta: 1 Banff (summit of Sulphur M[oun]t[ain], 8-VIII-10, N.B. Sansen [CNC]; 2 Jasper Park, VIII-1915, (Am[erican] Mus[eum] of Nat[ural] Hist[ory], Dept. Invert. Zool., No. [—]), [INHS]. **British Columbia:** 1 Chilkat Pass (mile 75), 13 July 1948, Mason & Hughes, 3500 ft [CNC]; 1 Halfway R[iver] (12 mi W. Pink M[oun]t[ain], Upper Peace R[iver] Dist[rict]), VII-21-1932, J. de N. Henry, 3000 ft; 2 Redfern L[a]k[e] (Upper Peace R[iver] Dis[trict]), VIII-21-1932, J. de N. Henry, 3000 ft [all, ANSP]. **Northwest Territories:** 1 Cameron Bay (Great Bear Lake), 6-VII-1937, T.N.F.; 1 Cameron Bay (Great Bear Lake), 7-VII-1937, T.N.F.; 1 Cameron Bay (Great Bear Lake), 12-VII-1937, T.N.F.; 1 Cameron Bay (Great Bear Lake), 15-VII-1937, T.N.F.; 4 Cameron Bay (Great Bear Lake), 19-VII-1937, T.N.F.; 3 Cameron Bay (Great Bear Lake), 21-VII-1937, T.N.F.; 2 Cameron Bay (Great Bear Lake), 22-VII-1937, T.N.F.; 15 Cameron Bay (Great Bear Lake), 27-VII-1937, T.N.F.; 1 Cameron Bay (Great Bear Lake), 16-VIII-1937, T.N.F. [all, CNC]; 1 Fairchild P[oin]t (Great Slave Lake Region), July 27, 1927, (Car[ne]g[ie] Mus[eum], Acc. 8158, Theodore H. Frison Coll[ectio]n) [INHS]; 3 F[or]t McPherson, 9-VII-1957, S.D.H.; 1 F[or]t McPherson, 9-VII-1957, R. Hurley; 5 F[or]t McPherson, 15-VII-1957, R. Hurley; 3 F[or]t McPherson, 16-VII-1957, S.D.H.; 1 F[or]t Norman (Mackenzie River), 6-VIII-1922, C.H. Crickmay; 1 F[or]t Rae (G[rea]t Slave L[ake] Reg[ion]), 8-VII-1913, J. Russell; 1 Fort Wrigley (Mackenzie River), 31-VII-1922, C.H. Crickmay; 1 Norman Wells, 25-V-1953, J.S.W.; 1 Reindeer Depot (Mackenzie Delta), 8-VII-1948, J.R.V.; 2 Reindeer Depot (Mackenzie Delta), 10-VII-1948, J.R.V.; 17 Reindeer Depot (Mackenzie Delta), 2-VIII-1948, J.R.V.; 13 Reindeer Depot (Mackenzie Delta), 10-VIII-1948, J.R.V.; 25 Reindeer Depot (Mackenzie Delta), 17-VIII-1948, J.R.V.; 1 Reindeer Depot (Mackenzie Delta), 19-VIII-1948, J.R.V.; 1 Reliance, 14-VIII-45 [all, CNC]. **Yukon Territory:** 4 Dry Creek, 23 July, 1948, Mason & Hughes; 3 Dry Creek, 25-VII-1948, W.R.M.; 1 Firth R[iver] (British M[oun]t[ain]s), 24-VII-1956, E.F.C.; 1 Rampart House, 22-V-1951, J.E.H.M.; 1 Rampart House, 23-V-1951, C.C.L.; 2 Rampart House, 10-VII-1951, C.C.L.; 2 Rampart House, 12-VII-1951, C.C.L.; 2 Rampart House, 13-VII-1951, C.C.L.; 2 Rampart House, 15-VII-1951, C.C.L.; 2 Rampart [House] (10 mi S. [of]), D.H. Nelles, 030 [all, CNC]. **Locality indeterminate:** 1 Tazin River (about 9 mi below Hill Island Lake), July 18-22, 1914, F. Harper; 1 Utsingi P[oin]t, 17-VIII-45 [all, CNC].

UNITED STATES

WORKERS

Alaska: I Alfred C[ree]k, VII-1922, R.A. Pope [CU]; 8 Gulkana (Paxson Lodge), 30-VII-1951, W.R.M.M.; 19 Gulkana (Paxson Lodge), 31-VII-1951, W.R.M.M.; 1 King Salmon (Naknek R[iver]), 19-VII-1952, J.B.H.; 2 King Salmon (Naknek R[iver]), 1-VIII-1952, J.B.H.; 1 King Salmon (Naknek R[iver]), 3-VIII-1952, J.B.H.; 8 King Salmon (Naknek R[iver]), 16-VIII-1952, W.B.S.; 7 King Salmon (Naknek R[iver]), 20-VIII-1952, W.B.S. [all, CNC]; 1 Kodiak, July 20, '99, T. Kincaid, (Harriman Expedition, '99), [NRS]; 1 Kodiak, 7-19-15, (Ac. 4859); 5 Kodiak, 17-19-15; 13 Kodiak, 7-25-15 [all, AMNH]; 2 Kodiak, Sept. '17, Jas. S. Hine, (Theodore H. Frison Coll[ectio]n) [INHS]; 62 [Mount] McKinley Nat[iona]l Park, July 30, 1951, H.C.S. 1750′ [SD]; 1 Nome, Aug. 24-25, '16, (Canadian Arctic Expedition, F.J., No. 57) [CNC]; 1 Nulato, VII-25-1916; 1 Paxson (Copper R[iver]), VIII-23-1929, 2700′ [all, AMNH]; 1 Richard[son] H[igh]w[a]y (Donnelly Dome, Mile 249), 25-VI-1951, W.R.M.M.; 5 Richard[son] H[igh]w[a]y (Mile 241), 21-VII-1951, W.R.M.M.; 17 Richard[son] H[igh]w[a]y (Mile 250), 27-VII-1951, W.R.M.M. [all, CNC]; 1 Steese H[ighway, Kenai Peninsula] (M[ile] P[ost] 110, Eagle Summit), 15-VII-54, C.P. Alexander, 3800′ [MASS]; 2 Summit L[ake] (Isabella Pass, mi. 198), 1-VIII-1951, Mason & McGillis [CNC]; 1 Umiat, 28-VII-47, C. Schultz [HEM].

CANADA

MALES

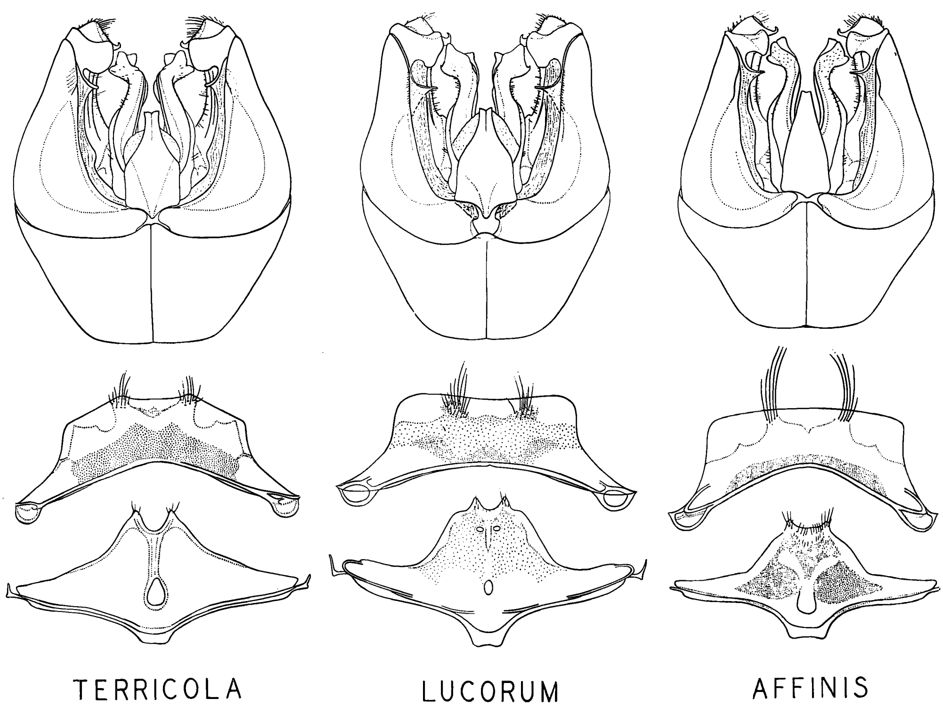
Alberta: 1 Banff, 2-VIII-1907, J. Fletcher; 1 Banff, N.B. Sanson [all, CNC]. **Northwest Territories:** 1 Fort Wrigley (Mackenzie River), 25-VII-1922, C.H. Crickmay [CNC]; 1 Fort Wrigley (Mackenzie River), 25-VII-1922, C.H. Crickmay, (Theodore H. Frison Collection)[INHS]; 1 Cameron

Bay (Great Bear Lake), 19-VII-1937, T.N.F.; 2 Cameron Bay (Great Bear Lake), 19-VII-1937, T.N.F.; 10 Cameron Bay (Great Bear Lake), 27-VII-1937, T.N.F.; 2 Norman Wells, 20-VIII-1956, R.E.L.; 1 Reindeer Depot (Mackenzie Delta), 2-VIII-1948, J.R.V.; 1 Reliance, 13-VIII-45 [all, CNC]. **Locality indeterminate:** 1 Toltheilei, 16-VIII-45 [CNC].

UNITED STATES

MALES

Alaska: 8 Kodiak, 6-19-15, [3 mislabeled '95] [AMNH]; 1 Kodiak, 7-23-15 [AMNH]; 1 Kodiak, VII-23-15, (Theodore H. Frison Collection) [INHS]; 1 Kodiak, 7-25-15; 1 Kodiak, Sept. '17, Jas. S. Hine, (Ac. 5094); 1 Kodiak, Sept. '17 (Ac. 5094); 2 Kodiak, Sept. '17, Jas. S. Hine [all, AMNH]; 167 Mount McKinley Nat[iona]l Park, July 30, 1951, H.C.S. 1750′ [SD]; 1 Nabesna R[oa]d, 7-VIII-56 [MCZ]; 1 Nulato, VII-24-1916 [AMNH].



(TERRESTRIS GROUP)

PLATE X.

Bombus lucorum patagiatus Nyl.

Apis lucorum L., 1761, p. 425 (p.p., paranominate ssp. only: *Bombus patagiatus* Nyl., 1848, p. 234, (Adnot), (re: paranominate ssp. only): *Bombus albocinctus* Sm., 1854, p. 397, [n. syn.]: *Bombus florilegus* Pnlfv., 1956, p. 1334; Tkalcu, 1962, p. 92, [n. syn.]: *Bombus terrestris* v. *japonicus* Fr., 1909*a*, p. 674, (*nec japonicus* D.T., 1890, p. 139; *nec A. terrestris* L., 1758, p. 578): *Bombus terrestris* v. *patagiatus* Fr., 1902, p. 487, (*nec A. terrestris* L., 1758, p. 578): *Bombus viduus* Erick., 1851, p. 65: *Bombus* (Terrestris group), Fkln., 1912, p. 261, (p.p.): Mlrn., 1961*a*, p. 55, (p.p.): *Terrestribombus albocinctus* Skor., 1922*a*, pp. 146, 154, (list): *Terrestribombus lucorum albocinctus* Bisch., 1930*a*, p. 4.

DESCRIPTION. **Queen, Worker.** Structurally like that of nominate subspecies. Thoracic dorsum anterad of tegulae, upper portion of pleurae and abdominal T2 pale yellowish-white to white, concolorous with T4 distally and all T5 (or nearly so).

Male (no Western Hemisphere specimens seen). Very much like the male of the nominate subspecies, except pubescence for that described as yellow is white or whitish, for this subspecies.

Original description, *B[ombus] patagiatus* Nyl., 1848, p. 234, no. 16, Adnot., verbatim.—*in lieu* of sufficient material at hand to adequately describe this taxon.

> "*Hirsuities albida vel albo-flavescens, verticis, fasciae latissimae thoracia (in metapleuria descendentis ibique angustioris) et segmenti tertii abdominis atra, pedum nigra vel in femoribus saltem basi albida, corbicularum ciliis fuscis vel obscure fulvescentibus; os descendens, longitudo corporis fere 20 millim.,* ♀, E. Sibiria, D. Sahlberg.
>
> *Ab*[.] *affinibus mox distinguitur colore hirsutiei collaris et scutelli alba vel albida et ore protracto. Ala ant. fere l6 millim. longa. Hirsuties saltem segmenti secundi abdominis flavescens vel etiam analis. Pilositas corporis infra alba vel albida*".

TYPE. Not examined. Either ♀ or ☿, Nylander (1848, Adnot., p. 234), probably in the collection of the Zoological Museum, University of Helsinki, Helsinki, Finland, though I did not find it because of lost identity.

TYPE LOCALITY. E[astern] Siberia; for *Bombus albocinctus* Sm., Kamchatka [Peninsula, USSR]. Specimens seen: several from northeastern Siberia, Kamchatka Peninsula, and western Aleutian Islands. In flight: no exact data are available. Distribution: northeastern Siberia, and peninsular areas to Alaska Peninsula (Aleutian Range). Floral visitations: no definite records are available.

UNITED STATES

QUEEN, WORKERS

Alaska: 1 "Bering Islands", July 30 to Aug. 1, 1922, Stejneger [USNM, det. *albocinctus* Sm., Fris.].

Bombus terricola Kby.

KEY TO SUBSPECIES

Females

Thoracic dorsum anterior to tegulae, scutellum (usually at least part), abdominal T2, T3 light to golden yellow; abdominal T4 (distally or more), sides of T6 tawny yellow; remainder of thorax, abdomen black (variable) .... *t. terricola* Kby. (p. 52)

Thoracic dorsum usually yellow anterior to tegulae, posteriorly with variable black band between wing bases (then some yellow on scutellum) or all either black or predominantly yellow; distal abdominal terga much as in *l. lucorum*; abdominal Tl usually black, T2, T3 usually all black though often with varying amounts of yellow (variable) .... *t. occidentalis* Grne. (p. 58)

Males

Abdominal T2, T3 yellow; usually T6 (sides) – 7 with tawny yellow, though sometimes black; no parts of T4–6 with distinct white pubescence; genitalia (Pl. X) .... *t. terricola* Kby. (p. 52)

Abdominal T2–3, either or both entirely black, or either or both with varying amounts of yellow; T4 (distally or more) – 7 white, much as in *l. lucorum*; genitalia essentially same as that of the above (Pl. X), averaging somewhat smaller .... *t. occidentalis* Grne. (p. 58)

Bombus terricola terricola Kby. New Status

Bombus terricola Kby., 1837, p. 273, (re: nominate ssp. only): *Bombus terrestris* v. *terricola*, F. & W., 1910, p. 28, (*nec A. terrestris* L., 1758, p. 578): *Bombus terricola,* Handl., 1888*a*, p. 234, (p.p.): *Bombus* (*B.*) *terricola* Fkln., 1912, p. 274: *Bombus* (Terrestris group), Mlrn., 1961*a*, p. 55 (p.p.): *Bombus* (*B.*) (Terrestris group), Fkln., 1912, p. 261, (p.p.): *Bremus terricola,* Fris., 1919*a*, p. 160 (*et seq.*): *Bremus* (*Terrestribombus*) *terricola*, Fris., 1927*e*, p. 67: *Terrestribombus terricola,* Skor., 1922*a*, p. 155, (list).

DESCRIPTION. **Queen.** Length, 17.5 mm; width at wing bases, 9.5 mm; abdomen, 10.5 mm, width across T2, 9.0 mm; front wing length, 16.0 mm, width, 5.5 mm. *Head:* Frontal outline broadly triangulate (excluding mouthparts), slightly wider than high; vertical region nearly flat, with rather deep coarse well-separated punctures except smooth and polished for considerable distance laterad and posteriad of lateral ocelli (ocellar half of ocellocular area), this smoothness extended antero-laterad into ocular half of ocellocular area; ocelli situated almost transversely, about as far apart as their diameters, interocellar and ocellocular lines equal; outline of compound eye only little narrower and slightly convergent above than below, little less than 3 times higher than broad; clypeus wider than high, its whole surface covered with small to large punctures, the median ventral area weakly convex; labrum nearly 3 times wider than thick, the ventral margin broadly arcuate, its surface strongly punctate including that on moderately strong tubercles transversely directed medially antero-ventrad, the intertubercular depression narrow, shallow and irregularly punctate, the moderately strong labral shelf irregularly arcuate medially; malar space shorter than distance between (and including) mandibular articulations, irregularly convex with few small punctations; flagellum less than 1½ times as long as scape, F1 little less than twice as long as distal width, distinctly longer than F2 but only perceptibly longer than F3, about ⅔ as long as F2 and F3 combined. *Legs:* Mesobasitarsite elongate rectangular, its obscurely rounded posterior angle recessed; outer hind tibial surface irregularly flat, glossy except for weak alutaceous sculpture; metabasitarsite twice as long as widest dimension, the posterior margin arcuate from base to distal end (widest medially), outer surface nearly flat, the disto-posterior angle arcuate and slightly extended beyond antero-posterior angle. *Pubescence:* Medium in length, even, compact (or dense), some longer and stronger on face, vertex and on distal abdominal terga; metabasitarsal fringe slightly longer on basal one-third beyond stronger and declining in length to distal end. *Color:* Head black except intermixture of fine dull yellow on face and vertex. Thorax black except golden (buff) yellow on pronotum and transversely on mesonotum from tegula to tegula, dorsally on mesopleurum ventro-anteriad of wing bases, the scutellum with admixture of dull yellow along its posterior half. Legs black (*cf.* under "Comments"). Abdomen black except T2-3 entirely covered with ochraceous (cadmium) yellow pile, the posterior margin of T5 and ventro-lateral margin of T6 with paler yellow hairs. Wings uniformly stained with brown.

Worker. Length, 15.0 mm; width at wing bases, 7.0 mm; abdomen, 8.0 mm, width across T2, 8.0 mm; front wing length, 12.5 mm, width, 4.0 mm. Morphological characteristics otherwise similar to those of the queen, except F1 about 1½ times as long as distal width, much shorter than rectangular F2 and subsequal to F2 and F3 combined. *Legs:* Similar to those of queen. *Pubescence:* Structurally similar to that of queen. *Color:* Head entirely black. Thorax as in queen except absence of noticeable pale pile on posterior scutellar margin. Abdomen as in the queen except pale (yellowish) pile on T5–6 is muched reduced.

Male. Length, 14.0 mm; abdomen, 7.0 mm, width across T2, 6.5 mm; width at wing bases, 6.5 mm; front wing length, 14.0 mm, width, 4.5 mm. *Head:* Frontal outline (excluding mouthparts) rounded trapezoidal, slightly wider than high; compound eye 2½ times higher than wide, more broadly rounded below than above, its inner margin weakly concave outwardly, though more strongly so dorsally; vertex nearly flat, mostly with irregular small to medium punctures except inner half of ocellocular area smooth and polished extending somewhat antero-laterally, the ocular half of ocellocular area with few irregularly arranged medium to small punctures; ocelli situated immediately below supraorbital line in nearly transverse position, each slightly closer together than their diameter, interocellar line little longer than ocellocular line; malar space perceptibly shorter than distance between (and including) mandibular articulations, its surface irregularly weakly convex, with few microscopic hairs anteriorly and especially posteriorly; labrum rectangular, about 2½ times wider than thick, its anterior margin arcuate at lateral corners, straight medially; flagellum little less than twice as long as scape, F1 nearly equal in length to F3, distinctly longer than F2 which is slightly longer than wide. *Legs:* Mesobasitarsite subrectangular, about 3 times longer than wide; hind tibial outer surface evenly convex mid-longitudinally, smooth, polished and devoid of hairs except on its basal third; metabasitarsite 3 times longer than wide, subrectangular, its outer surface nearly flat with recumbent microscopic pile, the posterior fringe longest (near widest dimension of segment), progressively lessening to very short rigid hairs distally. *Pubescence:* Somewhat longer and noticeably looser than that of queen and worker. Genitalia, seventh and eighth abdominal sterna (Pl. X). *Color:* Similar to that of female but generally light areas slightly paler, especially on head (which is usually predominantly yellow below antennal bases) and thorax; middle femur posteriorly and hind femoral fringe with noticeable dull burnt sienneous hairs; abdominal T1–3 similar to that of female; T5–6 distally (and disto-laterally), T7 (mostly) with pale sienneous yellowish hairs intermixed with some black (variable, see Comments).

Redescribed from hypotypes. **Queen**, St. Paul, Minn., May 2, 1939, R.W. Dawson; **worker**, Beaver Bay, Minn., Aug. 7, 1938, R.W. Dawson; **male**, Beaver Bay, Minn., Aug. 7, 1938, R.W. Dawson [all HEM].

TYPE. Not examined. The ♀ type of Kirby cannot be located and is presumed lost; Kirby's colored figure of the ♀ in Fauna Borealis-Americana (pl. 6, fig. 4) will serve *in lieu* of the type specimen.

TYPE LOCALITY. Canada (Northwest Territories?). Number of specimens at hand: 703. In flight: late April to early October, the males on the wing in early July. Distribution: (vertical), sea level to 6800 ft; (horizontal), transcontinental in Canada, and from Maine southward to Tennessee (and likely western Georgia), thence northwestward to Montana. *Floral visitations*: *Achillea*, *Angelica*, *Apocynum*, *Aster*, *Caragana*, *Cichorium*, *Cirsium*, *Donicera*, *Echium*, *Epilobium*, *Eupatorium*, *Medicago*, *Melilotus*, *Rhododendron*, *Rosa*, *Rubus*, *Salix*, *Solidago*, *Spiraea*, *Vaccinium*, *Verbena*, *Veronica*, and *Vicia*. Lutz and Cockerell (1920) added the following compiled records: *Aesculus*, *Aralia*, *Cornus*, *Gaultheria*, *Gaylusaccia*, *Impatiens*, *Rhodora*, and *Viburnum*. Leonard *et al.* (1928) added: *Ledum*, *Oxycoccus*, and *Potentilla*, and Mitchell (1962) further compiled: *Lonicera*, *Phleum*, (*Pyrus*), *Malus*, and *Pinus* with a query (*cf.* statement under *ternarius* with respect to coniferous records).

COMMENTS. Little morphological variation of significance, other than size, has been noted in this subspecies. The smallest workers seen are between 8 and 9 mm long, the others ranging in size up to that given for the queen. Chromatically, however, there is considerable variability shown in all three castes. The yellow is often pale (maize yellow) and not the more typical golden yellow. The head of the queen and worker might as often be entirely black as with a suffusion of yellow on the face and vertex. The scutellum is usually black or predominantly so, but often is variously covered with yellow, and the usual black between the wings might be intermixed with yellow, sometimes almost all yellow. Thoracic pleura of the female sometimes predominantly yellow above, the usual pale lobe anterior to wing base being extended ventrad to cover nearly all the upper half of the mesopleurum; and, often in the male the thoracic pleura are almost entirely yellow. Corbicular fringes range from entirely black to predominantly burnt sienna. Rarely is the female abdominal T1 all yellow, but it is common to find specimens with varying amounts of tawny yellow intermixed, especially laterally, with the usual dominant black on this tergum. The presence of variable amounts of yellow on the male abdominal T1 is common. It is not unusual to note considerable black intermixed with the yellow (especially medially) along abdominal T2 anterior margin of otherwise typical females of this subspecies, this showing a trend toward and mergence with what was described by Franklin (1912: 271) as subspecies *nigroscutatus* under *occidentalis* Grne. (*cf.*). Sometimes the female abdominal terga beyond T2 are entirely black; all gradations existing from that described for T4–6 to the condition where there is a considerable intermixture of yellow on T4, and T5–6 are entirely brownish to very pallid yellow. The chromatic variability of the male abdominal terga is even more pronounced than that of the female; often T5 is almost entirely yellow, and the pile on the distal terga (especially T6–7) is pale burnt sienna, similar to that indicated for some hairs on the legs.

