

# Four New Earthworms of the Genus *Amyntas* (Oligochaeta: Megascolecidae) from Korea

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Key Words:

New earthworm species  
*Amyntas*  
Oligochaeta  
Megascolecidae  
Korea

Four new species of the genus *Amyntas* are described from Korea: *Amyntas mujuensis* sp. nov., *Amyntas assimilis* sp. nov., *Amyntas moakensis* sp. nov., and *Amyntas sangumburi* sp. nov. The intestinal caeca are of simple type and genital markings lacking in all four species. *Amyntas mujuensis* sp. nov. has male field with large oval papillae, each papilla with longitudinal seminal groove; paired spermathecal pores present in 6/7, 7/8 dorsally. *Amyntas assimilis* sp. nov. has male field composed of paired symmetrical pear-shaped pads with broad ends laterally, axes of symmetry diagonally oriented towards posterior; spermathecal pores in 5/6, 6/7. *Amyntas moakensis* sp. nov. has male pores on small porophores surrounded by swollen concentric furrows, with the spermathecal pores in 6/7, 7/8, 8/9, ventrally. *Amyntas sangumburi* sp. nov. has male pores centered on 0.8 mm circular flat porophores, with the spermathecal pores in 5/6, 6/7, 7/8, 8/9, laterally.

The genus *Amyntas* is the largest genus of the *Pheretima*-complex group, consisting of more than 500 species (Sims and Easton, 1972). This genus is known to be diverse in litter layers and soils in natural forests. Species of Korean Megascolecidae were originally placed in the genus *Pheretima* Kinberg, 1867, but the latter has since been divided by Sims and Easton (1972). Those species with the intestinal caeca originating in the segment xxvii and lacking both nephridia on the spermathecal ducts and the copulatory pouches were placed in the genus *Amyntas*. Generally, Korean *Amyntas* species are distinguished by the conspicuous external characters including the region of male pore and the male pore itself. It may be of a simple porophore, or a disc shape with seminal groove. The location and shape of spermathecal pores, and the number and location of genital marking may differ and are reliable taxonomic traits but should be further supported by simple dorsal dissection and examination of a few internal features such as the form of the intestinal caeca, the structures of the testes sacs and genital marking glands, and the shape of the spermathecae.

The Korean earthworms have been studied with regard to the taxonomy of Megascolecidae (Kobayashi, 1934, 1936, 1937, 1938; Song and Paik, 1969, 1970a, 1970b, 1971, 1973; Hong and James, 2001, Hong and Lee, 2001). Kobayashi recorded 29 species of *Amyntas*

of which 18 were new and Song and Paik recorded nine species of this genus, including six new species from five forest areas, Dagelet Is., Jeju Is., Geoje Is., Mt. Jiri, and Mt. Sopaik. Hong and James (2001) described 20 new species of *Amyntas* collected from several locations in Korea including natural forests and islands. Hong and Lee (2001) reported three new species of this genus with multiple genital markings from Mt. Songni, Mt. Gaya, and Mt. Jiri.

Specimens studied in the present work had been collected from litter layers and soils in forests by digging and hand sorting from three locations, Mt. Deogyu, Mt. Moak, and Sangumburi from Jeju Islands. These specimens are those examined previously by the senior author (Hong and James, 2001; Hong and Lee, 2001) without naming them. Taxonomy follows Sims and Easton (1972). Illustrations are of anatomical views containing important features, prepared with a camera lucida. All descriptions are based on the external examination and dorsal dissection under the stereomicroscope. The holotypes of the new species are deposited in the collection of the Jeonbuk National University; paratypes of the two new taxa are deposited at the Museum of Natural History of Geneva.

