

WORMS AND THEIR WORK.

MR. DARWIN'S NEW BOOK—WORMS—THEIR HABITS—THEIR FOOD—THEIR WORK IN THE PRODUCTION OF VEGETABLE MOULD—OTHER KINDS OF WORMS ON AN ACRE OF LAND—ON THEIR CASTINGS—ON OBSERVATIONS ON THE BEHAVIOUR OF WORMS IN THE FIELDS—THE ADVANTAGES OF WORMS IN THE FIELDS—THEir WORK ON ANCIENT BUILDINGS—WORMS AS GARDENERS—LARGE STORES OF WORMS IN THEIR ACTION.

I have been reading a remarkable book by our greatest living English naturalist, entitled, "The Formation of Vegetable Mould, through the Action of Worms, with Observations on their Habits." Let me at once say that wherever I think that a book with such a title must be dull and heavy it is very greatly mistaken. Scientific, of course, any work by Mr. Darwin must be; but his treatment is light and pleasant, and I know of no more interesting narrative of the great facts of biological science. The book of which I am speaking is not to be read by everyone within whose reach it comes; but as I know that amongst my readers there are many who will never obtain an opportunity of getting its pages for themselves, I am about to tell to you as briefly as possible a few of the most interesting facts about worms which Mr. Darwin, after long years of patient observation and study, has given to the world. Forty-two years ago he first drew attention to the wonderful part played by these simple and unobtrusive agents in the economy of nature; and now, from the voluminous notes of Mr. John Murray, his collector comes not only a re-statement of his earlier conjectures, but to give the world an exact and up-to-date account of the habits and usefulness of these creatures of the lowest order of life.

Let us first hear what Mr. Darwin has to tell us as to the uses of worms. Pick up an earth-worm, and you will find that it has a mouth, but no eyes. It appears, however, that it is particularly sensitive to light. Mr. Darwin kept several worms in jars, which were protected from currents of air by glass plates. From experiments made on many successive nights he has come to the conclusion that light affects worms by its intensity and direction; but it is only the anterior extremity of the body, where the cerebral ganglia are situated, which is affected. If this part is shaded, other parts of the body may be fully illuminated, and no effect produced. The light presumably passes through their skin. This sensibility to light enables them to distinguish between day and night, and to thus escape the attacks of the many animals which prey on them during the day. The sense of hearing is totally wanting. Small vibrations, the deepest and loudest tones of a human voice, the noise of a piano, make no impression upon them; but they are extremely sensitive to vibrations, as, for instance, if placed on the piano. They can smell in this sense in holes, and, apparently, confined to the perception of certain natural odours, such as those of cabbage-leaves, onion, and horse-dung, upon which they feed. Of their mental qualities there is little to be said.

It has been seen that they are blind in respect of light and sight. Mr. Darwin decides whether they are an exception of an touch pain when injured as they seem to express by their contortions. "Judging by their responses for certain kinds of food," he writes, "they must enjoy the pleasure of eating." They are omnivorous. They swallow enormous quantities of earth, out of which they extract any digestible matter which it may contain. Half-grown larvae are consumed by them in great numbers; raw and roasted meat, and especially raw fat, seem pleasant to their taste; and they are also, it must be confessed, voracious. The earth softened by a worm is ejected from its nostrils in the form of "castings," and not upon the surface. It is in this process that the useful work of the earthworm begins. Let us look carefully at the following facts.

It has been estimated that 25,000 worms exist in an acre of land; but this estimate is founded upon the number of worms in grass. How numerous live in old pasture lands, Mr. Darwin tells us, is unknown; but he assumes that at least half the above number, or 12,500 worms, live on each acre. He has discovered that the weight of the "castings" annually thrown up on an acre of land amounts to 175 tons, and concludes that the total volume of earth which a system of about 25,000 of soil. The sifting of the floor from the cow-pie particles of which this work entails produce that layer of vegetable mould upon the surface which

