ON SOME EXOTIC EARTHWORMS FROM MEXICO

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Among collections received nearly six years ago from Dr. Eucario López-Ochoterena were immature specimens of a species never reported from the American hemisphere. Fortunately, fully mature worms from the type locality, provided by Dr. G. E. Pickford, were available. The species has been in three lumbricid genera, *Allolobophora, Helodrilus, Eophila,* and still is referred by some authors to *Allolobophora* and by others to *Eophila*. The data now being provided below enable a definitive decision as to the species group involved as well as a more adequate characterization of the species.

Other species included in the Mexican collections were *Microscolex dubius* (Fletcher, 1887, Acanthodrilidae), *Allolobophora chlorotica* (Savigny, 1826), *Eisenia foetida* (Savigny, 1826), *E. rosea* (Savigny, 1826), *Lumbricus terrestris* L., *Octolasion tyrtaeum* (Savigny, 1826, Lumbricidae) and two species not previously recorded from Mexico (*cf*. below).

LUMBRICIDAE

Allolobophora Eisen, 1874
Allolobophora moebii Michaelsen, 1895
Allolobophora möbii Michaelsen, 1895, Abhandl. Naturwiss.

Ver. Hamburg, 13; 4. (Type locality, Funchal, Madeira.
Types, if extant, presumably in the Hamburg Museum).

MATERIAL

Mexico. Bosque de Chapultepec, Mexico City, at *ca*.
2240m above sea level, in garden soil, September-December,
1964, 0-21-0. E. López-Ochoterena.
Madeira. Funchal, grass roots around fountain, June
20, 1926, 3-1-6. G. E. Hutchinson per G. E. Pickford.

DESCRIPTION

External characteristics. Length, 70-98 mm (Madeira), 74-112 mm (Mexico, strongly contracted). Diameter, 3.5-4.0 mm (Madeira), 4-5 mm (Mexico). Segments, 187-210 (Madeira), 145-229 (Mexico). Color, none recognizable (Madeira), brownish to slate dorsally, greenish Centrally, tail regenerates greenish only (Mexico). Body, behind clitellum becoming flattened dorsoventrally until almost transversely rectangular in cross section and with setae at the four corners, somewhat widened for a short distance near hind end and then narrowing again anally (Madeira), less flattened and shortly elliptical in cross section (Mexico). Prostomium, epilobus, tongue closed (21 specimens).

Setae, present from ii usually, *c, d*/ii or ii-iii lacking (2, Madeira), closely paired, *AB* = *CD, BC*<*AA, DD* = or < $^{1}/_{2}$C. First dorsal pore, at 4/5 (16 specimens), ?5/6 (1), 5/6 (1), ?6/7 (1).

Nephropores, inconspicuous, recognizable (Madeira) only in or near regions of epidermal tumescence, just above B in xv—xvi and some clitellar segments, probably alternating irregularly and with asymmetry between a level just above *B* and one that is above or well above *D*.

Spermathecal pores, at or slightly lateral to *C*, at 7/8-10/11 (Madeira). Female pores, just lateral to *B*. equatorial, in xiv. Male pores, minute, in median half of *BC*,

each in a short, shallow, equatorial cleft that does not reach down to general level of body surface outside of the male tumescence.

Clitellum, saddle-shaped (Madeira), red (formalin preservation), at maximal tumescence dorsal pores occluded and intersegmental furrows obliterated, reaching down at most to *B,* including some of segments lii-lxiv as follows; lii-lxi, lii-lxii; (lii ?) -lxiii, liii-lxii, liv-lxiii, lv-lxiv (one each). Tubercula pubertatis, uninterrupted longitudinal bands of translucence, without the red clitellar color, just lateral to *B,* the median margins indicated by a fine but distinct red line at *B,* in some of segments lv-lxiii as follows; lv-lxi, lvii-lxii, lvi-lxii, eq/lv-lxii/eq, lvii-lxiii, lix-lxiii (in same order as clitella were listed) Genital tumescences, including *a, b* only, transversely elliptical, reaching further beyond *B* than median to *A*, in xiii and some of xx-lxiv as follows, xiii (18 specimens), xx (2), xxi (2), xxii (2), xxiii (4), xxiv (4), xxv (3), xxvi (5), xxvii (2), xxix (1), xxx (1), xlii (5), xliii (4), xliv (3), lii (1), liii (4), liv (1). Male tumescences, conspicuous, extending from *B* well beyond *D* in xv and thus including *c, d* of that segment, obliterating 14/15 and 15/16, reaching well into xv and xvi but there only median to *C*.

