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NEW EARTHWORMS FROM CHINA, WITH NOTES ON THE
SYNONYMY OF SOME CHINESE SPECIES OF
DRAWIDA AND PHERETIMA

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NEW EARTHWORMS FROM CHINA, WITH NOTES ON
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Seven years and more ago the author undertook a study of the earthworms collected in the province of Szechuan, China, by Dr. D. C. Graham for the United States National Museum. As many of the Chinese species were inadequately characterized, completion of the report on this study had to be delayed until the gaps in our knowledge of the older forms could be filled out. In the meantime further collections made by Dr. Graham necessitated numerous changes in the earlier manuscript. Just recently opportunities have arisen to examine the types of many important species. As the types of the few remaining species are not likely to be available for examination in the immediate future, the report was brought to completion. As publication of the full report may be delayed for some time, owing to financial conditions, it seems desirable to publish diagnoses of the new species together with short notes on the changes in the synonymy. Full descriptions of the types of the new species, together with some account of the examinations of the older types, as well as explanations of the changes in the synonymy will be included in the definitive report.

In connection with a few of the species the opportunity has been taken to include brief remarks on a very recent paper by Chen (1933), published after the writer's longer paper was completed.

DRAWIDA Michaelsen

The clitellum, in this genus, appears to be a rather evanescent structure, often absent in most, if not all, of the specimens submitted to the systematist for examination, and possibly present or recognizable externally during only a small portion of the year. In these circumstances many of the species in this genus have been erected on aclitellate specimens.

Unfortunately, some of the types have been so juvenile that distinguishing specific characteristics are entirely unrecognizable, and

other types are so immature that there is doubt as to whether the structures of most importance for taxonomic purposes have reached a definitive stage in their development.

Criteria for the recognition of sexual maturity in the genus *Drawida* are therefore essential. Size (of the specimen) is not a satisfactory criterion: a worm 30 mm long may be fully mature, whereas other worms well over 100 mm in length may be too small to identify. Other criteria that might be suggested have proved unsatisfactory, but for most taxonomic purposes sexual maturity may be regarded as evidenced by the distension of ovarian segments or chambers and ovisacs by free ova, the distension of the testis sacs by testicular material, and the distension of the spermathecal ampullae by a flocculent, whitish material.

Especial attention is necessary, in identifications and specific descriptions, to the characteristics and contents of invaginations at the ectal ends of the male deferent apparatus and of the spermathecae, to the central body of the prostate, to the spermathecal atria, and to the glands of the genital markings and the male porophores. The extent of the closing off of the ovarian segment is also to be determined.

DRAWIDA GISTI Michaelsen, 1931

Distinguished from *D. hehoensis* Stephenson, 1924, by the greater size of the prostates and their relation to the penis pouches, greater length of the penes, larger size of the spermathecal atria, incompleteness of closure of the ovarian chamber, presence of an "urn-shaped" gland in the atrial wall, and by the definite genital markings with their glands projecting through the parietes into the coelom.

D. gisti f. *typica* Chen, 1933, differs from the types as follows: apertures of the penial chambers located in *bc* nearer to *c* than *b*, prostates shorter, 4 to 8 mm in length (including duct) rather than 9 to 11 mm, presence of a genital marking in the penis pouch. These differences may or may not be significant.

D. gisti var. *nanchangiana* Chen, 1933, differs from the types as follows: prostates smaller (2 to 2½ mm in length), relation of prostates to the penial chambers, minute size of the spermathecal atria, and "ventrally closer and more prominent setae". According to Chen the spermathecal atrium is "often minute, bulb-like embedded in body wall, rarely elongate like other varieties". Specimens with minute atria embedded in the body wall may, of course, be juvenile, but if sexually mature must be specifically distinct from forms with elongate and coelomic spermathecal atria.

D. gisti var. *anchingiana* Chen, 1933, is not adequately described but differs from the types as follows: limitation of the penis pouches (?) to the body wall, small size and smooth surface of the prostates, and the presence of the spermathecal atria in vii rather than viii. These differences are important enough to distinguish the worms specifically from *D. gisti*. The specimens may not be sexually mature—*vide* absence of granulations on the prostates, the empty ovisacs, and the small size of the spermathecal ampullae, as well as the indistinctness of the clitellum.

DRAWIDA GRAHAMI, n. sp.

Length 55 mm, diameter 4 mm. Spermathecal pores in 7/8 midway between *b* and *c*. Male pores in *bc*, nearer to *b* than to *c*, on small porophores seated on 10/11, intersegmental furrow 10/11 ending blindly against the lateral and median sides of the porophores. Genital markings on vii-xiii, each marking with a firm, rounded gland projecting through the parietes into the coelom.

Vas deferens short. Prostates sessile on the parietes, outline circular; central body tiny, ovoidal, pointed end buried in the parietes. Segment xi reduced to a horseshoe-shaped ovarian chamber. Spermathecal atria finger-shaped, erect in viii.

Type.—U.S.N.M. no. 20093, from Suifu, Szechuan.

Distinguished from *D. japonica* by the absence of the appendix on the ovisacs, the more median location of the spermathecal pores, and the sessile prostates.

DRAWIDA JAPONICA Michaelsen, 1892

This species is characterized by a posterior continuation of the ovisac into a very long and slender rodlike appendix, which may extend as far back as segment xliii. These appendices were overlooked by both Michaelsen and Stephenson.

