

**NOTICES OF INSECTS THAT  
ARE KNOWN TO  
FORM THE BASES OF  
FUNGOID PARASITES**

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Notices of insects that are known to form the bases of fungoid parasites by George Robert Gray

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**GEORGE ROBERT GRAY**

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*R. Gray*

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FUNGOID PARASITES.

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# NOTICES OF INSECTS

THAT ARE KNOWN TO FORM THE BASES OF

## FUNGOID PARASITES.

VARIOUS writers since the commencement of the eighteenth century<sup>1</sup> have published from time to time on the existence of plants having attached to them insects in the form of roots, and much light has been thrown upon the subject by the discoveries that have taken place during the last few years. These, in most instances, have appeared in works, the authors of which have more especially described the plants, although occasionally the botanical descriptions are accompanied with short notices of the habits of the larvæ or caterpillars to which the plants are attached. It is intended in the present paper to refer more particularly to the insect-portion of the Entomophytes, with a view of throwing some light on the position they occupy in the System of Entomology, and, at the same time, to offer some observations, as far as our knowledge will permit, on their habits, and thus to endeavour to account for the mode in which insects become the bases of the singular parasitical plants or fungi by which they are infested.

An American author has justly observed, that it is the zoologist who "must decide upon the various kinds of animals that bear the vegetable forest or harvest;" and it is his perfect coincidence in this remark which has induced the writer to compile the present confessedly imperfect account of the various species of insects which form the bases of the parasites, whether in the perfect or imago state, or in the pupa or larva stages of their existence. He trusts that it may be the means of drawing attention more particularly to the subject, and of thereby obtaining the co-operation of entomologists and others, who may have the opportunity of procuring information on this curious and interesting topic.

Five plates accompany this pamphlet, containing partly new figures, and partly copies from those given by other writers, which will be sufficient to convey a fair idea of the singular appearances presented by these compound animals

<sup>1</sup> The earliest account of an Entomophyte has been referred to by Mr. H. Hull in the *Proceedings of the Royal Society of Van Diemen's Land* for 1868, p. 183, who tells us that in the writings of Christian Franc. Paulinus, in the ninth century [this writer lived in the end of the seventeenth and the beginning of the eighteenth centuries], will be found the statement "that certain trees in the island Sombbrero in the East Indies have large worms attached to them under ground, in the place of roots," &c.

and plants to those who may not possess any examples of them, and will offer the materials of comparison to those who are already partially acquainted with the subject.

Hampstead, 1868.

G. R. Gray.

It is the intention of the writer to refer to these insects according to the position they occupy in the system; and this leads him in the first place to the Order COLLEOPTERA, in which several species of *Carabida* have been recorded as attacked by fungoid parasites. The imago of *Carabus hortensis*, which Vahl<sup>2</sup> remarked was not only found dead, but in a state of decay. To the mouth, thorax, side of the sternum, at the joints of the legs, and at the joints of the abdomen, were attached a species of *Clavaria*, for which he proposed the specific name of *setiformis*<sup>3</sup>. Other species of this family have been found to be infested during the autumnal months with the *Isaria cleuteratorum*<sup>4</sup>; while a larva<sup>5</sup>, probably of a species of *Corabus*, was discovered on the Pyrenees about 2900 feet above the sea, having growing on it the *Spharia entomorphiza*.

The larvæ and perfect insects of this family reside beneath stones, under the bark of trees, between clods of earth, in decaying vegetables, and in moss growing at the base of trees. They undergo their final metamorphoses in the autumn; on the approach of winter they hibernate in moss, &c., until the return of spring, when they may be seen wandering about paths, &c., in search of their prey, which consists of herbivorous larvæ and beetles.

Three species of the genus *Brachinus*, viz. *B. crepitans*, *B. sclopeta*, and *B. aspladens*, have been found by M. Rouget<sup>6</sup>, during spring and autumn, to be infested, while living, on the surface of their antennæ (Pl. I. f. 18), thorax, elytra, and legs, with a very curious minute yellow-coloured fungus, which has been named *Laboulbenia Rougeti*<sup>7</sup>. M. Rouget

<sup>2</sup> *Naturhist. Selak. Striet*, 1792, 2 band, 2 heft, p. 50.

