

A contribution to the earthworm (Annelida, Clitellata, Megadrili) fauna of the central Indian state Chhattisgarh, India

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Abstract. *Drawida willsi* was the first species of earthworm reported from Chhattisgarh state by Michaelsen in 1907. After that, only one survey of earthworm has been carried out there in 2021. Here we present a first-hand information on the survey of earthworms carried out in Chhattisgarh state in the year 2022. The study documents 12 species belonging to 4 families. Among these, *Dichogaster affinis* (Michaelsen, 1890) and *Polypheretima elongata* (Perrier, 1872) are exotic peregrine species. Species such as *Drawida limella* Gates, 1934, *Lenogaster chittagongensis* (Stephenson, 1917) and *Octochaetona compta* (Gates, 1945) expanded their distribution to central India. The study also noted the presence of microplastic for the first time in the ingesta of an earthworm (*Lampito mauritii* Kinberg, 1867) from India. Further detailed survey would add more species into the faunal list of Chhattisgarh, even species new to science.

Keywords. Annelida, east-central India, ingesta, microplastic, Oligochaeta.

INTRODUCTION

India is one of the most earthworm rich countries in the world. Perrier (1872) described the first earthworm species from India in the third quarter of the 19th century, and several new earthworm species have been described more recently (Narayanan *et al.* 2017, 2021, 2022, Lone *et al.* 2020, 2022, Tiwari *et al.* 2021, Ahmed *et al.* 2022, 2023a, b). In India, the Western Ghats and the West Coast Plains are considered as the richest in terms of earthworm diversity followed by the northeastern region (Narayanan *et al.* 2020,

Tiwari *et al.* 2020, Harit *et al.* 2014). Michaelsen (1907) described *Drawida willsi* from the Bilaspur in the present day political boundary of Chhattisgarh and formed the sole documented species of earthworm from the state in the last 115 years. Since then no taxonomical exploration for the earthworm fauna is carried out in detail in Chhattisgarh state. But recently, Hasan *et al.* (2023) made a small collection of the earthworms of this state and added another 9 species to the faunal list. In 2022, we conducted a pilot survey of earthworms in diverse habitats across various physiographic regions of the state Chhattisgarh.

This survey revealed the presence of several previously unreported earthworm species, adding to the faunal list of the Chhattisgarh.

Chhattisgarh is situated east-central India (Fig. 1) and lying in Deccan plateau and the Vindhyan Hill regions of central India. The border of the states surrounded by seven states of India *viz.*, Uttar Pradesh, Madhya Pradesh, Maharashtra, Jharkhand, Odisha, Telangana, and Andhra Pradesh, which spread over an area of 135,192 km² (between 170°47'N to 24°06' N and 80°15'E to 84°24' E) of which 44% is covered by forest (Naidu *et al.* 2019; ISFR 2021). The state is divided

into three agro-climatic zones: Chhattisgarh Plains, Northern Hills, and the Bastar Plateau. It is situated in the East Deccan physiographic zone. The average annual temperature ranges from 11°C to 47°C, while the average annual rainfall varies between 1,100 mm and 1,700 mm (ISFR 2021). Chhattisgarh is also considered as one among the heavily forested states in India and rich in biodiversity (Naidu *et al.* 2019). According to the Champion & Seth (1968) classification of forest types, the forest of Chhattisgarh comes under two groups, namely tropical moist deciduous and tropical dry deciduous forests, which are further subdivided into 12 forest types (ISFR 2021).

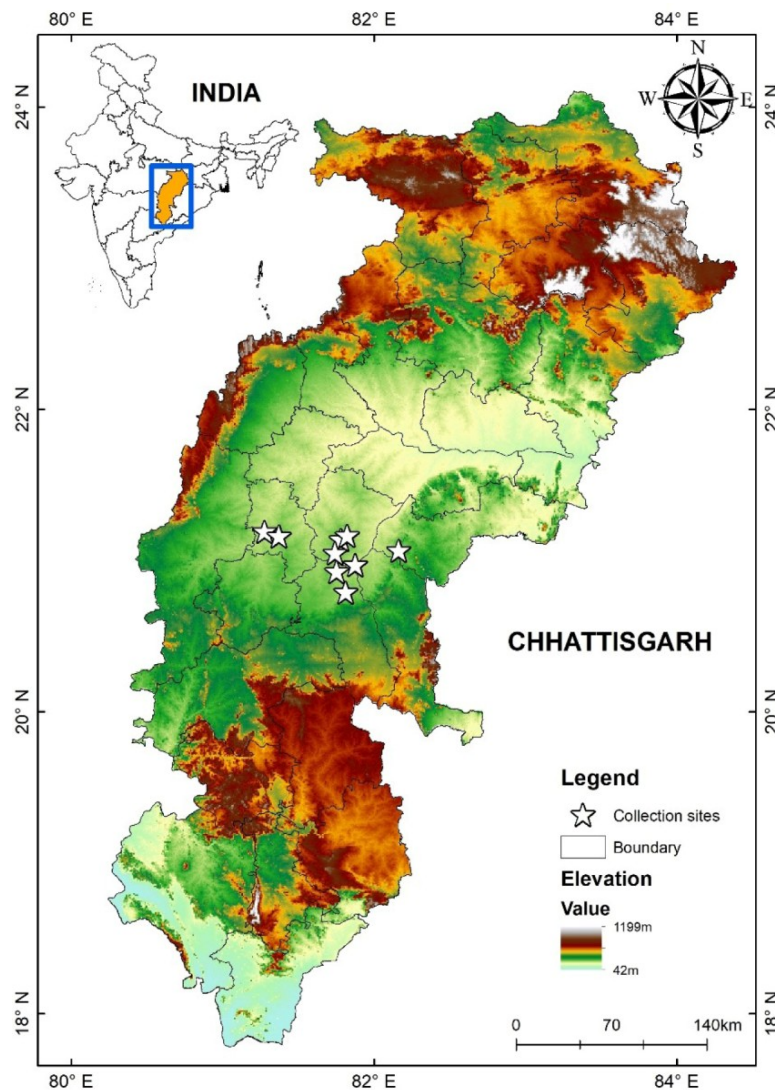


Figure 1. Map showing the location of collection sites in Chhattisgarh state.

MATERIALS AND METHODS

Nine randomly selected locations in Chhattisgarh Plains zone were used for earthworm sampling (Fig. 1). Earthworms were gathered by digging and hand-sorting as described by Julka (1990). Additionally, organic microhabitats including leaf litter and fallen tree trunks were looked for. Collected specimens were washed and then preserved in 5% formalin for further taxonomic identification. All relevant morphological and anatomical characterization of the earthworms was carried out under a Nikon stereomicroscope (Model: SMZ800N). Photos were taken with the help of a camera attached to the microscope. Specimens collected were identified with the help of Stephenson (1923), Gates (1972), Julka (1976, 1978, 1988, 2008) and Blakemore (2012). Following Narayanan *et al.* (2023a), identified earthworms were classified into endemic, subendemic, native peregrine and exotic peregrine categories. Here in this work, we have followed the family and genera level classification as given in the recent publications of Brown *et al.* (2023) and Mısırlıoğlu *et al.* (2023). The collected specimens were deposited in the earthworm museum of Advanced Centre of Environmental Studies and Sustainable Development (ACCESSD), Mahatma Gandhi University, Kottayam, Kerala, India.

