

## FAMILY APIDAE

This family includes the truly social bees, in which a worker caste, more or less distinct from the queen, is found. These social bees are the honey bees, *Apis*, the bumblebees, *Bombus*, and in the tropical regions two genera of stingless honeybees, *Melipona* and *Trigona*. Along with these are some non-social, non-parasitic, tropical genera such as *Euglossa* and *Eulema* which do not reach this region, and some parasitic groups, including *Psithyrus*, which is well represented in this part of the world.

In the non-parasitic genera the pollen-collecting surface of the hind tibiae is modified to form the so-called pollen-basket or corbicula, the surface being bare and highly polished, with a marginal fringe of elongate hairs. The scape is elongate, always much longer than the basal segment of the flagellum, and the pygidial plate is absent. In most of our species of *Psithyrus* and *Bombus*, the malar space is extensive, but this character is not constant throughout the family.

### KEY TO GENERA

1. Hind tibial spurs absent; eyes conspicuously hairy ..... *Apis* (p. 544)  
Hind tibial spurs present; eyes not hairy ..... 2
2. Females ..... 3  
Males ..... 4
3. Hind tibiae with well developed corbiculae ..... *Bombus* (below)  
Hind tibiae relatively slender, rather uniformly pubescent throughout .....  
..... *Psithyrus* (p. 538)
4. Hind tibiae somewhat flattened, rather sparsely pubescent on outer surface; gonostylus of genital armature very short, not much exceeding apex of gonocoxite ..... *Bombus*  
Hind tibiae more convex, quite densely pubescent on outer surface, gonostylus more elongate, much exceeding apex of gonocoxites ..... *Psithyrus* (p. 538)

### *Bombus* Latreille

(Fig. 128)

*Bremus* Jurine, 1801. Intell. Blatt. Litt.-Ztg. Erlangen 1, p. 164. Name suppressed by Internatl. Comm. Zool. Nomencl., Op. 135, 1939. Type: *Apis terrestris* Linnaeus. Desig. by Morice and Durrant, 1915.

*Bombus* Latreille, 1802. Hist. Nat. Fourmis, p. 437. Type: *Apis terrestris* Linnaeus. Monob.

*Bremus* Panzer, 1804 (?). Faunae Ins. German., p. 85. Type: *Apis agrorum* Fabricius. Desig. by Sandhouse, 1943.

*Bombus* subg. *Leucobombus* Dalla Torre, 1880. Naturhistoriker, 2, p. 40. Type: *Apis terrestris* Linnaeus. Desig. by Sandhouse, 1943.

*Bombus* subg. *Megabombus* Dalla Torre, 1880. Naturhistoriker 2, p. 40. Type: (*Bombus ligusticus* Spinola) = *Apis argillacea* Scop. Monob. Desig. by Sandhouse, 1943.

*Bombus* subg. *Pyrobombus* Dalla Torre, 1880. (= *Pyrrhobombus*) Naturhistoriker 2, p. 40. Type: (*Apis*) *Bombus hypnorum* (Linnaeus). Monob. Desig. by Sandhouse, 1943.

*Bombus* subg. *Bombus* Robertson, 1903. Amer. Ent. Soc. Trans. 29, p. 176. Type: *Bombus auricomus* Robertson. Orig. desig.

*Bombus* subg. *Terrestribombus* Vogt., 1911. Gesell. Naturf. Freunde Sitzber., p. 55. Type: *Apis terrestris* Linnaeus. Desig. by Frison, 1927.

*Bombus* subg. *Pratobombus* Vogt., 1911. Gesell. Naturf. Freunde Sitzber., p. 49. Type: *Apis pratorum* Linnaeus. Desig. by Frison, 1927.

*Bombus* subg. *Cullumanobombus* Vogt., 1911. Gesell. Naturf. Freunde Sitzber. p. 57. Type: *Apis cullumanus* Kirby. Desig. by Frison, 1927.

*Bombus* Franklin, 1913. Amer. Ent. Soc. Trans. 38, pp. 177-486. (revision).

*Bombus* Lutz and Cockerell, 1920. Amer. Mus. Nat. Hist. Bul. 42, pp. 502-544. (catalog).

*Nevadensibombus* Skorikov, 1922. Sta. Region. Protect. Plantes Petrograd Bull. 4, p. 149.

*Alpigenobombus* subg. *Fraternobombus* Skorikov, 1922. Sta. Region. Protect. Plantes Petrograd Bul. 4, p. 156. Type: *Apathus fraternus* F. Smith. Desig. by Frison, 1927.

*Fervidobombus* Skorikov, 1922. Sta. Region. Protect. Plantes, Petrograd Bul. 4, p. 153. Type: *Apis fervida* Fabricius. Desig. by Frison, 1927.

*Bremus* subg. *Separatobombus* Frison, 1927. Amer. Ent. Soc. Trans. 53, p. 64. Type: (*Bombus separatus* Cresson) = *Apis griseocollis* Degeer. Orig. desig.

*Bremus* subg. *Rufocinctobombus* Frison, 1927. Amer. Ent. Soc. Trans. 53, p. 78, pl. xvii, fig. 9. Type: *Bombus rufocinctus* Cresson. Monob.

*Bombus* Plath, 1934. Bumblebees and their ways, 201 pp., New York, Macmillan. (biology)

*Bombus*, *Megabombus* and *Pyrobombus* Milliron, 1961. Kans. Ent. Soc. Jour. 34, pp. 55-58.

This is a native group of social bees in which the average size is considerably greater than in the honeybees. Both sexes are conspicuously and quite densely hairy insects. Females resemble the honeybee in having the outer surface of the hind tibiae bare and polished, with a marginal fringe of hairs forming the pollen basket or corbícula. In the males also the hind tibiae tend to be somewhat flattened, rather smooth and sparsely pubescent on the outer surface. In the front wing the marginal cell is rather short, separated from the apex of the wing by about its own length. In the hind wing the jugal lobe is absent. Usually there is a quite distinct and often extensive malar space separating the lower end of the eye from the mandible. The gonostyli of the male genital armature are very short in the majority of species, extending only slightly beyond the tips of the gonocoxites and penis valves.

In this region these bees are annually social with respect to the organization of the colonies. Newly fecundated queens hibernate during the winter, each one starting a new colony in the spring. The earlier broods that result from the nest-building, foraging and egg-laying activities of each queen are workers of small size, which assume much or all of the foraging and nest-building functions. Thereafter, as the numbers increase, there is an increase in body size of succeeding broods of workers. As the season progresses these more near-

ly approach the queen in size, and the distinction between the two castes in some species becomes obscure. Finally males and true queens are produced, which mate, and the cycle is repeated.

The species of *Bombus* occurring in North America do not represent a homogeneous group. They have affinities with those that occur in the Old World and those to the south. In consequence, a natural classification can be achieved only by inclusion of the species of these other regions in comprehensive taxonomic studies. Milliron (1961) indicates that there is evidence of a polyphyletic origin of the group, and therefore he recognizes three separate genera, including a total of five subgenera. All of the other numerous subgenera that have been proposed in the past are being reduced to synonymy. Although it is possible to distinguish these three genera according to the male genital armature, it is very difficult to do so according to the characteristics of the queens or workers. His work is still incomplete, and it has been deemed expedient to avoid the difficulties that would result if an attempt were made to separate these genera in this manual. Thus all the species here are assigned to *Bombus* in its original, all-inclusive sense, recognizing the fact that a division into smaller genera is probable in the future. The following table indicates the classification proposed by Milliron, with respect to the species of this area:

*Bombus*—*affinis* and *terricola*.

*Megabombus*

*Bombias*—*nevadensis* and *n. auricomus*.

*Megabombus* — *borealis*, *fervidus* and *pennsylvanicus*.

*Pyrobombus*

*Cullumanobombus*—*fraternus*, *griseocolis* and *rufocinctus*.

*Pyrobombus* — *bimaculatus*, *impatiens*, *perplexus*, *sandersoni*, *ternarius* and *vagans*.

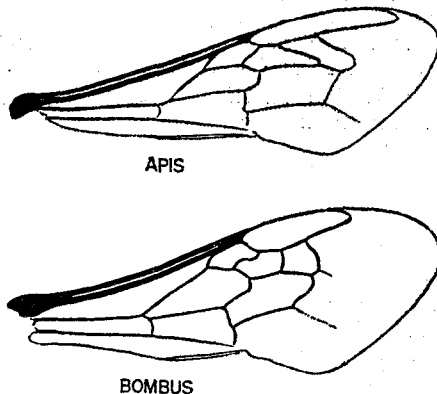


Figure 128

Venation of front wing in *Apis* and *Bombus*.

In the males, species assigned to *Bombus* may be recognized by the flared, dorso-ventrally compressed and cup-shaped heads of the penis valves. In *Megabombus* these structures are straight, either simple or with abrupt, apically dilated heads, while in *Pyrobombus* they are conspicuously hooked, the curve of the hook directed toward the mid line.

The following keys to the species of

*Bombus* queens, workers and males have limitations due to the degree of variability in these bees. This is especially true of color patterns of the pubescence which are used extensively in the keys. To employ other characters would necessitate the use of more obscure features difficult to describe, or to observe or interpret. Moreover, to account for all the possible variations in color patterns would greatly increase the length and complexity of the keys. In consequence the form in which they appear is a compromise, and it is hoped and believed that they will facilitate identification of the great majority of specimens. A margin of error, however, should be recognized, and where accuracy of identification is of paramount importance, submission of specimens to experienced specialists is recommended.

KEY TO SPECIES

Queens

1. Lateral ocelli distinctly below supraorbital line ..... 2  
     Lateral ocelli located at or near level of supraorbital line ..... 6
2. Malar space longer than width of mandible at base ..... 3  
     Malar space shorter than width of mandible at base ..... 4
3. Posterior half of dorsum of thorax black pubescent .....  
     ..... *nevadensis duricomus* (Robertson) (p. 520)  
     Dorsum of thorax yellow pubescent throughout .....  
     ..... *nevadensis nevadensis* Cresson (p. 521)
- 4(2). Dorsum of thorax usually with a conspicuous, transverse band of black pubescence between the wing bases ..... 5  
     Dorsum of thorax without an interalar black band, usually with a very small median area of black pubescence .....  
     ..... *griseocollis* (Degeer) (p. 527)
5. Very large (20-25 mm.); lateral ocelli much below supraorbital line; abdominal terga 3-6 entirely black pubescent .....  
     ..... *fraternus* (Smith) (p. 526)  
     Smaller (less than 20 mm.); ocelli only slightly below supraorbital line; terga 3-6 yellow or fulvous pubescent in part .....  
     ..... *rufocinctus* Cresson (p. 529)
- 6(1). Posterior half of scutum and all of scutellum black pubescent ..... 7  
     Posterior portion of dorsum of thorax with some yellow pubescence ..... 8
7. Lateral ocelli considerably nearer eyes than to hind margin of vertex .....  
     ..... *pennsylvanicus* (Degeer) (p. 524)  
     Lateral ocelli subequally distant from eyes and margin of vertex, or nearer to margin to vertex .....  
     ..... *terricola* Kirby (p. 519)
- 8(6). Dorsum of thorax with a transverse band of black pubescence, or posterior half of scutum black ..... 9  
     Dorsum of thorax without a transverse black band, with at most a small inconspicuous central black spot, largely yellow pubescent ..... 14
9. Vertex broad, the lateral ocelli much nearer eyes than to its hind margin. 10 not for *fervus*  
     Vertex narrower, the lateral ocelli subequally distant from its hind margin and the eyes, or nearer to the margin ..... 12
10. Malar space considerably shorter than width of mandible at base; pubescence of abdomen fulvous in part .....  
     ..... *rufocinctus* Cresson (p. 529)  
     Malar space fully as long as width of mandible at base; abdominal terga 1-4 yellow pubescent ..... 11
11. Pubescence of face, vertex and occiput largely yellow .....  
     ..... *borealis* Kirby (p. 522)  
     Pubescence of head largely black .....  
     ..... *fervidus* Fabricius (p. 523)
- 12(9). Basal abdominal tergum entirely black pubescent, 2 & 3 entirely yellow, and 4-6 black ... *terricola* Kirby (p. 519)  
     Basal tergum with considerable yellow pubescence ..... 13
13. Pubescence yellow on abdominal terga 1-4, rufous on 2 and 3, black only on 5 and 6 .....  
     ..... *ternarius* Say (p. 536)  
     At least tergum 3 black pubescent .....  
     ..... *sandersoni* Franklin (p. 534)
- 14(8). Pubescence of thorax laterally entirely yellow, that on tergum 3 entirely black ..... 15  
     Lower half of mesopleura with dark pubescence; or tergum 3 with some admixture of yellow pubescence .....  
     ..... *perplexus* Cresson (p. 533)
15. Tergum 2 of abdomen entirely yellow pubescent ..... 16  
     Tergum 2 black pubescent at least in part ..... 17
16. Malar space usually shorter than width of mandible at base; vertex with only a few pale hairs .....  
     ..... *affinis* Cresson (p. 518)  
     Malar space at least as long as width of

- mandible at base; vertex with a tuft of yellow hairs . . . *vagans* Smith (p. 537)
- 17(15). Tergum 2 of abdomen entirely black pubescent . . . *impatiens* Cresson (p. 532)  
Tergum 2 entirely yellow pubescent, or at least with some basal yellow pubescence . . . . . 18
18. Face entirely black; abdominal tergum 2 largely black pubescent, with a limited amount of yellow medially at base . . . . . *bimaculatus* Cresson (p. 531)  
Face with at least some light pubescence; tergum 2 yellow pubescent, sometimes with the apical margin narrowly black, or with scattered, intermixed black hairs toward margin . . . . . *vagans* Smith (p. 537)
- Workers*
1. Lateral ocelli distinctly below supraorbital line . . . . . 2  
Lateral ocelli about at level of supraorbital line . . . . . 5
2. Malar space fully equal in length to basal width of mandible; scutellum black pubescent . . . . . *nevadensis auricomus* (Robertson) (p. 520)  
Malar space much shorter than basal width of mandible; or scutellum yellow pubescent . . . . . 3
3. Dorsum of thorax and abdominal terga 1-3 entirely and densely yellow pubescent; malar space fully equal to basal width of mandible . . . . . *nevadensis nevadensis* Cresson (p. 521)  
Either scutum or tergum 3 with black pubescence; malar space much shorter than width of mandible at base . . . . 4
4. Dorsum of thorax with a distinct interalar black band; tergum 2 entirely covered with yellow pubescence . . . . . *fraternus* (Smith) (p. 526)  
Dorsum of thorax with no interalar band; tergum 2 narrowly black on apical margin, otherwise yellow, slightly tinged with brown . . . . . *griseocollis* (DeGeer) (p. 527)
- 5(1). Scutellum and posterior half of scutum black pubescent . . . . . 6  
Scutellum largely or entirely yellow pubescent . . . . . 7
6. Basal abdominal tergum entirely black pubescent; lateral ocelli nearer hind margin of vertex than to eyes . . . . . *terricola* Kirby (p. 519)  
Basal tergum yellow pubescent at least in part; lateral ocelli subequally distant from eyes and hind margin of vertex, or nearer the eyes . . . . . *pennsylvanicus* (DeGeer) (p. 524)
- 7(5). Dorsum of thorax largely pale pubescent, scutum with only a small median area of black pubescence, if any . . . . 8  
Dorsum of thorax with considerable black pubescence, either with a distinct, interalar black band, or scutum largely black, being only narrowly yellow along anterior margin . . . . . 13
8. Abdominal terga 2-6 entirely black pubescent, with only tergum 1 yellow; malar space shorter than basal width of mandible . . . . . *impatiens* Cresson (p. 532)  
At least tergum 2 with some yellow pubescence . . . . . 9
9. Tergum 2 largely black pubescent, but invaded by yellow along basal margin medially; malar space fully equal to width of mandible at base . . . . . *bimaculatus* Cresson (p. 531)  
Tergum 2 largely or entirely yellow pubescent . . . . . 10
10. Lower half of thorax with dark pubescence; or tergum 3 yellow, at least in part . . . . . *perplexus* Cresson (p. 533)  
Lower half of thorax yellow pubescent, tergum 3 black . . . . . 11
11. Malar space fully equal to basal width of mandible . . . *vagans* Smith (p. 537)  
Malar space much shorter than basal width of mandible . . . . . 12
12. Lateral ocelli slightly below supraorbital line; pubescence of tergum 2 rather short, tinged with brown, usually narrowly black along apical margin . . . . . *griseocollis* (DeGeer) (p. 527)  
Lateral ocelli approximately on the supraorbital line; pubescence of tergum 2 yellow apically, with a distinct median notch, usually fulvous across base . . . . . *affinis* Cresson (p. 518)
- 13(7). Malar space much shorter than basal width of mandible . . . . . 14  
Malar space at least nearly equal in length to basal width of mandible, or longer . . . . . 17
14. Pubescence of tergum 3 entirely black, that on 2 yellow laterally and apically, with a distinct median notch, usually fulvous across the base . . . . . *affinis* Cresson (p. 518)  
Tergum 3 usually with yellow or fulvous pubescence; if all black, then not as above . . . . . 15
15. Basal abdominal tergum entirely black pubescent . . . *terricola* Kirby (p. 519)  
Basal tergum yellow pubescent . . . . . 16
16. Abdominal terga 2 and 3 with rufous pubescence, that on the pleura and basal tergum yellow; lateral ocelli nearer

