

## Reports of *Drawida* (Oligochaeta: Moniligastridae) from far East Asia

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Moniligastrids are an important yet often ignored earthworm group commonly found in cultivated soils, especially paddy, in the tropical East. Seven new taxa are: *Drawida koreana austri*, *D. koreana nanjiro*, *D. koreana shindo*, *D. odaesan*, *D. jeombongsan*, *D. companio* and *D. csuzdii* Blakemore spp. or sub-spp. nov. from Korea. *Drawida csuzdii* is the first new species from North Korea since Lumbricidae *Eisenia koreana* (Zicsi, 1972). Historical East Asian moniligastrids are reviewed chronologically and *Drawida barwelli* (Beddard, 1886), *D. japonica* (Michaelsen, 1892) and *D. siemsseni* Michaelsen, 1910 are compared on their museum types. These three taxa were thought similar and related to *D. nepalensis* Michaelsen, 1907 and its possible synonym *D. burchardi* Michaelsen, 1903 (priority!) and both of these to prior *D. unica* (Bourne, 1887). Indian *Drawida calebi* Gates, 1945 is compared to new material of *D. japonica* from Japan, and *D. willsi* Michaelsen, 1907 to the new sub-species of *D. koreana* Kobayashi, 1938 from Korea. Where available, mtDNA COI gene barcodes are provided to help objective determinations and a phylogram is provided with outgroup Ocneroдрilidae *Eukerria saltensis* (Beddard, 1895) itself found in rice paddy/irrigation. The challenge now is comparison of all early taxa in their various homelands in order to assess the genetic variability and taxonomic boundaries acceptable, especially for unpigmented *D. barwelli* and also for pink/grey *D. japonica* and blue/grey *D. koreana*. A checklist of moniligastrids is appended showing 22 species from China (including Hainan and Taiwan), 21 from Korea, nine from Japan and the *Drawida ghilarovi* Gates, 1969 species-complex from far eastern Russian (Siberia). Recent *Drawida dandongensis* Zhang & Sun, 2014 from Sino-Korean border is misdescribed and cannot be meaningfully compared to any other *Drawidas*.

Keywords: biodiversity, Asian earthworms, soil fauna, species-complex, genetic phylogeny

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### INTRODUCTION

The Moniligastridae Claus, 1880 presumably arose in a region now occupied by the Malay Archipelago sufficiently long enough ago to have widely colonized and speciated in the Far East and to have radiated westwards even as the Himalayas formed to occupy the Indian sub-continent as far as Sri Lanka (Michaelsen, 1909; 1922; Gates, 1972). A less popular alternative is the family has “recent Indian origin” colonizing Asia after collision of the Indian Plate (Easton, 1981: 34), although most authors agree on a southern Indian homeland concentration for genus *Drawida* speciation. Along with holarctic Lumbricidae in the Northern Hemisphere, Acanthoдрilidae in the Southern Ocean and Octochaetidae in Indo-Australa-

sia, it is considered one of the most naturally widespread of earthworm families (Gates, 1972; Blakemore, 2013c). It currently has approximately 215 valid species in six genera (Csuzdi, 2012), mainly in South Asia and south-east Asia. The family diminishes further East, or rather its taxonomic study does; for example, Kobayashi (1940: 311) reporting on Manchurian worms listed less than a dozen East Asian species although these are still important in agricultural and ecological studies to this day. Only a few are peregrine cosmopolitans (Blakemore, 2012b), in particular *Drawida barwelli* (Beddard, 1893) is widely transported in the tropics, e.g. first Australasian moniligastrid report by Blakemore (1994), albeit many records of this small worm are likely mistaken as it was confused even in its earliest descriptions.

A major difficulty with moniligastrid description, apart

from often small size and subtle morphological differences, is that internal segmentation counts are confounded by septa progressively encroaching backwards around the ovaries where the septa combine, resulting in the successive internal segmentation misalignment with external counts.

This tiresome problem was noted much earlier: when Horst (1894: 139) said:

“As first stated by myself in *Monilig. Houtenii*, so also in the present species the internal segmentation does not correspond to the external one, due to the shifting of several septa. Benham observed the same feature in *Moniligaster indicus*, and according to Rosa it occurs also in *Desmogaster*. The shifting commences with the ninth septum, that instead of being inserted in the intersegmental groove IX/X [9/10] is attached to the body-wall about in the middle of segment X [10]; the next following septum is nearly thrown back a whole segment and is inserted close to the hinder boundary of segment XI [11]. In other *Moniligaster*-species the tenth and eleventh septum meet with each other and are confluent along a part of their surface; in the enclosed space the ovaria and the oviducal-funnel are situated.”

