[*Denudation of the forests in the Western Ghats, an important homeland of caecilians in South India, spells their extinction. A detailed study of their ecology with particular reference to the conditions of the soils in which they live, is important and urgent. Investigations on these amphibians were initiated by Prof. B. R. Seshachar in the Zoology Department, Central College, Bangalore, and the first paper by him was published in the first volume of "Current Science"* (1933, **1**, 311). *This article represents a revival of interest in these animals almost fifty years later. One hopes that such studies may even facilitate to establish suitable habitats for these rare and invaluable species. Ed.*]

ECOLOGY OF *ICHTHYOPHIS GLUTINOSUS* (LINN.) (APODA, AMPHIBIA)

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ABSTRACT

The restricted distribution of *Ichthyophis glutinosus* could be ascribed to the characteristics of the soils in which it lives. Porous soils, rich in humus and organic matter, aid the caecilian to remain in burrows for extended periods. A positively acidic pH (5·66) and uniformly high temperature (25·5±0·9° C) of the soils appear to determine the distribution of the species.

INTRODUCTION

THE Order Apoda (Gymnophiona) includes limbless amphibians popularly known as caecilians. They are mainly pan-tropical in distribution, reported from several areas in Asia, Africa, South and Central America[1]. India is believed to be the home of at least four genera of which three are reported from peninsular India[2]. Apart from a few Anura which lead a transient burrowing life in soil in search of food[3], or which exhibit behavioural adaptations to overcome unfavourable climatic conditions, caecilians are the dominant terrestrial amphibians. While considerable information is available on the ecology of Urodela[4] and Anura[5,6], practically nothing is known about the ecology of Apoda.

Denudation of the forests of the Western Ghats, which is the main home of caecilians in South India, is going on at a pace which spells the almost certain extinction of these animals within a short time. Hence, it appears imperative that their ecology and modes of life are understood before it is too late. That the Apoda have a highly restricted distribution suggests that the soils inhabited by them have special characteristics. After the Sarasins[7] who did pioneering work on *Ichthyophis glutinosus*, there is little information available on the ecology of this animal. The present paper deals with some aspects of ecology of *I. glutinosus*.

MATERIALS AND METHODS

Specimens of *Ichthyophis glutinosus* were found in two localities, KULUR and MURVINAKOMBE villages, near Sringeri, Chikmagalur District, Karnataka, about 380 km north-west of Bangalore. The soil samples where the specimens were found were analysed for the following constituents :

(*a*) pH was determined electrometrically[8].
(*b*) Specific conductivity was measured using a conductivity bridge[8]. The results are expressed as *micro mhos/cm*.
(*c*) Free calcium carbonate was determined by dissolving in standard hydrochloric acid and titrating the excess of HCl against standard sodium hydroxide solution[9]. The results are expressed as percentages by weight of calcium carbonate in the air-dried soil.
(*d*) Available phosphorus was determined by Bray's method (for acidic soils)[9]. The results are expressed as mg of P_2O_5/100 g of air-dried soil.

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(*e*) Total nitrogen was estimated by the Kjeldahl's method[9]. The results are expressed as 'percentages of nitrogen in the air-dried soil sample.

(*f*) Organic carbon was determined by the rapid titration method of *Walkley and Black*[9]. The results are expressed as percentages of the weight of the air-dried soil samples.

Results and Discussion

Occurrence and Abundance

It does not appear that caecilians anywhere are abundant in their occurrence. Fertilization is internal in *Ichthyophis* as in several other genera. It lays a relatively small number of eggs and the female keeps coiled for extended periods around the egg mass of 12–20 eggs. The life-history and development are synchronised with astonishing precision to the environmental conditions. All these militate against large populations. Adults are usually solitary and in an area of about 200 sq. ft., to find half a dozen specimens should be considered as a good collection.

