

KEYS FOR THE SEPARATION OF THE *BREMIDAE*,
OR BUMBLEBEES, OF ILLINOIS, AND OTHER
NOTES.

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The following five keys will serve for the separation of the males, queens, and workers of sixteen species of *Bremus*, and of the males and queens of four species of *Psithyrus*. These keys are not intended to represent the writer's views of our *Bremidae* phylogenetically, but are simply for the purpose of an easy identification of the Illinois species. Characters evident to the naked eye are used in the keys wherever possible, in preference to those of more obscure nature.

It has been found necessary to replace the name of *Bombidae* by that of *Bremidae* for the following reasons. The genus *Bombus* was first proposed for the bumblebees by Latreille in 1802. In 1805 *Bremus* was used by Panzer for this same group. Quite naturally, then, the term *Bombus* was at first accepted as having priority over *Bremus*. Panzer, however, writing in 1805, referred to an article by himself that was published earlier than 1805. A recent investigation has disclosed, in the library of the University of Erlangen, an article now known as the "Erlangen List." This list was published, unsigned by Panzer, its author, in May, 1801, and contained a synoptic list of the Panzer-Jurine Genera compared with the genera adopted by Latreille. In this list we find *Bremus* first used as the name for the bumblebee division of the Apidae. The discovery of this article naturally gives *Bremus* (1801) priority over *Bombus* (1802), and also explains the use of *Bremus* by Panzer in 1805. *Bremus*, however, must not be accredited to Panzer but to Jurine. It was Jurine, then living in Bern, Switzerland, who had first worked out the so-called "aary system" and had sent specimens and particulars of their "habitates" to Panzer in 1779. Panzer writing in 1801 merely published in an

expanded form the names and information sent him by Jurine. It is Jurine, then, who is responsible for *Bremus* and for certain other genera not considered in this paper. *Bremus* included both the true bumblebees and their bumblebee-like inquilines; hence the name *Psithyrus* of Lepeletier (1832) for these bumblebee-like inquilines still stands.

The writer has deemed it best, at least for the present, to follow Dr. Franklin and regard *Bombias* of Robertson (1903) as a subgenus instead of as a distinct genus. Future life history studies of the bumblebees may show that *Bombias* is really a valid genus. In a recent article (Frison, 1917) it has already been shown that the life history of *B. (Bombias) auricomus* Robt. differs widely from that of any other true *Bremus* with which I am familiar. It is thought best, however, at this time to wait until more work has been done on the life histories of our American bumblebees, before using such evidence as an aid towards a natural grouping of the *Bremidae*.

Because of the variation in the color of the pubescence of certain species of bumblebees, it has been found necessary to put such variable species in the keys in more than one place. There are several varieties of *B. rufocinctus* Cress, that have not been included in the keys, as they have only been reported from the Rocky Mountain region.

The males of the two genera of *Bremidae* may be easily separated from each other by the fact that the volsella and the squama of the genitalia of *Psithyrus* are membranous, whereas in *Bremus* they are corneous.

The outer surfaces of the hind tibiae are usually more or less covered with hairs in the males of *Psithyrus*, and in *Bremus* rather bare.

In the females, the outer surfaces of the hind tibiae of *Psithyrus* are more covered with hairs and rounded, while those of *Bremus* are more bare and flattened. In *Psithyrus* there are no workers.

The distribution of the Illinois species of bumblebees is interesting, in that Illinois represents what one might term an intermediate position. Illinois is intermediate between those states possessing the largest and those with

the smallest number of species. Many western states, with their diverse geological features, have listed nearly twenty-five species of this family, and I believe the lists will be considerably increased in the future. Florida is accredited with only four species, and all of the Gulf states appear to have a paucity of species. The writer has increased the Illinois list from ten to fifteen species of *Bremidae*, and believes the list will in time be swelled to twenty species.

Illinois has representatives of eight of the ten groups of *Bremidae* erected by Dr. Franklin and Radoszkowski. Five of the species of *Bremus* (*terricola*, *frigidus*, *nevadensis*, *borealis*, and *perplexus*) considered in these keys are here listed for Illinois for the first time. *B. frigidus* is included in the list because of the presence in the Illinois Natural History Survey Collection of specimens of this species collected in Northern Illinois by Mr. O. S. Westcott. *B. perplexus* is likewise reported from Northern Illinois by Mr. Westcott. *B. affinis*, *ternarius*, *rufocinctus*, *Ps. insularis* and *ashtoni* have not as yet been taken in this state, but will probably be captured eventually in the northern part of the state. The Illinois species of bumblebees range from Lower Austral to Boreal forms. The majority of the species are principally forms that reach their greatest abundance in the Transition and Upper Austral Zones.

