

its fangs into itself, when confined in a gallon jar containing water, which was inverted at intervals in order to drown it, is open to question as to its conclusion that it was a case of "deliberate suicide," for the following reasons:—

(1) That it was after "the snake ceased any attempt to rise to the surface of the water in the jar," that the blow was struck. The snake then being wholly beneath the water, would die from drowning, and not from the self-inflicted wounds caused by its poisoned fangs.

(2) That it has been proved by experiment by Dr. Weir Mitchell that the venom of the rattlesnake is of no effect upon itself, when introduced into any wound in its body. I speak from memory of an article which appeared in the *Atlantic Monthly* some few years ago. That self-insertion of the poison would make any difference is not likely.

Drowning (by the act of others) and not self-poisoning (or suicide) I take to be the cause of death in the case described.

Halifax, August 15.

W. H. WOOD.

Numerous Insects Washed up by the Sea.

THE phenomenon referred to under the above heading in your issue of August 17 may be in part accounted for by the fact that on August 7, at many spots in the neighbourhood of Godalming (S.W. Surrey), the air was thick for several hours with swarms of winged ants. The direction of the wind was from the north-west, force moderate. Assuming the like to have taken place at other places, it is quite possible that large numbers of ants may have been carried out to sea and drowned from this region of Surrey and Hampshire.

Hunstanton, August 19.

OSWALD H. LATTEK.

THE FUNGUS GARDENS OF CERTAIN SOUTH AMERICAN ANTS.

ONE of the most interesting papers that has appeared during the present year, whether considered from the point of view of general biology or of mycology, is that which has recently been published by Herr Alfred Möller, nephew of Dr. Fritz Müller.¹ The work was carried out at Blumenau during the years 1890-92, and presents a clear and thorough investigation into the habits of the leaf-cutting ants and their remarkable custom of cultivating and feeding upon certain fungi. The work is introduced by a quotation from Thos. Belt's "Naturalist in Nicaragua," where the author, speaking of the leaf-cutting ants, states: "I believe . . . that they are in reality mushroom growers and eaters." This statement Möller fully proves in the work before us. The first portion, forming the bulk of the work, is given up to the consideration of the fungus gardens of the leaf-cutting ants, and is divided into ten sections.

1. *The species of the leaf-cutting ants and their activity outside of the nest.*—Belt's description² of the Nicaraguan ants is quoted, and the differences between them and those of Blumenau are pointed out. The chief point of difference is that the latter form very narrow streets, travelling only in single file, and that their nests occur both in the forest and in the open. The commonest species is *Atta (Acromyrmex) discigera*, Mayr, whose workers are never more than 6.5 mm. long. Almost as common is *A. hystrix*, Latr., whose workers reach a length of 9 mm. Rarer than these are *A. coronata*, Fabr., and a doubtful form, which Möller terms *Atta IV.*

A minute description is given of a street of *A. discigera*, which was 26 metres long and about 1.5 cm. wide and high, roofed in in parts wherever possible. It led to a number of small Cupheas, whose leaves the ants were cutting. In the street could be seen a procession of loaded ants going towards the nest, and others empty-handed, going in the opposite direction. Some of the large workers run up and down the road unloaded, and

¹"Die Pilzgärten einiger südamerikanischer Ameisen," Heft 6 of Schimper's "Botanische Mittheilungen aus den Tropen." (Jena: G. Fischer, 1893.)

²"Naturalist in Nicaragua," p. 71.

act as road-menders if any accident happens to a part of the track. Other very small workers, which do not cut leaves, may also be seen carried upon the backs or even upon the loads of the actual leaf-cutters. An ant carrying a peculiarly shaped piece of leaf was watched from end to end of the track, and travelled the 26 m. in 70 minutes. The load was twice as heavy as itself.

The other species of the *Atta* have very similar streets. *A. hystrix* appears to work only at night.

The jaws of the ants are very strong, with serrated edges, and clash together laterally. The ant begins at the edge of a leaf, and cuts out a piece in about five minutes, revolving on one of its hind legs as a centre. When the piece is almost freed, the ant goes on to the main portion of the leaf, cuts through the last piece uniting it with the severed portion, drags up the latter, balances it on edge between its forelegs, and then, grasping it with its jaws, lifts it up above its head, so that the centre of gravity of the load is above the ant itself. It then marches off, down the stem, to the base, over the ground to the end of the street, and along this to the nest, travelling at a very uniform speed, and never letting go its load. The weight thus carried was found, on an average, to be twice that of the ant; but many were found carrying heavier loads, even as much as ten times their own weight! A street of *A. coronata* was watched for fifteen minutes, during which time 217 ants passed, carrying 3 grammes of leaves.

2. *The Nests of the Ants, and the Fungus Gardens.*—The nests of *A. hystrix* and *A. discigera* are usually below the surface of the soil, but covered, wherever necessary, with a thick mass of withered pieces of leaves and twigs, &c. They may be as much as 1½ metres in diameter. In the nests of all four species there is found, filling up the interior, a curious grey spongy mass, full of chambers, like a coarse sponge, in which the ants may be seen running about, and in which, here and there, occur eggs, larvæ, and pupæ. This is the fungus garden, termed by Belt "ant-food." It is separated from the roof and lateral walls of the nest by a clear space. The walls and roof are much thicker in winter than in summer; one nest examined had a roof 25 cm. thick and wall 40 cm. Photographs are given in the original paper, showing the appearance of the mushroom garden.

3. *Investigation of the Gardens. The Kohl-rabi clumps.*—The garden consists of two parts, differently coloured, but not very sharply marked off from one another. The older part is yellowish-red in colour; the newly-built portions, forming the surface of the garden, are of a blue-black colour. It is this part which is of the greater importance to the ants.

The garden is found, on examination, to consist of an immense conglomeration of small round particles of not more than .5 mm. in diameter, of a dark green colour when quite fresh, then blue-black, and finally yellowish-red. They are penetrated by, and enveloped in, white fungus hyphæ, which hold the particles together. These hyphæ are similar throughout the nest.

Strewn thickly upon the surface of the garden are seen round white bodies about .25 mm. in diameter; they always occur in the nests, except in the very young portion of the gardens. They consist of aggregations of peculiar swollen hyphæ, and are termed by Möller the "Kohl-rabi clumps." The hyphæ swell out at the ends into large spherical thickenings, about 10-24 μ in diameter (the ordinary hyphæ are 5-8 μ thick), filled with richly vacuolated protoplasm like the ordinary hyphæ. These clumps of "Kohl-rabi" are only found on the surface of the garden, and form the principal food of the ants. A microscopic examination of the particles of which the garden is composed shows that they contain remains of leaves; bits of epidermis, stomata, spiral vessels, &c., occur in them.

4. *The Importance of the Garden to the Ants.*—If a nest be broken into and the garden scattered the ants collect