

mass of ice, and Reaumur relates many similar instances." Later on, pages 452-3 of the same volume, in treating of hibernation of insects, I find the following very interesting remarks: "But though many larvæ and pupæ are able to resist a great degree of cold, when it increases to a certain extent they yield to its intensity and become solid masses of ice. In this state we should think it impossible that they should ever revive. That an animal whose juices, muscles and whole body have been subjected to a process which splits bombshells and converted into an icy mass that may be snapped asunder like a piece of glass, should ever recover its vital powers, seems at first view little less than a miracle, and if the reviviscency of the wheel animal (*Vorticella rotatoria*) and of snails, etc., after years of desiccation had not made us familiar with similar prodigies, might have been pronounced impossible, and it is probable that many insects when thus frozen never do revive. Of the fact, however, as to several species, there is no doubt. It was first noticed by Lister, who relates that he had found caterpillars so frozen that when dropped into a glass they clinked like stones, which nevertheless revived. Reaumur, indeed, repeated this experiment without success, and found that when the larvæ of *Bombyx Pityocampa*, F. were frozen into ice by a cold of 15° R. below zero (2° F. below zero) they could not be made to revive. But other trials have fully confirmed Lister's observations. My friend, Mr. Stickney, the author of a valuable "Essay on the Grub" (larva of *Tipula oleracea*) to ascertain the effect of cold in destroying this insect, exposed some of them to a severe frost, which congealed them into perfect masses of ice. When broken, their whole interior was found to be frozen. Yet several of these resumed their active powers. Bonnet had precisely the same result with the pupæ of *Papilio brassicæ*, which, by exposing to a frost of 14° R. below zero (0° F.), became lumps of ice and yet produced butterflies. Indeed, the circumstance that animals of a much more complex organization than insects, namely, serpents and fishes, have been known to revive after being frozen is sufficient to dispel any doubts on this head." In Burmeister's "Manual of Entomology" the above instances are also referred to though at much less length, but as no additional facts are adduced it is unnecessary to quote from his work.

The above would seem sufficient to establish the proposition that some insects can survive freezing, and indeed when one remembers that insects successfully maintain their existence in the most arctic lands which have ever been visited by man, it seems strange that any one should ever have questioned it. Is it conceivable that these tiny creatures, when in a state of lethargy and partaking of no nourishment, could successfully resist yielding to frost in regions subject to a temperature of over 70° F. below zero, and when in summer the soil only thaws to the depth of 12 or 15 inches, the ground below this depth being perpetually frozen?

The meteorological tables of the English Arctic Expedition of 1875-6 show that the mean temperature of the winter months at the stations of the two vessels, *Alert* and *Discovery*, varied from 5° F. below zero in October and 17° F. below zero in April to 40° F. below zero in the middle of the winter, and that the minimum temperatures recorded were: -73½° F. at the winter quarters of the first named vessel, and -70.8° F. at the station of the latter in Discovery Bay.

In spite of these terrible temperatures the naturalists attached to the expedition were very successful, and Mr. Robert McLachlan, F.R.S., to whom the collections of insects were submitted, wrote as follows in his report:

"The materials brought home from between the parallels 78° and 83° N. latitude, showed quite unexpected, and, in some respects, astonishing results. I have no hesitation in saying that the most valuable of all the zoological collections are those belonging to the entomological section, because these latter prove the existence of a comparatively rich insect fauna, and even of several species of showy butterflies, in very high latitudes."

But the most interesting account of experiments on this subject which I have seen, is that given by Commander James Ross, R.N., F.R.S., and inserted by Curtis in the Entomological Appendix to the "Narrative" of Sir John Ross's second arctic voyage. The

experiments were Boothia Felix, at account (page lxxi)

"About thirt and after being ex were brought into returned to life, at to the air at a tem in this state they twenty-three came the air, and again eleven were restor and only two retun the winter, and in other."

That a caterp severe treatment a that alternate freez experimented upon

Many other si have thus brought fatal to insects, and the beginning of tl

Mr. DEARNESS plants which cause

Mr. FLETCHER tissues by the cryst

Mr. DEARNESS slowly many of the who had endeavour After they were we in the morning and others under a fence time he watered the as soon as the water up again, and were said, could be buried thawing were gradu

Prof. BOWMAN stages of their gro bacteria, that a kil withstand the effect that the woolly co were intended to pr

Mr. HARRINGT treated with a numb

Mr. Fletcher g Mr. W. H. Edwards America," who lives methods of breeding many valuable poin placed in a glass bot batting rather than food for twenty-four