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[Running title: “REV. M. J. BERKELEY / ON ENTOMOGENOUS
SPHÆRIA”.]

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*On some Entomogenous SPHÆRIÆ. By REV. M. J.
BERKELEY, M.A. F.L.S. (with a Plate, TAB. VIII.)*

It has been long known that certain clavariæform fungi are produced on larvæ and pupæ of insects, and one species which has excited much attention is developed on full grown wasps. In the former cases it appears that the Fungus is uniformly produced on insects which have gone into the earth to undergo their transformation, and proceeds from the anterior part of the body. The Guêpes végétantes, as they are called, are wasps infested with a very long often twisted fungus, which, if we may believe what has been reported on the subject, without however giving heed to such fables as those of Father Torrubia,* at least commences its development [*sic*] on the living wasp, and, according to Dr. Maddiana,† arrives at its full growth during the life of the insect, though at length reduced by its parasite to the last stage of debility.

Several species have been noticed, but three only at present are admitted. I have no doubt however that the production first noticed by Réaumur in *Mémoires de l'Académie des*

* Apparato para la Historia Natural Española in Madrid. 1754.

† *Annals of Lyceum of Nat. Hist. of New York*, vol. i. pt. 1.
1824. p. 125.

Sciences, 1726, p. 302, under the name of Hia Tsao Tom Tchom, a drug much esteemed in China, whose properties are detailed by Duhalde, vol. 3, p. 490;—that by Watson and Hill in the Transactions of the Philosophical Society, 1763, vol. 53, p. 271, in their Memoir on Mouches Végétantes des Caraïbes, and admirably figured by M. Fougereux de Bondaroy in Mémoires de l'Académie Royale des Sciences, 1769, Mémoire sur les Insectes sur lesquels on trouve des plantes; and thirdly the parasite of the guêpes végétantes are so many distinct species. A fourth and most extraordinary species is one sent by Dr. Joseph Hooker from Australia.

Unfortunately in none of these species have I been able to detect perfect asci and sporidia, by which probably they would be as well characterised as the already described species. The characters therefore given will be necessarily imperfect; but my object is not so much to establish the species as to collect them together, leaving to future observers the task of completing what I am unable to render perfect. When the genus *Sphæria* shall have been revised, all will be arranged in *Hypocrea*.

1. *Sphæria militaris*, Ehrh.

2. *Sphæria sphecocephala*, Kl. in *Hook. Herb.*; lenta, pallida, stipite longissimo tortuoso: capitulo brevi subclavato.

Jamaica, *Dr. Bancroft*. St. Vincents, *Rev. Lansdown Guilding*. And in other islands of the West Indies.

The whole appearance of this species is very different from that of any state of *Sphæria militaris*. The name given to it by Klotzsch with the authority of Künze attached to it, is clearly a wrong transcription of Künze's name in *Myc. Hefte*, for a somewhat analogous form of *Sp. militaris*; viz., *S. sphærocephala*. It is, however, so good that I have retained it. It is much to be desired that correct information should be obtained by some one resident in the West Indies as to the developement [*sic*] of this species, and more perfect specimens procured than those in the collections of the British Museum, and Sir W. J. Hooker, to which alone I have had access. The heads in these are dotted with the

young perithecia, but there is not the slightest vestige of asci or sporidia.

3. *Sphæria entomorrhiza*, Dicks.

4. *Sphæria sobolifera*, Hill (sub *Clavariâ*) *carnosa*, pallide fusca; capitulo subglobose, stipite æquali tereti prolifero.

Clavaria sobolifera, Hill. Vide Watson and Hill in *Phil. Trans. vol. 53, p. 271, 1763. tab. 23. Edward's Gleanings of Nat. Hist. tab. 335. Fougereux de Bondaroy, Mém. de l'Acad. des Sc. 1769. tab. 4.* Guadeloupe, Martinica, Dominica on the nymph of a species of *Cicada*. There are several specimens in the collection of the British Museum.