Compared with many other bumblebee taxa, *t. terricola* is among the more constant in color pattern. Yet, the quantity of material examined from all parts of the distribution clearly reveals a marked chromatic variation, particularly amongst the specimens collected in the southeastern and northwestern areas of its range. In the north central and western regions many specimens of all castes assume a coloration that completely merges with that of *t. occidentalis* (*cf.*) by way of what Franklin described as *nigroscutatus*. While typical far western *t. occidentalis* averages somewhat larger and would chromatically appear to be specifically distinct from *terricola* as described by Kirby, there are to me no evident constant or reliable morphological features by which specimens of these two overlapping (allopatric) populations can be positively differentiated in these areas of overlap. In such allopatric locations, obviously the two subspecies (*terricola* and *occidentalis*) interbreed and produce numerous perplexing subspecific hybrids.

CANADA

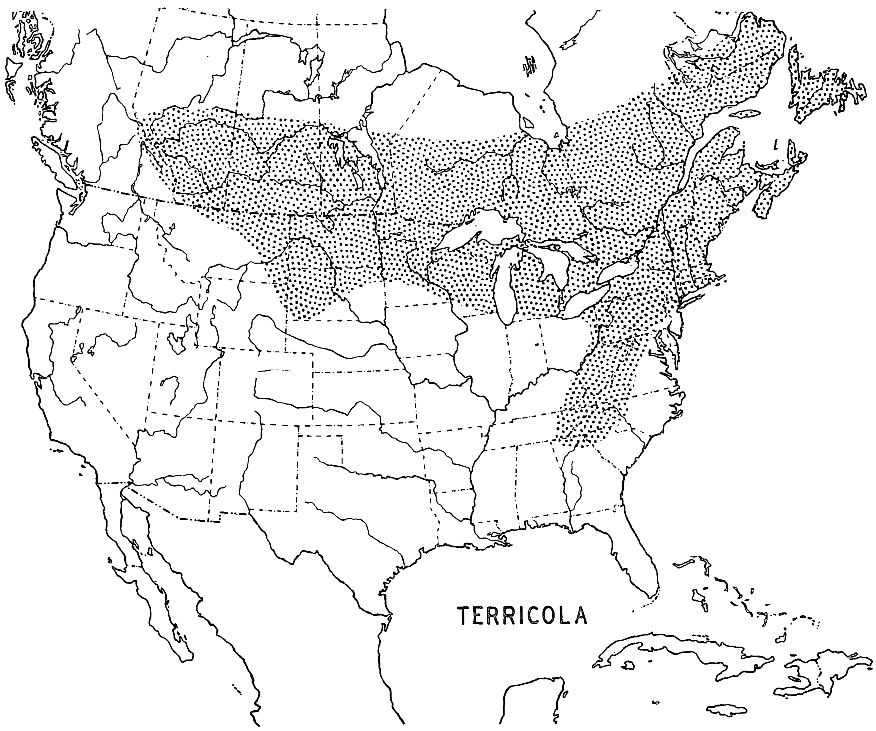
QUEENS

Alberta: 1 Edmonton, 24-V-1919, F.S. Carr [HEM]; 2 Edmonton, 16-V-1924, Geo. Salt. *Salix*; 1 Edmonton, 30-V-1924, Geo. Salt, *Caragana* [all, NRS]; I Laggan, VI-15-1886 (Bean Coll[ection] [AMNH]. **Manitoba:** 1 Cedar Lake, July 1936 [MCZ]; 2 MacCreary (E[ast] [of]), 26-VI-1961, H.E.M., on sweetclover; 1 Wanless, 29-VI-1961, H.E.M., on *Rubus*; 1 Wanless, 1-VII-1961, H.E.M., on *Rubus* [all, CNC]. **Ontario:** 1 Cedar Lake, June 1961, Wagner [CNC]; I Nakina, (Nakina T[o]wns[hi]p), July 18, 1955, Klots, F.&P.R. [AMNH]; 1 Orillia, June 12, '27 [TBM]; 1 Ottawa, 28-IV-61, H.E.M. [HEM]. **Quebec:** 1 Aylmer, 15-V-1961, G.G. Lewis; 1 Gatineau Park, 30-VII-1961, H.E.M., 1100′ [all, CNC]; 1 Parc du Mont Tremblant, 5-VI-52, A.R.; 1 Parc du Mont Tremblant, 25-VI-54, A.R.; 1 Parc du Mont Tremblant, 20-VII-1955, A.R.; 1 Parc du Mont Tremblant, 23-V-57, A.R.; 1 Région du Lac Mitassini, 21-VIII-53; Auger & Robert [all, AR]. **Saskatchewan:** 1 Regina Beach, 19-VII-1942, P. Larkin; 1 Regina Beach, 21-VII-1942, P. Larkin [all, CNC].

UNITED STATES

QUEENS

Maine: 2 Bangor, (no data), Frederich Allen Eddy Coll[ection]) [MCZ]; 1 Cutler, VIII-6-30, A.P.M. [SD]; 1 Kineo [Mountain], (no data), (Frederich Allen Eddy Coll[ection]) [MCZ]; 1 M[oun]t Desert Is[land], April 29, 1953 [CNC]; 2 M[oun]t Katahdin, (Table-Land), 25-VI-35, Dow & Hitchcock [MCZ]; 2 Orono, V-1961 [CNC]; 2 Orono, V-61 [RAM]; 3 Orono, (no data), (Frederich Allen Eddy Coll[ection] [MCZ]. **Massachusetts:** 1 Amherst, 18-12-[mo.?]-1938, [Kirsch Coll[ection]); 1 Amherst, May 2, 1952, R. Arsenault [all, MASS]; 1 Jamaica Plain, 27-V-1920, L.B. Uichanco [TBM]; 1 Martha's Vineyard, Sept. 19, 1956 (C.W. Sabrosky Coll[ection]) [USNM]; 1 Needham, V-30-28, T.B.M., *Vaccinium* [TBM]; 1 Sherborn, 8-30-13, E.J. Smith [SD]. **Michigan:** 1 Chippewa, 6-3-57, R.&K.D. [TBM]; 1 Iinterlochen, 30-VII-1937, (G.L. Gibson Coll[ection]) [USNM]. **Minnesota:** 1 Itasca Park, June 14, 1938, H.E.M.; 1 S[ain]t Paul, May 6, 1934, John Hitchcock; 12 S[ain]t Paul, May 2, 1939, R.W.D. [all, HEM]. **New Hampshire:** 1 Belknap Co[unty], 26-VIII-60, R.A.M., on *Aster macrophyllus* [CNC] 1 Balknap Co[unty], 26-VIII-60, R.A.M., *Aster macrophyllus* [RAM]; 1 Glen House, 11-VI-16 [MASS]. **New York:** 1 Ithaca,



MAP 2

May 20, '35 [COL]; Saratoga Co[unty], R.A.M., on *Salix* sp. [CNC]; 1 Saratoga Co[unty], 2-V-60, R.A.M., *Salix* sp. [RAM]. **North Carolina:** 1 M[oun]t Mitchell, Aug. 15, 1945, T.B.M.; 1 M[oun]t Mitchell, VI-24-1952, H.&A. Howden, 6600 ft [all, HEM]; 3 M[oun]t Mitchell, 12-VIII-57, J.G.C. [CNC]; 1 Great Sm[oky] M[oun]t[ains] N[ational] P[ark], (Andrew Bald Trail, 6-24-47, T.B.M., on *Rubus* [TBM]. **South Dakota:** I Sisseton, June 17, 1952, H.C.S. [SD]. **Tennessee:** 1 Gr[eat] Smoky M[oun]t[ain]s Nat[ional] Park, (M[ount] Le Conte), VI-13-54, H.E.&-M.A.E., 4-6500′ [HEM]. **West Virginia:** 1 Spruce Knob, 5-VIII-60, H.E.M., on *Epilobium* sp., 4860′; 2 Spruce Knob (R[oa]d to), Pendleton Co[unty], 14-VIII-60, H.E.M., 4000′ [all, HEM]. **Locality unknown:** 3 (no data), (C.H. Fernald [second] Coll[ection]); 2 (no data) [all, MASS].

CANADA

WORKERS

Alberta: 1 Edmonton, 30-V-1924, Geo. Salt, at *Caragana* [NRS]. **Manitoba:** 1 Brandon (N. [of]), 26-VI-1961, H.E.M., on sweetclover [CNC]; 1 Cedar Lake, July 1-15, 1936, F.M. Carpenter & C.T. Parsons; 13 Cedar Lake, July 1936 [all, MCZ]; 2 Riding M[ount]ain N[ational] P[ark], 26-VI-1961, H.E.M., 2000′ [CNC]; 1 Wanless (1 mi N. [of]), 20-VII-51, W.P. Stephen, coll[ected] on alfalfa [HEM]; 3 Wanless, 29-VI-1961, H.E.M., on *Rubus*; 1 Wanless, 4-VII-1961, H.E.M., on *Rubus*; 2 Wanless, 6-VII-1961, H.E.M., on dogbane [all, CNC]. **Newfoundland:** 1 N[orth] W[est] River, (Labr[ador]), VIII-15-1929, F.C. Sears; 1 N[orth] W[est] River, (Lab[rador]), VIII-1-1930, F.C. Sears [all, HEM]. **Nova Scotia:** 1 Hectanooga, 4-VII-1961, F.&L.; 1 Hectanooga, 7-VII-1961, F.&L.; 3 Hectanooga, 14-VII-1961, F.&L.; 4 Hectanooga, 16-VII-1961, F.&L.; 3 Hectanooga, 27-VII-1961, F.&L. [all, CNC]. **Ontario:** 2 Algonquin P[ar]k, (Annie Bay), VIII-10-1960, Paul Spangler; 1 Algonquin P[ar]k, (Annie Bay), VIII-15-1960, Paul Spangler [all, USNM]; 2 Bigshell Lake, 16-VII-1961, H.E.M. [CNC]; 1 Bluff Isl[and], Aug. 10, 1914, H.K. (Acc. 5248) [CM]; 1 Burditt Lake, 12-VII-61, H.E.M.; 1 Cedar Lake, (8-10 mi S. [of]), 13-VII-1961, H.E.M.; 4 Cedar Lake (3 mi S. [of]), 15-VII-1961, H.E.M.; 8 Cedar Lake (20 mi S. [of]), 15-VII-1961, H.E.M., on sweetclover; 1 Cedar Lake (20 mi S. [of]), 15-VII-1961, H.E.M.; 4 F[or]t Frances, 11-VII-1961, H.E.M. [all, CNC]; 1 Inwood Park (2 mi S. of Upsala), July 22, 1955, Klots, F.&P.R. [AMNH]; 3 Kenora (5-10 mi N. [of]), 13-VII-1961, H.E.M., on sweetclover [CNC]; 1 L[ake] Pelican, (Sioux Lookout), Aug. 30, [yr.?], (Carnegie Mus[eum], Acc. 5683) [CM]; 1 Madoc, 17-VII-1961, G.S.W., *Echium vulgare*; 1 Moar Lake, 16-VII-1961, H.E.M. [all, CNC]; 1 Nipigon, (Nipigon T[ow]ns[hi]p), July 14, 1955, Klots, F.&P.R. [AMNH]; 1 Pointe au Baril (not Point au Basil), Jul. 8, '30, L. Giovanni; 1 Pointe au Baril (not Point au Basil), Jul. 20, '30, L. Giovanni [all, HEM]; 7 Pointe au Baril (not Point au Basil), Jul. 20, '30, L. Giovanni; 1 Pointe au Baril (not Point au Basil), Aug. 19, '30, L. Giovanni [all, TBM]; 1 Robeson's Isl[and], VII-21-14, (Acc. 5248); 1 Robeson's Isl[and], July 26, 1914, H.K., on flowers of *Achillea millefolium*, (Acc. 5284); 1 Robeson's Isl[and) Jul. 26, 1914, on *Spiraea*, (Acc. 5248); 5 Robeson's Isl[and], Jul. 26, [yr.?], or *Achil[lea] millefolium*, (Carn[egie] Mus[eum], Acc. 5863); 3 Robeson's Isl[and], (Georgiai Bay), Jul. 26, [yr.?], on *Spiraea*, (Acc. 5248); 2 Robeson's Isl[and], (Georgian Bay), Jul 26 [yr.?], (Carn[egie] Mus[eum], Acc. 5248) [all, CM]; 1 Madoc, 17-VII-1961, G.S.W., *Echiun vulgare*; 1 Silver Island, (Sibley Pen[insula]), 18-VII-1961, H.E.M., on *Donicera*; 4 Silvei Island, (Sibley Pen[insula]), 18-VII-1961, H.E.M., on *Rubus*; 3 Silver Island, (Sibley Pen[insula]), 18-VII-1961, H.E.M. [all, CNC]; 1 Spicer Bay, (Georgian Bay ?), Jul. 22, [yr.?], on *Epilob[ium] angustifolium*, (Carn[egie] Mus[eum], Acc. 5248) [CM]; 2 Sydney Lake, 16-VII-1961, H.E.M., on *Epilobium* sp.; 4 Vermilion Bay 3-5 mi N. [of], 13-VII-1961, H.E.M. [all, CNC]. **Locality indeterminate** (Ontario): 1 Pays Plat[eau], July 15, 1912, O.S.J., on *Vicia*, (Acc. 4729) [CM]. **Quebec:** 2 Gr[ande]-Madeliene, (Gaspe Peninsula), 11-VIII-[yr.?], E.B. Bryant [MCZ]; 1 Mitassini, 30-VI-44, A.R.; 2 Mitassini, 19-VII-44, A.R. [all, AR]; 1 Montreal, 23-VIII-1956, H.E.M. [HEM]; 2 Parc du Mont Tremblant, 6-VIII-54, A.R.; 1 Parc du Mont Tremblant, 20-VII-1955, A.R.; 2 Parc du Mont Tremblant, 7-IX-1956, A.R.; 1 Parc du Mont Tremblant, 24-VI-1957, A.R.; 1 Parc du Mont Tremblant, 17-VIII-57, A.R.; 3 Parc du Mont Tremblant, 16-VIII-1958, A.R.; 2 Parc du Mont Tremblant, 23-VIII-1958, A.R.; 1 Parc du Mont Tremblant, 30-VI-1959, A.R.; 1 Parc du Mont Tremblant, 3-VII-1959, A.R.; 1 Parc du Mont Tremblant, 8-VII-1960, A.R.; 1 Région du Lac Tremblant, 4-VII-53, A.R. [all, AR].

UNITED STATES

WORKERS

Maine: 1 Bangor, (no data), (Collection [of] Frederick Allen Eddy); 4 Bangor, (no data), (Coll[ection] [of] Frederick Allen Eddy); 1 Bangor, (no data) [all, MCZ]; 2 Fort Kent, 17-VIII-10 [MASS]; 2 Kineo [Mountain], (no data), (Coll[ection] [of] Frederick Allen Eddy); 3 M[ount] Katahdin [North Peaks], 26-VI-35, Dow & Hitchcock [all, MCZ]; 1 M[ount] Katahdin, July 11, '60, A.E. Brower, 4600′ [CNC]; 1 New Brunswick, 10 Sept. '36; 1 Orono, (no data), (Coll[ection] [of] Frederick Allen Eddy) [all, MCZ]; 1 Saco, VI-7-1921, T.B.M., *Rubus*; 1 Saco, VIII-10-27, T.B.M. [all, TBM]; 1 Topsfield, Aug. 2, [yr. ?] [CNC]. **Massachusetts:** 1 Chilmark, 12-VIII-35 (Gnome Exped[ition]); 1 Lincoln, 11-VIII-37, C.H. Blake (F 317) [all, MCZ]; 1 Martha's Vineyard, Sept. 19, 1956, C.W. Sabrosky; 1 Martha's Vineyard, 9-19-56, C.W. Sabrosky [all, USNM]; 1 Nantucket, VIII-4-1911; 1 Nantucket, VIII-24-1922 [all, MASS]; 2 Needham, VII-3-27, Cult[ivated] Rose [TBM]; 1 (no data) [MASS]. **Michigan:** 1 Delta Co[unty], VIII-6-59, R.&K.D. [RRD]; 1 Douglas Lake, (no data), P.W.F. [HEM]; 1 Goebic Co[unty], 6-15-60, R.&K.D.; 1 Schoolcraft Co[unty], VI-5-59, R.&K.D. [all, RRD]. **Minnesota:** 9 Beaver Bay, Aug. 7, 1938, R.W.D. [HEM]; 3 Big Trout Lake, (Pine River), Aug. 1, 1929, H.C.S. [SD]; 1 Brainerd, Oct. 2, 1938, R.W.D.; 1 Itasca Park, July 17, 1938, H.E.M.; 1 Itasca Park, June 27, 1948, R.W.D. [all, HEM]. **New Hampshire:** 1 Belknap Co[unty], 24-VIII-60, R.A.M., on *Solidago* sp. [CNC]; 1 Belknap Co[unty], 24-VIII-60, R.A.M., *Solidago* [RAM]; 1 Belknap Co[unty], 26-VIII-60, R.A.M., on *Astor macrophyllus* [CNC]; 1 Belknap Co[unty], 26-VIII-60, R.A.M., *Astor macrophyllus* [RAM]; 1 Glen House, 17-VIII-16 [MASS]; 1 Meredith, 17-VII-60, R.A.M., on *Spiraea latifolia* [CNC]; 1 Meredith, 17-VII-60, R.A.M., *Spiraea latifolia* [RAM]; 1 Meredith, 22-VIII-60, R.A.M., on *Solidago* sp. [CNC]; 1 Meredith, 22-VIII-60, R.A.M., *Solidago* sp. [RAM]; 1 Meredith, 27-VIII-60, R.A.M., on *Eupatorium maculatum* [CNC]; 1 Meredith, 27-VIII-60, R.A.M., *Eupatorium maculatum* [RAM]; 6 M[oun]t Washington, (Tuckerman Ravine Trail), 14-VIII-38, R.M. Fox, 4500–5500 ft [ANSP]; 1 M[oun]t Washington, VII-16-1942, Marion E. Smith, 4500′ [MASS]. **New York:** 3 Essex Co[unty], 2-VIII-60, R.A.M., on *Cichorium intybus* [CNC]; 3 Essex Co[unty], 2-VIII-60, R.A.M. *Cichorium intybus* [RAM]; 9 Essex Co[unty], 2-VIII-60, R.A.M., on *Lotus cornicutatus* [CNC]; 9 Essex Co[unty], 2-VIII-60, R.A.M., *Lotus cornicutatus* [RAM]; 1 Ithaca, 27 July, 1926 [HEM]; 1 Oliverea, Ulster Co[unty], VIII-8-1922, E. Shoemaker, (Ernest Shoemaker Collection, 1956); 1 Oliverea, Ulster Co[unty], VIII-9-1922, E. Shoemaker (Ernest Shoemaker Collection, 1956) [all, USNM]; 2 Saratoga Co[unty], 17-VII-60, R.A.M., on *Melilotus alba* [CNC]; 2 Saratoga Co[unty], 18-VII-60, R.A.M., *Melilotus alba* [RAM]; 1 Tompkins Co[unty], 1-VIII-60, J.R., on *Veronica* sp. [CNC]; 1 Tompkins Co[unty], 1-VIII-60, J.R., *Veronica* sp. [RAM]. **North Carolina:** 1 Craggy Gardens, 6-15-50, C.F. Smith, on *Rhododendron*; 1 Mocksville, June 13, 1950, T.B.M., on cult[ivated] vetch [all, TBM]; 2 M[oun]t Mitchell, June 26, 1952, T.B.M., 6000 ft [HEM]; 1 M[oun]t Mitchell, 12-VIII-1957, J.G.C., 6800′ [CNC]; 1 Whiteside M[oun]t[ain], July

24, 1958, T.B.M., 6000 ft [HEM]. **Pennsylvania:** Williamsport, 5-IX-59, H.E.M. [HEM]. **South Dakota:** 1 Sisseton, June 17, 1952, H.C.S.; 1 Waubay, Aug. 18, 1924 [all, SD]. **Vermont:** 1 Bolton M[oun]t[ain], 15-VII-17; 1 Killington Peak, 26-8-19 [all, MASS]. **West Virginia:** 1 Bartow, 6-VIII-58, G.E. Wallace; 7 Durbin (n[ea]r Gaudineer Tower), 6-VIII-60, H.E.M.; 1 Durbin (n[ea]r Gaudineer Tower), 6-VIII-60, G.E. Wallace; 3 Spruce Knob, 5-VIII-60, H.E.M., on *Epilobium* sp.; 1 Spruce Knob, 5-VIII-60, H.E.M., 4000′; 23 Spruce Knob, 5-VIII-60, H.E.M., 4860′; 6 Spruce Knob, 6-VIII-60, H.E.M., 4000′; 3 Spruce Knob (R[oa]d to), Pendleton Co[unty], 14-VIII-1960, H.E.M., 4000′ [all, HEM].

CANADA

MALES

Alberta: 1 Jasper, 22-VII-[yr.?], E.B. Bryant [MCZ]; 2 Laggan, 14-IX-1884, (Bean Collection) [AMNH]. **British Columbia:** 3 Alcan H[i]g[h]w[a]y, (n[ea]r Mile 210), (Minaher Valley), 2-IX-60, Anthony Netting; 1 Alcan H[i]g[h]w[a]y (n[ea]r mile 209.5), 7-IX-60, Anthony Netting [all, CM]. **Manitoba:** 1 Cedar Lake, July 1–15, 1936, F.M. Carpenter & C.T. Parsons; 3 Cedar Lake, July 1936; 1 Cedar Lake, July 1936, (Amber B[ar], July 31, 1940); 1 Cedar Lake, July 1936, (Amber B[ar], Aug. 1, 1940) [all, MCZ]; 2 Cedar Lake (2 mi S. [of]), 15-VII-1961, H.E.M., on sweetclover [CNC]; 1 Wanless, 18-VII-51, W. P. Stephen, coll[ected] on fireweed [HEM]; 1 Wanless, 5-VII-1961, T.V. Cole [CNC]. **Nova Scotia:** 1 Hectanooga, 14-VII-1961, F.&L. [CNC]. **Ontario:** 1 Annie Bay, (Algonquin P[ar]k), VIII-12-1960, Paul J. Spangler [USNM]; 1 Burditt Lake, 12-VII-61, H.E.M., on *Cirsium* sp.; 4 Cedar Lake (20 mi S. [of]), 15-VII-1961, H.E.M., on sweetclover; 9 F[or]t Frances, 11-VII-1961, H.E.M.; 1 F[or]t William, (M[oun]t McKay), 18-VIII-1961, H.E.M., 1000′ [all, CNC]; 1 Inwood Park (2 mi SE. [of] Upsala), July 22, 1955, Klots, F.&P.R. [AMNH]; 2 Lake Despair (5 mi SW. [of]), 12-VII-61, H.E.M., on sweetclover [CNC]; 2 Ottawa, Johansen [NRS]; 1 Pointe au Baril (not Point au Basil), Jul. 20, '30, L. Giovannoli [TBM]; 1 Robeson's Island, (Georgian Bay), Jul. '26 on *Achil[lea] millefolium*, (Carn[egie] Mus[eum], Acc. 5248); 1 Robeson's Island, (Georgian Bay), Jul. '26, on Spiraea, (Carn[egie] Mus[eum], Acc. 5248) [all, CM]; 1 Silver Island, (Sibley Pen[insula]), 18-VII-1961, H.E.M., on *Rubus* [CNC]; 1 Spicer Bay, (Georgian Bay ?), Jul. '22, on *Epilob[ium] angustifolium*, (Carn[egie] Mus[eum], Acc. 5248) [CM]; 1 Vermilion Bay (3–5 mi N. [of]), 13-VII-1961, H.E.M., on *Epilobium*; 4 Vermilion Bay (3–5 mi N. [of]), 13-VII-1961, H.E.M. [all, CNC]. **Quebec:** 5 Gatineau Park, 30-VII-1961, H.E.M. [CNC]; 15 Montreal, 23-VIII-56, HEM [HEM]; 1 Parc du Mont Tremblant, 6-VIII-54, A.R.; 1 Parc du Mont Tremblant, 29-VII-56, A.R.; 2 Parc du Mont Tremblant, 29-VIII-56, A.R.; 3 Parc du Mont Tremblant, 7-IX-1956, A.R.; 1 Parc du Mont Tremblant, 18-VIII.1957, A.R.; 2 Parc du Mont Tremblant, 10-VIII-1958, A.R.; 1 Parc du Mont Tremblant, 16-VIII-1958, A.R.; 1 Parc du Mont Tremblant, 19-VIII-1958, A.R.; 1 Parc du Mont Tremblant, 24-VIII-1958, A.R.; 2 Région du Lac Mitassini, 19-VIII-53, Auger & Robert; 1 Région du Lac Mitassini, 23-VIII-53, Auger & Robert; 2 Région du Lac Mitassini, 24-VIII-53, Auger & Robert [all, AR].

