7.

PRESENT STATUS OF EARTHWORMS (ANNELIDA:OLIGOCHAETA) DIVERSITY IN SRI LANKA

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INTRODUCTION

Earthworms are a segmented soil invertebrate group which belongs to the Phylum Annelida, Class Oligochaeta and two main Orders: Haplotaxida and Moniligastrida. They are characterised by external and internal metameric segmentation of the body, absence of any segmental appendages or suckers and by the presence of a few setae on all of the body segments except the first and the last. Oligocheates dwell in all types of terrestrial and semi- terrestrial habitats where there is sufficient moisture and food.

Importance of Earthworms

Earthworms (Endogeic forms) are a major soil animal group which contributes a significant role in the tropical soil. Earthworm activities have resulted in many improvements; physical, chemical as well as biological changes in the soil. The potential role of earthworms as vectors of beneficial micro organisms such as *Rhyzobium*, *Pseudomonas*, *Mycorhysa* fungi has been investigated in a number of recent studies. Epigeic earthworms play an important role in converting organic matter and composting garbage.

Taxonomic status of Earthworms

According to Reynolds (1994) there are 7254 species of described Oligocheates of which 3627 species are terrestrial earthworms. Further, on average about 136 species have been described each year for the last eleven years. Majority of the newly described species are from the tropics with large regions still unexplored in America, Africa and Southeast Asia and even in the Indian subcontinent including Sri Lanka.

Table1. Summary of recorded earthworms

	Species	Genera	Families	Reference
World	3627	152	12	Reynolds (1994)
India	509	67	10	Julka (1988)
Sri Lanka	63	7	3	Stephenson (1923)

History of Taxonomic studies on earthworms in Sri Lanka

There is very little published information on earthworms of Sri Lanka. Systematic studies on the earthworms of Indian subcontinent were initiated by Templeton (1844) when he described a new species, *Megascolex caerueus* from Sri Lanka. Michelson (1900) and Stephenson (1923; 1930); have carried out work on Sri Lankan earthworms. Stephenson (1923) listed 63 species of earthworms of which 47 species are indicated as zoo-geographically important species, known only from Ceylon. This is the only monograph published on Asiatic earthworms and their endemism. Gates (1941, 1945) published taxonomic works on Sri Lankan earthworms including endemic and a few peregrine species in Sri Lanka. However, Lee (1959) pointed out lists of exotic species from Sri Lanka and also (Edward and Lofty 1977) reviewed some Sri Lankan earthworms. The latest taxonomic monograph on Indian earthworms by Julka (1988) includes many Sri Lankan earthworms.

CURRENT STATUS OF EARTHWORMS IN SRI LANKA

METHODOLOGY

Earthworms for the study were collected from a variety of habitats located in 22 sites mainly from the wet and intermediate parts of the country. The study was carried out in man made agro ecosystems such as organic farms, integrated farms, plantations, home gardens *etc.* and a few natural sites.

Earthworms were collected by extraction from soil sample obtained from the different sites. Random sampling and earthworms and their cocoons were sorted by hand in a standard method, Mature specimens were chemically preserved before identification (Fender & Fender,1989). Morphological variation in external and internal features was used in identification of collected earthworms. Standard taxonomic morphological features and keys were used (Stephenson, 1923; Lee,1959; Edward & Lofty, 1977) to identify them. Earthworms were categorised into three ecological groups according to habit and their micro habitat and morphological features common within the groups.
Cocoons of different earthworm species were collected from the same sites and their morphology and incubation periods were also studied separately.

RESULTS

Nine families containing nineteen genera and fourteen species have been identified. However, it was not possible to identify ten species in the collection due to the lack of adequate information.

Among the nine families recorded, four families are new to Sri Lanka, these being Lumbricidae, Eudrilidae, Ocnerodriliodae, Octocheatidae. Although, the family Almidae is new to Sri Lanka, this genus was included in the family Glossoscolecidae and sub family Microchetinae by Gates, (1941).

Eleven more genera, which have not been described earlier for Sri Lanka, were also identified during this study. Detailed list of the families and genera as well as species which were identified during this survey is as follows:

Table 2. List of Identified Earthworms from selected locations in Sri Lanka

	Family	Genus	Species	Ecological Category
1	Megascolecidae	*Pheretima*	*P.taprobania*	Endogeic
			P.hawayana	Endogeic
			P.elongata	Endogeic
			P.companulata	Endogeic
			P.hulliti	Endogeic
			P.anomala	Endogeic
		(2) *Amynthus.sp.*	Species have not been confirmed	Epigeic
		(3) *Megascolex*	Species have not been confirmed	Endogeic
		(4) *Notoscolex*	Species have not been confirmed	Endogeic
		(5) *Lampitto*	*(i) Lampito mauritii*	Endogeic
		(6) *Periyonix*	(i) *Periyonix excavatus*	Epigeic
			(ii) *Periyonix Ceylanencis*	Epigeric
2	Eudrilidae	(1) *Eudrilus*	(i) *Eudrilus eugenae.*	Epigeic
3	Glossoscolecidae	(1) *Pontoscolex*	(i) *Pontoscolex corathrures.*	Endogeic
4	Almidae	(1) *Glyphidrillus*	Species have not been confirmed	Endogeic
5	Lumbricidae	*Eisenia*	*Eisenia foeitida.*	Epigeic
		Octolacium	(i) *Octolacium Cyanium*	Endogeic
		(3) *Allobophora*	(i) *Allobophora.caliginosa*	Endogeic
6	Octocheatidae	*Dichogaster*	(i) *Dichogaster bolaui*	Epigeic
		Eudichogaste	Species have not been confirmed	Epigeic
		Ramiella	Species have not been confirmed	Epigeic
7	Moniligastridae	(1) *Drawida*	Species have not been onfirmed	Endogeic
8	Ocnerodrilidae	(1) *Malabaria*	Species have not been confirmed	Endogeic
9	Acanthodrilidae	*Plutellus*	Species have not been confirmed	Endogeic
		(2) *Pontrodrillus*	Species have not been confirmed	Endogeic

