ON A COLLECTION OF INDIAN EARTHWORMS OF THE FAMILY LUMBRICIDAE.

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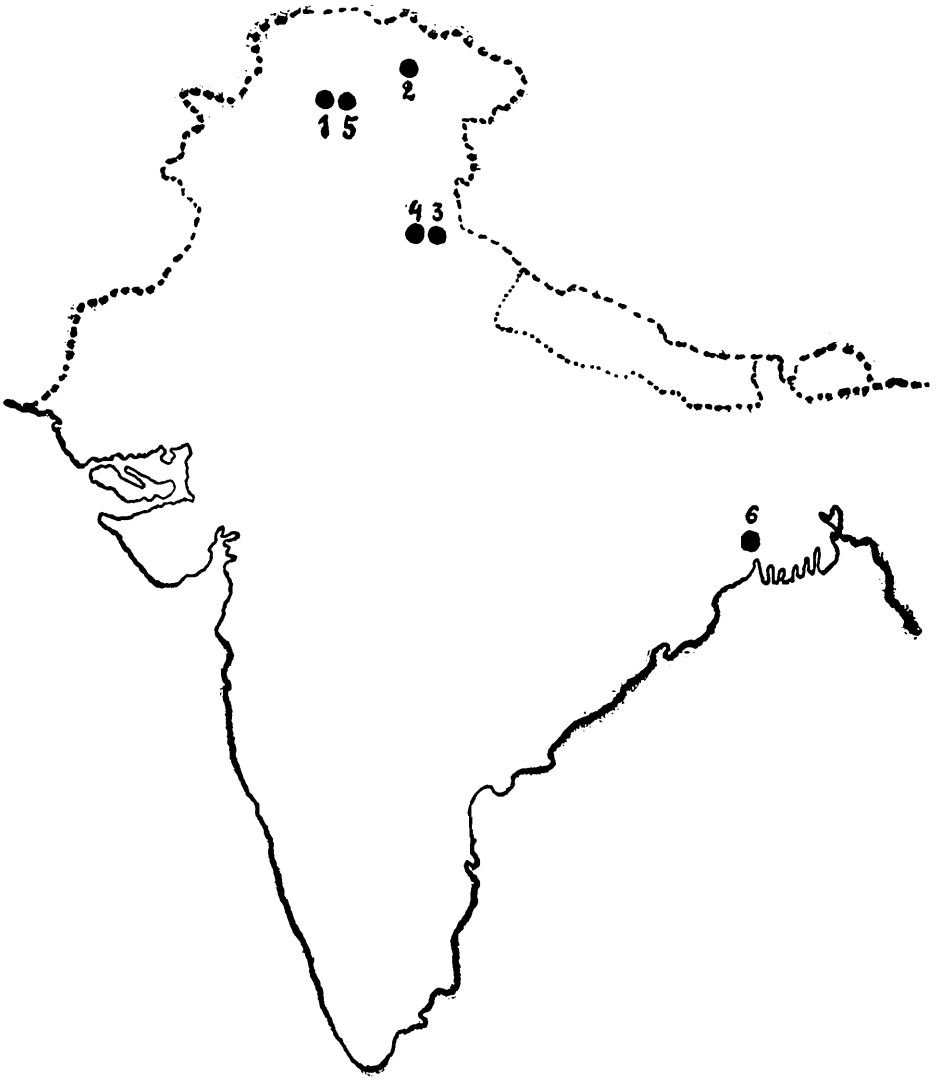
Terrestrial forms constitute the bulk of Indian Oligochaete fauna. All the Indian families, with the exception of the family Lumbricidae, belong to tropical families, which show a connection of the Indian fauna with Australia and New Zealand (all Megascolecidae), Malay Archipelago (the genera *Pheretima* and *Desmogaster*), Madagascar (the genus *Howascolex*), Africa (the genera *Gordiodrilus* and *Dichogaster*) and Central America (the family Diplocardiidae). The territory of the endemic species of the family Lumbricidae includes Middle and Central Europe, North Africa and a part of North America (the eastern part of the United States). In Asia endemic species are known from Palestine, Syria, Turkey, Persia, Caucasus, Turkestan, Tian-Shan, Tibet, Japan and India.