UNITED STATES

MALES

Maine: 1 New Brunswick, 10 Sept. '63; 1 Orono, (no data), (Coll[ection] [of] Frederick Allen Eddy) [all, MCZ]; 1 Saco, VIII-10-27, T.B.M.; 1 Saco, Sept. 7, 1957, T.B.M. [all, TBM]. **Massachusetts:** 1 Martha's Vineyard, Sept. 19, 1956, C.W. Sabrosky [USNM]; 1 Needham, IX-3-1927, T.B.M. [HEM]; 1 Sharon, 3-VIII-09 [MASS]. **Michigan:** 1 Delta Co[unty], 7-2-55, R.R.D. [TBM]; 1 Delta Co[unty], VIII-6-59, R.&K.D. [RRD]; 1 Douglas Lake, Aug. 11, 1915, P.W.F. [HEM]; 1 Mackinac Co[unty], 7-4-55, R.R.D. [TBM]; 1 Mecosta Co[unty], 7-17-55, R.R.D. [HEM]; 1 Ogemaw Co[unty], 7-28-57, R.&K.D. [TBM]; 1 Ostego Co[unty], VII-7-59, R.&K.D. [RRD]; 1 Venderbilt (5 mi E. [of] on Sturgeon River), Ostego Co[unty], July 8, 1955, Klots, F.&P.R. [AMNH]. **Minnesota:** 1 Beaver Bay, Aug. 7, 1930, R.W.D.; 1 Beaver Bay, Aug 7, 1938, R.W.D. [all, HEM]; 2 Big Trout Lake, (Pine River), Aug. 1, 1929, H.C.S. [SD]; 1 Duluth, 10 Sept. 1950, R.S. Filmer; 2 Grand Portage, Cook Co[unty], Aug. 21, 1938, H.E.M.; 2 Gunflint Trail, Aug. 7, 1938, R.W.D. [all, HEM]. **New Hampshire:** 2 Belknap Co[unty], 24-VIII-60, R.A.M., on *Solidago* sp. [CNC]; 2 Belknap Co[unty], 24-VIII-60, R.A.M., *Solidago* sp. [RAM]; 1 Belknap Co[unty], 25-VIII-60, R.A.M., on *Aster macrophyllus* [CNC]; 1 Belknap Co[unty], 25-VIII-60, R.A.M., *Aster macrophyllus* [RAM]; 1 Belknap Co[unty], 30-VIII-60, R.A.M., on *Aster macrophyllus* [CNC]; 1 Belknap Co[unty], 30-VIII-60, R.A.M., *Aster macrophyllus* [RAM]; 1 Coos Co[unty], Sept. 1–4, 1955, B.D. Burks [USNM]; 1 Glen House, 17-VIII-16 [MASS]; 1 Meredith, 23-VIII-60, R.A.M., on *Solidago* sp. [CNC]; 1 Meredith, 23-VIII-60, R.A.M., *Solidago* sp. [RAM]; 2 Meredith, 27-VIII-60, R.A.M., on *Eupatorium maculatum* [CNC]; 2 Meredith, 27-VIII-60, R.A.M., *Eupatorium maculatum* [RAM]; 1 Meredith, 31-VIII-60, R.A.M., on *Solidago* sp. [CNC]; 1 Meredith, 31-VIII-60, R.A.M., *Solidago* sp. [RAM]; 1 M[ount] Passaconaway, 12-IX-

12, [MASS]. **New York:** 1 Bluff Island, Aug. 10, 1914, H.K., on *Solidago*, (Carn[egie] Mus[eum], Acc. 5248); 1 Bluff Island, Aug. 12, 1914, H.K., (Carn[egie] Mus[eum], Acc. 5248); 3 Bluff Island, Aug. 10, [yr. ?], on *Solidago*, (Carn[egie] Mus[eum], Acc. 5248); 2 Bluff Island, Aug. 10, [yr. ?], (Carn[egie] Mus[eum], Acc. 5248); 2 Bluff Island, Aug. 12, [yr. ?], (Carn[egie] Mus[eum], Acc. 5248] [all, CM]; 1 Essex Co[unty], 2-VIII-60, R.A.M., on *Verbena hastata* [CNC]; 1 Essex Co[unty], 2-VIII-60, R.A.M., *Verbena hastata* [RAM]; 1 Grindstone Island, Jeff[erso]n Co[unty], Aug. 15, [yr. ?], on *Solidago*, (Carn[egie] Mus[eum], Acc. 5248) [CM]; 3 Heart Lake, Essex Co[unty], 18-VII-60, J.C.B. [all, HEM]; 1 Saratoga Co[unty], 18-VII-60, R.A.M., on *Melilotus alba* [CNC]; 1 Saratoga Co[unty], 18, VII-60, R.A.M., *Melilotus alba* [RAM]. **North Carolina:** 1 Black M[oun]t[ain]s, [M[oun]t Mitchell], Sept. 5, 1930, N. Banks, 5000–6711 ft [MCZ]; 5 Lickstone Ridge, (Richland Balsam), Haywood Co[unty], 30-VII-1957, C.J. Durden [CNC]; 1 M[oun]t Mitchell (near Scenic H[i]g[h]w[a]y), Aug. 15, 1945, T.B.M. [HEM]; 1 M[oun]t Mitchell (nr. Scenic H[i]g[h]w[a]y), Aug. 15, 1945, T.B.M. [TBM]; 1 M[oun]t Mitchell, 12-VIII-1957, J.G.C., 6800 ft; 1 Pisgah Nat[ional] Forest, Haywood Co[unty], 30-VII-1957, C.J. Durden [all, CNC]. **North Dakota:** 1 Rapid City, 26 Sept. 1950, R.S. Filmer [HEM]. **Pennsylvania:** 2 Benton, Columbia Co[unty], 20-VIII-1920, H.K. [CM]; 1 Tobyhanna, 23-VIII-1923, (Ernest Shoemaker Coll[ection], 1956), [USNM]. **South Dakota:** 1 Brookings, Sept. 22, 1961, H.C.S. [SD]. **Tennessee:** 6 Indian Gap (to Glingman's Dome), 6-VIII-1957, J.G.C., 5200–6600′; 9 Indian Gap, 6-VIII-1957, W.R. Richards [all, CNC]. **Vermont:** 1 Bolton M[oun]t[ain], 15-VII-17 [MASS]; 1 Durham, VIII-1915, W.M. Wheeler [MCZ]. **West Virginia:** 2 Bartow, 6-VIII-60, H.E.M.; 1 Durbin (n[ea]r Gaudineer, not Gardiner, Tower), 6-VIII-60, H.E.M., on *Epilobium* sp.; 4 Durbin (n[ea]r Gaudineer, not Gardiner, Tower), 6-VIII-60, H.E.M.; 2 Durbin (n[ea]r Gaudineer, not Gardiner, Tower], 6-VIII-60, G.E. Wallace; 5 Spruce Knob, 5-VIII-60, H.E.M., on *Cirsium* sp., 4000′; 4 Spruce Knob, 5-VIII-60, H.E.M., on *Epilobium* sp.; 29 Spruce Knob, 5-VIII-60, H.E.M., on *Epilobium* sp.; 2 Spruce Knob, 5-VIII-60, H.E.M., *Solidago* sp., 4000′; 20 Spruce Knob, 5-VIII-60, H.E.M., 4000′; 24 Spruce Knob, 5-VIII-60, H.E.M.; 4860′; 1 Spruce Knob, 5-VIII-60, G.E. Wallace, 4860′; 17 Spruce Knob, 6-VIII-60, H.E.M., 4000′; 12 Spruce Knob, 7-VIII-60, H.E.M., 4000′; 6 Spruce Knob, 7-VIII-60, G.E. Wallace, 4000′; 25 Spruce Knob (R[oa]d to), Pendleton County, 14-VIII-1960, H.E.M., 4000′ [all, HEM].

Bombus terricola occidentalis Grne.

Bombus terricola Kby., 1837, p. 273, (re: nominate ssp. only): *Bombus franklini*, Steph., 1957, p. 79, [n. syn.]: *Bombus occidentalis* Grne., 1858, p. 12, (re: paranominate ssp. only): *Bombus howardi* Cr., 1863*a*, p. 99: *Bombus howardii* Cr., 1879*a*, p. 231; 1887, p. 308: *Bombus howardii* v. *proximus* Cr., 1879*a*, p. 231; 1887, p. 308: *Bombus mckayi* Ashm., 1902*b*, p. 125: *Bombus nigroscutatus* F. & G., 1908, p. 111, (*nom. nud.*): *Bombus occidentalis* v. *howardi*, Ckll., 1910*g*, p. 128: *Bombus occidentalis* v. *perixanthus*, Ckll., 1919*e*, p. 358: *Bombus perixanthus* C. & P., 1899*a*, p. 386: *Bombus proximus* Cr., 1863*a*, p. 98: *Bombus proximus* v. *coloradensis* Titus, 1902, pp. 38, 41: *Bombus proximus* v. *howardi*, Ckll., 1906*b*, p. 313: *Bombus Bombus proximus* v. *perixanthus*, Ckll., 1906*b*, p. 313: *Bombus terricola*, Handl., 1888*a*, p. 234, (p.p.): *Bombus terricola* v. *howardii*, Handl., 1888*a*, p. 234: *Bombus terricola* v. *occidentalis*, Handl., 1888*a*, p. 234: *Bombus terricola* v. *proximus*, Handl., 1888*a*, p. 234: *Bombus* (*B.*) *franklini*, Brs., 1951, p. 1250, *In* Muesebeck *et al.*, [n. syn.]: *Bombus* (*B.*) *occidentalis* ssp. *occidentalis*, Fkln., 1912, p. 265: *Bombus* (*B.*) *occidentalis occidentalis* Brs., 1951, p. 1250, *In* Muesebeck *et al.*: *Bombus* (*B.*) *occidentalis* ssp. *nigroscutatus* Fkln., 1912, p.271: *Bombus* (*B.*) *occidentalis nigroscutatus*, Brs., 1951, p.1250, *In* Muesebeck *et al.*: *Bombus* (*B.*) *occidentalis proximus* Brs., 1951, p. 1250, *In* Muesebeck *et al.*: *Bombus* (*B.*) *terricola* v. *severini*, Brs., 1951, p. 1250, *In* Muesebeck *et al.*, [n. syn.]: *Bombus* (Terrestris group), Mlrn., 1961*a*, p. 55, (p.p.): *Bombus* (*B.*) (Terrestris group), Fkln., 1912, p. 261, (p.p.): *Bremus franklini* Fris., 1921*b*, p. 147, [n. syn.]: *Bremus occidentalis*, Fris., 1921*b*, p. 144: *Bremus occidentalis* v. *proximus*, Fris., 1926*a*, p. 132: *Bremus terricola* v. *severini* Fris., 1926*a*, p. 139, [n. syn.]: *Bremus* (*Terrestribombus*) *franklini* Fris., 1927*e*, p. 67, [n. syn.]:*Bremus* (*Terrestribombus*) *occidentalis*, Fris., 1927*e*, p. 67: *Bremus* (*Terrestribombus*) *occidentalis* v. *nigroscutatus*, Fris., 1927*e*, p. 67: *Bremus* (*Terrestribombus*) *occidentalis* v. *proximus*, Fris., 1927*e*, p. 67: *Bremus* (*Terrestribombus*) *terricola* v. *severini* Fris., 1927*e*, p. 67, [n. syn.]: *Terrestribombus occidentalis*, Skor., 1922*a*, p. 155, (list).

DESCRIPTION. The following descriptions are based on typical specimens representing the bulk of the far western populations of this subspecies.

Queen. Structurally not perceptibly distinguishable by any significant feature from that of *t. terricola*. *Color:* Head black except intermixture of drab brownish yellow on face, especially below antennal bases where such longer hairs tinged with burnt sienna, and on vertex. Thorax above from tegula to tegula and a little lobed ventrally anteriad of each, golden yellow; remainder of thorax black except intermixture of noticeable brownish yellow especially on posterior half of scutellum and less so on lateral portions of interalar area. Legs and wings as in *t. terricola*. Abdominal T1, basal third of T4 black with few scattered hairs on T2–3 tipped with brownish yellow, remainder of T4 and 5–6 whitish except some shorter finer pile laterally on T6 with pale golden tinge evident under strong illumination.

Worker. Structurally like that of *t. terricola*. Chromatically like queen except intermixture of yellow on face and vertex less, only very slight intermixture of yellow on thoracic dorsum posteriad of tegulae; wings somewhat paler.

Male. Structurally like that of *t. terricola*. *Color:* Head black and golden yellow, latter color predominating on face between and below antennal bases and on vertex, black pile above antennal bases with considerable intermixture of tawny yellow. Thorax above mostly ochraceous (yellow) except for poorly defined interalar black band, thoracic pleura black except for ochraceous (yellow) ventral extension anteriad of wing bases and most of remaining pleural pile tinged with burnt sienna. Legs black, most pile on coxae, trochanters, and ventrally on femora with considerable tawny yellow, that posteriorly on middle tibia and hind tibial fringes largely pale burnt sienna. Wings lightly, evenly stained with brown as in worker. Abdominal T1–3 and narrow basally on 4 black, the remainder of 4–7 whitish. Sterna 6–7 and genitalia as in *t. terricola* (Pl. X).

Redescribed from hypotypes. **Queen**, Robson, B.C., 20-IV-39, H.R. Foxlee; **worker**, Friday Harbor, Wash., July 2, 1939, R.W. Dawson; **male**, same data as worker [all HEM].

TYPE. Not examined. A ♀ (in fluid) which has either lost its identity or is not any longer extant. Evidently, in 1863 Cresson borrowed the Greene material from the Smithsonian Institution (Washington) and, if any of Greene's specimens still exist, my intensive search has not divulged their whereabouts.

TYPE LOCALITY. Washington (State), U.S.A., and (Vancouver Island, British Columbia, Canada). Number of specimens at hand: 1444. In flight: from late February or early March to *ca.* mid-November, the males first appearing in early June. Distribution: (vertical), from sea level to 12,500 ft; (horizontal), Alaska (including major Aleutian Islands), and in Canada south and southeastward to British Columbia, Alberta, and Saskatchewan, and in the United States eastward to the Dakotas and southward to Arizona and New Mexico. Floral visitations: *Aster*, *Chamaenerion*, *Cleome*, *Epilobium*, *Gypsophila*, *Lotus*, *Medicago*, *Melilotus*, *Petasites*, *Potentilla*, *Rubus*, *Rudbeckia*, *Sonchus*, *Taraxacum*, *Trifolium* and *Zinnia*. From Lutz and Cockerell (1920) we can add *Monarda* and *Solidago*.

COMMENTS: After having examined thousands of specimens of all castes of *t. terricola* and *t. occidentalis* I unhesitatingly agree with Handlirsch (1888*a*: 234), who first recognized that these forms were conspecific. Franklin (1912: 239, 272), who kept them apart was, however, aware that such a combination might be so.

As stated in the remarks appended to the description of *t. terricola*, I have not discovered reliable morphological characters that will justify a specific recognition of *occidentalis* Grne. Superficially, some far western populations appear to average slightly larger than those of *t. terricola*, but even this might be statistically questionable.

This subspecies shows a broad range of chromatic variability which is, in my opinion, associated with effects by a tolerance for and establishment in many different physical and biological habitats. The subspecies has numerous synonyms, as indicated.

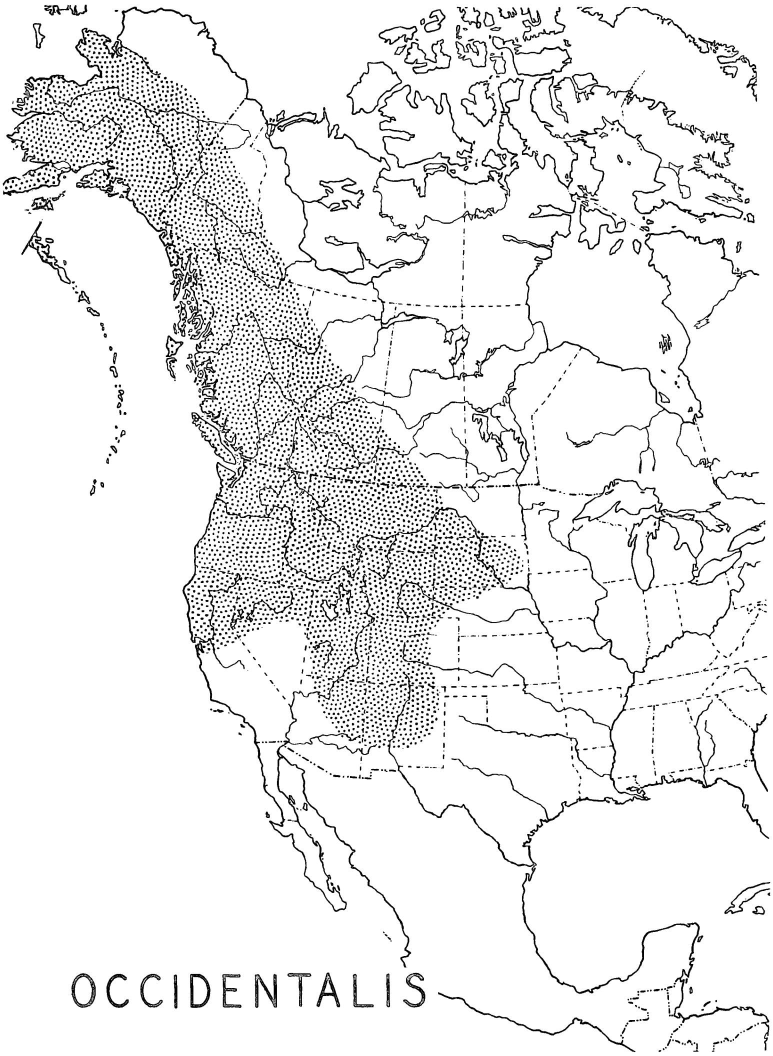
Often the queen head is predominantly black, as is usual in the worker. From the typical described above, the most pronounced variation in the female is the amount of yellow on the thoracic dorsum, on abdominal T1–3, and the complete mergence of whitish pile on T4–6 to the pale or tawny yellow that occurs on typical *t. terricola*; often a narrow to wide well-defined interalar black band occurs, and sometimes the thoracic dorsum is almost if not entirely yellow; abdominal T3 frequently entirely, T2 in part (especially laterally) to almost entirely covered with yellow, and on paler specimens some yellowish pile is evident on T1, and often irregularly on T4 replacing black or whitish pile. These female color variations from the typical *t. occidentalis* to *t. terricola* range mostly through the described synonyms *proximus* Cr. (1863*a*: 98), *perixanthus* C. & P. (1899*a*: 386), and *nigroscutatus* Fkln. (1912: 271). The male varies in color from that described above to specimens covered predominantly with golden yellow on head, thorax and abdominal T1–4, with only traces of black on head, between wing bases, on metapleurum and abdominal T1; legs of such pale specimens are also mostly yellow, the tibial fringes tinged with pale burnt sienna; and, base of abdominal T4 narrowly blackish, remainder and T5–7 pallid yellow to whitish.

By gross microscopic examination it is not always possible to positively separate many specimens of *t. occidentalis* (especially workers and males) with credible accuracy from those of *t. terricola* taken in certain northwestern allopatric locations.

CANADA

QUEENS

Alberta: I Banff, 21-V-1915, F.W.L.S.; 1 Banff (M[ount] Norquay), 25-V-1960, W.W.M., 6000′; 1 Calgary, 29-V-1924, Geo. Salt, at flowers of *Taraxacum officinale*; 1 Coutts, 22-V-1951, G.A.H.; 1 Elkwater, 1-VIII-1949, G.A.H.; 1 Elkwater Lake, 10-VI-56, E.E.S.; 1 Elkwater Lake, 12-VI-56, E.E.S.; 1 Elkwater Park, 22-V-1952, A.R.B., on dandelion; 2 Elkwater Park, 23-V-1952, A.R.B., on dandelion; 3 Elkwater Park, 24-V-1952, A.R.B., on dandelion; 2 Elkwater Park, 24-V-1952, L.A. Konotopetz, on dandelion; 1 Jasper, 19-6-46, R. Nursall; 1 Lacombe, 28-V-1915, F.W.L.S. [all, CNC]; 1 Laggan, V-25-1887, (Bean Coll[ectio]n); 1 Laggan, VI-18-1894, (Bean Coll[ectio]n) [all, AMNH]; 1 Lethbridge, June 20, 1938, R.W.S.; 4 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 12-V-1951, G.A.H.; 4 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 15-V-1951, G.A.H.; 6 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 21-V-1951, C.E.L.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 25-V-1951, B.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), V-31-1951, G.A.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 8-VI-1951, B.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 12-VI-1951, C.E.L.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 15-VI-1951, G.A.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 15-VI-1951, C.E.L.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 22-VI-1951, G.A.H.; 1 Lethbridge, 7-VI-1956, E.E.S.; 1 Lethbridge, 8-VI-1956, E.E.S.; 1 Lundbreck, 25-VII-1952, L.A. Konotopetz; 1 Manyberries (Dom[inion] Range Sta[tion]), 13-VII-1951, D.F.H.; 1 Medicine Hat, 1-VI-1952, A.R.B.; 1 Onefour, 17-VIII-1952, A.R.B.; 1 Pincher Creek, 15-VI-1961, H.E.M.; 1 Warner, 22-V-1951, G.A.H.; 1 Waterton, June 14, 1942, R.W.S.; 2 Waterton, 10-VI-1951, G.A.H.; 5 Waterton, 18-VI-1956, E.E.S. [all, CNC]. **British Columbia:** 1 Agassiz, 12-IV-1922, R. Glendenning; 1 Agassiz, 8-V-1926, R. Glendenning; 1 Agassiz, 11-IX-1926, R. Glendenning; 2 Aiyansh, 25-VI-1960, C.H.M.; 1 Aiyansh (Nass River), 25-VI-1960, B.S. Heming; 1 Aiyansh (Nass River), 25-VI-1960, G.E.S.; 1 Atlin, 6-VI-1955, B.A.G., 2200′; 3 Atlin, 7-VI-1955, B.A.G., 2200′; 3 Atlin, 8-VI-1955, B.A.G., 2200′; 3 Atlin, 9-VI-1955, H.H., 2200′; 1 Atlin, 13-VI-1955, H.H., 2200′; 1 Atlin, 14-VI-1955, B.A.G., 2200′; 1 Atlin, 20-VI-1955, H.H., 2200′; 1 Atlin, 24-VI-1955, B.A.G., 2200′; 1 Atlin, 3-VII-1955, H.H., 2200′; 1 Atlin, 16-VII-1955, H.H., 4800′; 1 Atlin, 29-VII-1955, B.A.G., 2200′; 1 Atlin, 22-VIII-1955, H.H., 4000′; 1 Boltano L[ake], J[u]ly 8, 1955, J. Sanjean; 1 Chilcotin, 14-V-1920, E.R.B.; 1 Cowichan Bay (Vancouver Island), 2-VI-1959, E.E.M.; 1 Cranbrook, 16-V-1922, C.B.D. Garrett; 1 Cranbrook, 18-V-1922, C.B.D. Garrett; 1 Departure Bay (Bio[logical] Sta[tion]), '08; 1 Diamond Head Trail (Garibaldi P[ea]k, n[ea]r Squamish), VIII-21-53, S.D.H., 3200′; 1 Fife, 8-VI-1959, R.E.L.; 1 Glacier, 17-V-1915, F.W.L.S.;



