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NOTES

ON THE

Habits of Some Species of Humble Bees,

AND ON THE

LEAF-CUTTING BEE.

BY F. W. PUTNAM.

THE

Humble Bees of New England

AND THEIR PARASITES :

WITH NOTICES OF

A NEW SPECIES OF ANTHOPHORABIA,

AND

A NEW GENUS OF PROCTOTRUPIDÆ.

BY A. S. PACKARD, JR.

WITH A PLATE.

FROM THE

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V. *Notes on the Habits of some species of Humble Bees.*  
BY F. W. PUTNAM.

(Communicated October 22, 1863.)

During the summer of 1862, while in Warwick, Mass., my attention was called to the Humble Bees by finding three nests of *Bombus fervidus* Fabr. and *B. vagans* Smith. These nests were formed of the deserted nests of mice, one under a barn in an old stump of a tree, the other two under piles of stones in a field. One of the nests of *B. fervidus* I kept in a box for some time, and watched the actions of the bees, but as I then neglected to make full notes, and as my first observations were confirmed by later ones, I allude to them here only to introduce an incident which has relation to the duration of life of the various kinds which always compose the communities of the Humble Bees. Upon leaving Warwick I left my valise, in which was a nest of bees, at the depot. Two months afterwards, in November, it was brought to me, when upon examining the nest several large queen bees were found in a lively condition, while the males, small females and workers were all dead. When the valise was left at the depot there was but one queen in the nest. This incident proves that the queens are not only late in leaving the cells, but that they are capable of enduring cold which is

fatal to the other bees. In the summer of 1863 while at Bridport, Vt., on the borders of Lake Champlain, I was so successful, in my entomological excursions, as to find as many as twenty-five or thirty colonies of bees, and to collect fifteen complete nests. These were of the following species: *Bombus fervidus* Fabr., *B. ternarius* Say, *B. separatus* Cresson and *B. virginicus* Fabr. As the general economy of these four species is the same, my observations may be considered as made upon one community, preceded however by the following special statements in regard to the several species.

**BOMBUS TERNARIUS.** Two nests collected: one under an old stump in a deserted mouse nest; the other, in September, under the clapboards of a house, about eight feet from the ground. Upon removing the boards, a large bunch of sheep's wool was found, evidently collected by rats, as there was a quantity of nut shells, with the under jaw and other bones of a rat among the wool. In the centre of the wool the bees had their cells. By etherizing the bees twenty-eight specimens were collected, which, as it was after dark, when the bees are generally at home, I have reason to believe were nearly all that belonged to the nest. There were thirty-five cells containing young, and thirty that were filled with honey, having their tops covered with wax. This is the only instance of my finding *the honey cells closed over*. There were also a number of bunches of pollen in which there were no eggs.

This species is not so common as *B. fervidus* and is far more savage in its disposition. I was informed by Mr. Brigham Rockwood, that he had noticed that this species never takes possession of the nests of mice (*Arvicola*) which are found so plentifully among the grass, but always chooses a place under cover of boards or stumps.

**BOMBUS FERVIDUS.** This is the most common species at Bridport, and is of quite a gentle disposition, allowing its nest to be disturbed for some time before it makes any show of resistance, merely exhibiting its uneasiness by buzzing. The communities of this species are found in old mice nests, both under stumps and boards; and also among the grass in the nests of the common field mice (*Arvicola riparia*). They also occupy the forsaken nests

of the house mice, as in one instance a colony was found under the flooring of a shed, in a nest made of bits of paper, rags, &c. This was the largest community collected, consisting of about seventy adult bees, one hundred and fifty cells containing young, and two hundred young larvæ, in various stages of growth, in the pollen masses, besides fifty cells filled with honey. This nest was found on the 23d of July. July 28th a nest was discovered in which there was a single queen bee and five or six large queen cells still soft and recently finished.

July 8th. Two queens were seen fighting upon the outside of a nest. So firmly were they united that they did not part until placed in alcohol, although pushed about for some time. They were both of the same species, but one might have been an invader, as I have found upon placing a strange queen, in a nest, that the rightful sovereign immediately commenced battle and in a short time expelled the intruder.

One community kept under glass on a window, with free ingress and egress, continued working, until, on a very hot day, the young became baked in their cells, by the heat of the sun. Then the old ones left and did not return.

Aug. 6th. A nest was brought home and the cells, containing young, placed apart from all old bees for the purpose of ascertaining if the young bee cuts its own way out of its cell. The cells were all of large size. In about half an hour a queen bee had come out and was seen walking over the other cells. She was immediately removed and the other cells were examined, but no signs of their having been cut could be seen. In the evening a slit was noticed in one of the cells and the young bee was seen at work cutting with its jaws. In a short time it made an opening in the cell large enough for it to push its head through. It then commenced cutting on each side, from the slit, above and below; now and then withdrawing its head and resting. Then it tried to force its way through the opening, but finding this was not large enough it cut a little more. The bee evidently did not wish to work more than was necessary, for it often tried to force its way out. At each attempt it made but a small enlarge-

ment of the orifice; but, after spending half an hour in alternate work and rest, it succeeded in freeing itself from its prison. Then it stood, for a short time, on the sides of the cell, moving its wings, after which it commenced walking over the other cells. This was a queen bee. Aug. 8th, another bee came out in the same way. Aug. 10th, two. Aug. 14th, one. Aug. 15th, another, which was the last in the cells. They were queens and all quite light colored when just from the cells.

These facts prove that the young cut their own way out of the cells. In another nest a young bee was seen to come from the cell while the old bees were present, which did not concern themselves about the matter further than to give a few passing glances and to cut off some jagged pieces of the cell. As soon however as the young bee was out of the cell, one or two old bees trimmed the edges of the cell and removed a few fragments from the inside.

**BOMBUS SEPARATUS.** Several colonies of this were found under old stumps and in other situations similar to those in which the nests of *B. fervidus* were found. This species is nearly as ferocious, on being disturbed, as *B. ternarius*.

**BOMBUS VIRGINICUS.** A single nest of this species was found under an old stump in an orchard. On the 27th of August three males were captured while flying under a large tree on which they frequently alighted. So much did these bees resemble large flies in their actions, that at first I mistook them for those insects. Male Humble Bees are often seen flying in this manner under trees. Are they not the drones which have left or been driven from the nest?

Let us now notice the life of a colony in its different stages. In the spring, the queen bee, having left her old home, may be seen roaming about in search of a new one, which she soon finds in some such place as previously described. She immediately collects a small amount of pollen mixed with honey, and in this deposits from seven to fourteen eggs, gradually adding to the pollen mass until the first brood is hatched. She does not wait, however, for one brood to be hatched before laying the eggs of

another, but, as soon as food enough has been collected, she lays the eggs for a second. The eggs are laid, in contact with each other, in one cavity of the mass of pollen, with a part of which they are slightly covered. They are very soon developed; in fact the lines are nowhere distinctly drawn, between the egg and the larva, the larva and pupa, and again between the latter and the imago; a perfect series, showing this gradual transformation of the young to the imago, can be found in almost every nest.

As soon as the larvæ are capable of motion and commence feeding they eat the pollen by which they are surrounded, and gradually separating, push their way in various directions. Eating as they move and increasing in size quite rapidly, they soon make large cavities in the pollen mass. When they have attained their full size they spin a silken wall about them, which is strengthened by the old bees covering it with a thin layer of wax, which soon becomes hard and tough, thus forming a cell. The larvæ now gradually attain the pupa stage and remain inactive until their full development. They then cut their way out and are ready to assume their duties as workers, small females, males or queens according to their individual formation.

It is apparent that the irregular disposition of the cells is due to their being constructed so peculiarly by the larvæ. After the first brood, composed of workers, has come forth, the queen bee devotes her time principally to her duties at home, the workers supplying the colony with honey and pollen. As the queen continues prolific, more workers are added and the nest is rapidly enlarged.

About the middle of summer, eggs are deposited which produce both small females and males, and it is supposed by some observers that it is from the union of these, at the last of the season, that the eggs are laid from which the queens are developed: but there seems some reason to doubt this, as a new nest, previously mentioned, was found on the last of July occupied only by a queen and queen larvæ. It is true, however, that all eggs, laid after the last of July, produce the large females, or queens, and, the males being still in the nest, it is presumed that the queens are impregnated at this time, as, on the approach

of cold weather all, except the queens, of which there are several in each nest, die.

The efforts of my friend Mr. Rockwood to procure nests for me during the winter have as yet been unsuccessful, those which he had marked for removal having been destroyed by mice.

It is desirable to ascertain whether the queens remain torpid during cold weather and what use is made of the pollen and honey stored during the last of summer and in the fall, which perhaps is food for the queens during the mild weather in spring before plants are in blossom.

But little wax is made by the Humble Bees, as it is only used for covering the cocoons of the larvæ, for thinly lining the nest on the inside, strengthening the old cells which are used for honey pots, and occasionally covering these pots, and propping up the old cells.

During some years Humble Bees are very numerous. This is generally the case when a dry and early spring is followed by a summer producing a good crop of clover. After such a season, if the following spring be favorable, nests are very abundant.

Though very similar to those made by Reaumer, over a hundred years ago, it will be noticed that my observations differ, in several particulars, from those made by some European naturalists who have written on the Bombi.

Some observers have stated that the eggs of the Humble Bee are deposited in cells, partly filled with pollen, which are enlarged by the workers as the young increase in size, and that the old bees, cutting holes in the cells, feed the young until they are fully developed when they relieve them from their prisons. This is quite contrary to the results of my observations in New England.

At present I cannot believe that the peculiarity of food, or the structure of the cells, produces a difference of development in Humble Bees, for the larvæ, as has been previously stated, were seen to make their own cells from the pollen paste, while the old bees were quite indiscriminate in selecting the plants from which they procured both pollen and honey.

Is it not more natural to believe, as has been suggested to me by Professor Wyman, that the difference in the de-

velopment of the eggs is owing to their being laid at various times after impregnation? Thus, if I am right in supposing that the queens are impregnated by the males late in the summer, the eggs laid soon after produce the large queen larvæ: the next set of eggs, laid in the spring, produce the workers, or undeveloped females, while from those deposited still later, male bees are principally developed.

