

New Species of the Genus *Pheretima* s. lat. (Annelida, Oligochaeta, Megascolecidae) from Tokyo, Japan—Part IV. The Species with Simple Intestinal Caeca (2)

**Kotaro Ishizuka**

Seikei High School, 3–10–13 Kichijoji-kitamachi, Musashino City, Tokyo, 180–8633 Japan

**Abstract** In the fourth series of the study on the genus *Pheretima* s. lat. (family Megascolecidae) collected from Tokyo, a group of the species with simple intestinal caeca is dealt with and 11 new species are described here: *Pheretima subrotunda*, *Ph. rufidula*, *Ph. flavida*, *Ph. silvestris*, *Ph. semilunaris*, *Ph. fulva*, *Ph. subterranea*, *Ph. subalpina*, *Ph. lactea*, *Ph. mitakensis*, *Ph. octo*.

**Key words:** Megascolecidae, *Pheretima* s. lat., new species, Tokyo.

**Introduction**

Forty seven undescribed species of the genus *Pheretima* s. lat. were found from Tokyo. Among them, 11 new species with manicate intestinal caeca were described in the first part (Ishizuka, 1999a), 10 new species with serrate intestinal caeca in part II (Ishizuka, 1999b), and 7 new species with simple intestinal caeca (1) in part III (Ishizuka, 1999c). In Part IV, 11 new species of simple intestinal caeca are described.

***Pheretima subrotunda* sp. nov.**

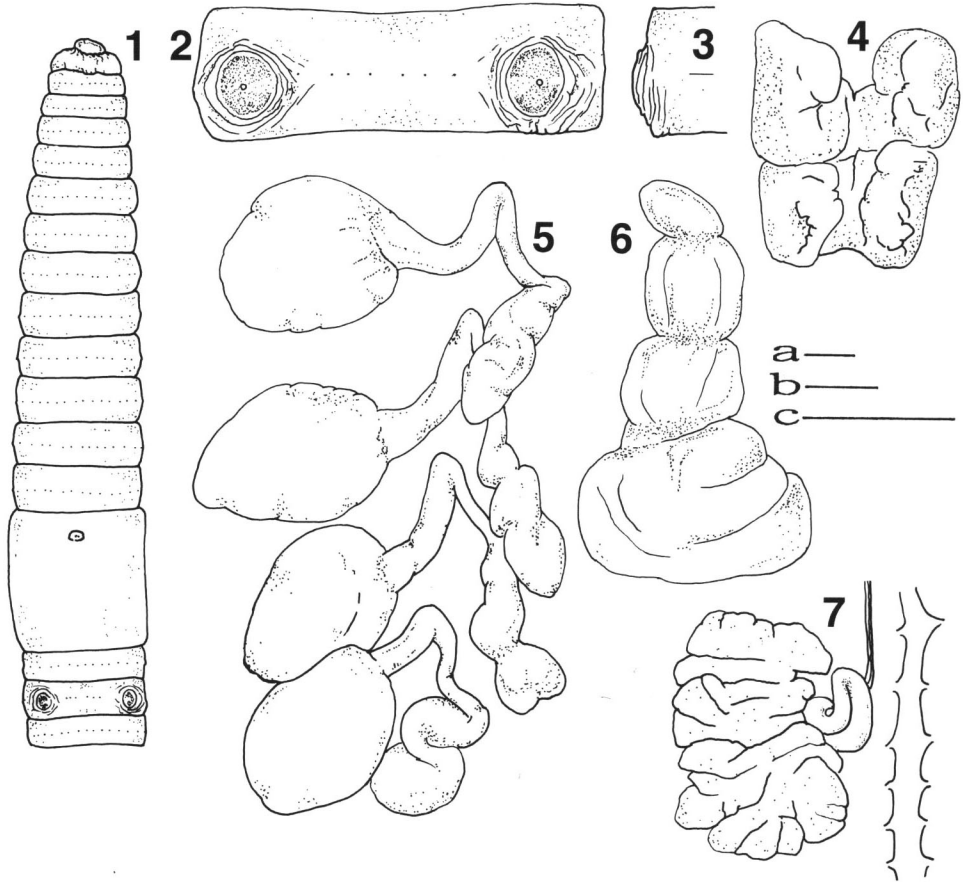
[New Japanese name: Enkei-mimizu]

(Figs. 1–7, Table 1)

**Description.** Body. Length 40–65 mm, width 2.1–2.8 mm. Number of segments 70–90. Reddish brown dorsally, greyish white ventrally.

**External characters.** Four pairs of spermathecal pores situated in furrows 5/6/7/8/9, in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings absent. Male pores large, simple, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Setal number 42–46 in segment VII, 46–52 in segment XX.

**Internal characters.** Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–4 segments. Intestine begins in XV. Genital glands absent. Septa absent in 8/9/10, thickened in 5/6/7/8 slightly thickened in 10/11/12/13/14. Four pairs of spermathecae, in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a thick duct; diverticulum consisting of a thick twisted

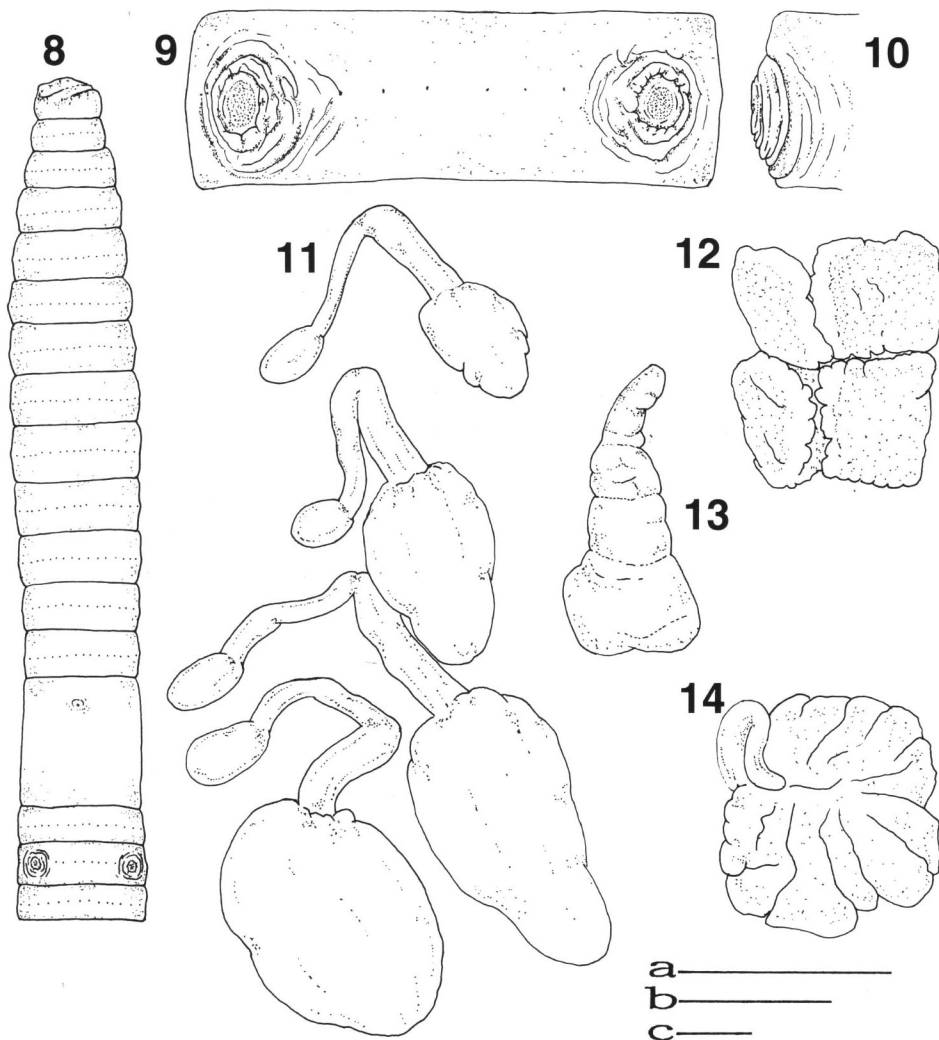


Figs. 1–7. *Pheretima subrotunda* sp. nov. Holotype (NSMT-An 292). 1: Ventral view of anterior body. 2: Male pores on segment XVIII. 3: Lateral view of segment XVIII. 4: Dorsal view of seminal vesicles. 5: Spermathecae. 6: Intestinal caecum. 7: Prostate gland with a duct. (Scale bars. a: 1 mm for 1, b: 1 mm for 4, 7, c: 1 mm for 2–3, 5–6.)

tube and a duct. Seminal vesicle large, extending in segments XI–XII. Prostata large, extending through segments XVI–XX, ducts corresponding to the male pores.