## Description

Genus *Amyntas* Kinberg, 1867  
*Amyntas mujuensis* sp. nov. (Fig. 1)\*

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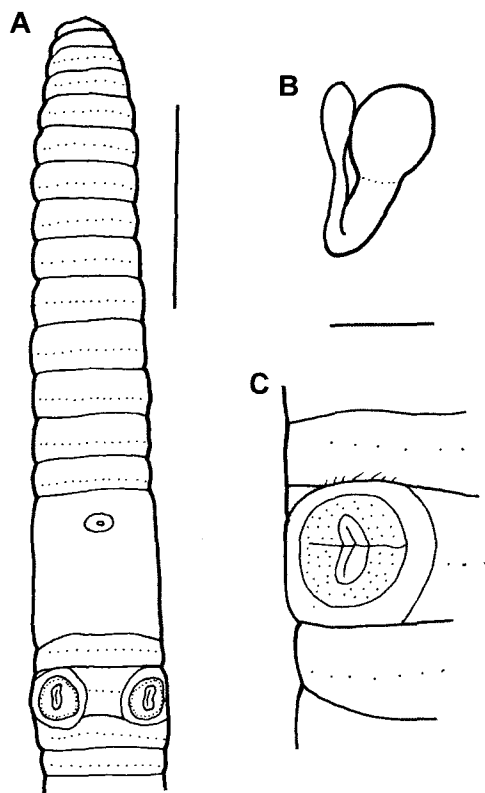


Fig. 1. *Amyntas mujuensis* sp. nov. A, Ventral view of anterior part of body. B, Male pore region in xviii. C, Spermathecae. Scale bars = 5 mm (A), and 1 mm (B, C).

Type material. Holotype: Litter layers in forest of 400-1000 m altitude, Mt. Deogyu (35° 53'-55'N, 127° 46'-47'W), Muju-gun, Jeollabuk-do, 4 July 1998, Y. Hong coll.

Description: Worm unpigmented. Dimensions 72 by 2.8 mm at segment x, 3.0 mm at xxx, 2.9 mm at clitellum; body cylindrical throughout, segments 102. Setae regularly distributed around segmental equators, numbering 33 at vii, 39 at xx; 5 between male pores, regular distance; setal formula AA : AB : YZ : ZZ = 2 : 1 : 2 : 3 at xiii. Female pore single in xiv, 0.6 mm, oval surround. First dorsal pore 12/13. Clitellum annular xiv-xvi; setae not visible externally within clitellum.

Male field pores in xviii, large oval papillae, diameter of inner ring 1.1 mm, outer ring 1.6 mm, each papilla with longitudinal seminal groove, anterior ends of male pores with grooves. Paired spermathecal pores in 6/7, 7/8 dorsally, slightly elevated, center spot prominent with flat top. No spermathecal patches, slight ochre color in segments vii, viii near spermathecal pores. Genital markings absent.

Septa 5/6-7/8 thick, 8/9, 9/10 absent, 10/11-13/14 thin. Gizzard medium size in viii-x. Intestine begins in xv, lymph glands small from about xxv. Typhlosole large fold from xxvii. Intestinal caeca simple, originating

from xxvii, and extending anteriorly to about xxiv, each consisting of finger-shaped lobe. Esophageal hearts x-xiii, ix lateral.

Ovaries in xiii. Paired spermathecae in vii, viii; each ampulla small pouch, ducts thick, longer than ampulla, diverticula club-shaped, as long as ampulla or shorter than ampulla; no nephridia on spermathecal ducts. Male sexual system holandric, testes and funnels in paired sacs in x, xi, sacs joined dorsally and ventrally, enclose other segment contents (hearts and seminal vesicles). Seminal vesicles 2 pairs in xi, xii. Prostate glandular portions lacking; ducts thick, muscular, and connected to sperm ducts.

Etymology: The species is named for its type locality.

Remarks: *Amyntas mujuensis* sp. nov., and the next three species have simple intestinal caeca, and can thus be distinguished from other species with two pairs of spermathecal pores in 6/7 and 7/8. *Amyntas yongshilensis*, *Amyntas alveolatus*, *Amyntas geomunensis*, *Amyntas eastoni*, *Amyntas boletiformis*, *Amyntas odaesanensis*, *Amyntas righii*, *Amyntas fasciformis*, *Amyntas sanchongensis* which were described by Hong and James (2001), and *Amyntas songnisanensis*, *Amyntas ephippiatus*, and *Amyntas multimaculatus* which were described by Hong and Lee (2001), all have spermathecal pores in 6/7 and 7/8 but with manicate intestinal cecum. The present species is similar to *Amyntas susakii typica* (Kobayashi, 1936) in the male pore region, but easily distinguished by the orientation direction of the seminal groove. *Amyntas susakii typica* has diagonal grooves, but in this species the grooves are longitudinal. *Amyntas mujuensis* sp. nov. has more dorsally placed spermathecal pores, the feature similar to *Amyntas deogyusanensis* Hong and James, 2001, *Amyntas cuneatus* Hong and James, 2001, and *Amyntas kobayashii* (Kobayashi, 1938), but differs from the latter three species in the shape of the male pore region and the location of spermathecae. *Amyntas vallis* (Kobayashi, 1936) also has more dorsally placed spermathecal pores though this species has three spermathecal pores in 5/6-7/8.

