

The Bombidae of Indiana¹

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Introduction

The insects of the family Bombidae are commonly called bumblebees. The family is made up of two genera, the genus *Bombus*, which includes the true bumblebee; and, the genus *Psithyrus*, which includes the inquiline bumblebees.

The bumblebees are characterized by being large hairy bees, the color of the pile being some combination of black and yellow, ferruginous, or rufous; the hind tibiae of the queens and workers of *Bombus* being dilated, with a fringe of stiff hairs on the lateral edges forming corbiculae or pollen-baskets; possessing apical tibial spurs; the marginal cell being pointed and as long as the three submarginal (cubital) cells united, extending far beyond the apex of the third submarginal cell; having the first submarginal cell nearly divided by a hair-like vein or nervure; and having the stigma poorly developed. There are three castes, queens, workers and males, in the genus *Bombus*; only females and males in the genus *Psithyrus*.

This paper lists fifteen species and three varieties of Bombidae as occurring within the state of which ten have been previously recorded. Thomas Say in his original description of *Bombus ternarius* in 1835 noted "Inhabits Indiana". Franklin (3) expressed the doubt that this species occurs in Indiana and listed eight other species of *Bombus* and one species of *Psithyrus*.

The collection of bumblebees belonging to the Entomology Department of Purdue University contains many determined specimens of nine Indiana species. The determinations were made by Dr. Henry J. Franklin, Mr. F. W. L. Sladen, Dr. Theodore Frison and Dr. Herbert E. Milliron. The Purdue University student collection was also studied, as were the private collections of Dr. B. E. Montgomery of the Purdue Entomology Department, Mr. William Kowlek of Gary, Carol and Dale Snelling of West Lafayette, and the collection of the author. The writer wishes to express his sincere appreciation to Dr. Howard O. Deay for his many helpful suggestions in the preparation of this paper and for specimens that were contributed by him for this work. Also to Mr. Ray T. Everly, who contributed many specimens from a wide range within the state, especial acknowledgment is made. Other collectors who gave material to the author are Mr. John Kingsolver, Mr. John Payne, Mr. Richard Thomas, Mr. Richard Wilkie, and Mr. M. Curtis Wilson.

The county has been chosen as the collection unit. Whenever a species is recorded from the state for the first time, locality, date and

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host plant will be listed. This data is necessarily omitted for the common species.

A complete description of the species and varieties can be found in Franklin (3) and Chandler (1). A summary of characters has been written by Plath (6) and Stevens (7), while Frison (4) and Milliron (5) have presented them in key form. Cresson (2) may be consulted in connection with the insect group under discussion.

Key for the Separation of Sexes and Genera of Indiana Bombidae

- | | | |
|-------|---|---|
| 1 | Antennae with twelve segments; six visible ventral abdominal segments; tarsal claws unequal; possessing stings
....queens and workers of <i>Bombus</i> ; females of <i>Psithyrus</i> | 2 |
| 1' | Antennae with thirteen segments; seven visible ventral abdominal segments; tarsal claws subequal; without stings
.....males of <i>Bombus</i> and of <i>Psithyrus</i> | |
| 2(1) | Outer surface of each hind tibia flattened or concave, bare, with a fringe of long hairs on the lateral margins forming a corbicula or pollen-basket..... <i>Bombus</i> | |
| 2' | Outer surface of each hind tibia convex, evenly covered with short hairs; possessing no corbicula..... <i>Psithyrus</i> | |
| 3(1') | Outer surface of each hind tibia with short hairs irregularly distributed; face usually covered with yellow pile; volsellae and squamae of genitalia corneus (Fig. 2)..... <i>Bombus</i> | |
| 3' | Outer surface of each hind tibia well covered with short hairs; face usually covered with black pile, never with an admixture of yellow; volsellae and squamae of genitalia membranous (Fig. 1)..... <i>Psithyrus</i> | |