<sup>3</sup> Probably the same as *Isaria cleuteratorum*?

<sup>4</sup> Nees von Esenb. *Syct.* 96. t. vii. f. 84; Ch. Rob. *Végt. Paras.* p. 607.

<sup>5</sup> Lucas, *Ann. Soc. Ent. de France*, 1840, vii. p. xl.; Ch. Rob. *Végt. Paras.* p. 661.

<sup>6</sup> *Ann. Soc. Ent. de France*, 1847, p. xxxiv.; 1850, p. 21. t. 3. f. 1.

<sup>7</sup> Mont. & Ch. Rob. *Ann. Sci. Nat.* 1846, p. 238; Ch. Rob. *Végt. Paras.* p. 622. t. viii. f. 1, 2, et p. 689. t. 1. f. 2.

says they are obtained on the mountains in the environs of Dijon, in dry as well as in low and moist places.

The habits of these insects are similar to the last; but they usually frequent damp places on the margins of great rivers and estuaries.

M. Bouget has also recorded three species of *Staphylinidae*, viz. *Goerius olens*, *Poderus riparius*, and *Ophonus brevicollis*, as affected by the minute parasite, *Laboulbènia Rougeti*; while M. Lebert states that the *Goerius olens* is also subject to a new disease, that shows itself in spots, in each of which fungi<sup>1</sup> are to be found, occupying the outer ring or its interior.

These insects reside in damp places on the margins of rivers, beneath dead leaves, and under the bark of decaying trees. Their food consists of decaying animal and vegetable matter, especially fungi, in which some of the species chiefly pass their existence.

A new species of *Gyrinidae* from the Cascades of Caracacas, which has been named *Gyrinus sericeus* (Pl. I. f. 17) by Ch. Robin and Laboulbène<sup>2</sup>, has a very minute parasite, the *Laboulbènia Guerinii*<sup>3</sup>, attached to the surface of the thorax, between the thorax and abdomen and the margins of the elytra.

This is the only true aquatic insect which has hitherto been recorded as having a parasitic fungus attached to it. The insects of this family pass their larva and perfect states in the water; but when the larva is about to assume the pupa state, it creeps out of the water up the stems of some plant that grows on the margin, and then envelops itself in an oval cocoon, which is pointed at each end.

The larva represented by Dickson may probably belong to the *Silphidae*?; it is that on which grows the typical example of the *Sphaeria entomorrhiza*<sup>4</sup>, springing from the pectoral portion of the thoracic segments.

Many of these insects frequent decomposed animal and vegetable substances, both in their larva and perfect states. Others reside under the bark of trees and in fungi.

Several large lamellicorn larvæ have been recorded by various writers<sup>5</sup> as thus infested, which, from the formation of their antennæ, are here placed provisionally in the family *Dynastidae*; although, from our imperfect knowledge of the peculiar characters of the various larvæ, it is impos-

<sup>1</sup> Ch. Rob. *Végét. Paras.* p. 636.

<sup>2</sup> *Paanhistophyton ovatum*, *Lebert*, *Berl. Entom. Zeit.* 1868, p. 170; *Noema bombycia*, *Négeti*.

<sup>3</sup> *Ann. Soc. Ent. de France*, 3 sér. i. p. 48. t. 11. f. 1.

<sup>4</sup> Ch. Rob. *Végét. Paras.* p. 624. t. ix. f. 1-3, et p. 637.

<sup>5</sup> *Dickson*, *Plant. Cryptog. Brit.* p. 22. t. 3. f. 3 (1785); Kirby and Spence, *Introd. to Ent.* iv. p. 208.

*Xylaria entomorrhiza*, *Gray*, *Nat. Arrang. of Brit. Plants*, i. p. 611. *Sphaeria (Cordyceps) entomorrhiza*, *Berkel.*

sible to affix any generic or specific names to them for the present.