RESULTS

During the study, altogether 12 species of earthworms belonging to 7 genera and 4 families (*viz.*, Moniligastridae, Acanthodrilidae, Benhamiidae and Megascolecidae) were collected from various sampled areas of the Chhattisgarh state. Species identified are – *Drawida calebi* Gates, 1945, *Drawida limella* Gates, 1934, *Lenogaster chittagongensis* (Stephenson, 1917), *Octochaetona beatrix* (Beddard, 1902), *Octochaetona compta* (Gates, 1945), *Octochaetona surensis* (Michaelsen, 1910), *Pellogaster bengalensis* (Michaelsen, 1910), *Dichogaster affinis* (Michaelsen, 1890), *Lampito mauritii* Kinberg, 1867, *Perionyx excavatus* Perrier, 1872, *Perionyx millardi* Stephenson, 1915 and *Polypheretima elon-*

gata (Perrier, 1872). Among these 2 are exotic species (*Di. affinis* and *Po. elongata*) originated from distant countries or biogeographical realms and rest of them are either native peregrine or endemic species.

TAXONOMY

Phylum Annelida

Class Clitellata

Order Moniligastrida

Family MONILIGASTRIDAE Claus, 1880

Drawida calebi Gates, 1945

(Figures 2A, B)

Drawida calebi Gates, 1945a: 211.

Material examined: 2 clitellates, 2 acitellates (ACCESSD/EW/1588), Megha (20.788672°N 81.813437°E), Dhamtari District, Chhattisgarh, agriculture field, 30 October 2022, Y. Lal.

Description: Length 50–54 mm, width 3–3.5 mm, segments 149–162. Clitellum annular in $\frac{1}{2}9\text{--}\frac{1}{2}14$ (=5) (Fig. 2A). Male pores paired, transverse slits in intersegmental furrow 10/11, at *bc* setal lines. Spermathecal pores paired, in intersegmental furrow 7/8, slightly median to *c* setal line. Genital markings, present, small, pre or post setal, usually single and median, widely paired in *bc* setal lines, on segments 7–13, sometimes widely paired in *ab* setal lines on segment 12 and closely paired in *aa* setal lines on segments 7–10; one of the paired markings sometimes absent or doubled or tripled. Nephridiopores in a single series close to *d* lines. Gizzards 2–4, in segments 12–17; intestine begins in segment 24–27. Ovisacs extend from segment 13–20, constricted by septa, bulging into the coelomic cavity. Vas deferens short, in a small column of loops in segment 9, almost straight in 10, entering the anteromedian aspect of the prostate directly. Prostates muscular (Fig. 2B), almost spheroidal, sessile, with an internal ventral portion protrusible as a shortly tubular penis. Spermathecal atrium

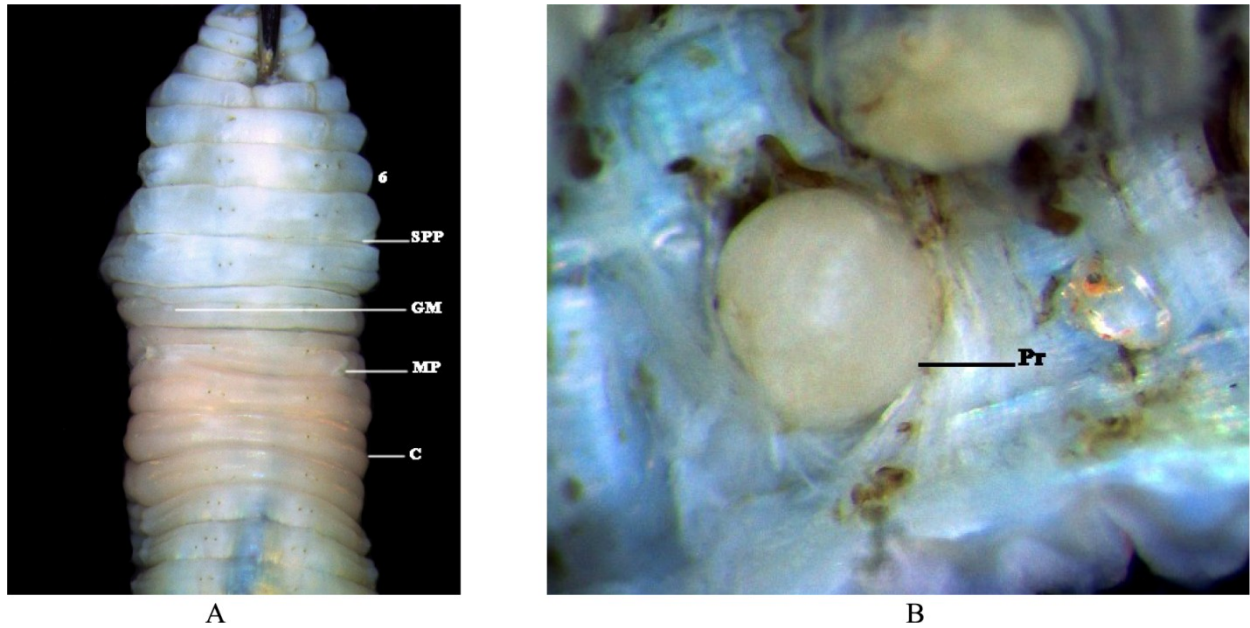


Figure 2. *Drawida calebi* Gates, 1945: A = anterior ventral view, B = muscular prostate, dorsal view. C = clitellum, GM = genital marking, MP = male pore, Pr = prostate, SPP = spermathecal pore.

conical, in segment 8, smaller than prostate. Genital marking glands spheroidal to shortly oval, concealed beneath longitudinal muscles.

Ingesta: Fine soil and few pieces of pebbles.

Distribution: Chhattisgarh: Megha (present record), Bakurma (Bakirma?), Ditenkhali, Jamnapur, Sanjay National Park – Ambikapur (Hasan et al. 2023); Jharkhand, Karnataka, Madhya Pradesh Odisha, Tamil Nadu, Uttar Pradesh (Gates 1945a, b, Julka 1976, Srivastava et al. 2003, Kathireswari et al. 2005a)

Remarks. Endemic to India. In the specimens studied, gizzards are in segments 13–15 (3 individuals). Intestine origin in segment 17, which differed from the descriptions of Gates (1945a, b). Ovisacs extend from segment 13–20, constricted by septa, bulging into the coelomic cavity. Based on the present study and Hasan et al. (2023), the dimension of *D. calebi* specimens from Chhattisgarh state is the following, length 20–95 mm, width 2–4 mm, segments 103–184.

***Drawida limella* Gates, 1934**

(Figures 3A, B)

Drawida limella Gates, 1934: 241.

Drawida periodiosa Gates, 1934: 247.

Drawida limella Gates: Julka 1976: 323.

Material examined: 6 clitellates, 4 acitellates (ACCESSD/EW/1508), Atal Nagar-Naya Raipur, Raipur District, Chhattisgarh (21.137545°N 81.781924°E), from roadside in a built-up area, 4 August 2022, A.K. Harit.