*Amyntas assimilis* sp. nov. (Fig. 2)\*

Type materials. Holotype and two paratypes: Litter layers in forest of 400-1000 m altitude, Mt. Deogyu (35° 53'-55'N, 127° 46'-47'W), Muju-gun, Jeollabuk-do, 4 July 1998, Y. Hong coll. Other material examined: 1 clitellate specimen, Mt. Deogyu, Muju-gun, Jeollabuk-do, 20 July 1996, Y. Hong coll.

Description: Dorsal pigment light brown. Dimensions 85-106 by 4.8 mm at x, 5.3 mm at xxx, 5.3 mm at clitellum; body cylindrical throughout, segments 83-109.

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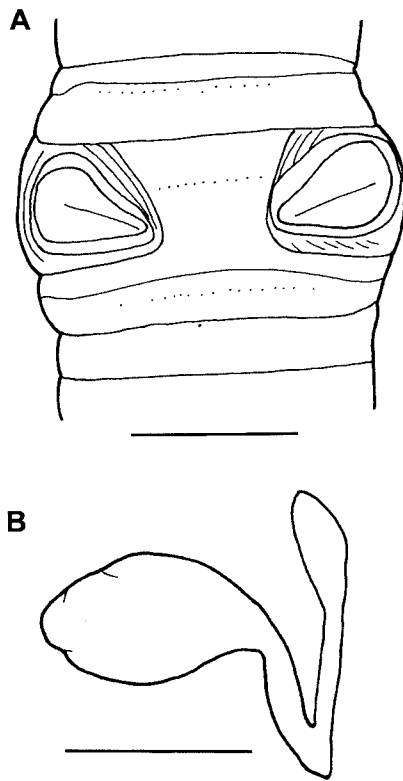


Fig. 2. *Amynthus assimilis* sp. nov. A, Male pore region in xviii. B, Spermathecae. Scale bars = 3 mm (A) and 2 mm (B).

Setae beginning in ii, size and distant irregular, numbering 16 at vii, 67 at xx; 11-12 between male pores; setal formula AA:AB:YZ:ZZ=2:2:2:5 at xiii. Female pore single in xiv. First dorsal pore 12/13. Clitellum annular, xiv-xvi, setae and dorsal pores not visible, externally within clitellum.

Male field composed of paired symmetrical pear-shaped pads with broad ends laterally, axes of symmetry diagonally oriented towards posterior; seminal groove from medial ends to centers of broad portions of pads. Male pores at lateral ends of seminal grooves. Spermathecal pores lateral in vi, vii close to 5/6 and 6/7, small white spot; ocher-colored genital patches on vi and vii, width 1.5 mm at vi, 1.8 mm at vii. Genital markings absent.

Septa 5/6-7/8 thick, 8/9, 9/10 absent, 10/11-13/14 thin, some muscle. Gizzard globular in viii-x. Intestine begins in xv, paired lymph glands small from xxviii along the dorsal vessel. Typhlosole low simple fold, medium height from xxvii. Esophageal hearts x-xiii, large dorsal vessel. Intestinal caeca simple, originating from xxvii, and extending anteriorly to about xxiii, each consisting of a large finger-shaped caeca, a few small pouches on ventral margin of caeca.

Ovaries in xiii. Paired spermathecae in vi and vii; each ampulla small egg-shaped pouch, ducts short, slender, diverticula with slender long stalk, short sau-