The central body of the prostate is shortly tubular, finger-shaped. The vas deferens passes ectally into the body wall just median to the prostate. The ovarian chamber is horseshoe-shaped. The male pores are located on segment x on the ventral faces of porophores in *bc*, nearer to *b* than to *c*.

D. japonica f. *siemsseni* Michaelsen, 1910 and 1931, is probably specifically distinct from *D. japonica*. It differs from the latter in size, number of gizzards, external genital markings and characteristics of the male porophores. Unfortunately, the internal organs of the single specimen have been lost so that the species cannot be adequately characterized.

D. japonica Chen, 1933, is probably only in part, if at all, conspecific with *D. japonica*. Chen's forms are characterized by greater size (70 to 200 by 3 to 5½ mm rather than 28 to 65 by 1 to 3 mm), location of the male pores, at least in part, on penes or penislike protuberances, and the absence of the characteristic appendices on the ovisacs. Possibly Chen's material is to be referred to two distinct species—mention is made of "some smaller ones about 30 mm long and 2 mm wide also showing sexually mature".

DRAWIDA LINHAIENSIS Chen, 1933

The types of this species are probably not fully mature—*vide* smooth or finely-granular surface of the prostates, the small size of the spermathecal ampullae, and the lack of clitellar development ("clitellum traceable only in one specimen"). The male porophore may possibly contain a spheroidal gland as in *D. nepalensis*.

Further information is needed on the penis (?) pouch (?) and relation of the prostate thereto, as well as on characteristics of the spermathecal atria and ovarian chamber in fully sexual specimens.

DRAWIDA SINICA Chen, 1933

Apparently a good species—the prostates and the spermathecal atria certainly appear to be quite characteristic. The types are not, however, fully mature—*vide* absence of ova in the ovisacs and ovarian segment and the small size and emptiness of the spermathecal ampullae.

DRAWIDA SYRINGA Chen, 1933

The description is rather abbreviated and the species cannot be adequately characterized in absence of information with regard to the central body of the prostates and the relation of the prostatic duct to the penis pouch(?). Length of ovisacs, in view of rather wide intra-specific variation in this characteristic, may possibly be of little importance.

PHERETIMA Kinberg

In this genus especial attention is necessary, in identifications and specific descriptions, to the characteristics and contents of the invaginations at the ectal ends of the male deferent apparatus and of the spermathecae, to the intestinal caeca, to the testis sacs and their relation to the seminal vesicles and to the glands of the genital markings. The failure to describe adequately some of these characteristics has

been responsible for the erection of unnecessary species and for considerable confusion in the synonymy.

Abnormalities probably occur much more frequently in this genus than in most other genera of earthworms and are often of such a nature as to render a particular specimen scarcely recognizable or indeed actually unrecognizable. Considerable taxonomic caution may therefore be necessary not only in connection with unique specimens but even with whole series or large batches.

PHERETIMA ABDITA, n. sp.

Length 80 to 140 mm, diameter $3\frac{1}{2}$ to 6 mm. Setae: vi/30-42, vii/30-44, xvii/14-16, xviii/13-17, xix/16-19, xx/54-69. First dorsal pore in 12/13. Spermathecal pores small, three pairs, in 5/6-7/8.

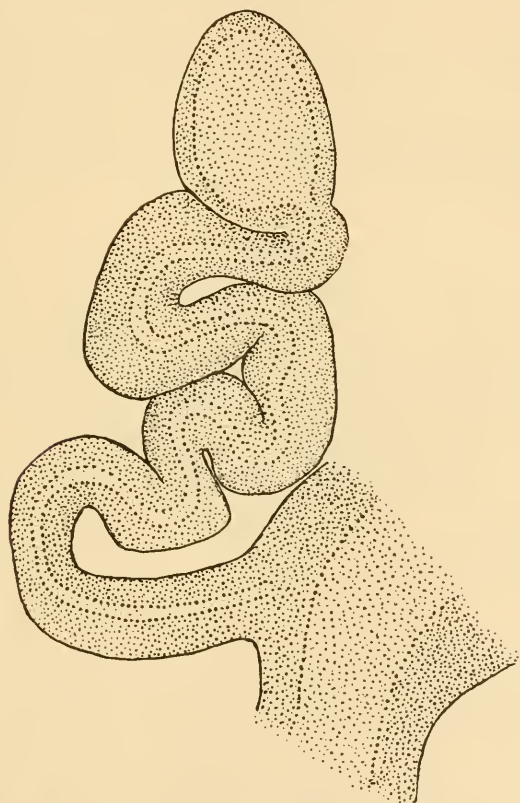


FIG. 1.—*Pheretima abdita*, new species. Spermathecal diverticulum and portion of spermathecal duct, cleared in lactophenol. \times ca. 94.

Male pores at ventral ends of tubular penes located in eversible, deep parietal invaginations with elongately slitlike apertures. Genital markings paired, presetal on xviii and xix.

Septa 8/9-9/10 present and thickly muscular. Intestinal caeca simple. Testis sac of x annular. Testis sac of xi U-shaped or annular. Seminal vesicles of xi included in the posterior testis sac. Spermathecal diverticulum with a short, muscular stalk, a middle portion more or less regularly bent back and forth in a zigzag fashion, and a terminal, ovoidal seminal chamber. Genital marking glands sessile, sometimes slightly protuberant into the coelom.

Type.—U.S.N.M. no. 20094; from Suifu, Szechuan.