MAP 3

3 Golden, 17-V-1915, F.W.L.S.; 1 Kamloops, May 23, 1949, G.B.R.; 1 Kamloops, 10-VI-1949, G.B.R.; 1 Kaslo, 1-VII-08, J.W. Cockle; 1 Kaslo, 5-V-08, J.W. Cockle; 1 Kaslo, J.W. Cockle; 1 Keremeos, 12-VI-1924, W.B. Anderson; 2 Kitimat, 2-VI-1960, R.J. Pilfrey; 1 Kitwanda, 1-VII-1960, C.H.M.; 1 Lac Du Bois, May 18, 1949, G.B.R.; 1 Lillooet, 23-VIII-1924, A. Phair; 1 Lillooet (Seton Lake), 21-V-1926, J.M. McDunnough; 1 Lillooet (Seton Lake), 26-V-1926, J.M. McDunnough; 1 Lower Post, 17-VI-1948, W.R.M.; 1 M[oun]t Chean, 10-VIII-13, J. Wilson, 7000′; 1 M[oun]t Revelstoke, 2-VI-52, G.P.H., 6000′; 1 M[oun]t Revelstoke, 26-VI-52, G.P.H., 6000′; 1 M[oun]t Revelstoke, 6-VII-52, G.P.H., 5400′; 2 M[oun]t Revelstoke, 6-VII-52, G.J.S., 5800′; 2 M[oun]t Revelstoke, 7-VII-52, G.J.S., 5400′; 1 M[oun]t Revelstoke, 10-VII-52, G.P.H., 5800′; 1 M[oun]t Revelstoke, 12-VII-52, G.J.S., 5900′; 1 M[oun]t Revelstoke, 14-VII-52, G.P.H., 4500′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva L[ake] Trail), 7-VII-1952, G.J.S., 6000′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva L[ake] Trail), 8-VII-1952, G.P.H., 6000′; 2 Northlands (M[oun]t Seymour), 9-VI-1952, G.P.H., 4000′; 1 Okanagan Lake, 28-8-06; 1 Oliver, 9-V-1953, D.F.H., 1000′; 1 Oliver, 12-V-1953, J.E.H.M., 2500′; 1 Oliver, 14-V-1953, D.F.H., 1000′; 1 Oliver, 22-V-1953, D.F.H., 1000′; 3 Oliver, 2-VI-1953, J.R.M., 1000′; 8 Oliver, 3-VI-1953, J.R.M., 1000′; 1 Oliver (MacIntyre Creek), 6-VI-1959, E.E.M.; 1 Osoyoos (Anarchist M[oun]t[ain]), 7-VI-1959, E.E.M.; 1 Penticton, 30-IV-1919, E.R.B.; 1 Penticton, 3-IX-1919, E.R.B. [all,

CNC]; 1 Robson, 18-IV-29, H.R. Foxlee; 1 Robson, 20-IV-39, H.R. Foxlee [all, HEM]; 1 Royal Oak, IV-23-1917, R.C. Treherne; 1 Royston, 7-VI-1955, R. Coyles; 1 Saanichton, 20-VIII-1913, J.M. Swaine; 1 Salmon Arm, 25-IV-14, Tom Wilson; 1 Salmon Arm, 4-VII-1914, F.W.L.S.; 1 Shames, 23-VI-1960, C.H.M.; 1 Sicamous, 16-V-1915, F.W.L.S.; 1 Skagway District (of No. B.C.), 1906, A. White—Fraser; 1 Terrace, 30-V-1960, G.E.S.; 1 Terrace (5 mi S. [of]), 3-VI-1960, J.G.C.; 1 Terrace (Spring Creek), 3-VI-1960, R.J. Pilfrey; 3 Terrace (32 mi W. [of]), 6-VI-1960, B.S. Heming, on flowers of *Heracleum lanatum*; 2 Terrace (32 mi W. [of]), 6-VI-1960, W.W.M. flowers of *Heracleum lanatum*; 1 Terrace (32 mi W. [of]), 6-VI-1960, R.J. Pilfrey, flowers of Umbelliferae (cow parsnip); 1 Terrace (Skeena Riv[er] Valley, 32 mi W. [of]), 6-VI-1960, G.E.S., flowers of *Heracleum lanatum;* 1 Terrace (Skeena Riv[er] Valley, 32 mi W. [of]), 8-VI-1960, G.E.S., flowers of *Heracleum lanatum*; 2 Terrace (32 mi W. [of]), 11-VI-1960, B.S. Heming, flowers of *Heracleum lanatum*; 1 Terrace, 25-VI-1960, C.H.M.; 2 Terrace (Gagnon Road), 29-VI-1960, C.H.M.; 1 Terrace, 6-VII-1960, W.R. Richards; 1 Thompson River, 26-IV-14, Tom Wilson [all, CNC]; 2 Vancouver, Aug. 21, 1947, H.C.S. [SD]; 1 Vancouver, 3-IV-57, Donny Rowles; 1 Vernon, 24-V-01; 1 Vernon (not Vernen), 16-V-1920, E.P. Venables; 1 Vernon, IV-28-1925, E.A. Rendell; 1 Vernon, 20-IV-1927, I.J. Ward; 1 Vernon, 11-V-1927, I.J. Ward; 1 Victoria [Vancouver Island], 25-III-21, Sladen; 1 Victoria [Vancouver Island], 5-V-1918, W.D.; 1 Victoria [Vancouver Island], May 24, '21, W.R. Carter; 3 Victoria [Vancouver Island], 7-V-1929, W.H.A. Preece; 2 Victoria [Vancouver Island], G.W. Taylor; 3 Wellington 3-VI-08; 1 (locality unknown), 8-8-97; 1 (locality unknown), 12-IV-98; 1 (locality unknown), 24-4-98; 1 (locality unknown), 16-VI-98 [all, CNC]. **Saskatchewan:** 2 Cypress Hills, 1-VI-1939, A.R.B.; 1 Cypress Hills, 10-VI-1939, A.R.B. [all, CNC]. **Yukon Territory:** 1 Fort Selkirk, June–July 1, '08, Mike Stymour; 1 Watson Lake, 21-VI-1948, W.R.M.; 1 Watson Lake, 20-VII-1949, D.L. Watson; 1 Whitehorse, 21-VI-1949, D.L. Watson; 1 Whitehorse, 30-VI-1949, J.K. Horie [all, CNC].

LOCALITY UNKNOWN (Canada or United States?)

QUEENS

1 May 3, 1950, Frances Cameron; 4 (no data) [all, CNC].

UNITED STATES

QUEENS

Alaska: 1 Anchorage, May 28, 1948, R.I. Sailer, (Alaska Ins[ect] Project) [HEM]; 1 Anchorage, 28-V-1951, R.S.B.; 1 Anchorage, 29-VI-1951, R.S.B.; 1 Big Delta, 27-V-1951, W.R.M.M.; 1 Big Delta, 28-V-1951, Mason & McGillis; 1 Big Delta, 16-VII-1951, J.R.M.; 3 Curry, 29-VI-1951, J.B.H., 200′; 1 Curry, 28-VI-1952, J.B.H., 2000′ [all, CNC]; 1 Eklutana, V-13-48, F.S. Blanton, (Alaska Ins[ect] Project); 1 [Kenai Peninsula] (22 Mi[le] Post, Steese [Highway]), May 8, 1951, J.M. Geary [all, HEM]; 1 Kenai Pen[insula], Lawing, 11-VI-51, W.J.B.; 1 King Salmon (Naknek R[iver]), 11-VII-1952, W.R.M. [all, CNC]; 1 Ladd A[ir] F[orce] B[ase], May 3, '51, J.M. Geary [HEM]; 1 [Mount] McKinley Nat[ional] Park, July 30, 1951, H.C.S., 1750′ [SD]; 3 Napaskiak, June 15-16 [yr.?], on *Petasites* [MCZ]; 4 Nulato, VII-25-1916 [AMNH]; 1 Richard H[igh]w[a]y (Mile 275), 6-VI-1951, W.R.M.M. [CNC]; Unalaska, 17-VI-59, F.N., [Ferris Neave Collection]. **Arizona:** 1 Oak Creek C[a]nyon, VI-26-1950, H.O. Wright; 1 San Francisco M[oun]t[ain]s, VI-25-1950, R.H. Beamer; 1 San Francisco M[oun]t[ain]s, VI-25-1950, H.O. Wright; 1 White M[oun]t[ain]s, VI-19-1950, Paul P. Cook [all, KU]. **Colorado:** 1 Gould (Crags Camp, 6 mi SE. [of]), Jackson Co[unty], VII-11-56, F.&P.R., 9600′ [AMNH]; 1 San Luis, VII-6-33, K. Maehier [KU]; 4 (locality unknown), Morrison [NRS]. **Idaho:** 1 Lewiston, 5-X-40, E. Greenfield [HEM]. **Montana:** 1 Lake Placid (Greenough), August 5, 1946, H.C.S., 4500′ [SD]. **Nevada:** 1 La Moille Can[yon], Elk Co[unty], VII-24-62, R.&K.D., 9000′ [RRD]. **New Mexico:** 2 Wheeler Peak (Taos), June 15-25, 1960, Burks & Kinzer, 12,500′ [USNM]. **Oregon:** 1 Corvallis, 2-31-26, H.A.S. [SD]; 1 Crater Lake, July 21, 1927, H.E. Guerlac [HEM]. **South Dakota:** 1 Brookings, June 26, '14, H.C.S.; 1 Harney Peak, July 21, 1924, M. [all, SD]. **Utah:** 1 Duchesne Riv[er] (N. F[or]k), 13-14 July, '27, (Cornell Univ[ersity], Lot 542, sub. 305); 1 M[oun]t Nebo (sagebrush ass[ociatio]n, east side, [nearer]), Noma (not Nephi), 6-24-28 [all, HEM]; 1 M[oun]t Timpanagos, Utah Co[unty], VII-15-62, R.&K.D. [RRD]; 1 Uintah Co[unty] (R[ou]t[e] 44), VII-9-62, R.&K.D., 8000′ [HEM]. **Washington:** 17 Illahee, Kitsap Co[unty], May 1956, D.F.; 2 Illahee, Kitsap Co[unty], 15-V [to] 8-VI-1956, D.F.; 4 Illahee, Kitsap Co[unty], June 1956, D.F.; 1 Illahee, Kitsap Co[unty], Aug. 1956, D.F.; 1 Illahee, Kitsap Co[unty], 1956, D.F. [all, CNC]; 1 Olympic M[oun]t[ain]s (Hurricane Ridge), 18-VI-1955, J.F.G.C., 5500′; 1 M[oun]t Baker, July 18, 1938, R.W.D. [all, HEM]; 3 M[oun]t S[ain]t Helen (Spirit Lake), VII-8-1956, C.P. Alexander [MASS]. **Wyoming:** 1 Jackson Hole, 17 Sept. 1950, R.S. Filmer [HEM]; 3 Lower Green River Lake (Wind River Range), Sublette Co[unty], July 30–Aug. 6, 1953, F.&P.R., 8000 ft [AMNH]; 1 Sibylee Cr[eek] (North Fork, n[ea]r Wheatland), Aug. 16, 1940, H.E.M. [HEM].

CANADA

WORKERS

Alberta: 1 Aden, 28-VI-56, E.E.S.; 1 Banff, 2-VIII-1907, J. Fletcher; 1 Banff, 13-VIII-1924, Geo. Salt; 9 Banff (14 mi W. of), 4-VIII-1955, J.R.W.M., 4500′; 1 Banff-Jasper H[igh]w[a]y (mi[le] 14) 2-VIII-1955, R. Coyles; 1 Calgary, 21-VIII-1925, G. Salt; 1 Elkwater, 20-VI-1956, E.E.S.; 1 Elkwater Park, 22-V-1952, A.R.B., dandelion; 1 Elkwater Park, 7-VII-1952, A.R.B.; 2 Elkwater Park, 14-VII-1952, L.A. Konotopetz; 1 Irvine, 9-VI-1952, L.A. Konotopetz; 1 Jasper [National] Park, Sept. 1916, F.J. [all, CNC]; 1 Laggan, VI-12-1886, (Bean Coll[ectio]n); 1 Laggan, VII-4-1894, (Bean Coll[ectio]n) [all, AMNH]; 1 Laggan, 12-VII-1914, F.W.L.S.; 1 Lethbridge, 2-IX-1948, G.A.H., sow thistle; 1 Lethbridge (Vet[erinary Re[search] Sta[tion]), 15-VI-1951, G.A.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 22-VI-1951, G.A.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 14-VIII-1951, B.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 20-VIII-1951, C.E.L.; 3 Milk R[iver], 18-IX-1950, G.A.H.; 3 [Onefour] (1-4), 12-VIII-1952, L.A. Konotopetz; 1 Scandia, 11-IX-1948, G.A.H., alfalfa; 1 Seven Persons, 8-VII-1952, T.H.B. Haig, sweetclover beside alfalfa; 1 Seven Persons, 27-VII-1953, G.A.H., sweetclover n[ea]r alfalfa; 1 Waterton, Aug. 7, 1927, E.R.T.; 1 (locality indeterminate, "Wi[ld] Horse"), 4-VIII-1952, C.E.L., alfalfa [all, CNC]. **British Columbia:** 2 Agassiz, 24-VII-1922, R. Glendenning [CNC]; 1 Alask[a] H[ighway] (M[ile] P[ost] 418), 26-VI-54, C.P. Alexander [MASS]; 2 A[laska] H[ighway] (MP), 27-VI-54, C.P. Alexander; 1 Atlin, 5-VII-1955, H.J.H., 2200′; 2 Atlin, 16-VII-1955, B.A.G., 4000′; 1 Atlin, 26-VII-1955, B.A.G., 2200′; 1 Atlin, 29-VII-1955, B.A.G., 2200′; 1 Atlin, 2-VIII-1955, H.J.H., 3000′; 4 Atlin, 4-VIII-1955, B.A.G., 2200′; 1 Atlin, 5-VIII-1955, H.J.H., 2200′; 1 Atlin, 19-VIII-1955, B.A.G., 2200′; 2 Bear Creek, 14-VI-49, G.B.R.; 1 Bella Doola, 16-VIII-1921, Garlan Smith [all, CNC]; 1 Ben My Chree, July 23, 1951, H.C.S. [SD]; 1 Bevan, 18-VI-1955, R. Coyles; 1 Bowser, 23-VI-55, R. Coyles; 1 Cape 'lairo, 1-VIII-13, Tom Wilson [all, CNC]; 1 Coalmont, (Ac. 30185) [AMNH]; 1 Comox, 22-VI-1933, J. McDunnough; 1 Comox, 9-VII-1933, J. McDunnough; 6 Cowichan Bay (Van[couver] Island), 2-VI-1959, R.E.L.; 1 Cowichan Bay (Van[couver] Island), 2-VI-1959, E.E.M.; 1 Cranbrook, 23-VIII-1959, L.A.K.; 1 Creston, 23-7-1950, McM.-Craig; 1 Departure Bay, V[ancouver] I[sland], 11-V-09; 1 Departure Bay, V[ancouver] I[sland], 5-VIII-13; 2 Downie Cr[eek], 8-26-55, J. Sanjean, on *Epilobium angustifolium*; 1 Duncans, 10-VIII-1907, J. Fletcher; 1 Durieu, 11-VI-1953, W.R.M.M.; 1 Edgewood, 24-7-1950, McM.-Craig, *Chamaeniron spicatum*; 1 Edgewood, 24-7-1950, McM.-Craig, *Melilotus alba*; 3 Edgewood, 24-7-1950, McM.-Craig; 1 Fitzgerald, Aug. 7, '21, W.R. Carter; 1 Fitzgerald, Aug. 14, '21, W.R. Carter; 1 F[or]t Steele, 22-7-1915, Tom Wilson; 1 Gray Creek, 22-VII-1959, L.A.K.; 1 Hazelton, 23-VII-1920, C.M. Barbeau; 1 Hazelton, 26-VII-1920, C.M. Barbeau; 1 Hazelton, 28-VII-1920, C.M. Barbeau; 1 Hazelton, 2-VIII-1920, C.M. Barbeau; 3 Hedley, 29-VIII-1923, C.B. Garrett; 1 Hedley (Nickel Plate [R.R. ?]), 16-VII-1953, J.R.M., 5000′; 3 Hedley (Nickel Plate [R.R. ?]), 17-VII-1953, J.R.M., 5000′; 1 Hedley (Nickel Plate [R.R. ?]), 21-VII-1953, J.R.M., 6000′; 1 Hope, 18-VII-1959, L.A.K.; 1 Kamloops, 25-V-1949, G.B.R.; 1 Kamloops, 28-V-1949, G.B.R.; 1 Kamloops, 30-V-1949, G.B.R.; 1 Kaslo, 5-VI-06, J.W. Cockle; 1 Kaslo (South Fork), 16-VIII-07, James Fletcher; 1 Keremeos, 20-VI-1923, C.B. Garrett; 1 Keremeos, 26-VI-1923, C.B. Garrett; 1 Keremeos, 16-VII-1923, C.B. Garrett; 1 Keremeos (Twin L[a]k[e]), 9-VII-1953, D.F.H., 4700′; 3 Keremeos (Twin L[a]k[e]), 29-VII-1953, D.F.H., 4700′; 10 Ladysmith, 13-VII-1959; L.A.K.; 3 Lake Lisadele (58° 41′ [N.], 133° 04′ [W.]), 7-VIII-1960, W.W.M., 4000′; 1 Lillooet, 29-VI-1919, A. Phair; 1 Lillooet, 2-VII-20, A.B.B.; 2 Lillooet (Seton Lake), 27-V-1926, J. McDunnough; 2 Lillooet (Seton Lake), 2-VI-1926, J. McDunnough; 1 Lillooet (Seton Lake), 20-VI-1926, J. McDunnough; 1 Lillooet (Seton Lake), 20-VI-1926, J. McDunnough; 1 Lillooet (M[oun]t McLean), 12-VII-1926, J. McDunnough; 1 Lillooet, 8-V-30, A.W.A. Phair; 1 Mission City, 17-VI-1953, W.R.M.M.; 1 Moosehorn Lake, 1-VIII-1960, W.W.M., Potentilla meadow; 1 M[oun]t Arrowsmith (summit), 3-8-01; 3 Mount Arrowsmith, 4-VIII-1903, J. Fletcher; 3 M[oun]t Cheam, 10-VIII-13, J. Wilson, 7000 ft; 1 M[oun]t Todd, 4 Sept. 1949, K. Bourns; 4 M[oun]t Revelstoke, 12-VIII-1923, P.N. Vroom 6000 ft; 3 M[oun]t Revelstoke, 6-VII-52, G.P.H., 5400′; 1 M[oun]t Revelstoke, 6-VII-52, G.J.S., 5800′; 3 M[oun]t Revelstoke, 7-VII-52, G.P.H., 5400′; 1 M[oun]t Revelstoke, 12-VII-52, G.J.S., 5900′; 1 M[oun]t Revelstoke, 13-VII-52, G.J.S., 5800′; 1 M[oun]t Revelstoke, 19-VII-52, G.J.S., 6000′; 2 M[oun]t Revelstoke, 25-VII-52, G.P.H., 6000′; 1 M[oun]t Revelstoke, 26-VII-52, G.P.H., 6000′; 2 M[oun]t Revelstoke, 26-VII-52, G.J.S., 6000′; 1 M[oun]t Revelstoke, 27-VII-52, G.P.H., 6000′; 1 M[oun]t Revelstoke, 28-VII-52, G.P.H., 5400′; 2 M[oun]t Revelstoke, 28-VII-52, G.J.S., 5400′; 3 M[ount] Revelstoke, 31-VII-52, G.J.S., 6000′; 1 M[oun]t Revelstoke, 3-VIII-52, G.J.S., 6500′; 1 M[oun]t Revelstoke, 4-VIII-52, G.J.S., 5400′; 1 M[oun]t Revelstoke, 5-VIII-52, G.J.S., 6200′; 2 M[oun]t Revelstoke, 7-VIII-52, G.P.H., 6000′; 2 M[oun]t Revelstoke, 10-VIII (not III)-52, G.P.H., 5800′; 1 M[oun]t Revelstoke, 12-VIII-52, G.J.S., 5800′; 2 M[oun]t Revelstoke, 16-VIII-52, G.J.S., 6200′; 3 M[oun]t Revelstoke, 18-VIII-52, G.J.S., 6200′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 6-VII-1952, G.J.S., 6000′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 8-VII-1952, G.J.S., 6000′; 2