This opinion seems to be corroborated by the state of the nest, previously noticed, found on the 28th of July, which had been recently commenced and contained only *queen* cells, the parent queen being obliged, by her recent impregnation, to lay only such eggs as were adapted to the season. As no first brood of workers, or second one of males and small females, had existed in this nest, the eggs producing the queen larvæ must have been laid by the large female or queen, found in the nest, and not by a small female.

The fact, that our species of Humble Bees take possession of the nest of mice and rats, accounts for the large number of *mites* found in most nests.

Three parasites are common in the nests of our New England Humble Bees. They are, a small beetle of the genus ~~*Byturus*~~ only known thus far in the imago state; a moth of the genus *Nephopteryx*: the larvæ of which is quite abundant in most nests, and a dipterous insect which is often found in the larval state.

It is singular that in all the nests, which I collected, not a single specimen of *Apathus* was found by Mr. Packard, though this parasitic bee is generally supposed to be quite common in the nests of *Bombi*.

*Additional Notes, August 3, 1864.* A nest of *Bombus pennsylvanicus* was found at Upton, Me., on the sixth of last June, in which there was but a single queen bee with seven cells of the smallest size, containing larvæ, and several eggs in a mass of pollen.

A queen of *B. pennsylvanicus* was taken, on July 20th, under leaves in a wood.

Professor A. E. Verrill found a queen Humble Bee in a torpid state under leaves, before the snow was off the ground in the spring of 1863.



VI. *Notes on the Leaf-cutting Bee.* By F. W. PUTNAM.

(Communicated Oct. 22, 1863.)

While at Bridport, Vt., I was enabled to make a few observations on the habits of the Leaf-cutting Bee (*Megachile*). My attention was first called, on the 26th of June, to a female busily engaged in bringing pieces of leaf to her cells, which she was building under a board, on the roof of the piazza, directly under my window. Nearly the whole morning was occupied by the bee in bringing pieces of leaf from a rose bush growing about ten yards from her cells, returning, at intervals of a half minute to a minute, with the pieces which she carried in such a manner as not to impede her walking when she alighted near her hole. About noon she had probably completed the cell upon which she had been engaged, as during the afternoon, she was occupied in bringing pollen, preparatory to laying her single egg in the cell. For about twenty days the bee continued at work, building new cells and supplying them with pollen. At the end of this time she had probably completed her allotted task, as she was not seen again.

On the 28th of July, upon removing the board, it was found that the bee had made thirty cells, arranged in nine rows of unequal length, some being slightly curved to adapt them to the space under the board. The longest row contained six cells, and was two and three quarters inches in length. The cells averaged about one half an inch in length; the whole leaf structure being equal to a length of fifteen inches. Upon making an estimate of the pieces of leaf in this structure, it was ascertained that there must have been at least a thousand pieces used. In addition to the labor of making the cells, this bee, unassisted in all her duties, had to collect the requisite amount of pollen (and honey?) for each cell and lay her egg therein, when completed. Upon carefully cutting out a portion of one of the cells, a full grown larva was seen engaged in spinning a slight silken cocoon about the walls of its prison, which were quite hard and smooth on the inside, probably owing to the movements of the larva and the consequent

pressing of the sticky particles to the walls. In a short time the opening made was closed over by a very thin silken web. The cells, measured on the inside of the hard walls, were .35 of an inch in length and .15 in diameter. The natural attitude of the larva is somewhat curved in its cell, but if straightened, it just equals the inside length of the cell.

On the 31st of July two female bees came out, having cut their way through the sides of their cells. Five other cells were opened, in the hope of finding a pupa, but without success; two of them containing larvæ, and three, dead bees fully formed. In these last mentioned cells, several hundred minute Ichneumons were seen, which came forth as soon as the cells were opened.

August 4. Three more bees came out. One was a male, and differed from the female by not having a sting; by its blunt abdomen; by the hairs on the under side being fewer and shorter and not of so deep a red color, and by being very hairy about the underside of the head.

August 5, and 6. A female came out each day, after which no more appeared, the rest of the cells having probably been ichneumonated, as upon being opened in October, by Mr. Packard, Ichneumons were found in nearly all. Most of these parasites being then in the larval or pupal stages, were probably not developed until the spring. Are there two broods of Ichneumons in one year, or are those that came out on the last of July of a different species?\*

July 3. A female Megachile was discovered making a cell of pieces of leaf in a small hole in the ground. The hole was about two inches in depth and the cell was just commenced, as there were but four quite fresh pieces in it, which appeared to have been cut from locust leaves. This was of the same species as the one that built her cells on the piazza, and which has been identified by Mr. Packard as *M. centuncularis*.

Another species was also seen cutting pieces from the rose leaves, but its cells could not be discovered. This

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\* For further observations on these parasites, see Mr. Packard's remarks in the following article.

was yellow, with the four terminal segments of the abdomen black.

July 22. Two cells of *Megachile* were brought to me, having been found in the crown of a bonnet in a closet. One of these cells, about half filled with pollen (mixed with honey?) contained a small larva, and was closed by several pieces of leaf which were quite fresh. The other cell was empty and not completed.

August 4. A third species was discovered, in considerable numbers, on the same bushes. These were of about the same color as the preceding, but so much larger as to be easily recognized.

These three species, assisted by a single specimen of a blue species of *Osmia*, which was captured while cutting out a piece of leaf, on the 28th of June, were so numerous, and worked so diligently, that they ruined five or six rose bushes, not leaving a single unblighted leaf uncut, and were forced to take the leaves of a locust tree as a substitute, though they almost invariably hovered over the rose bushes before going to the locust tree.

During the last of August many specimens of the three species of *Megachile* were collected from the thistle flowers, where they were quite abundant.

VII. *The Humble Bees of New England and their Parasites; with notices of a new species of Anthophorabia, and a new genus of Proctotrupidæ.* BY A. S. PACKARD JR.

[Communicated April 23, 1864.]

The following descriptions of all the species of Humble Bees known to inhabit New England, together with descriptions of some of their parasites will, it is hoped, draw the attention of entomologists to the great interest attending the study of the growth and economy of our native bees.

Mr. E. T. Cresson, in a "List of the North American species of *Bombus* and *Apathus*" published in the Proceedings of the Entomological Society of Philadelphia for July, 1863, has given descriptions of over forty species of *Bombus*, and eight species of *Apathus*. This has been of

service to me in distinguishing our species. I have also followed his synonymy of the species therein given.

We have in this country nothing published concerning the economy of our *Bombi* previous to the present year. For two years past Mr. F. W. Putnam has paid considerable attention to observing the habits of several species of wild bees, the results of which he has embodied in the interesting articles preceding. I am indebted to him for nearly all the material upon which these notices are based. I have also been much aided in identifying the species by a labelled series of most of our species received from Mr. E. Norton several years since, and more recently by a small collection of species from different parts of the country sent by him to the Museum of Comparative Zoölogy at Cambridge, Mass; the Museum also contains over twelve hundred specimens, of four species, in all stages of growth, being the collection made by Mr. Putnam. I have also had access to the small collection of this genus in the Harris Cabinet now belonging to the Boston Society of Natural History.

Among the numerous parasites upon the Humble Bee we have insects belonging to the Hymenoptera, the Lepidoptera, Diptera and Coleoptera. Each have a distinct mode of attack. The *Stylops* and *Conops* live within the abdomen of the bee upon the fatty tissues of its body. The *Meloe* clings to the outside of its body and sucks in the juices of its victim through the joints of its corneous harness; and after it assumes the pupa stage, passes a period of inactivity safely lodged among the cells of the bee's nest. The ~~*Bytorus*~~ is less intimate in its friendship and probably troubles the bee only as it consumes the stores of food laid up for the bee grub, while it may also prove to be serviceable in acting as a scavenger in clearing the nests of the cadavers of those bees which have perished within their enclosure. The unknown dipterous larva noticed below, is undoubtedly, from the structure of its mouth, a carnivorous animal, and lives by sucking in, like a leach, the juices of the young bees. The species of *Nephopteryx*, which differs so much from its allied species in its habits, feeds largely upon the waxen walls of the bee cells. As to the habits of *Apathus*,

in its early stages especially, we know nothing definite. We are not yet acquainted with the forms of the larva and pupa as distinguished from those of the bee upon which it is a parasite, and indeed know the two sexes of but a single species. As yet we know of no ichneumon parasite of *Bombus*. It will be of interest to determine whether this genus by reason of its secluded habits while in the preparatory stages of its existence, is exempt from the attacks of these vigilant enemies to most other insects.

For a proper study of our Humble bees, we should collect the nests and colonies from the last of May until late in the autumn. We should watch the queen bees as they are searching for deserted mice nests, or other convenient places, in which to rear their colonies, and follow them to their holes. We should then watch for the different broods, and collect the young and mature bees of both sexes, and also of the workers, or undeveloped females; and as it is a well known fact that each sex including the workers are composed of individuals of two sizes, we should endeavor to trace the history of each of the six forms into which the species is specialized and ascertain the functions of each. Early in the spring we can only capture those queens which have survived the winter, while late in the fall we can often secure the males in large numbers, as they frequent autumnal flowers.

It will therefore be necessary in order to collect the young of all these different broods, to take the nests at short intervals during the summer. The cells containing the young, with whatever parasites that may be found among them, may be placed in alcohol, while the mature bees may be pinned. The simplest method of collecting the nests is to visit them before sunrise or after sunset, when all the bees are in the nest and we can secure the whole colony. The bees can be picked up with forceps as they emerge from the nest, or caught with the net and then pinned. Refractory colonies may easily be quelled by pouring in ether or chloroform, or burning sulphur at the aperture, as is the best method of procedure with wasps' nests. The alcoholic specimens of the mature bees may

be dissected open for the purpose of finding the Stylops and Conops lodged within. The author would be greatly obliged for material to aid him in the study of our wild bees, and would take pleasure in corresponding with those interested in the study of their habits and forms.

*BOMBUS FERVIDUS* Fabricius.

*Male.* Head yellow in front both above and below the antennæ. Thorax yellow. Abdomen yellow with the tip black. The black band between the wings is broader than in the female, while also the front is much narrower and the legs and wings are paler. Length, .65—.70; breadth, .30—.32 inch.