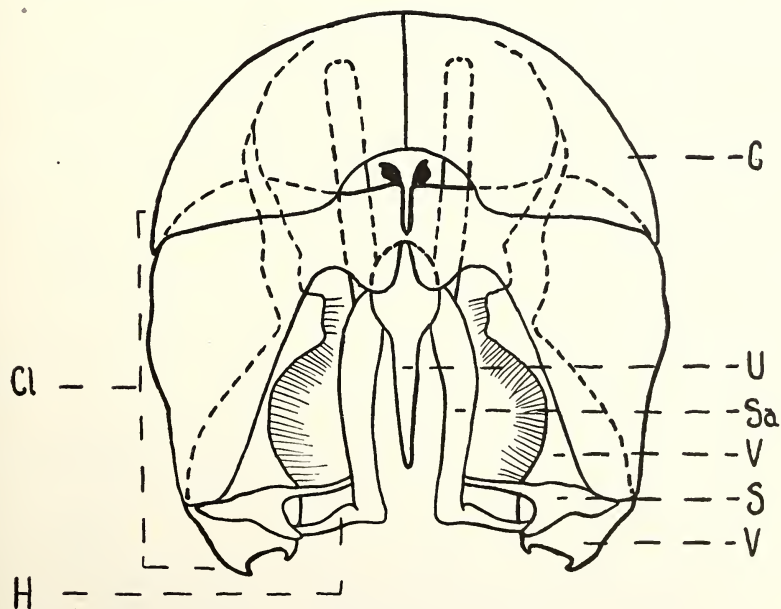
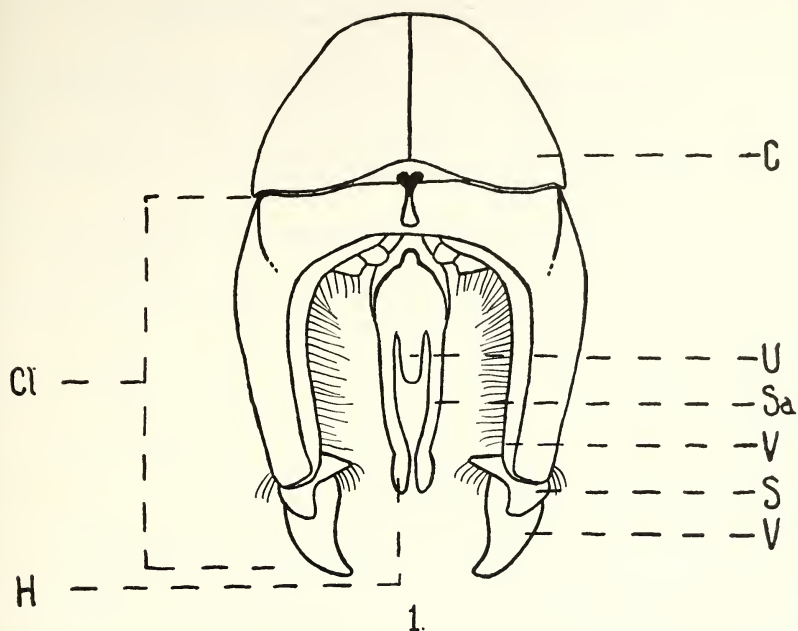
Genus *Bombus* Latreille

Latreille. Hist. Nat. Crust. and Insect, III: p. 385, 436. 1802.

This genus consists of the true bumblebees. There are three castes—queens, workers and males. Queens and workers may be easily separated from the *Psithyrus* females by the presence of corbiculae. No external characters have been found to distinguish the queens from the workers of most species of *Bombus* except by size, which is not a good criterion.

In order to readily distinguish the males of the two genera one must have considerable experience in working with them. For the most part *Bombus* males do not appear as shaggy as *Psithyrus* males and the color of the pile seems brighter since the black of the cuticle does not show through. *Bombus* males usually have considerable yellow pile on the face and *Psithyrus* males always have black pile with no admixture of yellow.

Twelve species and two varieties of *Bombus* are known to occur in Indiana.