*Material examined.* Holotype (NSMT-An 292) and 5 paratypes (NSMT-An 293): Nippara Valley, 30–VII–1981, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 23 exs. with same data as the type series.

*Remarks.* The new species resembles *Pheretima digna* Chen, 1946, but is distinguishable from the latter species by (1) the presence of four pairs of spermathecal pores, and (2) the diverticulum consisting of a thick twisted tube and a duct.



Figs. 8–14. *Pheretima rufidula* sp. nov. Holotype (NSMT-An 294). 8: Ventral view of anterior body. 9: Male pores on segment XVIII. 10: Latetal view of segment XVIII. 11: Spermathecae. 12: Dorsal view of seminal vesicles. 13: Intestinal caecum. 14: Prostate gland with a duct. (Scale bars. a: 5 mm for 8, b: 1 mm for 9–11, c: 1 mm for 12–14.)

***Pheretima rufidula* sp. nov.**

[New Japanese name: Kokage-mimizu]

(Figs. 8–14, Table 1)

**Description.** Body. Length 70–110 mm, width 2.6–3.3 mm. Number of segments 80–105. Reddish brown dorsally, yellowish grey ventrally.

External characters. Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings absent. Male pores simple, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 11/12. Clitellum including segments XIV–XVI. Setal number 26–28 in segment VII, 36–38 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–4 segments. Intestine begins in XV. Genital glands, absent. Septa absent in 8/9, very delicate in 9/10, thickened in 5/6/7/8 and 10/11/12/13/14. Four pairs of spermathecae, in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a thick duct, diverticulum comprising a small oval pouch and a duct. Seminal vesicles large, extending to the dorsal line on segments XI–XII. Prostata extending through segments XVIII–XX, ducts corresponding to male pores.

*Material examined.* Holotype (NSMT-An 294) and 3 paratypes (NSMT-An 295): Mt. Takao, 15–IX–1985, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 3 exs. with same data as the type series.

*Remarks.* The new species resembles *Pheretima lacertina* Chen 1946, but is distinguishable from the latter species by (1) presence of intestinal caeca, and (2) the diverticulum comprising a small oval pouch and a duct.

*Pheretima flavida* sp. nov.

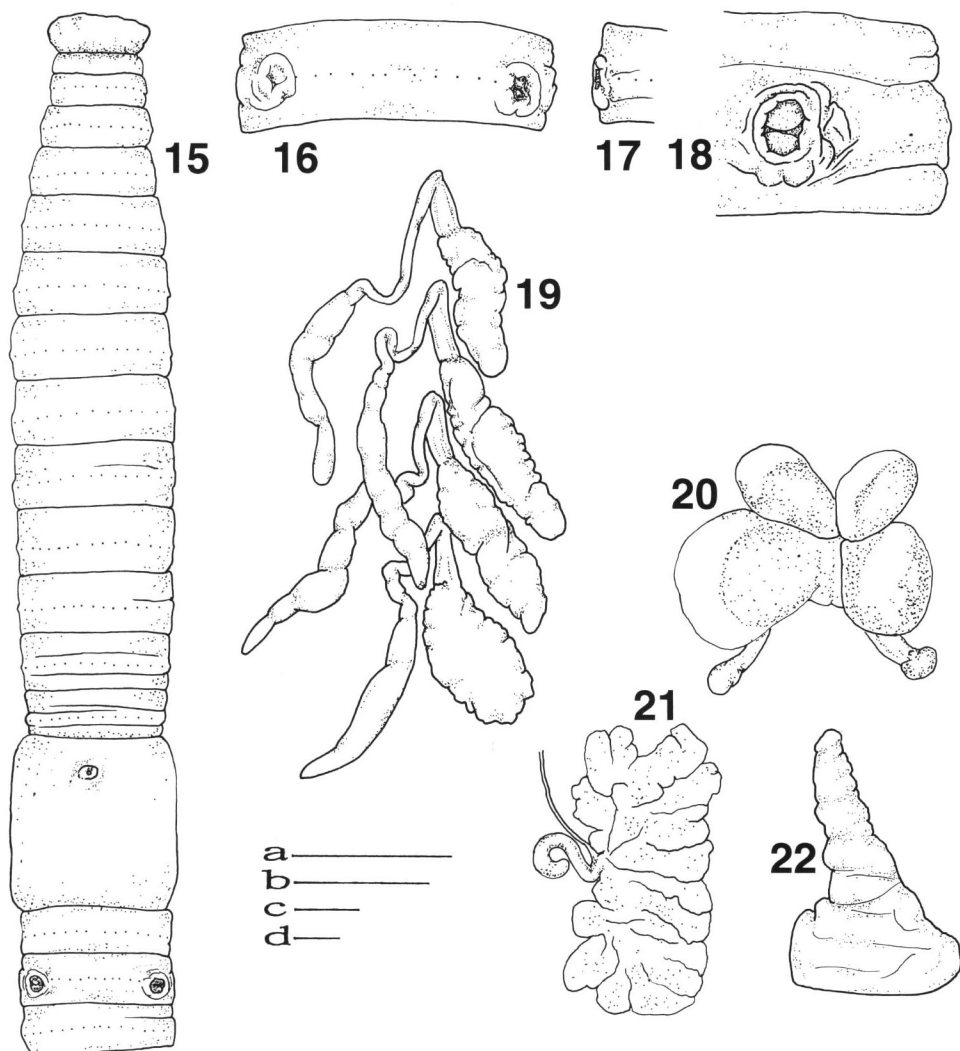
[New Japanese name: Kiobi-mimizu]

(Figs. 15–22, Table 1)

*Description.* Body. Length 130–170 mm, width 4.2–4.8 mm. Number of segments 102–111. light whitish brown dorsally, light whitish brown ventrally.

External characters. Four pairs of spermathecal pores small, situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings absent. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13 or 11/12. Clitellum including segments XIV–XVI. Setal number 42–44 in segment VII, 46–48 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 4 segments. Intestine begins in XV. Genital glands absent. Septa absent in 8/9/10, thickened in 5/6/7/8 and 10/11/12/13/14. Four pairs of spermathecae on segments VI–IX; ampulla consisting of a slender shovel-shaped pouch and a thick duct, diverticulum comprising a tubular pouch and a slender long duct. Seminal vesicle small, extending in segments XI–XII. Prostata extending



Figs. 15–22. *Pheretima flavida* sp. nov. Holotype (NSMT-An 296). 15: Ventral view of anterior body. 16, 18: Male pores on segment XVIII. 17: Lateral view of segment XVIII. 19: Spermathecae. 20: Dorsal view of seminal vesicles. 21: Prostate gland with a duct. 22: Intestinal caecum. (Scale bars: a: 5 mm for 15, b: 1 mm for 18, c: 1 mm for 16–17, 19–20, 22, d: 1 mm for 21.)

through segments XVI–XIX, ducts corresponding to male pores and occasionally lacking.

*Material examined.* Holotype (NSMT-An 296) and paratype (NSMT-An 297): Mt. Takao, 15–IX–1985, K. Ishizuka, from soil under a mixed forest of evergreen and

deciduous trees. Other specimens examined: 2 exs. with same data as the type series.

*Remarks.* The new species resembles *Pheretima phaselus* Hatai 1930, but is distinguishable from the latter species by (1) four pairs of spermathecal pores, (2) the simple male pores, and (3) the diverticulum comprising a tubular pouch and a slender long duct.

***Pheretima silvestris* sp. nov.**

[New Japanese name: Shinrin-mimizu]

(Figs. 23–29, Table 1)

*Description.* Body. Length 90–100 mm, width 4.2–4.7 mm. Number of segments 113–116. Light brown dorsally, whitish brown ventrally.

External characters. Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings absent. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Clitellum including segments XIV–XVI. Setal number 50 in segment VII, 56 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 4–5 segments. Intestine begins in XV. Genital glands absent. Septa absent in 8/9/10, very thickened in 5/6/7/8, very thickened and muscular in 10/11/12/13/14. Four pairs of spermathecae in segments VI–XIX; ampulla consisting of a shovel-shaped pouch and a thick duct; diverticulum consisting of a twisted tubular pouch and a short duct. Seminal vesicles small, extending to the dorsal line in segments XI–XII. Prostata large, extending through segments XV–XX, ducts corresponding to male pores.