This species is extremely variable in form, but in its most perfect state has a subglobose head and proliferous stem; sometimes the terminal head is not developed and the stem is terminated by a number of little heads, which form a cluster as in a recorded variety of *Sph. militaris*; sometimes the stem is branched above, each branch being terminated by a little clavate head; sometimes a single head only is developed but tuberculated, and in this case there are no proliferous processes on the stem ; and occasionally not only the stem is even, without any proliferous processes but the head instead of being subglobose is absolutely linear as in the two following species. I have in vain examined specimens both dry and preserved in spirits in the hope of finding perfect asci, but the perithecia, though tolerably well formed, contained merely a few threads which broke up into short cylindrical portions. These are probably imperfect strings of sporidia, and if so differ materially from those of *Sp. entomorrhiza* and *Sp. Robertsii*. The greater part of the figures in plate 5 of Fougereux' Memoir belong probably to *Sp. entomorrhiza*. The substance figured on a perfect *Cicada* is a secretion as Mr. Gray showed me in several species in the British Museum.

5. *Sphaeria Sinensis*, n. s.; Fusca, stipite cylindræo deorsum subincrassato; capitulo cylindrico cum stipite conflente apiculato ; apiculo sterili. (TAB. VIII. fig. 11. a. b. c. d.)

Hia Tsao Tom Tchom. *Réaumur Mém. de l'Ac. des Sc.* 1726. p. 302, tab. 16. *Rees' Cycl.* vol. 17.

Hia Tsao Tong Tchong. *Duhalde. China.* vol. 3, p. 490.

Hea Tsaon Taong Chung. *Westwood, Ann. of Nat. Hist.* vol. 8, p. 217.

China. *Mr. Reeves.* Collection of Brit. Mus.

Attached by simple or very sparingly branched, very slender flexuous inarticulate threads, which spread more or less over the surface of the caterpillar. The substance of the caterpillar is replaced by a tough mass of very fine branched threads, which are far more compact than those in the substance of the fungus, mixed with colourless oil globules. The head is sometimes split into two or three linear portions.

This species is a celebrated drug in the Chinese Pharmacopœia, but from its rarity only used by the Emperor's Physician; it resembles in its properties those of Ginseng, being a strengthener and restorative, but does not like that cause hemorrhage. Father Perennin states that he was raised from a state of extreme weakness by the use of this medicine, which was administered, dressed in the body of a duck. The Chinese name refers to the notion that it is a herb in summer and a worm in winter. The specimens figured by Réaumur were imperfect, and therefore their true nature was not recognised, but the fungus was supposed to be a portion of the root of some plant to which at a certain stage of growth the caterpillar attached itself. It is sold in little bundles tied up with silk. I have seen several of these, but have not been able to find any in which the perithecia were fully developed.

TAB. VIII. fig. I. I. *Sphæria Sinensis*; *not. size*: one specimen with the head longitudinally splitting, *a.* radiating appearance of a fractured stem; *b.* filaments from the base of the stem; *c.* globules from the body of the caterpillar; *d.* filaments forming the central substance of the fungus-bearing caterpillar—all more or less highly *magnifi[e]d*.

6. Sph. *Robertsii*, Hook.—Sp. *Hugelii*. *Corda. Ic. Fasc. 4. cum opt. analysi.*

On the larva of *Hepialus virescens*, Doubleday. NewZealand.