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FIG. 1. Dorsal view of male genitalia of *Psithyrus laboriosus* (Fabricius).
 FIG. 2. Dorsal view of male genitalia of *Bombus americanorum* (Fabricius).
 C, cardo; Cl, clasper; H, head of sagitta; S, squama. Sa, sagitta; U:
 spatha; V, volsella.

**Key for the Separation of Queens and Workers
of Indiana *Bombus***

1	Dorsum of thorax yellow; the center of the disc may be bare and with a few black hairs bending over the bare spot....	2
1'	An interalar black band or least black pile of irregular pattern between the wing bases which covers the scutellum in varying proportions.....	9
2(1)	Only the first abdominal tergite yellow, the remainder of abdomen black.....	<i>impatiens</i>
2'	The first abdominal tergite yellow or black, others with yellow, ferruginous or rufous pile.....	3
3(2')	Lower portion of pleurae dark.....	<i>perplexus</i>
3'	Pleurae yellow throughout.....	4
4(3')	First four abdominal tergites yellow.....	<i>fervidus</i> var. <i>dorsalis</i>
4'	Not all of first four abdominal tergites yellow.....	5
5(4')	First abdominal tergite yellow; second abdominal tergite with a basal median ferruginous patch; workers sometimes with entire tergite ferruginous.....	<i>griseocollis</i>
5'	First abdominal tergite yellow; second abdominal tergite with some yellow pile.....	6
6(5')	Second abdominal tergite with basal median yellow patch.....	<i>bimaculatus</i>
6'	Entire second abdominal tergite yellow.....	7
7(6')	Occiput predominately black; malar space as wide at apex as long; yellow of second abdominal tergite notched; queens (15-21 mm.).....	<i>affinis</i>
7'	Occiput usually yellow; malar space much longer than width at apex; yellow of second abdominal tergite entire: queens (13-17 mm.) and workers.....	8
8(7')	Only first two abdominal tergites yellow.....	<i>vagans</i>
8'	First two abdominal tergites yellow; third tergite black; yellow on some of the apical tergites.....	<i>vagans</i> var. <i>helenae</i>
9(1')	First four abdominal tergites yellow.....	10
9'	Not all of first four abdominal tergites yellow.....	11
10(9)	Occiput and face black; yellow of pleurae extending to or nearly to the bases of the legs; color lemon- or greenish-yellow.....	<i>fervidus</i>
10'	Occiput and face with whitish or yellowish pile; pleurae dark; color tawny yellow.....	<i>borealis</i>
11(9')	Second and third abdominal tergites rufous; first and fourth tergites yellow; remainder of abdomen black....	<i>ternarius</i>

11'	No abdominal tergite bearing rufous pile; fourth tergite black	12
12(11')	Third abdominal tergite black	13
12'	Third abdominal tergite yellow	14
13(12)	First and second abdominal tergites yellow; remainder of abdomen black; ocelli placed well below the supraorbital line	<i>fraternus</i>
13'	First abdominal tergite yellow; second tergite ferruginous; workers	<i>affinis</i>
14(12')	Occiput black; first abdominal tergite largely yellow; second and third tergites yellow; ocelli near supra-orbital line	<i>americanorum</i>
14'	Occiput with two yellow lines; first abdominal tergite largely black; second and third tergites yellow; ocelli below supra-orbital line	<i>auricomus</i>