A suggestion is to fix internal counts relative to external segmentation not to the septa, however, this is not always consistent with different authors' descriptions. Michaelsen (1900; 1907; 1909) was well aware of these problems and he also pointed out (1909: 146) that “as the colour in the species of this family, as also in those of other families, is variable, we dare not lay any stress upon it.” Moreover, gizzard numbers and locations often vary considerably within apparently valid taxa reducing this as a useful characteristic and emphasizing the need for DNA analysis of probable species-complexes. Thus the only unambiguous solution is to fix taxa on their DNA barcodes from primary types and neotypes or, at least, topotypes, thereby reducing dependence on traditional key characters. This was first accomplished with the neotype of *Drawida hattamimizu* Hatai, 1930 in Japan (Blakemore *et al.*, 2010) and is further attempted in the current paper.

This work contributes to the first author's Japanese and Korean studies, e.g. Blakemore (2003; 2008; 2012a; 2013a, 2013b), and attempts to use genetic barcodes of primary types or neotypes for definitive species identity (Hebert *et al.*, 2003; Blakemore *et al.*, 2010; Blakemore, 2013a, 2013b). Previous summaries and species checklist are from Blakemore (2006; 2008a, 2008b) and Huang *et al.* (2006) for China and Blakemore (2008c) for Russia; from Easton (1981) and Blakemore (2003; 2012a) for Japanese, and from Blakemore (2006; 2008; 2014) for Korean earthworms. These checklists are updated for moniligastrids from regionally neighbouring countries in an Appendix.

### Key to Moniligastridae

(from Gates, 1972; Blakemore, 2012b)

1. Female pores at or just behind 13/14, ovaries in 13 ..... 2  
     Female pores and ovaries more anteriorly ..... 3
2. Male pores at 11/12 and 12/13 ..... *Desmogaster*  
     Male pores at 11/12 only ..... *Hastirogaster*
3. Female pores at or just behind 12/13, ovaries in 12 .....  
     ..... *Eupolygaster*  
     Female pores at or just behind 11/12, ovaries in 11 .....  
     ..... 4
4. Y-shaped glands on spermathecal atria .....  
     ..... *Moniligaster*  
     Y-shaped branched glands lacking ..... *Drawida*  
     Originally masculine gender, Easton (1984: 111) explains how genus *Drawida* should be treated as feminine for adjectival species name agreement. Michaelsen (1900), Stephenson (1923) and Gates (1972) provide limited keys to endemic species; Blakemore (2012b) fully describes all the dozen or so global exotics.

## MATERIALS AND METHODS

Arabic numerals are used for segmentation as by Michaelsen (1900) and Easton (1981), and taxonomic determinations follow the classifications and conventions in Easton (1981) and Blakemore (2000; 2012b). Korean specimens in 80% EtOH lodged in the NIBR facility (prefix IV0000-) had small tissue samples taken for mtDNA COI barcode analysis using methods similar to Blakemore *et al.* (2010), with data in an Appendix. Genetic analyses are via a default phylogram (Fig. 1) from MEGA-6 ([www.megasoftware.net](http://www.megasoftware.net)) and Geneious 6.0 ([www.geneious.com](http://www.geneious.com)) after indication from BLAST ([www.blast.ncbi.nlm.nih.gov/BLAST.cgi](http://www.blast.ncbi.nlm.nih.gov/BLAST.cgi)) comparisons with Genbank ([www.ncbi.nlm.nih.gov/genbank/](http://www.ncbi.nlm.nih.gov/genbank/)) entries or the author's iBOL ([www.boldsystems.com](http://www.boldsystems.com)) 'Japanese Earthworm Types' project data and other ongoing Asian studies. In the rapidly developing field of molecular analysis strict use of Kimura 2-parameter model of sequence evolution (K2P) has recently been questioned (e.g. Srivathsan & Meier, 2011) and although some authors recommend more than one gene for analysing relationships, nevertheless, Hebert *et al.* (2003: 97) found that more than 2% COI sequence divergence is typically detected between closely related species, and this may be interpreted as the 'cut-off' especially when combined with morphological or other information on such organisms. Sub-species are taken as distinct specific entities that may actually or potentially interbreed with similar populations (after Mayr, 1969; Sims, 1983: 472).

