Mesenchytraeus asymmetriauritus, a new enchytraeid (Annelida, Clitellata) from northeastern China

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Abstract.—A new enchytraeid species, Mesenchytraeus asymmetriauritus sp. nov., collected from terrestrial habitats of Changbai Mountain in the northeast China, is described. It is characterized by the dorsal vessel originating in XV–XVII, four pairs of preclitellar nephridia in 6/7–9/10, spermathecae attached to oesophagus in segment V and each possessing three or four ear-shaped diverticula of different size, one pair of asymmetrical sperm sacs occupying X–XVII and containing bulk of naked sperm bundles, atrium cylindrical with 4 prostate-like glands and distinct from vas deferens, and well-developed egg sac extending to XVI–XVII.

Keywords: China, Clitellata, Enchytraeidae, Mesenchytraeus, new species

Mesenchytraeus Eisen, 1878 is one of the most speciose genera in the Enchytraeidae, containing as many as 85 species and subspecies worldwide (Cech et al. 2012, Christensen & Dózsa-Farkas 2012, Schmelz & Collado 2012, Shen et al. 2012a). Some taxa can prefer to glacial waters or tundra, but most of them occur in cold permanently humid habitats rich in organic matter (Welch 1919, Christensen & Dózsa-Farkas 1999, Rota & Brinkhurst 2000).

Changbaishan Mountain, located in Jilin Province, northeast China, is rich in enchytraeid species diversity (Lian et al. 2011). During previous investigations, some species new to science and endemic were found there, including three Mesenchytraeus (Shen et al. 2011, 2012a, b). During a further investigation of the enchytraeid fauna there, we identified one new species belonging to Mesenchytraeus. Herein, the species is described.

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Materials and Methods

Worms were collected from the field during Mar 2014 by taking soil samples and extracting them in the laboratory, using a standard hot wet funnel device (O’Connor 1962, Healy & Rota 1992). All mature worms were examined with a stereomicroscope and measured microscopically while alive. Live observations included general dimensions and body color. All other characters were studied with a light microscope equipped with interference contrast optics. For the examination of the soft–bodied internal organs and surface structures, we gently pressed the living specimens between a slide and coverslip in a drop of tap water. Subsequently, worms were preserved in 10% formalin or 70% alcohol (for future molecular studies). For taxonomic observation, some specimens were stained in paracarmine, dehydrated in an alcohol series, and mounted in Canada balsam, or dissected. Drawings from whole mounts were made with the help of an Olympus
drawing tube. The type material of the new species are deposited in the Museum of Aquatic Organisms (MAO), Institute of Hydrobiology, Chinese Academy of Sciences, China.

Unless otherwise specified, measurements refer to sexually mature, fixed (both whole-mounted and dissected) specimens. When ‘vivo’ is used, measurements refer to living specimens.

Mesenchytraeus asymmetriauritus, new species

Fig. 1

Holotype.—Sexually mature specimen (JLO201400001) collected in March 2014, stained and whole-mounted in Canada balsam.

Type locality.—Mixed coniferous and broadleaved forest, Mt. Changbai, Jilin Province (42.33579°N, 127.88446°E, 1109 m above sea level), dark brown forest soil under roots of Pinus koraiensis and Acer ukurunduense, 22–27 March 2014, coll. Z. J. Piao.

Paratypes.—Four whole specimens and one dissected adult specimen (JLO201400002–201400006), collected from the same locality and date as the holotype.

Other material examined.—About 15 additional mature and 10 submature specimens, all from the type locality, were examined.

Etymology.—“Auritus” means ear-equipped, and “asymmetri” means imbalanced or unequal. The specific name “asymmetriauritus” refers to the spermathecal ampulla bearing three to four ear-shaped diverticula of different size.

Description.—Small worms, yellowish in vivo. Body length 9–12 mm in vivo and 7.6–8.0 mm after fixation (holotype 8.0 mm), body width 0.3–0.4 mm at V, 0.4–0.5 mm at clitellum in vivo (0.22–0.24 mm at V and 0.27–0.29 mm at XII after fixation). Segment number 43–54 (holotype 50).

Head pore near the tip of prostomium, as a longitudinal slit. Epidermal gland cells inconspicuous, almost absent. Chaetal formula: 3, 4–3, 4: 4(3) –4. No enlarged chaetae. Chaetae sigmoid and nodulated, distally thinner and single-pointed. Both lateral and ventral chaetae shortest in segment II, reaching the maximum length in VII (Fig. 1A–F), and gradually shortening again posteriorly. Ventral chaetae longer and stouter than corresponding lateral ones. Lateral chaetae 46–75 μm long, 2.1–4 μm thick. Ventral chaetae 60–90 μm long, 3.2–5 μm thick. Chaetae of XII lacking in sexually fully-mature specimens. Ciliate elevated inconspicuously, extending from middle of XI to XIII. Hyalocytes and granulocytes irregularly arranged in lateral area of XII; glands scarce in mid-dorsal and mid-ventral of XII. Two separate male pores ventrolateral in ventral-middle of XII. Paired spermathecal pores in 4/5, each on the lateral line.


