5.—OUR FRIENDS THE EARTH-WORMS.[1]

The recently published work of the eminent naturalist, Charles Darwin, teaches us many curious facts concerning the earth-worm, its habits, and its services to man. He has carefully observed these little creatures for half a century ; not only watching them in their native haunts, but keeping them in pots in his study, and by marvellous patience and ingenuity discovering their habits and modes of action. His book imparts a most useful lesson of patient investigation and its invaluable results, in addition to its scientific teaching.

The body of a good sized earth-worm contains from one to two hundred rings, almost cylindrical, each surrounded by bristles, its muscular system is well developed, it has a mouth and something which corresponds to the proboscis in many insects, it has a gizzard and some calciferous glands—being in this respect unique—and these glands perform an important part in the process of digestion. Worms have no jaws or teeth, and they breathe through their skin, and their nervous system is fairly developed. Mr. Darwin discovered, by a series of most interesting experiments, that though they have no eyes, they are sensitive to light, and are capable of distinguishing night from day. They have no faculty of hearing, but they are extremely sensitive to vibrations amongst solid objects. Their sense of smell is very feeble, and is only affected by certain odours. Of all the senses, that of touch—including in this term the perception of a vibration—seems to be the most developed,

[1] *The Formation of Vegetable Mould through the action of Worms.* With observations on their habits. By Charles Darwin, F.R.S. Landon : Murray.

though Mr. Darwin thinks that they are not so sensitive to pain when mutilated, as their writhing would appear to indicate. Earth-worms are also fairly endowed with the sense of taste, and have their decided preferences with regard to food. Though they are omnivorous they live chiefly on half decayed leaves; they are fond of cabbage leaves, and make nice distinctions between the different sorts, and have a decided weakness for onions; they prefer raw fat to any other kind of meat, especially if fresh.

Little can be said of their mental qualities, though Mr. Darwin states that he has detected traces of social feeling; they are often found lying in contact, and are not disturbed by crawling over each other's bodies, though they frequently most unsociably pass the winter rolled together in balls at the bottom of their burrows. But blind as they are, and generally limited in their powers, yet they use these limited powers to very good purpose. In preparing their burrows they display a skill which works in accordance with the great laws by which birds construct their nests. Their burrows run down perpendicularly or a little obliquely. They are generally lined with a fine dark-coloured earth which has passed through the body of the worms. These burrows are mere excavations, but resemble tunnels lined with cement; the entrances are also usually lined with leaves, and the worms drag into them numbers of dead leaves and other parts of plants, partly for the sake of plugging the burrows and partly as food. The more luxurious of them even coat the mouths of their burrows to keep their bodies from contact with the cold damp earth.

The leaves which they have dragged in as food are—after being partially digested and saturated with their intestinal secretions—commingled with more earth, and this forms the dark-coloured, rich humus (the brown or black powder of the soil) which, to so large an extent, covers the surface of the land with a layer or mantle. During the heat of the summer, and the extreme cold of winter, they bury themselves at some distance from the surface and rest from work. The night is their period of activity, when they issue from their burrows, generally keeping their tails—which they have a power of extending—fixed in the burrows, and making use of some short, slightly deflected bristles, with which their bodies are armed, in such a way that they cannot be dragged out of the ground without pulling them in pieces.

Earth-worms have played a considerable part in the burial and concealment of many Roman and other ancient buildings. Coins, gold ornaments, stone implements, and other articles which had been dropped on the surface of the ground, being in a few years buried by the castings of the worms, and thus safely preserved until at some future time the land was turned up. Even the floors, and other remains of many ancient buildings in England, have been effectually buried, chiefly through the action of worms, as only to have been accidentally discovered of late, as at Chinger, Brading, Chedworth, and Beaulieu Abbey (destroyed by Henry the Eighth), where the floors of the old halls and passages have sunk, partly through the settling of the ground, but chiefly from the undermining of the foundations by earth-worms.

On the other hand, the most recent discovery attributes to their agency the propagation of some fatal diseases, especially of "charbon," a disease which has recurred in its deadliest form among sheep feeding on pasture where sheep had been buried after a similar plague ten years before. The carcasses had been interred ten or twelve feet below the surface, but M. Pasteur found in earth-worms a probable means of the conveyance of the poison germs, and by a series of experiments verified the fact.