Description: Length 76–113 mm, width 3–3.5mm, segments 207–257. Clitellum annular, in ½ 9, 10–13, 14 (4½–5½). Male pores tiny, in *ab* setal lines, each pore located on a nipple-like projection at the ventral end of a conical porophore which apparently belongs to segments 10 and 11 (Fig. 3A). Spermathecal pores tiny, at intersegmental furrow 7/8 or on 7 or 8 or on one of the genital markings near 7/8, at *bc* setal lines or slightly lateral to *b* or close to *c* lines. Genital markings, present, paired, circular to oval (Fig.

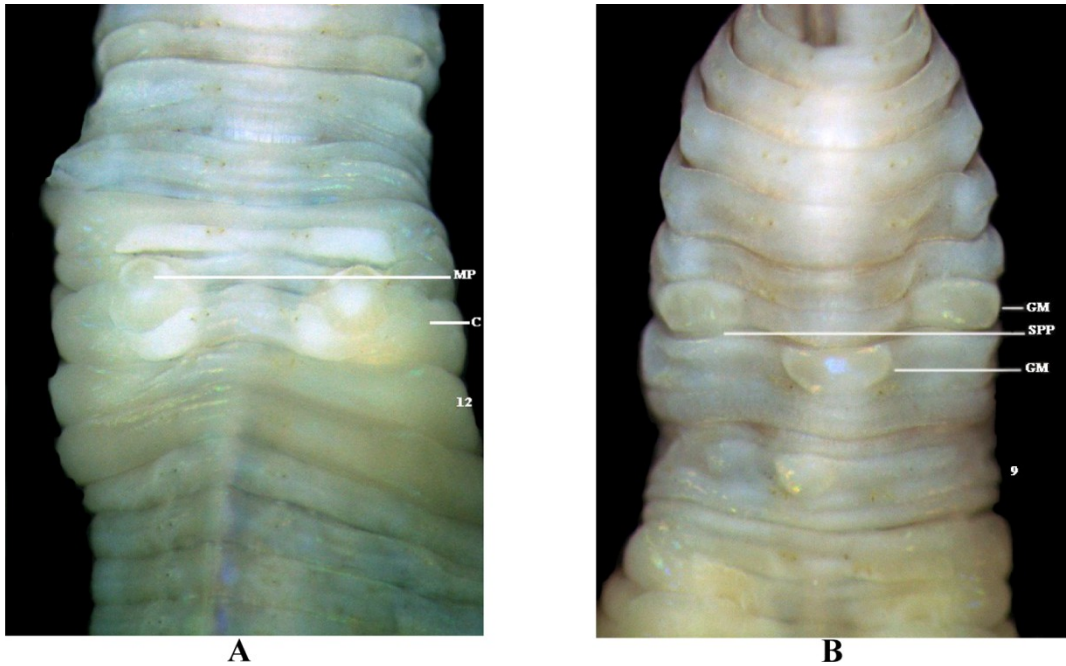


Figure 3. *Drawida limella* Gates, 1934: A = male field, B = spermathecal pore region. C = clitellum, GM = genital marking, MP = male pore, SPP = spermathecal pore.

3B), each with a minute central pore, usually in *bc* setal lines, in intersegmental furrow 7/8 or post-setal on segment 7 or presetal on segment 8, occasionally presetal on segment 9–10, sometimes in *ab* setal lines on segments 7–8, one of the paired markings may be absent. Gizzards 2–4, in segments 12–17; intestine begins in segment 17 (± 1). Vas deferens short, looped back and forth before opening directly into the mid-dorsal face of prostates. Prostates circular, sessile, glandular; prostatic capsule shortly tubular to digitiform. Spermathecal atrium short, tubular or pear-shaped, usually concealed beneath longitudinal muscles; atrium sometimes absent, where ectal end of spermathecal duct beneath longitudinal muscles quite enlarged. Genital marking glands tubular, erect, projecting into coelomic cavity, much longer than the prostate.

Ingesta: Coarse sand, pebbles, soil, small pieces of bark etc.

Distribution: Chhattisgarh: Atal Nagar-Naya Raipur (new record); Andhra Pradesh, Assam, Mizoram, Odisha, Puducherry (Tamil Nadu side),

Tamil Nadu, Tripura (Gates 1934, Julka 1976, Chaudhuri & Bhattacharjee 1999, Sathianarayanan & Khan 2006, Senthil & Sivakami 2018, Lone *et al.* 2021)

Remarks: Subendemic. Dimensions (length, width and segments) of the present specimens slightly exceeds the previously reported measurements (Gates 1972, Julka & Senapati 1987).

Order Crassicitellata

Family ACANTHODRILIDAE Claus, 1880

Lenngaster chittagongensis (Stephenson, 1917)

Eudichogaster chittagongensis Stephenson, 1917: 411.
Lenngaster chittagongensis (Stephenson): Gates 1940: 192.

Material examined: 1 clitellate (ACCESSD/EW/1596), Bhilai, Durg District, Chhattisgarh, grass patch between road and home, 14 September 2022, A.K. Harit, S. Bhattacharyya, A. Dutta.

Description: Length 30 mm, width 1.5 mm, segments 84. Setae lumbricine. Prostomium epilobic, closed. First dorsal pore at intersegmental furrow 11/12. Clitellum in segments 13–17 (5), reddish. Male field transverse, on segment 17, often rather spindle-shaped. Male pores minute at posterior ends of seminal grooves on segment 17, just anterior to intersegmental furrow 17/18, at *b* setal lines; prostatic pores minute at anterior ends of seminal grooves on setal arc of segment 17, at *a* setal lines; seminal grooves diagonally placed on oval porophores, at *ab* setal lines. Spermathecal pores minute on or slightly anterior to the setal arc of segment 8, lateral to *a* setal lines. Genital markings absent. Septa 4/5–7/8 delicate, 8/9–12/13 slightly muscular. Typhlosole present, in segments 17–18 to 72–78. Proandric, seminal vesicles absent. Prostates one pair, in segment 17. Penial setae present, ornamented with 12–17 circles of fine spines, tip truncate or narrowed to a short spine. Spermathecae one pair, in segment 8, each with an ental, pendant, shortly digitiform diverticulum. Copulatory setae present.

Ingesta: Colloids of very fine soil.

Distribution: Chhattisgarh: Bhilai (new record); Chandigarh, Himachal Pradesh, Jammu and Kashmir, Kerala, Tripura, West Bengal (Julka 1988, Dhiman & Battish 2006, Halder *et al.* 2007, Chaudhuri *et al.* 2008, Narayanan *et al.* 2023b).

Remarks: Subendemic.

***Octochaetona beatrix* (Beddard, 1902)**

(Figure 4)

Octochaetus beatrix Beddard, 1902: 456.

Octochaetus fermori Michaelsen, 1907: 171.

For further synonyms see Gates (1972), Julka (1988) and Blakemore (2012).

Material examined: 1 clitellate (ACCESSD/EW/1505), Atal Nagar-Naya Raipur, Raipur District, Chhattisgarh (21.137545°N 81.781924°E), from roadside in a built up area, 4 August 2022, A.K. Harit.