*Material examined.* Holotype (NSMT-An 298) and paratype (NSMT-An 299): Ohtanba Valley, 15–I–1987, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 1 ex. with same data as the type series.

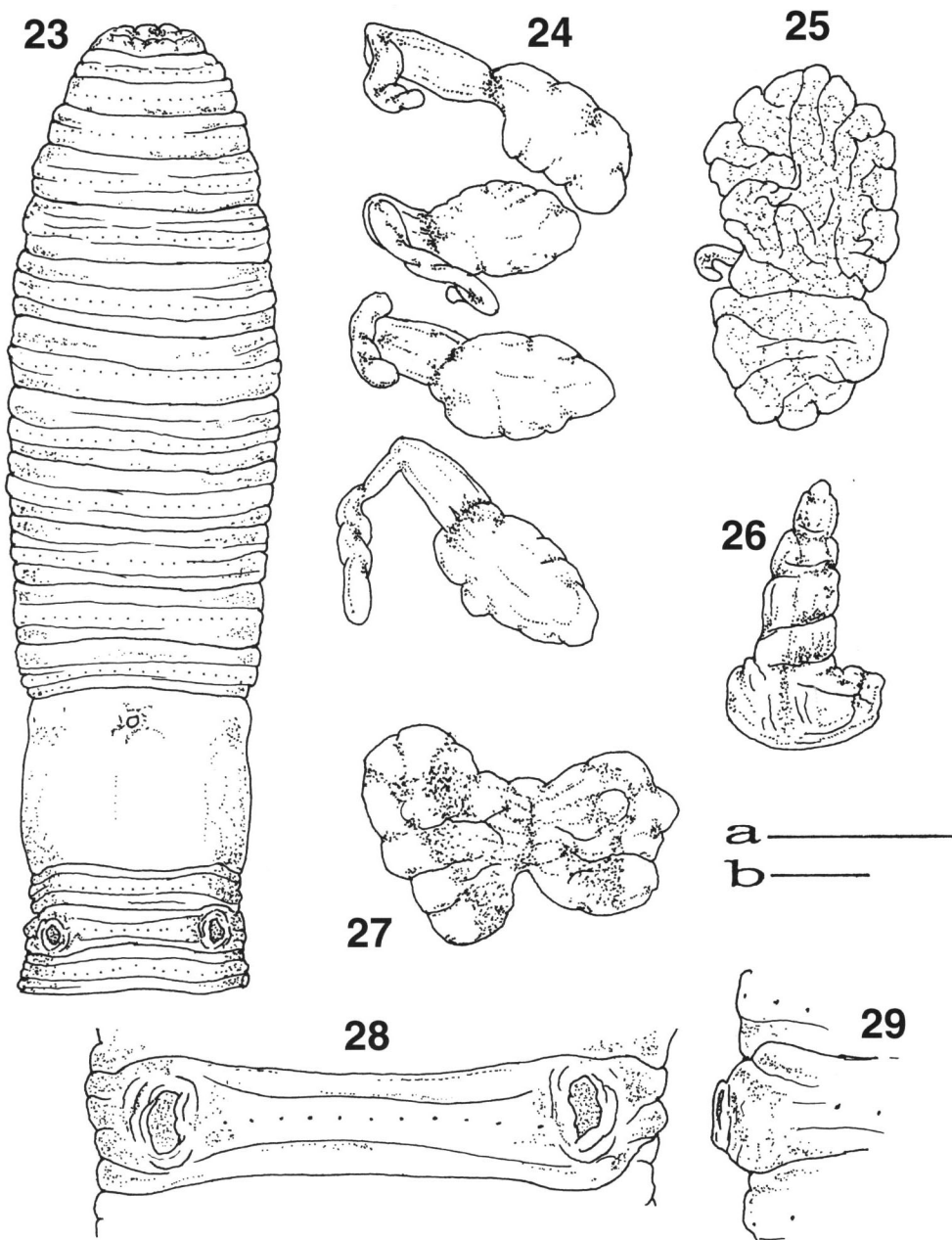
*Remarks.* The new species resembles *Pheretima phaselus* Hatai, 1930, but is distinguishable from the latter species by (1) four pairs of spermathecal pores and, (2) the simple male pores.

***Pheretima semilunaris* sp. nov.**

[New Japanese name: Hangetsu-mimizu]

(Figs. 30–36, Table 1)

*Description.* Body. Length 90–96 mm, width 2.4–3.5 mm. Number of segments 107–111. Light brown dorsally, light yellowish grey ventrally.



Figs. 23–29. *Pheretima silvestris* sp. nov. Holotype (NSMT-An 298). 23: Ventral view of anterior body. 24: Spermathecae. 25: Prostate gland with a duct. 26: Intestinal caecum. 27: Dorsal view of seminal vesicles. 28: Male pores on segments XVIII–XIX. 29: Lateral view of segment XVIII. (Scale bars: a: 5 mm for 23–26, b: 1 mm for 27–29.)

Table 1. Characters of the seven related species with simple intestinal caeca of the genus *Pheretima*.

	Male pores	Spermathecae		Body length	Dorsal coloration
		Ampulla	Diverticulum		
<i>Ph. phaselus</i>	Kidney bean	Shovel-shaped	Slender tube	80–130	Light whitish
Hatai	shaped-pach	pouch	shape	mm	brown
<i>Ph. subrotunda</i>	Simple	Shovel-shaped	A terminal	40–65	Reddish
sp. nov.	Large-size	pouch	twisted club	mm	brown
<i>Ph. rufidula</i>	Simple	Shovel-shaepd	A terminal	70–110	Reddish
sp. nov.	Medium-size	pouch	oval pouch	mm	brown
<i>Ph. flavida</i>	Simple	Slender shovel-	A terminal	130–170	Light whitish
sp. nov.	Medium-size	shaped pouch	long tubular pouch	mm	brown
<i>Ph. silvestris</i>	Simple	Shovel-shaepd	Short	90–100	Light
sp. nov.	Medium-size	pouch	twisted club	mm	brown
<i>Ph. semilunaris</i>	A half circle shape	Saccular	Absent	90–96	Light
sp. nov.	Medium-size	pouch		mm	brown
<i>Ph. octo</i>	Sucker shape	Shovel-shaepd	Absent	70–100	Brown
sp. nov.	Like the figure 8	pouch		mm	

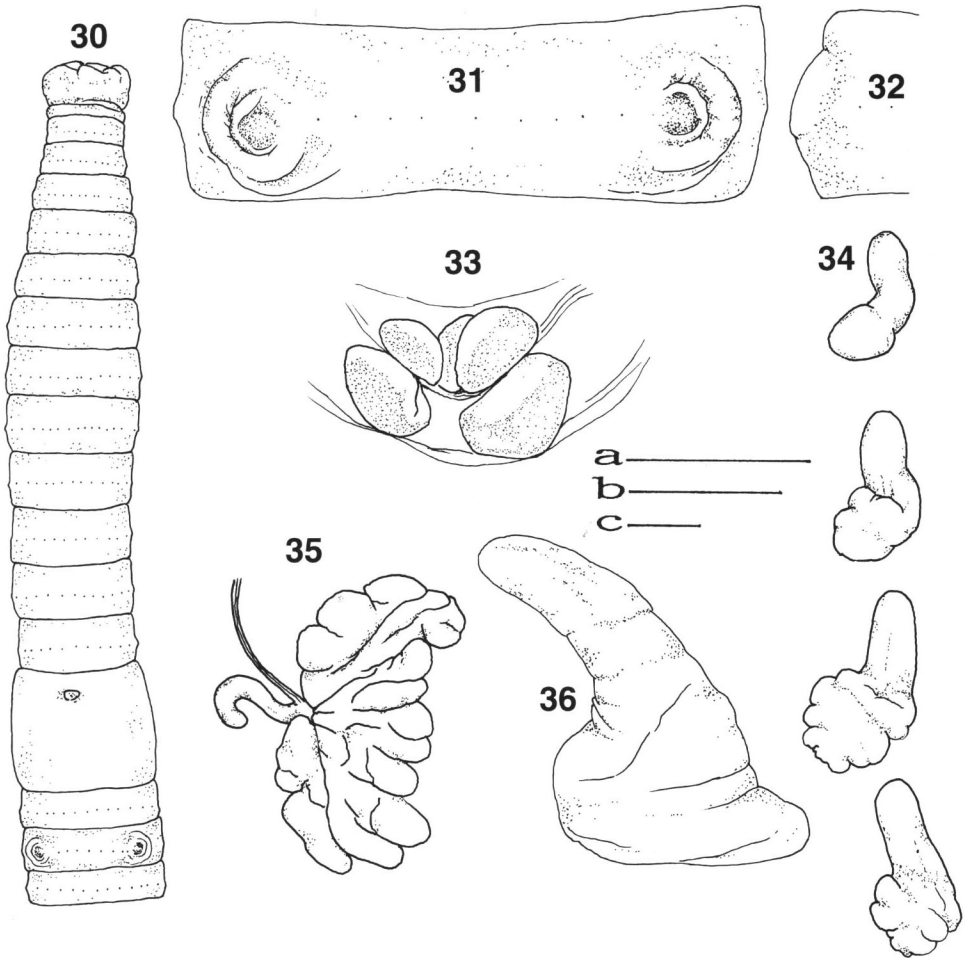
External characters. Four pairs of spermathecal pores, situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings absent. Male pores simple, a half circle, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13 or 11/12. Clitellum including segments XIV–XVI. Setal number 46–48 in segment VII, 48–52 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 4 segments. Intestine begins in XVI. Genital glands absent. Septa absent in 8/9/10, very thickened in 5/6/7/8 and 10/11/12/13/14. Four pairs of spermathecae small, in segments VI–IX; ampulla consisting of a saccular pouch and a thick duct; diverticulum absent. Seminal vesicles small, extending to the dorsal line in segments XI–XII. Prostata large, extending through segments XVI–XIX, ducts corresponding to male pores.