These larvæ (Pl. I. f. 5, 6, 9, 10) are usually found in tropical countries, buried a few inches beneath the surface of the soil, which generally consists of leaves, fibres, and roots of plants in a state of decomposition, and are especially fond of places that are used as potato patches by the inhabitants, even on the elevated plateau of the Andes to the height of 2400 feet above the sea. They form themselves chambers in which they reside, by feeding on the decayed vegetable matter that surrounds them. They remain for four or five years in their larva state before they undergo their change into the pupa, previous to their final metamorphosis into the perfect insect; so that it may be easily supposed that the larvæ have ample time to get affected with the germ of the fungoid parasite, especially during rainy seasons. There can be no doubt that it commences its growth internally, as specimens have been met with having the fungus just bursting forth from the mouth and other parts of the body, "resembling a green pea;" but the most usual place is from the pectoral surface of the thoracic segments, and from between the segments and from the spiracles of the abdomen, the specimens varying, however, much in position, number, and mode of growth. These larvæ, from their unwieldy proportions, lie on their side within the chamber amidst the decaying vegetable detritus, and thus cause the fungus to partake of various contortions (Pl. I. f. 5), arising from the limited space in which it is confined, from its incapability to make its way through the vegetable detritus, or from the depth it might be when growing. It invariably projects upwards towards the surface of the earth, even should it commence its growth from the side of the jaw, or of the abdomen, on which the larva lies. The larvæ are usually found dead, and sometimes partly decayed; but this latter circumstance may greatly depend on the length of time during which they have lain in the damp soil after death, their death having been occasioned in the first instance by the growth of the parasite. On the other hand, it has been recorded by Mr. Mackay<sup>6</sup>, that the larva obtained at Maracaibo<sup>7</sup> "was alive when first found," and it is added, that "this is by no means a solitary instance in which these vegetable productions have made their appearance on living insects."

Though the larvæ of these insects are numerous and easily found in some localities, yet it may be remarked that periods of several years often elapse before specimens with fungi are again discovered, which seems to depend entirely on the return of a wet season at certain portions of the year,

<sup>6</sup> Kirby and Spence, *Introd. to Ent.* iv. p. 208; *Westw. Journ. Proc. Ent. Soc.* iii. p. v. pl. iv. f. 6; Ch. Rob. *Végét. Paras.* p. 664; *Waterhouse, Journ. Proc. Ent. Soc.* iii. p. xxxvi.; Ch. Rob. *Végét. Paras.* p. 666; *Stereus*, *Journ. Proc. Ent. Soc.* 1853, p. 109; *Waterhouse, Proc. Zool. Soc.* 1839, p. 146; *Leidy, Proc. Acad. Nat. Sci. Philad.* 1861, p. 235 f.

<sup>7</sup> *Proc. Zool. Soc.* 1839, p. 146.

<sup>8</sup> Where it is known to the natives by the name 'Projojoy.' See under this word in *Mussler's Scient. Treas.* 1848.



producing a certain condition of the insect which appears to be essential to the development of the fungoid parasites.

Pl. I. f. 9 represents what is probably the young of the same kind of larva, but which does not exhibit the appearance of having the body so entirely filled with the thallus internally; yet from the dorsal portion of the thoracic segments, where the thallus is spread over the surface, grows a long thick fungus of the length of two inches and a quarter, having a somewhat lengthened clavate head<sup>1</sup>. Another example (Pl. I. f. 10) consists only of the head and thorax of the same kind of larva, but which is not in any way infested with thallus; though from the pectoral portion springs a lengthened stem of a fungus, which is curiously divided, as if cut into two slender branches for about half its length, each of the branches being much curved, and furnished with an oblong head at the apex. Both these fungoid parasites have evidently grown for some part of their length above the soil, and they exhibit an entirely different habit from any previously described. They were brought by Mr. Velez from New Grenada, and are now deposited by him in the British Museum.

Mr. Jervis has also kindly mentioned that he is acquainted with a *Scarabæus* (*Dynastes* ?), apparently in the perfect state, which had been found in the hotter parts of New Grenada, having a fungoid excrescence<sup>2</sup> attached to it.

It may be here noticed that "a large kind of brown beetle" is recorded by the Rev. Mr. Taylor<sup>3</sup>, under the New Zealand name of 'Mumutans,' as abundant "amongst the sand-hills in the vicinity of the sea." This insect, he states, is sometimes found "completely filled with the nut-like substance, but in no instance has he noticed any plant shooting from it."