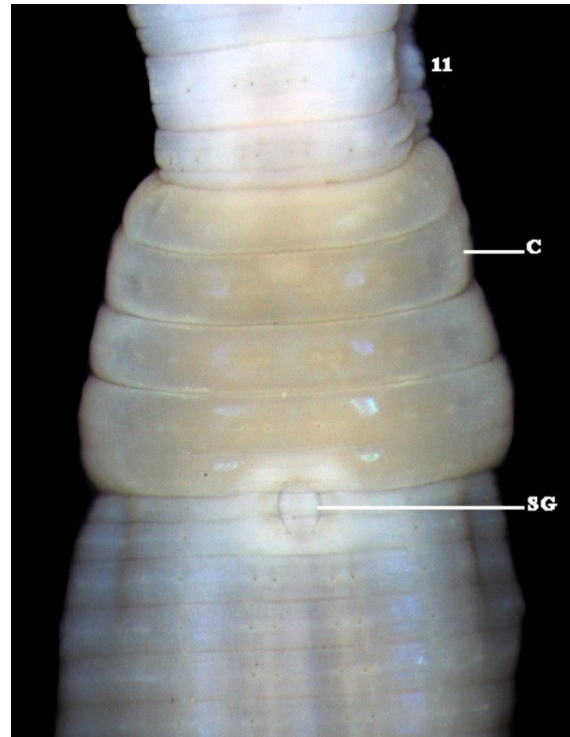


Figure 4. *Octochaetona beatrix* (Beddard, 1902): male field. C = clitellum, SG = seminal groove.

Description: Length 81 mm, width 3 mm, segments 185. Setae lumbricine. Prostomium epilobous. First dorsal pore at intersegmental furrow 12/13. Clitellum annular, covering segments 13–17, 18 (Fig. 4), setae retained, furrows obscured. Male genital field slightly depressed; male pores minute, at or just median to *a* setal line in segment 18. Prostatic pores minute, median to *a* setal line; seminal grooves concave between setal arcs of segments 17 and 19. Female pores paired on segment 14. Spermathecal pores minute, on or slightly anterior to the setal arcs of segments 8 and 9. Discrete genital markings absent, but paired oval to circular slightly thickened areas present, lateral to seminal grooves, on segments 18 and 19. Septa 4/5, 8/9–11/12 muscular, 5/6/7/8 absent. Gizzard between septa 4/5 and 8/9; intestine begins in 16 or 17. Typhlosole, large bifid lamelliform. Metandric. Penial setae ornamented with sparse triangular teeth. Spermatheca, two pairs, each with a spheroidal, shortly pyriform, oval or flattened and shelf-like, diverticulum shortly stalked, iridescent.

Ingesta: Colloids of fine soil and small pebbles.

Distribution: Chhattisgarh: Atal Nagar-Naya Raipur (new record); Andhra Pradesh, Arunachal Pradesh, Bihar, Chandigarh, Goa; Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan; Sikkim, Tamil Nadu; Tripura, Uttarakhand, Uttar Pradesh, West Bengal (Julka 1988, Halder & Dhani 2005, Halder et al. 2007, Chaudhuri et al. 2008, Mandal et al. 2011, Sharma & Bhardwaj 2014, Subedi et al. 2018, Lalthanzara et al. 2020).

Remarks: Native peregrine.

***Octochaetona compta* (Gates, 1945)**

(Figure 5)

Octochaetoides comptus Gates, 1945b: 80

Octochaetona compta (Gates): Gates 1962: 213.

Material examined: 4 clitellates (ACCESSD/EW/1506), Atal Nagar-Naya Raipur, Raipur District, Chhattisgarh (21.137545°N 81.781924°E), from roadside in a built up area, 4 August 2022, A.K. Harit.

Description: Length 63–118 mm, width 4–4.5 mm, segments 81–201. Setae lumbricine. Prostomium epilobic, closed. First dorsal pore in intersegmental furrow 12/13. Clitellum annular in segments 13–17 (=5). Copulatory setae on segment 8 sometimes being surrounded by tumescences. Male genital field transversely oval between intersegmental furrows 16/17 and 19/20. Male pores minute, slightly median to *b* setal line; prostatic pores minute, just median to *b* setal line; seminal grooves nearly straight or irregularly biconcave with indentations on the setal arc of segment 18, between the setal arcs of segments 17 and 19. Female pores paired. Spermathecal pores minute, slightly anterior to the setal arcs of segments 8 and 9, at *ab* setal lines, sometimes at *a* or *b*. Genital markings oval, unpaired and median (Fig. 5), presetal, usually on segment 13, sometimes on 15, 20–25, at *aa* or *bb* or reaching

laterally well into *be* setal lines. Septa 4/5, 8/9–11/12 muscular, 7/8 delicate to slightly muscular, 5/6/7 absent. Gizzard between septa 4/5 and 7/8. Intestine begins in segment 17; typhlosole present. Last pair of hearts in segment 13. Holandric. Seminal vesicles in segment 9, 11 and 12. Penial setae present, ornamented with 15–30 circles of small teeth, tip sharp or rounded, narrowed or widened, flattened. Ectal spermathecal diverticulum, dorso-ventrally flattened and circular disc-like.

Ingesta: Colloids of fine reddish soil and large pieces of reddish rocks and pebbles.

Distribution: Chhattisgarh: Atal Nagar-Naya Raipur (new record); Andhra Pradesh, Karnataka, West Bengal (Gates 1945b, Halder 1999, Mubeen & Hatti 2022).

Remarks: Endemic to India. Length and segments number of the present specimens slightly vary from the previously reported measurements by Julka (1988).

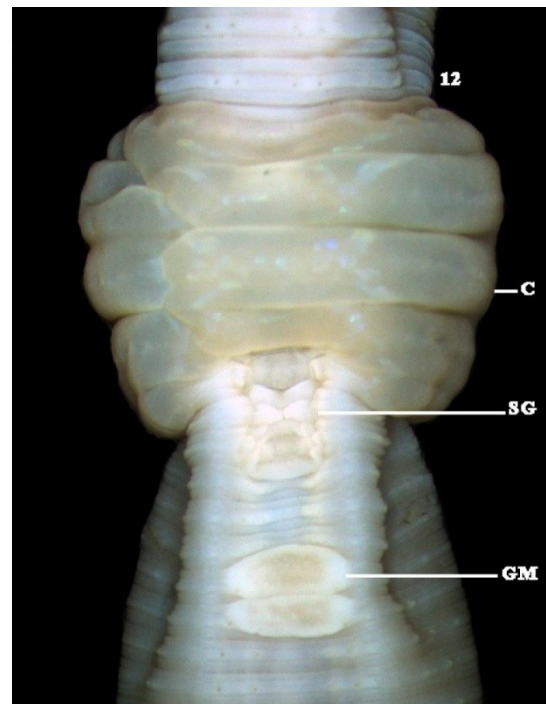


Figure 5. *Octochaetona compta* (Gates, 1945): male field. C = clitellum, GM = genital marking, SG = seminal groove.

***Octochaetona surensis* (Michaelsen, 1910)**

(Figures 6A, B)

Octochaetus surensis Michaelsen, 1910: 88.