Arranged chronologically with sub-species and on names as in Fig. 1. Discussion is confined to remarks

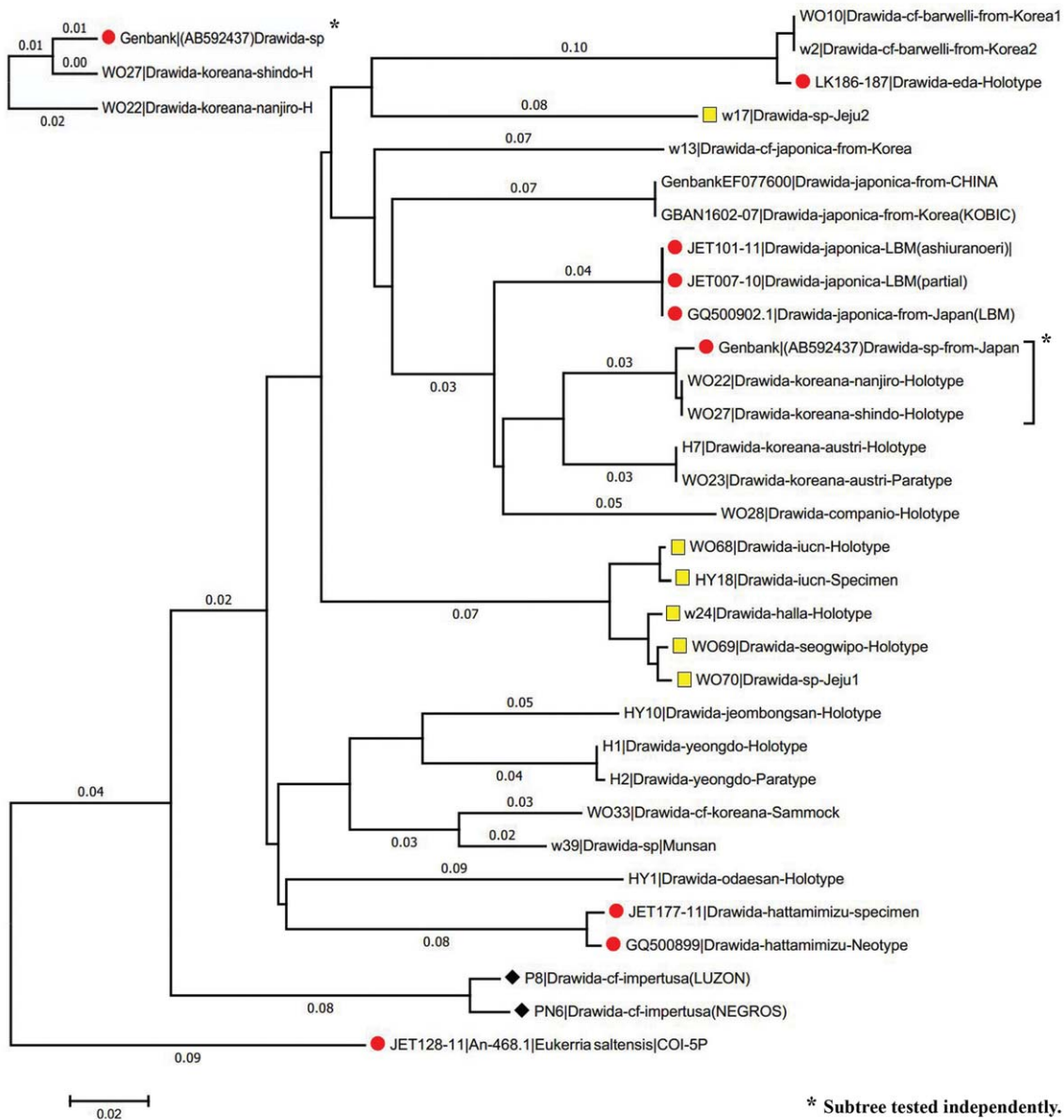
after species' descriptions. Setal ratios are available from scaled figures. Abbreviations: GMs – genital markings, LBM – Lake Biwa Museum, Shiga; lhs – left hand side; rhs – right; Np – nephridium. Scale bars=1 mm.

### Taxonomic Results: Description of species and remarks on their relationships

Fig. 1 shows DNA data for taxon identification and phylogenetic relationships (codes in Appendix).