- hind margin of vertex than to eyes . . . . . *ternarius* Say (p. 536)
- Abdominal terga with no rufous pubescence; lateral ocelli subequally distant from eyes and hind margin of vertex . . . . . *rufocinctus* Cresson (p. 529)
- 17(13). Abdominal tergum 3 entirely yellow pubescent . . . . . 18
- Tergum 3 black pubescent . . . . . 19
18. Pubescence of face, vertex and occiput largely yellow. *borealis* Kirby (p. 522)
- Pubescence of head entirely black . . . . . *fervidus* (Fabricius) (p. 523)
- 19(17). Malar space slightly shorter than basal width of mandible . . . . . *sandersoni* Franklin (p. 534)
- Malar space fully as long as basal width of mandible . . . *vagens* Smith (p. 537)
- Males**
1. Eyes usually converging above, the lateral ocelli nearer to margins of the eyes than to each other; malar space very short, length one-fourth or less the basal width of mandible . . . . . 2
  - Eyes about parallel, the lateral ocelli distant from eye margin; malar space nearly or quite as long as basal width of mandible . . . . . 6
  2. Malar space exceedingly short, almost obliterated, eyes nearly touching base of mandibles, strongly convergent above . . . . . *fraternus* (Smith) (p. 526)
  - Malar space distinct, even though short, eyes somewhat removed from base of mandibles . . . . . 3
  3. Lateral ocelli near supraorbital line, separated from eye margin by a space greater than their diameter; eyes only slightly convergent above . . . . . *rufocinctus* Cresson (p. 529)
  - Lateral ocelli much below supraorbital line, separated from eyes by less than their diameter . . . . . 4
  4. Eyes strongly convergent above, ocelli located midway between antennae and hind margin of vertex . . . . . 5
  - Eyes nearly parallel, even though face very narrow, with ocelli nearer margin of vertex than to antennae . . . . . *griseocollis* (Degeer) (p. 527)
  5. Pubescence of legs and of abdominal terga 4-7 entirely black . . . . . *nevadensis auricomus* (Robertson) (p. 520)
  - Posterior fringes of legs yellowish; abdominal terga 6 and 7 to some degree ferruginous . . . . . *nevadensis nevadensis* Cresson (p. 521)
  - 6(1). Basal abdominal tergum black pubescent . . . . . *terricola* Kirby (p. 519)
  - Basal tergum yellow pubescent . . . . . 7
  7. Dorsum of thorax with a median transverse band of black pubescence between the wing bases . . . . . 8
  - Dorsum of thorax entirely yellow pubescent, or with a median patch of black hairs that does not reach the tegulae 12
  8. Pubescence of terga 3 and 4 black, at least in part . . . . . *affinis* Cresson (p. 518)
  - Pubescence of terga 3 and 4 entirely yellowish . . . . . 9
  9. Abdominal terga 2-4 with some bright rufous pubescence, that on tergum 1 yellow, black on 5-7 . . . . . *ternarius* Say (p. 536)
  - Terga 1-4 entirely yellow pubescent . . 10
  10. Malar space not much longer than wide, about a fourth the length of the eye; abdominal tergum 5 usually black pubescent . . . . . *pennsylvanicus* (Degeer) (p. 524)
  - Malar space considerably longer than wide, about one third the length of the eye; tergum 5 yellow pubescent . . . 11
  11. Interalar band quite narrow; head largely black pubescent; outer face of hind tibia convex, closely punctate . . . . . *fervidus* (Fabricius) (p. 523)
  - Interalar band quite broad; vertex yellow pubescent, and face with some admixture of pale hairs; outer face of hind tibia flattened, sparsely punctate . . . . . *borealis* Kirby (p. 522)
  - 12(7). Pubescence of abdominal terga 1-4 usually pale yellow . . . . . *perplexus* Cresson (p. 533)
  - At least tergum 3 with black pubescence . . . . . 13
  13. Outer surface of hind tibiae flattened, its central portion bare and polished; hairs on face entirely black . . . . . *affinis* Cresson (p. 518)
  - Outer surface of hind tibiae rounded, well covered with hairs; face with considerable pale pubescence . . . . . 14
  14. Segment 2 of abdomen entirely black pubescent; malar space shorter than width of mandible at base . . . . . *impatiens* Cresson (p. 532)
  - Segment 2 of abdomen with at least some yellow pubescence; malar space longer than width of mandible at base . . . 15
  15. Pubescence usually dark on each side of abdominal tergum 2; outer surface of hind tibiae rather dull, finely and rath-

- er closely punctate and pubescent . . . . .  
 . . . . . *bimaculatus* Cresson (p. 531)  
 Pubescence of tergum 2 entirely yellow;  
 outer surface of hind tibiae polished  
 and largely impunctate medially to-  
 ward apex . . . . . 16
16. Basal segment of flagellum not much  
 longer than segment 2, distinctly short-  
 er than segment 3 . . . . .  
 . . . . . *vagans* Smith (p. 537)  
 Segments 1 and 3 of flagellum about equal,  
 segment 2 considerably shorter . . . . .  
 . . . . . *sandersoni* Franklin (p. 534)

### *Bombus affinis* Cresson

- Bombus affinis* Cresson, 1863. Ent. Soc. Phila.  
 Proc. 2, p. 103. ♀ ♂  
*Bombus affinis* var. *novae-angliae* (Bequaert),  
 1920. Psyche 27, p. 6. ♂ ♀  
*Bombus affinis* Plath, 1922. Psyche 29, pp.  
 190-192. (biology)  
*Bombus affinis* Plath, 1934. Bumblebees and  
 their ways, New York, Macmillan, p. 135.  
 (biology)

QUEEN—Length 21-22 mm., breadth of abdomen 9.5-11 mm.; black, legs becoming somewhat more piceous apically, mid and hind spurs reddish-piceous, tegulae piceous to black; wings rather deeply and uniformly infuscated, veins brownish to piceous; pubescence copious and dense but rather short in general, entirely black on head, on venter of thorax, propodeum, and in large part on legs; pronotum, scutum, scutellum and pleura largely yellow pubescent, the scutum black in a rather restricted area posteriorly, with intermixed black and yellow hairs between this patch and tegulae; tarsal segments in part with very fine pale pruinose pubescence, this distinct, especially on hind basitarsi; corbicular fringe of rather elongate, blackish hairs; pubescence entirely yellow on abdominal terga 1 and 2, that on 2 with a somewhat reddish tinge at certain angles, entirely black on 4-6; clypeus finely and closely punctate laterally and above, broad median area shining, very sparsely and minutely punctate, becoming rather closely punctate along the narrow apical margin; labrum with a basal ridge which is interrupted medially, this area somewhat excavated, surface on each side considerably depressed, quite copiously covered with short yellowish hairs; apex of mandibles with a pair of inner teeth, the lower third rather deeply and roundly emarginate, forming a quite distinct ventral apical angle, outer face somewhat shining, minutely punctate; malar space smooth and shining, without evident punctures, its median length considerably less than basal width of mandibles, no more than

one-sixth length of eye; punctures of face very fine and dense medially, becoming somewhat more distinct and coarse toward ocelli but still close, a limited, shining, impunctate area adjacent to each lateral ocellus; vertex very finely and densely punctate medially, becoming somewhat more distinctly but finely punctate laterally; antennal scape very slightly more than half total length of flagellum, basal segment of flagellum very slightly longer than segment 3, and 3 somewhat longer than 2; hind basitarsus quite broad, posterior margin slightly curved; tergum 6 smooth, rather narrowly rounded apically, punctures exceedingly minute and hardly evident.

WORKER—Length 11-16 mm., width of abdomen 5-8 mm.; pattern of pubescence and structure very similar to queen, but pubescence somewhat more copious and elongate, that on tergum 2 more deeply tinged with reddish or rufous.

MALE—Length 13-17.5 mm., breadth of abdomen 5-7 mm.; black, including legs and tegulae, spurs somewhat more reddish-piceous; wings lightly infuscated, veins testaceous to piceous; apical margins of abdominal terga very narrowly yellowish-hyaline; pubescence long and copious in general, largely black on head but with a few pale hairs intermixed on vertex; posterior half of scutum with numerous dark hairs intermixed with light, forming an obscure, interalar band, thorax otherwise largely pale yellowish pubescent; basal segments of legs, including the femora, with long, more or less intermixed light and dark hairs, tibiae rather prominently fringed posteriorly with largely pale pubescence, with some darker, shorter hairs beneath, hind tibiae prominently fringed with elongate hairs, posterior fringe pale in part; abdominal terga 1 and 2 entirely pale pubescent, 3-7 black, in marked contrast; clypeus very finely and densely punctate beneath dense pubescence; labrum broadly truncate, somewhat rounded laterally, surface shining, irregularly and finely punctate; mandibles small and slender apically, distinctly bidentate, outer surface densely covered with yellowish, appressed tomentum, lower margin fringed with elongate, curved, more or less yellowish hairs; malar space smooth and shining, very vaguely and minutely punctate, its median length slightly greater than basal width of mandible, eye nearly five times as long; median area of face very finely and densely punctate, becoming somewhat more shining and sparsely punctate below ocelli, shining and largely impunctate between lateral ocelli and eyes; vertex dull, with very fine and close punctures, these becoming more sparse laterally; segments 1 and 3 of flagellum about equal, seg-

ment 2 considerably shorter; outer surface of hind tibiae quite flat, rather smooth, shining and largely impunctate, somewhat resembling corbicula of female; hind basitarsus slightly and gradually narrowed toward base; sterna 7 and 8 and genital armature resembling those in *terricola* (fig. 133).

**DISTRIBUTION** — Ontario to New Brunswick, south to North Carolina, April to October.

**FLOWER RECORDS** — *Aralia*, *Aster*, *Hydrangea*, *Malus*, *Robinia*, *Solidago* and *Vaccinium*.

### *Bombus terricola* Kirby

(Fig. 133)

*Bombus terricola* Kirby, 1837. Fauna Bor.-Amer. 4, p. 273. ♀.

*Bombus terricola* Plath, 1922. Psyche 29, pp. 192-193. (biology)

*Bombus terricola* Plath, 1927. Psyche 34, pp. 122-124. (biology)

*Bremus terricola* Brittain and Newton, 1933. Canad. Jour. Res. 9, p. 343. (flower records)

*Bombus terricola* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 138. (biology)

**QUEEN**—Length 17-19 mm., breadth of abdomen 9-10 mm.; black, apical tarsal segments somewhat more piceous, spurs reddish-piceous, tegulae black; wings uniformly and rather deeply infuscated, veins brownish to piceous; pubescence rather short, entirely black on head, yellow on pronotum, tubercles, adjacent area of pleura above, anterior margin of scutum, and abdominal terga 2 and 3, otherwise black including that on legs and on base of abdomen; scutellum yellow or black, or with varying degrees of intermixture; corbicular fringe of elongate, usually black hairs; hind basitarsi with very fine, appressed, pale pruinose hairs; clypeus finely and rather densely punctate laterally and above, the broad median area shining and more minutely and rather closely punctate; labrum rather broadly subtruncate, with a basal elevated ridge which is slightly interrupted medially, apical margin of this area broadly rounded, slightly elevated above margin on each side and fringed with rather elongate, yellowish hairs; apex of mandible with a rather broad and deep, rounded emargination toward the inferior angle, and a pair of distinct notches toward the upper angle, outer face toward base shining and very minutely, irregularly punctate; malar space smooth and shining, only very minutely and obscurely punctate, length slightly less than basal width of mandible, about one-fourth length of eye; punctures

very fine and close on face medially, becoming somewhat more distinct but still close toward ocelli, surface laterad of ocelli rather narrowly shining and impunctate, becoming finely but rather distinctly punctate toward eye, vertex very densely and finely punctate medially, punctures becoming somewhat more distinct but still close laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; antennal scape approximately half total length of flagellum, basal segment of flagellum slightly longer than segment 3, and 3 slightly longer than 2 which is about as broad as long; posterior margin of hind basitarsus quite broadly outcurved, median breadth slightly more than one-third the length; tergum 6 smooth and shining, with exceedingly minute scattered and rather sparse punctures, apex narrowly rounded.

**WORKER**—Length 9-14 mm., breadth of abdomen 5-7 mm.; resembles queen in general, but pubescence relatively longer.

**MALE**—Length 13-17 mm., breadth of abdomen 6-8 mm.; black, apical tarsal segments somewhat more piceous, spurs brownish, tegulae piceous to black; wings lightly infuscated or subhyaline, veins brownish to piceous; pubescence copious and elongate in general, largely pale yellowish on clypeus, but with intermixed black hairs laterally, and chiefly black around antennae, vertex with pale yellowish hairs medially, more or less intermixed with black, especially laterally, cheeks with blackish pubescence above becoming somewhat paler below; pubescence pale yellowish on pronotum, tubercles, anterior margin of scutum, pleura in large part, and usually scutellum, fuscous on propodeum and black over posterior two-thirds of scutum; abdominal terga 2 and 3 with bright yellow pubescence, 1 and 5-6 largely black, sometimes with some pale hairs on 6 and 7 laterally and apically; basal segments of legs, including femora, with elongate, generally pale pubescence, dark on tibiae, with posterior fringes of rather elongate hairs which may be pale in part, hind tibiae fringed with elongate, intermixed, light and dark hairs; hind basitarsi nearly bare above, densely clothed beneath with very short, brownish-ochraceous hairs; clypeus very finely and closely but quite distinctly punctate beneath dense pubescence; labrum quite smooth and shining, with only very minute and vague punctures medially, broadly subtruncate apically; mandibles slender, distinctly bidentate apically, densely ochraceous pubescent on outer face, lower margin fringed with long, ochraceous or yellowish hairs; malar space shining, punctures very vague and minute, length about equal to basal width of mandible, about

one-fifth length of eye; median area of face very finely and closely punctate, the punctures becoming somewhat more distinct and more widely separated toward ocelli, surface laterad of ocelli shining and impunctate, punctures very fine and closely crowded on vertex medially, becoming somewhat more distinct laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; basal segment of flagellum subequal to segment 3, segment 2 somewhat shorter, about as broad as long; outer surface of hind tibiae rather flat, quite broad and entirely impunctate except toward the narrow margins; hind basitarsi gradually narrowed from center to base, which is very slightly broader than apex; sterna 7 and 8 and genital armature as shown (fig. 133).

**DISTRIBUTION** — In the East, Nova Scotia to Florida, April to October.

**FLOWER RECORDS** — *Rhododendron*, *Rosa*, *Rubus*, *Vaccinium* and *Vicia*. Brittain and Newton (1933) also record this species on *Lonicera*, *Phleum*, *Pinus*(?). *Pyrus malus* and *Salix*.

This species can be easily confused with *pennsylvanicus*, but in that species the malar space is somewhat longer, the scutellum in the queen and workers is always black pubescent, and the basal abdominal tergum is yellow at least in part. In males the abdominal terga 1-5 are yellow pubescent, contrasting with the limitation of yellow to terga 2 and 3 in *terricola*.

***Bombus nevadensis auricomus***  
(Robertson)

- Bombias auricomus* Robertson, 1903. Amer. Ent. Soc. Trans. 29, p. 176. ♀ ♂ ♀  
*Bombus auricomus* Frison, 1917. Ent. Soc. Amer. Ann. 10, pp. 277-286. (biology)  
*Bombus auricomus* Frison, 1918. Ent. Soc. Amer. Ann. 11, pp. 43-48. (biology)  
*Bombus auricomus* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)  
*Bombus auricomus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 153. (biology)  
*Auricomus* Group, Milliron, 1961. Kans. Ent. Soc. Jour. 34, p. 56.

**QUEEN**—Length 20-25 mm., breadth of abdomen 9.5-11 mm.; black, legs reddish-piceous, apical tarsal segments somewhat more brownish, spurs and tegulae reddish-piceous; wings quite deeply infuscated basally, becoming somewhat paler apically, veins testaceous

to black; pubescence rather short but quite dense, largely black on head, but vertex with a transverse band of yellow pubescence, posterior margin fringed with black; pubescence yellow on pronotum, tubercles and anterior margin of scutum, otherwise blackish or fuscous on thorax, largely black on legs, corbicular fringe fuscous or black, hind basitarsi thickly clothed with more reddish pubescence beneath, the more apical tarsal segments of all thinly clothed with very short pale tomentum; propodeum posteriorly with a thin covering of short, subappressed, golden tomentum, and with erect, darker hairs; abdominal terga 2 and 3 with a dense covering of short, yellow pubescence, terga 1 and 4-6 entirely black; clypeus shining, with rather sparse, very minute punctures and scattered, coarser punctures, more numerous laterally and above; labrum broadly rounded, with a basal ridge which is slightly interrupted medially, with a dense median tuft of more or less erect, brownish hairs, apical margin considerably depressed; apex of mandibles with a broad, rounded, lower margin or cutting edge and a pair of inner, nearly apical, acute teeth (in unworn specimens), the outer face toward the base rather dull, with exceedingly minute, vague and close punctures; malar space smooth and shining, hardly punctate, its length somewhat greater than basal width of mandible; eye about three and one-half times that of malar space; ocelli distinctly below supra-orbital line, lateral ocelli slightly nearer eyes than to each other, and nearer each other than to margin of vertex; total length of flagellum about twice that of scape, basal segment about equal to segments 2 and 3 combined; face finely and closely punctate, becoming shining and nearly impunctate adjacent to lateral ocelli; vertex densely and finely punctate medially, becoming shining and rather sparsely punctate laterally; scutum with a limited median posterior area that is shining and impunctate; hind basitarsus parallel-sided, width somewhat less than half the length; tergum 6 with a slight, median, apical ridge.

**WORKER**—Length 18-20 mm., breadth of abdomen 8-9 mm.; resembles queen except in size.

**MALE**—Length 17-20 mm., breadth of abdomen 8-9 mm.; black, apical tarsal segments somewhat more brownish-testaceous, mid and hind spurs piceous and tegulae reddish-piceous; wings rather uniformly and deeply infuscated, veins testaceous to piceous; pubescence short but quite copious and dense, pale yellowish on vertex and occiput, with some intermixed yellowish and black hairs on face medially, blackish on cheeks and lower part

of face; pubescence yellowish on scutum, scutellum and pleura, with a slight tawny tinge, scutum posteriorly with an intermixture of short, more fuscous hairs, that on scutellum more elongate and conspicuous on each side of a narrow, median, nearly bare line; pubescence fuscous on propodeum and venter along mid line; legs fuscous or blackish pubescent in general, mid and hind basitarsi with fringes of rather elongate, dark hairs, the more apical segments with very fine, more or less appressed, pale tomentum; abdominal terga 1-3 entirely yellow pubescent, this with a slightly reddish tinge at certain angles, the hairs quite short but dense, 4-7 entirely black, the hairs more elongate and erect except on 7 medially; eyes large and bulging, strongly converging above, lateral ocelli nearly contiguous with the inner margin, located about at mid-point between margin of vertex and antennae; clypeus finely and closely punctate in large part, apical margin somewhat more shining and more minutely and vaguely punctate; labrum rather broadly rounded or subtruncate apically, shining laterally, more densely and finely punctate medially; mandibles quite short and slender, bidentate apically, lower tooth rounded, upper tooth more acute, outer surface densely yellowish tomentose, lower margin with a fringe of elongate, dark hairs; malar space shining and nearly impunctate, short, its length only slightly more than half the basal width of mandibles; total length of flagellum somewhat more than twice length of scape, basal segment subequal in length to 2 and 3 combined; margins of hind basitarsi nearly parallel, the length somewhat more than twice the breadth; sterna 7 and 8 and genital armature as in *nevadensis* (fig. 130).

**DISTRIBUTION** — Minnesota to New York, south to Georgia, May to September.

**FLOWER RECORDS**—*Ceanothus*, *Hypericum*, *Malus* and *Rubus*.

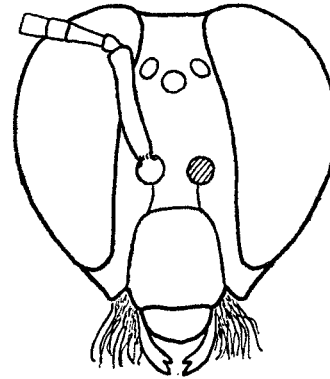
Milliron (1961) finds that *auricomus* is only subspecifically different from *nevadensis*, and states in correspondence that all intergradations between the two forms are to be found. This is the more eastern form, while typical *nevadensis* occurs only sparingly east of the Mississippi.