Octochaetus (Octochaetoides) surensis (Michaelsen): Stephenson 1923: 394.

Octochaetona surensis (Michaelsen): Gates 1962: 213. For further synonyms see Julka (1988).

Material examined: 9 clitellates (ACCESSD/EW/1589), Megha (20.788672° N 81.813437° E), Dhamtari District, Chhattisgarh, agriculture field, 30 October 2022, Y. Lal; 6 clitellates (ACCESSD/EW/1590), Rajim (20.969696° N 81.877096° E), Gariaband District, Chhattisgarh, Mahanadi River bank, 14 September 2022, A.K. harit, S. Bhattacharyya, A. Dutta; 6 clitellates (ACCESSD/EW/1598), Kesav (Keshwa?) Nala, Mahasamund District, Chhattisgarh, Jonk River bank, 5 October 2022, M. Singh.

Description: Length 36–57 mm, width 2.5–3.5 mm, segments 75–149. Setae lumbricine. Prostomium epilobic, closed. First dorsal pore at intersegmental furrow 12/13. Clitellum annular in segment 13–16, 17 (= 4–5). Copulatory setae on segments 8 and 9, surrounded by tumescences.

Male genital field extends from segment 16–20, with deep unpaired transverse depressions, postsetal on segment 17 and presetal on segment 19 (Fig. 6A). Male pores minute, median to *b* setal line; prostatic pores minute, at *b* line; seminal grooves convex between setal arcs of segments 17 and 19. Female pores paired, sometimes unpaired and median. Spermathecal pores minute, on or close to the setal arcs of segment 8 and 9, at *ab* setal lines (Fig. 6B). Genital markings present, oval shaped, paired or unpaired and median, postsetal on some of segments 18–22, at *aa* or *bb* setal lines. Septa 4/5, 8/9–10/11 muscular, 5/6/7/8 absent. Gizzard between septa 4/5 and 8/9. Intestine begins in segment 17, typhlosole present. Last pair of hearts in segment 13. Holandric, testes and male funnels in cylindrical sacs, in segments 10 and 11. Seminal vesicles in segments 9 and 12. Penial setae present, ornamented with a few longitudinal rows of triangular teeth, tip pointed or claw-shaped. Each spermatheca with a shortly stalked, multiloculate ental diverticulum, duct longer than ampulla. Copulatory setae ornamented with longitudinal rows of spikes or thorn-like protuberances, tip slightly claw-shaped. Genital marking glands absent

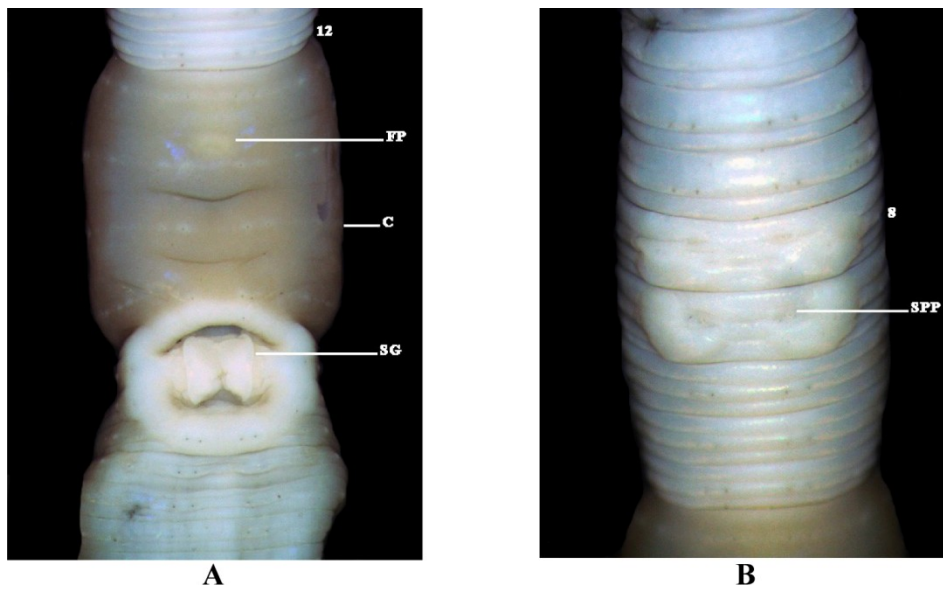


Figure 6. *Octochaetona surensis* (Michaelsen, 1910): A = male field; B = spermathecal pore region. C = clitellum, FP = female pore, SG = seminal groove, SPP = spermathecal pore.

Ingesta: Colloids of fine soil, sand, quartz and sparse fibres materials.

Distribution: Chhattisgarh: Kesav (Keshwa?) Nala, Megha, Rajim (present records), Bagicha (Hasan *et al.* 2023); Andhra Pradesh, Assam, Karnataka, Madhya Pradesh, Odisha, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal (Julka 1988, Halder & Dhani 2005, Kathireswari *et al.* 2005a, Biswas *et al.* 2008, Mandal *et al.* 2010, 2013).

Remarks: Native peregrine. In the present study, the lowest number of segments recorded is 75. Based on the present study, dimension of *O. surensis* is updated as length 36–140 mm, width 2.5–6 mm, segments 75–180 (Julka & Senapati 1987, Julka 1988).

***Pellogaster bengalensis* (Michaelsen, 1910)**

(Figures 7A, B)

Eudichogaster bengalensis Michaelsen, 1910: 96.
Pellogaster bengalensis (Michaelsen): Gates 1940: 201.
Pellogaster bengalensis f. *orissanus* Gates, 1940: 205.
Pellogaster bengalensis f. *jubbulporensis* Gates, 1940: 206.

Material examined: 6 clitellates (ACCESSD/EW/1591), Rajim (20.969696° N 81.877096° E), Gariaband District, Chhattisgarh, Mahanadi River bank, 14 September 2022, A.K. Harit, S. Bhattacharyya, A. Dutta.

Description: 62–86 mm, width 1.5–1.75 mm, segments 117–140. Setae lumbricine. Prostomium tanylobic. First dorsal pore at intersegmental furrow 10/11 or 11/12. Clitellum annular, in ½13, 14–16, 17. Male pores minute, at *ab* setal lines; prostatic pores minute, at *ab* setal lines; seminal grooves straight (Fig. 7A). Female pores slightly within *a* setal line. Spermathecal pores tiny, transverse or crescentic slits. Genital markings tiny, circular to oval, paired, close to the spermathecal pores on segments 8–9 (Fig. 7B), pre-setal on segment 17, postsetal on segment 19, at *ab* setal lines, sometimes on the setal annuli of segment 10, 20, posterior margin of segment 19, in or slightly posterior to 19/20, at *aa* setal lines. Intestine begins in segment 16, typhlosole present. Last pair of hearts in segment 12. Holandric. Seminal vesicles in segments 11 and 12, those of 12 extending to the dorsal line. Penial setae present, ornamented with *ca.* 15 irregular, broken circles of fine to triangular spines, tip claw-