Internal anatomy. Septa, 5/6-13/14 or 14/15 muscular, thickness increasing to 8/9 and then decreasing posteriorly, 17/18 fenestrated. Special longitudinal muscle band at mD, present from v. Pigment, unrecognizable (Madeira, presumably leached completely as also in the types), reddish brown, in circular muscle layer (Mexico), the greenish color presumably in solution as it is unrepresented by any recognizable deposit. Setal follicles, so closely paired as to create an impression at first glance of only four longitudinal gaps in the musculature, mostly confined to the parietes and often unrecognizable from the coelomic side. Median follicles in ix-l obviously are thicker and perhaps a trifle longer than the laterals. GS follicles protrude slightly into coelomic cavities and contain modified setae with the usual longitudinal grooving ectally. Ventral setae of xv, sigmoid, ornamented distally by short, transverse rows of fine serrations. Brain and all or most of lateral commissures left by a transverse section exactly along 3/4, in iii (3) or iv (1, Madeira).

Calciferous sacs, in x, vertical, reaching slightly above and below general level of esophagus, opening into gut mesially, with lamellae on posterior walls. Calciferous gland, reaching at least into xiii, without moniliform widenings and marked circunferential constrictions, lumen vertically slit-like in xi-xii (Madeira), xi only (Mexico), widened equatorially in xiii (Madeira). Intestinal origin, in xv (21). Gizzard, weak, in xvii as indicated by insertion of 17/18 ventrally, behind that insertion gut wall much thinner, much more heavily vascularized and without obvious muscular sheen. Gut valvular, in xix or at region of insertion of 19/20. Typhlosole, beginning rather gradually in region of xxi-xxiii, nearly filling gut lumen anteriorly (Mexico), on ventral face a median ridge clearly demarcated on each side by a fairly deep groove; ending in region of 132d-156th segments of unamputated and unregenerated individuals, leaving 54-67 segments atyphlosolate.

Dorsal trunk, complete, bifurcating near brain, branches passing ventrally along the nervous commissures. Ventral trunk, complete. Subneural trunk complete, adherent to nerve cord, bifurcating in front of subpharyngeal ganglion. Latero-neural trunks, present. Extra-esophageal trunks, median to hearts, passing up to dorsal trunk in xii (21). Hearts, lateral, in vi-xi (21, those of vi much smaller).

Nephridia (of intestinal region), large, nearly filling coelomic cavities, vesiculate. Bladders, small, confined to *BC*, shortly u-shaped though j-shaped might be a better characterization as one limb usually is siglty shorter. Duct, from anterior or dorsal limb of vesicle, length nearly equal to that of one of the vesicular; limbs, passing into *B* gap in parietes.

Holandric (21), testes large, fan-shaped. Seminal vesicles, four pairs, in ix-xii (21), those of xii the largest, those of x the smallest. Male funnels, large, polyplicate. Sperm ducts, slender, each immediately behind its funnel-septum looped, the loops bound together in a flat disc that may be larger than the testis. Ovaries, band-shaped, each tapering distally to a single egg string containing 1-5 ova. Ovisacs, present (21), lobed, often as large as or even larger than the ovaries. Spermathecae, ducts confined to parietes, ampullae partially imbedded in body wall and just visible from coelom behind the septa, about at *C*, in viii-xi.

Atrial, TP, supraparietal GS glands, lacking.

Reproduction. Male funnels of clitellate Madeira worms have a brilliant spermatozoal iridescence. Sperm ducts also are iridescent and especially so in the epididymal loops. Iridescence also is obvious in all spermathecal ampullae (4 Madeira clitellates) or only in those of the last two pairs (2 Madeira clitellates). Iridescence was less marked on male funnels of an aclitellate worm.

Reproduction, since sperm are matured and then exchanged during copulation, can be assumed to be amphimictic especially since there is no evidence to the contrary such as is supplied by male sterile and parthenogenetic individuals.

The clitella, at or near maximal tumescence, indicate that the breeding season on Madeira includes June.

Distribution. Iberian Peninsula, Canary Islands, Morocco, Madeira, Mexico. Presence outside the Iberian Peninsula probably is a result of transportation and presumably by man. The species could have been introduced to Mexico prior to 1540 as Cortes before his final return to Spain had brougth in numerous live plants.

Ingesta. Black earth, bits of leaves, bark, wood but no soil or rock particles (Mexico).

Parasites. Transparent cysts, of medium size and nearly spheroidal shape filled the last 14-18 segments of one juvenile and one aclitellate Madeira worm.

Remarks. The epidermis of one Mexican specimen seemed to be very slightly tumescent but only between li/n-lix (all setae and intersegmental furrows present in the supposed clitellar region). Spermathecae were recognized in 9 Mexican specimens, in viii-xi (8), in viii-x only (1). The ampullae could be seen because of presence therein of an opaque with the coagulum. Absence of such coagulum, perhaps associated with transparance and/or collapse of empty ampullae, may have been responsible for failure to recognize spermathecae in three other worms. Spermatozoal iridescence was recognized on male funnels of only one Mexican worm. Seminal vesicles, in some or all of ix-xi, once even in xii, contained spheroidal masses of brown debris. One such mass was found in an ovisac. Such conditions, in association with absence of clitellum, tubercula and male tumescences, can be found as worms emerge from estivation or hibernation or at end of a breeding period.