Of the caecilian genera known to occur in India, *Ichthyophis* is the most common. Several species are reported from various parts of India[10,11] and *I. glutinosus* is the best known and occurs in the Western Ghats[10]. During the present study, in both the localities mentioned above, specimens of *I. glutinosus* were collected from manure pits rich in fallen litter and decaying vegetation. Earlier records of *I. glutinosus* have also been made in soils rich in decaying vegetation, haystacks, rotten timber and fallen tree trunks[10–12].

It is interesting that the altitude at which the present collections were made (2,497 ft. above sea level) is comparable to that reported earlier[12]. The present collections were made on 20 September 1980 at Kulur and on 10 and 11 October 1980 at Muruvinakombe. A total of 34 individuals was found. It seems that the soils of Kulur and Muruvinakombe are quite suitable for *I. glutinosus*.

Length-weight Relationships

Figures 1 and 2 indicate the body length (cm) and body weight (g) relationship of the individuals collected from Kulur and Muruvinakombe villages respectively. The length-weight relationship of the individuals in either collection is comparable, indicating that the nature of the two soils inhabited by the animals is similar.

Nature of the Soils

The texture of the soils of both Kulur and Muruvinakombe, where *Ichthyophis glutinosus* were found, was characteristically porous, moist and rich in humus.