M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 9-VII-1952, G.P.H., 5800′; 2 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail) 14-VII-1952, G.J.S., 6000′; 5 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 31-VII-1952, G.J.S., 6000′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 3-VIII-1952, G.P.H., 6000′; 1 M[oun]t Revelstoke Nat[iona]l P[ar]k (M[oun]t Harry), 20-VIII-1952, G.J.S., 6200′; 5 Northlands (M[oun]t Seymour), 9-VI-1952, G.P.H. 4000′; 2 Nothic Hill, 27-7-50, McM.–Craig; 1 Okanagan (Similkameen), 11-12-IX-1913, T. Wilson; 1 Okanagan Falls, 16-VI-1953, J.R.M.; 1 Oliver, 9-V-1953, D.F.H., 1000′; 8 Oliver, 3-VI-1953, J.R.M., 1000′; 1 Oliver, 24-VI-1953, J.R.M.; 1 Oliver, 14-V-1959, L.A.K.; 2 Oliver (Madder Lake), 3-VII-1959, L.A.K.; 1 Oliver (Vaseaux L[ake]), 15-V-1959, R.E.L.; 1 Oliver (White Lake), 17-V-1959, R.E.L.; 1 Osoyoos, 21-V-1953, J.E.H.M., 3500′; I Osoyoos, 3-VII-1953, D.F.H., 3500′; 1 Osoyoos, 7-VII-1953, D.F.H., 2500′; 1 Osoyoos, 21-VII-1953, J.R.M., 3500′; 1 Osoyoos, 27-VII-1953, D.F.H., 4000′; 1 Osoyoos (Anarchist M[oun]t[ain]), 30-V-1959, L.A.K.; 1 Pass Lake, 27 July 1949, K. Bourns; 1 Penticton, 29-VI-1919, E.R.B.; 1 Penticton, 7-IX-1919, E.R.B.; 1 Peter's Lake, 8-VIII-49, K. Bourns; 1 Pitt Meadows (peat bog at), 9 July 1953, E.M.; 1 Pitt Meadows (peat bog at), 9 July, 1953, W.R.M.M.; 1 Qualicum, 21-VI-1955, G.E.S.; 2 Royal Oak, 30-VII-1917, W.D.; 1 Royston, 7-VI-1955, R. Coyles; 1 Ruskin, 26-VI-1953, W.R.M.M.; 1 Saanich[ton], 20-X-53, O.P.; 1 Saanichton, 15-VII-1959, L.A.K.; 1 Salmon Arm, 4-VI-1918, E.R.B.; 1 Salmon Arm, 27-VI-1925, A.A. Dennys; 1 Salmon Arm, 26-VII-1950, McM.–Craig; 1 Shames (18 mi SW. [of] Terrace), 17-VII-1960, C.H.M.; 1 Shuswah, 29-VII-13, J.M. Swaine; 1 Sicamous, 13-V-1915, F.W.L.S.; 1 Sidney, 8-V-1915, F.W.L.S.; 1 Sidney, 15-VIII-16, Sladen; 2 Skagway District (of No. B.C.), 1906, G. White – Fraser; 1 Spulanchien, 25-VII-13, Tom Wilson; 14 Squamish (Diamond Head Trail), Aug. 1, 1953, E.M., 3200 ft; 1 Squamish (Diamond Head Trail), Aug. 2, 1953, E.M., 3200 ft; 1 Squamish (Diamond Head Trail), 10 Aug. 1953, W.R.M.M., 4600 ft; 2 Squamish (Diamond Head Trail), 11 Aug. 1953, E.M., 4600 ft; 1 Squamish (Diamond Head Trail), 11 Aug. 1953, W.R.M.M., 4600 ft; 1 Squamish (Diamond Head Trail) 13 Aug. 1953, E.M., 3000 ft; 1 Squamish (Diamond Head Trail), 13 Aug. 1953, E.M., 3200 ft; 1 Squamish (Diamond Head Trail), Aug. 13, 1953, G.J.S., 3200 ft; 1 Squamish (Diamond Head Trail), 25 Aug. 1953, W.R.M.M., 4600 ft; 1 Squamish (Diamond Head Trail), VIII-28-53, S.D.H., 4800 ft; 1 Squamish (Diamond Head Trail), VIII-28-[1953], S.D.H., 5000 ft; 1 Squamish (Diamond Head Trail), Aug. 28, 1953, G.J.S., 3200 ft; 2 Squamish (Diamond Head Trail), Aug. 29, 1953, G.J.S., 3200 ft; 1 Squamish (Diamond Head Trail), Aug. 31, 1953, G.J.S., 3200 ft; 1 Sugar L[ake], 5-IX-1924, E.R.B.; 1 Terrace, 13-VII-1960, W.R. Richards; 1 Terrace (Kleanza Creek, n[ea]r), 12-VII-1955, G.P.H.; 2 Terrace (Kleanza Creek, n[ea]r), 13-VII-1955, G.P.H.; 1 Terrace (Kleanza Creek, n[ea]r), 15-VII-1955, G.P.H.; 1 Terrace (6 mi W. [of]), 24-VI-1960, C.H.M.; 1 Terrace (10 mi W. [of]), 9-VI-1960, B.S. Heming; 1 Terrace (Gagnon Road, 6 mi W. [of]), 20-VI-1960, W.W.M., on thimbleberry leaves and flowers; 4 Terrace (Kleanza Creek, 14 mi E. [of]), 19-VII-1960, W.R. Richards; 1 Terrace (Spring Creek), 3-VI-1960, B.S. Heming; 1 Terrace (M[oun]t Allard, 23 mi N. [of]), 11-VIII-1960, B.S. Heming, 3000′; 1 Terrace (M[oun]t Thornhill, n[ea]r), 26-VII-1960, B.S. Heming, 4300-5300′; 1 Toad River Lodge (Mi[le] 422, Alaska H[igh]w[a]y), 20-VII-1959, R.E.L.; 1 Tunjong Lake, 19-VII-1960, R.J. Pilfrey; 1 Tunjong Lake (58° 26′ [N.], 132° 45′ [W.]), 20-VII-1960, W.W.M., 3200′; 1 Union, 3-8-01 [all, CNC]; 3 Vancouver [Vancouver Island], Aug. 21, 1947, H.C.S. [SD]; 1 Vernon, VII-21-1921, E.P. Venables; 3 Vernon, VIII-1-1923, D.G. Gillespie; 1 Vernon, VIII-2-1923, D.G. Gillespie; 1 Vernon, VIII-2-1923, D.G. Gillespie; 1 Vernon, VIII-8-1923, D.G. Gillespie; 1 Vernon, VIII-30-1923, D.G. Gillespie; 1 Vernon, VIII-31-1923, D.G. Gillespie; 1 Vernon, VI-31 [!]-1925, E.A. Rendell; 1 Victoria [Vancouver Island], 27-V-1923, K.F. Auden; 1 Victoria [Vancouver Island], 4-VI-1923, K.F. Auden; 1 Victoria [Vancouver Island], 28-VI-1923, K.F. Auden; 1 (locality unknown), 16-5-97 [all, CNC]. **Saskatchewan:** 1 Cypress Hills (not Alberta), 29-VII-1925, F.S. Carr; 1 Cypress Hills, Aug. 30, 1938, R.W.S., on alfalfa; 1 Cypress Hills (Pro[vincial] P[ar]k), 30-VIII-1949, G.A.H.; 1 Val Marie, 8-9-VIII-55, C.D.M.; 8 Val Marie, 10-VIII-55, C.D.M.; 1 Wood Mountain, 5-8-1955, A.R.B. [all, CNC]. **Yukon Territory:** 1 Dawson, 8-VI-1949, W.W. Judd; 1 Dawson, 28-VI-1949, W.W. Judd; 2 Dawson, 29-VI-1949, P.F.B.; 1 Dry Creek, 25-VI-1948, W.R.M.; 4 Dry Creek, 23 July, 1948, Mason & Hughes; 1 Dry Creek, 28-VII-1948, W.R.M.; 1 La Force L[ake] (133° 20′ [W.], 62° 41′ [N.]), 5-VII-1960, J.E.H.M.; 2 La Force L[ake] (62° 33′ [N], 132° 20′ [W.], 5-VIII-1960, E.W. Rockburne, 5500′; 1 La Force L[ake] (133° 20′ [W.], 62° 41′ [N.]), 13-VIII-1960, E.W. Rockburne, 3300′; 2 Lat[itude] 62° 35′ [to] 63° 06′, long[itude] 137° 30′ [to] 139° 30′, 1916, D.D. Cairner; 1 Swim Lake (62° 13′ [N.], 133° [W.]), 23-VI-1960, J.E.H.M.; 1 Swim Lake (138° [W.], 62° 13′ [N.]), 12-VII-1960, J.E.H.M., 3200′; 1 Swim Lake (133° [W.], 62° 13′ [N.]), 12-VII-1960, E.W. Rockburne, 3200′; 1 Watson Lake, 17-VI-1948, Mason & Hughes; 2 Watson Lake, 25-VI-1948, W.R.M.; 1 Watson Lake, 6-VI-1949, D.L. Watson; 1 Whitehorse, July-Aug. 1922, A.P. Hawes; 1 Whitehorse, 5-VII-1948, M.T. Hughes; 1 Whitehorse, 20-V-1949, L.C. Cartis; 1 Whitehorse, 17-VI-1949, D.L. Watson; 1 (locality indefinite, "Y[u]k[on], N[orthwest] T[erritories]"), 4-VII-44, P.A.L. [all, CNC].

LOCALITY UNKNOWN (Canada or United States?)
3 (no data) [CNC]; 1 (no data) [MASS].

UNITED STATES
WORKERS

Alaska: 2 Anchorage, 28-VI-1951, R.S.B.; 2 Anchorage, 29-VI-1951, R.S.B.; 4 Anchorage, 3-VII-1951, R.S.B.; 1 Anchorage, 4-VII-1951, R.S.B.; 1 Anchorage, 5-VII-1951, R.S.B.; 4 Anchorage, 20-VII-1951, R.S.B.; 1 Anchorage, 23-VII-1951, R.S.B.; 1 Anchorage, 24-VII-1951, R.S.B.; 1 Anchorage, 27-VII-1951, R.S.B.; 1 Anchorage, 28-VII-1951, R.S.B.; 8 Anchorage, 31-VII-1951, R.S.B. [all, CNC]; 1 Beaver, Aug. 5, 1951, F.S. Barkalow [HEM]; 1 Big Delta, 24-VI-1951, J.R.M. [CNC]; 7 Butte Area, July 1, 1959, R.H.W. [USNM]; 1 Cold Bay, 26-VII-1952, J.B.H.; 1 Cold Bay, 21-VIII-1952, W.R.M.; 1 Cold Bay, 23-VIII-1952, W.R.M.; 1 Cooper Landing (Kenai Peninsula), 2-VIII-1951, W.J.B.; 5 Eklutna Lake, 29-VII-1951, R.S.B. [all, CNC]; 1 [Fairbanks] (Ladd A[ir] F[orce] Base), May 7, '51, J.M. Geary; 1 Fairbanks (Ladd A[ir] F[orce] Base), Jul. 3, 1955, D.A. Becker [all, HEM]; 3 Fort Yukon, Aug. 4, 1951, H.C.S., 900′ [SD]; 2 F[or]t Yukon, June 17, 1959, R.H.W. [USNM]; 1 Gulkana (Paxson Lodge), 30-VII-1951, W.R.M.M.; 4 Gulkana (Paxson Lodge), 31-VII-1951, W.R.M.M.; 1 Hope (Kenai Pen[insula]), 15-VII-1951, W.J.B.; 1 King Salmon (Naknek R[iver]), 1-VIII-1952, W.B.S.; 3 King Salmon (Naknek R[iver]), 16-VIII-1952, W.B.S.; 1 King Salmon (Naknek R[iver]), 20-VIII-1952, J.B.H.; 7 King Salmon (Naknek R[iver]), 20-VIII-1952, W.B.S. [all, CNC]; 1 Kukak Bay, 10-VII-1953, W.C.F.; 1 Matanuska, July 9, 1945, J.C. Chamberlin, (Rotary Trap Coll[ectio]n) [all, HEM]; 7 Moose Pass (Kenai Pen[insula]), 31-VII-1951, W.J.B. [CNC]; 36 [Mount] McKinley Nat[iona]l Park, July 30, 1951, H.C.S., 1750′ [SD]; 1 [Mount] McKinley [National] P[ar]k, 15-VII-56, W.C.F. [USNM]; 1 Naknek, 21-VII-1952, W.R.M. [CNC]; 1 Nunivak, Aug. 20, '59, R.H.W. [USNM]; 3 Palmer, Aug. 1, 1951, H.C.S., 300′ [SD]; 1 Seward, 27-V-1951, W.J.B., 100′ [CNC]; 1 Skagway, Aug. 9, 1951, H.C.S., 16′ [SD]; 4 Wasilia, (Ac. 23552) [AMNH]. **Arizona:** 1 Greer (Phelps M[ine?], July 24, 1953, L.A. Carruth, 9000′ [HEM]. **California:** 1 Bridgeville, 20-V-1959, R. Madge [CNC]; 1 Portula, Sept. 5, 1917, R.C. Shannon; 1 San Francisco, XI-13-21, C.L. Fox [all, HEM]; 1 S[an] F[rancisco] (Pine Lake), Aug. 24, '45, P.D.A. [USNM]; 1 Shasta Spr[in]gs, VII-1914, C.L. Fox [HEM]; 2 (Locality indeterminate, "Camp Creek"), VI-23-56, M.F. Rose, (Hopk[ins] 35202) [USNM]; 1 (locality unknown), (no data), Kinb., [NRS]. **Colorado:** 1 Alder, Aug. 23, 1940, H.E.M. [HEM]; 22 Buffalo Creek, Aug. 6, '39, G.A. Sandhouse [USNM]; 1 Deer Cr[eek] Canyon, 8-16-60, R.&K.D., 5000′ [RRD]; 5 F[or]t Lewis, Aug. 8, 1948, R.W.D.; 1 F[or]t Lewis, Aug. 15, 1948, R.W.D. [all, HEM]; 1 Granby, VII-1-62, R.&K.D., 8000–9000′; 1 J[un]c[tion] R[ou]t[es] 14 & 40 (10 mi N. [of]), VII-2-62, R.&K.D. [RRD]; 1 Minnehaha, July 8, 1919, *Rubus deliciosus* [HEM]; 1 Minturn, VIII-25-1917 [CNC]; 2 Pingree Park, Aug. 17, 1926, M.D. Farrar [SD]; 1 Poudre Canyon, Aug. 15, 1927; 16 Rand, Aug. 22, 1940, H.E.M.; 1 Rollinsville (4th of J[uly] Lake, n[ea]r), July 31, 1934, H.G. Rodeck [all, HEM]; 1 Tolland, Gilpin Co[unty], VII-15-16-1922, 9-12,000 ft [CNC]; 2 Walden, Aug. 25, 1941, H.C.S. [SD]; 1 Wolf Creek Pass, Aug. 24, 1940, H.E.M. [HEM]; 1 (locality indeterminate, "Un[iversity] Col[lege] Camp"), July 18, 1940, T.B.M., 9500 ft [TBM]; 2 (locality unknown), (no data), Morrison [NRS]. **Idaho:** 1 Lake Waha, Nez Perce Co[unty], VII-21-1937, F.W.P., (20982); 3 Rocky Bridge (Clearwater Nat[ional] For[est]), Clearwater Co[unty], VII-15-1937, F.W.P., (20907), [all, ANSP]; 1 Toller Ditch, Payette N[ational] Forest], 11-VIII-53, C.P. Alexander, 6000′ [MASS]; 1 Zaza, Nez Perce Co[unty], VII-21-1937, F.W.P., (20999), [ANSP]. **Montana:** 1 Bozeman (n[ea]r), Gallatin Co[unty], VI-22-1937, F.W.P., (20511); 1 Clinton, Missouli Co[unty], VI-24-1937, F.W.P., (20546), [all, ANSP]; 1 Gardiner (n[ea]r), Yellowstone N[ational] Park], VIII-16-1962, Phyl. & Paul Spangler [USNM]; 2 Hamilton, July 29, 1947, R.W.D. [HEM]; 1 Helena (W. [of] Continental Divide), VI-23-1937, F.W.P., (20526), [ANSP]; 72 Lake Placid (Greenough), Aug. 5, 1946, H.C.S., 4500′ [SD]; 1 McDonald Pass, Powell Co[unty], VI-23-1937, F.W.P., (20530), [ANSP]; 1 Rock Creek, Granite Co[unty], 7-20-50, Jellison; 3 Whitefish, Flathead Co[unty], 4-VII-40, W.L. Jellison [all, HEM]. **Nevada:** 1 (Locality unknown), Morrison [NRS]. **Oregon:** 1 Anthony Lake (Blue M[oun]t[ain]s), Aug. 3, 1929, H.A.S., 7100 ft [CNC]; 2 Anthony Lake (Blue M[oun]t[ain]s), Aug. 3, 1929, H.A.S., 7100′; 1 Anthony Lake (Blue M[oun]t[ain]s), Aug. 9, 1929, H.A.S., 7100′ [all, SD]; 1 Astoria, July 8, 1948, H.A.S., on *Lotus uliginosus*; 3 Coos Bay, VII-28-40, R.E. Rodock [all, HEM]; 1 Crater Lake Park (South Rim), Aug. 20, 1930, H.A.S., 7100 ft [INHS]; 1 Drake Peak, Lake Co[unty], July 26, 1930, H.A.S., 7850 ft [CNC]; 1 Meacham [8 mi W. [of]), July 19, 1929, H.A.S., 3400′ [SD]; 1 Medford, Jackson Co[unty], IX-11-1953, A.T. McClay; 1 McKenzie Bridge, 8-17-24, H.A.S.; 1 Polina Lake, Deschutes Co[unty], Aug. 17, 1930, (Canadian Zone); 1 Three Sisters (Scott L[a]k[e]), 8-9-1926, H.A.S., 4650 ft; 1 Three Sisters (Scott L[a]k[e]), Aug. 7-9, 1926, H.A.S., 4650 ft, *Aster* sp.; 2 Three Sisters (Camper's L[a]k[e]), 8-15-26, H.A.S., 4700 ft, *Aster* sp. [all, CNC]; 1 T[il]g[ar]d, VII-20-1922, F.J. Spruijt [HEM]. **South Dakota:** 2 Camp Judson (Black Hills), Aug. 13, 1937, H.C.S.; 1 Custer, Sept. 11, 1927, H.C.S.; 1 Deadwood, Sept. 9, 1925, H.C.S.; 1 Harney

P[ea]k, July 22, 1924, M.; 1 Rapid Canyon, Aug. 4, 1924, M.; 1 Spearfish, July 26, 1924, M.; 1 Spearfish, July 28, 1924, M. [all, SD]. **Utah:** 1 Duchesne Riv[er] (N[orth] F[or]k), 13-14 July '27, H.E. Guerlac, (Cornell Univer[sity] Exped[ition]); 1 Duchesne Riv[er] (N[orth] F[or]k, 13-14 July '27, (Cornell Univer[sity] Exped[ition], Lot 542, sub. 305), [all, HEM]; 1 Escalante (15 mi N. [of]), Garfield Co[unty], Aug. 9, 1950, T. Cohn, P. Boone & M. Cazier [AMNH]; 1 Mill Cr[eek] Canyon, S[alt] Lake Co[unty], VII-17-62, R. & K.D., 7600′ [HEM]; 1 Tucker (S. of), Utah Co[unty], VII-6-1938, F.W.P. [ANSP]. **Washington:** 1 Bothell, Aug. 22-26, 1954, H.E. & M.A.E. 1 Chuckanut Bay, Whatcom Co[unty], 24-VI-1955, J.F.G.C. [all, HEM]; 6 Deer P[ar]k (Olympic Nat[ional] P[ar]k), 3-IX-1955, J.R.M., 5500′ [CNC]; 5 Friday Harbor, June 25, 1939, R.W.D.; 2 Friday Harbor, June 26, 1939, R.W.D.; 30 Friday Harbor, June 27, 1939, R.W.D.; 2 Friday Harbor, June 28, 1939, R.W.D.; 20 Friday Harbor, July 2, 1939, R.W.D.; 1 Friday Harbor, July 3, 1939, R.W.D.; 7 Friday Harbor, July 4, 1939, R.W.D.; 4 Friday Harbor, July 11, 1939, R.W.D.; 1 Friday Harbor, July 16, 1939, R.W.D.; 1 Friday Harbor, July 22, 1939, R.W.D.; 2 Friday Harbor, July 25, 1939, R.W.D.; 2 Friday Harbor, Aug. 1, 1939, R.W.D.; 1 Friday Harbor, Aug. 29, 1939, R.W.D.; I Hoh (R.S.), Olympic M[oun]t[ain]s, 2-VIII-1955, T.M. Clarke [all, HEM]; 5 Illahee, Kitsap Co[unty], May 1956, D.F.; 4 Illahee, Kitsap Co[unty], June 1956, D. F.; 2 Unumclaw, IX-5-1955, J. Sanjean, on *Zinnia* [all, CNC]. **Wyoming:** 1 Lower Green River Lake (Wind River Range), Sublette Co[unty], July 30 [to] Aug. 6, 1953, F.&P.R., 8000′ [AMNH]; 1 Moran, Teton Co[unty], 27-VII-1948, Wallace–Bauer, (C[arnegie] M[useum], Acc. 14503) [CM].

CANADA

Males

Alberta: 1 Banff, Aug. 28, 1906, N.B. Sanson [CNC]; 6 Banff, 22-VIII-1907, J.L. Zabriskie [AMNH]; 1 Banff, 14-VIII-1922, C.B.D. Garret[t], 6–7000 ft; 1 Banff, 16-VIII-1924, Geo. Salt, 4521 ft, white clover; 1 Banff, 18-VIII-1924, Eric Hearie; 5 Banff, 18-VIII-1924, Geo. Salt, 4,521 ft, blue aster; 1 Elkwater Park, 30-VII-1952, L.A. Konotopetz; 1 Elkwater Park, 15-VIII-1952, L.A. Konotopetz; 5 Jasper [National] Park, Sept. 1916, F.J.; 1 Laggan, VIII-19-1891, (Bean Coll[ectio]n); 1 Lundbreck, 22-VIII-1952, L.A. Konotopetz; 1 Lundbreck, 25-VIII-1952, L.A. Konotopetz; 1 Pincher, 23-IX-13, C.G. Hewitt; 1 R[ed] Hills – Scandia, 29-VII-1952, T.H.B. Haig, *Cleome*; 1 Scandia, 11-IX-1948, G.A.H., alfalfa; 1 Scandia, 11-IX-1948, G.A.H., sweetclover [all, CNC]. **British Columbia:** 1 Agassiz, 1-VIII-1921, R. Glendenning; 1 Agassiz, 5-IX-1922, R. Glendenning; 1 Agassiz, 7-VIII-1924, R. Glendenning; 1 Agassiz, 27-VII-1926, R. Glendenning; 1 Agassiz, 17-IX-1926, H.H. Ross; 9 Alberni, 26-VIII-1913, J.M. Swaine; 1 Appledale, 23-7-1950, McM. – Craig, *Chamaeniron spicatum*; 1 Atlin, 4-VIII-1955, B.A.G., 2200′; 1 Atlin, 10-VIII-1955, H.J.H., 3000′; 1 Atlin, 11-VIII-1955, B.A.G., 3000′; 2 Atlin, 11-VIII-1955, H.J.H., 3000′; 4 Atlin, 22-VIII-1955, H.J.H., 4000′ [all, CNC]; 1 Bennett, VIII-23-1918 [AMNH]; 1 Blackwall (Manning Park), 7-VIII-1953, D.F.H., 6000′; 2 Campbell R[iver], 26 Aug. '50, T.K. Bourns [all, CNC]; 2 Coalmont, (Ac. 30185) [AMNH]; 2 Coal River, 21-VIII-1948, W.R.M.; 1 Deroche (Lake Errock, n[ea]r), 3-VIII-1953, W.R.M.M.; 2 Downie Cr[eek], 8-26-1955, J. Sanjean, on *Epilobium angustifolium*; 1 Fitzgerald, Aug. 7, '21, W.R. Carter; 2 F[or]t Steele, 22-7-1915, Tom Wilson; 1 Hedley (Nickel Plate [R.R. ?]), 17-VII-1953, J.R.M., 5000′; 1 Hope M[oun]t[ain]s, 18-VIII-1932, A.N. Gartrell, 4500′; 1 Invermere, 30-VI-1914, F.W.L.S.; 2 Kaslo, 4-VIII-05, J.W. Cockle; 1 Kaslo, 20-VIII-05, J.W. Cockle; 1 Kaslo, 9-IX-05, J.W. Cockle; 2 Kaslo, 30-IX-06, J.W. Cockle; 4 Kaslo (Montezuma Mine), 16-VIII-07, James Fletcher; 1 Kaslo [South Fork), 16-VIII-07, James Fletcher; 1 Lebahdo, 23-7-1950, McM. – Craig, *Chamaeniron spicatum*; 1 Lillooet, 29-VI-1919, A. Phair; 2 Lillooet (Seton Lake), 2-VI-1926, J. McDunnough; 1 Lillooet (Seton Lake), 29-VI-1926, J. McDunnough; 1 Mission City, 2-VII-1953, E.M.; 2 Moosehorn Lake, 28-VII-1960, W.W.M., 4500′, Potentilla Meadow; 2 M[oun]t Revelstoke, 12-VIII-1923, E.R.B., 6000 ft; 1 M[oun]t Revelstoke, 12-VIII-1923, P.N. Vroom, 6000 ft; 1 M[oun]t Revelstoke, 10-VIII-1952, G.P.H., 4000′; 1 M[oun]t Revelstoke, 10-VIII-1952, G.P.H., 5400′; 2 M[oun]t Revelstoke Nat[iona]l P[ar]k (Eva Lake Trail), 8-VIII-1952, G.J.S., 6000 ft; 1 M[oun]t Revelstoke Na[tiona]l P[ar]k (Eva Lake Trail), 19-VIII-1952, G.P.H., 6000 ft; 1 M[oun]t Tuktakamin, 5-VIII-1952, T.K.R. Bourns, 5800′; 1 Okanagan (Similkameen), 11-12-IX-1913, T. Wilson; 1 Okanagan Falls, 21-VII-17, Sladen; 1 Penticton, 3-IX-1919, E.R.B.; 1 Pinewoods (Manning Park), 7-VIII-1953, J.R.M., 4000′; 1 Pitt Meadows (Peat bog at), 9 July 1953, W.R.M.M.; 3 Saanichton, 19-VIII-13, Tom Wilson; 1 Squamish (Diamond Head Trail), 10 Aug. 1953, W.R.M.M., 4600 ft; 2 Squamish (Diamond Head Trail), Aug. 18, 1953, E.M., 3200 ft; 1 Squamish (Diamond Head Trail), 28 Aug. 1953, W.R.M.M., 3300 ft; 1 Squamish (Diamond Head Trail], Aug. 28, 1953, G.J.S., 3200 ft; 13 Squamish (Diamond Head Trail), Aug. 29, 1953, G.J.S., 3200 ft; 1 Squamish (Diamond Head Trail), Aug. 31, 1953, G.J.S., 3200 ft; 2 Squamish (Garibaldi P[ea]k, n[ea]r), VIII-28-53, S.D.H., 4800 ft; 1 Squamish (Garibaldi P[ea]k, n[ea]r), VIII-31-53, S.D.H., 3200 ft; 1 Vancouver [Vancouver Island], 15-VIII-16, Sladen [all, CNC]; 48 Vancouver [Vancouver Island], Aug. 21, 1947, H.C.S. [SD]; 1 Vernon, 2-X-02; 1 Vernon, VII-31-1923, D.G. Gillespie; 2 Vernon, VIII-1-1923, D.G. Gillespie; 4 Vernon, VIII-2-1923, D.G. Gillespie; 2 Vernon, VIII-14-1923, D.G. Gillespie; 1 Vernon, VIII-31-1923, D.G. Gillespie; 1 Victoria, 14-VII-16, Sladen; 1 Victoria, 3-VII-1938, G.S.W.; 1 Walhachin, 1-IX-1917, E.R.B.; 1 (locality unknown), 27-7-98; 2 (locality unknown), 26-8-99 [all, CNC]. **Northwest Territories:** 1 Cameron Bay (Great Slave Lake), 9-VII-1937, T.N.F.; 1 Cameron Bay (Great Slave Lake), 21-VII-1937, T.N.F.; 2 Cameron Bay (Great Slave Lake), 22-VII-1937, T.N.F.; 1 Cameron Bay (Great Slave Lake), 27-VII-1937, T.N.F.; 2 Cameron Bay (Great Slave Lake), 14-VIII-1937, T.N.F. [all, CNC]. **Saskatchewan:** 4 Cypress Hills, IX-5-1952, L.K. Peterson; 1 Gascoigne, 23-VIII-1957, A.R.&J.E.B.; 1 Willow Bunch, 27-7-1955, A.R.B. [all, CNC]. **Yukon Territory:** 1 Dry Creek, 23 July, 1948, Mason & Hughes; 2 Sheldon L[ake] (62° 41′ [N.], 131° [0]6′ [W.]), 21-VII-1960, J.E.H.M.; 1 Sheldon L[ake] (62° 41′ [N.], 131° [0]6′ [W.]), 21-VII-1960, E.W. Rockburne; 1 Whitehorse, 1921, E.P. Hawes [all, CNC].