Phylum Annelida Lamarck, 1802  
Class Oligochaeta Grube, 1850  
Superorder Megadrilacea Benham, 1890  
Suborder Exquisiclitellata Blakemore, 2013

[Note: Some Korean websites and papers incorrectly state “*Phylum Annelida Linnaeus, 1758*” rather than Lamarck, 1802, “*Class Clitellata Linnaeus, 1740*” rather than Michaelsen, 1919 (cf. defunct Class Vermes Linnaeus, 1758) and “*Order Haplotaxida Grube, 1850*” rather than correctly as Michaelsen, 1900].

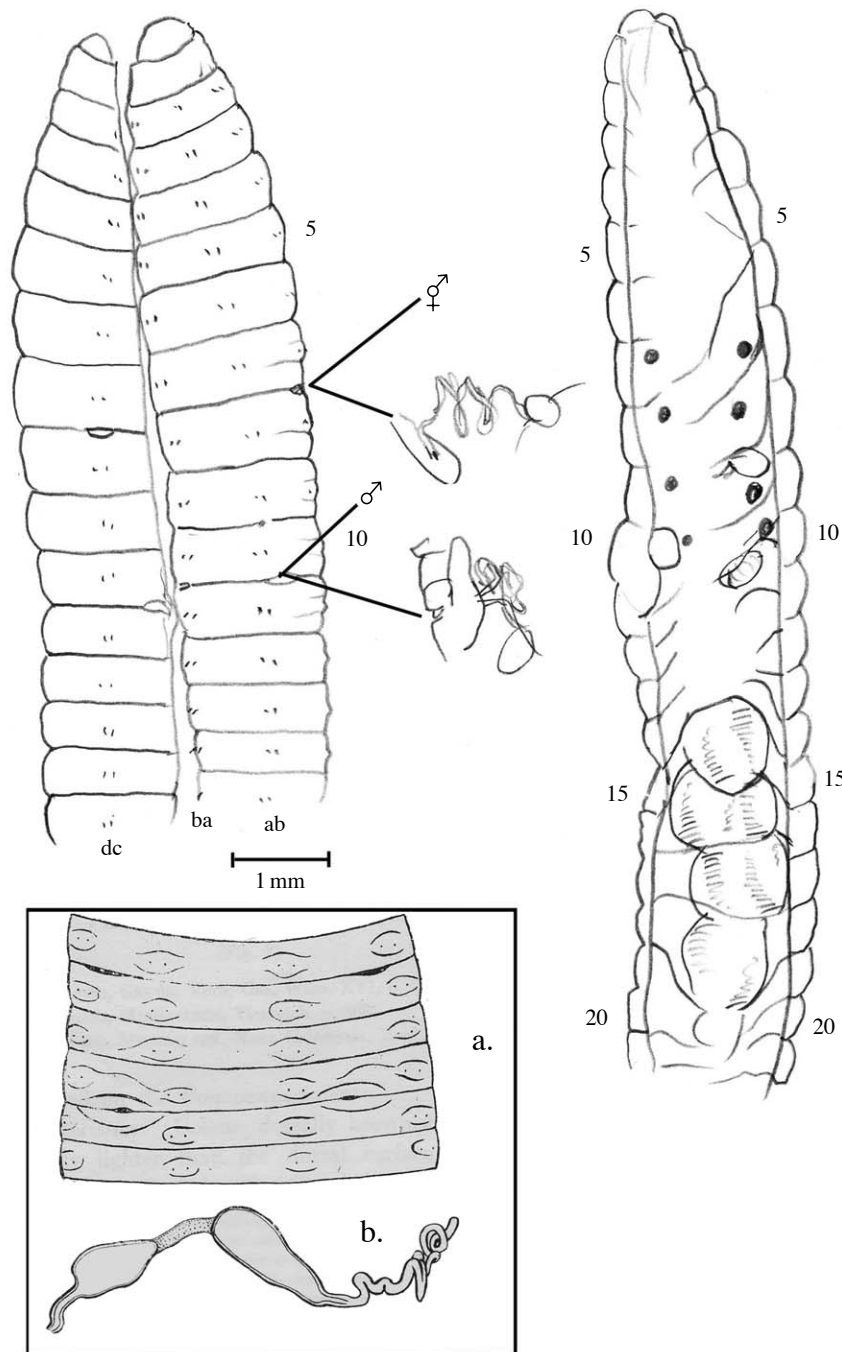


**Fig. 1.** Evolutionary relationships of taxa from MEGA6 defaults-generated phylogram after Clustal alignment (with WO22 sequence complements reversed) using the Minimum Evolution method optimal tree, drawn with branch lengths to scale (sum of units = 1.33) [see Tamura et al. (2013)]. Asterisk (\*) at top lhs is independent analysis of sub-tree; at bottom lhs is Distance Scale bar. Sample codes and provisional or new species names are explained in the text and Appendix legend; closed red circles (●) are Japanese samples, solid yellow squares (■) are from Jeju; black diamonds are Philippines samples. *Eukerria saltensis* is the outgroup.