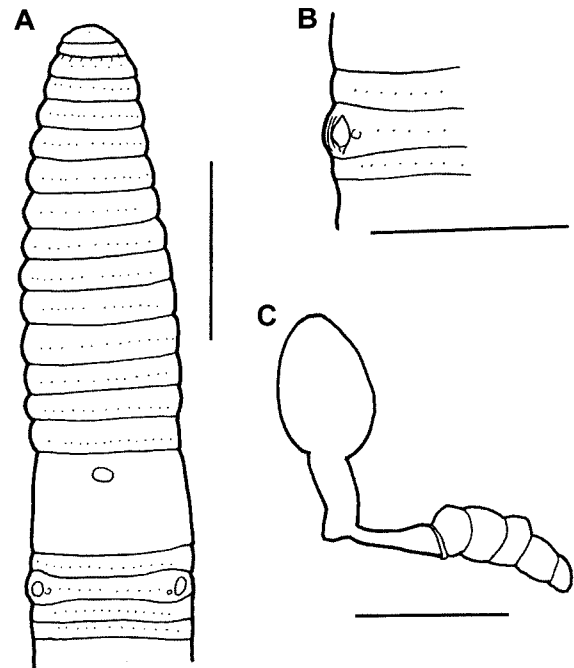


Fig. 3. *Amynthus moakensis* sp. nov. A, Ventral view of anterior part of body. B, Male pore region in xviii. C, Spermathecae. Scale bars = 3 mm (A), 2 mm (B), and 1 mm (C).

sages shaped to elongate ellipsoidal chamber; no nephridia on spermathecal ducts. Genital markings absent. Testis sacs 2 pairs in x, xi. Seminal vesicles 2 pairs in xi, xii, well developed. Prostates xviii within xvi-xviii, deeply divided into many long lobes; ducts long, muscular.

**Etymology:** The name *assimilis* is Latin for "similar", which means the close relationship of this species to *A. deogyusanensis*.

**Remarks:** The species appears to be closely related to *A. deogyusanensis*. But *A. deogyusanensis* has disc-shape resembling a droplet with its end narrowing laterally and in central axis with a diagonal seminal groove. Individuals from one site are similar to one another in all characteristics, but in two individuals the broad ends of the pads are oriented towards the mid-ventral rather than the lateral.

*Amynthus moakensis* sp. nov. (Fig. 3)\*

**Type material.** Holotype: Litter layers in forest of 200-400 m altitude, Mt. Moak, Wanju-gun, Jeollabuk-do, 11 July 1996, Y. Hong coll.

**Description:** Worm unpigmented. Dimensions 32 by 2.4 mm at segment x, 2.3 mm at xxx, 2.5 mm at clitellum;

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body cylindrical throughout, segments 75. Setae regularly distributed around segmental equators, numbering 43 at vii, 39 at xx; 12 between male pores, at regular distance; setal formula AA : AB : YZ : ZZ = 2 : 1 : 1 : 1.5 at xiii. Female pore single in xiv, 0.3 mm, oval shaped. First dorsal pore 12/13. Clitellum annular xiv-xvi; setae not visible within clitellum, but dorsal pores not blocked by clitellum.

Male pores near lateral margins of ventrum in xviii; on small porophores surrounded by swollen concentric furrows. Spermathecal pores in 6/7-8/9, ventrally. Genital markings absent.

Septa 5/6-7/8 thin, 8/9, 9/10 absent, 10/11 thin, 11/12-13/14 thin with some muscle. Gizzard large in viii-x. Intestine begins in xv, lymph glands not found. Typhlosole large fold from xxvi. Intestinal caeca simple, originating from xxvi, and extending anteriorly to about xxiv, each consisting of finger-shaped lobe. Esophageal hearts x-xiii, ix lateral.

Ovaries in xiii. Three paired spermathecae in vii, viii, ix; each ampulla small cylindrical ovate; ducts short, thick muscular stalk, diverticulum ectal tightly coiled section of chamber clear, longer than ampulla; no nephridia on spermathecal ducts. Male sexual system holandric, testes and funnels in ventral paired sacs in x, xi. Seminal vesicles 2 pairs in xi, xii with small dorsal appendages. Prostates xviii within xvii-xx; ducts muscular, thick; both glandular portions consist of 2 or 3 main lobes.

**Etymology:** The species is named after the type locality.

**Remarks:** The present species is small, and it differs from other species in the shape of the male pore region and having three pairs of spermathecae in vii, viii, and ix. The testes sacs or funnels are not certain. The previously recorded species *Amynthas quelpartus* (Kobataishi, 1936) and *Amynthas hupeiensis* (Michaelson, 1895), also have spermathecae in vi-viii, but differ in body shape, spermathecal shape, and male pore region.

*Amynthas sangumburi* sp. nov. (Fig. 4)\*

**Type materials.** Holotype and 3 paratypes: Soil and litter layers at 200-300 m elevation in volcanic crater, Sangumburi (33° 22'-23'N, 126° 47'E), Jeju-do, 17 October 1996, Y. Hong coll.