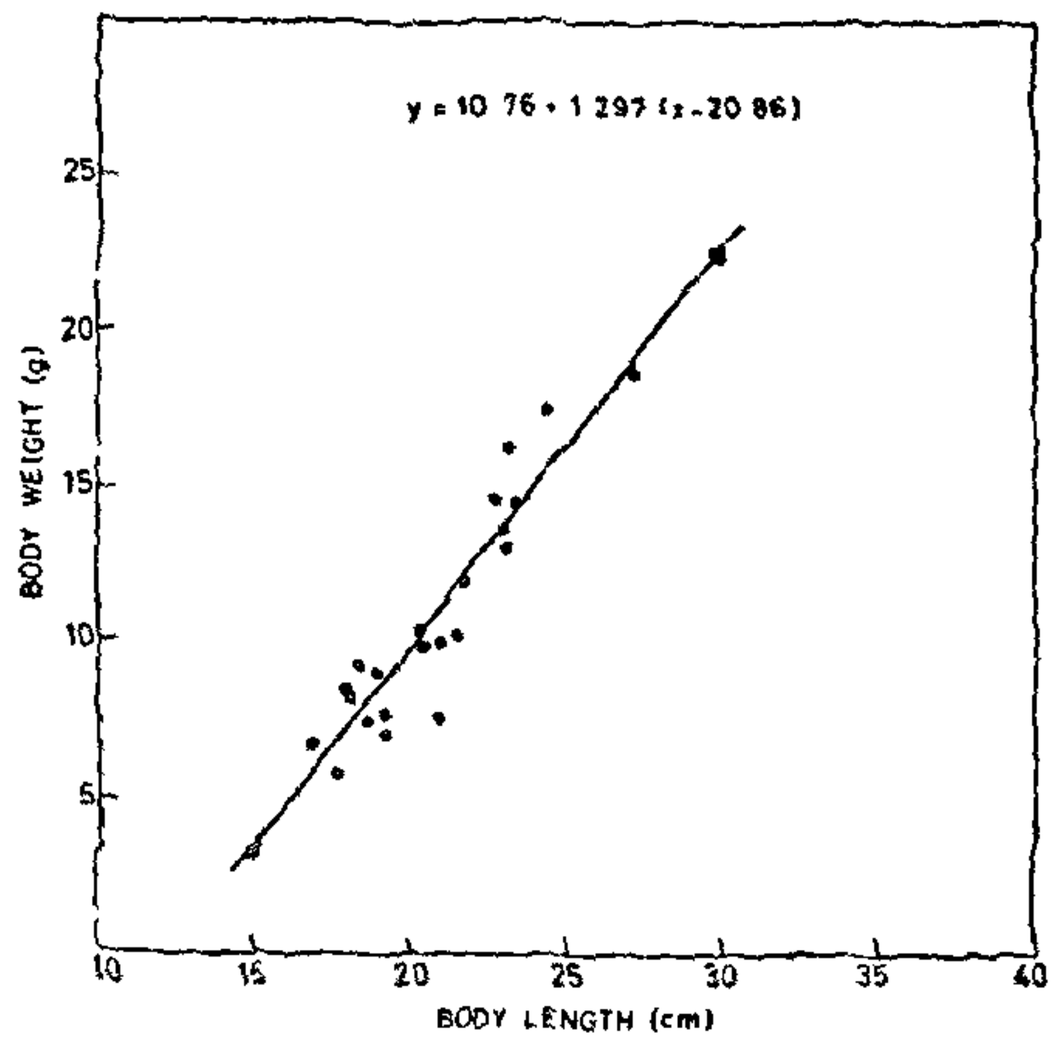

FIG. 1. Length-weight relationship of *I. glutinosus* collected from Kulur.