LOCALITY UNKNOWN [Canada or United States?]

MALES

3 (no data) [CNC].

UNITED STATES

MALES

Alaska: 2 Alaska-Richard H[igh]w[a]y (Mile 241), 21-VII-1951, W.R.M.M.; 2 Alaska-Richard H[igh]w[a]y (Mile 250), 27-VII-1951, W.R.M.M.; 1 Anchorage, 20-VII-1951, R.S. Bigelow; 1 Anchorage, 31-VII-1951, R.S. Bigelow; 1 Big Delta, 27-VII-1951, Mason & McGillis; 2 Eklutna Lake, 27-VII-1951, R.S. Bigelow; 3 Gulkana (Paxson Lodge), 30-VII-1951, W.R.M.M.; 3 Gulkana (Paxson Lodge), 31-VII-1951, W.R.M.M.; 3 King Salmon (Naknek R[iver]), 16-VIII-1952, W.B.S.; 1 King Salmon (Naknek R[iver]), 20-VIII-1952, W.B.S. [all, CNC]; 1 Kukak Bay, 11-VIII-1953, W.C.F.; 1 Matanuska, IX-44, J.C. Chamberlin, (Rotary Trap, Lot No. 44-22503), [all, HEM]; 1 Moose Pass (Kenai Pen[insula]), 31-VII-1951, W.J.B. [CNC]; 29 [Mount] McKinley Nat[iona]l Park, July 30, 1951, H.C.S., 1750′ [SD]; 3 Palmer, Sept. 10, 1956, R.H.W.; 1 Willow, 5-VIII-56, W.C.F. [all, USNM]. **Arizona:** 1 Greer (9 mi S.W. [of]), Aug. 18–22, 1952, L.A. Carruth [HEM]. **California:** 1 Milbrae, San Mateo Co[unty], IX-9-22, C.L. Fox; 1 Miranda, Humboldt Co[unty], 31 July '27, J.C.B.; 1 San Francisco, Sept. 23, '21, C.L. Fox [all, HEM]. **Colorado:** 8 Buffalo Creek, Aug. 6, '39, G.A. Sandhouse [USNM]; 1 Cimarron (Black Can[y]on), 13–15 Sept. '17, R.C. Shannon [HEM]; 2 Deer Cr[eek] Canyon, 8-16-60, R.&K.D., 5000′ [RRD]; 1 Glenwood Sp[rin]gs (39° 33′ N., 107° 11′ W.), Aug. 5, 1920, 5800′, (F4759), [INHS]; 1 Hesperus, Aug. 22, 1948, R.W.D. [HEM]; 2 Pingree Park, Aug. 17, 1926, M.D. Farrar [SD]; 1 Rollinsville (4th of J[uly] Lake, n[ea]r), July 31, 1934, H.G. Rodeck [HEM]; 2 Walden, Aug. 25, 1941, H.C.S. [SD]. **Idaho:** 1 Gibbonsville (Twin Cr[eek] Camp, 5 mi N. [of]), VII-30-56, F.&.P.R. 5200 ft [AMNH]; 1 Lewiston, June 24, 1939, E. Morton; 1 Lewiston, July 17, 1939, B.H. Stephenson [all, HEM]. **Montana:** 1 Bozeman, July 21, 1949, L. Ellig [SD]; 1 Bozeman, 15 Sept. 1950, R.S. Filmer; 1 Glacier Nat[ional] P[ar]k (McDonald L[a]k[e], 6-VIII-1955, T.M. Clarke; 3 Hamilton, July 29 1947, R.W.D. [all, HEM]; 19 Lake Placid (Greenough), Aug. 5, 1946, H.C.S., 4500′ [SD]. **New Mexico:** 1 Beulah, August, [yr. ?], Cockerell, 8000 ft [CNC]. **Oregon:** 1 Grant's Pass, Aug. 4, 1949, H.A.S., at Ladino clov[er] [HEM]; 1 Mary's Peak, 16-VIII-29, H.A.S., 1750–2200′, on *Epilobium angustifolium* [SD]; 1 M[oun]t Hood, VII-29-1922, F.J. Spruijt [HEM]. **South Dakota:** 3 Black Hills (Camp Judson), Aug. 13, 1937, H.C.S. [SD]; 2 Black Hills, July 26, 1940, T.H. & T.H. Frison, Jr. [INHS]; 1 Custer, Sept. 1, 1926, H.C.S.; 2 Custer, Sept. 11, 1927, H.C.S. [all, SD]; 4 Custer, Aug. 15, 1940, H.E.M. [HEM]; 1 Spearfish, July 28, 1924, M.; 1 Spearfish, July 28, 1924, H.C.S. [all, SD]. **Utah:** 1 Heber (12 mi S.E. [of]), J. Silver, 7500′, flowers of *Rudbeckia* [USNM]; 1 Salt Lake City, VIII-5-1953, R.E. Rodock, (R.E. Rodock Coll[ectio]n) [HEM]. **Washington:** 1 Bothell, Aug. 22–26, 1954, H.E.&M.A.E.; 1 Friday Harbor, June 27, 1939, R.W.D.; 3 Friday Harbor, July 2, 1939, R.W.D.; 1 Friday Harbor, July 4, 1939, R.W.D.; 1 Friday Harbor, July 9, 1939, R.W.D.; 2 Friday Harbor, July 21, 1939, R.W.D. [all, HEM); 7 Illahee, Kitsap Co[unty], June 1956, D.F. [CNC]; 3 Seattle, 18 Sept. 1933, R.A. Flock [HEM]; 10 Unumclaw, IX-5-1955, J. Sanjean, on *Zinnia* [CNC]. **Wyoming:** 3 Lower Green River Lake (Wind River Range), Sublette Co[unty], Jul. 30–Aug. 6. 1953, F.&P.R., 8000 ft [AMNH]; 1 Summit, Aug. 16, 1940, H.E.M., 8835′ [HEM].

Bombus affinis Cr.

Bombus affinis Cr., 1863*a*, p. 103 (☿, not ♀): *Bombus affinis*, *auct.*: *Bombus affinis* v. *novae-anglaie* Beq., 1920*b*, p. 6: *Bombus juxtus*, Titus, 1902, pp. 39, 43 (p.p.), (*nec* Cr., 1863*a*, p. 103, ☿ *Bombus vagans*, Cr., 1863*a*, p. 91 (♀ , p.p., *nec* Sm., 1854, p. 399): *Bombus* (*B.*) *affinis*, Fkln., 1912, p. 277: *Bombus* (*B.*) *affinis* v. *novae-angliae*, Brs., *In* Muesebeck *et al.*, 1951, p. 1250: *Bombus* (Terrestris group), Rad., 1884, p. 80 (p.p.): *Bremus affinis*, Fris., 1919*a*, p. 160 *et seq.*: *Bremus affinis* v. *novae-angliae*, Ltz. & Ckll., 1920, p. 503; Fris., 1923*b*, p. 324; B. & P., 1925, p. 278: *Bremus* (*Terrestribombus*) *affinis*, Fris., 1927*e*, p. 67: *Bremus* (*Terrestribombus*) *affinis* v. *novae-angliae*, Fris., 1927*e*, p. 67: *Terrestribombus affinis*, Skor., 1922*a*, p. 154 (list).

DESCRIPTION. **Queen**. Length, 21.0 mm; width at wing bases, 10.0 mm; abdomen, 11.0 mm, width across T2, 10.5 mm; front wing length, 18.0 mm, width 6.5 mm. *Head:* Frontal outline triangularly rounded (excluding mouthparts), distinctly wider than high; vertical region depressed (concave) especially about ocelli, with small to medium irregular punctures except smooth and polished on ocellar half of ocellocular area; ocelli positioned somewhat below supraorbital line in weak arc anteriorly inclined, removed from one another about as much as their diameters, ocellocular line somewhat less than interocellar line; outline of compound eyes narrower above than below, the inner margins of both rather strongly convergent dorsally, each eye slightly less than three times higher than wide; clypeus distinctly broader than high, strongly convex, well covered (rather densely) with small to medium punctures; labrum about 2½ times wider than thick, with strong triangulate tubercles rather coarsely punctate above, below broadly shallowly concave and less punctate, directed ventromesad, their well-separted inner summits about as far apart as length of F2, the distinct arcuate labral shelf extended slightly laterad of inner tubercle summits; malar space distinctly shorter than distance between (and including) mandibular articulations, irregularly convex and sparsely sculptured; flagellum nearly twice as long as scape, F1 about 1½ times longer than distal width, distinctly longer than F3 and about one-third shorter than F2–3 combined. *Legs:* Mesobasitarsite elongate rectangular, distally shaped as in *t. terricola*; hind tibial surface shining, weakly alutaceous, longitudinally convex a little anteriad of middle; metabasitarsite twice as long as its widest dimension, posteriorly evenly arcuate from base to distal end, the outer weakly alutaceous surface more deeply concave medially sub-basically, the disto-posterior angle obscurely rounded and in recess to disto-anterior angle. *Pubescence:* Rather short, dense, some hairs longer on face, vertex and on distal abdominal terga; metabasitarsal posterior fringe composed of relatively short arcuate hairs, gradually diminishing in length from base to distal third of segment. *Color:* Head black with only slight admixture of yellowish pile on face and vertex, but with considerable lemon yellow at sides of center on occiput. Thorax (maize) yellow except noticeable intermixture of black hairs across interalar area especially on the mesothoracic disc. Legs black. Abdominal T1–2 entirely covered with (cadmium) yellow, T3–6 black except sparse scattered yellowish hairs on T3 observable under strong illumination. Wings lightly, uniformly infumated with brown.

Worker. Length, 15.0 mm; width at wing bases, 6.5 mm; abdomen, 9.0 mm, width across T2, 7.0 mm; front wing length, 13.0 mm, width, 5.0 mm. Morphological characteristics otherwise similar to those of the queen except F1 distinctly longer than F2 but only slightly longer than F3. *Legs*: Similar to those of the queen. *Pubescence*: Closely compares with that of the queen but somewhat looser. *Color*: Head black without noticeable intermixture of any yellow. Thorax yellow except metapleurum black and interalar area with considerable intermixture of black, predominantly so on the disc (often with rather well-defined complete interalar black band). Wings somewhat paler than those in the queen. Abdomen as in the queen except basal two-thirds of T2 orange rufous to ferruginous, T3–4 black as in the queen (but sometimes with varying amounts of coppery or rusty red — variable), remainder of abdomen as in the queen.

Male. Length, 16.0 mm; abdomen, 9.0 mm, width across T2, 7.0 mm; width at wing bases, 6.0 mm; front wing length, 14.5 mm, width, 5.0 mm. *Head*: Frontal outline ovoid triangular (excluding mouthparts), about as wide as high; compound eye little more than twice as high as broad, more broadly rounded below than above, its inner margin weakly concave outwardly, slightly moreso above; vertex nearly flat, covered with small to medium irregular punctures, the ocellocular area smooth and polished except the ocular one-third with weak separated punctations; ocelli located transversely on supraorbital line, each slightly closer together than their diameters, interocellar and ocellocular lines equal; malar space equal to distance between (and including) mandibular articulations, its surface weakly irregularly convex and sparsely punctate; labrum subrectangular, about 2½ times wider than thick, its ventral margin arcuate, its surface moderately pubescent, without prominent callosities; flagellum twice as long as scape, F1 distinctly shorter than F3 but noticeably longer than F2 which is 1½ times longer than its distal width. *Legs*: Mesobasitarsite elongate subrectangular, nearly 3½ times longer than the greatest distal width; outer hind tibial surface moderately convex longitudinally a little anteriorad of middle, microscopically alutaceous, covered with reclining pubescence except on median distal half; metabasitarsite little more than 3 times as long as its greatest width, its outer surface strongly longitudinally concave, covered with well-separated recumbent hairs, the posterior fringe rather short, longest beyond base to distad of middle thence gradually declining to short more numerous hairs on distal third. *Pubescence*: somewhat longer and definitely looser than that of female, especially on face and vertex. Genitalia, seventh and eighth abdominal sterna (Pl. X). *Color*: Similar to that of worker on head and thorax except the yellow is more drab; legs black, the hind tibial posterior fringe with some pale tinge; abdominal T1 drab yellow, T2 mostly very pale burnt sienna except drab yellow laterally and narrowly mid-posteriorly, T3–7 mostly black except some pile laterally on T4–7 with pale tinge.

Redescribed from hypotypes. **Queen**, St. Paul, Minn[esota], May 1, 1939, R. Dawson—H. Milliron; **worker**, Columbus, O[hio], Aug. 13, 1947, H. E. Milliron; **male**, Hocking Co[unty], Salt Creek T[o]w[nshi]p, Ohio, Aug. 26, 1945, Edward S. Thomas [all HEM].

TYPE. Examined a ☿ (not a ♀) in the collection of the Academy of Natural Sciences of Philadelphia. This is a Cresson (1916: 110) lectotype.

TYPE LOCALITY. Canada (Ontario). Number of specimens at hand: 271. In flight: April to mid-October, the workers appearing in early June, and the males about mid-July. Distribution: (vertical), sea level to *ca.* 6000 ft; (horizontal), southern Quebec and Ontario in Canada, and Maine to Georgia, northwest to the Dakotas in the United States. Floral visitations: *Angelica*, *Asclepias*, *Aster*, *Chamaedaphne*, *Cirsium*, *Epilobium*, *Eupatorium*, *Lythrum*, *Malus*, *Medicago*, *Robinia*, *Solidago*, *Spiraea*, *Vaccinium*, and *Veronica*. Lutz and Cockerell (1920) also reported *Ceanothus*, *Parnassia*, and *Ribes*, and Frison (1926*a*) recorded the species visiting *Carduus* and *Impatiens*. Plath (1934) gave *Berberis*, *Delphinium*, *Hypersicum*, *Kalmia*, *Linaria*, *Rhododendron*, and *Rosa*. Mitchell (1963) added *Aralia* and *Hydrangea*.

COMMENTS: Evidently this is the most constant species of the genus *Bombus* (s.s.) in the Western Hemisphere. The queen appears chromatically most often as redescribed here, except that sometimes an indefinite black interalar band is often apparent, and on many specimens a conspicuous circular black patch occurs on the mesothoracic disc; abdominal T2 is usually entirely yellow but on some specimens the proximal two-thirds is of a dull burnt sienna, as on many workers; it is uncommon for the queen to show any rusty or coppery red on any of the normally entirely black abdominal T3–5. I have not seen a melanic of this species. In this connection, the queen with abdominal T2 entirely black, save for a sprinkling of yellow at extreme base, reported by Bequaert and Plath (1925: 279) as belonging to this species, could not be located by me despite an intensive search for it at Cambridge, Mass., or elsewhere, and it is highly probable that a misidentification was involved, this specimen being more likely a queen of *Pyrobombus* (*P.*) *impatiens* (Cr.), an adventive into the *affinis* nest whose "entire" collection was reported upon (*loc. cit.*).

The worker and male often have an indefinite interalar black band (widest medially), and as often none at all. The so-called variety *novaeangliae* described by Bequaert (1920: 6) refers to worker and male specimens which display a varying amount of rusty or coppery red pile on abdominal T2–5 (female) and less commonly on T2–6 in the male. The reddish pubescence, when evident on any specimen, will be noted on abdominal T4 foremost in specimens of all castes; but, the amount of such off-color is extremely variable on any abdominal tergum beyond T2, and also as to the number of terga so affected between T3–5 in the female and T3–6 in the male.

The occurrence of rusty or coppery red pubescence in varying amounts on abdominal T2 or 3–6 (female) or on normally, or for the most part, all black T2 or 3–7 (male) is nothing unusual; for example, I cite similar conditions in specimens of *Megabombus* (*M.*) *atratus* (Fkln.), *Megabombus* (*B.*) *griseocollis* (De G.), *Pyrobombus* (*P.*) *impatiens* (Cr.), *Pyrobombus* (*P.*) *bimaculatus* (Cr.), *Pyrobombus* (*P.*) *vagans* (Sm.), and others (*cf.* each). Chromatic aberrations relating to pubescence are common and likely the results of deficient (abnormal) immature physiological development in every case, except in instances where the existing gene pool of a species normally promotes variability in accord with different environmental conditions in the range, or even within varying conditions in the nest of known variable species.

The publications of Bequaert (1920*b*: 6–7), Bequaert and Plath (1925: 278–280) pertaining to the chromatic aberration "novaeangliae" are most confounding in respect to the "type" series; when this published information was critically compared by me with the "type" material available in the collection of the Museum of Comparative Zoology, Harvard University, Cambridge, Mass., I sensed inexcusable discrepancies between "types" and published information. Apparently, the "types" were labeled at some time subsequent to the publication of the above papers, and without serious attempt to bring labeling of such specimens and published information into accord. Bequaert (1920*b*: 6) whose original description of *novaeangliae* referred to both workers and males indicated on the following page that the holotype is a male from Forest Hills, Mass., on this same latter page (part of Bequaert's second variational category) two males (June 1911, W. M. Wheeler) are referred to, one presumably the holotype. I found no such male conforming with these data in the collection of the Museum of Comparative Zoology, Cambridge, and concluded that a mistake in the sex of the holotype had been made. A worker labeled as type and conforming as near as could be judged with the description and collecting data (Forest Hills, Mass., June 1911, W. M. Wheeler) was, therefore, labeled by me as the lectotype, 1960. While "novaeangliae" is given no nomenclatorial status here, this discussion of the confusion with regard to a type is warranted; and, intended to prevent additional misunderstanding of the common chromatic aberrations that occur in this and other species of bumblebees.

No significant morphological variations have been detected in any caste of this species. Length of workers ranges from about 8.0 mm to slightly more than that given in the redescription.

CANADA

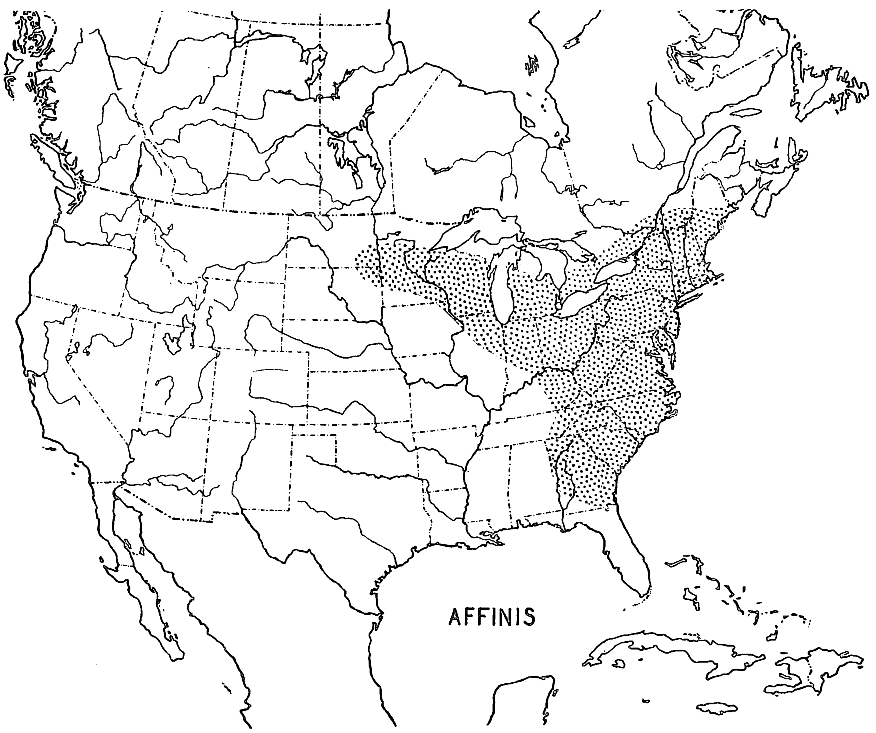
QUEENS

Ontario: 1 Constance Bay, 23-IX-1952, O.L. Cartwright [USNM].

UNITED STATES

QUEENS

Delaware: 1 Newark, 19-IV-1952, H.E.M. [HEM]. **Maine:** 1 Orono, V-1961 [CNC]; 1 Orono, V-1961 [RAM]. **Massachusetts:** 1 Amherst, VI-2-1917 [TBM]; 1 Amherst, 5-13-27, D. Crabbe; 1 Amherst, V-24-1938, O.G.J. [both, MASS]; 1 Danvers, IV-29-26, F.W. [SD]; 1 Forest Hills, (no data) [TBM]; 1 Lincoln, 16-V-37, C.H. Blake [MCZ]; 1 Martha's V[i]n[e]y[ar]d, 9-19-56, C.W. Sabrosky [USNM]; 1 Needham, V-30-28, T.B.M., *Vaccinium* [TBM]; 2 (locality unknown), (no data), (C.H. Fernald, [secon]d Col[lection]); 2 (locality unknown), (no data) [both, MASS]. **Michigan:** 4 Allegan Co[unty], V-18-59, R.K.&D.; 1 Grand Traverse Co[unty], VII-9-60, R.K.&D. [both, RRD]. **Minnesota:** 1 S[ain]t Paul, May 1, 1939, R.[W.]D.&H.[E.]M.; 1 Washington Co[unty], May 11, 1940, C.E. Pederson [both, HEM]. **New York:** 1 Essex Co[unty], VI-20 [SD); 1 Ithaca, June 6, 1925, Babiy [NRS]; 1 Ithaca, VI-13-1936, S. Bettini; 1 Ithaca, VI-21-1936, S. Bettini [both, ANSP]; 1 Otsego Co[unty], 11-V-59; R.A.M., *Barbarea vulgaris* [CNC]; 1 Otsego Co[unty], 11-V-59, R.A.M., *Barbarea vulgaris* [RAM]. **North Carolina:** 1 Waynesville, Apr. 30, 1952, W.A. Stephen, 3000-4000′, on apple [HEM]; 1 Waynesville, Apr. 30, 1952, W.A. Stephen, 3000-4000′,



MAP 4

on apple [TBM]; 1 Wilkes Co[unty], IV-23-1957, W.A. Stephen, on apple [HEM]; 3 Henderson Co[unty], Apr. 14, 1953, W.A. Stephen; 1 Macon Co[unty], 5-2-54, W.A. Stephen, on black locust [both, TBM]; 1 Moravian Falls, Apr. 10, 1953, W.A. Stephen, on apple [HEM]. **Pennsylvania:** 1 Pittsburgh, V-1956; 1 W[est]moreland Co[unty], (Powdermill Nature Res[erve]), 25-VIII-1960, A.C.L. [both, CM]. **South Dakota:** 8 Sisseton, June 17, 1952, H.C.S. [SD).