The northern limit of the territory of endemic species of Lumbricidae in North America and Europe coincides with the limit of glaciation during the Ice Age, and their present-day distribution may be explained by the influence of the ice cap which covered the northern part of Europe and North America (Michaelsen 1903, Černosvitov 1932 ; 1935*a*). The exact limits of the Lumbricid territory in Asia are not well known and the study of any fresh material, therefore, is not without interest. A few endemic species of Lumbricidae are known from Tian-Shan, Tibet and Japan. The Indian fauna includes only 4 such species—*Bimastus indicus* (Mich.), *Eophila mariensis* (Steph.), *Dendrobaena kempi* (Steph.) and *Allolobophora prashadi* (Steph.). They are all concentrated in the Himalayas and the range of only one—*Bimastus indicus* (Mich.)—extends as far as Calcutta. This species is considered by Stephensen (1923, 1930) as the southernmost outpost of Lumbricidae, having spread in a southerly direction from the north—the Himalayas proper representing the line of separation between the Palaearctic and Oriental faunas of Earthworms.

In the following pages I deal with a collection of Lumbricidae belonging to the Indian Museum. My thanks are due to Dr. B. Prashad, Director of the Zoological Survey of India, for the opportunity of examining it.

Amongst the 11 species identified there are two peregrine species which are recorded for the first time from India ; these are *Eiseniella tetraedra* (Sav.) f. *typica* and *Octolasium cyaneum* (Sav.). Two other—*Allolobophora jassyensis* (Mich.) and *Eophila himalayana*, sp. nov.—are apparently Palaearctic forms, though the latter may be endemic in India ; both the species, however, are found in Western Himalayas (Punjab)

and this supports the general conclusions of Stephenson on the distribution of Indian Lumbricidae (*vide* map, text-fig. 1).



TEXT-FIG. 1.—Map showing the distribution of endemic Indian Lumbricidae: 1. *Allolobophora jassyensis*, 2. *Allolobophora prashadi*, 3. *Dendrobaena kempi*, 4. *Eophila himalayana*, 5. *Eophila mariensis*, and 6. *Bimastus indicus*.

In the following list of the Indian Lumbricidae species marked with an asterisk are truly endemic species, while the others are the so-called peregrine species which are widely distributed almost all over the world, and are, therefore, of no importance in zoogeographic discussions.

List of Indian Lumbricidae.

Eiseniella tetraedra (Sav.) forma *typica*.
Eisenia foetida (Sav.).
Eisenia rosea (Sav.).
Dendrobaena rubida (Sav.).
Dendrobaena subrubicunda (Eisen).
* *Dendrobaena kempi* (Steph.).
Allolobophora caliginosa (Sav.) forma *typica*.
Allolobophora caliginosa (Sav.) forma *trapezoides* (A. Dug.).
**Allolobophora prashadi* (Steph.).

* *Allolobophora jassyensis* (Mich.).
* *Eophila mariensis* (Steph.).
* *Eophila himalayana*, sp. nov.
Bimastus tenuis (Eisen).
Bimastus eiseni (Lev.).
Bimastus parvus (Eisen).
**Bimastus indicus* (Mich.).
Octolasium lacteum (Örley).
Octolasium cyaneum (Sav.).
Lumbricus rubellus Hoffm.

Eiseniella tetraedra (Sav.) forma **typica.**

Kumaon Hills, Dhobi Ghat, 2 miles east of P. W. D. Bungalow. Dr. H. S. Pruthi coll., 2 specimens.
Kumaon Hills, The Lake, Naini Tal; alt. 6,359 ft. Dr. H. S. Pruthi coll., 2 specimens.

This species has not been recorded from India but is widely distributed all over. One of the specimens examined had a regenerated anterior part of the body : the male pores were situated on segment xii and the clitellum on segments xxi-xxvi.

Eisenia foetida (Sav.).

Kodaikanal, Palni Hills, S. India. Dr. S. L. Hora coll., 19+11+37 specimens.
Kodaikanal, Palni Hills, S. India—from dung heap. Dr. S. L. Hora coll., 34+33 specimens.
Kodaikanal, Palni Hills, S. India—along edge of a stream near Golf Link on way to Pillar Rocks. Dr. S. L. Hora coll., 41 mostly mature specimens.
Fern Hills, Nilgiris, S. India. Dr. S. L. Hora coll., 21 specimens.
Simla, W. Himalayas; alt. 6,000—7,000 ft. Dr. B. Chopra coll., 7+3 specimens.
Dharmsala, Punjab—from a heap of cow-dung. Dr. S. L. Hora coll., 4 specimens.

Eisenia rosea (Sav.).