*Female.* Head long in front; black, with a few yellow hairs above the insertion of the antennæ. Whole body lemon yellow except a narrow black band between the wings, and the two black terminal rings of the abdomen. Wings not as dark as in *B. pennsylvanicus*, but dark smoky. Legs with the second to the fifth tarsal joints very little longer and slenderer than in the females of the other species, though hardly differing from *B. pennsylvanicus* to which this species seems nearest allied; they are black; tibiæ with fuscous hairs on the tip and along the edges, while the first tarsal joint is dark fuscous above, beneath much lighter. Compared with the male, this sex often differs in having no yellow hairs below the antennæ, while throughout the body the hairs are finer, shorter and more dense. The tip of the abdomen is pure black, while in the male it is partly yellow. Length, 1—1.25; breadth, .40—.45 inch.

*Worker.* Only differs in size from the female. Length, .40—.60; breadth, .17—.35 inch.

In a nest of this species, collected by Mr. Putnam at Warwick, Mass., which numbered five females and forty workers, all had black fronts below the insertion of the antennæ. But, another colony of twenty females and workers from Bridport, Vt., had the fronts almost wholly yellow, with a few exceptions. This was especially marked in the larger sized females, while most of the smaller sized females had black fronts. I am hardly prepared to say that such differences as these

distinguish the two broods of larger and smaller sized females, but would at present consider that the variation noticed above is not confined to either size.

This species is common in all parts of Maine, and is one of the most common species in New England.

**BOMBUS PENNSYLVANICUS** Cresson.

*Male.* "Head black, intermixed with obscure yellowish on the face and vertex; eyes very large and prominent, almost contiguous on the vertex. Thorax above and on the sides tawny-yellow, with a blackish band between the wings; in some specimens the thorax is entirely yellowish. Wings fusco-hyaline, darkest along the costa and towards the base. Legs black; hairs of the basal joint of the posterior tarsi pale; tarsi brown. Abdomen with the first three segments tawny-yellow, slightly mixed with blackish on the base of the first segment; remaining segments black. Beneath black, sparsely clothed with pale hairs. Length 10 lines," Cresson.

*Female.* Head and eyes as described in *B. fervidus* but the antennæ are longer and more slender; black in front. The yellow band on the thorax is broader than in the male; in some specimens there are a few yellow hairs on the scutellum. The three basal rings\* of the abdomen are yellow above, and the basal one is often partially black, the remaining rings black. First tarsal joint fuscous, much larger than in *B. fervidus*. In the form of the body this and *fervidus* are closely allied, both being flatter and a little longer than in the other species. Length 1.05; breadth, .45; expanse of wings 1.85 inch.

The measurement given would indicate that this species was the same size as *fervidus*, but it is a little larger by about .05 inch.

From want of specimens I am obliged to quote Mr. Cresson's description of the male. This is our least abun-

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\* For convenience of description in this paper I have practically ignored the fact that the basal ring of the abdomen is in most hymenoptera thrown forward upon the thorax, as I have observed the passage to take place in the semi-pupa state; hence what is in reality the *second* segment of the abdomen is called in this paper the *first* or basal segment.

dant species, being very rare in Maine, but growing more abundant as we go southward. My specimens were collected by Mr. Sanborn in the vicinity of Boston.

**BOMBUS TERRICOLA** Kirby.

*Male.* Head broad and short, eyes narrow, as in *B. fervidus*; the front is a little broader than in that species but the eyes do not approximate so much above; there are a few yellow hairs on the vertex, and on the clypeus are a few yellow hairs mixed with black. Front of the thorax yellow, as are the sides; beneath black; no yellow hairs on the scutellum. Basal ring of the abdomen black, the second and third rings yellow, the remainder black, with scattered tawny hairs around the tip. Legs much as in the male of *B. fervidus*, but the basal joint of the tarsus is more arcuate, being broader in the middle, and narrowing more rapidly towards the base; they are black except the fuscous tarsi, with long black hairs on the under side of the femora, and the tips of the claws are black. Length, .65; breadth, .32 inch.

Compared with *B. fervidus* the antennæ are nearly one-fourth shorter, so that by this character it would be easily mistaken for a worker, though the hairs are much looser and more uneven than in the other sex.

*Female.* Head very broad and short, eyes of moderate width, much as in *B. pennsylvanicus*; front black, discolored with a few yellow hairs above and below the antennæ. There is a narrow line of black on the front edge of the thorax; behind, and extending as far as the insertion of the wings, is a yellow band; beyond, the thorax and basal ring of the abdomen are black. Second and third rings of the abdomen lemon-yellow, the hairs at the base of each ring honey-yellow; remaining rings black with long loose fuscous hairs about the tips and on the hind edge of the penultimate ring, the presence of which easily distinguishes this species from *B. pennsylvanicus*; beneath smoky black. Wings dark smoky, but not so much so as in the other species. The legs are also paler, but stouter with broader joints, while the femora and the tibiæ are black with smoky black hairs beneath.



The first tarsal joint is still more arcuate than in *B. pennsylvanicus*, and broader, while the remaining joints are shorter and thicker and more fuscous. Length, .80—.85; breadth, .45 inch.

*Worker*, length, .55—.60; breadth, .25—.30 inch.

This species replaces *B. pennsylvanicus*, in Maine where it is one of the most abundant species. The females are common early in the spring, while the workers first appear in the middle of June. I have one worker from Mr. Sanborn collected about Boston. It may be easily mistaken for De Geer's *B. pennsylvanicus* but it is shorter, broader and somewhat smaller. In form more regularly elliptical when seen from above than any of the other species. The broad head, honey tint of the basal abdominal rings, shorter antennæ and especially the fuscous hairs about the tip of the abdomen will further distinguish it from De Geer's species. Sometimes a few yellow hairs are present upon the scutellum.

*BOMBUS VIRGINICUS* <sup>C. Cresson (Am. Proc. Ent. Soc. Phil. II p. 89)</sup> ~~Fabricius.~~

*Male*. Head short and broad; the front being broader and the eyes narrower than in *B. fervidus*; the joints of the antennæ are also a little shorter than in that species; vertex of the head yellow; between this and the insertion of the antennæ the front is often black but more often yellow, while the clypeus is covered with black and yellow hairs. Whole thorax above and beneath, the under side of the femora and basal joint of the abdomen yellow, while the rest of the abdomen is black. Beneath on the side of the abdomen are thin yellow hairs; the basal yellow portion on the upper side of the abdomen is indented on the mesial line of the body. The legs are a little slenderer than in *B. fervidus*, while the tarsal joints are more cylindrical, longer, more dilated and provided with longer and slenderer spines; black; tarsal joints tinged slightly with fuscous brown, with fuscous hairs. The whole body is shorter and broader, more elliptical, the abdomen shorter, the sides converge more towards the acute tips; the wings are paler and the hairs longer and hardly so thick as in *B. fervidus*. The size of the male is equal

service to me in distinguishing our species. I have also followed his synonymy of the species therein given.

We have in this country nothing published concerning the economy of our *Bombi* previous to the present year. For two years past Mr. F. W. Putnam has paid considerable attention to observing the habits of several species of wild bees, the results of which he has embodied in the interesting articles preceding. I am indebted to him for nearly all the material upon which these notices are based. I have also been much aided in identifying the species by a labelled series of most of our species received from Mr. E. Norton several years since, and more recently by a small collection of species from different parts of the country sent by him to the Museum of Comparative Zoölogy at Cambridge, Mass; the Museum also contains over twelve hundred specimens, of four species, in all stages of growth, being the collection made by Mr. Putnam. I have also had access to the small collection of this genus in the Harris Cabinet now belonging to the Boston Society of Natural History.

Among the numerous parasites upon the Humble Bee we have insects belonging to the Hymenoptera, the Lepidoptera, Diptera and Coleoptera. Each have a distinct mode of attack. The *Sphex* and *Conops* live within the abdomen of the bee upon the soft tissues of its body. The *Meloe* clings to the outside of the body and sucks in the juices of its victim through the joints of its horny harness; and after the death of the bee, during a period of inactivity safely passes through the cells of the bee's nest. The *Byth* lives in the cells of the nest and probably troubles the bee while it is storing of food laid up for winter use. The *Microphagus* prove to be serviceable in clearing the nests of the bees which have perished within them. The dipterous larva noticed in the structure of its mouthparts sucking in, like a leech. The species of *Nephrop* its allied species in its waxen walls of the bee cell.

in its early stages especially, we know nothing definite. We are not yet acquainted with the forms of the larva and pupa as distinguished from those of the bee upon which it is a parasite, and indeed know the two sexes of but a single species. As yet we know of no ichneumon parasite of *Bombus*. It will be of interest to determine whether this genus by reason of its secluded habits while in the preparatory stages of its existence, is exempt from the attacks of those vigilant enemies to most other insects.

For a proper study of our Humble bees, we should collect the nests and colonies from the last of May until late in the autumn. We should watch the queen bees as they are searching for deserted mice nests, or other convenient places, in which to rear their colonies, and follow them to their holes. We should then watch for the different broods, and collect the young and mature bees of both sexes, and also of the workers, or undeveloped females; and as it is a well known fact that each sex including the workers are composed of individuals of two sizes, we should endeavor to trace the history of each of the six forms into which the species is specialized and ascertain the functions of each. Early in the spring we can only capture those queens which have survived the winter, while late in the fall we can often secure the males in large numbers, as they frequent autumnal flowers.

It will therefore be necessary in order to collect the young of all these different broods, to take the nests at short intervals during the summer. The cells containing the young, with whatever parasites that may be found among them, may be placed in alcohol, while the mature bees may be pinned. The simplest method of collecting the nests is to visit them before sunrise or after sunset, when all the bees are in the nest and we can secure the whole colony. The bees can be picked up with forceps as they emerge from the nest, or caught with the net and then pinned. Refractory colonies may easily be quelled by pouring in ether or chloroform, or burning sulphur at the aperture, as is the best method of procedure with wasps' nests. The alcoholic specimens of the mature bees may

to that of the worker of *B. fervidus*. Length, .50—.55; breadth, .25—.30 inch.

I have carefully compared male specimens from Maine and Massachusetts in Dr. Harris' cabinet labelled by him "*Bombus impatiens* Say Ms." They do not differ from undoubted males of *B. virginicus*, and I agree with Mr. Cresson in considering it as a synonym of our common species.

I have taken the males very abundantly flying about asters and solidagos during the middle of October, when out of twenty males but a single worker of some other species occurred.