Among *Melolonthidae* must be noticed the *Melolontha vulgaris*, which has been recorded as in a broken and decayed state, having the sides of the body and legs infested with small round spots of a fungus called *Lycogala fragilis* by Holm<sup>4</sup>.

As the four following larvæ also form part of the same family, their habits may thus be given together under one head. Like those of the last-mentioned family, they pass the chief portion of their existence in the earth, *i. e.* from the egg-state until they are on the point of undergoing the metamorphosis into the perfect state. Their larva state being much prolonged, they are very destructive to grass and other plants that clothe the surface of the soil, by feeding on their roots, while traversing the burrows which they make in search of such food.

Fougeroux de Bondaroy<sup>5</sup> has described a larva which most probably belongs to *Rhyetrogus* or *Ancylonycha*. The para-

site on this larva is represented by the author as growing from a broad base of thallus, which is deposited *externally* on the upper side of the larva, in which respect it differs from most others that have been recorded. In proof of his opinion, he states, that in some specimens which had been preserved in spirit of wine, the plant had separated from the body of the larva, and exhibited the under surface of the basal part of the stem or thallus of the parasite fluted (Pl. I. f. 8), as if occasioned by only lying close to the outer surface of the abdominal segments of the insect. This mode of separation, however, may have been entirely caused by the action of the spirit upon the Entomophyte; but as the larva retains in some measure its perfect form, it may be inferred that its interior was previously filled with the thallus; and that, as in other recorded Entomophytes, it was not until after this had taken place that the fungus showed itself externally, as is evidently exhibited in Pl. I. f. 1, where it is represented bursting forth between two of the dorsal segments of the thorax. This manner of growth of the parasite may probably be caused by the position of the insect at the time it was exhausted by the progress of the thallus internally, the point of external growth being the nearest portion to the surface of the earth. The latter remark is also applicable to the other figures (f. 2, 3, 4), which at the same time afford evidence that the plant had grown above the surface of the soil. It is usual to find only one parasite on each larva (Pl. I. f. 4), although in some two, and in others even three (Pl. I. f. 2) have been noticed, varying much in length and form. It is remarked by the Rev. Mr. Berkeley, that the greater part of the fungi represented on pl. 5 of Fougeroux's Memoir belong probably to *Sphaeria entomorphiza*<sup>6</sup>.

Some larvæ described by Mr. Cist in 1824<sup>7</sup>, as found in North America, were considered by the late Count Dejean to be those of *Ancylonycha punctiollis*<sup>8</sup>. "It is not unusual," says Mr. Cist, "to find a number of the larvæ which have attached to them vegetable sprouts, in some instances 3 inches long." These excrescences generally proceed from the space "between the head and under part of the thorax, and in a few instances from the mouth." He further remarks, that in every case where he observed the vegetation, "the grub was not only dead, but in a state of decay." The sprout arising above the surface of the ground is the indication where the animal lies.

This may be the same larva that is referred to by Mr. Mitchell<sup>9</sup> as "found in wood-yards, around the stumps of dead trees, and often in sward-ground; in the latter it does extensive damage by devouring the roots of grass and of plants that fall in its way." The fungus at times appears in many places, rising to the height of several inches above the surface of the earth.

<sup>1</sup> It bears a great similarity to the *Cordyceps Ravenslii*, Berk.

<sup>2</sup> The natives gravely assure Mr. Jervis that this excrescence would be transformed into, or become, a large tree, called 'Dioniso,' a name which is applied to a species of *Diospyros* remarkable for its hard and beautifully-veined wood.

<sup>3</sup> Taylor, *New Zealand*, p. 423.

<sup>4</sup> *Acta Hays*, 1781, l. p. . t. . f.

<sup>5</sup> *Mém. de l'Acad. Roy. des Sci.* 1768, p. 467. t. 5. f. 1-9.

<sup>6</sup> *Lond. Journ. of Bot.* ii. p. 207.

<sup>7</sup> *Sillim. Amer. Journ.* viii. p. 276. pl. iv.

<sup>8</sup> *Dej. Cat. des Coléop.* p. 177.