Distinguished from *P. floweri* and *P. gemella* as well as from *P. rockefelleri* by the presence and muscularity of septa 8/9-9/10.

PHERETIMA ANTEFIXA, n. sp.

Length 85 to 120 mm, diameter $3\frac{1}{2}$ to 5 mm. Setae: viii/12-14, xiv-xv/+ or -, xvi/7-16, xvii/12-18, xviii/6-10, xix/13-17, xx/36-42. First dorsal pore in 12/13. Spermathecal pores superficial, one pair, in 8/9. Male pores superficial, toward lateral margins of short, transverse ridges. Genital markings unpaired, median, presetal on iii, iv, and v.

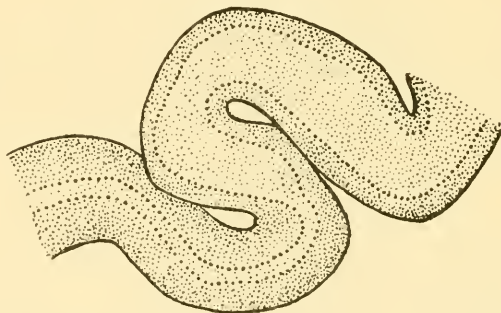


FIG. 2.—*Pheretima antefixa*, new species. Portion of spermathecal diverticulum, cleared in lactophenol.

Intestinal caeca simple. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a short, muscular stalk and an elongately tubular seminal chamber, the latter nearly straight, twisted or looped. Genital marking glands stalked and coelomic.

Type.—U.S.N.M. no. 20095, from Suifu, Szechuan.

Distinguished from other bithecal species of *Pheretima* with spermathecal pores in 8/9 by the extreme anterior location of the unpaired, median genital markings.

PHERETIMA ASPERGILLUM (E. Perrier), 1872

In the synonymy of this species there must now be placed the following: *Pheretima lauta* Ude, 1905, *Pheretima paraglandularis* Fang, 1929, *Pheretima siemsseni* Michaelsen, 1931 (in part).

PHERETIMA BUCCULENTA, n. sp.

Length 135 mm, diameter 6 mm. Setae: vi/22, vii/22, viii/25, xvii/16, xviii/20, xix/20. First dorsal pore in 12/13. Spermathecal pores minute and superficial, four pairs, in 5/6-8/9. Male pores on tiny, conical tubercles in the dorsalmost portions of deep parietal invaginations with longitudinally slitlike apertures. Genital markings paired, presetal on xviii.

Intestinal caeca simple. Testis sacs of x and xi unpaired and ventral. Genital marking glands sessile but protuberant through the parietes into the coelom.

Type.—U.S.N.M. no. 20096, from "Szechuan".

Distinguished from other octothecal Chinese species of *Pheretima* by the combination of superficial spermathecal pores and deeply invaginate male pores.

PHERETIMA EXILIS, n. sp.

Length 68 to 85 mm, diameter 2 to 2½ mm. Setae: vi/39, xvi/6, xvii/10-15, xviii/8, xix/11-13, xx/50. First dorsal pore in 12/13. Spermathecal pores minute and superficial, two pairs, in 5/6-6/7 or on the posteriormost margins of v and vi. Male pores within slight depressions on glistening, not sharply demarcated areas. Genital markings paired on xvii and xix, probably postsetal.

Intestinal caeca simple. One pair of testis sacs in x. One pair of vertical testis sacs in xi. Seminal vesicles of xi included within the posterior testis sacs. Genital marking glands sessile but slightly protuberant through the parietes into the coelom.

Type.—U.S.N.M. no. 20097, from Suifu, Szechuan.

Distinguished from quadrithecal Chinese species of *Pheretima* with spermathecal pores in 5/6-6/7 by the inclusion of the seminal vesicles of xi within the posterior testis sacs.

PHERETIMA FLEXILIS, n. sp.

Length 40 mm, diameter 2 mm. Setae; vii/16, viii/16, xvii/10, xviii/10, xix/11. First dorsal pore in 13/14. Spermathecal pores minute and superficial, three pairs, in 6/7-8/9. Male pores superficial, at the centers of tiny, transversely oval areas, each area surrounded by

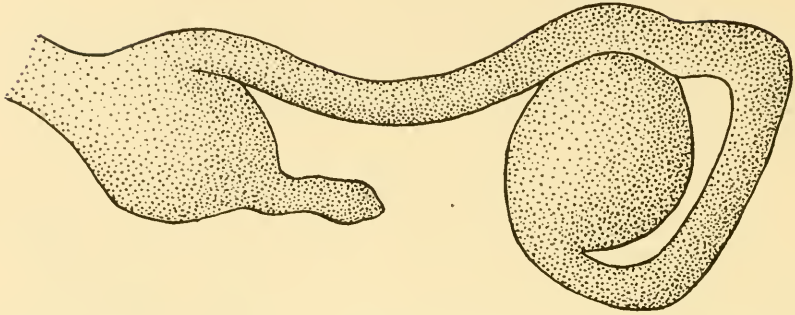


FIG. 3.—*Pheretima exilis*, new species. Spermatheca with iridescent mass in seminal chamber. \times ca. 64.