Family MONILIGASTRIDAE Claus, 1880  
 Genus *Drawida* Michaelsen, 1900: 114  
 Type-species: *Moniligaster barwelli* Beddard, 1886

**1. *Drawida cf. barwelli* (Beddard, 1886)**  
*Moniligaster barwelli* Beddard, 1886: 94, figs. 4-6; Bed-

dard, 1895: 200 (syns. *beddardii* Rosa, 1890, *M. sp.* Horst, 1893). [Type locality Manila, Luzon, P.I. Types in British Museum (BMNH 1904:10:5:522-3) were disputed by Easton (1984: 112) who re-described the species from new material after finding that the type series, that he labelled “(BMNH: 1904:10.5.2-3)”, comprised



**Fig. 2.** *Drawida cf. barwelli* (Beddard, 1886). Ventral view of sectioned specimen with spermathecae in 8 and male organs in 10 *in situ*. Section shows gizzards in 15-18. Boxed is Kobayashi's (1941: fig. 1) of Ponape *D. barwelli* a. ventrum, b. spermathecae with both ampullae conjoined and (on rhs only, not shown lhs) long duct lacking atrium and glands. These are doubtfully the same species since Kobayashi's (1941) specimen lacks spermathecal atria.

a posterior portion and a slide that produced no useful data (although DNA is possibly retained?). See note below under 'Material Examined' for BMNH 1974. 1. 101-102].

*Moniligaster beddardii* Rosa, 1890: 379. [Locality "Villa-gio di Chiala" 1400-1500 m (Carin Padaung o Asciiui Ghecu)", this village in Burma being now untraceable. Types missing (from Genoa?).]

*Drawida beddardi*: (sic) Gates, 1962: 312 (syns. *hehoensis*+*"fluvaitilis"*, tecta); 1972: 246 (syns. *D. barwelli* var. *hehoensis*+*D. "fluvaitilis"* Stephenson, 1924: 324 +325; *D. tecta* Gates, 1926, all from near Yaungwe). [Gates (1962, 1972) appears to reject synonymy of *beddardi* in *barwelli* but this one of his many reversals as Gates (1929: 3) had previously noted that *Moniligaster beddardii* was the same as *Drawida barwelli*].

?*Moniligaster* sp. Horst, 1893: 46. [A specimen from the isle of Flores]; Gates, 1965: 86.

*Moniligaster bahamensis* Beddard, 1893: 690, figs 1-5; Beddard, 1895: 202. [Type locality (under ICZN, 1999: Art. 76.1.1) Bahamas from where imported with plants to Kew. Types supposedly two specimens, now missing (Gates, 1982: 18) and not registered in BMNH, London (A. Cabrinovic adc@nhm.ac.uk pers. comm. 24.III.2010 and a personal search) although Coles (1981: 302) yet lists them as in BMNH].

*Drawida bahamensis*: Michaelsen, 1900: 118; Gates, 1954: 241; 1965: 85 (syn. *Moniligaster* sp. Horst, 1893; *D. "japonicus"* f. *bahamensis*: Michaelsen, 1910c: 50). Cf. Gates (1982: 18) who maintains *D. bahamensis* separately and claims two specimens from Puerto Rico, 33 from Calayan Island, Philippines, one adolescent from Nicaragua and some from Honolulu in earth from Tonga.

?[*Moniligaster parva* Bourne, 1894: 371, fig. 11. Type locality Ootacamund, southeast India; type material not known; also reported from Aru Islands near West Papua].

*Drawida barwelli* (some in part?): Michaelsen, 1900: 116 (syn. *beddardii* Rosa, 1890; ?*Moniligaster* sp. Horst, 1893); Michaelsen, 1910a: 51 (part, residue lacking dorsal pores is what will become known as *D. impertusa*); Stephenson, 1923: 133 (part, residue=*D. impertusa*); Gates, 1929: 3 (syn. *beddardii*); Gates, 1937: 307-309 (where he gives a good account and corrects many of Beddard's mistakes and removed *beddardi*); Gates, 1965: 87, 93 [syn. ?*D. parva* (Bourne, 1894)]; Gates, 1962: 312 (where he restores *beddardi*); Easton, 1984: 112, fig. 1g (syn. *D. bahamensis*, ?*D. parvus*: Michaelsen, 1910 non Bourne, 1894 but Easton apparently ignores the *beddardii* synonym that was restored by Gates, 1962: 312); Blakemore, 2012 (syns. as herein).