*Female*. Head broader than in *B. vagans*, front black with a few yellow hairs between the antennæ, and less than the usual number on the vertex. Thorax and basal joint of the abdomen yellow above and on the sides, black beneath; remainder of the body black. Wings paler than usual. Legs with the tarsal joints longer than in *B. vagans*; the first joint longer and slenderer, with fuscous hairs on the edges, and the remaining joints dilated more than in *B. vagans*; dark fuscous, with lighter fuscous hairs. Length, .30; breadth, .42; expanse of wings, 1.60 inches.

*Worker*. Length, .50; breadth, .20 inch.

#### BOMBUS SEPARATUS Cresson.

*Male*. Head a little broader than in *B. virginicus*, to which this species is very closely allied; the eyes are large and full, and the front is narrower by one third than in any other species; vertex yellow, the tuft larger than in *B. virginicus*; a yellow tuft below not reaching to the base of the labrum; both the maxillæ and lingua are shorter than in *B. virginicus*; lingua with a single circle of spinules near the tip, which last is longer than in that of *B. fervidus*; the joints of the antennæ are shorter and more contracted in the middle than usual. Thorax and abdomen colored as described in worker. Legs black; tarsal joints slightly tinged with testaceous; femora beneath thickly clothed with long yellow hairs; first posterior tarsal joint longer and narrower, remaining joints much stouter, though no longer than

in *B. virginicus*. Abdomen wholly black beneath. Length, .65; breadth, .35 inch.

Compared with *B. virginicus* this species is considerably larger; the head when seen from above is much broader, eyes twice as large, outer edge of the fore wings straighter, making the wings more triangular, and they are a little darker. In form the two species are very similar.

*Worker*. Head short and broad; the front is black, with a transverse yellow tuft just above the antennæ; the hairs are remarkably short, dense and more glossy and velvety than usual. Thorax of a rich lemon-yellow above; in certain lights, especially on the sides, tinged with pruinose. Two basal segments of the abdomen obscurely fuscous, intermixed at the base with yellowish hairs; second ring most distinctly fuscous; remainder of the abdomen black, with very short hairs. Length, .55; breadth, .22 inch.

This species connects *B. virginicus* with *B. vagans* and *B. ternarius*, which last it resembles in its broad head and compact body. The obscurely brick-red base of the abdomen will serve to separate this species from *B. virginicus*, besides the smooth, glossy, velvety bloom which is due to the short, evenly cut, dense hairs.

Mr. Cresson observes in a letter, "that the second ring of the abdomen varies from yellow to dark fuscous, sometimes quite red. The hairs on the head are sometimes mixed with yellow on the vertex and sometimes entirely black."

Mr. Putnam collected a nest of over twenty workers at Bridport, all of which had the second ring reddish above. At another time a solitary male was captured which did not differ from the workers. Another male was taken near Boston by Mr. Sanborn.

#### BOMBUS VAGANS Smith.

*Male*. In form and size closely resembling *B. virginicus*; the front is wholly yellow. Black; thorax above and beneath, two basal joints of the abdomen and the under side of the femora yellow; beneath, on the side of the abdomen to just before the tip are sparse yellow hairs. Tarsi dark fuscous, with fuscous hairs. Wings pale. Length, .55; breadth, .28 inch.

Compared with *B. virginicus*, the head is smaller, antennæ slenderer, front more yellow, and there are not so many yellow hairs beneath the abdomen as in that species, while the first tarsal joint is narrower and all the joints are a little more fuscous.

*Female.* Head a little narrower than usual; front dark, with a yellow tuft above and below the antennæ. Black; thorax and the two basal abdominal rings pale lemon-yellow. Abdomen wholly black beneath. Legs black; femora beneath black; first tarsal and remaining joints black. Length, .65—.80; breadth, .28—.42; expanse of wings, 1.04 inches.

*Worker.* Length, .35—.50; breadth, .17—.22 inch.

This species is full and plump. The larger sized females have finer, denser hairs than the workers, where they are more than usually loose and uneven. These last are often found with very pale yellow hairs.

In a colony of thirty workers collected at Warwick, Mass., by Mr. Putnam, there occurred no special variation except in the different shades of yellow on the fronts. It is one of our common species, and occurred abundantly the last of August in company with *B. ternarius* about Chamberlain Lake at the head waters of the Penobscot river.

#### BOMBUS TERNARIUS Say.

*Female.* Head broad and short; front broad with yellow tufts above and below the antennæ. Black; thorax and basal ring of the abdomen yellow; an irregularly defined black band between the wings, sometimes produced behind into a triangular point on the scutellum, extending to the base of the abdomen; second and third abdominal rings red; fourth yellow, and the tip black; beneath black, the posterior edges of the third and fourth abdominal rings provided with yellow hairs. Legs black; tarsi fuscous, especially the inner side of the first joint; femora clothed beneath with yellow hairs. Wings pale smoky, of the same size and form as in *B. vagans*. Length, .70; breadth, .32; expanse of wings, 1.30 inches.

*Worker.* Length, .40—.45; breadth, .17—.25 inch.

*Male.* "Colored same as the female," Cresson.

Compared with *B. vagans*, the legs are very similar; the first tarsal joint is however not so broad and convex without, while the remaining joints are much the same.

In a nest of twenty-three specimens collected by Mr. Putnam at Bridport, Vt., the scutellum was invariably yellow. Most of these specimens have the fifth abdominal ring red, so that there are three instead of two red rings. In nearly every case the front of the head was darker than above described, since by their pollen gathering habits the longer yellow hairs easily rub off. It is a common and widely distributed species ranging according to Cresson from Maine to Utah, Puget Sound and Arctic America, and southward to Pennsylvania.

I append the description of three additional species described from Connecticut and New York by Mr. Cresson.

*BOMBUS PERPLEXUS* Cresson.

*“Male.* Head black, with a tuft of pale hairs in front below the antennæ; vertex yellowish. Thorax bright honey-yellow. Wings hyaline, apical margins faintly clouded. Legs black; base of femora beneath yellowish. Abdomen with the three basal segments bright honey-yellow, the third segment having a slight admixture of black; remaining segments black. Beneath black, slightly mixed with yellowish. Length 8 lines.

*Female and worker* not seen.

One specimen, Connecticut. (Coll. Norton.)

This species closely resembles *B. hudsonicus*, but the form of the body is more elongate and not so compact as that of the latter species, and the color is much brighter.”

*BOMBUS BIMACULATUS* Cresson.

*“Male.* Head black, mixed with yellowish on the face and vertex. Thorax honey-yellow. Wings sub-hyaline, slightly stained with yellowish. Legs black, clothed with yellowish hairs, especially on the femora beneath. Abdomen with the whole of the first segment above, and the second, except a few black hairs on the middle, and a round black spot on each side, pale honey-yellow; the fourth segment mixed with black and yellow; the third

and apical segments black. Beneath yellowish, hairy. Length, 7 1-2 lines.

*Female* and *worker* unknown to me.

One specimen, Connecticut. (Coll. Norton.)”

#### BOMBUS AFFINIS Cresson.

“*Female*. Head black. Thorax in front and on the sides yellow; between the wings black; scutellum, yellow. Wings fusco-hyaline. Legs black. Abdomen with the whole of the first and the sides and posterior margin of the second segments above yellow; remainder of the second segment rufo-fulvous; remaining segments black; beneath black. Length, 8 lines.

*Male*. Colored the same as the female, except a slight admixture of yellowish hairs on the vertex. Length, 8 lines.

Canada, (Saunders); and New York, (Coll. Norton.)”

#### APATHUS.

The genus *Apathus* may be distinguished from *Bombus* by the males having broader fronts, and the tibiæ being convex instead of concave on the outer side, the whole joint being rounder and thicker, while the first tarsal joint is longer and not so convex on the posterior edge as in *Bombus*, being very straight and oblong.

The females are more easily known by having very acute, triangular, bidentate mandibles instead of having them spatulate and three toothed as in *Bombus*. The head is also shorter and broader; the front is much broader, since the eyes are a little smaller, as are the ocelli; both the clypeus and labrum are shorter and broader, and the antennæ are a little stouter. The tip of the abdomen is larger, acute, the surface convex and not concave as in *Bombus*, and the sides are flat, giving the tip a quadrangular form.

#### APATHUS ASHTONI Cresson.

This is the largest New England species yet discovered and differs very considerably in its coloration from the others.

*Female*. The head is short and broad, the front broad



and covered with short wholly black hairs. Thorax lemon-yellow above, descending partially down the sides in front of the fore wings; there is a short lozenge-shaped black space, lying partly on the hinder edge of the meso-scutum and the anterior half of the scutellum, while the hinder convex edge of this last piece is rather broadly margined with yellow. The two basal rings of the abdomen and half of the third are black, while the side of the third is yellow; fifth ring black above, yellow on the sides; tip naked, large, triangular, incurved, with an oval depression on the upper side; beneath, the body is wholly black. Legs stout, short, black: tips of the tibiæ fuscous; the inside of the first tarsal joint partially, or in certain lights, wholly deep fuscous; remaining joints dark fuscous; the fifth one including the claws darker than the others. The wings are a little paler than in *A. elatus*, with black veins. Length, .75; breadth, .35; expanse of wings, 1.45 inches.

I have taken several female specimens of this handsome species during the middle and last of summer, at Brunswick, Me. There is one specimen, "No. 215," not labelled, in the Harris collection belonging to the Boston Society of Natural History, which, as nothing to the contrary is stated, must have been captured near Boston.

In size and form and partially in its colors it is similar to *B. fervidus*, and is perhaps a parasite upon it.

#### APATHUS CONTIGUUS Cresson.

*Male.* Front black; vertex yellow; thorax and two basal joints of the abdomen yellow; body beneath, and the five terminal joints of the abdomen black. Legs black; tarsi fuscous, the basal joint blackish except on the edges.

It very closely resembles *B. vagans* Smith, differing from it by the nearly twice as broad front, which is black instead of yellow, as in *B. vagans*, and the body is entirely black beneath, where *B. vagans* has long yellow hairs. Length, .67; breadth, .28 inch. (Mus. Comp. Zoöl., Mr. Norton.)