***Bombus nevadensis nevadensis*  
Cresson**

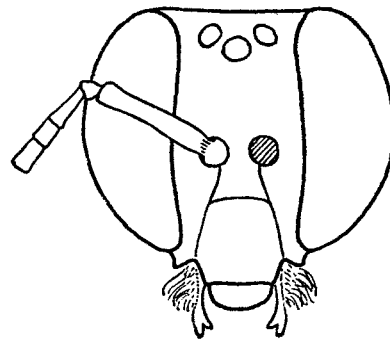
(Figs. 129 & 130)

*Bombus nevadensis* Cresson, 1874. Amer. Ent. Soc., Trans. 5, p. 102. ♀ ♂.

*Bombus improbus* Cresson, 1878. Acad. Nat. Sci. Phila. Proc., p. 186. ♂.



NEVADENSIS



GRISEOCOLLIS

Figure 129  
Facial view of heads in males of *Bombus*.

*Bombus nevadensis* race *cressoni* Cockerell, 1899. Ann. Mag. Nat. Hist. (7) 4, p. 388. ♀.

**QUEEN**—Pubescence of head entirely black, largely yellow on pronotum, scutum and scutellum, with a few black hairs in center of scutum, entirely black on pleura, propodeum and legs; abdominal terga 2 and 3 yellow, the basal tergum black at base, but yellow along apical margin of disc, 4-6 entirely black.

**WORKER**—Pattern of pubescence similar to that of queen.

**MALE**—Legs with posterior fringes of long, yellowish hairs, and tarsi with very short, yellowish pubescence; abdominal terga 1-3 and 6-7 with pubescence entirely yellow, that on 4-5 largely black, but becoming more or less yellowish laterally and apically.

**DISTRIBUTION** — Western United States, from Pacific coast to Illinois.

*Bombus borealis* Kirby

(Fig. 130)

*Bombus borealis* Kirby, 1837. Fauna Bor. Amer. 4, p. 272.*Bombus borealis* Plath, 1922. Psyche 29, pp. 193-194. (biology)*Bremus borealis* Brittain and Newton, 1933. Canad. Jour. Res. 9, p. 343. (flower records)*Bombus borealis* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 160 (biology)

QUEEN—Length 18-22 mm., breadth of abdomen 9-9.5 mm.; black, apical tarsal segments becoming somewhat more brownish-piceous, spurs and tegulae black to piceous; wings uniformly but rather lightly infuscated, veins testaceous to black; pubescence rather short but dense, largely pale on head, quite copious above clypeus and around antennae where it is nearly white, with a few dark hairs at each extreme side, pale yellow on vertex and occiput, with a few black hairs laterally, largely fuscous on cheeks, becoming elongate below; pubescence bright yellow on pronotum, tubercles, anterior margin of scutum, entire scutellum, and abdominal terga 1-4, black on propodeum, legs, posterior two-thirds of scutum and terga 5 and 6, that on pleura becoming somewhat more brownish-fuscous anteriorly and below; hind basitarsus and the more apical segments of the other legs with very fine, appressed, pale tomentum which does not quite obscure the surface; corbicular fringe of black, elongate hairs; lateral and upper margins of clypeus quite closely and finely punctate; the broad median area largely shining and impunctate; labrum shining, broadly truncate, with a low basal ridge on each side, broadly concave medially, with scattered, very minute punctures; apical margin of mandible with a pair of low teeth toward the upper angle, otherwise broadly rounded, outer face rather smooth, shining, punctures exceedingly minute, hardly evident; malar space smooth and shining, somewhat longer than basal width of mandibles, punctures exceedingly minute and hardly evident; length of eye about three and a half times that of malar space; punctures of face medially very fine and close, but distinct, becoming somewhat more sparse toward ocelli, space between lateral ocelli and eyes shining and largely impunctate; vertex finely and densely punctate medially, becoming somewhat more distinctly punctate laterally but still close; lateral ocelli slightly nearer eyes than to each other, and slightly nearer each other than to margin of vertex; antennal scape somewhat more than half the total length of flagellum, basal segment of flagellum considerably longer than segment 3 which is slightly longer

than 2; posterior margin of hind basitarsus very slightly curved, apex very slightly narrower than median area; tergum 6 narrowly rounded apically, surface obscurely roughened, without distinct punctures.

WORKER—Length 13 mm., breadth of abdomen 6.5 mm.; resembles queen except in size.

MALE—Length 14-17 mm., breadth of abdomen 6.5-7 mm.; black, legs somewhat reddened apically, apical tarsal segments more brownish-piceous; tegulae, and mid and hind spurs, brownish-piceous; wings uniformly but rather lightly infuscated, veins testaceous to piceous; pubescence in general quite long and copious, largely black around antennae and on face below, but with some shorter, greyish, densely plumose hairs beneath; vertex medially and occiput with elongate yellow hairs, erect and black on vertex laterally, and largely blackish or fuscous on cheeks, becoming very long beneath; pubescence yellow on pronotum, tubercles, anterior margin of scutum, entire scutellum and abdominal terga 1-4, largely black on posterior two-thirds of scutum, pleura, propodeum and legs, but pleura with intermixed pale hairs anteriorly and below, and coxae, trochanters and femora with considerable pale pubescence; abdominal terga 5 and 6 black pubescent toward base but with considerable yellow apically, tergum 7 with rather elongate black pubescence; clypeus very finely and rather closely punctate in general, median apical area becoming shining, with very minute, hardly evident punctures; labrum smooth and shining, apical margins slightly incurved over the median area, with a few scattered, irregular punctures medially, lateral areas impunctate and somewhat convex, median line slightly impressed; mandibles quite slender, distinctly bidentate apically, outer surface densely yellowish tomentose, fringed on lower margin with rather elongate, fuscous hairs; malar space smooth and shining, without distinct punctures, much longer than basal width of mandible, and about one-third that of eye; face very finely and closely punctate medially beneath the rather dense pubescence, becoming somewhat more coarse and sparse toward ocelli, space between ocelli and eyes shining and with only scattered, obscure punctures; vertex finely and closely punctate medially, becoming somewhat smoother and more minutely punctate laterally; basal segment of flagellum slightly longer than segment 2, somewhat shorter than 3; hind tibiae somewhat flattened, shining and sparsely punctate on outer surface, the hairs very short and entirely black; apical width of hind basitarsus very slightly less than median width; genital armature as shown (fig. 130).

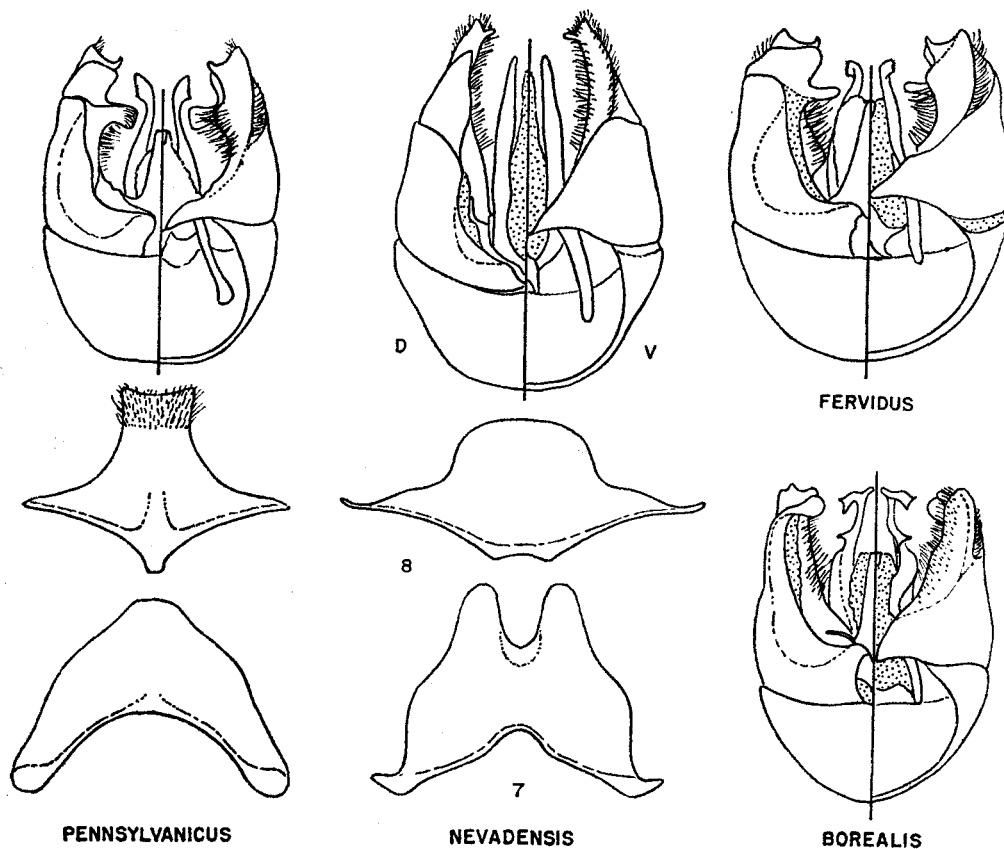


Figure 130—Dorsal (D) and ventral (V) views of genital armature, and sterna 7 and 8 in males of *Bombus*.

**DISTRIBUTION**—Southern Canada and the adjacent areas of the United States, May to September.

**FLOWER RECORDS** — Brittain and Newton (1933) record *borealis* on *Pyrus malus*.

***Bombus fervidus* (Fabricius)**

(Fig. 130)

*Apis fervida* Fabricius, 1798. Sup. Ent. Syst., p. 274.

*Bremus fervidus* Plath, 1922. Psyche 29, pp. 198-200. (biology)

*Bremus fervidus* Brittain and Newton, 1933. Canad. Jour. Res. 9, p. 343. (flower records)

*Bombus fervidus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 166. (biology)

**QUEEN**—Length 19-21 mm., breadth of abdomen 9.5 mm.; black, including legs, spurs and tegulae; wings deeply infuscated, veins

brownish to piceous; apical margins of abdominal terga narrowly yellowish-hyaline, pubescence copious, rather elongate in general, largely black on head but with a small amount of greyish pubescence intermixed in the black just above antennae; pubescence yellow, long and dense on pronotum, tubercles, pleura above, anterior half of scutum and entire scutellum, black on posterior half of scutum, pleura below and posteriorly, propodeum, and legs in large part; corbicular fringe of elongate black hairs; basitarsus covered with extremely fine pale tomentum which does not quite hide the surface, fringed posteriorly with black hairs, those toward the base more elongate; pubescence yellow on abdominal terga 1-4, black on 5 and 6; clypeus closely and deeply punctate laterally and above, the interspaces in part very minutely punctate, being thus doubly punctate, the median apical area shining and largely impunctate; labrum rather broadly rounded or subtruncate, elevated basally on each side of midline where it is somewhat excavated, with a

median, transverse row of short, fuscous hairs; apex of mandible with a deep notch at upper angle, and a finer notch just below, otherwise broadly rounded, outer face smooth, somewhat shining but minutely roughened; malar space smooth and shining, with scattered, very minute punctures, considerably longer than basal width of mandible, the eye about three and one-half times longer; lateral ocelli very slightly nearer eyes than to each other, and slightly nearer each other than to margin of vertex; median area of face very closely and finely punctate, punctures becoming more deep, distinct and coarse above, surface around ocelli more or less shining and impunctate, vertex finely and densely punctate medially, becoming somewhat more distinctly and finely punctate laterally; antennal scape somewhat more than half length of flagellum, basal segment of flagellum slightly shorter than segments 2 and 3 combined, slightly shorter than 3; posterior margin of hind basitarsus very slightly curved; tergum 6 narrowly rounded apically, rather flat, somewhat shining, minutely punctate.

**WORKER**—Length 10.5-16 mm., width of abdomen 4-6.5 mm.; similar to queen except for size, but clypeus not so definitely doubly punctate, with a much broader median area that is shining and largely impunctate.

**MALE**—Length 11-20 mm., breadth of abdomen 5-7 mm.; black, including legs, spurs and tegulae piceous; wings lightly infuscated, veins testaceous to piceous; apical margins of abdominal terga 1-5 narrowly yellowish-hyaline; pubescence copious and elongate, largely black on head, but face and cheeks with some obscure, short, greyish pubescence intermixed at base of the elongate black hairs, and a few yellowish hairs intermixed among the black on vertex; pubescence yellow on pronotum, anterior half of scutum, scutellum, pleura in large part, and propodeum, black on posterior half of scutum, resulting in a conspicuous black interalar band; basal segments of legs with more or less intermixed dark and light pubescence, but largely black on tibiae and tarsi, hind tibiae somewhat dilated apically, with very short, black hairs fringing both anterior and posterior margins; pubescence bright yellow, short and dense on abdominal terga 1-5, largely black on 6 and 7; clypeus closely and rather finely punctate laterally and above, median apical area shining and largely impunctate, punctures of two distinct sizes; labrum rather broadly rounded, narrowly shining and impunctate across base, elsewhere closely and rather finely punctate; mandibles very small and slender, distinctly bidentate at apex, the dorsal tooth somewhat smaller than the other, outer

face densely pale tomentose, lower margin fringed with long, curved, fuscous hairs; malar space smooth and shining, with a few scattered, minute punctures, considerably longer than basal width of mandible, eyes slightly less than four times as long; median area of face finely and closely punctate, becoming shining and sparsely punctate above, largely impunctate beneath anterior ocellus and adjacent to lateral ocelli, vertex very densely punctate medially, becoming more distinctly and rather coarsely punctate laterally; basal segment of flagellum distinctly longer than segment 2, 3 nearly twice as long as 2; hind basitarsus very slightly narrowed toward base; genital armature as shown (fig. 130).

**DISTRIBUTION**—Quebec and New Brunswick to Georgia, west to the Pacific Coast, May to October.

**FLOWER RECORDS**—*Cirsium*, *Helianthus* and *Vaccinium*. Brittain and Newton (1933) record *fervidus* on *Amelanchier*, *Caragana*, *Daucus*, *Lonicera*, *Muscari*, *Narcissus*, *Phleum*, *Pyrus malus*, *Salix*, *Taraxacum* and *Tulipa*.

### *Bombus pennsylvanicus* (Degeer)

(Figs. 130 & 131)

- Apis pennsylvanica* Degeer, 1773. Mem. Serv. Hist. Insects 3, p. 575.  
*Apis americanorum* Fabricius, 1775. Syst. Ent. p. 575.  
 (?) *Apis nidulans* Fabricius, 1798. Sup. Ent. Sys., p. 274.  
*Bombus pallidus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 92. ♀.  
*Psithyrus cevalliae* Cockerell, 1899. Entomologist 32, p. 157. ♂.  
*Bombus titusi* Ashmead, 1902. Ent. News 13, p. 50. ♂.  
*Bombus pennsylvanicus* Rau, 1922. Acad. Sci. St. Louis, Trans. 24, p. 40. (biology)  
*Bombus americanorum* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)  
*Bremus americanorum* Frison, 1930. Ent. Soc. Amer. Ann. 23, pp. 644-665. (biology)  
 (?) *Bombus americanorum* var. *umbratus* Friese, 1931. Konowia 10, p. 301.  
*Bombus americanorum* Rau, 1934. Acad. Sci. St. Louis, Trans. 28, p. 223. (biology)  
*Bombus americanorum* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 163. (biology)  
*Bombus* (*Fervidobombus*) *americanorum* Michener, 1953. Kans. Univ. Sci. Bul. 35, p. 1087. (larva)

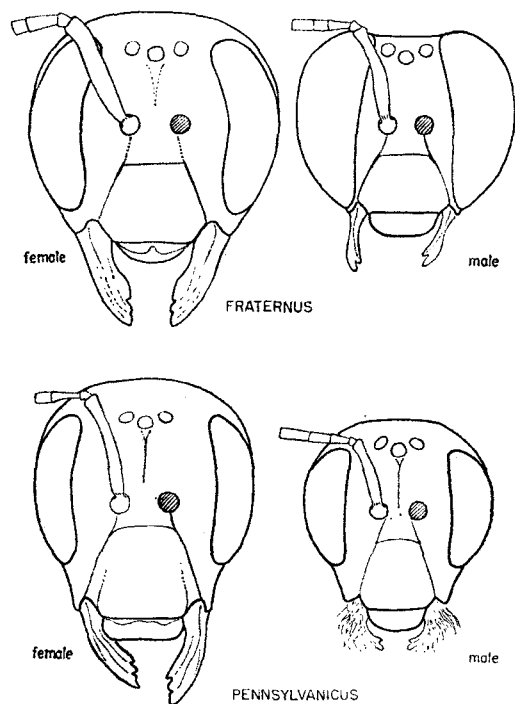


Figure 131  
Facial view of head in males and females of  
*Bombus*.

**QUEEN**—Length 21-25 mm., breadth of abdomen 9.5-11 mm.; black, including legs, spurs and tegulae; wings deeply infuscated, veins testaceous to blackish; pubescence rather short but copious and dense, bright yellow on pronotum, tubercles, anterior margin of scutum, and abdominal terga 1-3; scutellum with black or intermixed black and yellow pubescence, and basal tergum more or less intermixed with black; otherwise black over entire head, thorax, legs and abdomen; clypeus doubly punctate, rather closely so laterally and above, with quite coarse and rather close punctures, interspaces with very minute punctures, median line and apical margin to some degree impunctate; labrum broadly rounded or subtruncate apically, a basal protuberance on each side, rather deeply excavated medially, with a subapical, transverse row of rather short, fuscous hairs; inner apical angle of mandible with a pair of rather obscure notches, otherwise rather broadly rounded, outer surface somewhat shining, doubly punctate, with coarse, sparse punctures interspersed with very minute and rather close punctures; malar space smooth and shining, with a few minute, scattered punctures, length about equal to basal width of mandible, about one-fourth length of eye; punctures of face

fine and close but deep and distinct medially, becoming somewhat coarser and somewhat more distinctly separated just below ocelli, surface between lateral ocelli and eyes shining and impunctate in part, vertex very finely and densely punctate medially, becoming sparsely punctate laterally; lateral ocelli subequally distant from eyes and each other, this considerably less than distance to margin of vertex; scape slightly more than half length of flagellum, basal segment of flagellum considerably shorter than segments 2 and 3 combined; corbicular fringe composed of robust, rather long black hairs, the hind basitarsi very slightly broader at basal third than at apex; tergum 6 narrowly rounded apically, somewhat shining, minutely and rather sparsely punctate toward apex, the broad basal area dull, densely and finely roughened.

**WORKER**—Length 14-18 mm., breadth of abdomen 6.5-8 mm.; resembles the queen in most details other than size, but thoracic pubescence tends to be more elongate and copious.

