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It should, and doubtless will, prove a great encouragement to those who have, in ever so feeble a degree, the faculty of observation to find, as they will find, from a perusal of these pages, that the simplest, most readily made observations may, if carried out with patience and perseverance, lead to the most important results. Of course, there are few indeed who have the faculty of observation so finely developed as Mr. DARWIN. Few have his unwearied patience, his clearness and candour of statement; but on, the other hand, we think no one of ordinary intelligence can read these pages without feeling that it is in his power also, if he will but give the necessary patience, to add materially to the store of knowledge, and to arrive at results likely to be practically useful. The earlier chapters are devoted to the structure and habits of worms. So lowly organised are they that they have neither eyes, nor ears, nor sense of smell; they are, nevertheless, endowed with a digestive system, delicate sensibility to touch, and powerful muscles—even intelligence is not denied to them. We must refer our readers to the book itself, wherein these facts are substantiated by repeated observations and carefully devised experiments. These observations and experiments are very interesting—most important for the purpose to which they are applied—and valuable from the point of view we have already alluded to, viz., the ease with which they may be made even by unskilled observers; but to allude to them at length here would be as unfair to the reader and author as it would be to pick out the plot of a novel and unravel its *dénouement*. This is better done by the reader himself.

Briefly, then, we may say that the object of the volume is to show that worms have and do contribute a very large share in the formation of vegetable mould in districts where they exist, and to point out in what manner they do it. This necessitates an examination of their structure, and a study of their habits. As long ago as 1837, Mr. DARWIN published the results of his first observations, in which he showed that small fragments of burnt marl, cinders, &c., thickly strewn over the surface of some meadows, disappeared after a few years, and were found in a uniform layer at some few inches from the surface, buried beneath the accumulated fine soil brought to the surfaee by worms in the form of castings. "I was thus led to conclude," says Mr. DARWIN, "that all the vegetable mould over the whole country has passed many times through, and will pass again many times through, the intestinal canals of worms; hence the term animal mould would be in some respects more appropriate than that commonly used of vegetable mould." In a communication to the *Gardeners' Chronicle* so long ago as 1844 (p. 218) Mr. DARWIN gives an account of the successive layers of lime and cinders which he found in a pasture, and the varying depths at which he found them in succeeding years. At first on the surface, they were found in subsequent years 1, 2, 4, up to 17 inches below the surface. In the present volume evidence of a similar character is given on soils of various characters. Step by step, item by item, the evidence is given, till, as we have said, the inference becomes inevitable. At first sight it may appear to many as if the agency must be too insignificant to produce such vast results. Mr. DARWIN alludes to this in his introduction, wherein he quotes some remarks made by Mr. FISH (*Gardeners' Chronicle*, April 17, 1869, p. 418), in which that writer assumed—we call attention to the word assumed—that such feebly endowed creatures could not have accomplished such stupendous work. "Here," says Mr. DARWIN, "we have an instance of that inability to sum up the effects of a continually recurrent cause, which has so often retarded the progress of science as formerly in the case of geology, and, more recently, in that of the principle of evolution." Knowing what we do now as to the "stupendous" work continually carried on by creatures individually the most insignificant, the objection has, indeed, not much value; but it is not in Mr. DARWIN to be satisfied with "assumptions" when direct evidence can be obtained, and so, not content with his previous observations and the large number of similar ones made by himself, or by others at his instigation, he resolved to attack the problem from another side, and to ascertain the number of worms that live within a given space, and to weigh all the castings thrown up within a given time in a measured space, as had been done also by VON HENSEN. As to the number of worms, from his own and HENSEN'S statements it appears that an acre of land may contain 57,767 worms! With reference to the weight of earth brought up by worms, numerous experiments were made in different places and under different conditions. We have only space to cite one case, wherein a quantity of earth derived from worm castings in a given time over a square yard, well dried before a fire, was found to weigh 3½ lb., or at the rate of 7.56 tons of dry earth per annum per acre. In other cases 15 to 18 tons per acre were estimated to have been ejected, the thickness of mould so accumulated over the whole surface being estimated at from 0.83 inches in poor soil up to as much as 2.2 inches in the course of ten years.

Space will not allow us to do more than allude to the important and interesting chapters in which Mr. DARWIN has shown how ancient buildings, Roman villas, and the like have become covered up by the agency of worms, nor to those in which he treats of the amount of denudation of the rocks which form the earth's crust effected by worms, and the formation of parallel horizontal ledges on hill-sides, which he thinks may, in some instances, owe their formation to this agency. What worms do for the farmer and gardener is told in the following extract, which will show that, however objectionable these creatures may be in a flower-pot, their value in a pasture or in an arable field is beyond all that we have previously conceived on the subject:—

"Worms prepare the ground in an excellent manner for the growth of fibrous-rooted plants and for seedlings of all kinds. They periodically expose the mould to the air, and sift it so that no stones larger than the particles which they can swallow are left in it. They mingle the whole intimately together, like a gardener who prepares fine soil for his choicest plants. In this state it is well fitted to retain moisture and to absorb all soluble substances, as well as for the process of nitrification. The bones of dead animals, the harder parts of insects, the shells of land-molluscs, leaves, twigs, &c., are before long all buried beneath the accumulated castings of worms, and are thus brought in a more or less decayed state within reach of the roots of plants. Worms likewise drag an infinite number of dead leaves and other parts of plants into their burrows, partly for the sake of plugging them up and partly as food.

"The leaves which are dragged into the burrows as food, after being torn into the finest shreds, partially digested, and saturated with the intestinal and urinary secretions, are commingled with much earth. This earth forms the dark-coloured, rich humus which almost everywhere covers the surface of the land with a fairly well-defined layer or mantle. VON HENSEN* placed two worms in a vessel 18 inches in diameter, which was filled with sand, on which fallen leaves were strewed; and these were soon dragged into their burrows to a depth of 3 inches. After about six weeks an almost uniform layer of sand, a centimetre (.4 inch) in thickness, was converted into humus by having passed through the alimentary canals of these two worms. It is believed by some persons that worm-burrows, which often penetrate the ground almost perpendicularly to a depth of 5 or 6 feet, materially aid in its drainage; notwithstanding that the viscid castings piled over the mouths of the burrows prevent or check the rain-water directly entering them. They allow the air to penetrate deeply into the ground. They also greatly facilitate the downward passage of roots of moderate size; and these will be nourished by the humus with which the burrows are lined. Many seeds owe their germination to having been covered by castings; and others buried to a considerable depth beneath accumulated castings lie dormant, until at some future time they are accidentally uncovered and germinate.

"Worms are poorly provided with sense-organs, for they cannot be said to see, although they can just distinguish between light and darkness; they are completely deaf, and have only a feeble power of smell; the sense of touch alone is well developed. They can therefore learn little about the outside world, and it is surprising that they should exhibit some skill in lining their burrows with their castings and with leaves, and in the case of some species in piling up their castings into tower-like constructions. But it is far more surprising that they should apparently exhibit some degree of intelligence instead of a mere blind instinctive impulse, in their manner of plugging up the mouths of their burrows.

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