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Cover: *Euphaea pseudodispar* shot at Kalindi River, Thirunelli, Wayanad district, Kerala. © Muneer P.K.



Range extension of earthworm *Drawida impertusa* Stephenson, 1920 (Clitellata: Moniligastridae) in Karnataka, India

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Abstract: As a part of an ongoing study on the bio-ecology of earthworms, since 2017 surveys have been carried out in different ecosystems of Western Ghats, Karnataka. This has revealed the presence of one native peregrine species *Drawida impertusa* Stephenson, 1920 of the family Moniligastridae. The species is recorded for the second time from Karnataka state. The paper describes the morphological and anatomical details along with current distribution of the species.

Keywords: Anatomical details, biodiversity hotspot, distribution, ecosystems, native, peregrine species, Shivamogga, Western Ghats.

Earthworms are well-known terrestrial segmented worms belonging to phylum Annelida and they possess a unique position in soil macro fauna. They are the first group of multi-cellular, eucoelomate invertebrates (Kale & Karmegam 2010). Western Ghats and the western coast plains are the areas with highest diversity of earthworms in India (Narayanan et al. 2020). Karnataka state located in the southwestern part of peninsular India has high earthworm diversity. This richness is mainly due to the geographical position of the state, which has the western coastal plains, Western Ghats mountain ranges and Deccan Plateau. Taxonomic studies on the earthworms

of the Western Ghats started towards the last quarter of the 19th century by Bourne (1886), but the Karnataka state was explored during the first quarter of the 20th century by Michaelsen (1910) with a report on the presence of a peregrine species, *Pontoscolex corethrurus* (Müller, 1857). Afterwards, eminent taxonomists described several new species and reported many species from different parts of the state, especially from the Western Ghats and western coastal plains (Stephenson 1917, 1920, 1921, 1924, 1925; Michaelsen 1921, 1922; Rao 1921, 1922; Gates 1937, 1940a,b, 1942, 1945). Subsequent to independence, studies on the earthworms of the state become sporadic and mostly faunistic in nature (Gates 1958, 1965; Julka 1988; Julka et al. 2004; Siddaraju et al. 2010; Hatti 2013; Padashetty & Jadesh 2014; Harish et al. 2018a,b; Mubeen & Hatti 2018; Hasyagar et al. 2021). Since 2017, we have been surveying various regions in the Western Ghats of Karnataka state as a part of an ongoing research on the bio-ecology of earthworms from various habitats. The existence of one native peregrine species, *Drawida impertusa* Stephenson, 1920, of the family Moniligastridae is being reported for the second time

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from the state of Karnataka.

Samplings were done by digging and hand sorting method as proposed by Julka (1990). Soil lumps were broken and the soil was sifted between fingers to sort out the worms. Collected specimens were preserved in 5% formalin. Important anatomical details of earthworm were examined under a stereomicroscope (Nikon SMZ800N). Illustrations were made with the help of a drawing tube attached to the microscope. Specimens were identified following Stephenson (1920, 1923), Gates (1965), and Blakemore (2012). Collected specimens were housed at the museum, Department of Applied Zoology, Mangalore University, Mangalore, and laboratory of Advanced Centre for Environmental Studies and Sustainable Development (ACESSD), Mahatma Gandhi University, Kottayam, Kerala, India.

Drawida impertusa Stephenson, 1920

Drawida barwelli var. *impertusus* Stephenson, 1920: 200.

Drawida barwelli var. *impertusa* Stephenson, 1923: 134.

Drawida impertusa (Stephenson): Gates, 1965: 87.

Type locality: Victoria Gardens Bombay (Mumbai) (18.975° N, 72.825° E), Mumbai, Maharashtra State, India.

Type: ZSIC 301, BMNH 1925:5:12:77 (Reynolds & Wetzel 2020).

Material examined: ACESSD/EW/1177; 10 aclitellate, Nanjavalli (13.9928° N, 75.1876° E), Shivamogga District, Karnataka, India, 17 July 2017, elevation 610 m, edge of paddy field, coll. V. Hasyagar. (Image 1); 5 aclitellate, Eduvani (14.1948° N, 74.8348° E), Shivamogga District, Karnataka, India, 13 June 2017 elevation 549 m, semi-evergreen forest, coll. V. Hasyagar.