<sup>9</sup> *Sillim. Amer. Journ.* xii. p. 26.

Similar kinds of larvæ are also found in South Carolina during the spring and summer months. But their parasites differ entirely from those usually found on this kind of insect, both in their manner of growth and general appearance. They are composed of a long and somewhat thick stem with a lengthened and subclavate head, and plainly evidence that part of the fungus had been exposed above the surface of the vegetable detritus.

Some larvæ were discovered near Sta Fé de Bogota by the late Mr. Stevens, which may possibly belong to the genus *Ancylonycha*, but certainly to a smaller species than those just noticed. These larvæ bear a great similarity to those mentioned by Mr. Cist, and, like them, the parasite invariably arises from beneath the head and the prothorax; in one specimen it has just made its appearance (Pl. I. f. 7), in another it is about 2 inches long, while in a third it reaches to about 6 inches in length (Pl. I. f. 8), of nearly equal thickness throughout, and having the tip somewhat acute and of a light colour. These examples were no doubt discovered, like those observed by Mr. Cist, by the principal portion of the fungus appearing above the surface of the vegetable soil.

In the family *Cetonidae* two instances have been recorded by M. Riche<sup>1</sup>, one of which occurs in a species of *Cetonis* from Madagascar, having a fungus proceeding from its head; while the other is in a species of *Gymnetis*, having a similar production on the thorax. As he neither gives further description nor figures of these two Entomophytes, they must remain thus briefly noticed.

In South Carolina there have also been observed during the autumnal months several larvæ, which showed that they were but slightly buried in rotten logs, as they had roots springing from around the base only of the stem. These insects, judging from the figures, may possibly belong to the family *Elaterida*. The parasite<sup>2</sup> differs in form from any of those hitherto known, being long, slender, and with the middle of each stem swollen by the mass of sporules; but the stem is sometimes found perfectly simple.

Various species of *Curculionidae* appear very liable to become the bases of fungoid parasites, viz.,

- Helipus celeus*<sup>3</sup>, Schomb., of Cayenne, Pl. I. f. 15.  
 — *brachypterus*<sup>4</sup>, of Brazil, Pl. V. f. 4.  
 — *hylobioides*, of Brazil, Pl. I. f. 11.  
 —, n. sp. ♀, of Egs.  
*Chalcoderma* —, ♀, of Para, Pl. I. f. 14.

<sup>1</sup> Cordyceps Ravenelli, *Berkel. & Curt. Journ. of Proc. Linn. Soc.* 1867, p. 169. pl. . f.

<sup>2</sup> *Bull. Soc. Ent. de France*, 1846, p. lvi.

<sup>3</sup> *Cordyceps stylophora*, *Berkel. & Broome, Journ. of Proc. Linn. Soc.* 1867, p. 168. pl. I. f.

<sup>4</sup> *Ch. Rob. Végét. Paras.* p. 660. t. viii. f. 6, *Sphaeria entomorbis*.

<sup>5</sup> *Newm. Zoologist*, 1856, p. 6927.

<sup>6</sup> *Ch. Rob. Végét. Paras.* p. 650. t. viii. f. 5, et t. xii. f. 3, et t. x. f. 3, *Sphaeria entomorbis*.

These insects have the thallus protruding from the proboscis, the joints of the body, and along the suture of the elytra; while from between the thorax and elytra spring one (Pl. I. f. 11, 14) or two, and even three long slender excrescences; and others sometimes proceed from different parts of the body (Pl. I. f. 15). The apical portion of these fungi is usually tapering and light-coloured.

In some other species, as

- Helipus*, n. sp., of Lima<sup>7</sup>,  
*Dionychus* —, ♀, of Brazil<sup>8</sup>,  
*Auchonus* —, ♀, of St. Vincent, Pl. I. f. 18.

The lengthened fungi noticed on these insects also proceed from between the thorax and elytra; but they have at the apex of each projection a clavate head of a pale colour. In some examples the stem has been observed to be branched.

Other species of this family are subject to become the bases of a very different kind of fungoid parasite, viz.,

- Hyponotus cloacius*, Germ., of Brazil<sup>9</sup>.  
*Pyrenopus bufô*<sup>10</sup>, Say, of Brazil<sup>11</sup>, Pl. I. f. 12.  
*Rhyssomatus* —, ♀, of the Amazon.