**Key for the Separation of Males
of Indiana *Bombus***

1	Eyes large and bulging from the head; ocelli placed well below the supra-orbital line in narrow part of face	2
1'	Eyes normal; ocelli on or near supra-orbital line	4
2(1)	First abdominal tergite yellow; second abdominal tergite with a basal median patch or ferruginous pile; remainder of abdomen black	<i>griseocollis</i>
2'	No abdominal tergite bearing ferruginous pile	3
3(2')	First and second abdominal tergites yellow; remainder of abdomen black; malar space a mere line	<i>fraternus</i>
3'	First abdominal tergite yellow or black; second and third abdominal tergites always yellow; malar space distinct	<i>auricomus</i>
4(1')	First abdominal tergite yellow; remainder of abdomen black	<i>impatiens</i>
4'	First abdominal tergite yellow; other tergites also bearing yellow	5
5(4')	Second and third abdominal tergites rufous; sixth and seventh tergites black; remainder of abdomen yellow	<i>ternarius</i>
5'	No abdominal tergites bearing rufous pile	6
6(5')	First abdominal tergite yellow; only basal median patch of yellow on second tergite; remainder of abdomen black	<i>bimaculatus</i>
6'	First abdominal tergite yellow; second tergite entirely yellow or ferruginous	7
7(6')	Second abdominal tergite bearing admixture of yellow and ferruginous or entirely ferruginous pile	<i>affinis</i>

7'	Second abdominal tergite never bearing other than yellow pile	8
8(7')	First two abdominal tergites yellow; remainder of abdomen black	<i>vagans</i>
8'	Yellow of abdomen not confined to first two abdominal tergites	9
9(8')	Possessing a black interalar band	10
9'	Without a black interalar band	12
10(9)	Occiput and face yellow; pleurae dark; first four abdominal tergites yellow	<i>borealis</i>
10'	Occiput and face black; pleurae yellow or dark; first four abdominal tergites yellow	11
11(10')	Interalar band well defined; pleurae yellow; apical abdominal tergites always black; color lemon or greenish-yellow	<i>fervidus</i>
11'	Black of interalar extending back so that scutellum is mixed with yellow and black; pleurae variable, usually dark; apical abdominal segment usually with ferruginous pile; color dull yellow	<i>americanorum</i>
12(9')	Occiput black; apical abdominal segment always black	<i>fervidus</i> var. <i>dorsalis</i>
12'	Occiput yellow; some apical abdominal tergites bearing yellow pile	13
13(12')	First three abdominal tergites yellow, possibly the entire abdomen yellow; apical abdominal segment with a fringe of light pile	<i>perplexus</i>
13'	First two abdominal tergites yellow; third tergite black; some of the apical tergites bearing yellow pile	<i>vagans</i> var. <i>helenae</i>

Genus *Psithyrus* Lepeletier

Lepeletier. Ann. Soc. Ent. France, I: p. 372. 1832.

This genus consists of the inquiline bumblebees of which there are only females and males.

The female *Psithyrus* invades the nest of a species of *Bombus* and disposes of the queen by stinging her to death. She then takes over the nest and lays her own eggs, destroying any *Bombus* eggs which might have been laid. It is said that *Bombus fervidus* will not tolerate the intrusion of *Psithyrus* and in some cases the inquiline female is attacked by workers of other species and the invasion is repulsed.

The species of *Psithyrus* have specific hosts, generally not more than two species of *Bombus* in a single locality; therefore, the range of any species of *Psithyrus* coincides with that of the hosts. This genus is inquilineous only in the nests of *Bombus*.

**Key for the Separation of the Females
of Indiana *Psithyrus***

- | | | |
|-------|---|---|
| 1 | Pleurae dark throughout or at least the lower portion dark | 2 |
| 1' | Pleurae entirely yellow | 3 |
| 2(1) | Occiput black; abdominal tergites with some yellow pile
..... <i>ashtoni</i> | |
| 2' | Occiput yellow; abdomen entirely black
..... <i>variabilis</i> | |
| 3(1') | Mesonotum with some black pile; fourth and fifth abdominal
tergites bearing yellow pile
..... <i>insularis</i> | |
| 3' | Mesonotum with little or no black pile; fourth abdominal
tergite black
..... | 4 |
| 4(3') | Abdomen usually entirely black; sometimes with touches
of yellow pile on the sides of the third abdominal tergite
..... <i>laboriosus</i> | |
| 4' | Third abdominal tergite entirely covered with yellow pile;
remainder of abdomen black
..... <i>laboriosus</i> var. <i>citrinus</i> | |