Sperm funnel bell-shaped, with collar weakly developed, 125–200 μm long, 75–
125 μm in maximum width, backwards tapering into vas deferens. Head of spermatozoa ca. 110–120 μm long (Fig. 1H). Vas deferens with conspicuous ciliated canal, ca. 20–25 μm wide, wound in irregular spirals in coelom of XII–XIV, gradually widening posteriorly and entering atrium apically. Atrium slightly wider than vas deferens, ca. 170–280 μm long and 28–50 μm wide, with thin muscular
layers and thick epithelium extending into penial bulbs medially in XII. No cilia observed in atrial canal. Atrium with four long (200–300 μm) prostate-like glands projecting in opposite directions. Penial bulbs ventral, compact, consisting of masses of glandular cells and muscle strands. Several small accessory glands extending in different directions around the male pore. Paired sperm sacs of different size, both originating at X and reaching separately and posteriorly into XV–XVII, containing numerous naked but regular sperm bundles. One egg sac extending into XVII. One to two eggs mature at a time.

Paired spermathecae confined to V (Fig. 1G). No ectal glands visible. Ectal duct stout, thick-walled and rich in muscle fibres, ca. 75–100 μm long and 20–40 μm wide, projecting into ampulla. Latter as long as ectal duct, comprising an elongate proximal part and a short and widened distal one. Each ampulla possessing 3–4 asymmetrical diverticula sessile in the proximal part, both ampullar body and diverticula filled massively with sperm bundles in fully mature specimens. One small globular diverticulum, ca. 50–80 μm in diameter, attached to ampulla ventrally, others (2–3) much larger (variable in size between 60–120 μm long and 70–80 μm wide) and ear-shaped, attached dorsally to ampulla on the opposite sides and somewhat ectally. Ental ducts of the spermathecae join separately the ventral side of oesophagus in 5/6.

Discussion

Mesenchytraeus asymmetriauritus is characterized by the 1) dorsal vessel beginning from XV–XVII; 2) four pairs of preclitellar nephridia in 6/7–9/10; 3) one pair of asymmetrical sperm sacs occupying X–XVII, containing bulk of naked sperm bundles; 4) each spermatheca endowed with three or four diverticula of different shapes and sizes and attached entally to oesophagus in segment V; 5) male atrium cylindrical, with 4 prostate-like glands and distinct from vas deferens; and 6) well-developed egg sac extending to XVI–XVII.

Most of the species in Mesenchytraeus have one or two spermathecal ampullar diverticula or none. So far, only three congeners have been described with three or more diverticula, including the ice-worm M. solifugus (Emery, 1898) (possessing 3 diverticula), the Siberian and wetland M. mirabilis Eisen, 1878 (3–5), and the aquatic M. vshivkovae Timm, 1994 (at least 6) (Welch 1919, Eisen 1905, Cejka 1914, Goodman 1971, Timm 1994, Christensen & Dózsa-Farkas 1999, Shain et al. 2000). All three species differ from M. asymmetriauritus by having an intraclitellar origin of dorsal vessel in common (Table 1). Furthermore, M. mirabilis is distinguished from M. asymmetriauritus by having an intraclitellar origin of dorsal vessel in common (Table 1). The stream-dwelling M. vshivkovae differs from M. asymmetriauritus by the lack of atrial gland (Eisen 1905, Christensen & Dózsa-Farkas 1999) (Table 1). The stream-dwelling M. vshivkovae differs from M. asymmetriauritus by the lack of atrial gland, and by possessing at least 6 ampullar diverticula in each spermatheca (Timm 1994). The ice-worm, M. solifugus, is distinctly separate from M. asymmetriauritus by its dark...
brown body color, obvious copulatory papillae, the abrupt distal setal curvature and the enlarged ventral chaetae in XI, the fewer spermathecal diverticula, more atrial glands, and one sperm sac extending to XX (Eisen 1905, Welch 1919, Goodman 1971, Shain et al. 2000).

Mt. Changbai harbors a highly diverse assemblage of enchytraeids, numbering a total of ca. 50 species so far (Chen 2009, Shen 2013), including three species of *Mesenchytraeus* (Shen et al. 2011, 2012a, b). These taxa had been all collected during summer months. *M. asymmetriauritus* is the first record obtained in the spring season, indicating that this well-preserved mountainous ecosystem may contain an even larger array of enchytraeid species.

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<th>Table 1.—Comparison of <em>Mesenchytraeus asymmetriauritus</em> with three putatively related species.</th>
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Acknowledgments

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