Cart Road, Murree, W. Himalayas, Punjab. Dr. H. S. Pruthi coll., 5 specimens.
Dhar, Murree Sub-Divn., W. Himalayas, Punjab. Dr. H. S. Pruthi coll., 1 specimen.
Simla, W. Himalayas. 1 specimen.
Kodaikanal, Palni Hills, S. India—on the way to Pillar Rocks. Dr. S. L. Hora coll., 1 not fully mature specimen.
Rambhur River bank at Rambhur, Rambhur Valley, Chitral. Dr. B. Chopra coll., 1 specimen not fully mature.

Dendrobaena subrubicunda (Eisen).

Simla, W. Himalayas; alt. 6,000—7,000 ft. Dr. B. Chopra coll., 2 specimens.

The two specimens examined differ in some respects from the European individuals, chiefly in the arrangement of the setae. This species has been recorded from India and is widely distributed in other parts of the world (Europe, Siberia, North and South America), and I am, therefore, not inclined to regard the two aberrant specimens from India as representing a new variety. I include a brief description of these specimens for future reference.

Length 82 and 76 mm. Segments 114. Prostomium epilobous ($\frac{1}{2}$) or almost tanylobous. Anterior part of the body compressed dorso-ventrally, posterior end rounded. Skin pigmented strongly only on dorsal surface, posterior end very slightly pigmented. Setae widely paired, *ab*=*cd*, *aa*=2*ab*, *bc*=$1\frac{1}{2}$ *ab* (in European specimens *bc*=2*cd*, *cd*=*ab*, *aa*=$1\frac{2}{3}$ *ab*.) Ventral surface of segment xvi is glandular and the setae *ab* are situated on prominent papillae. Clitellum on segments xxvi-xxxi. Tubercula of puberty on segments xxviii-xxx.

Allolobophora caliginosa (Sav.) forma **trapezoides** (A. Dug.).

Fern Hills, Nilgiris, S. India. Dr. S. L. Hora coll., 1 specimen.
Bara Hotar, Murree Sub-Divn., W. Himalayas, Punjab—under stones. Dr. H. S. Pruthi coll., 1 specimen.
On hills sides at Jotla, Kangra Dist., Punjab—under stones. Dr. S. L. Hora coll., 1 specimen.
Kufri, Simla Hills, W. Himalayas ; alt. 8,400 ft. Dr. B. Chopra coll., 15 specimens.
Simla, W. Himalayas : alt. 6,999—7,000 ft. Dr. B. Chopra coll., 4 specimens.
Asni River near Junga, Simla Hills, W. Himalayas ; alt. 4,000 ft. Dr. B. Chopra coll., 1 specimen.
Simla, W. Himalayas. 3 specimens.
Kunusk, Chitral. Dr. B. Chopra coll., 17 specimens.
Rambhur River bank at Rambhur, Rambhur Valley, Chitral. Dr. B. Chopra coll., 1 specimen.
Under stones along banks of an irrigation channel off the Pallarga stream close to its junction with the Rambhur River, Rambhur Valley, Chitral. Dr. B. Chopra coll., 17 specimens.
A cultivated field near Uts or "Hot Springs", Lutkuh Valley, Chitral. Dr. B. Chopra coll., 21 specimens.
Under stones along banks of a small stream above Charun, Mastuj Valley, Chitral. Dr. B. Chopra coll., 1 specimen.
Ramram Gol below Arandu, Chitral. Dr. B. Chopra coll., 1 specimen.

In the large number of specimens from Chitral the spermathecae are obliterated in the muscle sheath. In dissections such specimens presented no spermathecae, but these were discovered in sections of the body wall. Such a case I described recently (1935*b*) in *Eophila cryptocystis* and Pool (1936) has shown that *Allolobophora dubiosa* (Örley) which was described as having no spermathecae really has these organs, but they are embedded in the muscles of the body wall. That permits us to doubt if in other species such as *Allolobophora acystis* (Mich.), *A. prashadi* (Steph.), *A. ribaucourti* Bretsch., *A. agatschiensis* Mich., and some others, the spermathecae are not so deeply embedded in the muscles that they cannot be seen in dissected specimens.

Allolobophora jassyensis (Mich.).

Topa, Murree Sub-Divn., W. Himalayas, Punjab ; alt. 7,250 ft.—under stones. Dr. H. S. Pruthi coll., 2 specimens.

This species is widely distributed. We have no records about the occurrence of *A. jassyensis* from India, but it is known from Europe [Rumania (Jassy), Switzerland, South Russia (Mariupol Dist.)], Palestine, Egypt (Cairo), Turkestan (Tashkent), Caucasus (Baku, Lenkoran Dist.) and West Tian-Shan (Pokem River).