**MALE**—Length 16-22 mm., breadth of abdomen 6.5-8 mm.; black, including legs, spurs and tegulae; wings quite deeply infuscated, veins testaceous to piceous; apical margins of abdominal terga narrowly yellowish-hyaline; pubescence in general quite long and copious, face and cheeks with short, greyish-white pubescence, interspersed with long and erect, black hairs, vertex largely black; pubescence yellow and elongate on pronotum, tubercles, anterior margin of scutum, and pleura adjacent to tubercles, black on posterior two-thirds of scutum, the scutellum, pleura and propodeum with long intermixed black and pale hairs; pubescence largely blackish or dark on legs anteriorly, the posterior fringes more or less pale, fringes on hind tibiae very short and distinctly black on anterior margin, yellowish on the posterior margin; abdominal terga 1-4 densely clothed with elongate and erect, yellow pubescence, 6 and 7 more or less black pubescent on the  $\sigma$ scs, fringed laterally and on 7 apically with yellowish hairs; tergum 5 is yellow in some specimens, black in others; clypeus closely, finely, deeply and distinctly punctate laterally and above, median apical area shining and impunctate; labrum shining and impunctate across basal margin, otherwise with close, irregular, rather minute punctures, apical margin rather broadly subtruncate, lateral margins rounded; mandibles short and slender, distinctly bidentate apically, the lower tooth more robust than the upper, outer face densely clothed with short, yellowish tomentum, completely hiding the surface, lower margin fringed with elongate, fuscous hairs; malar space smooth and shining, with very

minute, scattered punctures, length about equal to basal width of mandible, about one-fourth length of eye; median area of face rather finely and densely punctate, these becoming relatively coarse and well separated toward ocelli, surface between ocelli and eyes shining and sparsely punctate, vertex very closely but rather coarsely punctate medially, becoming somewhat more finely and more sparsely punctate laterally; lateral ocelli very slightly nearer each other than to eyes, subequally distant from eyes and margin of vertex; segments 1 and 2 of flagellum equal, segment 3 only slightly shorter than 1 and 2 combined; sterna 7 and 8 and genital armature as shown (fig. 130).

**DISTRIBUTION**—Quebec to Florida in the East, west to Pacific Coast, throughout season.

**FLOWER RECORDS**—*Aureolaria*, *Bidens*, *Cirsium*, *Cucurbita*, *Daucus*, *Eupatorium*, *Galactia*, *Hydrolea*, *Hypericum*, *Kuhnistera*, *Liatris*, *Malus*, *Medicago*, *Opuntia*, *Pontederia*, *Rhus*, *Richardia*, *Rubus*, *Spiraea*, *Vernonia* and *Vicia*. Robertson (1929) records this species on the following: *Abutilon*, *Actinomeria*, *Aesculus*, *Agastache*, *Amelanchier*, *Amorpha*, *Antennaria*, *Arctium*, *Asclepias*, *Aster*, *Astragalus*, *Baptisia*, *Blephilia*, *Boltonia*, *Brauneria*, *Campanula*, *Cassia*, *Cephalanthus*, *Cerastium*, *Cercis*, *Circaea*, *Claytonia*, *Clematis*, *Collinsia*, *Convolvulus*, *Coreopsis*, *Cornus*, *Crataegus*, *Crotalaria*, *Cuphea*, *Delphinium*, *Desmodium*, *Dentaria*, *Dianthera*, *Dicentra*, *Diospyros*, *Dipsacus*, *Dodecatheon*, *Eryngium*, *Frasera*, *Gaura*, *Gentiana*, *Geranium*, *Gerardia*, *Gymnocladus*, *Helenium*, *Helianthus*, *Heliopsis*, *Heuchera*, *Hibiscus*, *Hydrangea*, *Hydrophyllum*, *Impatiens*, *Ipomoea*, *Iris*, *Isopyrum*, *Krigia*, *Lantana*, *Leonurus*, *Lepedeza*, *Linaria*, *Lippia*, *Lithospermum*, *Lobelia*, *Lonicera*, *Ludwigia*, *Lycopus*, *Marrubium*, *Martinia*, *Melilotus*, *Mertensia*, *Mimulus*, *Monarda*, *Nelumbo*, *Nepeta*, *Oenothera*, *Orobancha*, *Oxalis*, *Pastinaca*, *Pelatostemum*, *Pentstemon*, *Philadelphus*, *Phlox*, *Physostegia*, *Plantago*, *Podophyllum*, *Polemonium*, *Polygonatum*, *Polygonum*, *Polytaenia*, *Potentilla*, *Prenthes*, *Prunella*, *Prunus*, *Psoralea*, *Pycnanthemum*, *Pyrus*, *Ranunculus*, *Rhamnus*, *Ribes*, *Robinia*, *Rosa*, *Rudbeckia*, *Ruellia*, *Sagittaria*, *Salix*, *Scutellaria*, *Seymeria*, *Sida*, *Silene*, *Silphium*, *Sium*, *Solanum*, *Solidago*, *Specularia*, *Stachys*, *Staphylea*, *Strophostyles*, *Stylosanthes*, *Sym-*

*phoricarpus*, *Tecoma*, *Teucrium*, *Tilia*, *Tradescantia*, *Triosteum*, *Trifolium*, *Uvularia*, *Verbascum*, *Verbesina*, *Verbina*, *Veronica*, *Veronica*, *Viburnum*, *Viola*, *Vitis* and *Zizia*.

The male of *pennsylvanicus* can be easily confused with that of *fervidus* (Fabricius). In the latter, however, the malar space is slightly longer than basal width of mandible, and the eyes only about three and one half times length of malar space: the short greyish pubescence on face and cheeks is much less evident, giving the head a much more definitely black appearance; segment 2 of the flagellum is distinctly shorter than the 1st, and the two combined are distinctly longer than segment 3; the scutellum, pleura and propodeum are definitely yellow pubescent, with no black hairs evident except on posterior surface of propodeum, just below the dorsal triangle; the wings are somewhat less deeply infuscated; the hind tibiae are somewhat more broadly dilated apically, with both the posterior and anterior fringes black.

### *Bombus fraternus* (Smith)

(Figs. 131 & 132)

*Apathus fraternus* Smith, 1854. Cat. Hym. Brit. Mus. 2, p. 385. ♂.

*Bombus scutellaris* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 96. ♀ ♂ ♀.

*Bombus scutellaris* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

**QUEEN**—Length 21-27 mm., breadth of abdomen 9-13 mm.; black, legs somewhat reddish-piceous, apical tarsal segments somewhat more brownish-piceous, the corbicular surface dark ferruginous; tegulae blackish; wings quite deeply infuscated basally, becoming slightly paler apically, veins testaceous to black; pubescence in general short but quite dense, entirely back on head; pubescence yellow on pronotum, anterior half of scutum, scutellum and in large part on pleura, the apical half of scutum black, forming a distinct interalar band; propodeum piceous laterally, nearly bare posteriorly, the venter and narrow anterior surface of pleura black; legs in general black pubescent, hairs quite short, without conspicuous posterior fringes, the corbicular fringe quite dense but of relatively short hairs; pubescence yellow, dense and short on abdominal terga 1 and 2, black on 3-6, in sharp contrast; upper half of clypeus quite finely, closely and deeply punctate,

the apical two-thirds shining, with minute, irregular and rather sparse punctures; labrum rather broadly rounded, with a basal, elevated ridge which is slightly interrupted medially, this area abruptly depressed to the margin; apex of mandible slightly notched toward upper angle, outer face somewhat shining, with minute, irregular and vague punctures; malar space shining and impunctate, very short, its median length only about half basal width of mandibles; eyes elongate, very slightly convergent above; ocelli much below supraorbital line, lateral ocelli subequally distant from eyes and each other, much more widely removed from margin of vertex; antennal scape two-thirds length of flagellum, basal segment of flagellum slightly shorter than segments 2 and 3 combined; posterior margin of hind basitarsus slightly incurved toward the base; tergum 6 narrowly rounded apically, largely bare, slightly impressed on each side.

**WORKER**—Length 13-18 mm., breadth of abdomen 6.5-9 mm.; with no evident structural or color differences from the queen.

**MALE**—Length 19-25 mm., breadth of abdomen 8-10 mm.; black, legs somewhat reddened apically, spurs reddish-piceous, tegulae blackish to piceous; wings quite deeply infuscated basally, becoming slightly paler apically, veins piceous to black; pubescence in general quite short but dense and copious, that on head entirely black, although somewhat hoary on lower part of face and cheeks; pubescence yellow on pronotum, scutellum and in large part on pleura and scutum, the latter with a small median area of short fuscous hairs posteriorly; pubescence fuscous on propodeum and on pleura beneath and anteriorly; legs largely black pubescent, apex of tibiae with some very dense, short, yellowish tomentum; abdominal terga 1 and 2 entirely and densely, short, yellow pubescent, 3-7 entirely black, the more apical terga with elongate and erect hairs; clypeus very finely and closely punctate except along apical margin; labrum somewhat more shining, irregularly and minutely punctate, slightly depressed medially, margin broadly rounded or subtruncate; mandibles very small and slender, slightly constricted medially, bidentate apically, the lower tooth much larger than the acute upper tooth; malar space linear, hardly evident, eyes nearly reaching base of mandible, strongly convergent above; lateral ocelli nearly contiguous with inner margin of eye, only slightly nearer margin of vertex than to antennae; flagellum long and slender, total length more than twice length of scape, basal segments 1 and 3 subequal in length, segment 2 consider-

ably shorter; sterna 7 and 8 and genital armature as shown (fig. 132).

**DISTRIBUTION**—Michigan to Florida, March to November.

**FLOWER RECORDS** — *Bidens*, *Eryngium*, *Gaillardia*, *Hypericum*, *Kuhnistera*, *Lespedeza*, *Monarda*, *Padus*, *Rhus* and *Vaccinium*. Robertson (1929) gives the following additional records: *Acerates*, *Aesculus*, *Asclepias*, *Aster*, *Boltonia*, *Brauneria*, *Cassia*, *Cephalanthus*, *Cirsum*, *Collinsia*, *Eupatorium*, *Gerardia*, *Helenium*, *Helianthus*, *Krigia*, *Lithospermum*, *Lepachys*, *Melilotus*, *Nelumbo*, *Petalostemum*, *Psoralea*, *Pycnanthemum*, *Robinia*, *Rudbeckia*, *Silphium*, *Solanum*, *Solidago*, *Teucrium*, *Trifolium*, *Verbena* and *Zizia*.

### *Bombus griseocollis* (Degeer)

(Figs. 129 & 132)

*Apis griseocollis* Degeer, 1773. Mem. Serv. Hist. Insectes 3, p. 576.

(?) *Apis virginica* Olivier, 1789. Encycl. Meth. 4, p. 66.

(?) *Apis virginica* Fabricius, 1793. Ent. System. 2, p. 318.

(?) *Bombus virginicus* Fabricius, 1804. Syst. Piez. p. 346.

*Bombus separatus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 165. ♀ ♂

*Bombus separatus* Plath, 1927. Psyche 34, pp. 125-127. (biology)

*Bombus separatus* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

*Bremus separatus* var. *nero* Bequaert and Plath, 1925. Mus. Compar. Zool. Bul. 67, p. 275. ♀

*Bombus separatus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 155. (biology)

**QUEEN**—Length 21-23 mm., breadth of abdomen 9.5-11 mm.; black, including legs, spurs and tegulae; wings quite uniformly, deeply infuscated, veins brownish to piceous; pubescence in general quite short but dense, black on head, yellow on scutum, scutellum, pronotum, and on pleura to bases of legs, scutum with a median, narrow, bare area which is fringed with a few short black hairs; pubescence black on venter of thorax and legs, very short on legs, but front and mid femora with posterior fringes of somewhat more elongate hairs, the corbicular fringe entirely black laterally and along the narrow apical margin, and terga 3-6 entirely black, hairs quite short but dense and suberect; clypeus closely and finely punctate laterally and above; the broad

median area smooth and somewhat shining; labrum rather broadly rounded or subtruncate apically, with a pair of basal ridges separated medially by a rather broadly rounded concavity which is slightly elevated above the margin on each side, with an apical fringe of very short yellowish hairs; apex of mandible with a pair of slight notches near the upper angle, outer face toward base somewhat shining, with extremely minute, rather close punctures; malar space smooth and shining, without distinct punctures, somewhat shorter than basal width of mandible, about one-fifth length of eye; punctures of face fine and very close, becoming somewhat more distinct and more widely separated below ocelli, surface between lateral ocelli and eyes smooth and nearly impunctate; vertex finely and very densely punctate medially, punctures becoming somewhat more distinct but still close laterally; lateral ocelli slightly nearer eyes than to each other, distinctly below supraorbital line, slightly nearer each other than to margin of vertex; antennal scape somewhat more than half total length of flagellum, basal segment of flagellum only slightly shorter than segments 2 and 3 combined, 3 slightly longer than 2; posterior margin of hind basitarsus very slightly curved, median width slightly less than half the length; tergum 6 shining, very minutely punctate, narrowly rounded apically.

**WORKER**—Length 9.5-18 mm., breadth of abdomen 5-8.5 mm.; resembles queen except for the usual smaller size.

**MALE**—Length 15-19 mm., breadth of abdomen 6-7 mm.; black, legs and tegulae somewhat more reddish-piceous, spurs brownish-testaceous; wings rather lightly but uniformly infuscated, veins testaceous to piceous; apical margins of the abdominal terga very narrowly yellowish-hyaline; pubescence in general rather short and dense, largely pale yellowish on face above and below antennae and on clypeus, with scattered, erect, black hairs intermixed; vertex and occiput with intermixed yellowish and black hairs medially, cheeks with more fuscous hairs above, becoming yellowish below; scutum with a small median fuscous pubescent area posteriorly, and pleura with a few fuscous hairs above mid coxae, otherwise entire thorax densely yellow pubescent; all femora fringed beneath with elongate yellowish hairs, these becoming more fuscous on upper surface; tibiae largely blackish or fuscous pubescent, with posterior fringes of elongate hairs; and basitarsi with some elongate, dark hairs posteriorly, clothed beneath with short brownish hairs; basal abdominal tergum, and basal margin of tergum 2 medially, with erect, yellowish pubescence, remainder of terga 2 and all of 3-7 black pub-

escent, hairs very short, dense and suberect; clypeus finely and quite closely punctate beneath dense pubescence, but with a median, apical, shining, impunctate area; labrum broadly truncate, somewhat shining, especially on each side basally, with obscure, irregular and rather shallow, fine punctures; mandibles slender, bidentate apically, outer surface densely short pubescent, this yellow in part but fringed along lower margin with elongate fuscous hairs; malar space smooth and shining, with very minute, barely visible punctures, its median length about half basal width of mandible, only about one-tenth length of eye; face very narrow, eyes very slightly convergent above, lateral ocelli separated from eyes by less than half their diameter, and much below supraorbital line, nearer to each other than to margin of vertex; facial punctures very fine and close beneath dense pubescence, becoming rather sparse on shining surface below ocelli, punctures of vertex medially quite deep and distinct but close, becoming somewhat finer laterally; basal segment of flagellum subequal to segment 3, segment 2 considerably shorter; hind tibiae shining, somewhat convex, very sparsely punctate, basitarsi elongate and parallel-sided; sterna 7 and 8 and genital armature as shown (fig. 132).

**DISTRIBUTION**—Quebec and Maine to Florida, and throughout the West, February to August.

**FLOWER RECORDS**—*Apocynum*, *Aronia*, *Asclepias*, *Ceanothus*, *Chamaecrista*, *Cirsium*, *Eryngium*, *Helenium*, *Helianthus*, *Hypericum*, *Ilex*, *Itea*, *Malus*, *Pontederia*, *Rhus*, *Rubus*, *Silphium*, *Solidago*, *Vaccinium* and *Vicia*. Robertson (1929) gives the following additional records: *Abutilon*, *Acerates*, *Actinomeris*, *Aesculus*, *Agastache*, *Amorpha*, *Arabis*, *Asclepias*, *Aster*, *Astragalus*, *Baptisia*, *Bidens*, *Blephilia*, *Brauneria*, *Camassia*, *Campanula*, *Cassia*, *Caulophyllum*, *Ceanothus*, *Cephalanthus*, *Cercis*, *Cirsium*, *Collinsia*, *Cornus*, *Crataegus*, *Delphinium*, *Dentaria*, *Desmodium*, *Dianthera*, *Dicentra*, *Diospyros*, *Dodecatheon*, *Erigeron*, *Eryngium*, *Eupatorium*, *Frasera*, *Gerardia*, *Geranium*, *Gleditzia*, *Helenium*, *Helianthus*, *Hibiscus*, *Houstonia*, *Hydrangea*, *Hypericum*, *Hydrophyllum*, *Ipomoea*, *Iris*, *Krigia*, *Liatris*, *Lobelia*, *Lythrum*, *Marubium*, *Melilotus*, *Mertensia*, *Monarda*, *Nelumbo*, *Nepita*, *Pastinaca*, *Pentstemon*, *Petalostemon*, *Phlox*, *Podophyllum*, *Polemonium*, *Prunella*, *Prunus*, *Psoralea*, *Pycnanthemum*, *Pyrus*, *Rhus*,

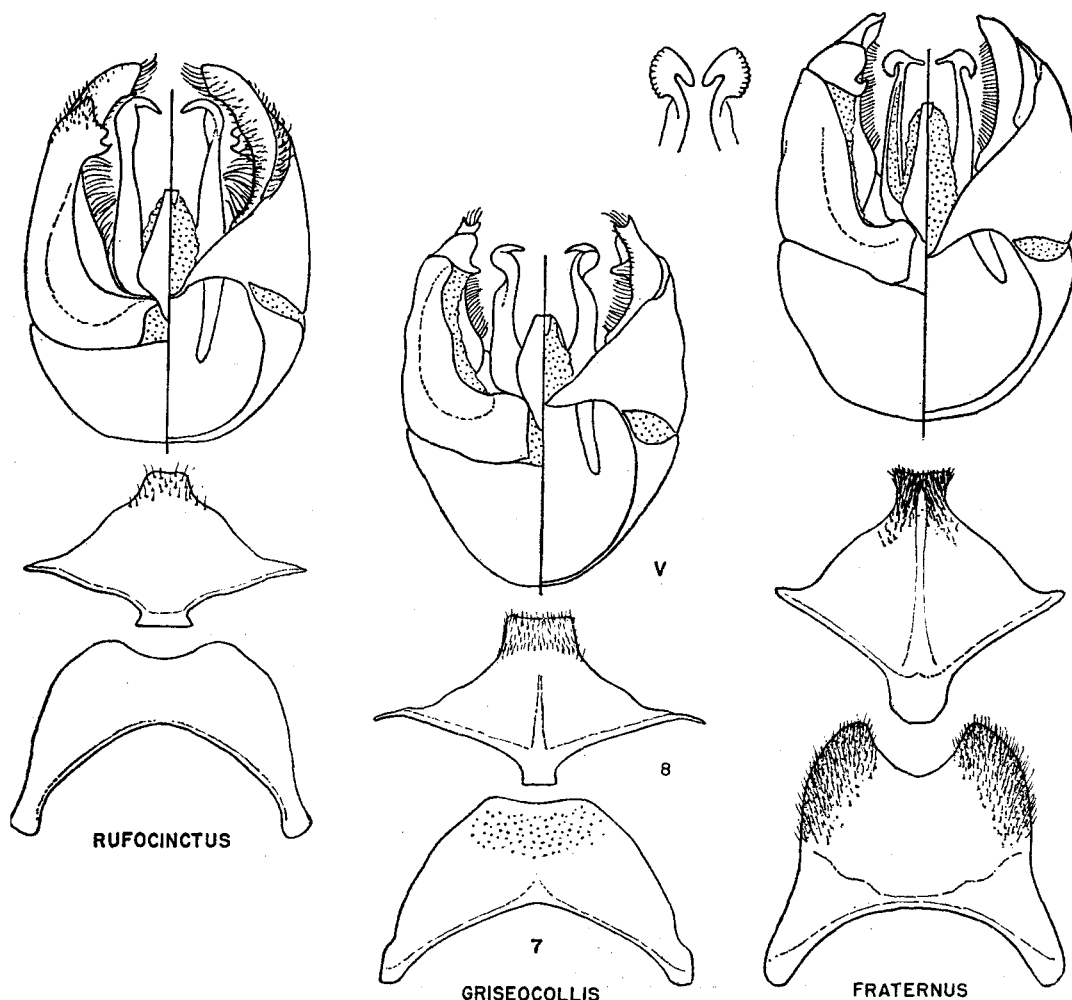


Figure 132—Dorsal and ventral views of genital armature, and sterna 7 and 8 in males of *Bombus*. A more detailed view of tips of penis valves in *B. fraternus* is shown.