Ecology of Earthworms

Earthworms make a large contribution to the diversity and abundance of invertebrates in soils of every kind of terrestrial ecosystems and their effective uses have been identified in different microhabitats of the soil.

According to Bouche, (1972) earthworms can be divided in to three ecological categories based not only on habitat, but also on morphological features common within the groups. These groups are namely, Epigeic, Endogeic and Anecic. The study mainly focused on endogeic and epigeic earthworms in natural and man made agro eco systems in Sri Lanka

Epigeic earthworms: Red coloured earthworms found, not in the mineral zones of soil, but in decaying plant debris such as compost litter and wood; morphologically, they are poorly adapted for burrowing.

Endogeic earthworms: Un-pigmented small to medium sized earthworms which continuously inhibit the organic mineral zones of the soil, feeding specially on dead roots; morphologically they are adapted for burrowing, but their burrows more or less horizontal

Anecic earthworms: Brownish medium to large scale size earthworms inhibiting vertical burrows into the mineral zone, but feeding at or near the surface, especially on dead roots; morphologically, adapted for burrowing and rapid movement therein.

The Earthworm Cocoons

The cocoon is the reproductive agent of earthworms. Information on Asiatic earthworms and their biology is very scarce and information on the systematic of earthworms is available in India and adjacent countries. However, understanding their reproductive biology has become very important with reference to Sri Lanka Cocoons of commonly available earthworms were collected from different habitats and morphology was studied. Cocoons were from different species of earthworms incubated under laboratory condition. The results indicated that size, shape and fresh colour of cocoons were varied in different species. The incubation period of cocoon shows a great variation among different species. These characters could be useful to identify common earthworms in the field collections.

Table 3 Morphological characters of cocoons of selected earthworms

Cocoon characteristic of Earthworm species	No. observed (n)	Mean length* ±SE(mm)	Mean width** ±SE(mm)	Cocoon colour (Coded)***
Eisenia foetidae	354	5.07 ±0.10	3.18 ± 0.05	Yellow-green
Eudrilus eugenia	186	5.16± 0.07	3.24 ± 0.05	Yellow-brown
Periyonix excavatus	675	4.03 ±0.06	2.98 ± 0.05	Yellow-brown
Octolacium cyanum	24	5.095 ±0.07	3.312 ± 0.05	Olive - green
Pontoscolex corathrurus	432	5.23 ±0.05	4.21 ± 0.05	White
Allobophora caliginosa	45	6.26 ±0.07	3.52 ± 0.05	light yellow
Dichogaster bhouli	20	1.90 ±0.06	1.575 ± 0.04	Orange
Pheretima posthuma	34	3.19 ±0.08	2.615 ± 0.06	Yellowbrown
Lampito muritii	32	4.79 ±0.05	3.24 ± 0.05	Mud brown

Cocoon of *E. foetida*

Cocoon of *E.eugenia*

Cocoon of *P.excavatus*

Figure 1: collected different earthworm cocoons

Incubation periods and number of Juvenile earthworms produced from each cocoon of each species were also observed separately and the results indicated that epigeic earthworms showed short incubation periods when compared to endogeic earthworm species and individuals (juveniles) per cocoon varied 1, 2, 4 and 6 in epigeic earthworms while endogeic earthworms produced a single individual from each cocoon under laboratory condition. This information could be very useful to identify common earthworms

Potential Use of Earthworms in Sri Lanka

The study investigated the identified earthworms that could be used in soil fertility management and to increase plant growth activities. Three epigenic earthworms *Eisenia foetidae, Eudrilus eugenia* and *Periyonix excavatus* have been practiced for vermicomposting in a laboratory condition.(Samaranayake & Wijekoon, 2010). The results indicated that there is a great potential to use this species for introduction of vermicompost technology in Sri Lanka

GAP

In conclusion, the study highlights the rich earthworm fauna in the selected study sites inferring that large scale surveys incorporating deeper soils, natural ecosystems and especially, the dry zone of Sri Lanka would yield a much higher diversity than is currently known. Lack of academic interest, expertise and funds for research are main constrains faced at present.

Farm surveys indicated a lack of awareness among present farmers on the importance of earthworms in agriculture. The role of earthworms in agriculture needs to be highlighted through agricultural extension. Furthermore, vermicomposting on a large scale needs to be encouraged with funding through the state and private sector. This would help to recycle garbage and produce valuable compost within a short period.

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