Perhaps some one with appropriate knowledge of weather conditions in Mexico City during the fall can decide which was involved. Egg strings were long and contained 1-5 ova.

The calciferous gland of the Mexican worms seemed rather small in comparison with size in the Madeira specimens.

Systematics. For adequate characterization of the species much more information obviously is needed about individual variation in characters such as, clitellar extent, location of tubercula, number and situation of genital tumescences typhlosole termination and number of atyphlosolate segments in fully grown, unamputated specimens.

Invariant anatomy (and especially the somatic) is such as to require inclusion of the taxon in a species group that contains *A. trapezoides* (Duges, 1828), *tuberculata* Eisen, 1874, *turgida* Eisen, 1873, *longa* Ude, 1885, *limicola* Michaelsen, 1890, *nocurna* Evans, 1946, and *icterica* (Savigny, 1826). That same invariant anatomy (*cf*. Gates, 1968, p. 207), contra-indicates inclusion of the group in the same genus as *Enterion chloroticum* Savigny, 1826, which unfortunately was designated as the type species of *Allolobophora* (Omodeo, 1956). The *trapezoides* species group cannot go in *Eophila* as that genus is defined by Omodeo (1958) and others. Furthermore just how *Eophila* should be defined is unknown as the conservative somatic anatomy of the type species, *Allolobophora tellinii* Rosa, 1888, is inadequately characterized. The *trapezoides* species group is left for the present in *Allolobophora*, in hope of avoiding unnecessary nomenclatural changes until the problems that are involved can all be solved.

Octolasion Oerly 1885
Octolasion cyaneum (Savigny, 1826)
Bosque de Chapultepec, Mexico City, garden soil,
September-October, 1964, 0-0-1. E. López-Ochoterena.

Octolasion tyrtaeum (Savigny, 1826)
Bosque de Chapultepec, Mexico City, garden soil, *ca*.
6000 feet, September-October, 1964, 1-0-4. December,
1964, 0-0-4. E. López-Ochoterena.
Ciudad Universitaria, D. F., black soil with many leaves
and moisture, January 18, 1966, 0-0-5. Manuel Banegas.
Azcapotzalco, D. F., black soil and dry, January 25,
1966, 0-0-2. Raúl Ciénega.
Ajuchitlán Qro., black soil, dry, January 30, 1966,
0-0-6. E. Esperón & A. Basurto.

MEGASCOLECIDAE
Pheretima Kinberg, 1866
Pheretima hawayana (Rosa, 1891)
Ciudad Universitaria, D. F., black soil with many leaves
and moisture, January 18, 1966, 0-0-2. Manuel Banegas.
Col. Sector Popular, D. F., black soil and moist, January
23, 1966, 0-0-5. Celia Martínez.

REFERENCES

GATES, G. E. 1968. What is *Entrion ictericum* Savigny 1826 (Lumbricidae, Oligochaeta)? Bull. Soc. Linreenne Normandie, (10), 9: 199-208.

OMODEO, P. 1956. Contributo alla revisione dei Lumbricidae. Arch. Zool. Italiano, 41: 129-212.

TABLE 1

Typhlosole termination, atyphlosolate segments and tail regeneration in *Allolobophora moebii*

Serial number	Locality	Typhlosole end in segment	Atyphlosolate segment	Level of tail regeneration	Number of segments in regenerate	Total number of segment
1	Ma	103-104	p.a.			
2	Me	115	41	110/111	46	156
3	Ma	116	23 p.a.			139
4	Ma	110-117	13 + p.a.			
5	Me	117	48 p.a.?			165
6	Me	118	34 p.a.?			152
7	Ma	120	0 p.a.?			120
8	Me	120	0 p.a.?			120
9	Me	120	60	134/135	46	180
10	Me	124	31 p.a.?			155
11	Me	126	66	108/109	84	192
12	Me	126	p.a.	89/90	37+	126 +
13	Ma	128	20 +			148+ p.a.
14	Me	129-132	13			145 p.a.
15	Me	132	28			162 p.a.?
16	Ma	132	55			187
17	Ma	141	67			208
18	Me	148	61			209
19	Me	151	78	127/125	105	229
20	Ma	156	54			210

Ma, Madeira. Me, Mexico. 103-104, typhlosole height decreases gradually, as a result of regression following amputation. The typhlosole ends abruptly in normal and unamputated worms

Tail regeneration has usually been thought to be hypomeric but the worm with the largest number of segments has a tail regenerate!