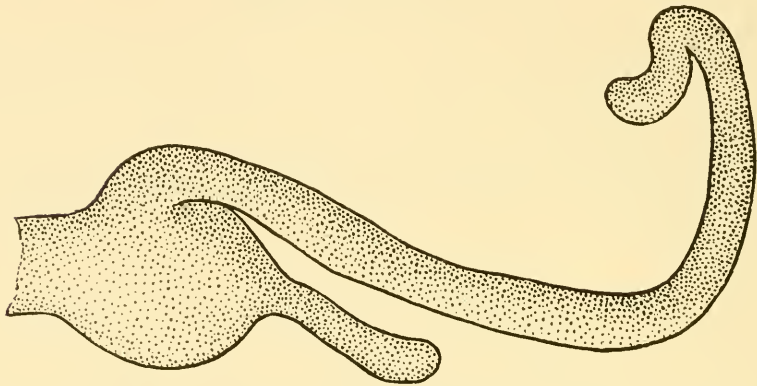


FIG. 4.—*Pheretima exilis*, new species. Spermatheca with no iridescence in diverticulum. \times ca. 64.

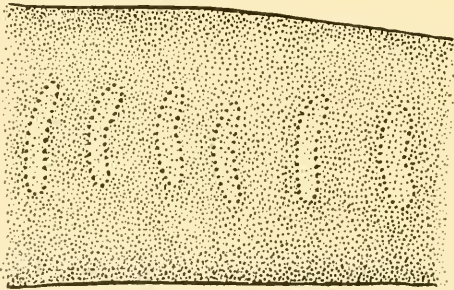


FIG. 5.—*Pheretima fornicata*, new species. An ectal portion of spermathecal diverticulum, cleared in lactophenol.



FIG. 6.—*Pheretima fornicata*, new species. Ental portion of spermathecal diverticulum, cleared in lactophenol. Magnification much less than in fig. 5.

several concentric furrows. Genital markings unpaired and median, presetal on viii, postsetal on xvii and xviii.

Intestinal caeca simple. Testis sac of x horseshoe-shaped. One pair of vertical testis sacs in xi. Seminal vesicles of xi included within the posterior testis sacs. Spermathecal diverticulum with short, muscular stalk and an elongately tubular seminal chamber, the latter variously bent, twisted or looped. Genital marking glands with long, coelomic stalks.

Type.—U.S.N.M. no. 20098, from between Gin Keo Ho and Dawei, Szechuan.

Distinguished from *P. hupciensis* by the absence of septa 8/9-9/10 and from *P. löhri* by characteristics of the testis sacs as well as by the extra pair of spermathecae.

PHERETIMA FORNICATA, n. sp.

Length 78 to 90 mm, diameter 4 to 6 mm. Setae: vi/17-24, vii/19-21, viii/18-23, xvii/13-14, xviii/9-14, xix/12-15, xx/56; a wide dorsal gap in the setal circle of ii. First dorsal pore in 12/13. Spermathecal pores minute and superficial, four pairs, in 5/6-8/9. Male pores superficial, on circular to transversely oval, disk-shaped porophores. No genital markings.

Septum 8/9 present but membranous. Intestinal caeca simple. Testis sacs of x and xi unpaired and horseshoe-shaped. Spermathecal diverticulum with a long, slender stalk and a spheroidal or asymmetrical seminal chamber.

Type.—U.S.N.M. no. 20099, from Tatsienlu, Tibet.

Distinguished from *P. hongkongensis* by the gap in the setal circle of ii, the exclusion of the seminal vesicles of xi from the posterior testis sac, and the absence of genital markings.

PHERETIMA GRAHAMI, n. sp.

Length 235 to 285 mm, diameter 11 to 15 mm. Setae: vii/22-25, viii/22-27, xvii/26, xviii/19, xix/19-25, xx/80-91. First dorsal pore in 12/13-13/14. Spermathecal pores on tiny, conical protuberances into large, club-shaped spermathecal chambers, the latter invaginated posteriorly and deeply into the coelom and bound by connective tissue to the ventral parietes; apertures of spermathecal chambers large, transversely slitlike, three pairs, in 6/7-8/9. Male pores on broadly conical tubercles in large copulatory chambers with apertures approximating to transversely slitlike. External genital markings lacking;

5 to 6 circular to oval, flat-surfaced markings in each copulatory chamber; one large, oval marking on the dorsal (morphologically anterior) wall of each spermathecal chamber.

Intestinal caeca simple. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a short, muscular stalk and an

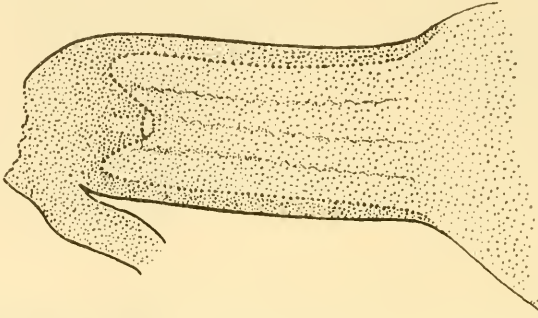


FIG. 7.—*Pheretima grahamsi*, new species. Portion of spermathecal duct, cleared in lactophenol.

elongately tubular seminal chamber, the latter often looped in a regularly zigzag fashion.

Type.—U.S.N.M. no. 20100, from Da Shiang Lin Pass, Szechuan.

Distinguished from *P. vulgaris* by the unpaired, ventral testis sacs and the large, club-shaped spermathecal chambers with their large, oval genital markings.