Description: Dimension: length 51–61 mm, diameter 3–4 mm, segments 144–168. Pigmentation dark pink at clitellar region, setae lumbricine, prostomium prolobous. Dorsal pores absent, indication present. Male pores are present on slightly raised papillae, bordered by thickened lips, at inter-segmental furrow 10/11, aligned to bc setal lines; genital markings present, paired, fairly large, long whitish papillae, anterior to male pores, in segment 10 (Figure 1). Genital glands absent. Female pores indistinct. Spermathecal pores paired, at inter-segmental furrow 7/8 below cd setal lines, close to c. Septa 5/6–7/8 muscular. Gizzards 4 in segments 12–15. Testis sacs paired, large irregular-shaped, anterior portion constricted by septum 9/10; vas deferens loosely coiled, entering prostate directly at median side. Prostates glandular, flat, sessile, circular (Figure 2); prostatic capsule circular. Spermathecae paired in segment 8, ampulla ovoid, each with short, lightly coiled

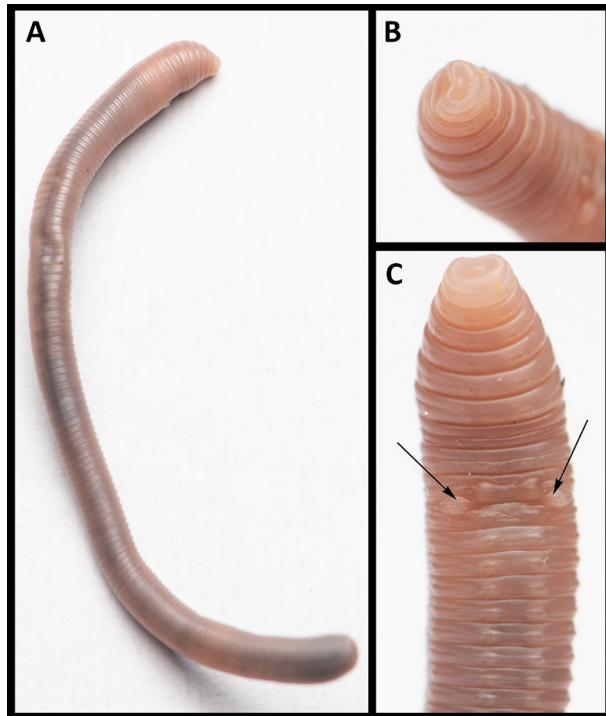


Image 1. *Drawida impertusa*: A—external morphology | B—prostomium region | C—male pores (pointed). © Vivek Hasyagar.

duct, penetrating septum 7/8, ectal end lightly thickened (Figure 3); atrium absent. Ovisacs present in segments 12–13, slightly projecting to segment 14.

Ingesta: Mainly colloids of soil, tiny mineral particles, very few strands of rootlets and barks.

Distribution

India: Karnataka: Nanjavalli and Eduvani in Shivamogga district (present records), Bangalore (Bengaluru); Andhra Pradesh, Maharashtra, Kerala, and Tamil Nadu (Figure 4).

Elsewhere: Philippines.

Drawida impertusa was collected and reported for the second time from Karnataka state of southern Peninsular India. It is one among the 3% of native peregrine species reported from the Western Ghats and western coast plains of India (Narayanan et al. 2016, 2020). Nearly 16 species from the genus *Drawida* were reported from Karnataka (Stephenson 1917, 1920, 1923; Rao 1921; Gates 1958, 1965; Blanchard & Julka 1997, 2013; Mandal et al. 2013; Harish et al. 2018a,b; Mubeen & Hatti 2020). *D. impertusa* resembles *D. barwelli* but lacks dorsal pores and having a pair of genital markings. Earlier the species was reported from Bangalore in Karnataka state (Gates 1965). Apart from Karnataka it has been reported from Andhra Pradesh (Tirupati), Maharashtra (Victoria Gardens – Mumbai), Kerala (Kanjikode, Karumadi, Thiruvalla, and