#### APATHUS CITRINUS Smith.

*Male.* Front black, a few greyish-yellow hairs on the vertex. Thorax and four baso-abdominal rings covered

with sparse greyish-yellow hairs, being very thin between the wings, and on the middle of the fourth joint of the abdomen; beneath black. The abdomen is at the extremity a little broader and more incurved than in the preceding species. My specimen is very pale greyish-yellow, Mr. Cresson however describes it as "pale lemon or greyish-yellow above and on the sides," and it is most probable that the specimen before me is hardly mature. Legs, outer half of tibiæ, and tarsi fuscous. Length, .55; breadth, .28 inch. (Mus. Comp. Zoöl., Mr. Norton.)

#### APATHUS ELATUS Cresson.

*Male.* Very closely resembling *B. fervidus* Fabr. The head is black, rest of the body, except a black band between the wings, and the black tip of the abdomen deep lemon-yellow. Wings much darker than in the preceding species. Legs black, sometimes dark fuscous; femora clothed with yellowish hairs beneath. The extreme tip of the abdomen has a few fulvous, or yellow hairs. Distinguished from *B. fervidus* chiefly by the black front. Length, .55—.85; breadth, .25—.35 inch.

#### NEPHOPTERYX Hübner.

##### NEPHOPTERYX EDMANDSII nov. sp.

Cinereous, with a decided purplish hue. Head, antennæ, thorax and abdomen rather pale cinereous, concolorous, without any dark scales; palpi much darker at the tips and on the outer side; within paler. Fore wings with two transverse parallel lines; the inner one a little outside of the basal third of the wing; blackish, diffuse, angulated just before the costa, straight below; a slight blackish discal dot; the outer sub-marginal line is situated on the outer fourth of the wing; it is dark within, the outer half pale, straight, angulated acutely opposite the discal dot; not angulated in the costa; just within this line and in front of the discal dot there is a pale patch, free from the dusky scales. An obscure marginal row of dots, the apical one much larger than the others. Fringe pale cinereous. Secondaries, abdomen and legs uniform pale shiny

cinereous; the former paler towards the internal edge; beneath both wings are nearly concolorous, the primaries a little darker however, but without any markings. Length of the body, .37; expanse of wings, .75 inch.

*Larva.* Body cylindrical, tapering slightly towards each end. The head is of moderate size and somewhat flattened as usual, presenting the usual semi-elliptical form; the three simple eyes are placed in nearly a straight line parallel with the anterior edge of the pro-thoracic ring. The pro-thoracic (cervical) shield is sub-lunate; each of the two succeeding rings is impressed by three transverse lines, forming four transverse ridges. On the abdominal rings there is but one of these impressed lines like the suture between the different rings, except that it extends only as far as the sides of each ring; like the sutures they are roseate flesh-colored; there are two sub-dorsal rows of minute setiferous tubercles, one on each elevation of the ring; and a similar lateral row; the pleural region is raised considerably; of the nine stigmata, the pro-thoracic one and the last abdominal one are the largest, and the pro-thoracic stigma is placed a little below the line of the others; the supra-anal plate is semi-oval; ten pairs of rather short abdominal (prop-) legs. Of a pale flesh-color with the lines and sutures deeper roseate. Length, .45; breadth, .08 inch.

These larvæ were observed Jan. 16th, twenty or more in number, in a box containing the remains of a nest of *Bombus fervidus* taken during the previous fall at Warwick, Mass. The larvæ had eaten up all the cells, and while some were spinning their thin cocoons, which were very slight compared with those of *Galleria*, the honey-bee moth, others had died for want of food.

*Pupa.* The body is obtusely spindle-shaped, since the upper and under sides are continuously convex from the head to the tip of the abdomen. Head prominent, the front convex; epicranial piece large and broad, convex behind, on the sides deeply excavated for the insertion of the antennæ; the clypeus nearly round, being convex behind and on the sides, which narrow towards the square slightly concave front; in front of the clypeus is the transversely narrow labrum which is a little produced in

front and obtusely pointed; in front are two triangular pieces, united for a slight distance along the mesial line, but they soon separate to allow the base of the maxillæ to pass up between them; these last are very long and slender, and with the legs and wings extend down to the anterior edge of the fifth abdominal ring; the forewings are long, narrow and acute, the outer edge very oblique, and continuous with the hind edge; the pro-thorax is short, excavated in front, with a slight mesial tooth; the hind margin convex, with a mesial excavation corresponding to the tooth in front; there is a mesial ridge on the pro- and meso-thorax; the meso-scutellum is soldered in front without suture, behind acutely pointed; behind is (probably) the post-scutellum, transversely linear, but distinct; meta-thorax as usual, square behind; the second pair of wings are visible at their insertion and along the hinder edge. Ten abdominal rings very equal in length, minutely punctured, smooth on the emarginated hind edge; from the fifth, the tip slowly becomes conical; the extreme tip is rather obtuse, not spinous, but with a few hairs. In color it is of the usual reddish testaceous tint, but paler than usual. Length, .34; breadth, .08 inch.

The year after this larva was discovered at Warwick, Mr. Putnam raised it from the larvæ found in bees' nests at Bridport. This species is respectfully dedicated to Miss A. M. Edmands of Cambridge, who was the first to draw attention to its interesting habits. In this respect it differs much from other species of the same genus. Ratzeburg in his "Forstinsecten" figures two species which feed on the pine leaves, and Dr. Clemens\* describes the habits of two species which feed upon the American Elm.

#### MICROGASTER Latreille.

##### MICROGASTER NEPHOPTERICIS nov. sp.

*Male.* The body of this species is black with pale and black-brown legs. The eyes are provided with short scattered pale hairs thickest around the margin like those on

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\*Proc. Acad. Nat. Sci. Philad. p. 205. 1860.

the head, which is wholly black. The surface is finely punctured, and the front is covered with fine hairs, especially thick on the middle of the clypeus where they form two lines of silvery hairs pointing inwards, while the lines themselves diverge outwards, thus forming a triangular space, and below is another triangle of silvery, but much shorter hairs on the labrum; the four sub-equal jointed labial palpi are pale testaceous; the basal joint darker; the three-jointed maxillary palpi have the middle joint pale, the other two darker. The surface of the black thorax is hardly punctured, but finely and irregularly striated. The pale white wings contrast with the black body; patagia pale testaceous; base of the wings black, nervures pale; the marginal one darkening towards the blackish pterostigma which is a little paler in the middle. Legs black at their base; outer two-thirds of first pair, outer half of second, and tip of third pair of femora pale; fore and middle tibiæ and tarsi pale, hind pair pale on the basal two-thirds; the hind tarsi dark; all three pairs of claws blackish. Abdomen black, with a few pale sparse hairs. Length of body, .13; breadth, .03; length of one primary wing .09 inch.

This species agrees well with the typical European species in most respects. The antennæ are 18-jointed, and the joints are long cylindrical, impressed in the middle by a slight constriction. The neuration is like Ratzeburg's figure of *M. flavilabris*, but the pterostigma is a little broader, and the outer cubital cell is still more incomplete, no traces of the third and outer side of the minute triangular cell being present.

Two males found by Mr. Putnam to be parasitic on the species of *Nephopteryx* described above, were raised by him while at Bridport, Vt.

#### CONOPS Linnæus.

The history of this genus is very fragmentary. I quote from Westwood's "Modern Classification of Insects" a summary of what was known in regard to its habits up to the date of the publication of that work. "These insects are

generally prettily colored, and are met with upon plants and flowers. The species are parasites in the larva state upon bees, as first discovered by Baumhauer. Latreille also states that the *Conops rufipes* undergoes its transformations in the interior of the abdomen of living humble bees, escaping at the margin of the segment, having reared four specimens of the *Conops* in a box in which he had placed some of the *Bombi*; and Messrs. Lachat and Audouin have published an interesting memoir upon an apod larva found in the intestines of *Bombus lapidarius* which Latreille attributed to this species of *Conops*. M. Robineau Desvoidy has also observed a species of *Conops* pursuing a *Bombus* with great patience, and flying on it several times (*Comptes Rendus de l'Acad.* No. 23, 1836), as has also M. Dufour, who, moreover, possesses a *Bombus terrestris* from the anal part of which a *Conops rufipes* is dependent, the swollen extremity of the abdomen of the latter being retained within the former. (*Ann. Sc. Nat.* Jan. 1837.) I have also frequently observed *Myopa atra* flying about sand-banks in which were the burrows of various bees." Vol. II p. 560.

I translate two passages from the memoir of Messrs. Lachat and Audouin\*, referred to above, which describe the larvæ and their habits. "A white, very soft and footless larva (figs. 1, 2, 3, 4,) was found the 7th July 1818, between the ovaries above the stomach, between it and the sting and under the dorsal vessel of a *Bombus lapidarius* Fabr. which was deprived of its fat; it had eleven rings, a long neck, a mouth, two lips, two hooks and several papillæ dependant from the skin; the rest of its body was distended, a little furrowed above and beneath, by a longitudinal series of points grouped usually three by three on the side of each ring, which likewise appeared plainly constricted. The extremity opposed to the mouth, corresponds to the rectum of the *Bombus*, has an anus slit vertically, and two more elevated lateral plates, placed near each other and very curious in their organization and their importance. It bears much resem-

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\*Mémoire sur une larve apode trouvée dans le bourdon des pierres. Mém. de la Soc. d'Hist. Nat. 1823. Tom. I. p. 326-339. avec fig.

blance to *Dipodium apiarium* of Bosc, and is like several dipterous larvæ described by Réaumur (*Mémoires*, tomes iv and v.) M. Latreille refers it to *Conops rufipes* of which he has found four individuals in a box in which he had placed some *Bombus terrestris* Fabr."

"This larva, then, passes its first three stages, lodged directly within another insect, there living upon the fats, and receiving like most dipterous larvæ, through its posterior openings, an abundant supply of air, that another being inspires for it. Already has M. Dumeril surmised, that from the curvature of its abdomen, the *Conops* must lay its eggs within the body of some other insect."

The larvæ are represented by the authors as being flask-shaped, convex above, flattened beneath, with the anterior portion of the body elongated and very slender; while upon the obtuse anal extremity are placed the crescentic respiratory organs.

We have nothing new to communicate respecting the habits of this genus, but merely to note the occurrence of a species which is parasitic either upon *Bombus vagans* Smith, or *B. fervidus* Fabr. Unfortunately the specimen died while issuing from the body of the bee so that the wings were not expanded and the colors were not developed; and since a colony of each of the two species above mentioned were pinned in the box, it is uncertain upon which species the *Conops* was a parasite.