The great work of the earth-worms has, however, been far more extensive and beneficial than has been hitherto recognized. It is ascertained that each earth-worm found in English soil passes through its body an average of twenty ounces of matter in the course of a year, or brings that quantity of earth to the surface, and there deposits it, but it is brought up in a very different form from that in which it existed before passing through the body of the worm. In the first place, the particles of earth are finely powdered in the gizzard of the worm and interpenetrated with the fibrous parts of the leaves on which it feeds, and with which it lines its burrows, so that the mould which results is what we may call vegetable mould, a substance far more valuable to farmers and gardeners than the raw earth on which the worm begins to act.

According to Mr. Darwin, worms are extraordinarily numerous in damp climates. For their size they possess great muscular power; it is calculated that in many parts of England a weight of ten tons of dry earth in each acre of land annually passes through their bodies and is brought to the

surface, so that in the course of a few years the whole superficial layer of vegetable mould is passed through them. From the collapsing of their old burrows the mould is in constant, though slow, movement, and the particles composing it are thus rubbed together, and by these means fresh surfaces are continually exposed to the action of carbonic acid, and of the soluble acids in the soil, which decompose the surfaces of stones or rocks. Moreover the particles of the softer rocks are triturated in the muscular gizzard of worms in which very minute stones serve as millstones.

The smoothness of the wide turf-covered expanse (on which so much of its beauty depends) is mainly due to its inequalities having been slowly levelled by worms. The plough is one of the most ancient and most useful of man's inventions, but long before man was created the land was prepared for his service by the regular unintermitting ploughing of these indefatigable creatures who still continue their useful work. The amount of work accomplished seems incredible when we remember that only twenty ounces can be passed through a worm's body in one year, but it is calculated that there are at the least from twenty to thirty thousand worms in every acre of British earth suitable for their activity, and there are thirty-two million millions of such acres in Great Britain. If ten tons of earth pass through their bodies in each acre, three hundred and twenty million millions of tons of mould must be brought up by them to the surface of this island in each year, and when this is multiplied by the many thousand years in which the work has been going on, the amount of what the earth-worms have accomplished in the formation of vegetable mould can hardly be exaggerated, for Darwin also gives irresistible evidence that the whole of the superficial layer of the soil of this country has been passed many times, and continues to be passed through the bodies of worms, and has been triturated and combined in a way which no mechanical or chemical appliances of ours can rival in its adaptation to the purpose of producing vegetable mould.

Thus we learn that ages before man appeared upon earth, the soil from which his food was to be produced was being crumbled into the finest particles, and changes effected in its chemical constitution by the agency of these lowly creatures (who creep in vast, uncounted numbers on the surface of the world), which have adapted it to the growth of the richer products required for the nourishment of beings of higher organiza-

tion. Hence it is clear that the benefit conferred on the human race by the work of the earth-worm is infinitely greater than that accruing to the worm itself by that work, for the larger the quantity of earth passed through the worm in proportion to the nourishment it appropriates, the greater is the benefit which is conferred on the world generally, and the greater the amount of ploughing done by the earth-worm, the more the soil is chemically improved by its agency. Whereas the less work the worm has to do, to procure adequate nourishment for itself, the better would be its chance of obtaining that nourishment, and of multiplying its species. It appears too that the gizzard—that part of the essential structure of earth-worms in which the earth is powdered by being crushed up with the minute stones swallowed for this purpose—is provided solely for the execution of this extra work, and is not to be found in other varieties which live in mud or water, and feed entirely on dead or living matter without having to grind down an enormous proportion of innutritious soil, only to extract the very minute particles of organic matter which may possibly be contained therein.

Strange to say, the earth-worm would find a much richer supply of the nourishment adapted to its own need upon the surface of the ground, without passing through its mill so much of what is in relation to its own wants only waste, for the sake of so small a proportion of food.

The instinct of the earth-worm appears to guide it to a course of life which has its end chiefly, not in the good of the creature who does the work, but in the good of other and higher beings, who did not exist upon the earth until it had been prepared for them. Ages of this pulverization were required to pierce the crumblings and to bring up successive layers of richer and richer mould, not for the use of these little insects only, but for the ultimate good of man.

The earth-worms are the ploughs by which through successive ages the earth was being prepared to yield abundantly, long before we or our harvests had been conceived, except in the mind of the Eternal Wisdom Who seems to have been providing for the good of ages yet unborn, even by the labours of the poor despised earth-worm.

We will only add that if any of our readers desire to know more about earth-worms, they cannot do better than study Mr. Darwin's learned and interesting book.