CANADA

WORKERS

Ontario: 2 Ottawa, 4-VII-60, H.E.M.; 1 Ottawa, 6-VII-60, H.E.M. [both, HEM]. **Quebec:** 1 Gatineau Park, 30-VII-1961, H.E.M., 1100′; 1 Gatineau Park, 8-VIII-1961, H.E.M. [both, CNC].

UNITED STATES

WORKERS

Delaware: 2 Newark, 20-VII-1957, H.E.M. [HEM]. **Kentucky:** 1 Morehead, July 5, 1962, F.&L. [CNC]. **Maine:** 2 Saco, Sept. 5, 1957, T.B.M., on *Solidago* [T.B.M.]. **Massachusetts:** 1 Amherst, 9-11-1916; 1 Amherst, Aug. 11, 1921 [both, MASS]; 1 Amherst, VII-18-1954, F.P. [INIA]; 1 Barnstable, 22 Sept. 1927, W.T.M. Forbes [HEM]; 1 Beverly, 8-7-20, R.T. Webber [MASS]; 1 Lincoln, 11-VII-37, C.H. Blake [MCZ]; 1 Long Pond, 7-39, E. Gray [MASS]; 1 Mattapoisett, VII-15-27, T.B.M. [HEM]; 1 Needham, Sept. 13, 1927, T.B.M., on *Solidago* [TBM]. **Michigan:** 1 Montcalm Co[unty], IX-12-59, R.R.D. [RRD]. **Minnesota:** 1 Brainerd, Oct. 2, 1938, R.W.D.; 2 Mille Lacs Lake, Oct. 2, 1938, R.W.D.; 2 Minneapolis, Sept. 26, 1938, R.W.D. [all, HEM]. **New Hampshire:** 2 Meredith, 17-VII-1960, R.A.M., on *Spiraea latifolia* [CNC]; 2 Meredith, 17-VII-1960, R.A.M., on *Spiraea latifolia* [RAM]; 1 Meredith, 27-VIII-1960, R.A.M., on *Eupatorium maculatum* [CNC]; 1 Meredith, 27-VIII-1960, R.A.M., on *Eupatorium maculatum* [RAM]; 1 Meredith, 29-VIII-1960, R.A.M., on *Solidago* [CNC]; 1 Meredith, 29-VIII-1960, R.A.M., on *Solidago*; 1 Meredith, 30-VIII-1960, R.A.M., on *Solidago* [both, RAM]; 1 Meredith, 31-VIII-1960, R.A.M., on *Solidago*; 1 Meredith, 1-IX-1960, R.A.M., on *Solidago* [both, CNC]; 1 Meredith, 1-IX-1960, R.A.M., on *Solidago* [RAM]; 1 Plaistow, 2-IX-35, Richard Dow [MCZ]. **New Jersey:** 2 Ramsay, Sept. 1935 [TBM]. **New York:** 1 Essex Co[unty], VI-20 [SD]; 2 Ithaca [Cornell

(Campus)], 30 Sept. 1925, P.P. Babiy [NRS]; 2 Minetto, July 31, 1951, F.P. Sivik [TBM]; 1 Tompkins Co[unty], (McLean Res[ervation]), VIII-2-40 [HEM]; 1 Tompkins Co[unty], 1-VIII-59, R.A.M., on *Asclepias*; 1 Tompkins Co[unty], 7-VII-60, R.A.M., on *Medicago savita* [both, CNC]; 1 Tompkins Co[unty], 7-VII-60, R.A.M., on *Medicago savita* [RAM]; 2 Tompkins Co[unty], 11-VII-60, J.R., on *Medicago sativa* [CNC]; 2 Tompkins Co[unty], 11-VII-60, J.R., on *Medicago sativa* [RAM]; 1 Tompkins Co[unty], 22-VII-60, J.R., on *Veronica* sp. [CNC]; 1 Tompkins Co[unty], 22-VII-60, J.R., on *Veronica* sp. [RAM]. **North Carolina:** 1 Clay Co[unty], (Glade Gap), VIII-5-1939, R.&R., 3673′ [ANSP]; 1 Great Smoky Nat[ional] Park, 6-23-40, C.T. Brues [MCZ]; 1 Highlands, Aug. 19, 1960, T.B.M. [TBM]; 1 M[oun]t Mitchell, June 22, 1954, T.B.M., 6000′ [HEM]; 1 Raleigh, early June, [yr. ?], C.S. Brimley; 1 Scenic H[i]g[h]w[a]y, (near M[oun]t Mitchell), Aug. 15, 1945, T.B.M. [both, TBM]; 2 Transylvania Co[unty], Aug. 21, 1960, T.B.M. [HEM]; 1 Transylvania Co[unty], Aug. 21, 1960, T.B.M. [TBM]. **Ohio:** 1 Columbus, Aug. 13, 1947, H.E.M. [HEM]. **Pennsylvania:** 1 Fulton Co[unty], (nr. top, Sideling M[oun]t[ain]), 14-VIII-1960, G.E. Wallace [HEM]; 1 Westmor[eland] Co[unty], (nr. Laughlintown), 22-VIII-53, G.E. Wallace; 1 W[est]moreland Co[unty], (Powdermill Nature Res[erve]), 10-VIII-1960; 1 W[est]-moreland Co[unty], (Powdermill Nature Res[erve]), 14-IX-1960 [all, CM]. **Tennessee:** 1 Gr[eat] Smoky M[oun]t[ain]s Nat[ional] Park, (Indian Gap), VIII-5-1939, R.&R., 5266′ [ANSP]. **Vermont:** 1 Durham, VIII-1918, W.M. Wheeler [MCZ]. **West Virginia:** 2 Bartow, 6-VIII-60, H.E.M.; 1 Cranberry Gl[ade]s, Aug. 11, 1957, T.B.M.; 2 Durbin (nr. Gaudineer Tower), 6-VIII-60, H.E.M.; 5 Pendleton Co[unty], (r[oa]d to Spruce Knob), 14-VIII-60, H.E.M., 4000′; 3 Spruce Knob, 5-VIII-60, H.E.M., 4860′; 1 Spruce Knob, 5-VIII-60, H.E.M., 4860′, on *Solidago*; 2 Spruce Knob, 6-VIII-60, H.E.M., 4000′; 2 Spruce Knob, 7-VIII-60, H.E.M., 4000′ [all, HEM].

CANADA
MALES
Quebec: 1 Gatineau Park, 8-VIII-61, H.E.M. [CNC]; 4 Montreal, 23-VIII-56, H.E.M. [HEM].

UNITED STATES
MALES
Connecticut: 1 Meriden (Fairview), July 17, 1950, S.I. Parfin, 500′ [USNM]; 1 New Canaan, Fairfield Co[unty], IX-20-1956, M. Stratham [AMNH]. **Maine:** 1 Orono, Oct. 6, 1936 [HEM]. **Massachusetts:** 1 Beverly, 10-2-25 [SD]; 1 Forest Hills, 12-IX-23 [MCZ]; 1 Needham, Sept. 13, 1957, T.B.M., *Aster* [HEM]; 1 Needham, Sept. 13, 1957, T.B.M., on *Solidago* [TBM]; 1 Salem, VIII-29-1925, F.H. Walker [SD]. **Minnesota:** 1 Brainerd, Oct. 2, 1938, R.W.D.; 10 Mille Lacs Lake, Oct. 2, 1938, R.W.D.; 1 Moorhead, Sept. 11, 1948, A. Stevens, *Aster paniculatus* [all, HEM]. **New Hampshire:** 1 Jaffrey, 5-X-29 [MASS]; 1 Meredith, 26-VIII-60, R.A.M., *Solidago* sp. [CNC]; 1 Meredith, 26-VIII-60, R.A.M., *Solidago* sp. [RAM]; 3 Meredith, 27-VIII-60, R.A.M., *Eupatorium maculatum* [CNC]; 3 Meredith, 27-VIII-60, R.A.M., *Eupatorium maculatum* [RAM]. **New York:** 1 Minetto, 10-V-1941, L.D. Newsom [TBM]; 1 New York City, (Van Cortt Park), Aug. 1, 1956, S. Bettini [ANSP]; 1 Tompkins Co[unty], 1-VIII-59, J.R. [RAM]; 1 Tompkins Co[unty], 18-VIII-60, J.R., *Solidago* sp. [CNC]; 1 Tompkins Co[unty], 18-VIII-60, J.R., *Solidago* sp. [RAM]; 1 (locality indeterminate), (Ith[aca ?]), 10-14-21 [HEM]. **North Carolina:** 1 Blowing Rock, VIII-17-1921, T.B.M. [TBM]; 1 Ela, VIII-30-1920, T.B.M. [HEM]. **Ohio:** 1 Hocking Co[unty], (Salt Creek T[o]w[nshi]p), Aug. 26, 1945, Edward S. Thomas [HEM]. **Pennsylvania:** 1 S[ain]t Lawrence Co[unty], (Slippery R[ock] Cr[eek]), 7-VIII-1960, John Bauer; 1 Westmor[eland] Co[unty], (nr. Laughlintown), 22-VIII-53, G.E. Wallace; 1 W[est]moreland Co[unty], (Powdermill Nature Res[erve] Lodge, nr. Rector), 6-VIII-1960; 1 Westmor[eland] Co[unty], (nr. Kooser St[ate] Park), summer 1960, M. Lawrence; 1 W[est]moreland Co[unty], (Powdermill Nature Res[erve] Lodge, nr. Rector), 10-VIII-1960; 3 W[est]moreland Co[unty], (Powdermill Nature Res[erve] Lodge, nr. Rector), 8-IX-1960; 1 Westmoreland Co[unty], (Powdermill Nature Res[erve] Lodge, nr. Rector), 14-IX-1960 [all, CM]. **Rhode Island:** 1 Kingston, Sept. 27, 1950, (Entomology class) [TBM]. **Virginia:** 1 Galax, Aug. 27, 1955, S.R. Gapco [TBM]; 2 Galax, Aug. 28, 1955, S.R. Gapco [HEM]; 2 Galax, Aug. 28, 1955, S.R. Gapco [TBM]. **West Virginia:** 3 Bartow, 6-VIII-60, H.E.M.; 1 Cranberry Gl[ade]s, Aug. 11, 1957, T.B.M. [all, HEM]; 1 Cranberry Gl[ade]s, Aug. 11, 1957, T.B.M. [TBM]; 1 Durbin, (nr., R[oa]d to Gaudineer Tower), 6-VIII-60, G.E. Wallace; 3 Durbin, (nr., R[oa]d to Gaudineer Tower), 6-VIII-60, H.E.M., *Asclepias*; 2 Durbin, (nr., R[oa]d to Gaudineer Tower), 6-VIII-60, H.E.M., *Epilobium*; 1 Durbin, (nr., R[oa]d to Gaudineer Tower), 6-VIII-60, H.E.M., Joe-pye weed; 28 Pendleton Co[unty], (R[oa]d to Spruce Knob), 14-VIII-1960, H.E.M., 4000′; 4 Spruce Knob, 5-VIII-60, H.E.M., 4000′; 6 Spruce Knob, 5-VIII-60, H.E.M., 4860′; 6 Spruce Knob, 5-VIII-60, H.E.M., 4000′, on *Cirsium;* 1 Spruce Knob, 5-VIII-60, H.E.M., 4860′, on *Epilobium*; 1 Spruce Knob, 5-VIII-60, H.E.M., on *Epilobium* sp.; 4 Spruce Knob, 5-VIII-60, H.E.M., 4000′, on *Solidago*; 5 Spruce Knob, 6-VIII-60, H.E.M., 4000′; 7 Spruce Knob, 7-VIII-60, H.E.M.; 1 Spruce Knob, 7-VIII-60, G.E. Wallace [all, HEM].

Genus *Megabombus* D.T., 1880, p. 40

TYPE: *Apis argillacea* Scop., 1763, p. 305, pl. 43, fig. 814, [= *Bombus ligusticus* Spin., 1805, p. 13, No. 3]. Monobasic.
Megalobombus (*Bombus*) Schulz, 1906, p. 267. *Emend.* Type: (*Apis*) *Bombus argillaceus* (Scop.), 1763, p. 305, pl. 43, fig. 814. Monobasic.

Subgenus *Bombias* Robt., 1903, p. 176 (*partim*)

Type: *Bombias auricomus* Robt., 1903, p. 176. Original designation.
Mendacibombus Skor., 1914*a*, p. 125. Type: *Bombus mendax* Gerst., 1869, p. 323; designated by Sandhouse, 1943, p. 572.
Nevadensibombus Skor., 1922*a*, p. 149. Type: *Bombus nevadensis* Cr., 1874, p. 102; designated by Frison, 1927*e*, p. 64, (absolute tautonomy).

AURICOMUS GROUP, *Sola*

Megabombus (*Bombias*) *nevadensis* (Cr.)

KEY TO SUBSPECIES

Females

Thoracic dorsum entirely ochraceous (often with some dark or black hairs at center of disc, rarely with as much as indefinite interalar black band) .... *n. nevadensis* (Cr.) (p. 73)
Thoracic dorsum light to golden yellow, with rather broad interalar black band ...... *n. auricomus* (Robt.) (p. 77)

Males

Thoracic dorsum entirely light ochraceous; abdominal T6–7 (usually) with at least some ferruginous pubescence .... *n. nevadensis* (Cr.) (p. 73)
Thoracic dorsum yellow, usually with rather narrow, well defined to obscure interalar black band; abdominal T6–7 without ferruginous .... *n. auricomus* (Robt.) (p. 77)

Megabombus (*Bombus*) *nevadensis nevadensis* (Cr.)

Bombus nevadensis Cr., 1874, p. 102, (re: nominate ssp. only): *Bombus africanus* F., 1805, p. 346, (p.p.), (*nec Apis africana* F., 1781, p. 477), [n. syn.]: *Bombus crotchii* v. *semisuffusus* Ckll., 1937, p. 148, [n. syn.]: *Bombus crotchii* ssp. *semisuffus*, Steph., 1957, p. 61 [n. syn.]: *Bombus improbus* Cr., 1877, p. 188, (*nec impbrobus*, How., 1901, pl. 2, fig. 13): *Bombus nevadensis*, Handl., 1888*a*, p. 245: *Bombus nevadensis* race *cressoni* C. & P., 1899*a*, p. 388: *Bombus nevadensis* ssp. *miguelensis* Ckll., 1937, p. 338, [n. syn.]: *Bombus nevadensis* ssp. *nevadensis*, Steph., 1957, p. 44: *Bombus* (*Bombias*) *nevadensis*, Fkln., 1912, p. 416: *Bombus* (*Bombias*) *nevadensis nevadensis*, Brs., 1951, p. 1247, *In* Muesebeck *et al.*: *Bombus* (*Bombias*) (Auricomus group) Fkln., 1912, p. 412, (p.p.): *Bombus* (*Crotchiibombus*) *crotchii semisuffusus*, Kromb., 1958, p. 260, [n. syn.]: *Bombus* (*Separatobombus*) *crotchii semisuffusus*, Brs., 1951, p. 1248, *In* Muesebeck *et al.*, [n. syn.]: *Bremus nevadensis*, Fris., 1921*b*, p. 146: *Bremus* (*Bombias*) *nevadensis*, Fris., 1919*a*, p. 160 (*et seq.*); Fris., 1929*b*, pp. 117, 118, (*pro Nevadensibombus* Skor., *q.v.*, Fris., 1927*e*): *Bremus* (*Nevadensibombus*) *nevadensis*, Fris., 1927*e*, p. 64: *Megabombus* (*Bombias*) *nevadensis*, Mlrn., 1961*a*, p. 56, (p.p.): *Megabombus* (Auricomus group), Mlrn., 1961*a*, p. 56, (p.p.): *Nevadensibombus nevadensis*, Skor., 1922*a*, p. 149, (list).

DESCRIPTION. **Queen.** Length, 22.0 mm; width at wing bases, 10.0 mm; abdomen, 11.0 mm, width across T2, 7.0 mm; front wing length, 19.5 mm, width, 8.0 mm. *Head*: Frontal outline rather elongate trapezoidal (excluding mouthparts), perceptibly wider than high, broadly rounded laterally above; vertical region slightly concave only about ocelli, the ocular one-third of ocellocular area with medium irregular punctation, the ocellar two-thirds smooth and polished, the vertical area posteriad of ocelli irregularly sculptured with medium punctures; outline of compound eye somewhat more broad below than above, the inner margin only slightly concave (outwardly) dorsally, each eye about one-fourth higher than wide; ocelli rather large, much below supraorbital line, situated in a weak arc, each much closer together than their diameters, which combined are about equal to ocellocular line; clypeus nearly as wide as high, more strongly convex above than below, entirely covered with dense rather uniform small punctures [there is, to me, no other species of bumblebees whose clypeus is so uniformly scupltured]; labrum little more than 2½ times wider than thick, roughly and irregularly sculptured above, with weak "tubercles" nearly confluent medially, ventrad rather flat to the abrupt narrowly elevated margin; malar space about 1¼ longer than distance between (and including) mandibular articulations, its surface irregularly convex with noticeable pubescence on the posterior half; flagellum twice the length of scape, F1 two and one-half times as long as distal width, subequal to subquadrate F2, F3 and subrectangular F4 combined. *Legs*: Mesobasitarsite elongate rectangular, distally subtruncate, the disto-posterior angle short spinate, its outer surface moderately concave mid-longitudinally; outer hind tibial surface finely alutaceous, posteriorly broadly but weakly concave; metabasitarsite nearly 3 times longer than widest dimension, the posterior margin weakly nearly evenly arcuate from base to distal end, the base almost as wide as distal end, its outer surface shallowly concave, distally weakly emarginate with slightly acute disto-posterior angle somewhat more extended than disto-anterior angle. *Pubescence*: On thorax rather short, dense and even throughout, somewhat longer, looser and more uneven on head, most of scutellum and on abdomen; corbicular fringe rather long and loose; metabasitarsal posterior fringe composed of long, arcuate well-separated hairs on basal two-thirds, longest hairs nearly equal to widest dimension of segment, the distal one-third with few short reclining hairs. *Color*: Head black with some admixture of yellow on vertex, moreso on postocciput. Thorax above and ventrally extended lobe anteriad of tegulae light ochraceous yellow, remainder and legs black. Abdominal T1 (except predominantly black at anterior corners and medially), T2–3 light ochraceous yellow, remainder of abdomen black. Wings rather deeply evenly infumated with chocolate brown.

Worker. Length, 17.0 mm; width, at wing bases, 8.0 mm; abdomen, 10.0 mm, width across T2, 7.0 mm; front wing length, 16.0 mm, width, 5.5 mm. Structural features of this average worker relatively very similar to those of the average queen. *Pubescence*: Physical characteristics as in queen. *Color*: Head black except conspicuous intermixture of yellow on face, vertex, and postocciput; yellow on thoracic dorsum extended somewhat farther ventrad of tegulae than in queen, noticeable intermixture of black on mesothoracic disc, and abdominal T1–3 entirely somewhat paler; otherwise colored as in queen, except wings slightly less infumated.

Male. Length, 19.0 mm; abdomen, 10.0 mm, width across T2, 7.5 mm; width at wing bases, 8.5 mm; front wing length, 14.5 mm, width, 5.0 mm. *Head*: Frontal outline triangulate ovoid (excluding mouthparts), only slightly wider than high; compound eye swollen, about three times higher than wide, the inner margin only weakly concave outwardly, divergent (in relation to same margin of opposite eye) dorsally, outline broadly arcuate posteriorly, above broadly rounded, ventrally more narrowly so; vertex very weakly convex, shallowly irregularly sculptured; ocelli positioned as weak arc below shortest inner margins of compound eyes and far below supraorbital line, removed from each other about as far as their diameters, interocellar and ocellocular lines nearly equal; malar space very short, not longer than distance between (and including) mandibular articulations; labrum noticeably less than twice as wide as thick, covered with strong and fine hairs but without prominent lateral callosities, its ventral margin broadly arcuate; flagellum 2½ times longer than scape, F1 about twice as long as its distal thickness, much longer than subquadrate F2 or rectangular F3, equal to combined lengths of two latter segments. *Legs*: Mesobasitarsite elongate rectangular, little more than 3 times longer than widest dimension, its subacutely rounded disto-posterior angle much in recess of the more acutely rounded disto-anterior angle, the alutaceous outer surface moderately concave mid-longitudinally; metabasitarsite slightly more than twice as long as greatest width, the disto-posterior angle subacutely rounded and recessed with relation to the subacutely rounded disto-anterior angle, the outer alutaceous surface only weakly but sharply narrowly concave on disto-posterior half, the posterior fringe long (longest hairs exceeding widest dimension of segment), the pubescence on outer surface moderately short, numerous, recumbent. *Pube-*

scence: That on head and thorax shorter and somewhat denser than in the female; pile on abdominal T1–2 similar to female in length and texture, longer on T3–7. Genitalia, seventh and eighth abdominal sterna (Pl. XI). *Color*: Head (except for admixture of some black), thorax, legs (mostly), and abdominal T1–3 pale ochraceous yellow; T4 with some black intermixed on its basal half, but otherwise pale ochraceous yellow; T5 mostly black medially, pale ochraceous yellow laterally and distally; T6–7 rufous yellow. Wings moderately evenly stained with some brown as in the worker.

Redescribed from hypotypes. **Queen**, Chenney [Heeney ?] G[u]l[c]h, Col[orado], 5–15 [HEM]; **worker**, Jacob's Cabin, Hart M[out]t[ain], Lake Co[unty], Ore[gon], elevation 6600 ft, July 9, 1937, Bolinger–Jewett [HEM]; **male**, Plainview, Jeff[erson] Co[unty], Colo[rado], 7–8000 ft, VII–9-14, 1927, (Brooklyn Museum Coll[ectio]n, 1929) [USNM].

TYPE. Examined a Cresson (1916: 125) lectotype ♀ (No. 2637) in the collection of the Academy of Natural Sciences of Philadelphia.

TYPE LOCALITY. Nevada, U.S.A. Number of specimens at hand: 72. In flight: late April to the first half of September, the males making an appearance in early July. Distribution: (vertical), from near sea level to 11,000 ft; (horizontal), Alaska to southern Mexico (Hidalgo); eastward in the United States to Wisconsin. Recent examination of additional material not tabulated herein has extended the range considerably inland in British Columbia and western Alberta. Adjustment for this has been made on Map 5. Floral visitations: *Cirsium*, *Crepis*, *Melilotus*, and *Trifolium*. Lutz and Cockerell (1920) have added or compiled: *Achillea*, *Astragalus*, *Cleome*, *Delphinium*, *Malvastrum*, *Monarda*, *Polemonium*, *Senecio*, *Sicyos*, and *Solidago*. LaBerge and Webb (1962) listed *Helianthus*, *Medicago*, and *Verbena* as additional records.