In the dilapidated specimen, which Baron Osten Sacken has referred to the genus *Conops* after reading my description, the large eyes do not meet on the vertex, but their opposite edges are straight and parallel, leaving the front of the head between them of even width above and below, and as wide as the breadth of either of the eyes; the front is deeply excavated for the reception of the antennæ, on each side of a triangular prominence; the antennæ are apparently three-jointed; the first very long, square, and truncated at the tip; the second is a third shorter than the basal joint, but broader and conical, and continuous with the slender, minute, acute third joint; the proboscis is very long, reaching nearly to the tip of the abdomen and clavate at the extremity. The abdomen is apparently somewhat shrivelled, and is cylindrical, the

tip a little obtuse and incurved. The legs are large and long, with stout joints and strong claws; the femora are dilated, the tip of the tibiæ much enlarged; and the tarsal joints are broadly triangular.

*Notes on an unknown larva allied to that of Volucella.*

Westwood (Intr. II. p. 558) states that the "larvæ of Volucella reside in the nests of Bombi and Vespæ, upon the larvæ of which they subsist; they have the body long, narrowed in front, transversely wrinkled, with fine lateral points, and the tail armed with six radiating points; the mouth is armed with two bifid mandibles, and with three pairs of tentacula." The pupæ of this genus have not been described, DeGeer figuring only the larva and imago of *V. bombylans* (*Mém.* tom. vi. tab. 8. fig. 4—9; and see Réaumur, *Mém.* tom. iv. pl. 33.)

Several nests of *Bombus fervidus* and *B. vagans* were found by Mr. Putnam to be infested by larvæ which it will be seen agree in many respects with the above description of those of *Volucella*.

They were 13-jointed. The terminal triangular portion appears to consist of a single ring, though in reality made up of three segments soldered together. In form the larvæ are oval lanceolate, narrowing in front, and the dorsal surface is convex continuously from the head to the anal tip, and beneath flattened; with two dorsal and two lateral rows of stout bristles spinulated at the base. The head is broad oblong, flattened from above; it is nearly as long as the pro-thoracic ring, and two-thirds as broad; very square in front, the sides are parallel and very slightly convex, arising from the front edge of the head, and above the mouth are two minute setæ which do not appear to be jointed, or to differ structurally from the other spinules upon the surface of the body, except that they are simple; these are all the appendages to the head that can be seen when the mouth is retracted; in one specimen however where the mouth is partially thrust out there is seen attached a v-shaped organ (maxillæ?) such as are described as occurring in *Volucella*; on



each side and near the base of the head is a convex raised vertical ridge, with its edge armed with obtuse short spines which probably protect a simple eye situated at the bottom of the depression. The middle of the body is nearly twice as wide as the pro-thoracic ring. All the rings are separated by well defined sutures; they are convex, and angularly so on the sides; the spines are very equal in length, the two dorsal rows approximate and are rather remote from the two lateral rows; the tip of the abdomen, which, judging from the three pairs of spines, is originally composed of three rings, is semi-ovate, triangular in form, suddenly flattened above; at the base is a pair of obsolete spines; the remaining spines are longer than those on the front of the body, radiating outwards, but like them are armed at the base with three or four pairs of obtusely bifurcate spinules which stand out stiffly at right angles to the spine itself; the longitudinal anal opening is protected on the sides with minute obtuse spines; on the under side of each ring of the body, with the exception of the terminal one, are two transverse angulated ridges; the front one smooth, while the posterior ridge is provided with a single row of minute teethlike spines. The larvæ are of a dirty pale flesh color. The head is concolorous with the rest of the body and of but little harder consistence. Length, .36; breadth, .10; height, .07 inch.

While bearing a general resemblance to the larva of *Volucella* as figured by Westwood, they differ in being much narrower, very hairy, or rather spinulated, and the terminal portion of the body is not provided with stout spines as in *Volucella*, but is continuously hairy with the rest of the body.

I quote in this connection notices by Westwood of other dipterous genera which are parasitic on wild bees, with the hopes of stimulating observers in this country to search for these interesting parasites in the nests of American wild bees.

"Some species of *Anthrax* were supposed by Latreille to be parasitic on bees, while Réaumur (*Mém.* tom. vi. pl. 27. fig. 13) figures *Anthrax morio*, of which he observes. "Plusieurs mouches de cette espèce ont été tirées d'un

nid creusé dans le bois". p. 290. "All these authors have, however, overlooked the direct observations of Schaffer, who has figured the larva, pupa and imago of *Anthrax ornata* (or a closely allied species) as one of the parasites in the nest of the Mason bee (*Megachile muraria*) (Abhand. v. Ins. vol. II. pl. 5. figs. 11, 12, 13.)"

"M. V. Audouin has confirmed in his unpublished observations the parasitic habits of *Anthrax morio* by rearing it from the nest of an *Anthophora*. He has given me one of the exuviae of the pupa, which retains its previous pupiform, and exactly resembles the pupa of *Bombylius*. He remarked that the *Anthrax* makes its way out of the cell of the bee, immediately before assuming the perfect state, by the assistance of its dorsal spines, in the same manner as *Cossus*. I have also found exactly similar exuviae in the nest of *Megachile muraria*." p. 534.

The muscid genus *Tachina* besides attacking parasitically grasshoppers, caterpillars, the larvæ of saw-flies and other insects, is known also to frequent the burrows of the smaller species of wild bees, such as the *Andrenidæ*.

#### ANTHEROPHAGUS Latreille.

##### ANTHEROPHAGUS OCHRACEUS Melsheimer.

*Female.* Pale testaceous honey yellow, with darker antennæ, legs, and elytra; the head and pro-thorax above and beneath are honey yellow; the anterior two-thirds of the head, pro-thorax and elytra is covered with very fine yellowish hairs arising from the fine punctures which cover the upper part of the body; the antennæ are also very finely haired; on the head the minute hairs are arranged longitudinally; while upon the pro-thorax they all converge to a mesial point near the hind edge of the pro-notum. The elytra are a little darker especially along the suture. The ends of the antennal joints, the base of the coxæ and tibæ, and tip of the terminal joint of the tarsi are black. Length of the body, .16—.18; breadth, .06—.08 inch.

This species was identified for me by Mr. F. G. Sanborn of Boston. He informs me that the species is common

on the flowers of the sweet briar and other Rosaceæ, but that my female specimen is much larger than usual. Hence the above description will not be out of place.

Both at Warwick, Mass., and at Bridport, Vt., Mr. Putnam found several nests of bees infested by this beetle. Though it is probable from the fondness which these insects manifest for the sweets of flowers, that they visit the nests of the bees for the purpose of consuming the honey stored up within them, we do not as yet know the extent of the injury they cause, or whether in their early stages of growth they are not true parasites.

*Larva of* MELOE ANGUSTICOLLIS Say.

This insect, as is well known, is parasitic in its early larval stage on the bodies of wild bees, and dwells as a pupa in their nests. I have found them several times upon the bodies of *Bombus*, *Halictus*, and *Andrena*, with their heads plunged in between the head and thorax of their victims. During the flowering of the willows in April, I have found them in abundance upon the flowers, while those bees which had evidently brought them there were more or less infested by them. I have tried in vain as yet to rear the larvæ by feeding the bees with sugar. They are comparatively hardy and with proper care in changing the bees as fast as they die can most probably be raised to maturity. They are very active in their habits, very quickly deserting the half-dead bee for a newly introduced and more lively one.

I would here venture to suggest that there is nothing very abnormal in the development of this genus of Coleoptera, so far as concerns the different forms of the young; judging simply from the form of the *semi-pupa* figured by Newport, which is called by him and previous observers a distinct *form* equivalent to the *larva and pupa form*, I would suggest that that stage is simply the beginning of the pupa form.

In studying the development of *Bombus*, I have ascertained that the semi-pupa takes on a most remarkable form, intermediate between that of the worm-like larva and the

matured pupa; but the transitional forms between show that they gradually merge together. Owing to the great rapidity with which the pupa is developed beneath the larval skin which in most insects is hard and thick, the intermediate stages pass on so rapidly that we know really little about them.

The "*semi-pupa*," as it may be called of *Meloe* has not been compared with the similar stage in other Coleoptera, of which we know almost nothing, hence it is not to be wondered at that so philosophic and acute an observer as Newport should call the immature pupa of *Meloe*, a fourth stage of existence, intermediate between the larval and pupal.

The specific characters of our larva can be best brought out by comparing it with the figure of Newport.\* It is shorter and broader throughout. The head and thoracic rings are together longer than the abdomen, which is shorter and more ovate than in the European species; the head is longer and the pro-thoracic ring is longer than the two succeeding rings, where, according to Newport's figure, it is a little shorter than the mesial thoracic ring; the two hinder rings also dilate more on the posterior edge, as do the abdominal rings; the setæ attached to the hinder edge of each abdominal segment, which are large and conspicuous in Newport's figure, are in our species minute, and the terminal setæ are shorter; the legs of our larvæ are a little stouter than in the species referred to. Its color in the young is very pale, becoming in the full sized individuals nearly black. Length, .06; breadth, .02 inch.

#### *Notice of STYLOPS CHILDRENI Gray.*

I was fortunate enough during the past spring and after this article was presented to the Institute, to discover the male of this species.

According to Westwood (*Modern Class. Insects*) this species was discovered in the abdomen of a species of

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\* *Trans. Linn. Soc. Vol. 20, tab. 14.*

*Andrena*, carried to England from Nova Scotia, which was in the collection of Mr. G. B. Sowerby; it was figured by Prof. Westwood and with many details formed plate 59 of Griffith's Cuvier, Part Insects. Though named by Mr. Gray, no description has ever been made. The insect has not subsequently been noticed by observers in this country.

On the 29th of April I captured an *Andrena placida* Smith flying about the flowers of the Mezerion. This specimen was stylitized, and flying briskly within the nest and in company with the bee was a male *Stylops*, which agrees in all respects with Westwood's figures, except that he does not represent the abdomen as being long enough. In a few hours my specimen died, and its abdomen long and flexible, which the insect had kept in constant motion, opening and shutting its large and broad anal forceps, soon partially dried up, then resembling more Westwood's figure which must evidently have been taken from a dried specimen. The whole body, the antennæ and appendages of the mouth were velvety black; abdomen slightly brownish; legs and anal forceps pale resinous brown; the tarsal joints, and tips of tibiæ pale testaceous.