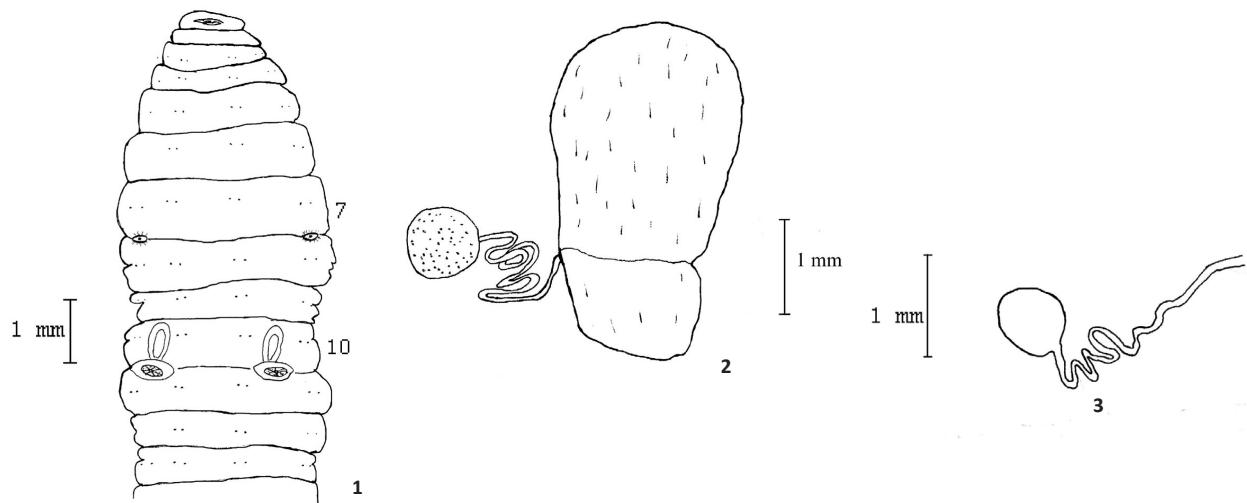


Figure 1–3. *Drawida impertusa*: 1—ventral view showing genital pores | 2—prostate gland | 3—spermatheca.

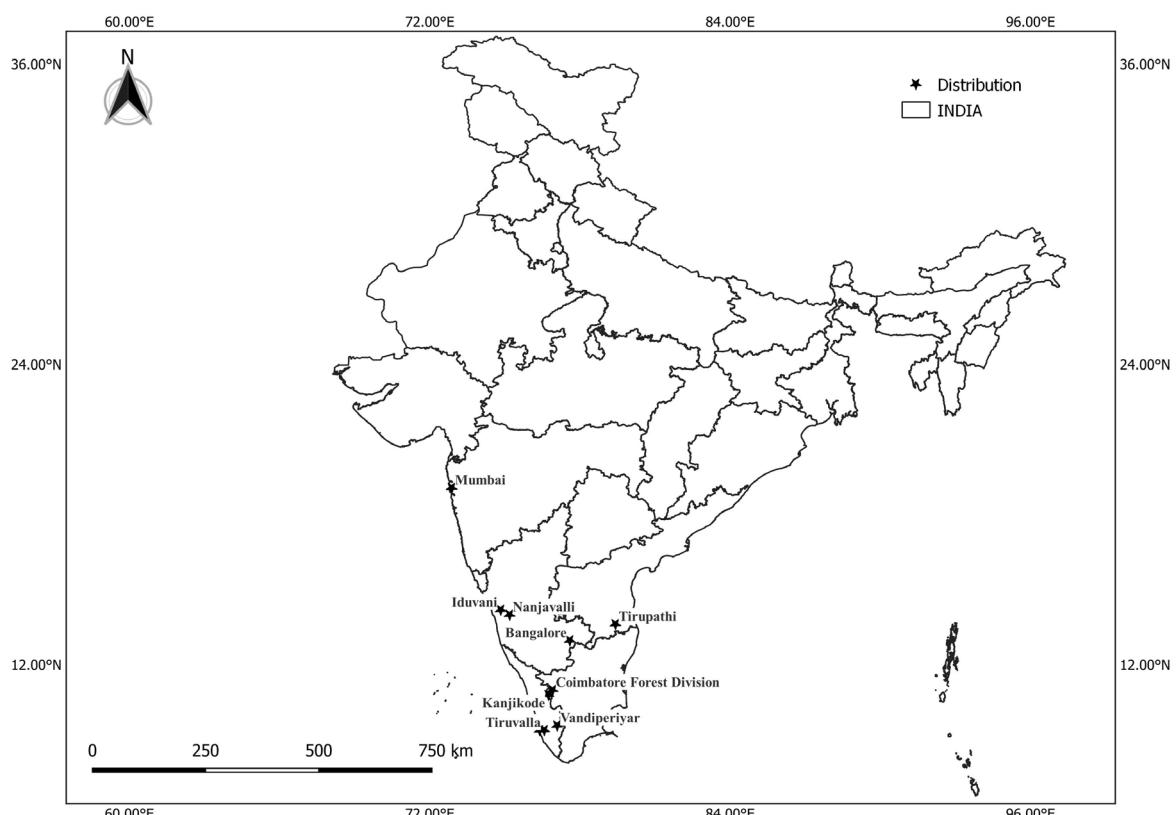


Figure 4. The distribution of *Drawida impertusa* in India.

Vandiperiyar) and Tamil Nadu (Coimbatore forest division) states of India (Michaelsen 1910; Stephenson 1920, 1924; Aiyer 1929; Gates 1965; Kathireswari et al. 2005, 2008; Blakemore et al. 2014; Narayanan et al. 2016). Outside India it was sampled from diverse habitats like garden, hills, rotting tree, sea-shore and considered as introduced

species in Philippines (Blakemore 2012). But present specimen was collected from the semi-evergreen forest and paddy fields. *D. impertusa* is an endogeic species and analyses of the ingesta of the present specimens agrees with the findings of Gates (1965). Several areas of Karnataka state are still unexplored in terms of earthworm

fauna. Therefore, additional intensive survey may discover a few of the undescribed species of the genus *Drawida* from the state.

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