3. BIOLOGY

3.1 *Eisenia foetida*

**Systematic position**

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Annelida</th>
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<tbody>
<tr>
<td>Class</td>
<td>Oligochaeta</td>
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<tr>
<td>Order</td>
<td>Opisthopora</td>
</tr>
<tr>
<td>Series</td>
<td>Megescolicidae</td>
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<tr>
<td>Family</td>
<td>Lumbricidae</td>
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<tr>
<td>Subfamily</td>
<td>Lumbriciniae</td>
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<tr>
<td>Genus</td>
<td><em>Eisenia</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>foetida</em> (Savigny)</td>
</tr>
</tbody>
</table>

3.2 HABIT, SIZE AND BEHAVIOR

*E. foetida* is often found in sewage dumps (sewage filter mesh grills), sludge, tanks and filters. They are marketed under different name like red worm, Pink worm or Purple worm, Tiger worm, Brandling worm or even vermiculture or vermicomposting worm. Living worms appear coloured (red, brown or purple or even darker) on maturity; clitellum spreads over 7-9 segments in length over 26-32 body segments. The average conversion efficiency ranges upto 7 mg/worm/day. They have fast growth rate. Mature adults attain body weight upto 1.5 gm and attain reproduction capability within 50-55 days of hatching from cocoon.

3.3 FOOD, FEEDING, DIGESTION AND CASTING

Cow manure, known to be one of the best natural feeds for earthworms, was used as a control feed and used as experimental feed. Worm castings can be an excellent soil adjuvant depending on the food the worms were fed with (a market-basket) average of four different, commercially packaged castings was 0.61, 0.08 and 0.16% N, P and K respectively.
3.4 GROWTH

*E.foetida* was produced than on the same weight of ratio consisting entirely of sludge. The suggests that cellulose is required for rapid growth of *Eisenia foetida*. This suggest that there was sufficient endogenous cellulose in the sludge itself to enable *E.foetida* to grow as rapidly as it could under the constraints of the kinds and quantities of microbes available in the food, moisture content, temperature and perhaps other ambient factors and conditions. (The endogenous source of cellulose in the sludge is under composed toilet paper, undigested fibres from the diet of the populace and possibly cellulose present in certain micro-organisms).

Moreover since, the rates of growth and sexual maturation are dependent upon such factors as temperature (Michon, 1954 and substrate quality Neuhauser et al, 1980 a), the chronological age of an earthworm would be a poor predicator of its reproductive potential.

3.5 REPRODUCTION

After 70 days all cocoons, including evacuated shells, were removed and counted. The results showed that one earthworm laid on average 14 cocoons in 70 days or one cocoon every 5 days. The number of hatchings per cocoon varied from one to seven wills an average of 3.9.

3.6 *Eudrilus eugeniae*

**Systematic position and distribution**

- Phylum: Annelida
- Class: Oligochaeta
- Order: Opisthopora
- Series: Megascolecina
- Super Family: Megascolicidae
- Family: Eudrilidae
- Genus: *Eudrilus*
- Species: *eugeniae* (Kinberg)
3.7 HABIT, SIZE AND BEHAVIOR

This species is the fastest growing and second most widely used earthworm in vermitechnology for composting and for use as Vermi-protein. It is popularly known as Night crawler. The living worms appear brown and red to dark violet. The general colouration is like animal flesh. Their length ranges from 32-140 mm; diameter is 5-8 mm and total body segments range 145-196. In mature adults clitellum spreads over 5-6 segments numbering 14 to 18 spermathecal and female pores are fused commencing after 13/14 body segments. Male pores commence before 17/18 body segments.

Earlier investigations (Mba 1978) showed that the earthworm *E. eugeniae* (Kinberg) is capable of ingesting and excreting similar organic materials at a high rate. The present study concerns its possible utilization in the disposal of cassava peel, production of which is very high in Nigeria.

3.8 FOOD, FEEDING, DIGESTION AND CASTING

The mouth leads into the buccal cavity, which is followed by a thick walled, muscular pharynx. The pharynx leads into the oesophagus, which leads into a thick walled gizzard. The gizzard is followed by the intestine which is narrow and straight for the first few segments (around 14 segments) after which it is wide and sacculated up to the anal segment where it opens to the outside through the anus Madge (1969) described casts of the Eudrilids *E. eugeniae* fine granular pellets.