I have little doubt but that this male was at the time of capture adhering to the body of the bee in order to unite with the wingless female, within the abdomen of the bee, and thus the use of the long flexible abdomen and large terminal forceps are obvious.

Is the wingless specimen a pupa, or female? That it is a female, and was destined in about six weeks to produce immense numbers of young there can be little doubt.\*

I proceed to notice a female and young discovered during the preceding year.

On the 18th of June while collecting Hymenoptera which were feeding upon the flowers of the garden Raspberry I captured an *Andrena vicina* Smith, which was stylitized. Near the middle of the abdomen, on the upper side, projected from between the rings, the flat triangular head of the female. Upon drawing out the whole body,

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\* During the middle of May I captured two more of the same species of *Andrena*, each with a female *Stylops* within its body.

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 ditto last document

which was very extensible, baggy and full of a thin fluid, I examined it under a high power and found multitudes, at least three hundred, of very minute, dust-like *Stylops* larvæ issuing in every direction from the body of the parent. Most of them issued from near the head, over which they ran, as they must do when the parent is in its natural position, in order to get out upon the surface of the bee. The soft body of the female rapidly dried up, causing the death of many of the larvæ, and as I was unable to rear them, my only object in mentioning them now, is to describe briefly the appearance of the female and the young at the time of birth. It appears therefore that the female does not lay eggs, but is viviparous. Siebold was the first to show that the females were such, though apterous, wormlike, of so abnormal form and so different from the winged male; and it seems a little strange that Westwood and others should call this form a "larva" when they plainly perceived that its body was filled with the newly hatched young. The head of the single female that fell under my observation resembles very closely the figures of Newport in the Linnæan Transactions; it is flattened, triangular, nearly equilaterally so, with the apex or mouth-region obtuse, and the two hinder angles each containing a minute simple eye; the larger part of the head above consists of the epicranium, which is narrowed in front and its edge convex; no clypeus, or labrum can be distinguished; the mandibles are also obsolete, being two flattened portions lying in front of the "gena" and separated from that region by a very distinct suture; the mouth is transverse and opens on the upper side of the head, while in front lies the rather large labium, and the rounded papilliform maxillæ.

The larvæ are in form linear elliptical; head semi-ovate, while the tip of the abdomen is truncate. The sides of the body are continuous, there being no suture between the segments; seen laterally the larva is thickest at the meta-thoracic ring. Two simple eyes are lodged near the base of the head. The body is so transparent that the intestine can be traced easily to just before the tip, where it ends in a *cul de sac*. The two anterior pair of legs are much alike; coxæ short; femora and tibiæ small, cylindri-

cal; a single slender tibial spur; tarsi consisting of a single clavate joint equalling the tibia in length, much swollen at the tip, where no claws can be discovered; the hind tarsi are longer, very slender, two jointed, the terminal one being bulbous. The pair of terminal stylets inserted in the fourteenth and terminal joint of the body are a little more than one half the length of the body. The whole body, especially the abdomen is partially covered with long setose scales, which project from the side of each ring. In color the body is pale grayish.

In their movements these infinitesimal larvæ were very active, as they scrambled over the surface of the body of the parent or of the glass slide, holding their caudal setæ nearly erect.

*Notes on a new species of Anthophorabia parasitic on the Leaf-cutting Bee, and a new genus of Myrmarides probably parasitic on the former.*

In Westwood's "Introduction to the Modern Classification of Insects," we find the following notices of chalcid parasites on wild bees and wasps. "Pteromalus apum is parasitic gregariously in the nest of the mason bee. A brood of Encyrtus varicornis was obtained by Esenbeck from a cell of Eumenes coarctata. Réaumur has described and figured (*Mém.* vi. pl. 20, fig. 2, and pl. 21, fig. 3,) a species of Chalcis, which is parasitic in the nests of the American wasp (*Epipone nidulans*) and which he regarded as the female of that wasp." Westwood also mentions that Monodontomerus lives in the nests of Osmia, the mason bee; and on the authority of Audouin states that the same genus is also "parasitic in the provisioned nests of Odynerus, Anthophora and Osmia. The male has most singular antennæ, and minute rudiments of wings, so that it does not quit the cell."

Newport\* has given us many new details of the history of the wild bee parasites. He states that the larvæ of Monodontomerus are flat, very hairy, and spin silken co-

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\* On the Anatomy and Development of certain Chalcidæ and Ichneumonidæ. Trans. Linn. Soc. Vol. 21, 1855.

coons when about to pupate. The imago appears about the last of June, perforating the cell of the bee. The larva is an "external feeding parasite" consuming the pupa as well as the larva of *Anthophora*. Very full information is given concerning the habits and structure of two species of a new genus of these minute parasites, which he calls *Anthophorabia*. The males differ remarkably from the females, especially in having simple eyes instead of compound organs of sight, besides the usual three ocelli.

We were fortunate enough in cutting open the cells of *Megachile centuncularis*, brought by Mr. Putnam from Bridport, Vt., to find that nearly a dozen were ichneumonized by these parasites. There were counted in one cell upwards of one hundred and fifty of the larvæ; whereas Mr. Newport only found thirty to fifty in a cell of *Anthophora*. A few perfect females had hatched out, it being the middle of October, and there were besides a few pupæ, but the large majority were larvæ which have survived the winter as such, so that a new and much larger spring brood of the Chalcids must appear, when it is to be hoped we shall have an opportunity of describing the male. The larvæ were all clustered upon the outside of the dead and dry *Megachile* larva.

Upon one of the female *Anthophorabia* I accidentally discovered an exceedingly minute Proctotrupid, one-ninth of an inch in length, which I am unable to refer to any known genus, and which will be found partially described on a following page; it is highly probable that it is an egg-parasite, as are most of the Mymaridæ, to which section it properly belongs; and it is not too large to live in the eggs of the *Anthophorabia*, small as the last named insect is.

#### ANTHOPHORABIA MEGACHILIS nov. sp.

*Female.* The head is very stout, broad and flattened posteriorly; the front is rounded ovate, narrowing a little anteriorly; the occiput is very distinct, and its vertex is very considerably elevated and slightly angulated; above the ocelli-bearing piece it is linear, but towards the eyes widens out into a linear triangular portion; in front, is a



transversely oblong piece bearing the three ocelli; in front of this is a smooth triangular area which rapidly contracts to a narrow line which connects this area with the anterior portion of the epicranium, thus dividing the front region of the head into two lateral halves composed of the large broad pieces, unusually developed in this genus, which bear the ovate eyes; the anterior portion of the epicranium is narrow triangular, and its surface is very convex; clypeus very short, transversely linear oblong; the mandibles are long and narrow, their tips very acute and slightly incurved; antennæ nine-jointed; second joint nearly as long as all the remaining ones collectively, a little dilated beyond the middle, but not bent so much as in *A. fasciata* Newp.; the succeeding four joints are shorter and more closely united together than in *A. fasciata* and the three terminal ones are united apparently into a single joint more acute than in the European species. Thorax and abdomen much flattened, hardly convex above; prothorax longer than broad, triangular; meso-scutum very small, trapezoidal, the sides converging a little towards the scutellum, which is larger than the scutum, oblong, twice as long as broad, the sides very exactly parallel and a little convex behind next the curved transversely oblong post-scutellum; on each side is a linear oblong parapsidal piece, and the parapsidal pieces on each side of the scutum are here especially marked, occupying a space larger than the scutum itself; meta-thorax narrow, small, shorter than broad. The fore wings have the costa divided into three convex portions of which the basal third is most convex; the sub-costal nervure follows these convexities, terminating nearly at the outer third of the wing, directed inwards at its extremity towards the middle of the wing, being more incurved than in *A. fasciata*. Hind wings nerveless, lanceolate, obtusely angulated in the middle of the costa, apex sub-acute. The legs are rather long and slender; coxæ long; femora, especially the hind ones, considerably swollen; tibiæ long, slender, not dilated at the extremity, with very slight and unequal spurs; tarsi five-jointed, slender, of very equal length, not dilated at the extremity, hairy and having the tip of each joint provided with a slender spine. The six-jointed abdo-

men is flattened, oblong, ovate, the sides quite parallel; tip a little obtuse ending in the slightly exerted ovipositor which is only visible from beneath. The body is of a uniform pitchy blackish brown including the entire head and antennæ. The legs are of a uniform pale testaceous honey yellow. Length, .04 inch.

*Pupa.* Side view. Head and thorax very exactly equal in length to that of the abdomen. The head is very narrow, and the rather long ovate eyes are situated nearly midway between the vertex and the anterior edge of the "gena" near where the antennæ are inserted. The thorax is bent at nearly right angles to itself a little in front of the middle; the terminal half of the antennæ lie near and parallel to the wings and the middle pair of long slender legs, which last reach to the middle of the abdomen. The first pair of legs are seen bent upon themselves midway between the insertion of the wings and the head; only the femora and tibiæ are visible, the tarsi being laid under the antennæ and the front of the head. Only the first pair of wings are visible, being inserted just half way from the vertex of the head to the base of the abdomen; they are long and narrow oblong, and in length equal the distance from the vertex of the head to a point parallel with the base of the abdomen. From under the tip of the wings proceed the tarsi of the last pair of legs, which terminate a little beyond the basal third of the abdomen; they are a little incurved towards the middle of the sternal surface. The meso-scutellum is distinctly seen, and is quite separate from the meta-thorax, when the body of the pupa is slightly contracted. In outline, the abdomen is elongate oval; the pleural line between the tergum and under side runs diagonally from the tergum of the base to near the tip. The minute, slender ovipositor surrounded by the pupal membrane projects considerably beyond the tip.

It differs very considerably from Newport's figure of the pupa (side view) of *A. fasciata*. The head is larger and the vertex much lengthened, rising up beyond the thorax which is stouter and bent at right angles to itself, while in *A. fasciata* it is simply convex. The wings are laid straight upon the side of the body, while in *A. fasciata* they are directed a little forwards.