**Description:** Dorsal pigment light brown. Dimensions 46-68 by 2.3 mm at segment x, 2.3 mm at xxx, 2.5 mm at clitellum; body cylindrical throughout, segments 58-79. Setae regularly distributed around segmental equators, numbering 39 at vii, 43 at xx; 3-4 between male pores, irregular; setal formula AA : AB : YZ : ZZ = 1 : 1 : 1.5 : 2.5 at xiii. Female pore single in xiv, very small

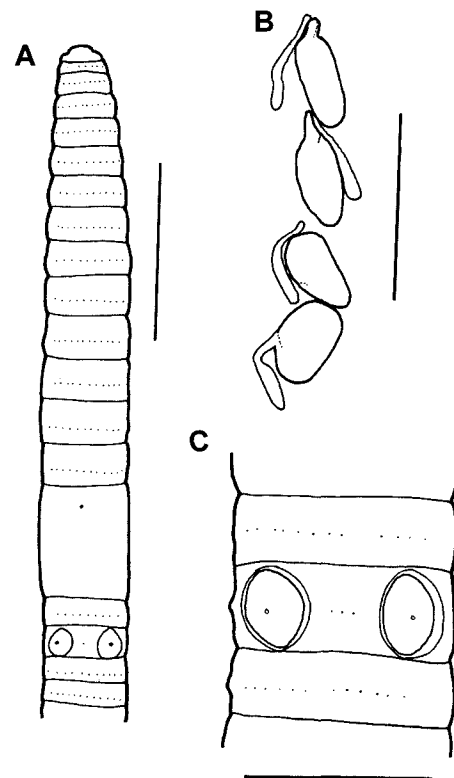


Fig. 4. *Amynthas sangumburi* sp. nov. A, Ventral view of anterior part of body. B, Male pore region in xviii. C, Spermathecae. Scale bars = 5 mm (A) and 2 mm (B, C).

white pores. First dorsal pore 12/13. Clitellum annular xiv-xvi; setae and dorsal pores not visible, externally.

Male pores centered on 0.8 mm circular flat porophores extending to lateral margins of ventrum in xviii. Spermathecal pores in 5/6-8/9, lateral, very small. Genital markings absent.

Septa 5/6, 6/7 thick, 7/8 some muscle, 8/9 absent; 9/10 if present is part of testis sac x, 10/11-13/14 thin. Gizzard in viii-x. Intestine begins in xv, lymph glands small from xx, vestigial. Typhlosole large fold from xxvii. Intestinal caeca simple, originating from xxvi/xxvii, and extending anteriorly to about xxiii/xxiv each consisting of a finger-shaped sac. Esophageal hearts x-xiii, x enclosed in testis sac; ix lateral.

Ovaries in xiii. Four pairs of spermathecae in vi-ix; ampulla cylindrical (vi, vii) to sagittate or ovate; ducts short, not muscular, diverticula stalked, gradually widening distally; no nephridia on spermathecal ducts. No genital marking glands. Male sexual system holandric, testes and funnels in ventral paired sacs in x, xi; joined dorsally. Seminal vesicles, 2 pairs in xi, xii; xi smaller, enclosed in testis sac. Prostates in xviii, large within xvii-xx; thick ducts of median length, nearly straight, both glandular portions consist of 2 or 3 main lobes, each lobe divided into leaflets.

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**Etymology:** The species is named after the type locality.

**Remarks:** All other Korean species of *Amyntas* with 4 pairs of spermathecae are much longer than *Amyntas sangumburi* sp. nov. The previously recorded species from Korea with 4 pairs of spermathecae, *Amyntas carnous* (Goto and Hatai, 1899), *Amyntas corticis* (Kinberg, 1867), *Amyntas heteropoda* (Goto and Hatai, 1898), *Amyntas monstrifera* (Kobayashi, 1936), *Amyntas morii* (Kobayashi, 1938), and *Amyntas murayamai* (Kobayashi, 1938), also have spermathecal pores in 5/6-8/9, but differ from the new species in the body shape, spermathecal shape, and male pore region. The new species is separated from other species of *Amyntas* by the shape of the male pore region centered on 0.8 mm circular flat porophores extending to lateral margins, and the ampulla cylindrical to sagittate or ovate.

#### Acknowledgements

The authors would like to express sincere thanks to Dr. Samuel W. James, Maharishi University of Management, Iowa, USA, who kindly made valuable taxonomic suggestions to this study.

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[Received May 15, 2002; accepted August 12, 2002]