

A WORM WILL TURN IF TRODDEN UPON.

UNTIL lately we were in ignorance of whatever else a worm could do, but turn when trodden upon. Mr. Darwin has thrown a light upon our ignorance, and given us a delightful history of the occupation and habits of Worms, which reads more like a fairy tale than one of real and proved facts.

As far back as 1837, Mr. Darwin publicly read a paper on the "Formation of Mould." Readings or Lectures upon such subjects make little impression on any, excepting those to whom the wonderful works of the Creator are an incessant and undestroyable delight. In 1881 (nearly half a century afterwards, Mr. Darwin has given to the world his volume respecting the "Formation of Vegetable Mould through the Action of Worms; with Observations on their Habits."

It is a curious subject, which all men and women should not only read, but understand—to this point, that man could not dispense with the despised earth-worm. It is these creatures which have made the land fit for agriculture and for the residence of man.

The greatest part of mould is of their manufacture. In some parts of the British Islands, they annually bring to the surface of each acre of land from ten to eighteen tons of rich fine mould—that is to say, they do not make the earth, but take the common earth, with its particles of sand and its decayed vegetation, and by continually consuming and passing it through their bodies over and over again, the rich and valuable mould is formed, is by them thrown to the surface, and, in time, the face of the country is thus renewed.

Mr. Darwin calculates the actual weight of soil rendered serviceable for vegetable life in Great Britain alone by the worms, since man's appearance on the islands, at the enormous total of *three hundred and twenty billion tons*.

And how do they manage this? They are earth's scavengers, and drag from it decayed leaves and vegetable matter (and we happen to know that they try hard to abstract lace and fine muslin when put on the grass to whiten), and return it in a changed form to germinate seeds and force the growth of plants, and to render the earth lighter and more capable of receiving the chemical properties of the air and sun; and thus these much despised creatures are the benefactors of mankind.

Earth worms are blind, yet sensitive to light. Each has a mouth, which corresponds to the proboscis or trunk in other animals. It digests its food by a secretion in its "calciferous glands," or lime glands, which in this respect is unique, and does not exist in other animals. Their sense of smell is feeble; yet they show in their choice of food a decided preference for the odour and taste of cabbage and onions, and also for raw fresh fat. If they are not deaf, they show no signs of hearing anything, excepting that they are sensible to the vibration of the earth caused by solid bodies falling on it. Mr. Darwin says they have a mechanical intellect, as they know perfectly well which end of a leaf is capable of being drawn into their burrow without injury to themselves. They take hold of the base of a fir-needle and drag it down, because if drawn in by the point it would injure their burrows, and they are careful to press the point of the needle into the fine earth. The leaves of the ash they draw in by the point, as they use these for food. It was proved, by furnishing them with triangles of greased paper, that the worms chose sixty-two times out of a hundred the easiest point by which to draw it into their burrows.

Mr. Darwin gives the following respecting the intelligence of worms:—"If worms are able to judge, either before drawing or after having drawn an object close to the mouths of their burrows, how best to drag it in, they must acquire some notion of its general shape. This they probably do by touching it in many places with the anterior extremity of their bodies, which serves as a tactile organ (or organ of feeling). It may be well to remember how perfect the sense of touch becomes in a man when born blind and deaf, as are worms. If worms have the power of acquiring some notion, however rude, of the shape of an object and of their burrows, as seems to be the case, they deserve to be called intelligent; for they act in nearly the same manner as would a man under similar circumstances.

"However, as chance does not determine the manner in which objects are drawn into the burrows, and as the existence of special instincts for each particular case cannot be admitted, the first and most natural supposition is that worms try all methods until they at last succeed; but many appearances are opposed to such a supposition. One alternative alone is left, namely, that worms, although

standing low in the scale of organization, possess some degree of intelligence.

"This will strike everyone as very improbable; but it may be doubted whether we know enough about the nervous system of the lower animals to justify our natural distrust of such a conclusion. With respect to the small size of the cerebral ganglia (the brain's nerve-knots) we should remember what a mass of inherited knowledge with some power of adapting means to an end is crowded into the minute brains of a worker ant."