*Material examined.* Holotype (NSMT-An 300) and paratype (NSMT-An 301): Nipara Valley, 14–IX–1985, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 2 exs. with same data as the type series.

*Remarks.* The new species resembles *Pheretima phaselus* Hatai, 1930, but is distinguishable from the latter species by (1) four pairs of spermathecal pores, and (2) absence of diverticulum.





Figs. 30–36. *Pheretima semilunaris* sp. nov. Holotype (NSMT-An 300). 30: Ventral view of anterior body. 31: Male pores on segment XVIII. 32: Lateral view of segment XVIII. 33: Dorsal view of seminal vesicles. 34: Spermathecae. 35: Prostate gland with a duct. 36: Intestinal caecum. (Scale bars: a: 5 mm for 30, b: 1 mm for 31–32, 34, 36, c: 1 mm for 33, 35.)

***Pheretima fulva* sp. nov.**

[New Japanese name: Kashokufuto-mimizu]

(Figs. 37–47, Table 3)

*Description.* Body. Length 130–230 mm, width 4.5–6.5 mm. Number of segments 105–130. Darkish brown dorsally, light yellowish grey ventrally.

*External characters.* Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference.

ence. Genital markings paired, circular sucker-shape; preclitellar closely associated with the spermathecal pores, postsetal on segments VI–IX. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Clitellum including segments XIV–XVI. Setal number 36–40 in segment VII, 44–46 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–5 segments. Intestine begins in XV. Genital glands, paired, glandular masses, in segments VI–IX, associated with genital markings restricted to body wall. Septa absent in 8/9/10, very thickened and muscular in 5/6/7/8 and 10//12/13/14. Four pairs of spermathecae in segments VI–IX; ampulla consisting of a slender shovel-shaped pouch and a long duct; diverticulum absent. Seminal vesicles, extending to the dorsal line in segments XI–XII. Prostata extending through segments XVII–XX or XVII–XIX, ducts corresponding to the male pores.

*Material examined.* Holotype (NSMT-An 302) and 5 paratypes (NSMT-An 303): Higashi-kurume City, 14–VI–1983, 14–VII–1983, 25–IX–1983, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 8 exs. with same data as the Holotype.

*Remarks.* The new species resembles *Pheretima divergens* (Michaelsen, 1892), but is distinguishable from the latter species by (1) simple intestinal caeca, (2) absence of diverticulum, and (3) genital markings situated closely associated with the spermathecal pores.

***Pheretima subterranea* sp. nov.**

[New Japanese name: Komichi-mimizu]

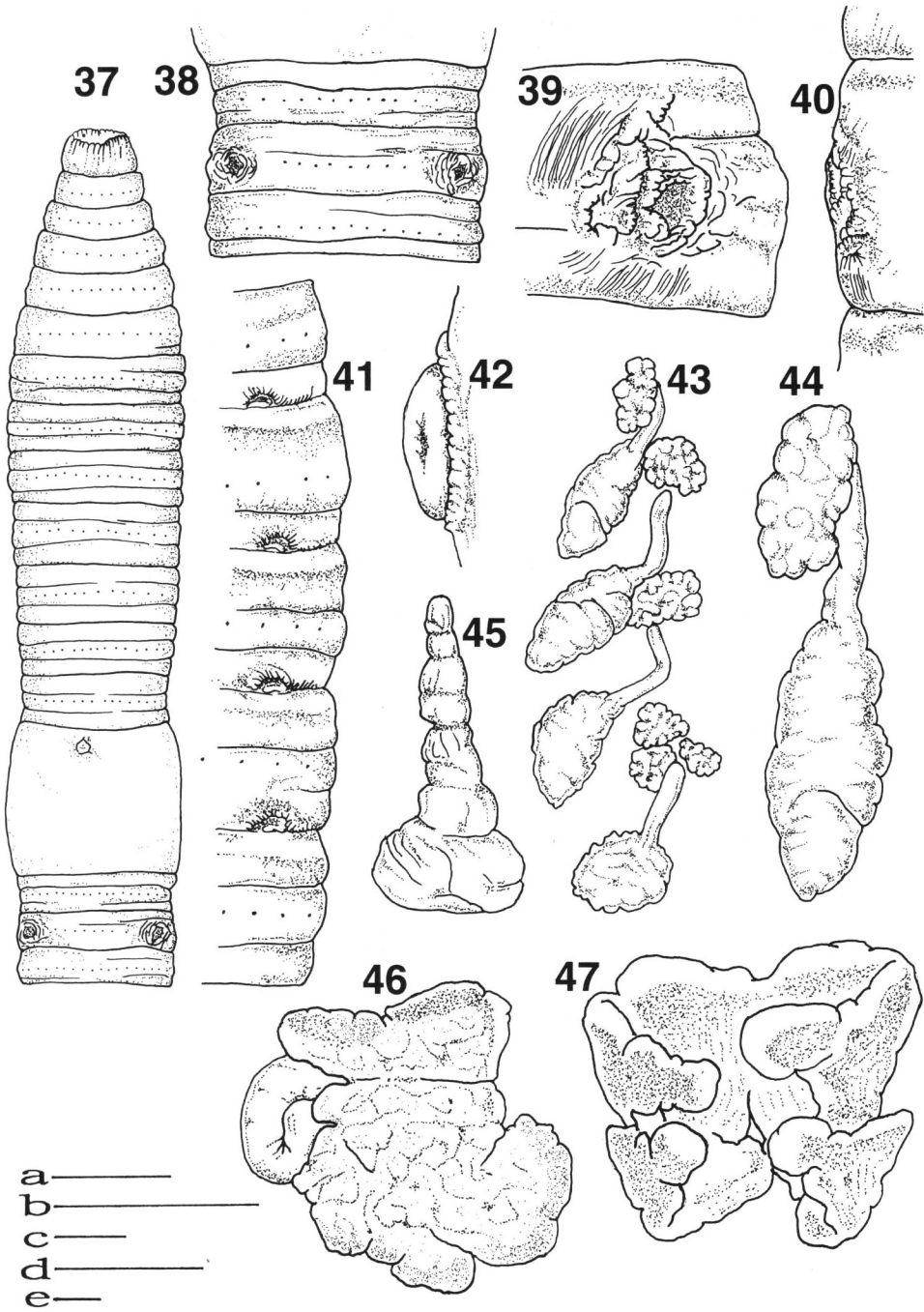
(Figs. 48–56, Table 3)