*Ribes*, *Robinia*, *Rosa*, *Rubus*, *Rudbeckia*, *Salix*, *Scutellaria*, *Silphium*, *Sisyrinchium*, *Solidago*, *Specularia*, *Symphoricarpos*, *Taenidia*, *Teucrium*, *Tradescantia*, *Trifolium*, *Verbena*, *Vernonia*, *Viburnum*, *Viola*, *Vitis*, *Uvularia* and *Zizia*.

***Bombus rufocinctus* Cresson**  
(Fig. 132)

*Bombus rufocinctus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 106. ♂ ♀  
*Bombus rufocinctus* var. *astragali* Cockerell, 1907. Entomologist 40, p. 97. ♀.  
*Bombus rufocinctus* var. *castoris* Cockerell, 1915. Ann. Mag. Nat. Hist. (8) 15, p. 537. ♂.

*Bombus rufocinctus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 158. (biology)

QUEEN—Length 16-18 mm., breadth of abdomen 8.5 mm.; black, including legs, spurs and tegulae; wings rather deeply infuscated, veins brownish to piceous; pubescence copious but rather short, largely black on face and cheeks, but with some intermixed, shorter light hairs above antennae, cheeks with some greyish hairs intermixed with the black; vertex with a tuft of pale yellowish hairs medially, becoming black on each side, occiput with a dense, pale yellowish fringe; pubescence bright yellow on pronotum, tubercles, anterior third of scutum, entire scutellum, pleura and propodeum in large part, the scu-

tum bare medially, with black pubescence over posterior two-thirds, the thoracic venter narrowly fuscous pubescent beneath, and legs clothed with largely black hairs, with some paler hairs on the inferior fringe of hind femora, the corbicular fringe of elongate, largely black hairs, basitarsi clothed beneath with brownish pubescence, upper surface nearly bare but with very minute, pale pruinose hairs that do not hide surface; abdominal terga 1 and 4 with bright yellow pubescence, 2 with yellow pubescence medially and across the base, but with elongate fulvous hairs apically and laterally, 3 with largely fulvous hairs which overlie tergum 4 which is largely yellow pubescent; terga 5 and 6 black pubescent but with dense yellow fringes on each side of 5; clypeus very finely and rather closely punctate laterally and above, a broad median area shining and nearly impunctate, with only very minute or widely scattered punctures; labrum slightly elevated at base, this broadly interrupted medially by a quite deep impression, its apical margin rounded and slightly elevated above the apical margin on each side, and fringed apically with ochraceous hairs; apex of mandible with a pair of distinct notches toward the upper angle, otherwise entire, outer face rather smooth, with barely evident, minute punctures; malar space smooth and shining, without evident punctures, its length hardly more than half the basal width of mandible, hardly more than one-eighth the length of the eye; median area of face with rather deep and distinct but quite close punctures, intervening spaces with more minute and shallow punctures, surface shining and impunctate around ocelli; the vertex densely punctate medially beneath the pubescent tuft, becoming somewhat more distinctly but very closely punctate laterally; lateral ocelli somewhat nearer eyes than to each other and nearer each other than to margin of vertex; antennal scape considerably more than half the total length of flagellum, basal segment of flagellum only slightly shorter than segments 2 and 3 combined, these nearly equal in length; hind basitarsi quite broad, the length only about twice the greatest breadth; tergum 6 shining and minutely punctate, punctures becoming somewhat closer toward margins, narrowly rounded at apex.

**WORKER**—Length 11-12.5 mm., breadth of abdomen 5-5.5 mm.; quite similar to queen but pubescence relatively more elongate, with considerable variation in the pattern of pubescence on abdominal terga, with some black pubescence evident on the more median terga in some specimens.

**MALE**—Length 12-13 mm., breadth of abdomen 5.5-6 mm.; black, apical segments of

legs and tegulae somewhat more piceous, mid and hind spurs reddish-piceous; wings rather lightly infuscated, veins testaceous to piceous; apical margins of abdominal terga narrowly testaceous-hyaline; pubescence copious and erect, largely yellow on cheeks below, on clypeus and on vertex medially, black around and above antennae and along margins of eyes, on cheeks above and vertex laterally, with a few black hairs overlying ocelli; pubescence bright yellow on pronotum, anterior third of scutum, around tubercles, over most of pleura, and on scutellum and propodeum; posterior two-thirds of scutum with conspicuous black pubescence, basal segments of legs, including femora, more or less yellow pubescent, the lower margin of femora rather densely fringed with yellowish hairs, tibiae more black pubescent, with rather conspicuous posterior fringes, hind tibiae very narrowly fringed with black anteriorly, and with more elongate, black hairs posteriorly; basitarsi with pale brownish pubescence beneath, with somewhat darker pubescence above on front and middle legs, hind pair with a rather conspicuous fringe of elongate dark hairs posteriorly; abdominal terga 1, 2, 5 and 6 with conspicuous yellow pubescence, 3, 4 and 7 largely black; clypeus very finely and rather closely punctate beneath the dense pubescence, but median apical area becoming shining and largely impunctate; labrum broadly truncate, shining and impunctate in large part, with only a few scattered, irregular punctures; mandibles slender apically, bi-dentate, outer face very densely tomentose, hiding surface, and fringed beneath with long curled hairs; malar space smooth and shining, impunctate, very short, no more than half basal width of mandibles, and about one-tenth length of eye; median area of face finely and closely but not densely punctate, punctures becoming more distinct and sparse toward ocelli, space between ocelli and eyes smooth and impunctate; punctures very close and fine but not crowded on vertex medially, becoming somewhat more minute and irregular laterally; ocelli slightly below supraorbital line, considerably nearer each other than to margin of vertex, and much nearer eyes than to each other; antennal scape much less than half total length of flagellum, basal segment of flagellum about equal to segment 3, segment 2 considerably shorter, not much longer than broad; hind tibiae strongly convex but rather narrow, shining and largely impunctate on outer surface, hind basitarsus broad, length not much greater than twice the maximum breadth; sterna 7 and 8 and genital armature as shown (fig. 132).

**DISTRIBUTION**—Pacific Coast to Michigan, Quebec and Maine, July to October.

***Bombus bimaculatus* Cresson**

*Bombus bimaculatus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 92. ♂.

*Bombus bimaculatus* Plath, 1922. Psyche 29, pp. 194-195. (biology)

*Bombus bimaculatus* Frison, 1928. Ent. Amer. (n.s.) 8, pp. 159-223. (biology)

*Bombus ridingsi* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

*Bombus bimaculatus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 141. (biology)

**QUEEN**—Length 17-22 mm., breadth of abdomen 8.5-10 mm.; black, apical tarsal segments becoming more piceous, spurs reddish-piceous, tegulae black; wings lightly infuscated, veins brownish to piceous; pubescence copious and dense but rather short, largely black on head but with some conspicuous yellow pubescence on vertex medially just posterior to a dense fringe of black hairs; thorax largely yellow pubescent, with only a rather small, median posterior area of black hairs and some dark hairs on lateral faces of propodeum below; pubescence of legs largely black or fuscous, with a few pale hairs in posterior fringes of femora, corbicular fringe composed of elongate, black hairs; basal abdominal tergum yellow pubescent and tergum 2 with a small amount of yellow toward base across the median third, abdomen otherwise densely black pubescent; clypeus smooth and shining, with rather close, fine, irregular punctures along the narrow lateral and upper margins, the broad, median, apical area nearly impunctate; labrum quite broadly truncate, with a basal ridge which is interrupted medially, apical margin fringed with golden hairs, slightly rounded medially and on each side, with a low emargination separating them; apex of mandible with a pair of low, obscure notches toward upper angle, lower angle very slightly emarginate, outer face rather smooth, only obscurely punctate; malar space smooth and shining, median length about equal to basal width of mandible, about one fourth length of eye; median area of face very finely and closely punctate, punctures becoming somewhat more distinct and separate toward ocelli, surface largely smooth and impunctate between ocelli and eyes; punctures minute and densely crowded on vertex medially, very fine and close even laterally; antennal scape slightly more than half total length of flagellum, basal segment of flagellum only slightly shorter than segments 2 and 3 combined, 3 somewhat longer than 2; posterior margin of hind basitarsus nearly parallel with anterior margin; tergum 6 narrowly rounded apically, with a low, obscure, median

ridge apically, surface shining and minutely punctate.

**WORKER**—Length 11-16 mm., breadth of abdomen 5-6.5 mm.; very similar to queen except in size.

**MALE**—Length 13-14.5 mm., breadth of abdomen 6-6.5 mm.; black, apical tarsal segments somewhat more piceous, mid and hind spurs reddish; tegulae becoming obscurely yellowish-hyaline along outer margin; wings lightly infuscated, veins testaceous to piceous; pubescence long, copious and dense, black and erect below and above antennae and just above ocelli, but vertex with dense yellow pubescence along posterior margin; cheeks below with elongate yellowish pubescence, this becoming darker toward vertex; clypeus with considerable short, yellowish pubescence, with scattered, elongate black hairs; thorax largely yellow pubescent, with only a very small, median, posterior area of obscure dark pubescence; legs with considerable pale pubescence basally but with largely fuscous fringes on tibiae, outer surface of basitarsi more or less pale pubescent, the lower surface reddish-brown; basal abdominal tergum and median basal area of tergum 2 with yellow pubescence, the following segments with varying amounts of black and yellow, sometimes entirely black, sometimes largely yellow on 4 or 5 and tergum 2 in some specimens entirely yellow; clypeus very finely and rather closely punctate but shining beneath quite dense pubescence; labrum shining, truncate apically with only a few obscure, minute punctures medially toward base, apical half more closely but minutely punctate; mandibles very small and slender, bidentate apically, outer surface densely ochraceous tomentose, apical margin with a fringe of elongate, testaceous hairs; malar space smooth and shining, only very minutely and obscurely punctate, its median length somewhat greater than basal width of mandible, about one-fourth length of eye; face very finely and closely punctate medially beneath quite dense pubescence, becoming more coarsely and sparsely punctate toward ocelli, space between lateral ocelli and eyes shining and largely impunctate; vertex very densely and rather finely punctate medially, becoming more minute and obscure but still quite close laterally; basal segment of flagellum slightly longer than segment 2, slightly shorter than 3; lower surface of hind tibiae somewhat convex, shining and sparsely punctate, posterior fringe of elongate hairs, the basitarsus nearly parallel-sided; terga 7 and 8 and genital armature as in *impatiens* (fig. 133).

DISTRIBUTION — Ontario to Maine, south to Mississippi and Florida, March to September, February in Florida.

FLOWER RECORDS — *Batodendron*, *Cirsium*, *Halesia*, *Hydrangea*, *Hypericum*, *Ilex*, *Itea*, *Kalmia*, *Malus*, *Melilotus*, *Pentstemon*, *Prunus*, *Rhododendron*, *Rosa*, *Rubus*, *Solidago*, *Stachys*, *Vaccinium* and *Vicia*. Robertson (1929) records *bimaculatus* also on *Amelanchier*, *Blephilia*, *Collinsia*, *Caulophyllum*, *Cephalanthus*, *Dentaria*, *Dicentra*, *Geranium*, *Helianthus*, *Hydrophyllum*, *Mertensia*, *Monarda*, *Nepeta*, *Phlox*, *Polemonium*, *Ribes*, *Seymeria*, *Triosteum*, *Trifolium*, *Uvularia* and *Verbena*.

***Bombus impatiens* Cresson**  
(Fig. 133)

- Bombus impatiens* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 90. ♂.  
*Bombus impatiens* Plath, 1922. Psyche 29, pp. 195-197. (biology)  
*Bombus impatiens* Frison, 1929. Brooklyn Ent. Soc. Bul. 24, pp. 261-282.  
*Bombus impatiens* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)  
*Bombus impatiens* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 144. (biology)  
*Bombus impatiens* var. *deayi* Chandler, 1956. Ind. Acad. Sci. Proc. 65, p. 116. ♀.

QUEEN—Length 17-21 mm., breadth of abdomen 8.5-11 mm.; black, including legs and tegulae, spurs reddish-piceous; wings lightly infuscated, veins brownish to piceous; pubescence bright yellow, copious but rather short on pronotum, scutum, scutellum, mesopleura in large part, and basal abdominal tergum, a few black hairs on scutum medially and some yellowish pubescence on propodeum laterally, becoming black below; a small amount of yellowish pubescence intermixed with black on vertex and occiput medially, otherwise entirely black on head, venter of thorax, legs and abdominal terga 2-6; corbicular fringe quite dense and elongate, entirely black; clypeus quite closely and finely punctate laterally and above, the broad median area shining, minutely and obscurely punctate; labrum rather broadly truncate, with a basal elevation on each side, shallowly excavated or concave between, apical margin of this area rather broadly rounded, somewhat elevated above the margin on each side; apex of mandible with a pair of short but quite distinct teeth on the upper angle, otherwise broadly rounded, outer face shining, only very minutely and obscurely punctate; malar space smooth and shining,

practically impunctate, considerably shorter than basal width of mandible, about one-fifth length of eye; punctures of medial area of face very fine and close, becoming somewhat more sparse and distinct toward ocelli, space between lateral ocelli and eyes shining and impunctate, vertex very finely and densely punctate medially beneath dense pubescence, becoming somewhat more distinctly but still closely punctate laterally; lateral ocelli slightly nearer eyes than to each other, and somewhat nearer each other than to margin of vertex; antennal scape slightly more than half the total length of flagellum; basal segment of flagellum very slightly longer than segment 3, and 3 slightly longer than 2; posterior margin of hind basitarsi slightly and regularly curved; apex of tergum 6 very narrowly rounded, the surface smooth, shining and only very minutely and quite sparsely punctate.

WORKER—Length 8.5-16 mm., breadth of abdomen 4-7 mm.; very similar to queen in color, pubescence and structure, usually with fewer yellowish hairs on vertex, pubescence somewhat more elongate and copious, wings somewhat paler.

MALE—Length 12-17 mm., breadth of abdomen 5-6.5 mm.; black, including legs, the spurs somewhat more piceous and tegulae brownish-piceous; wings subhyaline, veins testaceous to piceous; apical margins of the terga very narrowly testaceous-hyaline; pubescence long and copious, yellowish on vertex, occiput, cheeks posteriorly and below, and on median area of face and clypeus, with erect black hairs on cheeks above, vertex laterally, face between ocelli and antennae, and with intermixed, long, black hairs on face below antennae; pronotum, scutum, scutellum and pleura in large part yellow pubescent, a few intermixed blackish hairs on median posterior area of scutum, and propodeum largely yellow; legs with yellowish pubescence at base but becoming black on femora apically and on tibiae and basitarsi; basal abdominal tergum yellow pubescent, following terga entirely black pubescent; clypeus shining, finely and quite closely but regularly punctate beneath dense pubescence; labrum quite smooth, shining, truncate apically, lateral margin rounded, very minutely and rather sparsely punctate; mandibles slender, bidentate apically, outer surface densely yellow pubescent, completely hiding the surface, fringed below with long, curled, yellowish hairs; malar space smooth and shining, not distinctly punctate, length about equal to basal width of mandible; median area of face very finely and closely punctate, the punctures becoming somewhat more coarse and distinct but still close toward ocelli, area between lateral ocelli and eyes polished and impunctate, vertex finely

and densely punctate medially beneath dense pubescence, punctures becoming somewhat more distinct but still close laterally; lateral ocelli somewhat nearer eyes than to each other, and slightly nearer each other than to margin of vertex; segments 1 and 2 of flagellum about equal in length, segment 3 somewhat longer; hind tibiae quite slender, outer surface shining and very sparsely punctate, especially apically, only slightly convex, the fringe of rather elongate, black hairs; hind basitarsi quite slender and elongate, about three times longer than the maximum width; sterna 7 and 8 and genital armature as shown (fig. 133).

**DISTRIBUTION** — Ontario to Maine, south to Florida, March to November, January and February in Florida.

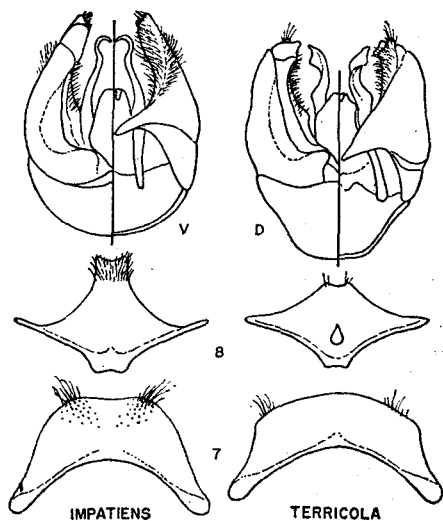
**FLOWER RECORDS** — *Abelia*, *Apocynum*, *Bidens*, *Cirsium*, *Erigeron*, *Eupatorium*, *Gelsemium*, *Ilex*, *Malus*, *Polygonum*, *Pontederia*, *Solidago*, *Trilisa* and *Vaccinium*. Robertson (1929) lists the following genera: *Actinomeris*, *Aesculus*, *Agastache*, *Amphicarpa*, *Arabis*, *Arctium*, *Asclepias*, *Aster*, *Blephilia*, *Boltonia*, *Brauneria*, *Camassia*, *Campanula*, *Cassia*, *Caulophyllum*, *Cephalanthus*, *Cercis*, *Cicuta*, *Claytonia*, *Clematis*, *Collinsia*, *Coreopsis*, *Crataegus*, *Cucurbita*, *Delphinium*, *Dentaria*, *Desmodium*, *Dianthera*, *Dicentra*, *Diosypros*, *Dodecatheon*, *Eryngium*, *Erythronium*, *Fragaria*, *Gaura*, *Geranium*, *Gerardia*, *Gymnocladus*, *Helenium*, *Helian-*

*thus*, *Heliopsis*, *Hydrophyllum*, *Impatiens*, *Lactuca*, *Liatris*, *Linaria*, *Lithospermum*, *Lobelia*, *Lonicera*, *Lycopus*, *Lythrum*, *Malva*, *Monarda*, *Nelumbo*, *Nepeta*, *Osmorrhiza*, *Pastinaca*, *Pentstemon*, *Petalostemum*, *Phlox*, *Podophyllum*, *Polemonium*, *Prenanthes*, *Prunella*, *Prunus*, *Psoralea*, *Pycnanthemum*, *Pyrus*, *Ribes*, *Robinia*, *Rosa*, *Rubus*, *Rudbeckia*, *Salix*, *Scrophularia*, *Scutellaria*, *Seymeria*, *Sicyos*, *Silphium*, *Sium*, *Smilax*, *Solanum*, *Stachys*, *Staphylea*, *Symphoricarpos*, *Taraxacum*, *Teucrium*, *Tradescantia*, *Trifolium*, *Uvalaria*, *Verbena*, *Viola*, *Vitis*, and *Zizia*.