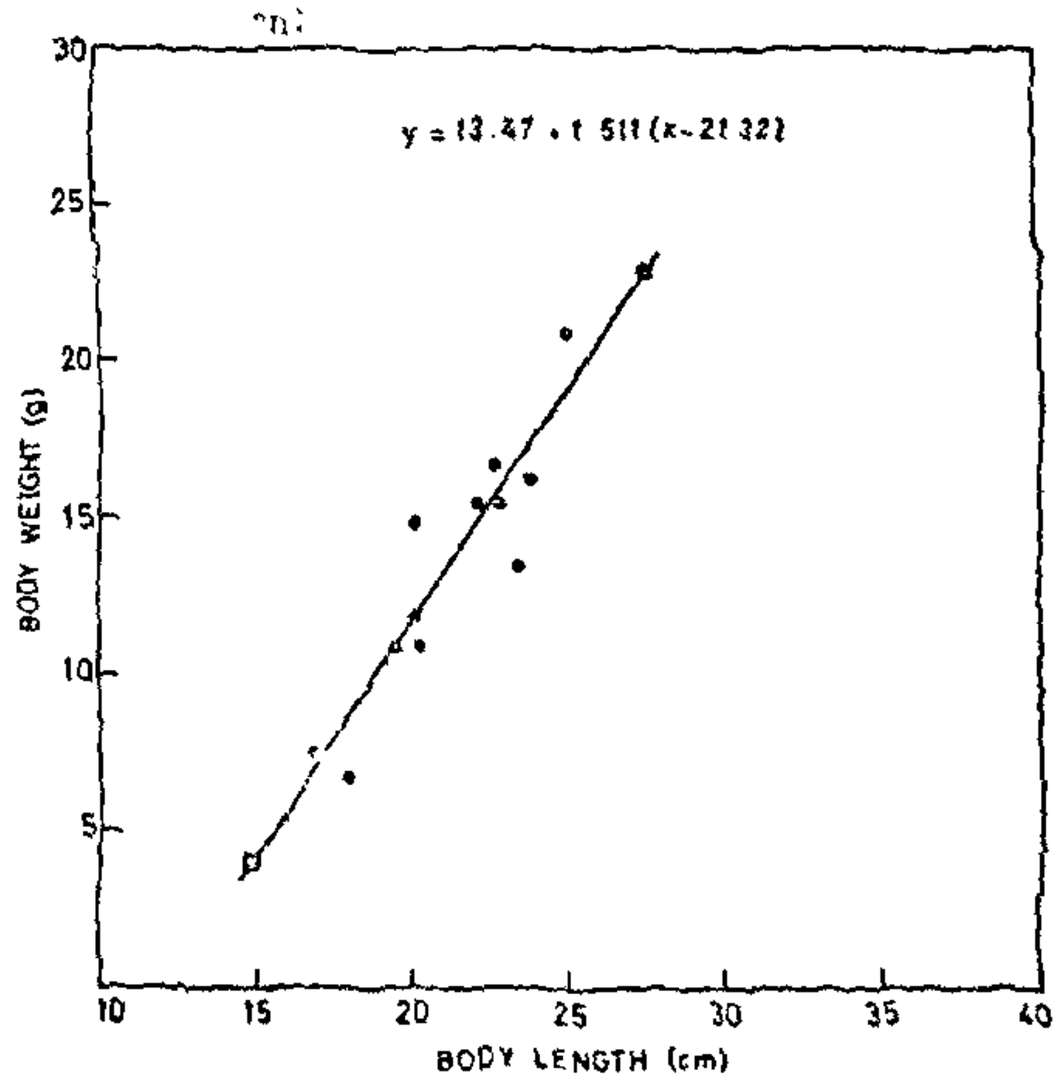

FIG. 2. Length-weight relationship of *I. glutinosus* collected from Muruvinakombe.

I. glutinosus (as also other Apoda) is essentially a burrower but possesses no special organs for burrowing, other than a dense skull and skin secretions. During the dry seasons of the year, from November to May or June the following year, it should burrow quite deep, to be able to find the right conditions of moisture, temperature and pH so essential for its survival. A porous soil would be highly suitable. Soils rich in humus are known to have high water holding property since humus itself has a relatively high capillary

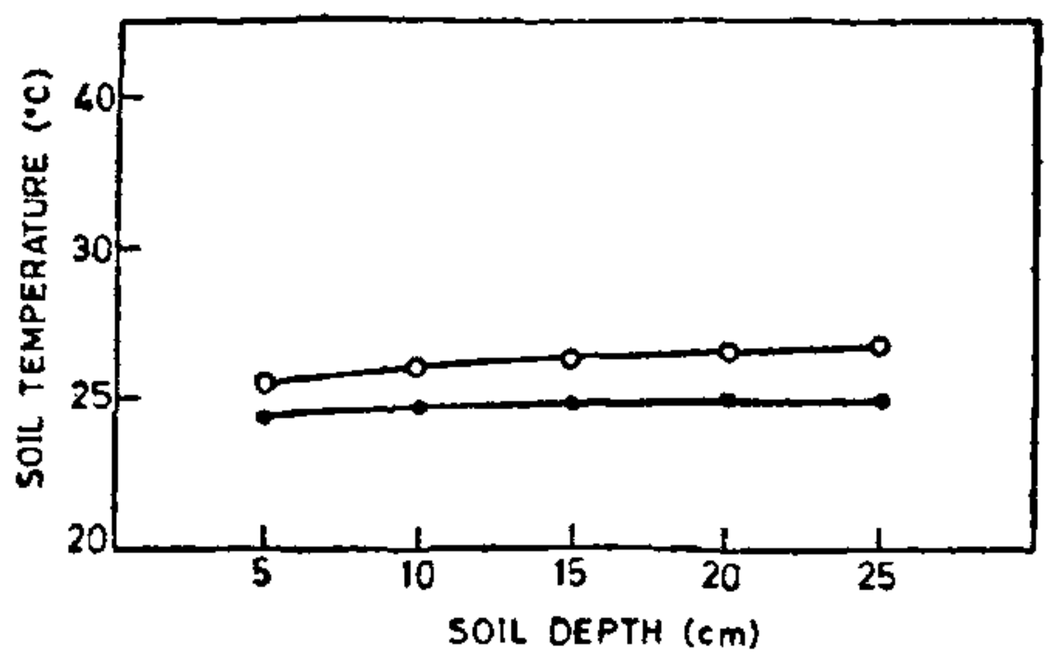

FIG. 3. Temperature profile of soil at different depths.
●—● Soil samples from Kulur.
○—○ Soil samples from Muruvinakombe.

amount of water. This would ensure retention of capillary water for relatively longer periods than other soils[3, 13].

The temperatures of the two soil samples at various depths are indicated in Fig. 3.. It is evident that the temperatures do not vary much in the two localities or in relation to depth of the soil column. An average temperature of $25{\cdot}49 \pm 0{\cdot}85°C$ appears most suitable for *I. glutinosus*. The fairly uniform, high temperature appears a characteristic preference of the organism.