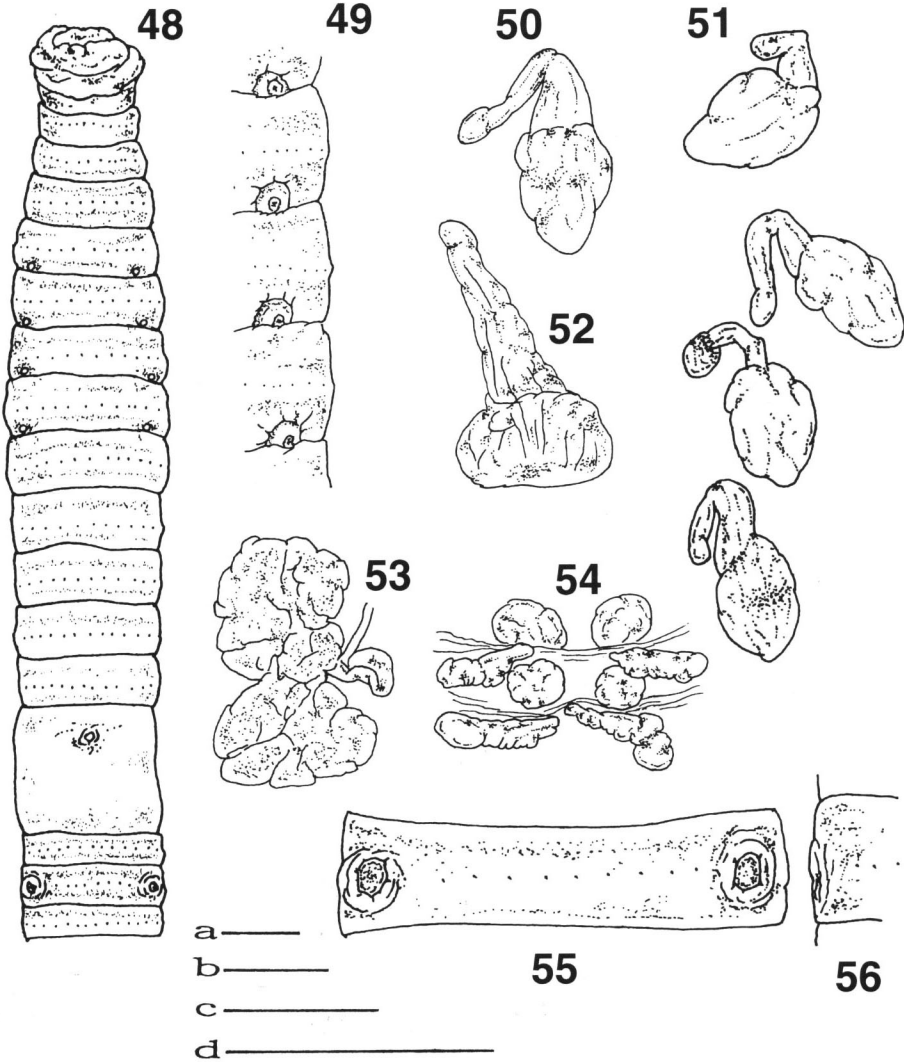
*Description.* Body. Length 130–230 mm, width 4.5–6.5 mm. Number of segments 105–130. Reddish brown dorsally, yellowish grey ventrally.

External characters. Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings paired, circular sucker-shape; preclitellar closely associated with the spermathecal pores, pre- and postsetal on segments VI–IX and occasionally absent. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single,

---

Figs. 37–47. *Pheretima fulva* sp. nov. Holotype (NSMT-An 302). 37: Ventral view of anterior body. 38, 39: Male pores on segment XVIII. 40: Lateral view on segment XVIII. 41: Lateral view of segments V–IX. 42: Lateral view of genital markings. 43–44: Spermathecae and genital glands (glandular masses). 45: Intestinal caecum. 46: Prostate gland with a duct. 47: Dorsal view of seminal vesicles. (Scale bars. a: 5 mm for 37, b: 1 mm for 42, c: 1 mm for 41, 43, 45–47, d: 1 mm for 39–40, 44, e: 1 mm for 38.)





Figs. 48–56. *Pheretima subterranea* sp. nov. Holotype (NSMT-An 304). 48: Ventral view of anterior body. 49: Lateral view of segments V–VIII. 50–51: Spermathecae. 52: Intestinal caecum. 53: Prostate gland with a duct. 54: Dorsal view of seminal vesicles. 55: Prostate gland with a duct. 55: Male pores on segment XVIII. 56: Lateral view on segment XVIII. (Scale bars. a: 1 mm for 48, b: 1 mm for 53–54, c: 1 mm for 49, 51–52, 55–56, d: 1 mm for 50.)

mid-ventrally on segment XIV. First dorsal pore beginning in furrow 11/12. Clitellum including segments XIV–XVI. Setal number 53–55 in segment VII, 57–58 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment

XXVII, extending anteriorly for 3–5 segments. Intestine begins in XV. Genital glands absent. Septa absent in 8/9/10, slightly thickened in 5/6/7/8 and 10//12/13/14. Four pairs of spermathecae in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a short thick duct; diverticulum absent. Seminal vesicles, extending to the dorsal line in segments XI–XII. Prostata extending through segments XVII–XX, ducts corresponding to the male pores.

*Material examined.* Holotype (NSMT-An 304) and paratype (NSMT-An 305): Hikawa, 27–X–1998, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 1 ex. with same data as the type series.

*Remarks.* The new species resembles *Pheretima divergens* (Michaelsen, 1892), but is distinguishable from the latter species by (1) simple intestinal caeca, and (2) small body (length 70–75 mm).

***Pheretima subalpina* sp. nov.**

[New Japanese name: Shimaobifuto-mimizu]

(Figs. 57–67, Tables 2–3)

*Description.* Body. Length 175–250 mm, width 6.2–8.0 mm. Number of segments 112–138. Light brown dorsally, greyish white ventrally, a reddish brown band each in intersegmental furrow, showing a pin-striped pattern in appearance.

*External characters.* Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings 1–2 paired, circular sucker-shape; preclitellar closely associated with the spermathecal pores, postsetal on segments V–VIII and rarely on segment XVIII. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Clitellum including segments XIV–XVI. Setal number 42–46 in segment VII, 48–56 in segment XX.

*Internal characters.* Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–5 segments. Intestine begins in XIV. Genital glands, paired, glandular masses, on segments VI–IX, associated with genital markings restricted to body wall. Septa absent in 8/9/10, strongly thickened in 5/6/7/8, very thickened and muscular in 10//12/13/14. Four pairs of spermathecae in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a small oval pouch, diverticulum consisting of a narrow duct. Seminal vesicles large, extending to the dorsal line on segments XI–XII. Prostata extending through segments XVII–XX or XVII–XIX, ducts corresponding to the male pores.

*Material examined.* Holotype (NSMT-An 306) and 5 paratypes (NSMT-An 307): Sayama Park, 30–IX–1985, K. Ishizuka, from soil under a grassy place. Other specimens examined: 18 exs. with same data as the type series. 8 exs. Sayama Park,

Table 2. The number, arrangement and position of genital markings of *Ph. subalpina* sp. nov. Twenty individuals from Musashimurayama City, Tokyo.