***Bombus perplexus* Cresson**

- Bombus perplexus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 91. ♂.
- Bombus hudsonicus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 92. ♂.
- Apathus dorsalis* Provancher, 1888. Addit. Corr. Faune Ent. Canada, Hym. p. 343. ♂ (not ♀). New synonymy.
- Bombus perplexus* Plath, 1927. Psyche 34, pp. 124-125. (biology)
- Bombus perplexus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 146. (biology)

**QUEEN**—Length 17-21 mm., breadth of abdomen 8.5-9 mm.; black, apical tarsal segments somewhat more piceous, mid and hind spurs and tegulae piceous; wings rather lightly infuscated, veins pale testaceous to piceous; pubescence copious and quite elongate, largely black on head, with a small amount of pale pubescence on occiput and vertex medially; pubescence yellow on pronotum, tubercles, scutum in large part, scutellum, upper portion of pleura and abdominal terga 1 and 2, the median posterior area of scutum relatively bare, sometimes with a few marginal or intermixed black hairs; pubescence of legs and of abdominal terga 3-6 black, or tergum 6 with a few pale hairs laterally; pleura either black, or yellow at bases of legs; corbicular fringe of elongate black hairs; basitarsi with brownish pubescence beneath, dark on outer surface, the hind basitarsus and following segments with very fine and rather obscure pale pruinose hairs; clypeus very finely and closely punctate laterally and above, becoming quite sparsely and very finely punctate over the broad median area, surface shining; labrum with a basal ridge which is slightly interrupted medially, this area somewhat excavated but slightly elevated above the margin on each side, this fringed with short, ochraceous hairs; apex of mandible with a pair of low notches toward upper



**Figure 133**  
Dorsal (D) and ventral (V) views of genital armature, and sterna 7 and 8 in males of *Bombus*.

angle, very shallowly but broadly emarginate toward lower angle, outer face smooth, without distinct punctures; malar space smooth and shining, not noticeably punctate, its length very slightly shorter than basal width of mandible and slightly less than one-third length of eye; face medially very minutely and densely punctate, punctures becoming somewhat more distinct, well separated, but still very fine toward ocelli, space between ocelli and eyes polished and only very sparsely and minutely punctate; vertex minutely and densely punctate medially, the punctures becoming somewhat more distinct but still very close laterally; lateral ocelli slightly nearer eyes than to margin of vertex, subequally distant from eyes and each other; antennal scape very slightly more than half total length of flagellum, basal segment of flagellum considerably longer than segment 3, the latter very slightly longer than 2 which is considerably longer than broad; maximum width of hind basitarsus only very slightly less than half the length, posterior margin very slightly curved, base and apex about equal in breadth; tergum 6 shining, only very vaguely and minutely punctate if at all, very slightly ridged medially toward the narrowly rounded apex.

**WORKER**—Length 12-14 mm., breadth of abdomen 5-6 mm.; pubescence somewhat more copious and elongate than in queen, bright yellow above, that on pleura somewhat more whitish or possibly largely black; terga 1 and 2 entirely pale yellow pubescent, 3 either entirely black or with largely yellow pubescence medially, becoming intermixed with black hairs laterally, the more apical terga largely black but with intermixed paler hairs, especially on tergum 6; resembles queen in most other details.

**MALE**—Length 13-14 mm., breadth of abdomen 5-6 mm.; black, mandibles more or less ferruginous at tip, apical segments of legs somewhat more piceous, mid and hind spurs piceous to black, tegulae piceous; wings rather lightly but uniformly infuscated, veins pale testaceous to piceous; pubescence long and copious, largely whitish on head, with a few elongate, dark hairs along inner orbits, before ocelli, and on vertex laterally, vertex otherwise more yellowish pubescent, more whitish on cheeks below, the shorter pubescence of face very fine and densely plumose; pubescence of thorax entirely pale, bright yellow above, more whitish beneath, the legs, including the femora, whitish pubescent basally, mid trochanters with some short curved ochraceous bristles; tibiae with some very short, dark pubescence anteriorly but rather prominently fringed with pale hairs posteriorly, the basi-

tarsi with brownish pubescence beneath; clypeus somewhat shining between fine but rather close and distinct punctures beneath the dense pubescence; labrum quite broadly rounded, more or less truncate medially, somewhat shining on each side basally, the median apical area with scattered, shallow punctures; mandibles slender, distinctly bidentate apically, outer surface densely yellow tomentose, lower margin with a fringe of elongate, more or less curled, yellowish hairs; malar space smooth and shining, only very vaguely punctate except below, its length slightly greater than basal width of mandible, about one-fourth length of eye; median area of face very finely and closely punctate beneath dense pubescence, punctures becoming quite coarse and rather sparse toward ocelli, space between ocelli and eyes largely polished and impunctate; vertex finely and very densely punctate medially, becoming somewhat more distinctly, sparsely and finely punctate laterally, area between eyes and ocelli shining and impunctate; lateral ocelli subequally distant from margin of vertex and each other, very slightly closer to eyes; basal segment of flagellum very slightly longer than segment 2, very slightly shorter than 3; hind tibiae convex on outer face, shining, very sparsely punctate; hind basitarsus nearly parallel-sided, slightly narrowed at base, length about three and one-third times the maximum breadth; sterna 7 and 8 and genital armature as in *impatiens* (fig. 133).

**DISTRIBUTION** — Alaska to Maine, south to Georgia, April to September.

**FLOWER RECORDS** — *Angelica*, *Hydrangea*, *Malus*, *Rhododendron*, *Rubus* and *Vaccinium*.

### *Bombus sandersoni* Franklin

*Bombus vagans sandersoni* Franklin, 1913.  
Amer. Ent. Soc. Trans. 38, p. 353. ♀.

**QUEEN**—Length 15-16 mm., breadth of abdomen 6 mm.; black, the more apical segments of the legs becoming brownish-testaceous, mid and hind spurs testaceous, tegulae brownish-piceous; wings lightly infuscated, being almost hyaline in central area, veins pale testaceous to piceous; pubescence copious but rather short, largely pale on head, with long, erect, black hairs on vertex and front, a small amount of short, greyish, densely plumose hairs around antennae, cheeks below becoming somewhat more greyish pubescent, and a few pale hairs intermixed with the dark on vertex; pubescence dense, erect and yellow on pronotum, tubercles, narrow anterior margin of scutum, most of pleura, propodeum

laterally, and entire scutellum, that on venter somewhat more greyish, largely fuscous on legs but largely pale on coxae and trochanters, mid trochanters with a patch of short, curved, brownish bristles beneath; front and mid tibiae with rather elongate pubescence posteriorly and on outer face, the corbicular fringe on hind legs of very long, dark hairs; tarsal segments thinly covered with very fine, pruinose hairs that do not obscure the surface, basitarsi beneath with brownish pubescence; abdominal terga 1 and 2, and sometimes 5 and 6, yellow pubescent, with no dark mixture on 1 or 2, terga 3 with erect and copious black pubescence; clypeus quite finely, closely and deeply punctate laterally and above, broad median area shining and nearly impunctate; mandible with a basal ridge which is somewhat interrupted medially, this area somewhat depressed, its apex very slightly elevated above margin on each side, and fringed with short, ochraceous hairs; apex of mandibles with a pair of distinct and rather deep notches toward upper angle, very slightly and rather broadly emarginate toward lower angle, outer face toward base smooth and somewhat shining, with only minute and very vague punctures; malar space shining and impunctate, slightly shorter than basal width of mandible, about one-fourth length of eye; punctures over median area of face very fine and rather densely crowded, becoming more distinct but still quite close toward ocelli, largely shining and impunctate between ocelli and eyes; vertex medially with very fine, densely crowded punctures, these becoming somewhat more distinct but still very fine and close laterally; lateral ocelli subequally distant from eyes and margin of vertex, somewhat more widely separated from each other; antennal scape somewhat more than half the total length of flagellum, basal segment of flagellum considerably longer than either 2 or 3, but somewhat shorter than the two combined; hind basitarsus almost parallel-sided, posterior margin only very slightly curved, median length nearly twice the breadth; tergum 6 somewhat shining, very minutely and rather sparsely punctate medially, more closely so toward margins, apex narrowly rounded, very densely short pubescent, forming an apical tuft.

**WORKER**—Length 8-13 mm., breadth of abdomen 3.5-5.5 mm.; resembles queen, but pubescence relatively more elongate, with the same general pattern except that the apical abdominal terga are usually entirely black pubescent.

**MALE**—Length 10-13 mm., breadth of abdomen 5-6 mm.; pubescence long and copious, in large part yellow on head, especially on face

below antennae, on vertex medially and cheeks posteriorly, with intermixed, long, black hairs along inner orbits, around and above antennae, behind ocelli, on cheeks above and along posterior orbits; center of scutum thinly pubescent, usually posterior half black, the scutellum, pleura and anterior half of scutum yellow; legs largely yellow pubescent basally, hairs long and quite copious, tibiae with somewhat shorter pubescence on outer face, fringed with pale hairs, more or less intermixed with black, the mid and hind basitarsi with brownish-ochraceous pubescence beneath, largely bare on exterior surface, fringed with ochraceous hairs; hind tibiae quite slender, outer surface shining but convex, with sparse punctures, fringed with dark hairs anteriorly, and with more elongate, pale hairs, intermixed with dark, posteriorly; abdominal terga 1 and 2 with copious and elongate yellow pubescence, following terga black; clypeus with fine and close but quite distinct punctures beneath dense yellow pubescence; labrum rather broadly truncate, smooth and shining, with only minute scattered and rather obscure punctures; mandibles slender, bidentate apically, densely covered with ochraceous pubescence on outer face, this forming an elongate, somewhat curled fringe beneath; malar space smooth and shining, with only very vague and obscure punctures, length somewhat greater than basal width of mandible, about one-fourth length of eye; median area of face beneath the dense pubescence very finely and closely punctate, the punctures becoming distinct and quite sparse above toward ocelli, space between ocelli and eyes shining and impunctate, vertex medially quite closely punctate becoming more sparse and irregular laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; basal segment of flagellum very slightly longer than segment 2, about equal to segment 3; median width of hind basitarsus slightly less than one-third the length; sterna 7 and 8 and genital armature similar to *impatiens* (fig. 133).

**DISTRIBUTION** — Ontario to Newfoundland, south to Tennessee and North Carolina, April to October.

**FLOWER RECORDS**—*Epilobium*, *Malus*, *Pentstemon*, *Rhododendron*, and *Rubus*.

Although *sandersoni* was originally described as a form of *vagens*, it has more recently been placed under *frigidus* (Catalog of Hymenoptera, p. 1252). However, Milliron has expressed the opinion in correspondence that it is distinct and that neither typical *frigidus* nor any of its forms occurs in the East.

*Bombus ternarius* Say

*Bombus ternarius* Say, 1837. Boston Jour. Nat. Hist. 1, p. 414. ♂.

(?) *Bombus ornatus* Smith, 1854. Cat. Hym. Brit. Mus. 2, p. 398. ♀ ♂ ♀.

*Bombus ternarius* var. *expallidus* Cockerell, 1916. Mich. Univ. Mus. Zool. Occas. Papers 23, p. 9. ♀.

*Bombus ternarius* Plath, 1927. Psyche 34, p. 125. (biology)

*Bombus ternarius* Brittain and Newton, 1933. Canad. Jour. Res. 9, p. 343. (flower records)

*Bombus ternarius* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 149. (biology)

QUEEN—Length 17-19 mm., breadth of abdomen 8.5-9 mm.; black, legs apically and spurs and tegulae more piceous; wings uniformly and rather deeply infuscated, veins brownish to piceous; pubescence copious and dense but rather short, largely black on head, with a few pale yellowish hairs around antennae and some intermixed pale hairs on vertex medially, otherwise erect and black on vertex, front of face and on cheeks; pubescence yellow and erect on pronotum, anterior margin of scutum, posterior margin of scutellum, tubercles, and mesopleura to bases of legs, black on scutum in large part, and on scutellum medially, propodeal area with more or less intermixed light and dark hairs; pubescence pale on basal segments of legs, elongate and largely black on femora, with only a few pale hairs at base, short on tibiae and tarsi, the corbicular fringe of quite elongate, blackish hairs, and hind basitarsus thinly covered with pale pruinose hairs which do not obscure the surface; abdominal terga 1 and 4 yellow pubescent, 2 and 3 fulvous, unless faded, 5 and 6 entirely black; clypeus shining, punctures close and rather fine laterally and above, the broad median area with sparse shallow punctures of two different sizes; labrum with a basal ridge that is narrowly interrupted medially, this area somewhat excavated, its apical margin broadly rounded, somewhat elevated above the margin on each side, the entire margin fringed apically with rather short yellowish hairs; apex of mandible with two rather deep notches near upper angle, outer surface smooth but rather dull, with some minute and very vague punctures; malar space smooth and shining, without distinct punctures, somewhat shorter than basal width of mandible, about one-fifth length of eye; median area of face very finely and closely punctate, punctures becoming somewhat more distinct and more widely separated toward ocelli, space between lateral ocelli and eyes smooth and impunctate or nearly; vertex very finely and densely punctate medially,

punctures becoming somewhat more distinct but still close laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; antennal scape somewhat more than half the total length of flagellum, basal segment of flagellum only slightly shorter than 2 and 3 combined, the latter nearly equal; posterior margin of hind basitarsus very slightly curved, base and apex of nearly equal width; tergum 6 smooth and shining, with exceedingly minute, rather sparse punctures, apex rather broadly rounded.

WORKER—Length 8-13 mm., breadth of abdomen 4.5-5.5 mm.; closely resembles queen except in size.

MALE—Length 9.5-13 mm., breadth of abdomen 4.5-5.5 mm.; black, legs and tegulae more piceous, spurs reddish-piceous; wings subhyaline, veins pale testaceous or yellowish to dark brownish; pubescence long and copious, largely yellow on head but with erect and elongate black hairs along margin of eyes, across upper part of face above antennae, just posterior to ocelli, on cheeks above and vertex laterally; posterior two-thirds of scutum and anterior median area of scutellum in part, black pubescent, otherwise thorax with entirely yellow, dense, copious and erect pubescence; pubescence of legs largely pale, quite elongate but with some blackish hairs on mid femora above and on front and mid tibiae posteriorly; abdominal terga 1 and 4 yellow pubescent, 2 and 3 bright fulvous, unless faded, 5-7 black, bordered with yellow laterally; clypeus with fine and close punctures beneath dense pubescence; labrum broadly truncate, shining, with shallow and minute, irregular punctures; mandibles slender, bi-dentate apically, the two teeth nearly equal, outer surface densely yellow pubescent, lower margin fringed with elongate, more or less curled hairs; malar space smooth and shining, with only very obscure, minute punctures at all evident, length about equal to basal width of mandible; median area of face beneath dense pubescence very finely and closely punctate, punctures becoming more distinct and more widely separated toward ocelli, space between lateral ocelli and eyes shining and largely impunctate, but with a few punctures toward the eyes; punctures of vertex fine and densely crowded medially, becoming somewhat more distinct but still very close laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; basal segment of flagellum very slightly shorter than segment 3, very slightly longer than segment 2; hind tibiae shining and nearly impunctate on the convex outer surface, fringed with elongate pale hairs; hind basitarsus gradually narrowed toward the

base which is considerably narrower than the apex; sterna 7 and 8 and genital armature as in *impatiens* (fig. 133).

**DISTRIBUTION**—Yukon to Nova Scotia, south to Georgia, May to October. This species is rarely observed south of Pennsylvania.

**FLOWER RECORDS**—*Asclepias*, *Rubus*, *Solidago* and *Vaccinium*. Brittain and Newton (1933) record *ternarius* on *Chrysanthemum*, *Cirsium*, *Daucus*, *Narcissus*, *Pinus*(?), *Pyrus malus*, *Rhododendron*, *Taraxacum* and *Tulipa*.

### *Bombus vagans* Smith

*Bombus vagans* Smith, 1854. Cat. Hym. Brit. Mus. 2, p. 399. ♀.

*Bombus consimilis* Cresson, 1864. Ent. Soc. Phila. Proc. 3, p. 41. ♀.

*Bombus vagans* Plath, 1922. Psyche 29, pp. 197-198. (biology)

*Bremus vagans* var. *coctus* Bequaert and Plath, 1925. Mus. Compar. Zool. Bul. 67, p. 276. ♀ ♂.

*Bremus vagans* var. *helenae* Frison, 1929. Amer. Ent. Soc. Trans. 55, p. 110. ♀ ♂.

*Bombus consimilis* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

*Bombus vagans* Frison, 1930. Brooklyn Ent. Soc. Bul. 25, pp. 109-122. (biology)

*Bremus vagans* Brittain and Newton, 1933. Canad. Jour. Res. 9, p. 343. (flower records)

*Bombus vagans* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 151. (biology)

**QUEEN**—Length 14.5-19 mm., breadth of abdomen 6-8.5 mm.; black, legs often somewhat reddened, mid and hind spurs and tegulae reddish-piceous; wings very lightly and rather uniformly infuscated, veins brownish to piceous; pubescence copious and rather elongate, largely black on head, but with a dense tuft of yellowish hairs on vertex medially and a few pale hairs beneath the more elongate black pubescence around antennae; thorax almost entirely yellow pubescent, but median posterior area of scutum bare and somewhat shining, more or less fringed with obscure black hairs; pubescence of legs largely black, somewhat intermixed with greyish on front femora, pubescence short and largely dark on front tibiae, much more elongate posteriorly and entirely dark on mid tibiae; corbicular fringe on hind legs of elongate black hairs, and hind basitarsi rather densely covered with very minute, yellowish, pruinose hairs that do not hide the surface; abdominal terga 1 and 2 yellow pubescent, that on 2 becoming

narrowly blackish apically in many specimens, entirely black on 3-6; clypeus smooth and shining, with only a narrow band of close punctures along lateral and upper margins, with only very minute and sparse punctures otherwise; labrum with a very low, basal ridge which is quite broadly interrupted medially, this area concave, with margin somewhat elevated above that on each side, surface smooth and shining on each side, with only a few scattered punctures, the median concave area finely rugose or subpunctate, apical margin fringed with rather short ochraceous hairs; apex of mandible with a pair of rather deep notches toward the upper angle, otherwise broadly rounded, outer face rather smooth, somewhat shining, with exceedingly minute, obscure punctures; malar space smooth and shining, without distinct punctures, its median length slightly greater than basal width of mandible; median area of face very finely and closely punctate, punctures becoming more deep, distinct and rather sparse below ocelli, space between lateral ocelli and eyes shining and impunctate; punctures of vertex minute, close laterally, densely crowded medially; lateral ocelli slightly nearer eyes than to margin of vertex, somewhat more distinct from each other; antennal scape somewhat more than half total length of flagellum, basal segment of flagellum longer than 2 or 3, but somewhat shorter than the two combined; median width of hind basitarsus nearly equal to half the length, apex slightly narrower; tergum 6 rather smooth but dull, punctures exceedingly minute but rather close, with rather copious but short, fine pubescence, narrowly rounded apically.