PHERETIMA GUILLELMI (Michaelsen), 1895

A good species. Distinguished from *P. houlleti* (E. Perrier), 1872, with which it has been confused, by the limitation of the male pore invaginations to the parietes (in *P. houlleti* the male pores are in copulatory chambers). *P. houlleti* Stephenson, 1925, and *P. ichangensis* Fang, 1933, must be included in the synonymy. *Amyntas houlleti* Michaelsen, 1899, is probably also a synonym. *P. vulgaris agricola* Chen, 1930, is probably also, at least in part, a synonym. *P. guillelmi* Chen, 1933, is a composite of *P. guillelmi* and *P. vulgaris*.

PHERETIMA HONGKONGENSIS Michaelsen, 1910

The unpaired testis sac of x is ventral and median. The unpaired testis sac of xi is U-shaped, the limbs of the U reaching to the dorsal blood vessel. The seminal vesicles of xi are included within the posterior testis sac and are surrounded by a layer of testicular coagulum.

The holotype is either not fully sexual or is not quite normal.

PHERETIMA HUPEIENSIS (Michaelsen), 1895

The testis sacs of x and xi are U-shaped. Chen (1933) appears to regard the testis sacs as annular. Chen's account is not quite clear. He places the seminal vesicles of xii in a membranous sac similar to that which contains the seminal vesicles of xi, though there is no testis sac in xii. Coelomic coagulum may sometimes be compacted around the seminal vesicles so closely as to produce an appearance somewhat similar to that of a testis sac filled with testicular coagulum.

Perichaeta hupeiensis Gee, Boring, and Wu, 1927, is certainly not *P. hupeiensis* and is probably a composite of three distinct species.

PHERETIMA IGNOBILIS, n. sp.

Length 55 mm, diameter 3 mm. Setae: vi/17, vii/16, viii/16, xvii/15, xviii/9, xix/16. First dorsal pore in 11/12. Spermathecal pores in parietal invaginations with transversely slitlike apertures, four pairs, in 5/6-8/9. Male pores on the roof and toward the median side of transversely slitlike depressions. No genital markings.

Intestinal caeca simple. Testis sacs of x and xi paired and ventral.

Type.—U.S.N.M. no. 20101, from near Ningyuenfu, Szechuan.

Distinguished from all octothecal Chinese species of *Pheretima* by the location of the spermathecal pores in parietal (or deeper?) invaginations.

PHERETIMA LIMELLA, n. sp.

Length 60-85 mm, diameter 2½-5 mm. Setae: v/38, vi/51, xiv-xvi/+, xvii/18-29, xviii/14-21, xix/18-26. First dorsal pore in 12/13. Spermathecal pores minute and superficial, one pair, in 5/6. Male

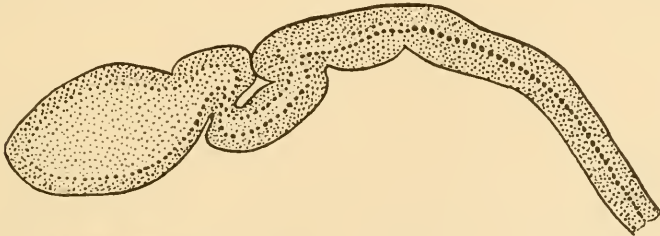


FIG. 8.—*Pheretima limella*, new species. Spermathecal diverticulum, cleared in lactophenol.

pores at centers of small, oval tubercles; a thin fold of tissue at the lateral margin of each male porophore can be drawn mesially over the tubercle in the manner of an eyelid. Genital markings paired and presetal on xvii.

Septa 8/9-9/10 present and thickly muscular. Intestinal caeca simple. Testis sacs of x and xi unpaired. Spermathecal diverticulum with a muscular stalk and an elongate seminal chamber, the ectal portion of the latter looped, the ental portion ovoidal. Genital marking glands sessile.

Type.—U.S.N.M. no. 20102, Suifu, Szechuan.

Distinguished from *P. zoyisiae* Chen, 1933, by the presence and muscularity of septa 8/9-9/10 and by the presence of genital markings.

PHERETIMA MIRABILIS (Bourne), 1887

In the synonymy of this species there must now be placed *P. heterochaeta* (Michaelsen), 1891, and *P. divergens* var. *yunnanensis* Stephenson, 1912.

PHERETIMA MODESTA Michaelsen, 1927

The male pores are in copulatory chambers which, in a completely retracted condition, protrude rather conspicuously into the coelom. A very large portion of the coelomic protuberance is composed of tiny quirks in the prostatic duct on the dorsal face of the chamber and a mass of connective tissue surrounding these quirks. The lumen of the chamber is rather small but is narrowed in the outer layers of the parietes as if by a contraction of an annular, sphincter muscle. In slightly softened specimens the apertures of the chambers gape open, and the lumen of the chamber does not extend internally beyond the level of the coelomic face of the parietes.

In the synonymy of *P. modesta* are to be placed *P. kiangensis* Michaelsen (in part only?) and *P. hesperidum* Chen, 1931 and 1933. The status of Beddard's *P. hesperidum* was discussed in Gates (1932). Stephenson (1933) considered the status of *P. hesperidum* and has also refused to accept Beddard's species.

PHERETIMA OBSCURITOPORA Chen, 1931

Erected on juvenile specimens of uncertain age, in which the adult and hence definitive specific characteristics are unrecognizable. The Szechuan specimens might be rather small juveniles of *P. grahami* or *P. praecipuus*; the Nanking specimens may possibly belong to *P. tschiliensis*.