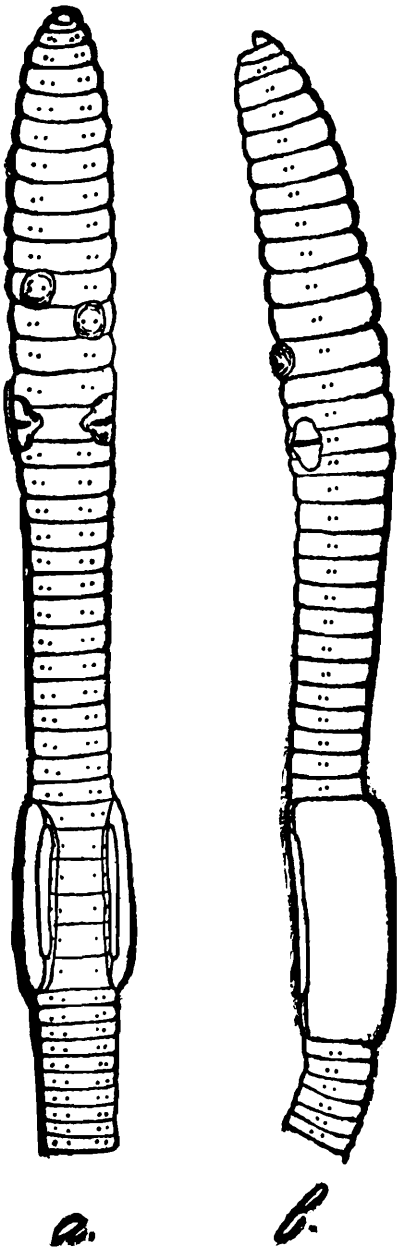
I had the opportunity of studying only two specimens from the Punjab. The largest of these is 76 mm. in length and 5 mm. thick and has 150 segments. Intersegmental furrows well marked. Setae

paired very closely, *ab*>cd, *ab* a little larger than *bc*, behind the clitellum *aa*=1½ *bc*. Prostomium epilobous (⅓). The setae *ab* on the x, xi, xxvii and xxviii or only xxvii segments situated on glandular papillae. The dissepiments 7/8-9/10 strongly thickened, 6/7 and 10/11 only slightly. Clitellum in both specimens extends over segments xxvii-xxxvi, and the tubercula of puberty over segments xxxi-xxxiv. In the larger specimen only two pairs of seminal vesicles are developed, as was observed by Michaelsen (1910) in specimens from Turkestan.

Eophila himalayana, sp. nov.

Simla, W. Himalayas ; alt. 6,000—7,000 ft. Dr. B. Chopra coll., 2 specimens.

Length of mature specimens 52 and 63 mm. diameter of anterior end about 2·5 mm., posterior end about 2 mm. Body rounded through-



Text-fig. 2.—*Eophila himalayana*, sp. nov.
a. ventral view, *b*. side view of the anterior part of a specimen.

out. Segments about 128, large with well marked intersegmental furrows. Colour of alcoholic specimens yellowish, only the clitellum

dorsally reddish; skin without pigment. Prostomium epillobous ($\frac{1}{2}$). No dorsal pores could be discovered before the clitellum. Setae small, closely paired. Anteriorly *ab* a little larger than *cd*, *aa*=3*ab*, *bc*=2$\frac{1}{2}$ *ab*, posteriorly ventral and dorsal pairs are more widely paired than anteriorly, *ab* a little larger than *cd*, *aa*=2*ab*, *ab*=*bc*>*cd*, *dd*=$\frac{1}{3}u$.

The ventral setae (*ab*) of segment xi in one specimen only on the left side of the body on prominent elevated rounded glandular papilla of a lighter colour than the surrounding skin. In other specimen on one side of the body the setae of segment xi on the other of the segment xii on similar papillae (text-fig. 2*a*).

Septa in the anterior part of the body not thickened. Last hearts in segment xi. Gizzard in segments xvii, xviii. Intestine with calciferous glands in segments xi-xiii.

Clitellum saddle-shaped, with indistinct intersegmental furrows, extending over segments xxx-xxxv (=6). Puberty " walls " well marked, extending over the segments $\frac{1}{2}$ xxx-$\frac{1}{2}$ xxxv, close over the lines of setae *b*. Male pores in the form of big transverse slits on segment xv with large elevated glandular areas extending on segments xiv and xvi, and obliterating the intersegmental furrows (text-figs. 2 *a*, *b*).

Two pairs of free testes and funnels in segments x, xi. Two pairs of very small, simple seminal vesicles in segments xi, xii. Two pairs of spermathecae opening in intersegmental furrows 9/10 and 10/11 in line of setae *cd*. The ampullae are large, sessile, without a prominent duct.