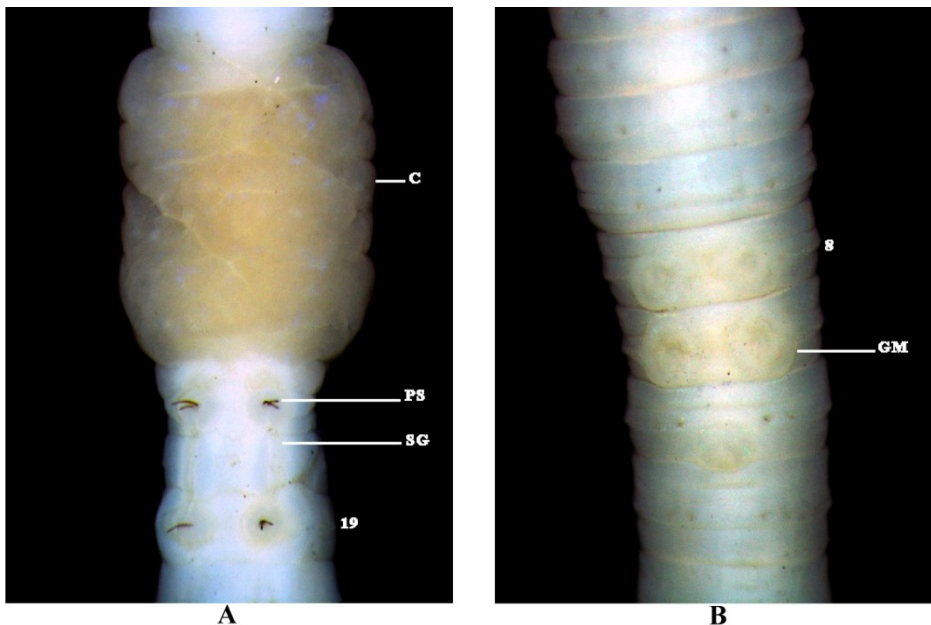


Figure 7. *Pellogaster bengalensis* (Michaelsen, 1910): A = spermathecal pore region; B = male field. C = clitellum, GM = genital marking, PS = penial setae, SG = seminal groove.

shaped or simply pointed and bluntly rounded. Spermatheca with a sessile ental diverticulum, duct as long as or longer than ampulla.

Ingesta: Very fine soil, quartz pieces and sparse pieces of pebbles etc.

Distribution: Chhattisgarh: Rajim (new record); Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, West Bengal (Julka 1988, Verma et al. 2010).

Remarks: Subendemic. In the present study, one worm had a length of 86 mm and the width varied from 1.5–1.75 mm, which differs from the previous report by Julka (1988).

Family BENHAMIIDAE Michaelsen, 1897

Dichogaster affinis (Michaelsen, 1890)

Benhamia affinis Michaelsen, 1890: 9.

Dichogaster (Diplotheocodrilus) affinis (Michaelsen): Csuzdi 1996: 357.

For further synonyms see Csuzdi (2010).

Material examined: 1 clitellate (ACCESSD/EW/1586), Megha (20.788672° N 81.813437° E), Dhamtari District, Chhattisgarh, agriculture field, 30 October 2022, Y. Lal.

Description: Length 22 mm, width 1 mm, segments 66. Setae lumbricine, closely paired. Prostomium epilobous. First dorsal pore starts at intersegmental furrow 5/6. Clitellum saddle-shaped, in segments 13/14–21/22. Spermathecal pores two pairs, in line with *a* setal line. Prostatic pores, two pairs, on segments 17 and 19, in line *ab* setal line; seminal grooves almost straight, each included by a whitish wall, which also includes the prostatic pores. Gizzards 2, in segments 6 and 7. Calciferous glands, three pairs, kidney-shaped, in segments 15–17, the most anterior the smallest. Prostates straight. Spermathecae with very thick, fairly long duct, which bears immediately below its middle a small club-shaped diverticulum. Penial setae present,

thin, gently undulating, with slightly knob like distal end.

Distribution: Chhattisgarh: Megha (new record); Andhra Pradesh, Arunachal Pradesh, Gujarat Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Tamil Nadu, Tripura, West Bengal (Julka 1988; Srivastava et al. 2003; Halder & Dhani, 2005; Halder et al. 2007; Chaudhuri et al. 2008).

Remarks: Exotic peregrine.

Family MEGASCOLECIDAE Rosa, 1891

Lampito mauritii Kinberg, 1867

Lampito mauritii Kinberg, 1867: 103.

For full list of synonyms see Gates (1972) and Blakemore (2012).

Material examined: 3 juveniles (ACCESSD/EW/1587), Megha (20.788672° N 81.813437° E), Dhamtari District, Chhattisgarh, agriculture field, 30 October 2022, Y. Lal; 3 clitellates (ACCESSD/EW/1592), Rajim (20.969696° N 81.877096° E), Gariaband District, Chhattisgarh, Mahanadi River Bank, 14 September 2022, A.K. Harit, S. Bhattacharyya, A Dutta; 2 juveniles (ACCESSD/EW/1593), Parkhanda (20.9250148° N 81.7543418° E), Dhamtari District, Chhattisgarh, agriculture field, 26 October 2022, A. Singh; 1 acitellate (ACCESSD/EW/1595), Durg, Durg District, Chhattisgarh, near human habitation, 8 September 2022, A.K. Harit, S. Bhattacharya, A. Dutta.

Description: Length 87–92 mm, width 3.5 mm, segments 150–155. Setae perichaetine, some ventral setae on the anterior part of the body much enlarged. Prostomium epilobous. First dorsal pore, in intersegmental furrow 10/11 or 11/12. Clitellum annular, in segments 14–17. Spermathecal pores three pairs in intersegmental furrows 6/7/8/9. Male pores on segment 18. Female pores, paired, on segment 14. Gizzard in segment 5. Meganephridia accompany the micronephridia from segment 20 onwards. Prostates large race-mose in segments 18–19, with muscular duct.

Spermathecae with long elongated ampulla, constricted in the middle, and narrowing towards the external opening; duct not distinctly marked off; bidiverticulate, diverticula club-shaped, opposite each other, one-third as long as ampulla. Penial setae present.

Ingesta: Largely plant materials, semi digested fibrous grass leaves, soil, pebbles etc. Also noted a red coloured microplastic fibre.

Aberration: In one specimen male pore of the left hand side is located in the 19th segment.

Distribution: Chhattisgarh: Durg, Megha, Parkhanda, Rajim (present records), Aujhariya, Anjay National Park – Ambikapur, Jannatpur (Hasan et al. 2023); Andaman and Nicobar Islands, Andhra Pradesh, Assam; Delhi; Goa, Gujarat, Haryana, Himachal Pradesh; Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Lakshadweep Islands, Madhya Pradesh, Maharashtra; Odisha, Puducherry; Punjab; Rajasthan, Tamil Nadu; Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal (Stephenson 1923, Stephenson 1924, Gates 1944, Halder & Ghosh 1997, Chaudhuri & Bhattacharjee 1999, Srivastava et al. 2003, Mandal et al. 2010, Khan & Rampal 2014, Sharma & Bhardwaj 2014, Rajkhowa et al. 2015, Ahmed et al. 2020).

