Earthworms

Class Oligochaeta
Phylum Annelida

Earthworms belong to a large phylum, the Annelida, or segmented worms. They belong to the Class Oligochaeta. This name means 'few bristles' and refers to the few bristles, or setae, on each body segment compared with the many setae of marine annelids in the Class Polychaeta ('many bristles'). There are four pairs of setae on each segment. These can be detected as a roughness if the animal is stroked from tail to head.

Earthworms are diverse enough to be broken into four major families, with approximately 3,000 known species.

Earthworms range in size from several millimetres to two or three metres in length.

Where are earthworms found?

Earthworms are mainly free-living terrestrial (land dwelling), or freshwater worms. They are found in soil, leaf litter and under stones and logs in most habitats, including arid areas, but most species are found in wetter, more heavily vegetated regions. Native Australian earthworms are often eliminated by the clearing of natural vegetation, and many introduced species (primarily from Europe) dominate disturbed habitats, such as suburban gardens and pasture.

How do earthworms burrow?

Earthworms burrow by passing successive waves of contraction and relaxation along the musculature of the body wall. They have no external appendages other than the protrusible setae (bristles that stick out), which are used to anchor the worm firmly in its burrow. Earthworms move along by extending the front end of the body, taking hold of the substrate using the front bristles, then retracting the bristles at the rear of the body and drawing up the rear end.

How do earthworms breathe?

Earthworms breathe in the same way as their aquatic ancestors. They don't have lungs, but instead breathe through the skin. In order for gas exchange to take place this way, the outermost layers of an earthworm are thin and must be kept moist. Mucous is excreted onto the skin to keep it moist. It is also wet by body fluid which is excreted through 'dorsal pores' located along the dorsal (back) midline in the grooves between the segments. This need for moisture restricts their activities to a burrowing life in damp soil. They emerge only at night when the evaporating potential of the air is low, and retreat deep underground during hot, dry weather. Light-sensitive tissues near the worm's head enable it to detect light, so they can avoid venturing out by day.

How do earthworms feed?

Most earthworms are scavengers that feed on dead organic matter. They feed by passing soil through the gut, from which nourishment is extracted, or by eating organic

debris, including leaves accumulated on the surface of the soil. This method of feeding does not require highly developed sense organs (such as eyes, which would be of little use underground) or food-catching structures, and earthworms never possess the often very remarkable and versatile head appendages developed in some of the free-swimming, carnivorous marine polychaete worms.

The digestive system is divided into a number of regions, each with a special function. Food that enters the mouth is swallowed by the action of the muscular pharynx, then passes through a narrow esophagus that has three swellings on each side. These are the calciferous glands that excrete calcium carbonate to dispose of excess calcium obtained in the food. The food then moves to the crop, which seems to serve only as a storage organ, and then to the muscular gizzard. With the aid of very tiny stones swallowed by the worm, the gizzard grinds the food thoroughly. Food is then digested by juices secreted by gland cells in the intestine. It is absorbed by blood vessels in the intestinal wall and from there distributed to the rest of the body.

Earth consumed by worms is deposited on the surface of the ground, in the form of 'castings'. The effects of worms on the soil are many. The earth of the castings and the burrows themselves are exposed to the air and, therefore, aerate the soil, improve drainage and increase its water holding capacity. The soil is 'cultivated' by being ground up in the worm's gizzard. Leaves and other matter pulled underground, and the addition of excretory wastes from worms, introduce organic matter and nutrients.

Earthworms have a considerable influence on the physical structure of the soil by their active burrowing and ingestion of the soil. This results in mixing of the surface and sub-surface soils. Their presence or absence in any soil, and the overall species composition, may also reflect environmental changes that are not easily recognised using physical or chemical means. This provides a sensitive measure of soil pollution.

How do earthworms reproduce?

All earthworms are hermaphrodites (that is, a single individual can produce both male and female gametes, the eggs and sperm). Eggs are produced when two earthworms inseminate each other during mating. Hermaphroditism makes possible two exchanges of sperms, instead of only one, when two individuals meet.

The sex organs, which produce the eggs and the sperm, are open to the ventral, or lower, surface on particular segments, which differ depending upon the species. There are two male openings, and two pairs of small sacs, the sperm receptacles. During mating, these receive sperm from the other partner. The eggs, formed in a pair of ovaries, are released from the oviducts into one of two tiny pores: the female genital openings. The male and female sexual openings (the gonopores) are situated on or near the clitellum. This ring-like, glandular swelling secretes a cocoon for the reception of the eggs.

Mating occurs usually when the ground is wet following rain. Earthworms may emerge and travel over the surface of the ground before they mate, but most often they merely protrude the anterior end and mate with a worm in an adjacent burrow. The two worms join the lower surfaces of their anterior ends, with heads pointing in opposite directions. Mucous is secreted until each worm is enclosed in a tube of slime. When the sperm is released, it is carried backwards in longitudinal groves that are converted into tubes by the mucous sheath to the sperm receptacles of the mating partner. The worms then separate and egg-laying and fertilisation occur later.

Egg-laying starts when the gland cells of the clitellum secrete a mucous ring that is moved forward over the body of the worm. As this passes the opening to the oviducts, it receives several ripe eggs and a quantity of albuminous fluid (like the white of an egg). Then, as it passes the sperm receptacles nearer the anterior end, it receives sperm that was deposited there previously. Fertilisation of the eggs takes place within the mucous ring, which finally slips past the anterior tip of the worm and becomes closed at each end to form a sealed capsule, called an 'egg cocoon'.

Egg cocoons are deposited in the soil. The fertilised eggs develop directly into young worms, which then escape through the egg membrane and eat the nourishing albumen contained in the cocoon. This enables them to increase rapidly in size until they are big enough to escape from the protective cocoon and begin life in the soil. The juveniles grow continuously until they reach adult size.

Most earthworms possess amazing powers of repairing body damage caused by predators or by accident. If a worm is torn or cut in two (for instance when a bird catches the head end of a worm protruding from its burrow) it can regenerate the missing end.

Links

- Recognising Australian Earthworms Fact Sheet
- CSIRO Fact Sheet on Earthworms: summarises current CSIRO research on earthworms and list of publications available from CSIRO Publishing
  http://www.biodiversity.csiro.au/2nd_level/3rd_level/fact_sheet_earthworms.htm
- Australian Museum Annelid website: features information on earthworms (oligochaetes), bristleworms (polychaetes) and leeches
  http://www.amonline.net.au/invertebrates/ann/index.htm
- Gardening Australia Fact Sheet: Wonder of Worms. Tips on setting up a worm farm
  http://www.abc.net.au/gardening/stories/s1074679.htm
- Australian Worm Growers Association
  http://users.dragnet.com.au/~lindah/awga/AWGA.html

References

- Barnes, R. D. 1980. *Invertebrate Zoology*. Saunders College, Philadelphia, USA. Jamieson, B. G. M. 2001 (Supplement). *Native Earthworms of Australia (Megascolecidae, Megascolecinae).* CD-ROM. Science Publishers, Inc. Enfield, New Hampshire: USA.