3.9 GROWTH

Earthworm’s growth is subject to such ambient conditions as moisture, temperature substrate quality and availability, mortality agents such as toxins and the size of the worm. The effects of temperature and organism size were incorporated in the model and subtracts quality was accounted for by relating the maximum growth rate (k) to specified growth conditions.

The microbial contents of the four-month worm culture residues and the eight month decomposed peel were 6.5 and 5.5 times that of the air dried peel and contained a slightly higher proportion of bacterial to fungal biomass.
3.10 *Lampito mauritii*

**Systematic position and distribution**

- **Phylum:** Annelida
- **Class:** Oligochaeta
- **Order:** Opisthopora
- **Series:** Megascolicina
- **Family:** Megascolicinae
- **Genus:** Lampito
- **Species:** mauritii (Kinberg)

3.11 HABIT, SIZE AND BEHAVIOR

It is also referred in old documents as *Megascolex mauritii* (kinb). They are distributed throughout India. They are also common in many parts of South and South East Asia. The body colouration is dark yellow except at anterior end which has purplish tinge. The total body length is 80-210 mm with a diameter of 31/2- 5mm. They have 166 –190 total body segments. Clitellum spread over to four body segments, on XIV to XVII and is ring shaped.

3.12 FOOD, FEEDING DIGESTION AND CASTING

Carbon and nitrogen content of the organic matter determine the abundance and diversity of earthworm species in soil. The order of preference to disintegrating leaf matter and to dry leaf powders differ succinctly in earthworms. These variations in the acceptability of leaf matter suggest that palatability depends on the texture as well as chemical nature of food material.

(Darwin 1881) was aware of the wide geographical distribution of earthworms that cast at the ground surface and to describe many forms of casts that had been observed in temperate regions, and also in India, ceycon and Burma surface casting species are known among all the families of earthworms, and they are important agents of pedogenesis and soil fertility.
3.13 DIAPAUSES & GROWTH

At the same time in the year, the soil at the surface becomes too dry, too cold, or too worm for earthworms to survive in it. There are several ways of surviving in such adversities. For instance the cocoons can resist desiccation and extreme temperatures much better than the worms and hatch out when conditions becomes more favourable during non-active state i.e. diapauses, the worms stop feeding and with empty gut coil tightly. The covering of mucus-lined cell provides protection against extreme temperatures and also from desiccation.

Earthworms continue to grow throughout their life by continually adding segments proliferated from a growing zone just in front of the anus. Reports are also available that earthworms emerge from the cocoon possessing the full number of segments as in adult and grow by enlargement of segments. The usual length of pheretima is 25cm and the adult form is attained in 3 weeks time.

3.14 REPRODUCTION

Cocoons of *L.mauritii* at an average are 6mm in length and 8mm across the widest part. Each cocoon is more or less oval in shape and tapers at the ends. When the cocoon is shed, it is a translucent while, with a slightly greenish tinge at the ends. This greenish colour gradually spread over the entire cocoon changing finally to dark reddish-brown before hatching. Though only one juvenile is generally released from each cocoon of *L.mauritii* a maximum of three juveniles have been noticed, but this is rare. The weight of the cocoon is normally between 5mg and 20mg, which increase with each stage of incubation.

Though the number of fertilized ova in each cocoon ranges from one to twenty for lumbricid worms (Stephenson, 1930), often only one or two survive and hatch (Edwards and Lofty, 1972).
3.15 HABIT, SIZE AND BEHAVIOR

Earthworms live in moist soil containing much organic matter. They are burrowing in habit. They are detritus feeders. Earthworm has long cylindrical body with pointed ends. It grows to about 15cms.

The body is divided into 100 to 120 segments called metameres. Externally the metameres are marked by circular grooves called annuli. Similarly internally the segments are marked by partitions called septa. This type of segmentation is called metamerism.

Earthworm has no head. The first segment is called peristomium. It bears mouth. Anteriorly the peristomium has a fleshy lobe called prostomium. The last segment is called anal segment or pygidium.

In the adult earthworm the four segments from 14th to the 17th segments are swollen into a ring like structure called clitellum. The clitellum has many glandular cells. These cells secrete the egg case. The clitellum divides the body into three regions, namely anterior pre-clitellar region, the middle clitellar region and the posterior post-clitellar region.

3.16 EGESTION

The undigested material and the soil are collected at the posterior part of the intestine. They are passed out through the anus in the form of worm castings.