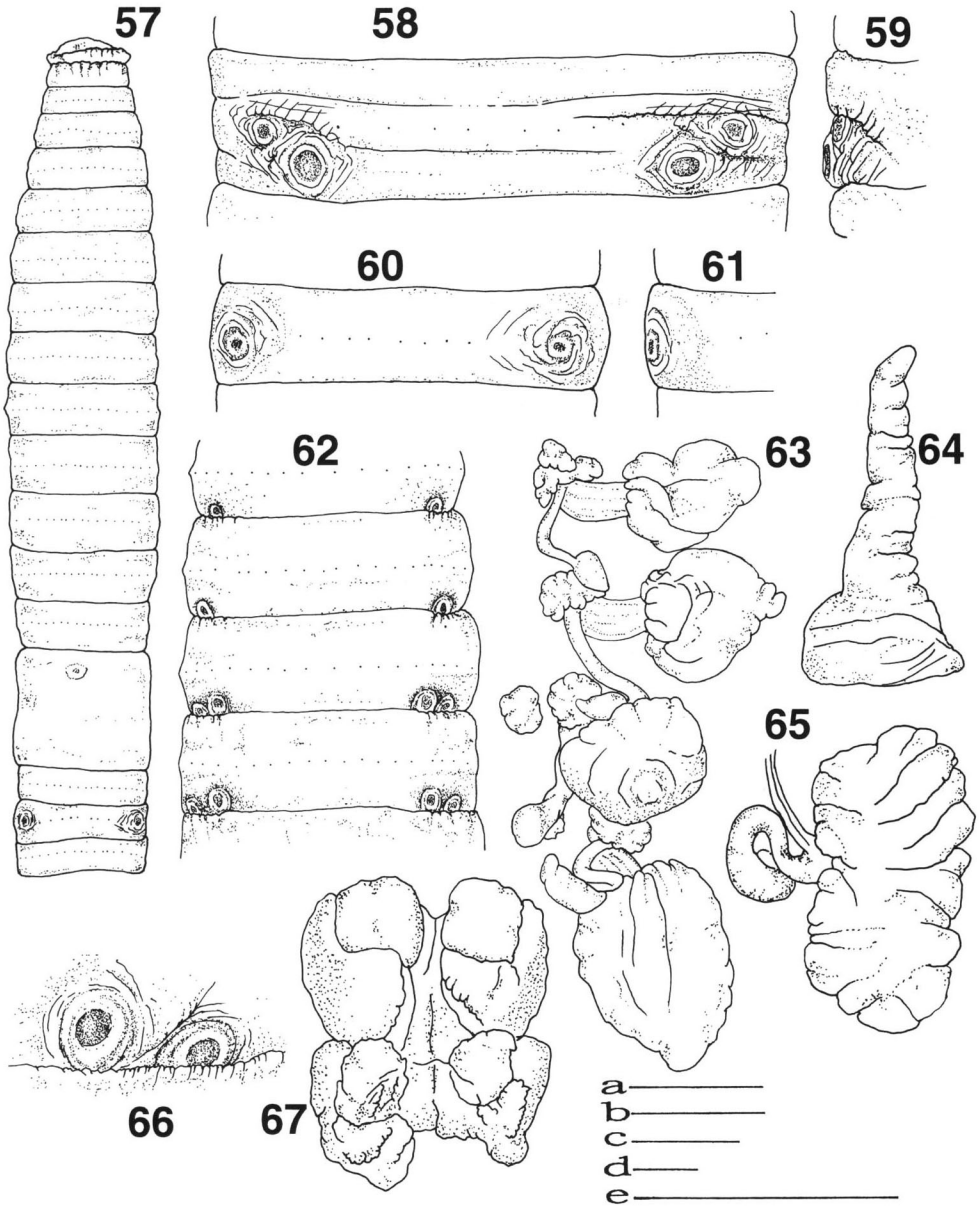
No.	Preclitellar				No.	Preclitellar			
	V	VI	VII	VIII		V	VI	VII	VIII
1	1 pair	1 pair	1 pair	2 pairs	11	1 pair	1 pair	3 pairs	2 pairs
2	1 pair	1 pair	1 pair	1 pair	12	1 pair	1 pair	2 and 3	2 and 3
3	1 pair	1 pair	1 pair	1 pair	13	one side	1 pair	2 pairs	2 pairs
4	1 pair	1 pair	1 pair	1 pair	14	1 pair	1 pair	2 pairs	2 pairs
5	1 pair	1 pair	1 pair	1 pair	15	1 pair	1 pair	1 pair	1 pair
6	1 pair	1 pair	2 pairs	2 pairs	16	1 pair	1 pair	2 pairs	2 pairs
7	1 pair	1 pair	1 pair	1 pair	17	1 pair	1 pair	2 and 3	2 pairs
8	1 pair	1 pair	1 pair	1 pair	18	1 pair	1 pair	1 pair	2 pairs
9	1 pair	1 pair	2 pairs	2 pairs	19	1 pair	1 pair	2 pairs	2 pairs
10	1 pair	1 pair	2 pairs	2 pairs	20	1 pair	1 pair	1 pair	1 pair

Table 3. Characters of the five related species with genital markings anterior to clitellum of the genus *Pheretima*.

	Intestinal caeca	Genital marking preclitellar	Spermathecae Diverticulum	Body length	Dorsal coloration
<i>Ph. heteropoda</i> (Goto et Hatai)	Simple	Slightly median, presetal on segments VI–IX	Present	90–220 mm	Greenish brown
<i>Ph. divergens</i> (Michaelsen)	Serrate	Slightly median, presetal (on segments VI–IX)	Present	90–220 mm	Brown
<i>Ph. fulva</i> sp. nov.	Simple	Closely associated with the spermathecal pores (on segments VI–IX)	Absent	130–230 mm	Darkish brown
<i>Ph. subterranea</i> sp. nov.	Simple	Closely associated with the spermathecal pores (on segments VI–IX)	Present	130–230 mm	Reddish brown
<i>Ph. subalpina</i> sp. nov.	Simple	Closely associated with the spermathecal pores (on segments V–VIII)	Present	175–250 mm	Light brown Pin-striped pattern

12–VII–1995, K. Ishizuka. All the specimens were collected by the authors.

*Remarks.* The new species is similar in body size and in striped pattern to *Pheretima vittata* (Goto & Hatai, 1898), but is distinguishable from the latter species by (1) pin-striped pattern of intersegmental furrows, (2) four pairs of spermathecal pores, (3) absence of genital papillae, and (4) fresh color on ventrall side of segments VI–VIII, where deep grooves arranged a long its setal line. The coloration of the segments VI–VIII and the pin-striped pattern are peculiar feature of the new species.



Figs. 57–67. *Pheretima subalpina* sp. nov. Holotype (NSMT-An 306). 57: Ventral view of anterior body. 58: Male pores and genital markings on segment XVIII. 59, 61: Lateral view of segment XVIII. 60: Male pore on segment XVIII. 62: Ventral view on segments V–VIII. 63: Spermathecae and genital glands (glandular masses). 64: Intestinal caecum. 65: Prostate gland with a duct. 66: Genital markings. 67: Dorsal view of seminal vesicles. (scale bars: a: 5 mm for 57, b: 1 mm for 58–59, c: 1 mm for 60–61, d: 1 mm for 62–65, 67, e: 1 mm for 66.)

*Pheretima lactea* sp. nov.

[New Japanese name: Tanshoku-mimizu]

(Figs. 68–73)

*Description.* Body. Length 80–120 mm, width 4.0–5.2 mm. Number of segments 112. light whitish brown dorsally, light whitish brown ventrally.

External characters. Four pairs of spermathecal pores minute, situated in furrow 5/6/7/8/9, in ventro-lateral side, separated by a distance of ca. 1/3 body circumference. Genital markings very large, paired, circular to oval sucker; postclitellar slightly median to the line of the male pores, presetal on segments XIX–XXI. Male pores simple, on medium-sized porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13 or 11/12. Clitellum including segments XIV–XVI. Setal number 40–44 in segment VII, 52–56 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–5 segments. Intestine begins in XV. Genital glands large, paired, glandular masses, in segments XIX–XXI, associated with genital markings restricted to body wall. Septa absent in 8/9/10, very thickened and muscular in 5/6/7/8 and 10/11/12/13/14. Four pair of spermathecae in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a thick duct; diverticulum consisting of a thick tubular pouch and a twisted duct. Seminal vesicles extending to the dorsal line in segments XI–XII. Prostata ducts associated with the male pores.

*Material examined.* Holotype (NSMT-An 308) and 2 paratypes (NSMT-An 309): Sayama Park, 30–VI–1985, K. Ishizuka, from soil under a grassy place. Other specimens examined: 2 exs. Itsukaichi City, 24–VII–1985, K. Ishizuka.

*Remarks.* The new species resembles *Pheretima phaselus* Hatai, 1930, but is distinguishable from the latter species by (1) four pairs of spermathecal pores, (2) the presence of genital markings, and (3) the simple male pore (on medium-sized porophores). The light whitish brown body coloration is one of the important criteria to distinguish this species.

*Pheretima mitakensis* sp. nov.