?*Drawida parvus* (sic): Michaelsen, 1910b: 25; Gates, 1965: 93 [?non *Moniligaster parva* Bourne, 1894, nec

*D. parva* (Bourne, 1894): Michaelsen, 1900: 118].

?*Drawida barwelli* var. *hehoensis* Stephenson, 1924: 324. [From Heho Plain near Yaungwe; Gates 1931: 340; Types BMNH: 1925:[5:?]12:34, and ZSIC Calcutta 1107. Cf. *D. gisti* Michaelsen, 1931: 525 and its subspecies *D. g. nanchangiana* Chen, 1933: 200 and *D. g. anchingiana* Chen, 1933: 202 especially by Gates, 1935: 2; 1939: 408].

?*Drawida fluvaitilis* Stephenson, 1924: 325. [Also misspelt "*fluvaitilis*"; from White Crow stream near Yaungwe. Types BMNH: 1925.5:12:120?].

?*Drawida tecta* Gates, 1926: 148. [Type locality Yaungwe. Types in US Natl. Mus.].

?*Drawida* sp. Gates, 1930: 298. [Later named as *D. delicata* Gates, 1962: 319].

*Drawida glabella* Chen, 1938: 377, fig. 1. Syn. nov. by Blakemore (2006). [From Sha-moh-chiu, Hainan; type not known but only one specimen]. [Nothing in this specimen's description nor figures separate it from the following description, except perhaps that dorsal pores are stated to be evident behind the clitellum (as in *D. paradoxa* Rao, 1921!) and the male atrium's "*glandular portion probably enclosed by peritoneal sheet (not to be sectioned)*" (nor figured). Chen's specimen lacked accessory glands to spermathecae and was similar to *D. japonica*].

?*Drawida delicata* Gates, 1962: 319. From Myanmar. Types lost. **Syn. nov.?**

*Drawida borwelli*: (sic laps.) Global Names Index, 2010 ([www.globalnames.org/name\\_strings?search\\_term=borwelli&commit=Search](http://www.globalnames.org/name_strings?search_term=borwelli&commit=Search)).

Non *Drawida barwelli*: Cognetti, 1911: 494 (= *D. impertusa*: Gates, 1965: 87) nec *Drawida barwelli impertusa* Stephenson, 1920: 200; Stephenson, 1923: 134 (= *D. impertusa*: Gates, 1965: 87) as described below.

**Material Examined.** At Tokyo Museum in May, 2010 I requested the BMNH types 1904:10:5:522-3, 582, apparently now numbered 1974.1.101-102 and labelled: "*Moniligaster barwelli* TYPE 1974.1.101-102 Loc. Manila, Philippines Coll. Mr H.E. Barwell Ref. Ann. Mag. Nat. Hist. 5 xvii p. 74" and "*Beddard 1886 Manila, Phillipines [sic] Collector: H.E. Barwell" plus another note: "These fragments are far too large to be types of M. barwelli which is less than 40 mm long EGE [aston] April, 1981"*. This material comprised one tail portion with the anterior end cleanly cut (length=35 mm, segments=152) and one mid-portion that is cleanly cut at both ends (length=30 mm, segments=198), both blackened and neither yielding useful information but small tissue samples were taken from each to attempt COI barcoding, 26.VIII.2010 that was, unfortunately, not successful on this old material. This material reinspected by RJB VI.2013 and details confirmed as probable syntypes.

Korean specimens IV0000245078 (DNA sample WM8, redone as WO10, then as w2 and w3 from both), two acitellate specimens (one figured and sectioned the other now desiccated) from Jeollanam-do, Gurye-gun, Masan-myeon, Naengcheon-ri, (N35° 12'41.0" E127° 28'51.8") 37 m AMSL found coiled in diapause from frozen, icy soil, 19<sup>th</sup> Jan, 2012 by RJB. These specimens were flagged as "*Drawida cf. barwelli* (Beddard, 1886)" in Blakemore *et al.* (2012: 1); DNA data was then pending but the specimens are newly figured and described here.

**Distribution.** Widespread - see Blakemore (2012b) and Blakemore & Kupriyanova (2010) for descriptions of types and of Australian/Japanese material.