PHERETIMA OMEIMONTIS Chen, 1931

P. paraglandularis var. *omeimontis* Chen, 1931, is distinguished from *P. paraglandularis* Fang, 1929 (= *P. aspergillum*), by differences so numerous and significant that *omeimontis* must be regarded as specifically distinct.

PHERETIMA PAETA, n. sp.

Length 75-136 mm, diameter 5-6 mm. Setae: viii/22-24, xvii/18-21, xviii/10-16, xix/21-24, xx/65-68. First dorsal pore in 11/12-12/13. Spermathecal pores on circular to oval areas within deep invaginations with transversely slitlike apertures, two pairs, in 7/8-8/9. Male pores on the dorsal wall of large copulatory chambers conspicuously protuberant into the coelom. On the median wall of the copulatory chamber a presetal, transversely oval genital marking, occasionally also a postsetal marking; on the roof of the chamber one or two further markings of variable shape and size. External genital markings paired, on the posteriormost margins of vii and viii, each marking one to three intersetal intervals median to the aperture of the spermathecal invagination.

Intestinal caeca compound, dorsalmost secondary caecum the longest. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a muscular stalk and an elongately tubular seminal chamber, the latter looped back and forth in a regularly zigzag fashion.

Type.—U.S.N.M. no. 20103, from Song Pan, Szechuan.

Distinguished from *P. omeimontis* by the copulatory chambers, and from *P. schmardae* by the larger size, the invagination of the spermathecal pores, and the presence of genital markings.

PHERETIMA PAPILLIFERA, n. sp.

Length 100 mm, diameter 4 mm. Setae: vi/11 (+ ?), vii/13 (+ ?), xvii/18 (+ ?), xviii/10, xix/10, xx/ca. 41; lacking on ii-iii and dorsally on iv. First dorsal pore in 11/12. Spermathecal pores minute and superficial, three pairs, in 5/6-7/8. Male pores superficial, at centers of circular areas demarcated by slight furrows. Genital markings paired, presetal, on xi-xiv.

Intestinal caeca simple. Testis sacs of x and xi paired. Spermathecal diverticulum with a short muscular stalk and a longer, more irregular seminal chamber. Genital marking glands sessile on the parietes.

Type.—U.S.N.M. no. 20104, from near Zachoo, Szechuan.

Distinguished from sixthelcal Chinese species of *Pheretima* with spermathecal pores in 5/6-7/8 by the absence of setae on ii-iii and dorsally on iv and by the location of the genital markings.

PHERETIMA PECTENIFERA Michaelsen, 1931

The male pore region of *P. pectenifera* is so remarkably similar to that figured for *P. yamadai* Hatai, 1930, that the former may be, in reality, a synonym of the latter. Hatai's species is not adequately

characterized and *P. pectenifera* must, accordingly, be allowed to stand until after reexamination of the Japanese types or amplification of the original description. Further information is needed with regard to size, spermathecal pores, setal numbers, septa 8/9-9/10, intestinal caeca, testis sacs, and the preclitellar genital markings.

Pheretima yamadai Chen, 1933, is almost certainly a composite of two distinct species, *P. pectenifera* and *P. tschiliensis* Michaelsen, 1928. Chen himself distinguishes two forms, A and B; A is probably *tschiliensis*, B probably *pectenifera*.

P. pingi Michaelsen, 1931, may be, in part, synonymous with *P. pectenifera*. At least four of the Hamburg specimens labelled "*P. pingi*" are obviously *P. pectenifera*.

PHERETIMA PINGI Stephenson, 1925

The hearts of x are present but are small, usually empty and bound by connective tissue to the anterior face of 10/11. In these circumstances the hearts of x are easily overlooked. According to Chen (1933) the hearts of x are entirely lacking.

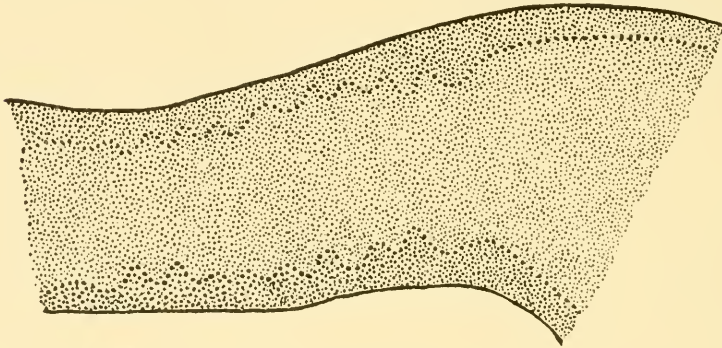


FIG. 9.—*Pheretima pingi*. An ental portion of spermathecal diverticulum, cleared in lactophenol.

(The term "heart" is used to refer to a segmental commissure connecting the ventral blood vessel with the supra-esophageal vessel or the dorsal blood vessel or both, in any of segments ix-xiii.)

PHERETIMA POMELLA, n. sp.

Length 87 mm, diameter 5 mm. Setae: vii/19, xvii/19, xviii/14, xix/19, xx/ca. 50; lacking dorsally on ii. First dorsal pore in 10/11. Spermathecal pores minute and superficial, two pairs, presetal on vii and viii, slightly nearer to the intersegmental furrows than the setal circles. Male pores superficial, on rather indistinctly demarcated areas. Genital markings paired, presetal on xii, xiii and xviii, post-

setal on xviii; markings on xviii in line with male pores, on xii-xiii about in *ab*.