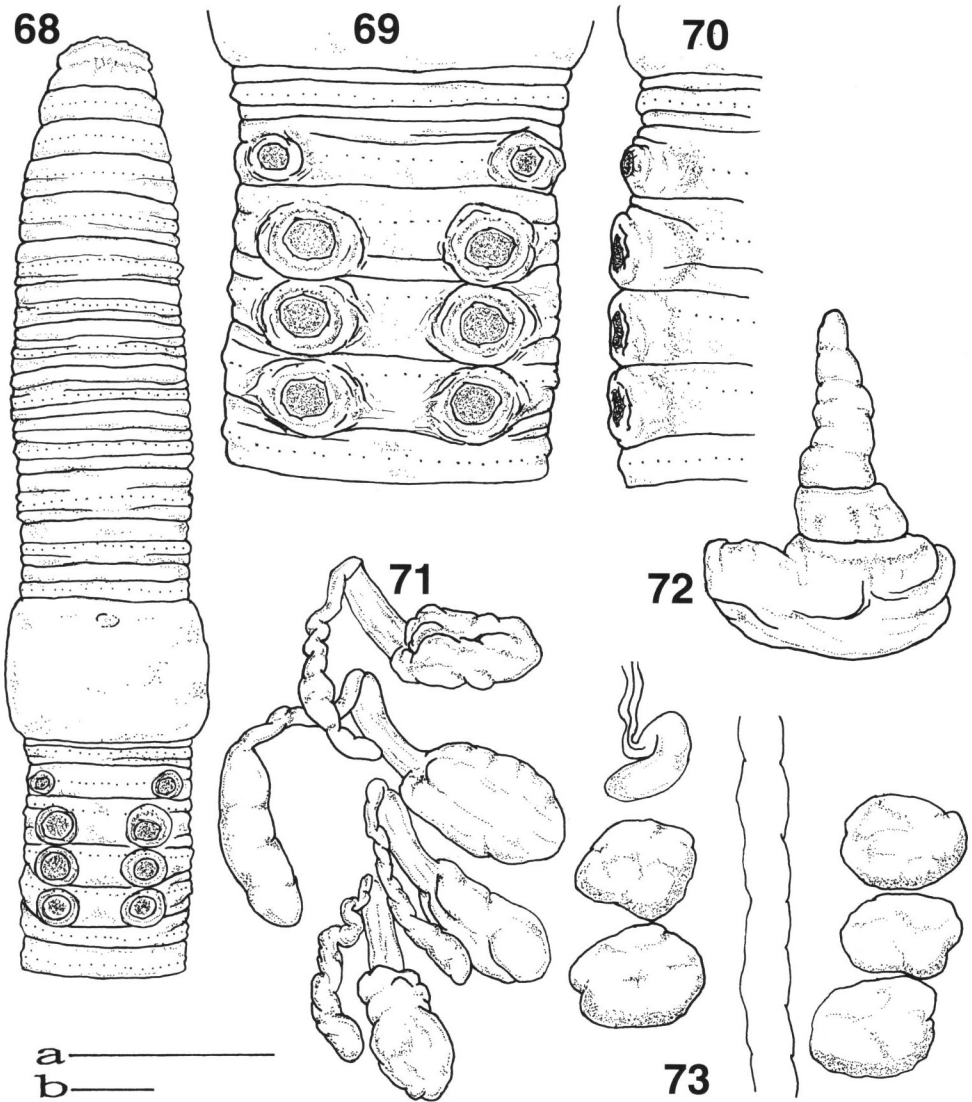
[New Japanese name: Mitake-mimizu]

(Figs. 74–80)

*Description.* Body. Length 83–95 mm, width 3.0–3.4 mm. Number of segments 106–120. Light brown dorsally, greyish white ventrally.

External characters. Four pairs of spermathecal pores situated in furrows 5/6/7/8/9, in ventro-lateral sides, separated by a distance of ca. 1/3 body circumference. Genital markings large, paired, circular sucker-shape; postclitellar slightly median to the line of the male pores, postsetal on segment XIX. Male pores large, sim-

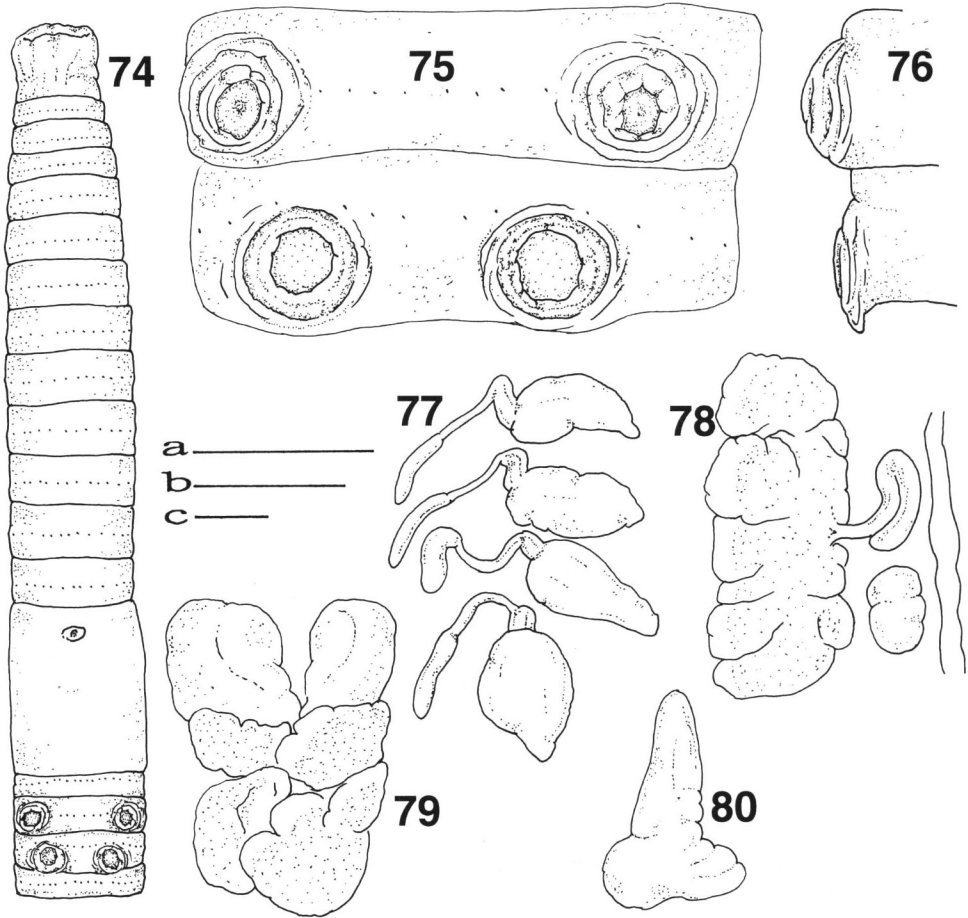




Figs. 68–73. *Pheretima lactea* sp. nov. Holotype (NSMT-An 308). 68: Ventral view of anterior body. 69: Male pores on segment XVIII and genital markings on segments XIX–XXI. 70: Lateral view of segments XVIII–XXI. 71: Spermathecae. 72: Intestinal caecum. 73: Prostate duct and glandular masses. (Scale bars. a: 5 mm for 68, b: 1 mm for 69–73.)

ple, superficial on segment XVIII, separated by a distance of ca.  $1/3$  body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Setal number 42 in segment VII, 46 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment



Figs. 74–80. *Pheretima mitakensis* sp. nov. Holotype (NSMT-An 310). 74: Ventral view of anterior body. 75: Male pores on segment XVIII and genital markings on segment XIX. 76: Lateral view of segments XVIII–XIX. 77: Spermathecae. 78: Prostate gland with a duct and glandular mass. 79: Dorsal view of seminal vesicles. 80: Intestinal caecum. (Scale bars. a: 5 mm for 74, b: 1 mm for 75–76, c: 1 mm for 77–80.)

XXVII, extending anteriorly for 3–4 segments. Intestine begins in XVI. Genital glands, paired, glandular masses, in segment XIX, associated with genital markings restricted to body wall. Septa absent in 8/9/10, thickened in 5/6/7/8 and 10/11/12/13/14. Four pairs of spermathecae in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a short thick duct; diverticulum consisting of a slender tubular pouch and a slender duct. Seminal vesicles, extending to the dorsal line in segments XI–XII. Prostata extending through segments XVI–XXI, ducts associated with the male pores.

*Material examined.* Holotype (NSMT-An 310) and paratype (NSMT-An 311): Mt. Mitake, 30–VII–1981, K. Ishizuka, from soil under a mixed forest of evergreen and a deciduous trees, Other specimens examined: 1 ex. Mt. Mitake, 30–VII–1981, K. Ishizuka.

*Remarks.* The new species resembles *Pheretima phaselus* Hatai, 1930, but is distinguishable from the latter species by (1) four pairs of spermathecal pores, (2) presence of genital markings, (3) presence of genital glands, and (4) simple male pores.