**Description** (of two current Korean specimens). Pale unpigmented. Prostomium prolobous, not notched. Length 45-60 mm. Segments 121, 134. Clitella absent. Setae closely paired aa=bc. Dorsal pores absent (typically present behind the clitellum). Nephropores in atria in cd lines but closer to d from segment 3. Spermathecal pores in 7/8 in cd-lines. Male pores on 10/11 in bc lines closer to b. Female pores in 11/12 in b lines. Genital markings absent.

Septum 10/11 absent (combined with 11/12). Spermathecae on long, convoluted ducts in 8, atria present but no glands. Moderately coiled vasa deferentia in 10 from testis sacs in 9/10 to small, stubby penes with small prostates present in 10/11. Ovaries in septum 11/12 that is combination of two septa with elongate ovisacs protruding. Gizzards in 15-18 (four of) with intestine from 19. Last hearts are in 9.

**Remarks.** These specimens key to *Drawida beddardii* (Rosa, 1890) from Michaelsen (1900) and Gates (1972), but this is generally held as a junior synonym of *Drawida barwelli* (Beddard, 1886). Gates (1972: 246) allows 3-4 gizzards in 12-19, as here; cf. Gates (1962: 312) whereas Easton (1984: 112) has 3-4 gizzards in 12-16. Thus some ambiguity still exists since Michaelsen (1900: 116) first synonymized these two names (in part) and their subsequent accounts have been variously intermingled - see Blakemore (2010b: 142-154, figs. 1-6; 2012b) and Blakemore & Kupriyanova (2010) for further details.

In Fig. 1 the current specimens are far removed genetically from cogeners except *D. eta* and BLAST analysis of WO10 vs. LK186-187 (*Drawida eda* Holotype) had Identities=651/660 (99%), i.e., 9 from 660 bases differ (Appendix), showing close similarity and questioning their identity as *D. barwelli*. Unfortunately, no barcode sequences are found for *D. barwelli* to determine its true genetic identity from the type-locality "*the neighbourhood of*" Manila nor from its original homeland.

Whilst recording one immature specimen from Philippines amongst other locations, Gates (1965: 85; 1972: 244; 1982: 18) maintained *D. bahamensis* (Beddard, 1892) and dismissed prior *D. barwelli* on the grounds that its

types were immature, poorly defined and lost. This however is not a legitimate ICZN reason for ignoring priority and it seems *D. barwelli* (1886) should be yet retained until topotypic materials have been characterized and the possibility of synonymy with *D. beddardii* quashed.

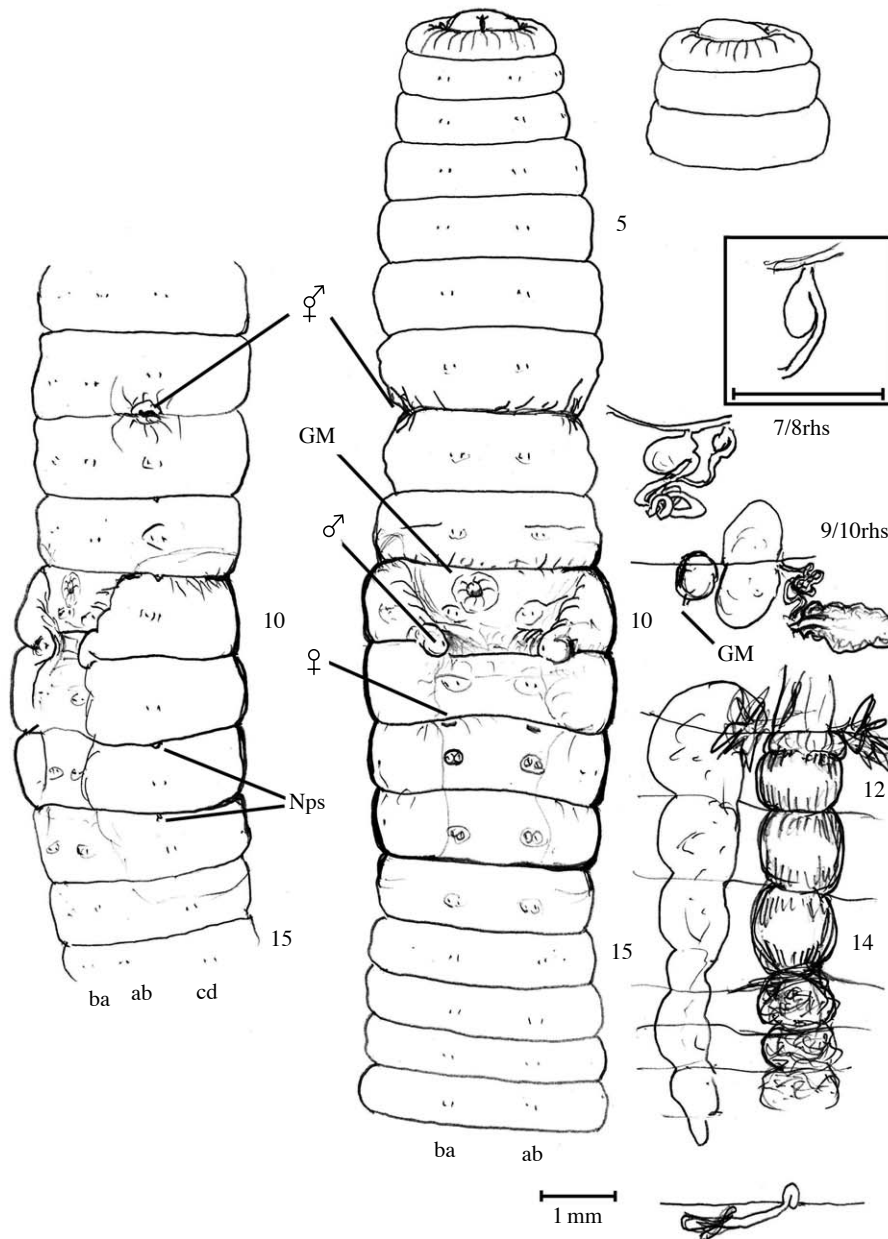
Erstwhile subspecies, *Drawida hehoensis* Stephenson, 1924, is presently a synonym of *D. beddardii*, similarly retained until further revision under *D. barwelli*; the other, *Drawida impertusa* Stephenson, 1920 is described separately below.