**Key for the Separation of Males
of Indiana *Psithyrus***

- | | | |
|-------|--|---|
| 1 | Pleurae yellow throughout | 2 |
| 1' | Pleurae dark throughout or at least lower portion dark | 4 |
| 2(1) | Mesonotum with black pile suggesting an interalar band;
some abdominal tergites after third bearing yellow pile
..... <i>insularis</i> | |
| 2' | Mesonotum usually bare in center or with a slight admixture
of black pile; no abdominal tergite after the third bearing
other than black pile | 3 |
| 3(2') | First two abdominal tergites yellow; remainder of abdomen
black
..... <i>laboriosus</i> | |
| 3' | First three abdominal tergites yellow; remainder of ab-
domen black
..... <i>laboriosus</i> var. <i>citrinus</i> | |
| 4(1') | First abdominal tergite entirely yellow; third and fifth
antennal segments subequal
..... <i>ashtoni</i> | |
| 4' | First abdominal tergite mostly black, occasionally yellow at
extreme sides; fifth antennal segment much longer than
third
..... <i>variabilis</i> | |

Collection Records of Species and Varieties

Bombus affinis Cresson

Collection data:

25-V-27 Tippecanoe Co. (queen-Student Collection); 8-VIII-50 Porter
Co. (worker-red clover—R. T. Everly).

This species has not previously been reported from Indiana.

Bombus americanorum (Fab.)

Collection data:

Allen, Benton, Brown, Carroll, Clark, Clay, Clinton, Dearborn, Elkhart, Fountain, Gibson, Greene, Harrison, Hendricks, Huntington, Jasper, Jennings, Johnson, Kosciusko, Lake, LaPorte, Lawrence, Marion, Marshall, Miami, Montgomery, Morgan, Orange, Owen, Porter, Posey, Pulaski, Putnam, Randolph, Ripley, Shelby, Steuben, Tippecanoe, Vigo, Wabash, Warren, Warrick, White.

This species is also known as *Bombus pennsylvanicus* (DeG.). Very common.

Bombus auricomus (Robt.)

Collection data:

Allen, Benton, Boone, Clark, Dearborn, Elkhart, Fountain, Greene, Hendricks, Jasper, Jennings, Knox, Kosciusko, LaGrange, Lake, Marion, Marshall, Miami, Montgomery, Morgan, Owen, Pike, Porter, Pulaski, Putnam, Ripley, Rush, Starke, Tippecanoe, Tipton, Warren.

This is one of our most common species.

Bombus bimaculatus Cresson

Collection data:

Clark, Dearborn, Fountain, Marion, Morgan, Ripley, Sullivan, Tippecanoe, Warren.

This species is more common than collection data shows. It is probably the first bumblebee to be seen in the spring.

Bombus borealis Kirby

Collection data:

7-VI-50 Marshall Co. (queen-hairy vetch-Michael Chandler).

This is the first record of this species from Indiana. Another queen of this species was observed one week later at this same location but was apparently killed by flying through a prebloom alfalfa spray which was being applied.

Bombus fervidus Fab.

Collection data:

Allen, Clark, Elkhart, Fountain, Howard, Huntington, Jennings, Kosciusko, LaGrange, LaPorte, Madison, Marshall, Noble, Owen, Parke, Pulaski, Steuben, Tippecanoe, Wabash.

This is a common species in northern Indiana.

Bombus fervidus var. *dorsalis* Cresson

Collection data:

?-1943 Blackford Co. (queen-Purdue Student Collection); 20-X-49 Tippecanoe Co. (male-Purdue Student Collection); 31-VIII-50 Jasper Co. (male-red clover-R. T. Everly).

Since the typical *Bombus fervidus* integrades into this variety, it should be taken in the counties where *Bombus fervidus* occurs. It is quite rare.