is so important to the agriculturist. "When we behold a wide level-surfaced expanse," writes Mr. Darwin, "we should remember that this smoothly levelled surface, to all the inequalities having been slowly levelled by worms. It is a marvellous discovery that the whole of the superficial mould over any such expanse has passed, and will again pass every few years, through the medium of worms. The plough is one of the most important agents in the levelling of man's (artificial) surface; but before he raised the land was levelled by nature, and still continues to be thus ploughed by earth-worms. It may be thought that there are many other things which have played an important part in the levelling of the world as done by organized creatures. In particular, one of our great field-workers, Coles, long ornamental, stone implements, every object liable to decay is dropped on the surface of the land, and is slowly levelled by the castings of worms; and it may be levied by the castings of worms in a few years, and will thus be raised to the level of the land at some future time is turned up. For instance, in some years ago, a great field was discovered in the neighbourhood of Stroudwater, with the result that a great many iron arrow-heads were discovered in the furrows, which were undoubtedly raised in the days of Alexander the Great in the year 330. In 1870, Mr. Darwin bought twelve tons of iron in Norway, which he had shipped at a distance of 1,000 miles, and to a depth of 10 or 12 feet, and the arrow-heads found on many occasions reminded that Mr. T. H. Furness, of Alnwick Hall, covered an adjoining field to be searched. This led to the excavation of ordinary and of several Roman weapons, dating from 121 to 124, were discovered.

To show how rapidly the surface of the earth undergoes transformation by the labour of worms, it may be noted that amongst these relics was found a halfpenny of George I., 1714, which had probably been dropped on the ground during the last century, and since then buried under the soil to a considerable depth by the castings of worms. Recent theories and observations made at Alnwick proved that many worms lived beneath the floor and the walls of the various of the villa at the time when the excavation was made; and that quantities of soil were being brought up, by them to the surface. There is not the same reason to doubt, says Mr. Darwin, that worms have acted in the manner ever since the period when the accurate was sufficiently deepened to allow them to penetrate it; and even before that period they would have lived beneath the floor as soon as it became previous to rain, so that the soil beneath was kept damp. The floor and walls, which must, therefore, have been continually undermined; and their earth must have been heaped on them during many centuries, perhaps for a thousand years." Similar observations at Deanby Abbey, in Hampshire, destroyed by Henry VIII.; at Chesham, in Gloucestershire; at Driffield, in the Isle of Wight, at Holesden, in Hampshire, prove that worms have been the most important part in the burial and concealment of Roman and ancient buildings in England.

Worms prepare the ground in an excellent way for the growth of those rooted plants and seeds of all kinds. Not only do they, as we have seen, periodically expose the mould to the air in the form of castings, but they bring the limbs of the dead animals, the harder parts of insects, the shells of land mollusks, leaves, twigs, &c., beneath the surface within reach of the roots of plants. That rich, dark soil, so much prized by gardeners, is chiefly due to the action which worms drag into their burrows, partly for the purpose of food and partly in plug up their holes. The work is, indeed, a most curious and successful gardening. It allows the air to permeate deeply into the ground; it lightens the mould for the downward and retarded progress of roots; its castings enable many seeds to strike root. We have all heard farmers speaking of how much objects are buried, stone, lime, and clinkers on the surface of their fields work downwards; and I suppose as if by magic. But Mr. Darwin proves that the work is the industrious husbandman who performs this useful office. For instance, suppose a large stone of irregular shape to be lying on the surface, "it casts, of course," writes Mr. Darwin, "its most protruding parts; but worms soon fill up with their castings all the hollows which the stone leaves behind." They appear to like the staling of stones, so anyone who raises a large piece of rock embedded in the soil will discover. "As soon as the hollows are filled up the worms open the earth which they have

underlaid behind, the circumference of the stone, and thus the surface of the ground is raised all round the stone. As the hollows are filled directly beneath the stone after a time collapses, the stone sinks a little." It is almost impossible to over-estimate the importance which this work, proceeding constantly on it in an every acre of cultivated land in England, has in the farmer or the gardener.

The immense indebtedness of man to these humble denizens of the crust of the earth has been long concluded. The worm has been highly spoken of and just justice has been done to the continuous perseverance with which it levels our fields, makes fruitful the soil, and accomplishes the good which Shakespeare tells us to look for in everything—

Killing lice and gnawing wood,
And things of that kind and industry have.

All have they paid to give in the great romance of nature; and Mr. Darwin's book should at least serve to impress upon light-thinking people that, after all, the man who would turn aside rather than step upon the worm in his path has gratitude and wisdom on his side.