The construction of the burrows of worms forms another interesting item of natural history. "The burrows run down perpendicularly, or more commonly a little obliquely. They are said sometimes to branch, but as far as I have seen this does not occur, except in recently dug ground and near the surface. They are generally, or, as I believe, invariably, lined with a thin layer of fine dark-coloured earth voided by the worms, so that at first the burrows must be made a little wider than their ultimate diameter. I have seen several burrows in undisturbed sand at a depth of four feet six inches, and others close to the surface thus lined, in recently dug ground. The walls of fresh burrows are often dotted over with little globular pellets of voided earth still soft and viscid, and these are spread out on all sides by the worm as it travels up or down its burrow. The lining thus formed becomes very compact and smooth when nearly dry, and closely fits the worm's body. The minute reflexed bristles which project in rows on all sides from the body have excellent points of support; and the burrow is rendered more adapted for the rapid movement of the animal. The lining appears also to strengthen the walls, and perhaps saves the worm's body from being scratched. I think so because several burrows which passed through a layer of sifted coal-cinders spread over the turf to a thickness of one-and-a-half inch, had been thus lined to an unusual thickness. In this case the worm, judging from the castings, had pushed the cinders away on all sides, and had not swallowed any of them. In another place, burrows similarly lined, passed through a layer of coarse coal-cinders three-and-a-half inches in thickness. We thus see that the burrows are not mere excavations, but may rather be compared with tunnels lined with cement.

"The mouths of the burrow are, in addition, often lined with leaves; and this is an instinct distinct from that of plugging them up, and does not appear to have been hitherto noticed.

Many leaves of the Scotch fir or pine (*Pinus sylvestris*) were given to worms kept in confinement in two pots; and when after several weeks the earth was carefully broken up, the upper parts of three oblique burrows were found surrounded for lengths of seven, four, and three-and-a-half inches with pine-leaves, together with fragments of other leaves which had been given the worms as food. Glass beads and bits of tile which had been strewed on the surface of the soil were struck into the interstices between the pine-leaves, and these interstices were likewise plastered with the viscid castings voided by the worms. The structures thus formed cohered so well that I succeeded in removing one with only a little earth adhering to it. It consisted of a slightly curved cylindrical case, the interior of which could be seen through holes in the sides and at either end. The pine-leaves had all been drawn in by their bases, and the sharp points of the needles had been pressed into the lining of the voided earth. Had this not been effectually done, the sharp points would have prevented the retreat of the worms into their burrows; and these structures would have resembled traps armed with converging points of wire, rendering the ingress of an animal easy and its egress difficult or impossible. The skill shown by these worms is noteworthy, and is the more remarkable as the Scotch pine is not a native of this district.

"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 shell of land-molluscs, leaves, and twigs, 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, partly 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 eighteen 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 three inches. After about six weeks an almost uniform layer of sand, a centimeter (four inches) 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 five or six 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."

When we behold a wide turf-covered expanse we should remember that its smoothness, on which so much of its beauty depends, is mainly due to all the inequality having been slowly levelled by worms. It is a marvellous

reflection that the whole of the superficial mould over any such expanse has passed, and will again pass every few years through the bodies of worms. The plough is one of the most ancient and most valuable of man's inventions; but long before he existed the land was in fact regularly ploughed, and still continued to be thus ploughed by earth-worms. It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organised creatures. Some other animals, however, still more lowly organised, namely, corals, have done far more conspicuous work in having constructed innumerable reefs and islands in the great ocean, but these are almost confined to the tropical zones.*

How Mr. Darwin gained his knowledge of the habits of the worms, whose history and work he has given, must be ascertained by the readers of his fascinating book, which has seven chapters. Chapter IV. shows the part which worms have played in the burial of ancient buildings. Mr. Darwin's book should not be hurriedly read.

NOTE.—We refer our readers to December number, 1881, of the *Ladies' Treasury*, page 686, for information as to the animalculæ-polypi, which form the foundations of new land and purify the ocean of foreign substances—tiny creatures which yet produce ten thousand children in a day.