

EARTHWORMS.

Every one is more or less fully aware of the importance of 'little things'; but few indeed have any adequate conception of the great results effected by the long-continued operation of seemingly insignificant agencies. It is a well-known fact that many of the once famous cities of antiquity have long since disappeared, some of these cities so vast that it is quite impossible the stones of them can have been all removed. Yet where we may have reason to believe that some few centuries ago a city stood, we find to-day a green expanse of pasture-land, with here and there perhaps a few rounded knolls or mounds relieving the flatness of the scene. Turning up the sod behind us, we probably find a fine black loam, suggestive of a deep rich virgin soil; but digging deeper, we may strike upon the marble plinth of a ruined column, or the tesserae of some old mosaic pavement. The fact that in the course of years great cities are found thus buried many feet below the ground, must often have appeared a mystery to many. We confess to having been frequently puzzled by this strange problem, but without ever obtaining a satisfactory solution of the difficulty till recently; and the explanation was then as unexpected as it possibly could be. Yet, however incredible it may appear, we have it on the trustworthy authority of Darwin that the key to the whole mystery is supplied by the one word, worms; and in his latest work, *The Formation of Vegetable Mould through the Action of Worms, with observations on their Habits* (London: John Murray), we have abundant proof of the hitherto unrecognised importance of this humble creature.

In his earlier observations Mr Darwin discovered that small fragments of burnt marl, cinders, &c., which had been strewed over the surface of several meadows, were found after a few years at a depth of some inches below the turf, but still forming an unbroken layer. This apparent sinking of superficial bodies he found was due to the large quantity of fine earth brought up to the surface by worms, in the form of castings, which soon covered up any object left on the surface. He was thus led to the startling conclusion, that all the vegetable mould over the country has passed many times through the intestinal canal of worms; and hence the term 'animal mould' would be more appropriate than the common one of 'vegetable mould.'

After dealing with the subject and the criticisms of his early paper, Mr Darwin goes on to describe the habits and structure of the common earthworm. As every one knows, worms live in holes or burrows in the ground. The interior of these they coat with leaves, to prevent their bodies from coming into contact with the cold damp earth; and as a rule they lie motionless close to the mouth of these holes, so that by looking carefully, one can see their heads quite near the surface of the ground. In winter, however, they completely close the entrance of their holes, and go deeper down, to be beyond the reach of birds or frost, their burrows being often found to penetrate the earth to the depth of even five or six feet. It is chiefly during the evening and the night, when the earth is moist, that they leave their holes in search of food. They are not at all particular what they feed upon; but such preference as they do exhibit is

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in favour of cabbage leaves and similar vegetable substances.

Regarding their digestive powers, we find they are omnivorous, and drag into their holes anything that appears at all edible, showing no particular objection even to such articles as rose-thorns or splinters of glass. The leaves which they get hold of, they smear over with an alkaline fluid, which partially digests them before they are actually introduced into the body; a fact remarkable as being the only instance recorded of any animal of digestion outside the stomach. But the earthworm does not depend altogether upon meat and leaves for its existence; it finds nourishment in the very soil. Its mouth consists simply of two lips; and as it has no teeth, the particles of sand do not interfere with its mastication, so it goes on swallowing earth, which in its passage through the intestines has all the digestible ingredients thoroughly extracted from it. The indigestible portions are then ejected in the form of little heaps called worm-casts, which every one who lives in the country or possesses a garden must be quite familiar with. The fine earth brought up to the surface in these little heaps of worm excreta is afterwards spread out by wind and rain more or less uniformly over the ground; the actual weight of these castings thrown up during twelve months being calculated in one case to amount to as much as eighteen and one-eighth tons per acre. Multiplying this by years, we can readily understand how surface objects will soon be covered up, or appear to sink into the ground; and numerous instances are given by Mr Darwin of stones and walls and pavements which have thus been slowly undermined and sunk by worms. Thus we have at any rate one explanation of the hitherto mysterious fact, that the ruins of old cities have been found as far beneath the surface that the soil has been ploughed and re-ploughed for years without the least suspicion of the existence of the ancient monuments below.

Mr Darwin, in this connection, furnishes a number of striking illustrations of this burying or covering process in regard to fields which a number of years ago were thickly strewn with stones on the surface, and which stones in course of time entirely disappeared. A field near his own residence was ploughed in 1841, and afterwards allowed to remain in pasture; and so thickly covered was the surface with stones, some of them half as large as a child's head, that it was called 'the stony field.' Thirty years afterwards, a cutting was made in the field, when these stones were found to be covered by about two inches of mould, and a man might have ridden a horse from one end of the field to the other without the shoe of the steed striking a single stone. Mr Darwin traces this change entirely to the agency of worms. We would take leave to suggest, however, that perhaps frost has also something to do with this sinking of stones, small and large, into the soil.

While, therefore, Mr Darwin regards the earthworm as a preserver of the records of old time, this comparatively humble creature is nevertheless one of the chief agents in the destruction of the land surface of the globe. The rains and the frosts act powerfully upon the

struction of the land surface of the globe. The rains and the frosts act powerfully upon the higher portions of the land ; and the glacier and the mountain torrent carry down the materials of the disintegrated rocks ; but these when brought down to the lower grounds might remain there for ages longer than they do but for the agency of worms. In the first place the particles of stone and earth which are swallowed by worms are acted on both chemically and mechanically during the process of digestion ; then again, as the old worn burrows collapse and fresh castings are brought to the surface, the whole layer of mould is subjected to a slow circulation, during which the friction of the particles of earth on one another still further reduces their size. Thus the soil becomes finer and finer ; and as the ordinary means of disintegration, namely, running water and the waves of the sea, act with less power on rock fragments the smaller they are, we see how great is the assistance which worms hold in the decomposition and disintegration of the soil. The area of cultivable soil is also thus extended, because castings thrown up either during a shower or shortly before rain, are washed down any inclined surface ; while during dry weather strong winds blow these little pellets of excreta from one place to another.

Earthworms we know are valuable as food for birds and fishes ; and to worms our thanks are due for assisting to preserve many an ancient monument which has thrown light upon the history of the past. They are ploughers and tillers of the soil, for they are constantly turning it over and loosening it ; thus fitting it for seedlings to take root and for roots to penetrate with ease. By their constant labours, the soil is exposed to the improving action of the air and atmospheric agencies ; it is enriched by mixture with partially digested leaves and other organic matter dragged into their burrows ; and the rain which falls upon the ground sinks deeper through the loosened soil than it might otherwise have done. But their chief work is to sift the finer from the coarser particles, and by their castings to produce a layer of the finest mould, thus proving themselves co-operators with the farmer and the gardener as cultivators and fertilisers of the soil.