Table I indicates the chemical composition of the soils inhabited by *I. glutinosus*. It is evident that the two samples have a comparable chemical composition. Both the soils are rich in specific conductivity (due to the presence of salts), organic carbon and organic matter. The pH of both samples is nearly alike and is positively acidic. The rich organic carbon/organic matter is characteristic of these acidic soils. The rather low values of free calcium carbonate and available phosphorus are also confirmative of the acidic nature of the soils[13]. The fairly high values of C/N ratio indicate bacterial activity, perhaps for nitrogen fixation[8]. On the whole, it is clear that *I. glutinosus* inhabits acidic solis rich in organic matter.

Table II indicates the localities where the several Indian species of Apoda have been recorded. It is of interest that the localities fall in the belt of Western/Eastern Ghats and the hilly areas. Further,

TABLE I
Chemical composition of soils inhabited by Ichthyophis glutinosus

Constituents	Locality	
	Kulur	Muruvinakombe
pH	5·76	5·56
Specific conductivity (micro mhos/cm)	2533·33	2228·33
Free calcium carbonate (%)	1·17	1·58
Available phosphorus (mg/100 g soil)	1·598	1·865
Total nitrogen (%)	0·1568	0·1638
Organic carbon (%)	2·679	2·621
Organic matter (%)	4·6186	4·5186
C/N ratio	17·055	16·001

TABLE II
Record of caecilians in Peninsular India

Species collected	Locality	Author/s	Ref. No.
Ichthyophis glutinosus	Kottigehar, South India	Seshachar and Iyer	10
Uraeotyphlus sp.	Kerala, South India	Seshachar	14
Gegenophis carnosus	Kottayam, Kerala, South India	Ramaswami	12
		Seshachar and Ramaswami	11
Ichthyophis glutinosus and *Ichthyophis monochrous*	Nellore, Coastal Orissa (Eastern Ghats)	Ramaswami	15
Ichthyophis sikkimensis	Eastern Himalayas	Jayaram	16
Herpele sp.	Eastern India	Jayaram	16
Ichthyophis beddomii	South Kanara, South India	Rahman and Rajagopal	17

in all these areas, the soils are reported to be in the acidic range[13] An acidic nature of the soil may be a prerequisite for not only *I. glutinosus* but perhaps also for other apodan species. The soil analysis presented here offers the first analytical evidence of the requirements of the animals of this interesting amphibian order.

A comparison of habitat variations of the three orders of Amphibia is interesting. The Urodela are restricted in their distribution consequent on the special requirements of low temperature and aquatic medium. The Anura appear to exhibit greater adaptability in regard to temperature as well as other environmental requirements. The paucity of individuals as well as of species of Apoda appears to be determined by the special habitat characteristics of the animals of this order. From the present study it is evident, among the factors governing the severe restriction of Apoda to tropical and pan-tropical regions, are the characteristic physico-chemical features of the soil.

ACKNOWLEDGEMENTS

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ANTIFUNGAL ACTIVITY OF SOME NOVEL LANTHANON THIOSEMICARBAZONE COMPLEXES

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ABSTRACT

Antifungal activities of some newly synthesized and well-characterized lanthanon complexes of salicylidine- and 2-hydroxy-1-naphthalidine thiosemicarbazones have been determined. The ligands and their resulting complexes have been shown to be toxic against the two pathogenic fungi, *viz.*, *Aspergillus niger* and *Draschelera australiensis* and the results indicate that the toxicity decreases on metallation. Overall, the 2-hydroxy-1-naphthalidine-thiosemicarbazonelanthanon complexes are more toxic to fungi than the corresponding lanthanon derivatives of salicylidinethiosemicarbazones.

INTRODUCTION

SCHIFF bases and thioureas are amongst the most important nitrogen and sulphur containing ligands, which show remarkable pharmacological activity and have wide biological applications[1]. Perhaps, the group N–C–S is of considerable chemotherapeutic interest and is responsible for the pharmacological activity[2]. It has been indicated that the microbiol activity of these compounds is due to their ability to chelate traces of metal ions[3].