Remarks: Native peregrine, widely distributed in the tropical regions of the globe. Record of microplastic in the ingesta of *L. mauritii* is of special significance. Microplastics are defined as the plastic fragments with particle size < 5 mm and is widely distributed in terrestrial environment (Jiang et al. 2020). Cui et al. (2022) recently summarized the adverse effects of microplastics on earthworms, as it adversely affects the growth, behaviour, oxidative response, gene expression, and gut microbiota of earthworms. This is the first report of microplastic in an earthworm from India.

***Perionyx excavatus* Perrier, 1872**

Perionyx excavatus Perrier, 1872: 126.

For full list of synonyms see Blakemore (2012).

Material examined: 7 clitellates (ACESSD/EW/1594), Kalinga University Campus - Kotani, Raipur District, Chhattisgarh, grassland, 16 October 2022, A. Dutta, M. Singh, A.K. Harit, S. Bhattacharya.

Description: Length 60–78 mm, width 2–2.5 mm, segments 162–176. Setae perichaetine. Prostomium epilobic, tongue open. First dorsal pore in intersegmental furrow 2/3–5/6. Clitellum annular, in segments 13–17. Male pores on a small papilla in a single male field, each papilla with 4–9 peni-setal follicles contained in a transverse groove. Spermathecal pores paired, near mid-ventral line in intersegmental furrow 7/8/9. Genital markings absent. Gizzard absent or slightly developed in segment 5; intestine begins in segment 15 or 16. Last pair of hearts in segment 12. Holandric. Seminal vesicles in segments 11 and 12. Spermathecae paired, large, in segments 8 and 9, each with intramural seminal chambers near ental end of duct.

Ingesta: Colloids of soil, in one specimen, intestine is devoid of any food materials.

Distribution: Chhattisgarh: Kalinga University Campus - Kotani (present record), Bagicha (Hasan et al. 2023); Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal (Stephenson 1923, Gates 1931, Julka 1977, 1978, 2006, Soota & Halder 1981, Chaudhuri & Bhattacharjee 1999, Nesemann et al. 2004, Ramanujam et al. 2004, Halder & Dhani 2005, Sathianarayanan & Khan 2006, Nair et al. 2007, Sinha et al. 2013, Khan & Rampal 2014, Vishwakarma & Yadav 2017, Jing et al. 2022).

Remarks: Native peregrine, which attained worldwide distribution. Original home of this species is believed to be in the Himalaya. According to Gates (1972), no other species of earthworm is presently known to live in so many different kinds of climate.

***Perionyx millardi* Stephenson, 1915**

(Figures 8A, B)

Perionyx millardi Stephenson, 1915: 74.

Perionyx igatpuriensis Stephenson, 1920: 220.

Material examined: 28 clitellates (ACCESSD/EW/1507), Atal Nagar-Naya Raipur, Raipur District, Chhattisgarh (21.137545° N 81.781924° E), from roadside in a built up area, 4 August 2022, A.K. Harit; 10 juveniles, 1 clitellate (ACCESSD/EW/1599), Abhanpur, Raipur District, Chhattisgarh, cattle dung and nearby field, 19 September 2022, H. Sen.

Description: Small size. Length 49–116 mm, width 2.5–3 mm, segments 149–247. Setae perichaetine. Prostomium epilobic, tongue closed or open. First dorsal pore in intersegmental furrow 4/5 or 5/6. Clitellum annular, in segments 13–17. Spermathecal pores paired, in 7/8/9 (Fig. 8A), near mid-ventral line, at *b* setal line. Male pores near mid-ventral line (Fig. 8B) on small papillae. Genital markings absent. Nephridiopores incons-

picuous, in a rather irregular longitudinal rank on each side. Septa all present from 4/5. Gizzard slightly developed in segment 6. Intestine begins in segment 18 or 19. Last pair of hearts in segment 13. Holandric. Seminal vesicles in segment 11 and 12, those of 12 extend posterior to septum 13/14. Penial setae ornamented with 9 or 10 circles of fairly sized spines. Spermathecae paired, in segments 8 and 9, each with an ental diverticulum. Nephridia avesciculate.

Ingesta: Colloids of soil, small organic materials, plant parts, bark pieces etc.

Distribution: Chhattisgarh: Abhanpur, Atal Nagar-Naya Raipur (new records); Karnataka, Madhya Pradesh, Maharashtra, Odisha (Stephenson 1915, Gates 1951, Julka 1978, Mubeen & Hatti 2018).

Remarks: Endemic to India. The dimension of *P. millardi* specimens is updated based on the present study and Stephenson (1923), length 40–116 mm, width 2–4 mm, segments 103–247.

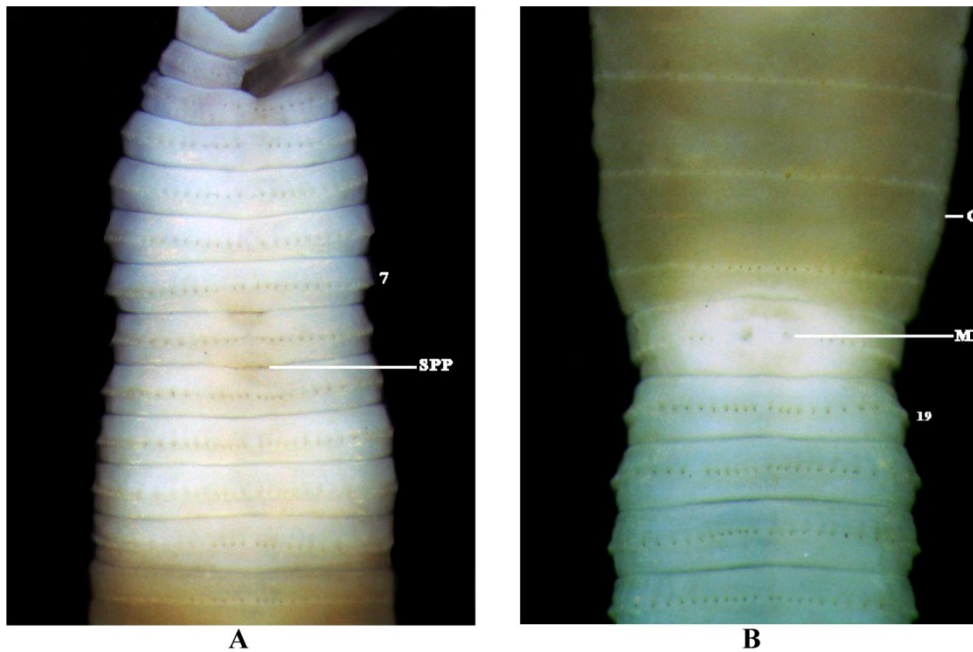


Figure 8. *Perionyx millardi* Stephenson, 1915: A = spermathecal pore region; B = male field. C = clitellum, MP = male pore, SPP = spermathecal pore.

***Polypheretima elongata* (Perrier, 1872)**

(Figure 9)

Perichaeta elongata Perrier, 1872: 124.

Polypheretima elongata (Perrier): Easton 1979: 53.

For complete synonyms see Blakemore (2012).