***Pheretima octo* sp. nov.**

[New Japanese name: Hachinoji-mimizu]

(Figs. 81–89, Table 1)

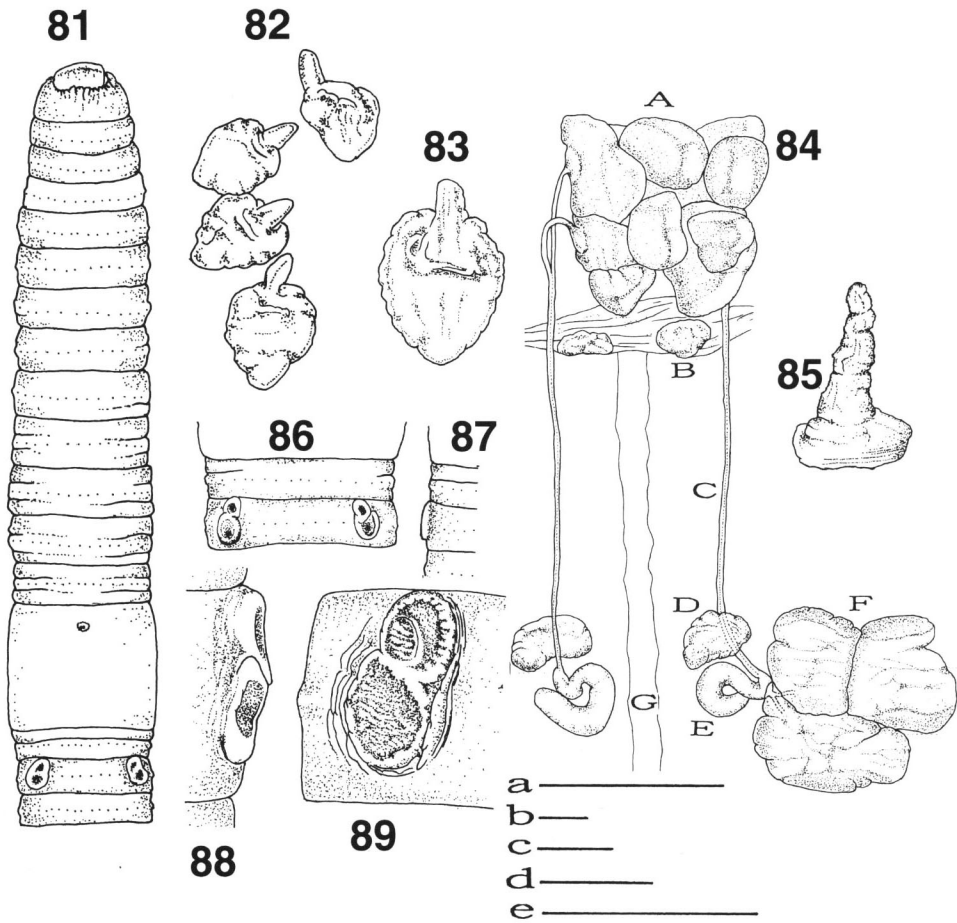
*Description.* Body. Length 70–100 mm, width 3.0–4.0 mm. Number of segments 80–110. brown dorsally, pail yellowish grey ventrally.

External characters. Four pairs of spermathecal pores situated in furrows 5/6/7/8/9 in ventro-lateral sides separated by a distance of ca. 1/3 body circumference. Genital markings, paired, circular sucker-shape; postclitellar, presetal on segment XVII, in contact with the male pores and like the figure 8 of the whole form. Male pores, sucker shape porophores, superficial on segment XVIII, separated by a distance of ca. 1/3 body circumference. Female pore single, mid-ventrally on segment XIV. First dorsal pore beginning in furrow 12/13. Clitellum including segments XIV–XVI. Setal number 36–39 in segment VII, 38–49 in segment XX.

Internal characters. Simple intestinal caeca, paired, originating in segment XXVII, extending anteriorly for 3–4 segments. Intestine begins in XIV or XV. Genital glands, paired, glandular masses, on segment XVIII, associated with genital markings restricted to body wall. Septa absent in 8/9/10, thickened in 5/6/7/8, slightly thickened in 10/11/12/13/14. Four pairs of spermathecae in segments VI–IX; ampulla consisting of a shovel-shaped pouch and a short stout duct; diverticulum absent. Seminal vesicles large, extending in segments XI–XII. Prostata extending through segments XVII–XIX, ducts corresponding to male pores.

*Material examined.* Holotype (NSMT-An 312) and 2 paratypes (NSMT-An 313): Institute for Nature Study, National Science Museum, Tokyo, 18–VII–1985, K. Ishizuka, from soil under a mixed forest of evergreen and deciduous trees. Other specimens examined: 1 ex. with same data as the type series. 13 exs. Institute for Nature Study, National Science Museum, Tokyo, 30–VII–1985. 5 exs. Asukayama Park, 25–VII–1985. 1 ex. Rikugien Park, 25–VII–1985. All the specimens were collected by the authors.

*Remarks.* The new species resembles *Pheretima mutica* Chen, 1938, but is distinguishable from the latter species by (1) four pairs of spermathecal pores, (2) absence of genital glands, and (3) absence of diverticulum.



Figs. 81–89. *Pheretima octo* sp. nov. Holotype (NSMT-An 312). 81: Ventral view of anterior body. 82–83: Spermathecae. 84: Dissection of the reproductive system in dorsal view. (A. Seminal vesicles, B. Ovary, C. Vas deferens, D. Glandular masses, E. Prostate duct, F. Prostate gland, G. Nerve cord.) 86, 89: Male pores and genital markings on segment XVIII. 87–88: Lateral view of segment XVIII. 85: Intestinal caecum. (Scale bars. a: 5 mm for 81, b: 1 mm for 85–87, c: 1 mm for 82, 84, d: 1 mm for 83, e: 1 mm for 88–89.)

### Acknowledgments

The author gratefully acknowledges Prof. Jun-ichi Aoki of Yokohama National University for his critical valuable advice and reading through the manuscript. Particular thanks are also due to Dr. Minoru Imajima, Honorary Curator, National Science Museum, Tokyo, and Dr. E. G. Easton, formerly British Museum (Natural History) for their valuable advice.

## References

- Adachi, T., 1955. Note on the terrestrial earthworms collected at the Tokyo Agricultural University Farm. *J. Agr. Sci., Tokyo Nogyo Univ.*, **2**: 537–561.
- Chen, Y., 1938. Oligochaeta from Hainan, Kwangtung. *Contr. Biol. Lab. Sci. Soc. China*, **12**: 357–427.
- Chen, Y., 1946. On the terrestrial Oligochaeta from Szechuan III. *J. W. China Res. Soc.*, **16**: 83–141.
- Goto, S., & S. Hatai, 1898. New or imperfectly known species of earthworms. No.1. *Annot. Zool. Japon.*, **2**: 65–78.
- Hatai, S., 1929. On the variability of some external characters in *Pheretima vittata*. *Annot. Zool. Japon*, **12**: 271–284.
- Hatai, S., 1930. Note on *Pheretima agrestis* (Goto & Hatai), together with the description of four new species of the genus *Pheretima*. *Sci. Rep. Tohoku Imp. Univ.*, (4), **5**: 651–667.
- Ishizuka, K., 1999a. New species of the genus *Pheretima* s. lat. (Annelida, Oligochaeta, Megascolecidae) from Tokyo, Japan—Species with manicate intestinal caeca. *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, **25**(1): 33–57.
- Ishizuka, K., 1999b. New species of the genus *Pheretima* s. lat. (Annelida, Oligochaeta, Megascolecidae) from Tokyo, Japan—Part II Species with serrate intestinal caeca. *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, **25**(2): 101–122.
- Ishizuka, K., 1999c. New species of the genus *Pheretima* s. lat. (Annelida, Oligochaeta, Megascolecidae) from Tokyo, Japan—Part III. Species with simple intestinal caeca (1). *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, **25**(4): 229–242.
- Michaelsen, W., 1892. Terricolen der Berliner Zoologischen Sammlung. II. *Arch. Naturg.*, **58**: 209–261.
- Ohfuchi, S., 1937. On the species possessing four pairs of spermathecae in the genus *Pheretima*. together with the variability of some external and internal characters. *Res. Bull. Saito Ho-on Kai Mus.*, **12**: 31–136.
- Yamaguchi, H., 1962a. On the terrestrial earthworms from Hokkaido. *Seibutu Kyozai Kaihatu*, (2): 16–35. (In Japanese.)
- Yamaguchi, H., 1962b. On earthworms belonging to the genus *Pheretima* collected from the southern part of Hokkaido. *J. Hokkaido Gakugei Univ.*, **13**: 1–21.