The distribution of the species of *Psithyrus* depend upon the distribution of the species of *Bremus* whose nests they infest. In Illinois I have shown that *Ps. variabilis* infests the nests of *B. pennsylvanicus* (1916). *Ps. variabilis* is therefore to be expected wherever *B. pennsylvanicus* occurs, other conditions being the same. It is not known in this country whether the same species of *Psithyrus* is an inquiline in nests of more than one species of *Bremus* or not. Sladen (1915) found *Ps. insularis* in the nest of *B. flavifrons*. *Ps. insularis* is, however, listed from regions *B. flavifrons* is not known and is not even likely to occur; indicating that *Ps. insularis* must be an inquiline in the nest of more than one species of *Bremus*. The distribution of *Ps. laboriosus* in this and other states has impressed the writer with the belief that it is an inquiline in the nests of *B. fervidus* or *B. vagans*.

Key for the Separation of the Males of the Genus

Bremus from Illinois

1. Eyes large and bulging out from the sides of the head; ocelli large and placed well below the supra-orbital line (*Bremus*, subgn, *Bombias*) 2
- Eyes normal, not bulging out from the sides of the head; ocelli small, placed near the supra-orbital line, and above the narrowest part of the vertex (*Bremus*) 6
2. Third antennal segment as long as the fourth and fifth segments taken together 3
- Third antennal segment not as long as the fourth and fifth segments taken together 4
3. Sixth and seventh dorsal abdominal segments usually with ferruginous pubescence *nevadensis* Cress.
- Sixth and seventh dorsal abdominal segments black 4
4. Second dorsal abdominal segment with its basal middle covered with a fawny or dirty yellow pubescence, the remainder of the segment being black *auricomus* Robt.
- Second dorsal abdominal segment not so colored 5
5. First two dorsal abdominal segments with yellow pubescence, the remaining segments black; eyes greatly swollen and bulging out from the sides of the head; malar space a mere line *fraternus* F. Sm.
- Last five dorsal abdominal segments usually with other than black pubescence; eyes somewhat swollen and bulging out from the sides of the head; malar space about one-half as long as its width at lower margin or apex. *rufocinctus* Cress.
6. Fourth to seventh dorsal abdominal segments with black pubescence dominating 7
- Fourth to seventh dorsal abdominal segments not so colored... 10
7. First dorsal abdominal segment yellow, remaining segments black *impatiens* Cress.
- Dorsal abdominal segments not so colored 8
8. First two dorsal abdominal segments entirely yellow *Vagans* F. Sm.
- First two dorsal abdominal segments not entirely yellow 9
9. First dorsal abdominal segment, and at least the basal middle portion of the second segment, yellow.... *bimaculatus* Cress.
- First dorsal abdominal segment yellow; second segment with sides and apical margin yellow, the remainder having a tawny or dull ferruginous pubescence..... *affinis* Cress.
10. First dorsal abdominal segment, except for a very few light colored hairs, black *terricola* Kirby.
- First dorsal abdominal segment not so colored 11
11. Third dorsal abdominal segment black *frigidus* F. Sm.
- Third dorsal abdominal segment not so colored 12
12. Second and third dorsal abdominal segments ferruginous *ternarius* Say.
- Second and third dorsal abdominal segments not so colored... 13
13. Dorsum of the thorax covered, except for a few occasional black hairs upon the disk, with yellow pubescence 14
- Dorsum of the thorax with more or less of a decided black band between the bases of the wings 15
14. Third antennal segment as long as the fifth; occiput usually with yellow hairs dominating; malar space about as long as its width at apex; dorsal abdominal segments somewhat variable, but usually with the first three segments yellow and the remaining segments black..... *perplexus* Cress.