The new species of *Eophila* described above is allied to *E. tyrtea* (Ribauc.), but differs in the presence of spermathecae, form of male pores and position of first dorsal pore.

Bimastus tenuis (Eisen).

Kodaikanal, Palni Hills, S. India. Worms seen to live in tubes formed by their slime. Dr. S. L. Hora coll., 60 specimens.
Fern Hills, Nilgiris, S. India. Dr. S. L. Hora coll., 8 specimens.
Asni River near Junga, Simla Hills, W. Himalayas; alt. 4,000 ft. Dr. B. Chopra coll., 1 specimen.

Among the great number of examined specimens from the first locality I found some with well developed spermathecae, this is not often the case in *B. tenuis*, as it normally does not possess these organs. One specimen presented 2 pairs of fully developed spermathecae in the line of setae *c*, the other only one and one duct without the ampulla on the left side of the body in intersegmental furrows 9/10 and 10/11. Three other specimens had on the left or right side only one spermatheca with the ampulla situated in intersegmental furrow 9/10 or 10/11. Similar cases have been described by Smith (1917, 1928) and the author (1935*a*, 1936) in specimens from the United States and France and by Eisen and Michaelsen in *B. norvegicus* (Eisen) which I (1935*a*, 1936) regard as a synonym of *B. tenuis* (Eisen).

The clitellum in Indian specimens usually extends over segments xxvi-xxxi, but in one case (from Asni River, Simla Hills) over segments xxiv-xxx. The tubercula of puberty are developed in many cases, especially in the specimens with well developed spermathecae; they usually extend over segments xxix-xxx.

Bimastus parvus (Eisen).

A cultivated field near Uts or "Hot Springs", Lutkuh Valley, Chitral. Dr. B. Chopra coll., 1 specimen.
Ramram Gol below Arandu, Chitral. Dr. B. Chopra coll., 5 specimens.

Octolasium cyaneum (Sav.).

Murree near Sunny Bank, W. Himalayas, Punjab; alt. 6,500 ft. Dr. H. S. Pruthi coll., 2 specimens.
Cart Road, Murree, W. Himalayas, Punjab. Dr. H. S. Pruthi coll., 1 specimen.

This species is widely distributed in Europe, but has also been found in Australia and South America (Argentine). From India it is being recorded for the first time.

Octolasium lacteum (Örley).

Dhar, Murree Sub-Divn., W. Himalayas, Punjab. Dr. H. S. Pruthi coll., 9 specimens.
Cart Road, Murree, W. Himalayas, Punjab. Dr. H. S. Pruthi coll., 4 specimens.

LITERATURE.

Černosvitov, L. (1932).—Die Oligochaetenfauna der Karpathen. II Die Lumbriciden und ihre Verbreitung. *Zool. Jahrb.* LXII, p. 525.
Černosvitov, L. (1935*a*).—Monographie der tschechoslovakischen Lumbriciden. *Arch. prir. vyzk. Čech.* XIX, No. 1.
Černosvitov, L. (1935*b*).—Zur Kenntnis der Oligochaetenfauna des Balkans. IV Hohlen-Oligochaeten aus Jugoslavien. *Zool. Anz.* CXI, p. 265.
Cernosvitov, L. (1936).—Oligochètes des grottes artificielles du Nord-Est de la France. *Arch. zool. exper. et general.* LXXVIII, 1, p. 1.
Michaelsen, W. (1903).—*Die geographische Verbreitung der Oligochaeten.* Berlin.
Michaelsen, W. (1910).—Zur Kenntnis der Lumbriciden und ihrer Verbreitung. *Ann. Mus. Acad. Imp. Sci. Petersbourg* XV
Pool, G. (1936).—Eiseniella tetraedra (Sav.) Ein Beitrag zur vergleichenden Anatomie und Systematik der Lumbriciden. *Acta Zoolog.* XVIII, p. 1.
Smith, F. (1917).—North American Earthworms of the family Lumbricidae in the collections of the United States National Museum. *Proc. U. S. Nat. Mus.* LII, p. 1.
Smith, F. (1928).—An account of changes in the Earthworm fauna of Illinois and a description of one new species. *Ill. Dep. Reg. and Educ. Div. Nat. Hist. Surv.* XVII, No. 10.
Stephenson, J. (1923).—*Oligochaeta* in the *Faun. Brit. India* Series.
Stephenson, J. (1930).—*Oligochaeta.* Oxford.