

SYSTEMATICS OF EARTHWORMS FROM JHARKHAND. I. MONILIGASTRIDAE

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ABSTRACT

The communication records for the first time the systematics of earthworm collected from different habitats of Jharkhand. Two species *Drawida caloti* (Gates) and *Drawida willsi* (Michaelsen) belonging to family Moniligastridae of the order Moniligastrida have been described. There is no previous record of the species from this region. The eco-biology of the species in brief has also been dealt with.

Key Words : Moniligastridae, *Drawida caloti*, *Drawida willsi*.

INTRODUCTION

Earthworms have played a very important role in the history of mankind. There are 3527 species (Fragoso, 1997) of earthworms on global record while more than 500 species (Dash, 1999) have been reported from India. The earthworm fauna of Jharkhand (previously the South Bihar region as part of Bihar) has not been studied so far. A gap in knowledge exists so far earthworm biodiversity and its functional role in particular reference to Jharkhand is concerned.

The present paper is an attempt to bridge the gap of knowledge on earthworm systematics from different habitats of Jharkhand.

Michaelsen (1910) provided the first records of earthworms from Bihar and adjoining states. Subsequently, several species were described by Stephenson (1914, 1915, 1916, 1917, 1921, 1923, 1926) from different parts of India. Julka (1976, 1978-1981) also described earthworms from different parts of India. Due to their importance in the soil ecosystem, significant work has been carried out on the ecology and biology of the Orissan earthworms during the last decade by Dash and Patra, (1977), Senapati and Dash (1979) Dash and Senapati

(1980), Senapati *et al.* (1979) and Senapati (1980). Recently important contribution on earthworm has been made by Sinha *et al.* (2000) and Sinha and Srivastava (2001). In addition, some unpublished observations on their ecology and biology and new records derived from recent collections are presented for the first time. For a detailed synonymy of the species, the works of Gates (1972) and Julka (1975, 1978) may be referred. In this work the classification of Oligochaeta into orders and suborders as proposed by Brinkhurst and Jamieson (1971) and the division of the suborder Lumbricina into superfamilies and families as given by Sims (1980) are followed. The classificatory schemes and systematic details have been followed similar to Julka and Senapati (1987). All specimens are kept in the museum of Department of Zoology, Ranchi University, Ranchi.

MATERIAL AND METHOD

Earthworms were collected from different habitats viz. agroecosystems, grassland, forest, pasture and garbage sites from different parts of Jharkhand following the monolith method as described by Dash and Patra (1977). Sampling was done up to 40 cm depth of soil. The earthworms were hand sorted and preserved in 5% formaldehyde solution with some amount of glycerine after spreading them in ice-cold water.

SYSTEMATIC ACCOUNT

Order Moniligastrida belongs to class Oligochaeta of Phylum Annelida.

Order MONILIGASTRIDA

Diagnosis. Testes and male funnels intraseptal in paired dorsal testis sacs; male pores at or close to the intersegmental furrow immediately posterior to the testis sac.

Family MONILIGASTRIDAE

Diagnosis. Dorsal pores absent. Male pores at or close to 10/11 or 11/12 or 12/13. Spermathecal pores anterior to male pores. Oesophagea gizzards posterior to the ovarian segment. Ovaries band-shaped, ova large, yolk. Holonephric.

Distribution. Southeast and eastern Asia, from South India to Manchuria, Korea, also Japan, the Philippines, Borneo, Sumatra.

Genus *Drawida* Michaelsen

Diagnosis. Setae lumbricine. Male pores paired, at or near 10/11; female pores paired, at or just posterior to 11/12; spermathecal pores paired, at or close to 7/8. Septa all present from 4/5, 5/6, 9/10, muscular. Oesophagus with one to several gizzards. In *xii-xxvii*, intestinal caeca and supra-intestinal glands absent. Capsular prostates paired, in *x*. Holonephridia in *iii* and posterior segments.

Distribution. India, Nepal, Burma, Malay Peninsula, Thailand, Indo-China, China, Korea, Manchuria, Siberia, Japan, Philippine islands, Borneo, Sri Lanka, Sumatra and Java.



A : Drawida calebi Gates

1945. *Drawida calebi* Gates, *Proc. Indian Acad. Sci.*, **21(B)** : 211 (Type locality : Jubbalpore, Madhya Pradesh, India); Julka 1976. *Mitt. Zool. Mus. Berlin*, **52** (2) : 322.

Diagnosis. Length 32-63 mm diameter 2-4.5 mm 115-170 segments. Male pores paired, transverse slits, at mid *bc*. Spermathecal pores paired slightly median to *c* lines. Genital markings small, pre or postsetal, usually single and median, widely paired in *bc*, on *vii-xiii*; sometimes widely paired in *ab* on *xii* and closely paired in *aa* and *vii-x*; one of the paired markings sometimes absent or doubled or tripled. Nephridiopores in a single series close to *a* lines.

Gizzards 2-4, in *xii-xvii*. Intestine begins in *xxvi* (± 1). Vas deferens short, in a small column of loops in *ix*, almost straight in *x*, entering the anteromedian aspect of the prostate directly. Prostates muscular, almost spheroidal, sessile, with an internal ventral portion protrusible as a shortly tubular penis. Spermathecal atrium conical, in *viii*, smaller than prostate. Genital marking glands spheroidal to shortly oval, concealed beneath longitudinal muscles.