COMMENTS. Disregarding size variability within the castes, the species *nevadensis* is otherwise remarkably constant in its morphological features except, perhaps, for length and compactness of pubescence. Chromatically, however, the species does show considerable range in respect to the thoracic dorsum and abdominal T1 in both this and the following subspecies. Sometimes females of the nominate subspecies have considerable black on the thoracic disc and abdominal T1, and often the interalar area is predominantly black, depicting a rather sharp, wide interalar black band. A female (queen) *n. nevadensis* has been seen taken as far southward as about 50 miles northeast of Mexico City in the state of Hidalgo; this specimen has longer and looser pile, the lighter of which is duller throughout. Some specimens of the nominate subspecies from the lower coastal areas of the Northwest (British Columbia) grade into almost entirely black (melanics). Large series of both subspecies reveal a continuous range in size from the smallest workers to the smallest queens. In some general locations where this and the following subspecies are allopatric, hybridization occurs (*cf.* under *n. auricomus*).

CANADA

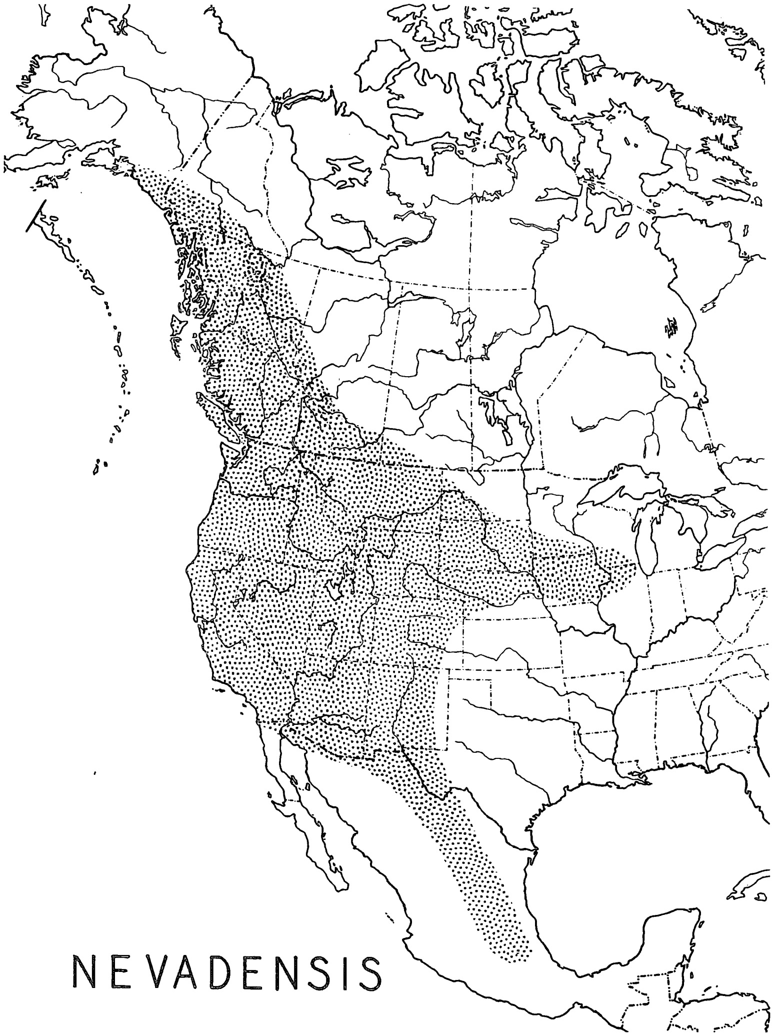
QUEENS

Alberta: 1 F[ort] MacLeod, 17-VI-61, H.E.M., on sweetclover [CNC]; 1 High River, Baird [ANSP]; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 16-V-51, G.A.H.; 1 Lethbridge (Vet[erinary] Res[earch] Sta[tion]), 21-V-51, C.E.L.; 1 Milk R[iver] (R[oa]d to Delbopita), 22-V-51, G.A.H. [all, HEM]. **Saskatchewan:** 1 Val Marie, 10-VIII-55, C.D.M. [CNC].

MEXICO

QUEENS

Hidalgo: 1 Tepeapulco (3 mi N. [of]), 17 June 1961, on *Asclepias*, (U[niversity of] Kans[as] Mex[ican] Exped[ition]) [KU].



MAP 5

UNITED STATES

QUEENS

Arizona: 1 Oak Cr[eek] Can[y]on, Coconino (not Cocinino) Co[unty], Englehart [MCZ]. **Colorado:** 1 Deer Cr[eek] Canyon, 8-16-60, R.&K.D., 5000′ [RRD]; 1 Nederland (not Niederland), 8-13-60, R., K.D., 8500′ [HEM]; 1 Nederland (not Niederland), 8-13-60, R., K.D., 8500′ [RRD]; 1 (locality unknown), 8-5-8, C.F. Baker [HEM]; 2 (locality unknown), (no data), Morrison [NRS]; locality indeterminate, 1 Chenney [Heeney?], G[u]l[c]h, 5-15 [HEM]. **Idaho:** 1 Lewiston, May 1939, (Children's Project, R.E. Rodock Coll[ectio]n), 1 Lewiston, VII-6-1941, R.E. Rodock (R.E. Rodock Coll[ectio]n) [all, HEM]. **Montana:** 1 Little Big Horn (n[ea]r Hardin), June 4, 1941, G.R. Ferguson [HEM]. **New Mexico:** 1 Closson, Aug. 25, 1940, H.E.M. [HEM]; 3 Wheeler Peak (Taos), June 15–25, 1960, Burks & Kinzer [USNM]. **Oregon:** 2 Hart M[oun]t[ain] (Jacob's Cabin), Lake Co[unty], July 9, 1937, Bolinger – Jewett, 6600′; 1 Milton, June 22, 1938, K. Gray & J. Schuh; 1 Thorn Hollow, April 29, 1938, K. Gray & J. Schuh [all, HEM]. **South Dakota:** 1 Buffalo, Sept. 9, 1927, H.C.S.; 2 Camp Crook, Aug. 1, 1924; 2 Cottonwood, July 26, 1948, H.C.S.; 1 Custer, July 29, 1935, H.C.S.; 1 Eagle Butte, June 19, 1929, H.C.S.; 1 Hot Springs, Aug. 12, 1932, Fred R. Bingham; 1 Hot Springs; 1 Newell, June 28, 1923, H.C.S. [all, SD]. **Utah:** 1 M[oun]t Timpanagos, 8-16-60, R.&K.D., 5000′ [RRD]. **Wyoming:** 1 Laramie, 6-30-25, C.L.C.; 1 Laramie, 1918 [both, HEM].

CANADA

WORKERS

Alberta: 1 F[or]t MacLeod, 17-VI [not VII]-61, H.E.M., on sweetclover [CNC]. **Saskatchewan:** 1 Saskatoon, 22-VI-1912, N. Willing, (Theodore H. Frison Coll[ectio]n) [INHS]; 1 Val Marie, 8-9-VIII-55, C.D.M. [CNC]. **Yukon Territory:** 2 Tagish L[ake], 4-VII-54, M.E. Smith [MASS].

UNITED STATES

WORKERS

California: 1 Lake City, Modoc Co[unty], July 29, 1922, C.L. Fox [HEM]. **Colorado:** 1 Denver, July 5, 1914, O.E. Jackson [NRS]; 1 Pinewood Sp[rin]gs, Laramie Co[unty], VI-62-26, R.&K.D. [HEM]; 5 (no data), Morrison [NRS]. **Nevada:** 3 Angel Lake, Elko Co[unty], VIII-23-60, R.&K.D., 8200′ [RRD]. **Oregon:** 1 Trail Crossing Flats, Jefferson Co[unty], July 15, 1948, H.A.S., on (Midland) red clover [HEM]. **South Dakota:** 4 Custer, July 29, 1935, H.C.S.; 1 Interior, Aug. 6, 1924 [all, SD]. **Wyoming:** 1 Cody, Park Co[unty], 20-VII-1948, Wallace – Bauer, (C[arnegie] M[useum], Acc. 14503, 126) [CM]; 1 Summit (Beartooth M[oun]t[ain]s), 24-VIII-54, C.P. Alexander, 10,000′ [MASS].

CANADA

MALES

Yukon Territory: 1 Haines J[un]ct[ion], 2 Aug. 1948, Mason & Hughes [CNC].

UNITED STATES

MALES

California: 1 Bishop (43 mi N. [of]), Aug. 17, 1948, (C[arnegie] M[useum] Acc. 14702) [USNM]. **Colorado:** 1 Colorado Springs (Palmer Park), July 20, '17, T.E. Snyder [USNM]; 1 Creeds, August 1914, S.J. Hunter, 8844′ [MASS]; 1 Plainview, Jeff[erson] Co[unty], VII-9-14-1922, 7–8000′, (Brooklyn Museum Coll[ectio]n) [USNM]. **Montana:** 1 Lake View, VIII-4-20, A.N. Caudell [USNM]. **New Mexico:** 1 White M[oun]t[ain]s, (S. F[or]k, Eagle Cr[eek], 8-20, Townsend, 8200′ [MASS-(H.J.F. *improbus* homotype)]. **Washington:** 1 Ellensburg, (no data) [USNM].

Megabombus (Bombias) nevadensis auricomus (Robt.)

Bombus nevadensis Cr., 1874, p. 102, (re: nominate ssp. only): *Bombus auricomus* Robt., 1903, pp. 176, 177, (re: paranominate ssp. only): *Bombus africanus* F., 1805, p. 346, (p.p.), (*nec Apis africana* F., 1781, p. 477), (*cf. Megobombus* (*Bombias*) *nevadensis nevadensis, ante*): *Bombus* (*Bombias*) *auricomus*, Fkln., 1912, p. 413: *Bombus* (*Bombias*) (Auricomus group), Fkln., 1912: p. 412, (p.p.): *Bombus nevadensis*, Handl., 1888*a*, p. 245, (p.p.): *Bombus n. auricomus*, L. & W., 1962, p 27: *Bombus pennsylvanicus*, Cr., 1863*a*, p. 94, ♀ ☿ (p.p.), ♂, (*nec Apis pensylvanica* De G., 1773, p. 575): *Bremus auricomus*, Fris., 1923*b*, p. 325: *Bremus* (*Bombias*) *auricomus*, Fris., 1919*a*, p. 160 (*et seq.*); Fris, 1927*e*, pp. 63, 64: *Megabombus* (*Bombias*) *n. auricomus*, Mitch., 1962, p. 514: *Megabombus* (*Bombias*) (Auricomus group), Mlrn., 1961*a*, p. 56, (p.p.): *Nevadensibombus auricomus*, Skor., 1922*a*, p. 149, (list). *Cf.* Fris., 1927*e*, pp. 63, 64; Fris. 1929*b*, pp. 117, 118, re: *Nevadensibombus* Skor.

DESCRIPTION. **Queen**. Structurally [including physical appearance of pubescence] like that of the nominate subspecies. *Color*: Head black except for slight admixture of canary yellow above antennal bases, moreso on vertex and occiput. Thorax black, except pronotum, mesoscutum including upper part of mesopleurum anteriad of wing bases deep yellow, with noticeable admixture of ochraceous yellow over posterior scutellar half. Abdominal T1 black, T2 (except for scattered black hairs basally) and T3 covered with light ochraceous yellow; T4–6 black. Wings uniformly deeply infumated with blackish brown.

Worker. Smaller but structurally much as in the queen. *Color:* As in the queen except the yellow on thorax and abdomen paler.

Male. Morphologically like *n. nevadensis*, including abdominal sterna and genitalia. *Color*: Head and thorax as in *n. nevadensis* except dorsum with moderately wide indefinite black interalar band. Wings less deeply infumated than in female. Abdominal T1 (mostly) –3 covered with ochraceous yellow, T4–7 black though some hairs laterally on T5–7 with tinge of burnt sienna.

REDESCRIBED FROM HYPOTYPES: **Queen**, Columbus, O[hio], Aug. 13, 1947. H. E. Milliron [HEM]; **worker**, same data [HEM]; **male**, West P[oin]t, Neb[raska], Aug. 17, '03, ["Oma weed"(?)], (Crawford, No. 312), J.C. Crawford [HEM].

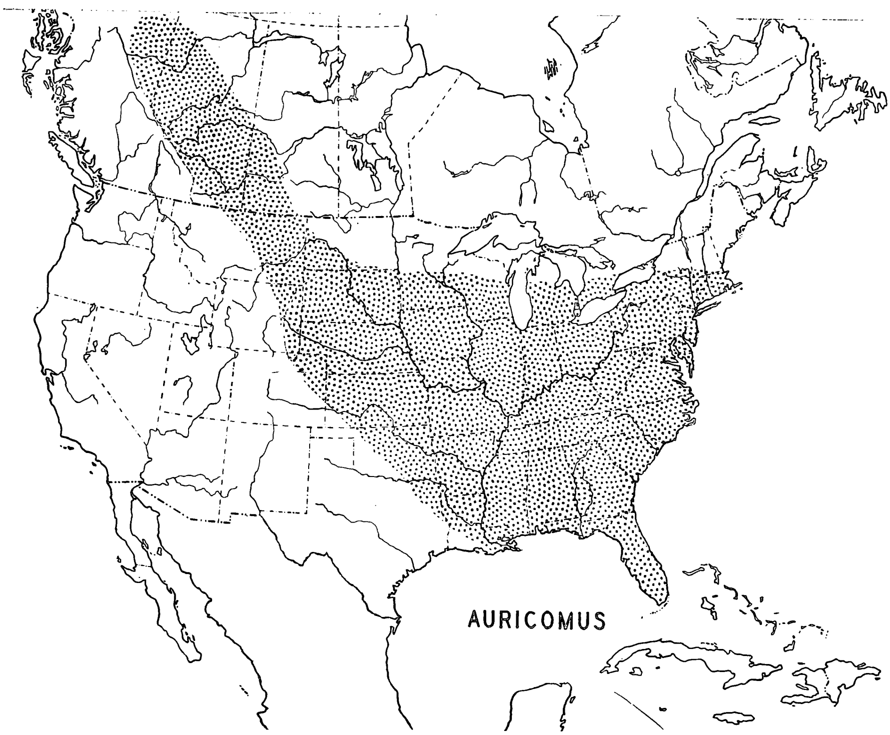
TYPE. Examined—my (1959, unpub.) lectotype ☿ (mounted *in copula* with a conspecific male) bearing Robertson's notebook number 19944 (referring to Carlinville, Ill., July 19, 1897), is a part of the Theodore H. Frison Collection, Illinois Natural History Survey, Urbana. A penciled label on the pin indicated that K. Sommerman had previously designated this female as a "♀ lectotype", but such information was never published. The pin also bears what is presumed to be Robertson's red "type" label; evidently he meant this male to be the type because he established *Bombias* on the basis of that sex of *auricomus*. However, in conformity with Cresson's type of the species (a ♀, *n. nevadensis*, 1916: 125) the above large worker was selected by me as the lectotype of the subspecies *auricomus*.

TYPE LOCALITY. Carlinville, Ill., U.S.A. Number of specimens at hand: 99. In flight: late April to early September, the earliest appearance of males *ca.* mid-July. Distribution: (vertical), sea level to 4500 ft; (horizontal), Ontario, and Massachusetts south and southwestward to Texas, northward to the Dakotas. Recent examination of additional material not tabulated herein has extended the range into southern Ontario and considerably so northward in western Canada. Adjustment for this has been made on Map 6. Floral visitations: *Epilobium* and *Pentstemon.* From Lutz and Cockerell (1920) can be added: *Asclepias, Antirrhinum, Astragalus, Carduus, Cnicus, Collinsia, Crataegus, Eupatorium, Fragaria, Helianthus, Mertensia, Phlox, Pyrus* [*Malus* ?], *Ribes* and *Vernonia.* Additional records from Robertson (1929) are: *Achillea, Aesculus, Agastacha, Aster, Bidens, Brauneria, Blephilia, Camassia, Cardamia, Cassia, Cephalanthus, Cercis, Cicuta, Cirsium, Claytonia, Clematis, Cornus, Delphinium, Desmodium, Dicentra, Dodecatheon, Gerardia, Hibiscus, Hydrophyllum, Ipomoea, Iris, Lactuca, Leonurus, Malva, Melilotus, Monarda, Nepeta, Oxalis, Petalostemon, Polemonium, Psoralea, Ptelea, Pycnanthemum, Robinia, Rosa, Rudbeckia, Scutellaria, Sisyrinchium, Solidago, Stachys, Tradescantia, Trifolium, Verbenia, Verbesina, Viola,* and *Zizia.* Mitchell (1963) has added *Ceanothus, Hypericum, Malus,* and *Rubus.*

COMMENT. This is, in respect to the nominate subspecies, chromatically more variable. Sometimes females have the entire scutellum canary to light ochraceous yellow with rather wide, distinctly limited black interalar band; and, on such specimens the pale pubescence extends farther ventrad on the mesopleurum anteriad to wing bases. Often in the female all the thoracic dorsum is black except for yellowish pubescence on the pronotum and on the anterior margin of the mesonotum. Abdominal T1 in the female ranges from the usual black to almost completely yellow of various shades. The male might, or not, have any semblance of a distinct interalar black band, and often specimens of this caste have lateral pile on abdominal T5–7 distinctly tipped with burnt sienna.

Hybridization between the eastern and western subspecies frequently occurs in most allopatric locations, especially in broad expanses in the mid-western and northwestern United States and in certain southwestern areas of British Columbia (Canada). Often it is difficult to assign such hybrid specimens (especially males) to either subspecies.

The subgenus *Bombias* of *Megabombus*, represented by a single species, is restricted to the Western Hemisphere. I know of no very closely related species in the Eastern Hemisphere.



MAP 6

UNITED STATES

QUEENS

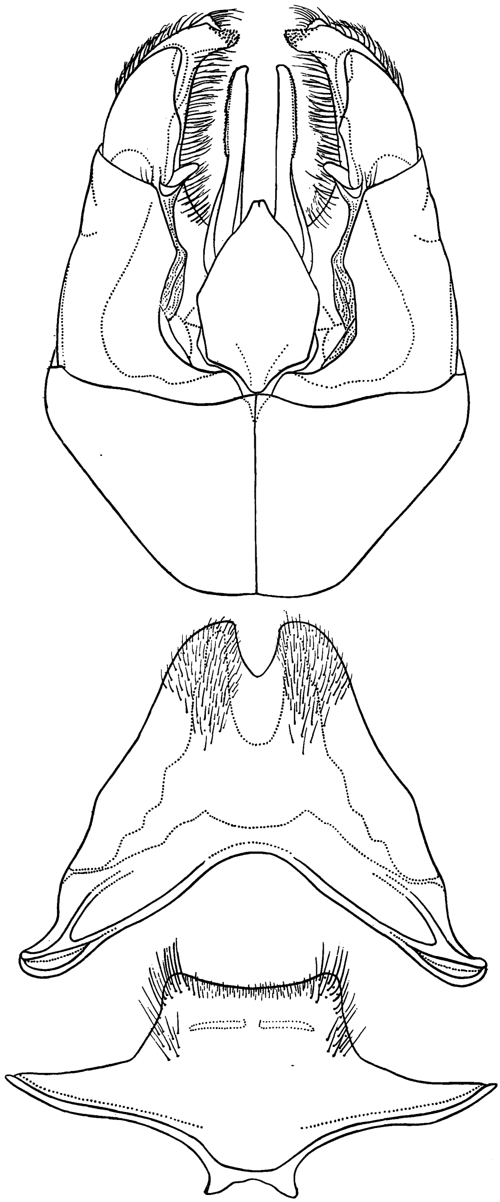
Arkansas: 2 Goodwin, S[ain]t Francis Co[unty], V-12-1938, F.W.P., at *Penstemon tubae florus* & *digitalis* [ANSP]. **Illinois:** 1 Carlinville, (no data), Robertson [NRS]. **Indiana:** 4 Flat Rock, 23-VI-62, F.&L. [CNC]. **Iowa:** 2 Ames, I-VI-1954, L.A.K. [CNC]. **Kentucky:** 1 Morehead, Aug. 29, 1962, F.; 1 Morehead, 1 Sept. 1962, F. [both, CNC]. **Michigan:** 1 Allegan Co[unty], V-18-59, R.&K.D. [RRD]; 1 E[ast] Lansing, 5 June 1937 [HEM]; 1 Hillsdale Co[unty], 5-21-60, R.K.&D. [RRD]. **Minnesota:** 1 Interstate St[ate] P[ar]k, 7-VI-52, M.E. Smith [MASS]. **Nebraska:** 2 Thedford, 8-31-60, R.&K.D. [RRD]. **Ohio:** 1 Columbus, Apr. 24, 1947, H.E.M.; 1 Columbus, May 17, 1947, Bresser; 1 Columbus, Aug. 2, 1947, H.E.M.; 1 Columbus, Aug. 13, 1947, H.E.M. [all, HEM]. **Pennsylvania:** 1 Harrisburg, VIII-23-08, P.R. Myers [HEM]. **South Dakota:** 1 Beresford, July 17, 1945, H.C.S.; 1 Brookings, May 17, 1919, H.C.S.; 1 Brookings, July 31, '22, H.C.S.; 1 Canton, June 16, 1924, H.C.S.; 2 Capa, Aug. 12, '22, H.C.S.; 1 Cottonwood, July 26, 1948, H.C.S.; 1 Garretson, June 16, 1924, H.C.S.; 1 Platte, June 22, 1934, H.C.S.; 10 Sisseton, June 17, 1952, H.C.S. [all, SD].

WORKERS

Iowa: 10 Ames, July 27, 1949, K. Swenson [SD]; 1 Ames, 1-VI-1954, L.A.K. [CNC]. **Kentucky:** 1 Morehead, 2-VII-62, F.&L.; 1 Morehead, July 3, 1962, F.&L.; 9 Morehead, 23 Aug. 1962, F.; 1 Morehead, 26 Aug. 1962, F.; 1 Morehead, 29 Aug. 1962, F.; 1 Morehead, 31 Aug. 1962, F. [all, CNC]. **Michigan:** 1 Romeo, 3 Aug. 1939 [HEM]. **New York:** L[ong] I[sland], (no data), (W.H. Ashmead Coll[ectio]n) [HEM]. **Ohio:** 3 Columbus, Aug. 13, 1947, H.E.M. [HEM]. **Pennsylvania:** 1 Lehigh Gap, VII-7-1901, (J. McFarland Coll[ectio]n) [ANSP]; 1 Rector (Powdermill Nature Res[erve], nr.), W[est]moreland Co[unty], 28-VII-1960 [CM]. **South Dakota:** 1 Brookings, July 31, '22, H.C.S.; 2 Elk Point, Aug. 29, 1954, H.C.S.; 1 Hecla, Aug. 30, 1927, H.C.S.; 1 McNeely, Aug. 20, 1927, H.C.S.; 1 Newell, 8-31-22, H.C.S.; 1 Sioux Falls, June 13, 1929, H.C.S.; 2 Sisseton, June 17, 1952, H.C.S.; 5 Springfield, Sept. 1, 1954, H.C.S.; 1 Vermillion (5 mi S. [of]), Aug. 5, 1941, N.P. Larson; 1 White, July 26, '22, H.C.S. [all SD]. **West Virginia:** 1 Spruce Knob Lake, 5-VII-60, H.E.M., 4500′, on *Epilobium* sp. [HEM].

MALES

Michigan: 1 Gr[and] Rapids, 12 July 1937 [HEM]. **Minnesota:** 2 Mound Springs St[ate] P[ar]k, Rock Co[unty], Sept. 5, 1948, H.E.M. [HEM]. **Nebraska:** 1 West P[oin]t, Aug. 7, '03, J.C. Crawford [HEM]; 1 West P[oin]t, Aug. 19, '03, J.C. Crawford [USNM]; 1 West P[oin]t, Aug. 17, 1903, J.C. Crawford [HEM]. **Pennsylvania:** 1 (locality unknown), (no data), C.V. Riley [USNM]. **Virginia:** 1 (locality indeterminate), (Ch. Bridge), 20 July 1912, Fred[eric]k Knab; 1 (locality unknown), July 24, [yr. ?], C.V. Riley [both, USNM].



Nevadensis

(Auricomus Group)

PLATE XI.