Seen from below, in its general outline, the insect is long, narrow, elliptical ovate. The head is ovate, being longer than broad, and narrowing in front of the eyes; the vertex is very high and convex; eyes remote, the intermediate space broad and curvilinearly ridged just within the eyes; between the insertion of the antennæ and the eyes is a broad space; the antennæ are inserted near the anterior fourth of the front of the head; they are elbowed at the end of the second joint, which projects at a right angle beyond the head, thence they are folded upon the sternum, converging slightly, and their very acute tips reach to just before the coxæ of the second pair of legs. All the three pairs of coxæ are visible. The forelegs terminate at the second pair of coxæ. The ovipositor seems as if a continuation of the mesial ridge, and is nearly one-third the length of the entire abdomen.

*Larva.* Body short and thick, fourteen jointed, cylindrical, both extremities much alike; the larva assumes a lunate form, the head being inclined towards the tip of the abdomen, which is likewise incurved; the head is concolorous with the rest of the body, which is pale, pearly white; the rings are slightly convex, with no lateral raised line; terminal anal segment orbicular and rather large. Length, .04 inch, being one-third as broad as long.

#### PTERATOMUS\* nov. gen.

This genus will be easily distinguished from *Anagrus*, to which it is nearest related, by the obtusely conical abdomen and the narrower linear wings. The generic characters laid down by authors are so scanty that the comparison with other genera of this group cannot be carried farther. In the figure, a side view of the insect is given, and the following description is made from the insect in that position. Owing to its minute size the single specimen was unfortunately lost from the glass slide before a complete description could be prepared. Hence I am unable to state the number of tarsal joints, or the exact

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\* From the Greek *pteron*, a wing, and *atomos*, an atom.

number of the antennal joints, since they could not be distinctly made out with the light used; the figure represents the insect when magnified 250 diameters. It will be noticed that one of the forewings is fissured, while the other is undivided, but has the base of the inner edge of the wing dilated into a tooth-like expansion, at a point corresponding to the origin of the lower branch in the other wing. I am inclined to think that the simple wing is the normal form. The fact that one of the wings is fissured is interesting as showing the tendency of the wings of a low Hymenopterous insect to be fissured like those of *Pterophorus* and *Alucita*, the lowest Lepidopterous genera. In the figure I have not attempted to place the wings in their natural position. It will also be noticed that the right hind tibia and tarsus were wanting in the specimen. The species, which so far as I am aware is undescribed, is dedicated to my friend Mr. Putnam, who has enabled me to bring it to the notice of entomologists.

**PTERATOMUS PUTNAMII** nov. sp.

*Male.* Side view. Head very large, equalling the thorax in size, but surpassing that of the abdomen; in outline sub-rhomboidal, five sided, the vertex being equal in length to the under side of the head; the greatest length of the head is from the base to the obtuse point in front of the eyes; the eyes are large, globose, occupying a third of the side of the head; antennæ equalling in length the thorax; divided into three portions, the basal thick and cylindrical, the fourth joint large and much swollen, while the terminal joints form a slender cylindrical tip. The thorax is short and high; the outline of the tergum is very convex, especially above the insertion of the wings; the hind edge of the meso-scutum extends a little behind the middle of the entire thorax, whence it descends at an angle of  $50^{\circ}$  to the insertion of the abdomen; the wings are nearly twice the length of the body; the forewings in the single specimen are dissimilar, since one is deeply fissured into two linear spatulate feather-like portions, while the edges of the wing are fringed with long nearly straight hairs; the other primary is as large as the former, but a little longer, it is entire, spatulate, dilated

slightly on the base of the inner edge, with a central row of fine scales representing a median nervure, and the edges of the wings are fringed with hairs much longer than those on the other wing, and a little curved, thus giving a graceful, feather-like appearance to the wing. The hind wings are half as large, very slender linear and fringed like the forewings. Legs very long and slender, hardly longer than the whole body, hairy on the tibiæ and especially so on the tarsi; coxæ long and narrow; all the remaining joints are very equal in length and size in each pair of legs; femora linear, not swollen; tibiæ linear; tarsal joints very indistinct, slender and hairy beneath; no claws distinguishable. Abdomen compressed, triangular, truncated broadly at the tip which is obtusely rounded. In color the species is of a uniform dark piceous, with pale, almost whitish legs. Length, one-ninetieth of an inch.

A species of mite is also abundant in the nests of bees. According to Mr. Putnam several of our species of *Bombus* almost invariably occupy the forsaken nests of field mice, and he supposes that these mites which are of comparatively large size, come from the mice. This opinion is most probably the correct one. Mr. Newport has given a most interesting account of a new genus of mites peculiar to *Anthophora* which lives on that wild bee in all stages of its existence, but mostly while a larva. *Heteropus ventricosus* Newp. was found in immense numbers in the bee cells. When the female mite is full grown, its previously small abdomen swells to an enormous size, so that the animals look like "clusters of microscopic grapes." This immensely distended abdomen serves as a nidus for the young, which it is probable, are born alive, as Lyonnet has observed to be the case with the cheese-mite when exposed to high temperatures. (It is worthy of notice that the viviparous *Stylops* lives in a high temperature; i. e. in the abdomen of living bees.) We also learn that there are two other genera of *Acari* peculiar to the *Apidæ*; the *Trichodactylus* Dufour which is parasitic on *Osmia*, and *Ansetus* Dujardin.

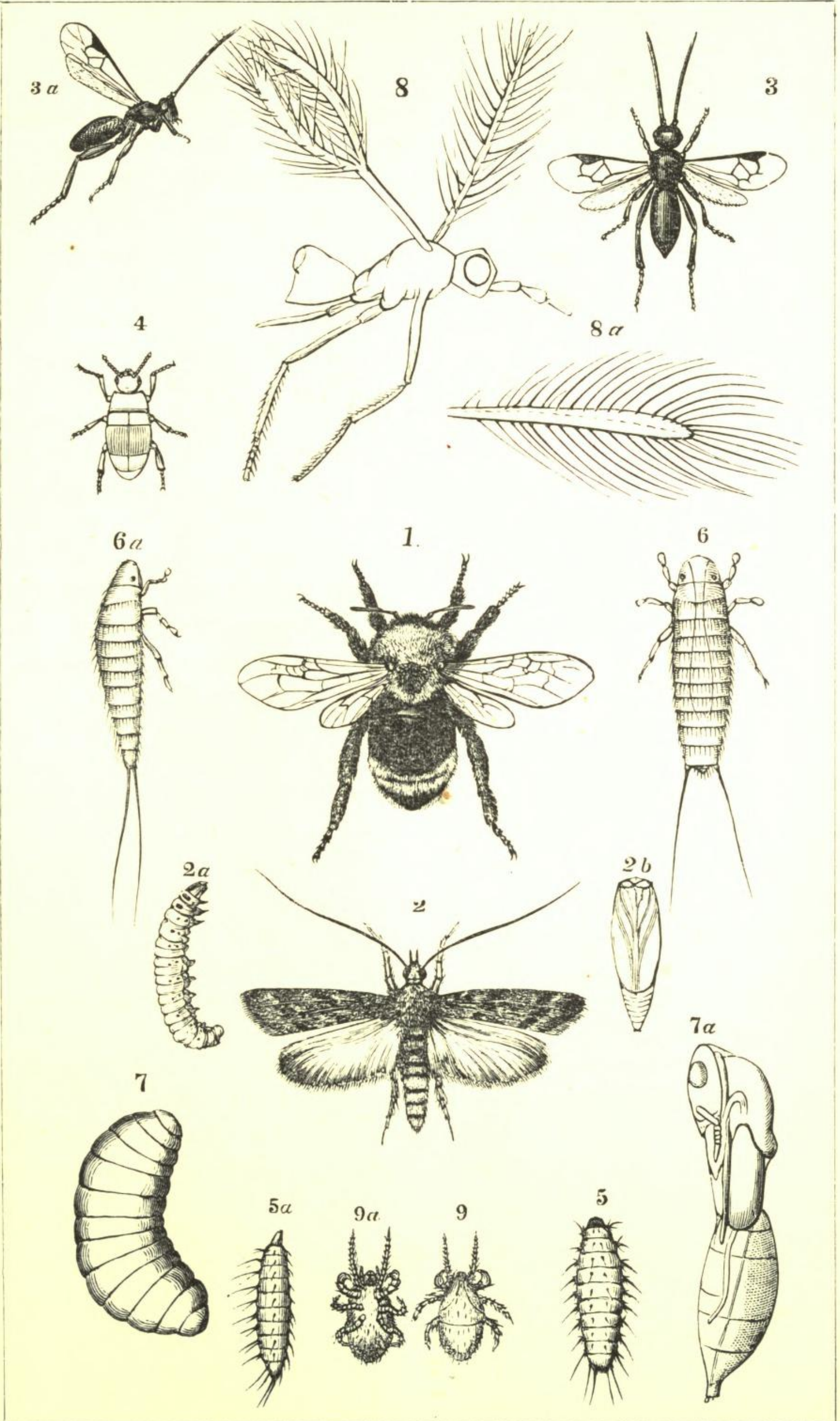
## EXPLANATION OF PLATE 3.

- Fig. 1. APATHUS ASHTONI Cresson.  
 Fig. 2. NEPHOPTERYX EDMANDSII Packard : 2a, *Larva* ; 2b, *Pupa*.  
 Fig. 3. MICROGASTER NEPHOPTERICIS Packard : 3a, side view.  
 Fig. 4. ANTHEROPHAGUS OCHRACEUS Melsheimer.  
 Fig. 5. DIPTEROUS LARVA, allied to VOLUCELLA : 5a, side view.  
 Fig. 6. *Larva* of STYLOPS CHILDRENI Gray : 6a, side view.  
 Fig. 7. *Larva* of ANTHOPHORABIA MEGACHILIS Packard : 7a, *Pupa*.  
 Fig. 8. PTERATOMUS PUTNAMII Packard, side view : 8a, Fore wing.  
 Fig. 9. MITE from nest of *Bombus* : 9a, ventral view (enlarged).

## ERRATA.

- Page 104, line 24, and page 108, line 30, for *Byturus* read *Anthrophagus*  
 " 131, " 9, for *Mezercon* read *Mezereon*.  
 " " " 11, for nest read net.  
 " " " 25, after female, insert situated almost wholly.  
 " 132, " 15, " abnormal, insert a.





J. H. EMERTON, on wood.