These insects have the thallus surrounding the abdomen, and sometimes extending between the thorax and elytra, from which spring numerous short excrescences having tuberculated heads of a yellow colour. This kind of parasite has been named *Stilbum Buquetii*<sup>12</sup>.

A specimen of *Calandria* is referred to by Messrs. Kirby and Spence<sup>13</sup> as having a fungus projecting from its rostrum.

The insects of this family, which are very numerous in tropical climates, live entirely on vegetable substances, and many of them are apterous; they are not unfrequently seen on the leaves, or in cracks and cavities in the bark of trees, and in the interior of stems of plants, &c. Some species are, however, found by turning over the partly decomposed leaves which lie on the ground, and the rotten trunks of fallen trees: such localities probably facilitate these insects becoming, during rainy seasons, the bases of the different kinds of fungoid parasites.

The only coleopterous insect that now remains to be noticed belongs to the family *Erotylidae*, and is the *Erotylus leniatus*<sup>14</sup> of Columbia. It is remarkable for producing occasionally from the head, from between the head and thorax, and from the sides of the body, a number of very slender vegetable appendages<sup>15</sup> (Pl. I. f. 18), the apex of each ending in a small tuberculated head of a yellowish colour.

The species of this genus are seen flying about during the

<sup>7</sup> *Hops, Journ. Proc. Ent. Soc. II. p. iv. pl. 8. f. 8.*

<sup>8</sup> *Ch. Rob. Végét. Paras.* p. 640. t. ix. f. 4, 5.

<sup>9</sup> *Prionopus lignarius*, Dej., *F. griseus*, *Forst.*

<sup>10</sup> *Ch. Rob. I. p. p. 640. t. viii. f. 3, 4.*

<sup>11</sup> *Mont. & Ch. Rob. Végét. Paras.* p. 640. t. xi. f. 1, 2, 3.

<sup>12</sup> *Introd. to Entom.* 1836, iv. p. 208.

<sup>13</sup> *Latr., Dejean, Cat. des Coléop.* p. 446.

<sup>14</sup> *Parry, Journ. Proc. Ent. Soc.* 1847, p. iv.

day in the dense forests of the tropical regions of the New World; when in repose, they seek the leaves of plants; while in the larva state, however, they live under the bark of trees or in fungi; but they chiefly feed upon decayed vegetable matter.

The LEPIDOPTERA are divided into two sections; the first of which embraces the *Lepidoptera Rhopalocera*, or Diurnal Lepidopterous Insects. These, however, require but a brief notice, as they have hitherto remained unrecorded as being the bases of parasitical fungi, or even of filamentous species or moulds,—and this notwithstanding the fact that most of these insects pass their existence and undergo their metamorphoses, as it may be said, in the air, where the seeds of these singular plants are stated to float, and thereby, in the opinion of some writers, get affixed to insects in their different stages of life; notwithstanding also that their food entirely consists of vegetable matter, which is supposed to be one of the chief channels by which the spores or seeds are conveyed into the interior of insects, where they are thought to lie dormant until some extraordinary coincidence awakes them into active life. Yet this section of Lepidopterous insects has, so far as is known, escaped from becoming the bases of these fungoid parasites.

It is different, however, with the next section, which consists of *Lepidoptera Heterocera*, or Nocturnal Lepidopterous Insects. It embraces various families.

The first family is composed of *Sphingidae*; various species belonging to several genera have to be noticed, as attacked by fungoid parasites or moulds, viz.,

- Pachylia achemenides*<sup>1</sup>, of Surinam.  
*Macrosila collaris*<sup>2</sup>, of St. Domingo, Pl. III. f. 12.  
*Sphinx carolina*<sup>3</sup>, of North America.  
*Anceryx Ello*<sup>4</sup>, of Para.  
*Anceryx pinastri*<sup>5</sup>, of Europe.  
*Smerinthus populi*<sup>6</sup>, of Europe.  
*Sphinx*? —? , of Jamaica.  
*Sphinx*? —? , of Guadaloupe.