The following valuable information was transmitted by Dr. Joseph Hooker, of H. M. Discovery ship, Erebus. “About *Sphæria Robertsii* I collected all the information and as many specimens as I could, but am still much at a loss to account for its developement [*sic*]. They are found in spring generally under tree ferns; the caterpillar is buried in the ground as is the lower portion of the fungus. Now both these fungi (i. e. this and the following species) belong to caterpillars which bury themselves for the purpose of undergoing the metamorphosis; and both Mr. Taylor and Mr. Colenso hold the same opinion that in the act of working the soil, the spores of the fungus are lodged in the first joint of the neck, and the caterpillar settles head upwards to undergo its change, when the vegetable developes [*sic*] itself. I do not remember, you have remarked in your “*Icones*,” that the entire body of the insect is filled with a pith or corky vegetable substance, and that the intestines are displaced, which my specimens in spirits shew well, and then what does the muscular fibre of the animal become? It must I suppose be all turned into vegetable, for the skin of the creatures remains quite sound all the time. This change may take place from the displacement of one gas and developement of another; it also occurs in the dark, and is hence somewhat analogous to the formation of Fungi on the timber-work in mines. However this may be, the whole insect seems entirely metamorphosed into vegetable with the exception of the skin and intestines.”

As in silk-worms attacked by *Botrytis Bassiana*, it is most probable that the caterpillar lingers a short time till the vital organs are clogged up with the mycelium. It does not appear that in any case it has made any progress with its cocoon [*sic*]. We are indebted to Mr. Dieffenbach for the knowledge of the moth to which the larva belongs.

7. *Sphæria Taylori*, n. s. stipitibus fasciculatis connatis

anastomosantibus; stromate breviter palmato rufo fulvo subtiliter velutino; ramis compressis; apicibus acutiusculis. (TAB. VIII. f. II. *a, b, c.*)

Banks of Murrumbidgee. Australia. *Mr. Adams.*

Springing from the head of an extremely large caterpillar. About six stems grow from the same point, forming a compact cylindrical mass $2\frac{1}{2}$ inches long, $\frac{3}{4}$ of an inch thick, connate slightly branched and anastomosing; expanding slightly upwards, and giving off a branch of short much compressed forked and palmate branches, which are dotted above with the perithecia. The apices are somewhat pointed. The colour of the whole is a deep red brown, inclining to tawny when dry. The whole of the branches are clothed with a very thin coat of extremely short forked irregular flocci, which give the surface a dull appearance when dry. They are at first solid, but at length become hollow. A portion of the caterpillar is filled with a white corky substance, for the root is more or less coated with a spongy mass, consisting of very slightly branched wavy threads.

The only specimen I have seen was not mature, but probably arrived nearly at its full growth as the incipient perithecia were evident towards the tops of the branches.

The following notes are from a letter of Dr. Joseph Hooker:—The information he states was received from the Rev. Mr. Taylor of Waimate. “This caterpillar Fungus was picked up on the banks of the Murrumbidgee River, 10 miles from the township of Yap (in New Holland) in a rich thick alluvial soil, with many others of the same kinds. When fresh it was 8 inches long, and 3 inches of the fungus from the nape of the neck were buried under ground, on the surface of which is the oval or circular flower-like bunch of branches of a brown velvety appearance when fresh. The caterpillar has a great resemblance to the green wattle caterpillar, which produces a large brown moth. The discoverer Mr. John Allan, the only person who has heard of it, found many empty holes near, as if the chrysalis had been hatched, and he saw many empty shells of these grubs scattered about

the same place, and at night the brown moths were so numerous as to be quite troublesome. The body of the insect was solid and pithy; the outer skin attached to the substance of the centre which has no roots in it; and moreover the pith is of the same substance as the stem, which is as thick if not thicker than the body of the caterpillar. Both the pith and stem when burnt have a strong animal smell. Mr. Allan saw nearly 30 about March, 1837.

TAB. VIII. fig. II. *Sphæria Tylori*, *nat. size*; *a.* a. magnified branchlets; *b.* filaments of sponge about the root, highly *magnd.*; *c.* do. from velvety surface, *do.*

I cannot close my paper without due acknowledgement to Mr. I. E. Gray and Mr. White of the British Museum for their kind assistance in the prosecution of my inquiries. Several other fungoid productions on insects are preserved in our National Museum, but none certainly referrible [*sic*] to the genus *Sphæria*.