- Third antennal segment shorter than the fifth; occiput usually with black hairs dominating; malar space longer than its width at apex; first five dorsal abdominal segments yellow, remaining two segments black *fervidus* subsp. *dorsalis* Cress.
15. Occiput with yellow pubescence dominant; usually a large amount of dirty white or pale yellow pubescence above the bases of the antennae; middle anterior area of the clypeus bare and glossy, with a few hairs on its anterior portion; yellow pubescence of the thorax and the abdomen a tawny yellow *borealis* Kirby.
- Occiput with black pubescence dominant; pubescence about the bases of the antennae black, or with black and light gray hairs intermixed; clypeus nearly covered over with pubescence; the yellow pubescence of the thorax and the abdomen more of bright lemon yellow 16
16. Black band between the bases of the wings usually narrow and distinct; scutellum usually well covered over with yellow pubescence; first five dorsal abdominal segments yellow, the two apical segments black; yellow pubescence usually lemon yellow in color; size medium (18-24 mm.).... *fervidus* Fabr.
- Black band between the bases of the wings more or less indistinct; scutellum usually with a large amount of black pubescence; first four dorsal abdominal segments usually entirely yellow; apical segments black, yellow, ferruginous or with combinations of these three colors; pubescence more or less dull yellow in color; size large (22-30mm.) *pennsylvanicus* DeGeer.

Key for the Separation of the Queens of the Genus

Bremus from Illinois

1. Anterior dorsal portion of the thorax yellow, a black band between the bases of the wings; scutellum usually yellow, but sometimes completely dominated by black pubescence 2
- Dorsum of the thorax completely yellow, except for occasional black hairs about the center of the disk 12
2. Third, fourth, fifth and sixth dorsal abdominal segments black 3
- Third, fourth, fifth and sixth dorsal abdominal segments not entirely black 4
3. Occiput of the head bearing black pubescence, or with only a few yellow hairs intermixed; ocelli placed well below the supra-orbital line; second dorsal abdominal segment entirely yellow; of large size (20-28mm.) *fraternus* F. Sm.
- Occiput of the head bearing mostly yellow pubescence; ocelli slightly below the supra-orbital line; second dorsal abdominal segment usually with black on its side margins; of small to medium size (14-16mm.) *rufocinctus* Dress.
4. The first four dorsal abdominal segments entirely yellow; fifth and sixth segments black 5
- Dorsal abdominal segments not so colored 6
5. Occiput and face with considerable light yellowish pubescence; the middle anterior portion of the clypeus smooth and glossy *borealis* Kirby.
- Occiput and face with black pubescence; clypeus with middle portion more or less punctate, and as a rule not glossy *fervidus* Fabr.
6. Second and third dorsal abdominal segments entirely yellow, first segment either yellow, black or both, remaining three segments black 7

- Dorsal abdominal segments not entirely so colored 8
- 7. Ocelli placed considerably below the supra-orbital line, in the narrowest part of the front; first dorsal abdominal segment usually black; scutellum usually with yellow hairs *auricomus* Robt.
- Ocelli placed near the supra-orbital line, above the narrowest part of the front; first dorsal abdominal segment usually with some yellow pubescence; scutellum usually with a strong mixture of black hairs *pennsylvanicus* DeGeer.
- 8. First dorsal abdominal segment entirely black. *terricola* Kirby. 9
- First dorsal abdominal segment not so colored 10
- 9. Both second and third dorsal abdominal segments ferruginous
- Second and third dorsal abdominal segments not both ferruginous 11
- 10. Ocelli just below the supra-orbital line; occiput usually dominantly yellow; black band between the bases of the wings more or less indistinct; fourth dorsal abdominal segment ferruginous *rufocinctus* Cress.
- Ocelli not below the supra-orbital line; occiput usually dominantly black; black band between the bases of the wings distinct and broad, with its posterior margin usually extending backward in the form of a V; fourth dorsal abdominal segment yellow *ternarius* Say.
- 11. Last two dorsal abdominal segments with black pubescence dominant; corbicular fringes black. *rufocinctus* Cress.
- Last two dorsal abdominal segments with a light ferruginous pubescence dominant; corbicular fringes with some ferruginous hairs. *frigidus* F. Sm.
- 12. Second dorsal abdominal segment entirely black. *impatiens* Cress.
- Second dorsal abdominal segment not entirely black. 13
- 13. First dorsal abdominal segment yellow; second segment, except for a basal middle tawny patch, black; remaining segments black; ocelli placed well below the supra-orbital line *separatus* Cress.
- Dorsal abdominal segments not so colored; in some species the ocelli not below the supra-orbital line. 14
- 14. First four dorsal abdominal segments yellow; fifth and sixth segments black. *fervidus* subsp. *dorsalis* Cress.
- Dorsal abdominal segments not so colored. 15
- 15. Yellow pubescence of the pleura not extending to the bases of the legs. 16
- Yellow pubescence of the pleura, at least the meso-pleura, extending to the bases of the legs. 18
- 16. Malar space longer than its width at lower margin; ocelli placed well below the supra-orbital line; first three dorsal abdominal segments mostly yellow, the remaining segments black. *nevadensis* Cress.
- Malar space not longer than its width at lower margin; ocelli not placed below the supra-orbital line, or only slightly so; first three dorsal abdominal segments not as above. 17
- 17. Ocelli placed near the supra-orbital line, above the narrowest part of the vertex; malar space about as long as its width at lower margin; first two dorsal abdominal segments usually yellow, and the remaining segments black; size medium (15-21mm.) *perplexus* Cress.
- Ocelli placed just below the supra-orbital line; malar space shorter than its width at lower margin; second and third dorsal abdominal segments usually with some ferruginous pubescence, but the second segment sometimes with a basal median patch of yellow pubescence, the remainder of the segment being black; size small (14-16mm.) *rufocinctus* Cress.