Bombus fraternus (F. Smith)

Collection data:

?-VI-15 Marion Co. (worker-H. F. Dietz); 28-X-50 Posey Co. (queen-B. E. Montgomery).

Although this species has been previously recorded from the state by Franklin (3), its occurrence seems to be so rare as to warrant the above data.

Bombus griseocollis (De Geer)

Collection data:

Allen, Benton, Clark, Dearborn, Fountain, Greene, Hendricks, Jasper, Johnson, Lake, Marshall, Miami, Montgomery, Morgan, Owen, Parke, Porter, Pulaski, Ripley, Starke, Tippecanoe, Tipton, Wabash, Warren, Warrick, White.

This is one of our most common species. Until very recently this species was known as *Bombus separatus* Cresson.

Bombus impatiens Cresson

Collection data:

Adams, Allen, Benton, Brown, Clark, Daviess, Dearborn, Elkhart, Fountain, Greene, Harrison, Hendricks, Huntington, Jasper, Jennings, Kosciusko, LaGrange, Lake, LaPorte, Lawrence, Marion, Marshall, Montgomery, Morgan, Noble, Orange, Owen, Parke, Porter, Posey, Pulaski, Ripley, Starke, Sullivan, Tippecanoe, Warren, White.

A very common, if not the most common, bumblebee in Indiana.

Bombus perplexus Cresson

Collection data:

3-V-30 Tippecanoe Co. (queen-Purdue Student Collection).

This is the only record of this species from Indiana. The specimen runs to Color Variant 1 in Franklin since the pleurae is covered with yellow pile to the bases of the legs. This species has a distinctive shade of yellow, having somewhat of an orange cast.

Bombus ternarius Say

Collection data:

Say, in his original description, noted "Inhabits Indiana". I know of no other record of this species from the state.

Bombus vagans F. Smith

Collection data:

Allen, Clark, Jasper, Jennings, LaGrange, Lake, Marion, Marshall, Parke, Porter, Ripley, Starke, Tippecanoe.

This is a common species.

Bombus vagans var. *helenae* Frison

Collection data:

2-VII-50 Ripley Co. (male-red clover-Leland Chandler); 12-VIII-50 Clark Co. (male-B. E. Montgomery).

This variety occurs with the typical species and has the same range of distribution. It seems to be rare in the state.

Psithyrus ashtoni (Cresson)

Collection data:

Two males in the Purdue University collection were determined to be this species by Dr. Milliron. Both specimens bear labels which are practically illegible. It is entirely possible that these specimens did not come from within the state but if so, they are from Cass Co.

Plath (6) states that *Psithyrus ashtoni* is an inquiline in the nests of *Bombus affinis* and *Bombus terricola*. Since the latter species has not been taken in the state and the former has been taken but twice, this species of *Psithyrus* must occur rarely if at all.

Psithyrus insularis (F. Sm.)

Collection data:

Two unlabeled female specimens in the Purdue University collection were determined to be this species by Dr. Milliron. This species is included in the hope that further collecting will establish a definite record from Indiana. Milliron (5) reports that the host is unknown in Michigan.

Psithyrus laboriosus (Fab.)

Collection data:

Carroll, Clark, Harrison, Lake, Madison, Owen, Ripley, Tippecanoe, Warren.

Plath (6) reports it as being an inquiline in the nests of *Bombus vagans* and *Bombus impatiens*. This is a very common species.

Psithyrus laboriosus var. *citrinus* (F. Sm.)

Collection data:

Adams, Carroll, Clark, Tippecanoe.

This variety is reported by Bequaert and Plath (1925) to be an inquiline in the nests of *Bombus vagans* and *Bombus impatiens*. It appears to be fairly common.

Psithyrus variabilis (Cresson)

Collection data:

Benton, Boone, LaGrange, Lake, Marion, Morgan, Montgomery, Sullivan, Tippecanoe, Warren, Wayne.

This is the most common species of *Psithyrus* in Indiana. Plath (6) states that this species is an inquiline in the nests of *Bombus americanorum*.

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