Intestinal caeca simple. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a short, muscular stalk and an elongately tubular seminal chamber, the latter twisted into a ball-like mass of loops.

Type.—U.S.N.M. no. 20105, from Suifu, Szechuan.

Distinguished from *P. planata* Gates, 1926, by the posterior location of the spermathecal pores, the absence of copulatory chambers, and the locations of the genital markings.

PHERETIMA PRAEPINGUIS, n. sp.

Length 207-(357?) mm, diameter 16 mm. Setae: vii/23, viii/24, xvii/20, xviii/9+, xix/22, xx/93. First dorsal pore in 12/13. Spermathecal pores on tiny tubercles located in parietal invaginations with transversely slitlike apertures, three pairs, in 6/7-8/9. One circular genital marking on the anterior wall of each invagination. Male pores on tubercles in the lateralmost portions of deep parietal invaginations with crescentic apertures, lateral walls of the invaginations thin and nonsetigerous. Just median to each male pore tubercle a single genital marking; on the median wall of the male invagination a transversely oval, presetal genital marking. External genital markings paired, presetal on vii, viii and ix.

Intestinal caeca simple. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a short, muscular stalk and an elongately tubular seminal chamber, the latter with several slight constrictions.

Type.—U.S.N.M. no. 20106, from Mount Omei, Szechuan.

Distinguished from *P. tschiliensis* by the spermathecal invaginations and the genital markings therein.

PHERETIMA ROBUSTA (E. Perrier), 1872

In the synonymy of this species there must now be placed the following: *P. siemsseni* Michaelsen, 1931 (in part), *P. fokiensis* Michaelsen, 1931, *P. lauta* Ude, 1932. *P. löhri* (Michaelsen), 1899, can be distinguished from *P. robusta* only by the small size. The types of *P. löhri* may be dwarfed forms of *P. robusta*, the dwarfing the result of a heavy infection of parasitic protozoa. *P. lauta* Chen, 1933, is probably in large part, if not entirely, synonymous with *P. robusta*. Chen does, however, differentiate between "coast" and "inland" forms, and possibly some of one or both groups may be referable to

P. aspergillum. Chen's specimens appear to be more or less abnormal—"prostates not well developed . . . or totally absent or very rudimentary".

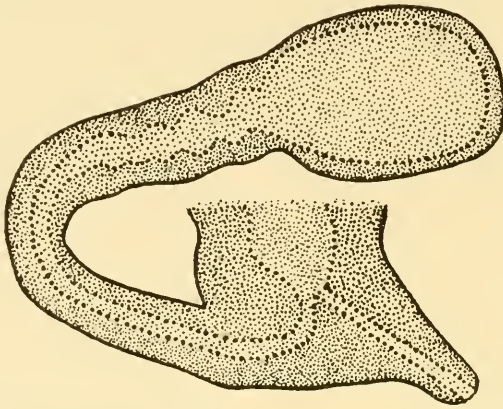


FIG. 10.—*Pheretima robusta*. Portion of a spermatheca, cleared in lactophenol.
 \times ca. 54.

All Szechuan specimens that can be referred to *P. corrugata* Chen, 1931, are abnormal. The two paratypes that have been available for examination are also abnormal. *P. corrugata* is therefore regarded as very dubious, possibly synonymous with *P. robusta*.

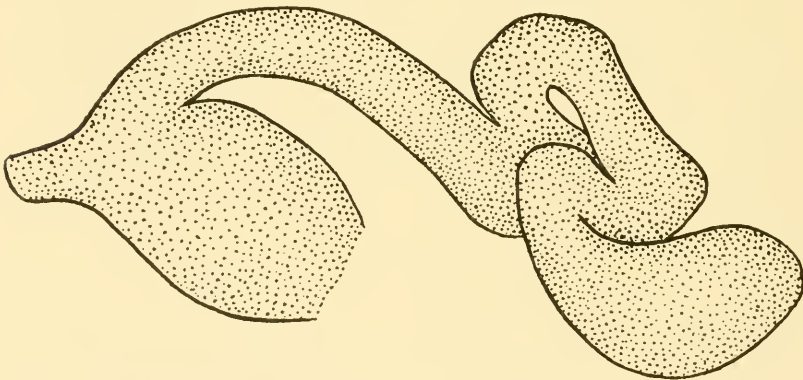


FIG. 11.—*Pheretima schwardae*. Duct and diverticulum of a spermatheca.
 \times ca. 70.

PHERETIMA TSCHILIENSIS MICHAELSEN, 1928

In the synonymy of this form there must now be placed the following: *P. asiatica* Michaelsen, 1902 (in part), *P. tibetana* Michaelsen, 1931, and *P. kiangsuensis* Chen, 1930 and 1931.

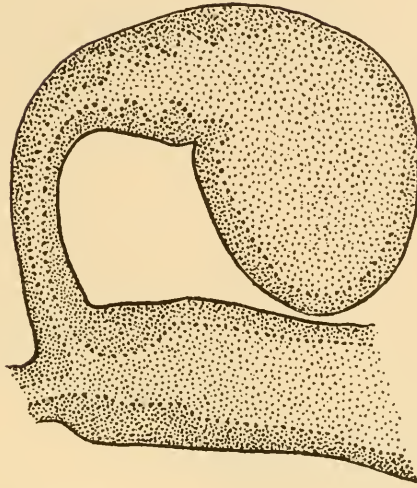


FIG. 12.—*Pheretima szechuanensis*. Spermathecal duct and diverticulum, cleared in lactophenol. \times ca. 52.