Distribution. India : Jharkhand : Ranchi, Dhurwa, Pundug, Haratu, Ramgah, Khunti, Orissa : Machya Pradesh; Uttar Pradesh : Karnataka.

Habitat. Geophagous; usually found in pastures, grasslands, lawns, upland crop fields and compost pits at a depth below 10 cm of soil.

Biology. A maximum population of 131 m² and 32 m² has been reported in an upland pasture (Senapati and Dash, 1981) and a forest (Mishra and Dash, 1984) respectively. It has been estimated that this species comprises about 21% and 29% of total worm population in pasture and forest habitat respectively. Cocoons are round with distinct ornamentation, diameter 4.3 mm, length 4.66 mm, diameter: length ratio 0.94 (Senapati et. al., 1979). Live weight of cocoon was about 15-17 mg and the incubation period varied from 3 to 8 weeks. Usually one young worm hatches from each cocoon. A high rate of reproduction (3-5 cocoons per adult/year) and high mortality rate has been reported in a grazed upland pasture as compared to a protected upland pasture (Senapati, 1980). Young hatched worms may take 18-20 months to become adults, with 4-6 months of quiescence. *Drawida calebi* undergoes diapause at low soil moisture (<10g%) and higher soil temperature (>30°C). This species deposits sub-soil casts in the form of globular pellets.

Economic importance. Digestive enzymes like protease, amylase, invertase, cellulase and urease in its gut have been reported by Mishra and Dash (1980a). Abundance of these worms in compost pits and presence of cellulase degrading enzymes in their gut indicate that this species might be important in bio-degradation of waste biomass. Dash *et al.*, (1979) have shown selective fungal feeding for this species, hence its importance in the decomposer sub-system.



B : Drawida willsi Michaelsen

1907. *Drawida willsi*. Michaelsen. *Mitt. Naturh. Mus. Hamb.* **24**: 145 (Type locality : Hyderabad, Andhra Pradesh, India); 1909. *Drawida willsi*, Michaelsen. *Mon. Ind. Mus.* **1**: 143 Stephenson, 1923. *Fauna Br. India. Oligochaeta* : 161-162; Gates, 1945. *Proc. Indian Acad. Sci.* **21** (B) : 214.

Diagnosis. Length 55-60 mm diameter 2.5 mm. 155-160 segments. Prostomium prolob-c. Clitellum annular. x-xiii. Setae aa=bc. Male pores paired, minute at or very close to b lines; each pore on ventral end of slightly depressed or conically protuberant central area of circular to oval porophore. Spermathecal pores paired, small at ab. Genital markings paired, circular, smaller than male porophores, with minute central pores, on 9/10 on or near b lines; one of the paired markings sometimes absent.

Gizzards 2-4, in xii-xvi; intestinal origin in xxi, sometimes in xxii or xxiii. Vas deferens rather short, in several loops on anterior and posterior faces of septum 9/10 entering the ental end of the prostate directly. Prostates glandular, erect; capsule digitiform. Spermathecae paired, in viii. atrium digitiform, in vii, as long as or slightly longer than the prostate, arising from the ental end of the spermathecal duct. Genital marking glands digitiform, occasionally or slightly protuberant into coelomic cavity, smaller than the prostates.

Distribution. India : Jharkhand: Ranchi, Dhurwa, Morhabadi, Kantatoli, Harmu, Ramgarh, Khunti, Orissa; Madhya Pradesh: Andhra Pradesh, Jltar Pradesh.

Material examined. 2 acclitellate, 3 clitellate specimens from Dhurwa, Kantatol and Harmu in Ranchi district. October 1999-September 2000.

Habitat. *Drawida willsi* inhabits soils with high organic matter content (>10g%). It is abundant in crop fields, compost pits and drains; pH ranging from slight acid c to alkaline soils (6.8-7.8).

Biology. It is phytogeophagous. A maximum population density of 32 m² in an upland protected pasture, 250 m² in a low land crop field and 500 m² in a compost pit has been recorded.

(Senapati, 1980).

Live cocoons are pale to reddish brown, round (diameter : length = 0.9), 3.2 mm long and 2.9 mm diameter, and weigh around 6 mg. Incubation period is 14 - 18 days at 25° C of soil temperature and 16 g% of soil moisture. Usually two young worms hatch from each cocoon, rarely three, although four worms emerging from a single cocoon have been recorded (Dash and Senapati, 1980). Cocoons are laid throughout the year in complete moist habitats, but in rainfed areas they are found only during post-rainy season. However, in exclusively rain-fed habitats where quiescence disrupts growth, maturity is attained in about 18-20 months. It forms diapause coils during dry summer months.

About 5-8 kg of annual dry cast production per gram dry weight of worm has been estimated under laboratory conditions. Casts are deposited on the soil surface in the form of globular pellets. Rate of cast production has been estimated to be around 10 times higher than that of *Lampito mauritii*. Soil moisture of 15 to 22 g% is most suitable for worm cast production.

Economic importance. Dash (1999), reported the presence of cellulase, urease, invertase and protease in its gut. Laboratory observations have shown that this species enhances decomposition of green manure and straw in culture.

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