- 18. First dorsal abdominal segment and a basal median patch of the second segment yellow, remainder of the pubescence of the abdomen black.....*bimaculatus* Cress. 19
- Dorsal abdominal segments not so colored.....
- 19. Malar space longer than its width at apex; occiput usually with yellow pubescence dominant; sixth dorsal abdominal segment always black.....*vagens* F. Sm.
- Malar space at the most not longer than its width at apex; occiput usually with dark pubescence dominating; sixth dorsal abdominal segment sometimes rusty colored at its tip.....*affinis* Cress.

Key for the Separation of the Workers of the Genus

Bremus from Illinois

- 1. Anterior dorsal portion of the thorax yellow; a black band between the bases of the wings; scutellum usually yellow, but sometimes completely dominated by black pubescence.... 2
- Dorsum of the thorax completely yellow, except for occasional black hairs about the center of the disk..... 13
- 2. Third, fourth, fifth and sixth dorsal abdominal segments with black pubescence..... 3
- Third, fourth, fifth and sixth dorsal abdominal segments not entirely black..... 5
- 3. First dorsal abdominal segment with yellow pubescence; second segment brown-ferruginous, except the sides and the apical portions, which are yellow; remaining segments mainly black.....*affinis* Cress. 4
- Dorsal abdominal segments not so colored.....
- 4. Occiput bearing black pubescence, or with only a few yellow hairs intermixed; ocelli placed well below the supra-orbital line; second dorsal abdominal segment entirely yellow; medium to large size (13-22mm.).....*fraternus* F. Sm.
- Occiput bearing mostly yellowish pubescence; ocelli not well below the supra-orbital line; second dorsal abdominal segment usually with side margins black; small size (7-14mm.).....*rufocinctus* Cress. 6
- 5. First four dorsal abdominal segments entirely yellow; fifth and sixth segments black..... 7
- Dorsal abdominal segments not so colored.....
- 6. Occiput and face with much light yellowish pubescence; the middle anterior portion of the clypeus smooth and glossy.....*borealis* Kirby.
- Occiput and face with black pubescence; clypeus with its middle anterior portion more or less punctate and as a rule not glossy.....*fervidus* Fabr. 8
- 7. Second and third dorsal abdominal segments entirely yellow; first segment yellow, black or both; remaining segments black..... 9
- Dorsal abdominal segments not entirely so colored.....
- 8. Ocelli placed well below the supra-orbital line, in the narrowest part of the front; first dorsal abdominal segment usually black; scutellum usually with yellow hairs.....*auricomus* Robt.
- Ocelli placed near the supra-orbital line, above the narrowest part of the front; first dorsal abdominal segment usually black, but often with yellow hairs; scutellum usually with a strong mixture of black hairs.....*pennsylvanicus* DeGeer.
- 9. First dorsal abdominal segment entirely black; apical segment whitish.....*terricola* Kirby.
- First dorsal segment not so colored..... 10
- 10. Both second and third dorsal abdominal segments ferruginous 11