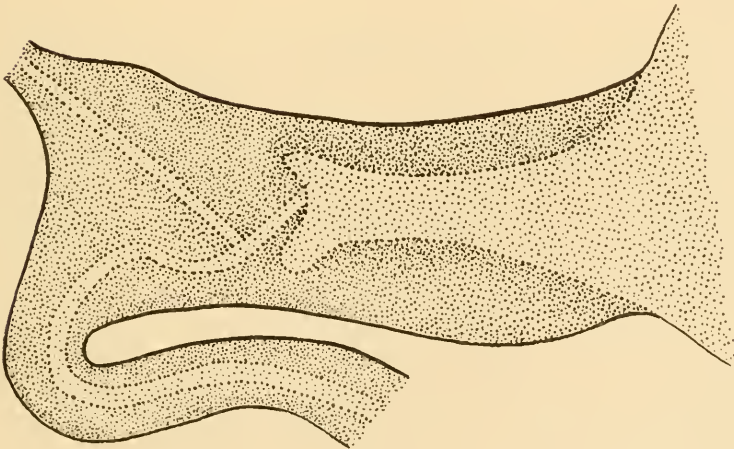


FIG. 13.—*Pheretima tschiliensis*. Spermathecal duct and diverticular stalk, cleared in lactophenol.

Types of *P. asiatica* (Michaelsen), 1900, have not, unfortunately, been available for examination, but inasmuch as Michaelsen's reasons for splitting off *P. tibetana* from *P. asiatica* do not appear to be adequate—especially in view of the variability of the form under consideration—it is quite possible that *P. tschiliensis* may have to be placed in the synonymy of *P. asiatica*. The latter is not, however, sufficiently distinguished from *P. guillelmi* to warrant further change at the present.



FIG. 14.—*Pheretima tschiliensis*. Spermathecal diverticulum, cleared in lactophenol. \times ca. 45.

PHERETIMA TUBERCULATA, n. sp.

Length 80-110 mm, diameter 3-5 mm. Setae; vi/9-10, vii/9-14, xvii/16-19, xviii/10-13, xix/17-20, xx/40-53. First dorsal pore in 10/11. Spermathecal pores minute and superficial, three pairs, in 5/6-7/8. Male pores superficial, at centers of small, oval areas. Genital markings small tubercles in immediate vicinity of male and spermathecal pores.

Intestinal caeca compound, dorsalmost secondary caecum the longest. Testis sacs of x and xi unpaired and ventral. Spermathecal diverticulum with a muscular stalk and an elongately tubular seminal chamber, the latter often looped in a regularly zigzag fashion. Genital marking glands stalked and coelomic, stalks erect in the coelom.

Type.—U.S.N.M. no. 20107, from Suifu, Szechuan.

Distinguished from sixthelial Chinese species of *Pheretima* with spermathecal pores in 5/6-7/8 by the compound intestinal caeca.

PHERETIMA VULGARIS Chen, 1930

A good species if the account of the typical forms is correctly interpreted, distinguished from *P. guillelmi*, with which Chen has lately (1933), confused it, by the characteristic club-shaped copulatory chambers as well as by the spermathecal invaginations.

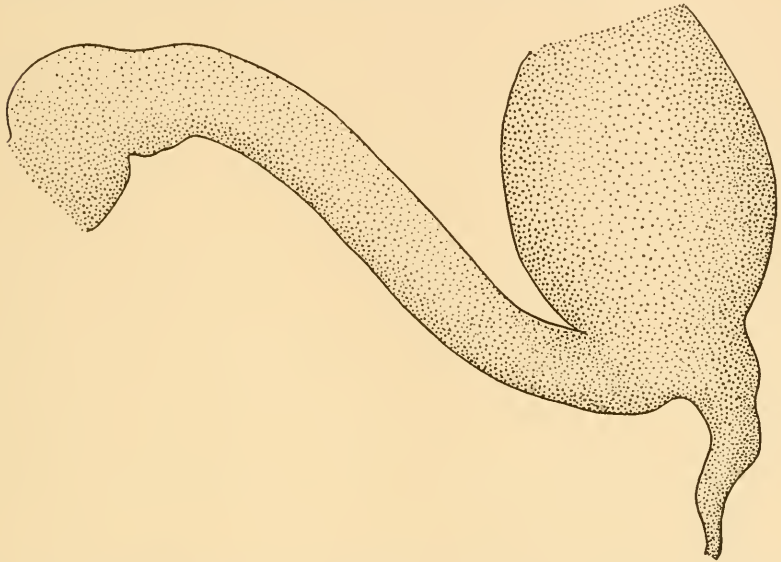


FIG. 15.—*Pheretima vulgaris*. Spermathecal duct and ectal portion of diverticulum. \times ca. 36.

P. pingi Michaelsen, 1931, and *P. kiangensis* Michaelsen, 1931, are probably, at least in part, synonymous with *P. vulgaris*; some of the Hamburg specimens labelled *P. pingi* and *P. kiangensis* are obviously *P. vulgaris*. An acitellate specimen from Ichang in Hupeh, referred by Fang to *P. vulgaris*, is correctly identified, but specimens from Peiping referred to *P. vulgaris* by Fang cannot be properly placed.

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