**WORKER**—Length 6-15.5 mm., breadth of abdomen 3.5-6.5 mm.; very similar to queen except in size; often with median posterior area of scutum more copiously black pubescent.

**MALE**—Length 11-13 mm., breadth of abdomen 4.5-5.5 mm.; pubescence long and copious, in large part yellow on head, especially on face below antennae, on vertex medially and cheeks posteriorly, with intermixed, long, black hairs along inner orbits, around and above antennae, behind ocelli, on cheeks above and along posterior orbits; center of scutum somewhat bare, fringed with elongate, black hairs, with a few black hairs intermixed with the yellow toward the lateral margins; thorax otherwise entirely bright yellow pubescent; legs largely yellow pubescent basally, hairs long and quite copious, tibiae with somewhat shorter, black pubescence on outer face, fringed with pale hairs more or less intermixed with black, the mid and hind basitarsi with brownish-ochraceous pubescence beneath,

largely bare on exterior surface, fringed with ochraceous hairs; hind tibiae quite slender, outer surface shining but convex, with sparse punctures, fringed with dark hairs anteriorly, and with more elongate, pale hairs, intermixed with dark, posteriorly; abdominal terga 1 and 2 with copious and elongate yellow pubescence, following terga black, but with some intermixed yellowish hairs on the more apical segments, and margins with more or less evident yellowish pubescence; clypeus with fine and close but quite distinct punctures beneath dense pubescence; labrum rather broadly truncate, smooth and shining, with only minute, scattered and rather obscure punctures; mandibles slender, bi-dentate apically, densely covered with ochraceous pubescence on outer face, this forming an elongate, somewhat curled fringe beneath; malar space smooth and shining, with only very vague and obscure punctures, length somewhat greater than basal width of mandible, about one-fourth length of eye; median area of face beneath the dense pubescence very finely and closely punctate, the punctures becoming distinct and quite sparse above toward ocelli, space between ocelli and eyes shining and impunctate, vertex medially with deep and distinct but quite close punctures, becoming somewhat more irregular but still close laterally; lateral ocelli subequally distant from eyes, margin of vertex and each other; basal segment of flagellum very slightly longer than segment 2, and very slightly shorter than segment 3; median width of hind basitarsus slightly less than one-third the length; sterna 7 and 8 and genital armature as in *impatiens* (fig. 133).

**DISTRIBUTION**—Ontario to Nova Scotia, south to Georgia, June to August.

**FLOWER RECORDS**—*Asclepias*, *Aster*, *Azalea*, *Betula*, *Cirsium*, *Eupatorium*, *Helianthus*, *Hydrangea*, *Malus*, *Pentstemon*, *Rubus*, *Solidago*, *Spiraea* and *Vaccinium*. Robertson (1929) records *vagans* on *Actinomeris*, *Agastache*, *Amphicarpa*, *Arc-tium*, *Asclepias*, *Aster*, *Blephilia*, *Cassia*, *Cercis*, *Cirsium*, *Claytonia*, *Clematis*, *Delphinium*, *Dicentra*, *Ellisia*, *Erigenia*, *Eupatorium*, *Geranium*, *Gerardia*, *Helianthus*, *Hydrophyllum*, *Hypericum*, *Ipomoea*, *Liatris*, *Linaria*, *Lobelia*, *Malva*, *Mertensia*, *Mimulus*, *Monarda*, *Nepta*, *Pentstemon*, *Phlox*, *Physostegia*, *Polygonatum*, *Polygonium*, *Prunella*, *Ribes*, *Scrophularia*, *Scutellaria*, *Seymeria*, *Silphium*, *Solidago*, *Stachys*, *Staphylea*, *Symphoricarpus*, *Teucrium*, *Tradescantia*, *Trifolium*, *Triosteum*, *Verbascum*, *Verbena*, *Veronica*, *Viola* and *Zizia*. Brittain and Newton record *vagans*

on the following: *Caragana*, *Daucus*, *Narcissus*, *Phleum*, *Pinus*, *Prunus*, *Pyrus*, *Salix*, *Spiraea*, *Taraxacum*, *Tulipa*, and *Vaccinium*.

### *Psithyrus* Lepeletier

*Psithyrus* Lepeletier, 1832. Soc. Ent. France Ann. 1, p. 372. Type: *Apis rupestris* Fabricius. Desig. by Curtis, 1833.

*Apathus* Newman, 1835. Ent. Mag. 2, p. 404 (footnote). Type: *Apis rupestris* Fabricius. Autobasic.

*Psithyrus* subg. *Ashtonipsithyrus* Frison, 1927. Amer. Ent. Soc. Trans. 53, p. 69. Type: *Apathus ashtoni* Cresson. Orig. desig.

*Psithyrus* subg. *Fernaldaepsithyrus* Frison, 1927. Amer. Ent. Soc. Trans. 53, p. 70. Type: *Psithyrus fernaldae* Franklin. Orig. desig.

*Psithyrus* Milliron. 1961. Kans. Ent. Soc. Jour. 34, p. 59.

These parasitic bees are closely related to the bumblebees which are their hosts. Correlated to their parasitic habit, the pollen baskets or corbiculae, characteristic of this family Apidae, are lacking, and the hind tibiae of the females are slender, convex, closely punctate and well covered with short pubescence. Males are somewhat difficult to distinguish from their hosts, but the hind tibiae in this sex also are more evenly convex on the outer surface, more closely punctate and more densely pubescent than those of the host species. The genital structures are very different, however, the gonostyli being much more elongate in *Psithyrus*, extending much beyond the tips of the gonocoxites or penis valves.

It has been shown (p. 333) that *Laboriopsithyrus* Frison is a junior homonym of *Emphoropsis*. As the other two subgenera proposed by Frison have been placed in synonymy by Milliron (1961), it is not deemed necessary to propose a new name replacing *Laboriopsithyrus*, for it also would be placed in synonymy.

#### KEY TO SPECIES

##### Females

1. General aspect of abdomen black, with no dorsal pale pubescence ..... 2
- Abdominal terga 3-5 yellow pubescent in part ..... 3
2. Posterior half of scutum black pubescent; hairs covering abdominal terga very short and only suberect ..... *variabilis* (Cresson) (p. 534)

*CITRINUS* can have some yellow pub.

- Scutum with only a small amount of black pubescence medially on posterior half; abdominal terga covered with dense, erect, black pubescence, the individual hairs nearly half the length of the plate  
 ..... *citrinus* (Smith) (p. 540)
- 3(1). Apical sternum elongated beyond tip of tergum, this slender projection down-curved; pleura, vertex and scutellum yellow pubescent  
 ..... *fernaledae* Franklin (p. 541)
- Apical sternum not produced beyond its tergum; pleura, vertex and scutellum black pubescent at least in part ..... 4
4. Pubescence of head largely black, that of tergum 4 entirely yellow  
 ..... *ashtoni* (Cresson) (p. 539)
- Head yellow pubescent in part, and tergum 4 with at least some black pubescence ..... 5
5. Abdominal terga 3-5 yellow pubescent laterally, black medially  
 ..... *insularis* (Smith) (p. 542)
- Tergum 3 largely yellow pubescent, 4 and 5 black ..... *citrinus* (Smith) p. 540

*Males*

1. Segment 3 of flagellum little if any longer than basal segment; abdominal tergum 4 pale pubescent ..... 2
- Segment 3 considerably longer than basal segment of flagellum, often equal to segments 1 and 2 combined ..... 3
2. Pubescence of pleura dark in large part; gonostyli of genital armature broad and flat, subtriangular, acute apically  
 ..... *ashtoni* (Cresson) (p. 539)
- Pleura largely pale pubescent; gonostyli slender, abruptly dilated at base  
 ..... *fernaledae* Franklin (p. 541)
- \* 3(1). Hypoepimeral area and posterior half of mesopleura fuscous or black pubescent; segment 3 of flagellum shorter than 1 and 2 combined; pubescence of abdominal terga relatively short  
 ..... *variabilis* (Cresson) (p. 543)
- At least upper half of mesopleura, including hypoepimeral area, covered with yellow pubescence ..... 4
4. Abdominal terga 1 and 2 yellow pubescent, 3-7 black, often with some black intermixture across base of 2, or with some yellow hairs among the black on 3  
 ..... *citrinus* (Smith) (p. 540)
- Abdominal terga 1-3 entirely yellow pubescent ..... 5

5. Abdominal terga 4-7 entirely black pubescent ..... *citrinus* (Smith) (p. 540)
- Tergum 4 largely yellow pubescent, and 5 and 6 with some yellow hairs along lateral margins  
 ..... *insularis* (Smith) (p. 542)

*Psithyrus ashtoni* (Cresson)

*Apathus ashtoni* Cresson, 1864. Ent. Soc. Phila. Proc. 3, p. 42. ♀.

*Psithyrus ashtoni* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 169. (biology)

FEMALE—Length 17-18 mm., breadth of abdomen 8-8.5 mm.; black, apical tarsal segments becoming brownish-testaceous, spurs testaceous; wings lightly infuscated, veins testaceous to piceous; pubescence of scutum and scutellum pale yellowish, with a limited area of fuscous on scutum posteriorly, yellow on tubercles and adjacent area of pleura, otherwise fuscous or black on head, thorax and legs; abdominal terga 1-3 with erect fuscous pubescence, that on 4 conspicuously yellow, more elongate laterally, and tergum 5 with elongate, fuscous pubescence, sterna with relatively thin, dark pubescence throughout; clypeus closely and finely punctate; labrum triangularly produced at base on each side, median area depressed, densely fringed apically with fuscous hairs; apex of mandible faintly crenulate but not distinctly dentate, outer face somewhat shining, with a few, minute, irregular punctures; malar space shining with distinct punctures, somewhat shorter than basal width of mandible, eye nearly 5 times as long; lateral ocelli subequally distant from eyes and each other, this about half the distance to margin of vertex; scape somewhat more than half the length of the flagellum, basal segment of flagellum slightly longer than segment 3, and 3 slightly longer than 2; facial punctures below ocelli and on vertex medially very fine and close, becoming more shining and somewhat more sparsely punctate laterally, a shining area adjacent to each lateral ocellus impunctate; median posterior area of scutum shining, with rather coarse, deep, distinct and somewhat separated punctures, otherwise punctures of thorax very fine and close; sternum 6 not protuberant, subtriangular, smooth and shining medially, slightly elevated laterally just before apex.

MALE—Length 12-16 mm., breadth of abdomen 5-7 mm.; black, apical tarsal segments brownish-testaceous, spurs testaceous; wings very faintly infuscated, veins yellowish to piceous; pubescence of head long and erect, largely black, with only a very few intermixed

s. 3 just  
 2-4 shorter

pale hairs on vertex; anterior half of scutum and area around tubercles with long, copious, erect, yellowish pubescence, this extending narrowly along margins of scutum, posterior half largely covered with blackish pubescence; scutellum with intermixed, short, black hairs and long yellow hairs; thorax otherwise black pubescent laterally, posteriorly and beneath; legs largely black pubescent basally, the basitarsi more or less conspicuously fringed with elongate, fuscous hairs, apical tarsal segments with relatively short, pale pubescence; abdominal terga 1 and 4 pale yellowish pubescent, hairs long and copious; terga 2 and 3 and 5-7 black pubescent, at least medially, 5 and 6 with elongate yellowish hairs evident laterally; clypeus and labrum quite closely and finely punctate, apical margin quite strongly depressed, evenly rounded; mandibles very short, with a small subapical tooth near the tip above, and with a prominent fringe of elongate fuscous hairs below, outer surface rather dull and impunctate; malar space smooth and shining, very slightly shorter than basal width of mandible, eye about five times as long; lateral ocelli very slightly nearer eyes than to each other, much more widely removed from margin of vertex; segment 3 of flagellum very slightly longer than basal segment, segment 2 much shorter; sterna 7 and 8 and genital armature similar to *variabilis* (fig. 134).

**DISTRIBUTION**—Saskatchewan to New Brunswick, south to Michigan, Ohio and the New England States, May to October.

**FLOWER RECORDS**—*Vaccinium*.

**HOSTS**—Plath (1934) lists *Bombus affinis* and *B. terricola* as hosts of *ashtoni*.

### *Psithyrus citrinus* (Smith)

*Apathus citrinus* Smith, 1854. Cat. Hym. Brit. Mus. 2, p. 385. ♂.

*Apathus contiguus* Cresson, 1863. Ent. Soc. Phila. Proc. 2, p. 112. ♂.

*Psithyrus laboriosus* Frison, 1921. Canad. Ent. 53, p. 100. (biology)

*Psithyrus laboriosus* Bequaert and Plath, 1925. Mus. Compar. Zool. Bul. 67, pp. 268-272.

*Psithyrus laboriosus* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

*Psithyrus laboriosus* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 175. (biology)

**FEMALE**—Length 17-21 mm., breadth of abdomen 7-9.5 mm.; black, the apical tarsal segments brownish, mid and hind spurs brown-

ish-testaceous and tegulae brownish-piceous; wings uniformly lightly infuscated, veins testaceous to piceous; vertex with a median area of rather short, yellowish pubescence, somewhat interspersed with black hairs, pubescence of head otherwise entirely black, rather short, but erect and copious; pubescence yellow, quite dense and copious but rather short on scutum, scutellum and pleura, the venter narrowly black pubescent, propodeum with some dark pubescence at sides, and scutum with a few short black hairs adjacent to a median, polished, impunctate and more or less bare area; legs black pubescent, with pale hairs only on the more apical tarsal segments; abdomen entirely black pubescent, the hairs quite dense and erect but very short; clypeus closely and finely punctate above, becoming somewhat more coarsely so medially and at sides, apical margin rather broadly shining, sparsely and minutely punctate; labrum somewhat excavated medially, with a basal, triangular protuberance on each side, apical margin quite abruptly depressed; apex of mandible with a rather deep median notch, outer surface shining, punctures exceedingly minute and sparse; malar space smooth and shining, with exceedingly minute, indefinite, rather close punctures, somewhat shorter than basal width of mandible, and one-fourth length of eye; space between lateral ocelli and margin of vertex fully twice that between ocelli and eyes, subequally distant from eyes and each other; scape very slightly more than half the length of the flagellum, segments 1 and 3 of flagellum subequal in length, considerably longer than segment 2 which is slightly broader than long; punctures of face quite close and rather coarse, becoming sparse between eyes and ocelli; vertex very closely and finely punctate medially, becoming more coarsely and sparsely so laterally; sternum 6 not protuberant, disc somewhat depressed between the quite strongly elevated lateral and apical margins, obscurely rounded apically.

**MALE**—Length 13-15 mm., breadth of abdomen 5-6 mm.; black, apical tarsal segments more brownish-piceous, mid and hind spurs reddish and tegulae piceous; wings lightly infuscated, veins testaceous to piceous; head largely black pubescent, with a few yellowish hairs interspersed among the black across vertex posteriorly; scutum anteriorly, tubercles and adjacent area below with copious, elongate, yellow pubescence, scutellum fringed with long yellow pubescence posteriorly; pubescence otherwise black on scutum, scutellum, pleura, propodeum and legs, with short, inconspicuous pale hairs only on the more apical tarsal segments; abdominal terga 1 and 2 with elongate, copious and erect, yellowish

pubescence, with possibly some black hairs on 2 basally toward the sides, and 3 sometimes with yellowish pubescence at extreme sides, but 3 medially and 4-6 or 7 entirely black pubescent, the hairs copious, elongate and erect; clypeus very finely and closely punctate except along apical margin medially; labrum somewhat shining, with a transverse line of erect, black hairs, surface somewhat shining below, margin shallowly depressed, broadly truncate; mandibles quite short, distinctly bidentate apically, densely pubescent on outer surface toward base, the lower margin fringed with elongate, somewhat curved dark hairs; face very finely and closely punctate but becoming quite sparsely and more coarsely so above, around ocelli and across vertex; punctures of vertex medially quite close, ocelli surrounded in part by a shining, impunctate area laterally and below; malar space smooth and shining, very minutely and sparsely punctate, median length slightly less than basal width of mandibles, about one-fifth length of eyes; lateral ocelli very slightly nearer eyes than to each other, somewhat more widely removed from margin of vertex; segment 3 of flagellum considerably longer than segment 1, and this longer than segment 2 which is about as long as broad; sterna 7 and 8 and genital armature similar to *variabilis* (fig. 134).

**DISTRIBUTION** — Ontario to New Brunswick, south to Alabama and Georgia, May to October.

**FLOWER RECORDS** — *Asclepias*, *Pycnanthemum* and *Rubus*. Recorded by Robertson (1929) on *Blephilia*, *Cirsium*, *Trifolium*, and *Verbena*.

**HOSTS**—Plath (1934) has found this *Psithyrus* breeding in nests of *Bombus vagans* and *B. impatiens*.

### *Psithyrus fernaldae* Franklin

(Fig. 134)

*Psithyrus fernaldae* Franklin, 1911. Amer. Ent. Soc. Trans. 37, p. 164. ♀.

*Psithyrus tricolor* Franklin, 1911. Amer. Ent. Soc. Trans. 37, p. 167. ♂.

*Psithyrus fernaldae* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 171. (biology)

**FEMALE**—Length 14.5-17 mm., breadth of abdomen 7-8.5 mm.; black, tibial spurs reddish-piceous; wings rather uniformly, lightly infuscated, veins brownish to piceous; pubescence of face and cheeks black, vertex with copious and elongate, yellow pubescence, with

a few intermixed yellowish hairs just above antennae; thorax with long and copious, largely yellowish pubescence, but scutum with a median posterior patch of fuscous pubescence; pleura beneath and legs largely dark pubescent, but posterior fringe of front femora pale in part; pubescence of abdominal terga erect and copious, intermixed yellowish and fuscous on basal tergum, largely fuscous on terga 2 and 3, with some yellowish hairs along apical margin, and laterally also on 3, tergum 4 yellow pubescent, 5 black pubescent, 6 with only very short and inconspicuous, appressed pubescence; clypeus shining, punctures fine, rather deep and distinct along lateral and upper margins, becoming very minute and sparse apically; labrum slightly excavated medially, the basal margin slightly produced on each side, apical margin rounded, rather strongly depressed; apex of mandible entire, outer face smooth and shining, punctures exceedingly minute and indefinite; malar space smooth and shining, length fully equal to basal width of mandible, about one-fourth length of eye; lateral ocelli subequally distant from eyes and each other, somewhat more widely removed from margin of vertex; punctures of face and of vertex medially fine and close, vertex becoming more shining and more minutely and sparsely punctate laterally, a shining area adjacent to each lateral ocellus nearly impunctate; flagellum fully twice the length of the scape, its basal segment very slightly longer than segment 3, and 3 slightly longer than 2; scutum with a median, shining, impunctate space, punctures otherwise rather fine and close over most of thorax; sternum 6 elongate, produced beyond apex of the tergum, its tip somewhat down-curved, lateral margins very slightly elevated medially, the narrower apex densely, pale, short pubescent.