Material examined: 2 clitellates, 1 juvenile (ACCESSD/EW/1597), Bhilai, Durg District, Chhattisgarh, grass patch between road and home, 14 September 2022, A.K. Harit, S. Bhattacharya, A. Dutta. **Description:** Length 211 mm, width 4.5 mm, segments 221. Setae perichaetine. Prostomium prolobous. First dorsal pore in intersegmental furrow 12/13. Clitellum annular, in segments 14–16, without setae and dorsal pores. Spermathecal pores small, two pairs, lateroventrally placed, in intersegmental furrows 5/6/7. Male pores inside copulatory pouches in segment 18, porophores placed on large elevated area (Fig. 9). Female pore single, mid-ventral in segment 14, in a small circular depression. Genital markings present, simple, large smooth discs, presetal, paired in segments 19–23. Septa 3/4–7/8 strongly thickened, 8/9/10 absent, 10/11/12/13 thin. Gizzard large, muscular, spherical after septa 8/9; intestine begins in segment 15; caeca absent. Last pair of hearts in segment 13. Typhlosole simple. Holandric. Seminal vesicles in segments 11–12. Spermathecae large, in 5/6/7, 6 (3 lhs, 3 rhs) per segment; ampulla large and ovoid, duct relatively short, ectal diverticulum, simple, shorter than ampulla, slightly bent, expanded entally. No accessory glands. Prostate racemose, placed in segments 16–19, prostatic duct muscular, C-shaped.

Ingesta: Fine soil, organic materials, plant parts etc.

Distribution: Chhattisgarh: Bhilai (new record); Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttar Pra

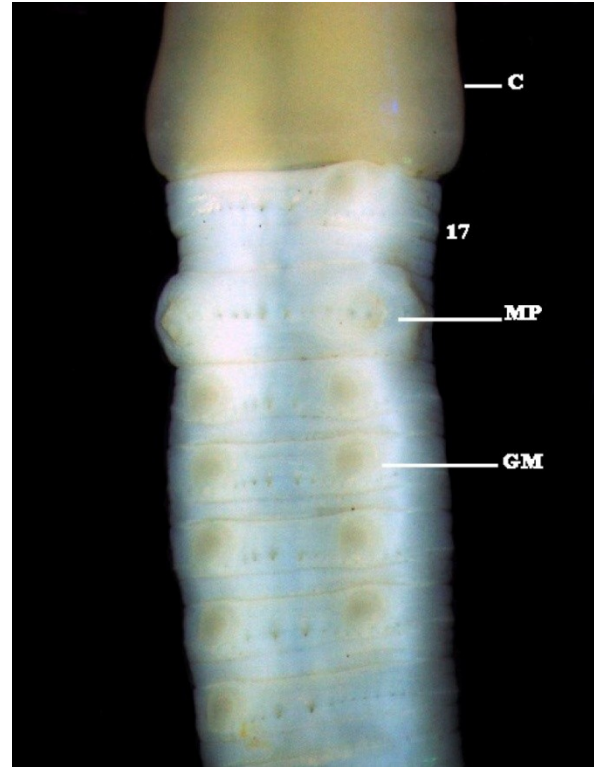


Figure 9. *Polypheretima elongata* (Perrier, 1872): male field; C = clitellum, GM = genital marking, MP = male pore.

desh, West Bengal (Stephenson 1923, 1924, Gates 1932, 1960, Chaudhuri & Bhattacharjee 1999, Batish & Dhiman 2002, Kathireswari *et al.* 2005b, Halder *et al.* 2007, Verma *et al.* 2010, Kumar *et al.* 2021).

Remarks: Exotic peregrine.

DISCUSSION

The taxonomic investigations on the earthworm fauna have not been carried comprehensively in majority of Indian states and union territories (Narayanan *et al.* 2023a) and Chhattisgarh was not an exception either. Before the present study, only 10 species of earthworm were reported from the Chhattisgarh state (Michaelsen 1907, Hasan *et al.* 2023). Current investigation has documented 12 species from the state and this has enriched the knowledge on the megadrile

fauna of this central Indian state. Now, altogether 18 species of earthworms are known from Chhattisgarh (Table 1). Species such as *Drawida limella* Gates, 1934, *Lennogaster chittagongensis* (Stephenson, 1917) and *Octochaetona compta* (Gates, 1945) were found extended their distribution to central India. Even though they have been reported from the neighboring states, the current range extension may be the result of lack of previous thorough exploration at this region. Most of the nearby states have more earthworm species than the Chhattisgarh (Narayanan *et al.* 2023a). Here in the present study, all the

samplings were restricted to the zone of Chhattisgarh Plain region and the rest of the zones are to be sampled. The present finding is only a preliminary one and further investigations would reveal the presence of more species.

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Table 1. List of the earthworm species reported from Chhattisgarh state

Family/Species	Status (Narayan <i>et al.</i> 2023a)	Ecological category	References
Family Moniligastridae			
1. <i>Drawida calebi</i> Gates, 1945	Endemic	Endogeic	Hasan <i>et al.</i> (2023), Present study
2. <i>Drawida limella</i> Gates, 1934	Subendemic	Endogeic	Present study
3. <i>Drawida willsi</i> Michaelsen, 1907	Endemic	Anecic	Michaelsen (1907)
Family Acanthodrilidae			
4. <i>Lennogaster chittagongensis</i> (Stephenson, 1917)	Subendemic	Endogeic	Present study
5. <i>Octochaetona beatrix</i> (Beddard, 1902)	Native peregrine	Endogeic	Present study
6. <i>Octochaetona compta</i> (Gates, 1945)	Endemic	Endogeic	Present study
7. <i>Octochaetona surensis</i> (Michaelsen, 1910)	Native peregrine	Endogeic	Hasan <i>et al.</i> (2023), Present study
8. <i>Pellogaster bengalensis</i> (Michaelsen, 1910)	Subendemic	Endogeic	Present study
Family Benhamiidae			
9. <i>Dichogaster affinis</i> (Michaelsen, 1890)	Peregrine	Epi-endogeic	Present study
Family Megascolecidae			
10. <i>Lampito mauritii</i> Kinberg, 1867	Native peregrine	Anecic	Hasan <i>et al.</i> (2023), Present study
11. <i>Metaphire houlleti</i> (Perrier, 1872)	Peregrine	Anecic	Hasan <i>et al.</i> (2023)
12. <i>Metaphire planata</i> (Gates, 1926)	Peregrine	Epi-endogeic	Hasan <i>et al.</i> (2023)
13. <i>Perionyx excavatus</i> Perrier, 1872	Native peregrine	Epigeic	Hasan <i>et al.</i> (2023), Present study
14. <i>Perionyx millardi</i> Stephenson, 1915	Endemic	Epigeic	Present study
15. <i>Perionyx sansibaricus</i> Michaelsen, 1891	Native peregrine	Epigeic	Hasan <i>et al.</i> (2023)
16. <i>Polypheretima elongata</i> (Perrier, 1872)	Peregrine	Endogeic?	Present study
Family Eudrilidae			
17. <i>Eudrilus eugeniae</i> (Kinberg, 1867)	Peregrine	Epigeic	Hasan <i>et al.</i> (2023)
Family Lumbricidae			
18. <i>Eisenia fetida</i> (Savigny, 1826)	Peregrine	Epigeic	Hasan <i>et al.</i> (2023)

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