All these insects are infested in their imago or perfect state, and are usually found, principally during or after the rainy season, attached to a leaf or trunk of a tree, sitting

<sup>1</sup> *Sphinx achemenides*, *Cram. Pap. Exot. t. 267. f. A. B*; *Griff. Anim. Kingd. Ins. ii. pl. 127. f. 1.*

<sup>2</sup> *Euchylia achemenides*, *Walk. List. Pap. Heter. B. M. viii. p. 191.*

<sup>3</sup> *Macrosila collaris*, *Walk. l. c. p. 201.*

<sup>4</sup> *Sphinx carolina*, *L.*  
*Phlegothonius carolina*, *Hübner, Walk. l. c. p. 216.*

<sup>5</sup> *Sphinx Ello*, *L.*  
*Anceryx Ello*, *Walk. l. c. p. 224.*

<sup>6</sup> *Sphinx pinastri*, *L., Lebert, Berl. Ent. Zeit. 1858, p. 179.*

*Anceryx pinastri*, *Walk. l. c. p. 228.*

<sup>7</sup> *Phallus radicante* de R. P. Engramelle, *Richard, Journ. de Phys. xv. p. 403 (1780).*

*Sphinx populi*, *L., Ernat, Pap. Eur. iii. t. 116. f. 162. m. (1782).*

*Smerinthus populi*, *Godart, Walk. l. c. p. 248.*

with their wings at rest, as if they had been suddenly exhausted by some peculiar action that progressed internally. This eventually shows itself in the form of a fungoid matter or mould\* entirely covering the external surface of the body and the principal nervures of the wings; at the same time, the margins of the latter and the basal joints of the legs become firmly attached to the leaves or trunks of trees; the fungus then grows rapidly on the head and thorax, and especially from the joints of the abdomen, in the form of slender filaments of various length and thickness. The parasite varies in different specimens: in some the filaments are rather thick, and sometimes flattened, especially at their base, reaching in the longest example to the length of about nine lines; while in others, they are slender and minutely branched on the sides, attaining the length of an inch and a half to two inches. There seems no doubt, from the position in which these are discovered, that the parasite was, as observed by Dr. Halsey<sup>7</sup>, "evolved while the *Sphinx* was yet in a state of existence:" but the fungus does not become fully developed externally until after the death of the insect; and it is usually more or less in a state of decay, dependent upon the length of time it has remained on the leaf or trunk after the development of the parasitical mould before it is discovered. The caterpillars of this family pass their life exposed to the atmosphere, in the same manner as those of Diurnal Lepidoptera, which appear equally to protect them from the attacks of the parasite. The chrysalides, on the contrary, bury themselves in the earth, to await their final metamorphoses; yet they also have not been found affected with fungoid parasites.

The next group, which produces several fungoid caterpillars, possesses the singular character of having its caterpillars covered on the segments of the thorax by horny shields, varying in form and strength, which protect that part of the insect while burrowing and forming chambers, either in the earth or timber, in which they reside. These characters not only differ in the genera, but also assume slight variations in the species of the same genus, giving rise to modifications in the form of the shields.

It embraces several families: the species about to be referred to belong to the *Heplialidae*. In this family, the horny shields partake more or less of the character of the trans-

<sup>7</sup> Mitchell, *Sillim. Amer. Journ. xii. p. 22.*

<sup>8</sup> Byess —, *Richard, Journ. de Phys. 1780, xv. p. 402.*

*Isaris sphingum*, *Halsey, Ann. Lyc. of N. Y. 1833, p. 125.*

*Isaris sphingum*, *Schwenk, Carol. n. 1296; Ch. Rob. Végét. Paras. p. 616.*

*Isaris sphingophila*, *Link, Spec. ii. 114.*

Mr. Mitchell thinks "that the seeds were scattered on the back and sides of the" caterpillar, "which was exposed everywhere to their influence, . . . whereupon it might be inferred they would germinate and enlarge until after the beginning of the fourth metamorphosis, when they would probably overcome their supporter."—*Sillim. Amer. Journ. xii. p. 24.*

<sup>9</sup> *Ann. Lyc. of New York, 1833, p. 125.*