- Second and third dorsal abdominal segments not both ferruginous 12
- 11. Ocelli just below the supra-orbital line; occiput usually dominantly yellow; black band between the bases of the wings more or less indistinct; fourth dorsal abdominal segment with ferruginous pubescence.....*rufocinctus* Cress.
- Ocelli not placed below the supra-orbital line; occiput usually dominantly black; black band between the bases of the wings distinct and broad, with its posterior margin extending backward in the form of a V; fourth dorsal abdominal segment with yellow pubescence.....*ternarius* Say.
- 12. Last two dorsal abdominal segments with black pubescence dominant; orbicular fringes black.....*rufocinctus* Cress.
- Last two dorsal abdominal segments with light ferruginous pubescence dominant, corbicular fringes with some ferruginous hairs.....*frigidus* F. Sm.
- 13. Second dorsal abdominal segment entirely black *impatiens* Cress.
- Second dorsal abdominal segment not entirely black..... 14
- 14. First dorsal abdominal segment yellow; second segment, except for a basal medial tawny patch, black; remaining segments black; ocelli placed well below the supra-orbital line.....*separatus* Cress.
- Dorsal abdominal segments not so colored; in some species the ocelli not below the supra-orbital line..... 15
- 15. First four dorsal abdominal segments yellow; fifth and sixth segments black.....*fervidus* subsp. *dorsalis* Cress.
- Dorsal abdominal segments not so colored..... 16
- 16. Yellow pubescence of the pleura not extending to the bases of the legs..... 17
- Yellow pubescence of the pleura, at least the mesopleura, extending to the bases of the legs..... 19
- 17. Malar space longer than its width at lower margin; ocelli placed well below the supra-orbital line; first three dorsal abdominal segments mostly yellow; the remaining segments black.....*nevadensis* Cress.
- Malar space not longer than its width at lower margin; ocelli not placed below the supra-orbital line or only slightly so; first three dorsal abdominal segments not as above..... 18
- 18. Ocelli placed near the supra-orbital line, above the narrowest part of the vertex; malar space about as long as its width at lower margin; first two dorsal abdominal segments usually yellow, and the remaining segments black....*perplexus* Cress.
- Ocelli placed just above the supra-orbital line; malar space shorter than its width at lower margin; second and third dorsal abdominal segments usually with some ferruginous pubescence, but the second segment sometimes with a basal middle patch of yellow pubescence, the remainder of the segment being black.....*rufocinctus* Cress.
- 19. First dorsal abdominal segment and a medial basal patch of the second segment yellow; remaining segments black*bimaculatus* Cress.
- Dorsal abdominal segments not so colored..... 20
- 20. First two dorsal abdominal segments yellow....*vagens* F. Sm.
- First dorsal abdominal segment yellow, second segment with ferruginous and yellow pubescence.....*affinis* Cress.

Key for the Separation of the Males of the Genus

Psithyrus from Illinois.

- 1. Yellow pubescence of the thorax extending down on the pleura to the bases of the legs..... 2

- Yellow pubescence of the thorax not extending down on the pleura to the bases of the legs..... 3
- 2. Fourth dorsal abdominal segment bearing black pubescence..... *laboriosus* Fabr.
- Fourth dorsal abdominal segment bearing yellow pubescence..... *insularis* F. Sm. (*consultus* Frankl.)
- 3. First dorsal abdominal segment bearing mostly black pubescence; fifth antennal segment longer than the third segment..... *variabilis* Cress.
- First dorsal abdominal segment bearing mostly yellow pubescence; fifth antennal segment no longer than the third segment..... *ashtoni* Cress.

Key for the Separation of the Queens of the Genus

Psithyrus from Illinois.

- 1. Occiput of the head bearing mostly black pubescence..... *ashtoni* Cress.
- Occiput of the head bearing mostly yellow pubescence..... 2
- 2. Yellow pubescence of the thorax not extending far below the bases of the wings..... *variabilis* Cress.
- Yellow pubescence of the thorax extending well down on the pleura..... 3
- 3. Dorsum of the thorax yellow, except for occasional black hairs about the center of the disk; usually with some yellow between the eyes..... *laboriosus* Fabr.
- Dorsum of the thorax with more or less of an indistinct band between the bases of the wings, or a large number of black hairs about the disk; usually with a great deal of yellow pubescence on the upper half of the space between the eyes..... *insularis* F. Sm.

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