**MALE**—Length 13-15 mm., breadth of abdomen 6-7 mm.; black, tarsal segments becoming brownish-testaceous apically, mid and hind spurs brownish-piceous; wings lightly but quite uniformly infuscated, veins testaceous to piceous; pubescence of face and cheeks entirely black, quite long and copious, vertex with elongate, copious, yellowish pubescence; thorax with long, copious, largely yellow pubescence but posterior half of scutum with copious, erect, black pubescence, that on venter fuscous in part; legs with intermixed light and dark hairs, the posterior fringes of femora and basitarsi largely pale; abdominal terga 1 and 4 with elongate, yellowish pubescence, 2 3, 5, and 6 with largely black pubescence, that on 7, and on 6 laterally, yellowish; clypeus very finely and closely punctate, rather dull; labrum shining, punctures minute and to some degree separated, apical margin

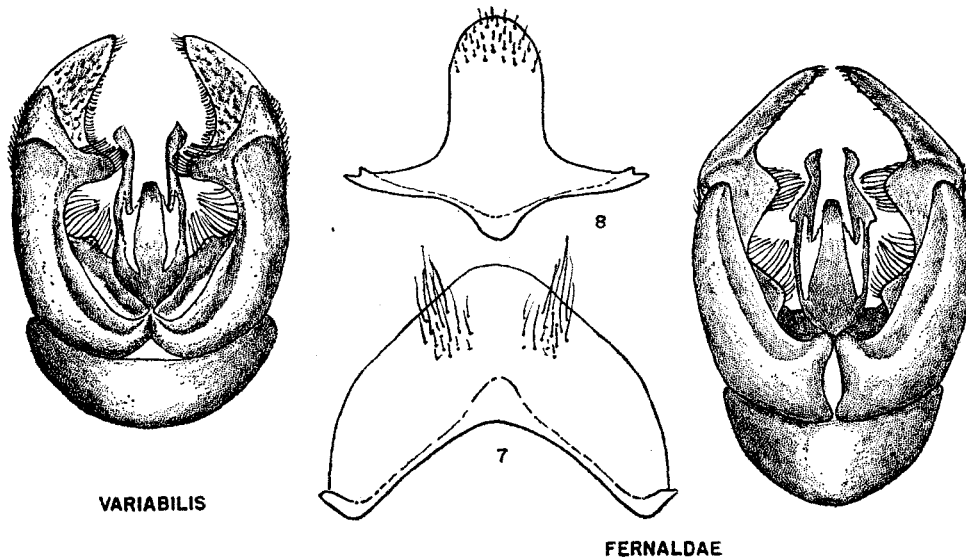


Figure 134—Dorsal view of genital armature in male of *Psithyrus variabilis*, and sterna 7 and 8, and armature of *P. fernaldae*.

only slightly depressed, broadly subtruncate, with a transverse, median line of erect black hairs separating the lower and upper surfaces; mandibles small but quite distinctly bidentate at apex, with a rather prominent fringe of elongate pale hairs below; malar space smooth and shining, with only exceedingly minute, well separated punctures, length equal to basal width of mandible; eye about four and one-half times longer; lateral ocelli slightly nearer eyes than to margin of vertex, subequally distant from eyes and each other; segments 1 and 3 of flagellum about equal in length, somewhat longer than segment 2 which is about as broad as long; sterna 7 and 8 and genital armature as shown (fig. 134).

**DISTRIBUTION**—Widespread in Canada and the United States, from Alaska to California in the West, New Brunswick to North Carolina in the East, June to September.

**FLOWER RECORDS**—*Potentilla*, *Rubus* and *Trifolium*.

**HOST**—Plath (1934) suggests the possibility that *Bombus perplexus* is the host of *fernaldae*, but positive evidence is lacking.

#### *Psithyrus insularis* (Smith)

*Bombus interruptus* Greene, 1858. Lyc. Nat. Hist. N. Y. Ann. 7, p. 11. ♀. (Preocc.)  
*Apathus insularis* Smith, 1861. Journ. of Ent. 1, p. 155. ♀.

*Psithyrus consultus* Franklin, 1913. Amer. Ent. Soc. Trans. 38, p. 459. ♂.

*Psithyrus insularis* Plath, 1934. Bumblebees and their ways, New York, Macmillan, p. 173. (biology)

**FEMALE**—Length 16-19 mm., breadth of abdomen 8-9 mm.; black, the tarsi piceous, tegulae brownish-testaceous, wings rather lightly infuscated, veins testaceous to blackish; face and cheeks largely black pubescent, but with erect, rather copious, yellowish pubescence between and above the antennae and on vertex; pubescence of thorax long and copious, pale yellowish in large part, but venter and posterior half of scutum largely black pubescent; legs with short, largely black pubescence; abdominal terga 1 and 2 with dense black pubescence, 3 and 4 yellow pubescent laterally but black medially, 5 largely black, but with some elongate, yellowish hairs at each extreme side, tergum 6 nearly bare; clypeus quite coarsely, closely and deeply punctate laterally, more finely so along upper margin, median apical area shining, with very minute and sparse punctures; labrum slightly excavated medially, basal area on each side triangularly produced, the projecting lip beyond this medially with a slightly elevated margin, the apical margin rather broadly rounded and considerably depressed; apex of mandible with a very slight, median notch, outer surface shining, with only extremely minute, scattered and obscure punctures evident; malar space shining, very irregularly and minutely punc-

tate, median length about two-thirds basal width of mandible, and about one-third length of eye; lateral ocelli subequally distant from eyes and each other, distance to margin of vertex about twice as great; scape slightly more than half the length of the flagellum, segments 1 and 3 of flagellum about equal, segment 2 considerably shorter and slightly broader than long; sternum 6 shining, rather broadly rounded apically, strongly swollen on each side medially, with a quite dense, apical fringe of very short, brownish hairs.

**MALE**—Length 13-16 mm., breadth of abdomen 4-5.5 mm.; black, apical tarsal segments and spurs more piceous; tegulae brownish-testaceous; wings uniformly but lightly infuscated, veins testaceous to piceous; vertex with a median patch of elongate, yellow pubescence and a small amount of yellow just above antennae medially, head otherwise with copious and elongate, black pubescence; posterior half of scutum black pubescent, with a small amount of black on scutellum medially, the venter of thorax and lateral margins of propodeum black in part, otherwise pleura, scutum anteriorly, scutellum posteriorly and posterior face of propodeum with elongate, copious, yellow pubescence; legs black pubescent basally, becoming somewhat paler on the tarsal segments, the posterior fringes of sparse, elongate, pale hairs; abdominal terga 1-4 with copious, rather elongate, yellowish pubescence, 5-7 with black, a small amount of yellow on 6 laterally; clypeus finely, closely and deeply punctate in general, only the apical margin narrowly shining and impunctate medially; labrum shining, punctures minute, apical margin broadly subtruncate, only slightly depressed, with a transverse fringe of short, erect, black hairs; mandibles short and slender, distinctly bidentate apically, outer surface quite densely pubescent, lower margin with a fringe of elongate, more or less curved, fuscous hairs; malar space shining, with only very minute, scattered punctures, median length somewhat less than basal width of mandibles about one-fifth length of eye; lateral ocelli subequally distant from eyes and each other, distance to margin of vertex only slightly greater; punctures of face very fine and densely crowded, vertex medially with densely crowded but rather fine striate punctures medially, lateral punctures close but more rounded, area adjacent to each lateral ocellus polished and impunctate; scutum with a narrow, median area posteriorly where the surface is shining and sparsely punctate, punctures otherwise quite uniformly close on scutum, scutellum and pleura; sterna 7 and 8 and genital armature similar to *variabilis* (fig. 134).

**DISTRIBUTION**—Although widespread in Canada and the Northern United States, this species has been rare in collections received for study. Specimens have been identified only from New Brunswick and New York, May to August.

**HOST**—Plath (1934), quoting Sladen, gives *Bombus flavifrons* as the host of *insularis*. Since the ranges of these two species do not entirely coincide, it seems evident that it will select some other species of *Bombus* as well.

### *Psithyrus variabilis* (Cresson)

(Fig. 134)

*Apathus variabilis* Cresson, 1872. Amer. Ent. Soc. Trans. 4, p. 284. ♀ ♂.

*Psithyrus variabilis* Robertson, 1929. Flowers and Insects, Lancaster, Pa., Science Press. (flower records)

**FEMALE**—Length 17.5-19 mm., breadth of abdomen 8.5-9 mm.; black, including tarsi and spurs, the tegulae reddish-piceous; wings deeply infuscated, veins testaceous to black; pubescence quite short in general, largely black on head, with median area of vertex yellow pubescent with a few black hairs intermixed; anterior third of scutum and area around tubercles with dense but rather short, copious, yellow pubescence, and scutellum densely yellow pubescent across posterior margin, the scutum posteriorly relatively bare medially but otherwise with short, black pubescence, continuing sparsely onto scutellum medially; pleura, propodeum and legs largely black pubescent, only the apical tarsal segments with some short, pale pubescence evident, hairs on the legs very short; abdominal terga entirely black pubescent, hairs very short, no more than one-fourth the length of the terga; clypeus finely and densely punctate across upper margin, becoming deeply and rather coarsely punctate on each side below, the median apical area shining and sparsely, minutely punctate; labrum with a flattened, basal tubercle on each side, separated by a deep and narrow depressed area, apical margin rounded, quite abruptly depressed; apical margin of mandible with a very minute, median notch, outer face shining, very sparsely and minutely punctate; malar space shining, very minutely but rather closely punctate, median length about two-thirds basal width of mandible, one-fourth length of eye; face closely and finely punctate from clypeal margin to ocelli, becoming shining and sparsely punctate between ocelli and eyes, vertex minutely and closely punctate medially, becoming shining, finely and sparsely punctate laterally; lateral

ocelli subequally distant from eyes and each other, space between ocelli and margin of vertex fully twice as great; scape slightly more than half the length of the flagellum, segments 1 and 3 of flagellum about equal, somewhat longer than segment 2 which is broader than long; sternum 6 subtriangular, not protuberant, the disc medially somewhat shining, lateral margins only very slightly elevated.

**MALE**—Length 14.5-17 mm., breadth of abdomen 6-7 mm.; black, apical tarsal segments becoming somewhat more brownish-testaceous, the more basal leg segments somewhat reddish, spurs testaceous and tegulae reddish-piceous; wings deeply infuscated, veins testaceous to blackish; vertex with copious and rather elongate yellowish pubescence medially, pubescence of head otherwise largely black, rather short and dense; scutum anteriorly and area around tubercles with rather copious, elongate, yellow pubescence, the scutellum fringed with long yellow pubescence posteriorly, scutum posteriorly and scutellum medially with rather short, black pubescence, and pleura and propodeum largely black; legs blackish or fuscous pubescent in large part, more elongate on the more basal segments, short on tibiae and tarsi except for a posterior dark fringe on front tibiae, apical tarsal segments with very short pale pubescence; pubescence of abdominal terga quite short, the individual hairs no longer than half the median length of the plates, largely black but with varying amounts of yellow on the more median terga laterally, terga 3 and 4 sometimes largely yellow; clypeus dull, very finely and closely punctate; labrum somewhat more shining, punctures minute and rather vague, apical margin slightly depressed, broadly truncate; mandibles quite short and slender, distinctly bidentate apically, outer face densely covered with short, yellowish pubescence and fringed below with elongate, somewhat curved, dark hairs; malar space smooth and shining, somewhat shorter than basal width of mandible, about one-fourth length of eye; face very finely and closely punctate from clypeus to area just below ocelli, surface shining and sparsely punctate between eyes and ocelli; vertex closely and finely punctate medially but becoming somewhat more distinctly separated laterally; lateral ocelli subequally distant from eyes and each other, much more widely removed from margin of vertex; basal segment of flagellum only very slightly shorter than segment 2, segment 3 much longer; sterna 7 and 8 and genital armature as shown (fig. 134).

**DISTRIBUTION**—Illinois and Ohio, to North Carolina and Florida, west to the

Dakotas and Mexico, June to November, with earlier records in Florida.

**FLOWER RECORDS**—*Amorpha*, *Asclepias*, *Aster*, *Bidens*, *Blephilia*, *Brauneria*, *Cephalanthus*, *Cirsium*, *Eupatorium*, *Geranium*, *Helianthus*, *Hydrophyllum*, *Lycopus*, *Melilotus*, *Petalostemum*, *Phlox*, *Polemonium*, *Polygonum*, *Pycnanthemum*, *Rubus*, *Rudbeckia*, *Solidago*, *Teucrium*, *Trifolium*, *Verbena* and *Vernonia* are listed by Robertson, (1929).

## *Apis* Linnaeus

(Fig. 128)

*Apis* Linnaeus, 1758. Syst. Nat. 10th ed., p. 343. Type: (*Apis mellifica* Linnaeus) = *Apis mellifera* Linnaeus. Desig. by Latreille, 1810.

*Apiarus* Rafinesque, 1815. Analyse Nature ou Tabl. Univers, p. 123. Proposed unnecessarily to replace *Apis*.

*Megapis* Ashmead, 1904. Ent. Soc. Wash. Proc. 6, p. 120. Type: *Apis dorsata* Fabricius. Orig. Desig.

*Micrapis* Ashmead, 1904. Ent. Soc. Wash. Proc. 6, p. 122. Type: *Apis florea* Fabricius. Monob. and orig. desig.

Systematics of the Apinini, Maa, 1953. Treubia 21, pp. 525-640. (classification)

*Apis* is an Old World genus, and none of the species is native to the Americas. Of the four included species, only the domesticated honey bee, *Apis mellifera*, has been introduced into North America, but it is widespread throughout the continent.

In contrast with the bumblebees, the species of *Apis* are perennially social, colonies persisting over the winter from one season to the next for periods of three or four years. Moreover, there is no intergradation in size or structure between the queen and the worker caste, and queens never engage in foraging activities or nest building. Queens and workers are genetically similar, the development of a fertilized egg into one or the other dependent upon the size of the cell and the character of the food supplied the larva by the workers. Males or drones, of course, result from unfertilized eggs, as in most other Hymenoptera, but they also require larger cells for the development of the larva.

In *Apis* the hind tibial spurs are absent, the jugal lobe of the hind wing is present, and the marginal cell of the front wing is

narrow and elongate, its tip approaching the apex of the wing. The head is characterized by the densely hairy eyes, while the labrum is transverse, broad and very short.

### *Apis mellifera* Linnaeus

*Apis mellifera* Linnaeus, 1758. Syst. Nat. Ed. 10, p. 576.

*Apis mellifica* Linnaeus, 1761. Fauna Suecica, Ed. 2, p. 421. Proposed to replace *mellifera*.

*Apis mellifica* var. *Ligustica* Spinola, 1806. Insectorum Liguria 1, p. 35.

*Apis mellifica* var. *remipes* Gerstaecker, 1862. Geog. Verbr. d. Honigbiene, p. 61.

*Apis mellifera* Dalla Torre, 1896. Catalogus Hymenopterorum 10, p. 595-610 (bibliography)

*Apis mellifera* Michener, 1953. Kans. Univ. Sci. Bul. 35, p. 1094. (larva)

*The Behavior and Social Life of Honeybees*, Ribbands, 1953. Bee Research Assoc., pp. 1-352. (biology)

*The World of the Honeybee*, Butler, 1954. London, Collins, pp. 1-226. (biology)

*The Dancing Bees*, von Frisch, 1955. New York, Harcourt, Brace & Co., pp. 1-183. (physiology)

*Anatomy of the Honey Bee*, Snodgrass, 1956. Ithaca, N. Y., Comstock Publishing Associates, pp. 1-334. (morphology)

*Communication Among Social Bees*, Lindauer, 1961. Harvard Univ. Press, pp. 1-143. (biology)

Probably there is a more voluminous literature devoted to the honey bee than to any other insect. In Volume 10 of Dalla Torre's Catalog of Hymenoptera, for example, the list of references covers 15 pages and numbers about 750. Moreover it seems likely that the number of articles concerning it which have appeared annually during the 65 years since this catalog is greater than during the earlier period. Therefore the bibliography above includes only those references having significance with respect to the name used, and some of the more recent general works concerning the morphology, physiology and biology of this insect. The two varieties listed refer to subspecies or races, the Italian bee (*Ligustica*) and the Caucasian bee (*remipes*), which have been introduced into the New World along with typical *mellifera*, the German bee. These have interbred on this continent to the degree that it is practically impossible to find typical representatives of any of the three forms.

In the following descriptions the worker

caste is stressed, for it is the form usually collected along with wild bees of other species during its visits to flowers. The queen is rarely seen by other than beekeepers and does not visit flowers. Drones (males) also are more conveniently collected in the vicinity of bee hives than on visits to flowering plants.

**WORKER**—Length 12 mm.; head and thorax piceous, abdomen more or less testaceous anteriorly, becoming piceous posteriorly, legs brownish-testaceous to piceous, front and middle spurs yellowish, hind spurs absent; wings subhyaline, veins pale yellow, but costa more piceous; clypeus rather flat; labrum short, transverse, margin slightly curved; mandibles somewhat constricted medially, broadened apically, apical margin forming a smooth, non-dentate edge; malar space considerably longer than basal width of mandible; cheeks slightly broader than eyes; lateral ocelli only very slightly removed from margin of vertex; eyes well covered with erect but rather short hairs; basal segment of flagellum about equal to segment 3, segment 2 much shorter; mid basitarsus broad and flat, fully as long and broad as the tibia; hind basitarsus also broad and flat, fully as broad as apex of tibia but considerably shorter; hind tibiae with well developed corbiculae; body surface generally quite smooth, punctures exceedingly minute and obscure where evident; pubescence copious on head and thorax, pale yellowish, becoming more or less fuscous on vertex and scutum, short and suberect on abdominal terga, yellowish, becoming fuscous on the more apical segments.

**QUEEN**—Length 16-20 mm.; head almost circular in frontal view; mandible with an acute apical tooth separated from a broader cutting edge by a distinct indentation; mid basitarsus flattened but distinctly shorter and narrower than the tibia; hind basitarsus broad and flat, nearly as broad as the tibia; outer surface of hind tibiae more convex, finely pubescent, and thus lacking the corbiculae; color, pubescence and puncturation similar to worker.

**DRONE (MALE)**—Length 15-16 mm.; eyes extremely large, occupying most of lateral and upper surface of head, meeting at mid line above, ocelli located near mid transverse line of face, lateral pair adjacent to inner margin of eye; clypeus and front of face much restricted, pubescence short and dense; mandibles very small, with a fine apical tooth and a longer upper edge; malar space very short; segments 1 and 2 of flagellum very short, ring-like, following segments elongate; front and