## 2. *Drawida japonica* (Michaelsen, 1892)

*Moniligaster japonicus* Michaelsen, 1892: 232-233. [From Japan. Syntype in Hamburg Museum: 403, but originally stated by Michaelsen as in Zoological Museum, Berlin: Verm. 2122 and this syntype also listed by Hartwich & Kiliyas (1989: 268 as "*Japan; HILGENDORF leg.*" just after *Allolobophora japonica* (Verm. 2117). Both were inspected by Blakemore in Blakemore & Kupriyanova (2010: 9), they were collected by Herr Dr Franz Hilgendorf, the latter definitely at Enoshima on 29.III.1875 - thus this is possibly a type-locality of the *D. japonica* syntype although my searches of the island have thus far proved fruitless for this species; yet other Berlin specimens from the Hilgendorf series were definitely not collected there (e.g. Michaelsen's record of *M. sieboldi* that must be from further south). Gates (1939: 411-413) did not mention #403 but he inspected three specimens from Hamburg labeled "*V 1194. Drawida japonicus Mich. f. Typ. Dr Chen F. Wu c. Dr Michaelsen a. Nanking, China*" and other materials none of which were types, saying (on page 413) that the original two types - described by Michaelsen as "*Diese Art ist durch ein geschlechtstreifes und ein unreifes Exemplar vertreten*" - were sectioned and are no longer available for study. This is incorrect as #2122 is a dissected specimen 26 mm long with the last 24 of its 95 segments regenerated that, although the internal organs are mostly removed, is nevertheless in good condition. Note the "*Typ.*" in the China label refers to *D. japonicus f. TYPica* not to a true type specimen].

[?*Moniligaster bahamensis* Beddard, 1893: 690, figs. 1-5. Included by Michaelsen (1910: 50) as a *D. japonica* subspecies, it is now held in *D. barwelli* synonymy].

*Drawida japonica*: Michaelsen, 1900: 115; 1910: 48; Stephenson, 1922: 119, figs. 1-6; Chen, 1933: 189, fig. ?; Gates, 1935: 3 (maintaining *D. grahami* and questioning Chen's '*D. japonica*'); Chen, 1936: 291 (syn. *grahami*); Kobayashi, 1937, 1938: 94, fig. 1; Gates, 1939: 411 (cf. *grahami*); Kobayashi, 1940: 263 (part. +*propatula*); 1941: 458, 515; Chen, 1959: 15, fig. 22; Ohfuchi, 1965: 546 (plus fig. apparently copied from Chen); Easton, 1981: 37 (part. excluding *grahami* and with China not included in distribution range); Blakemore,



**Fig. 3.** *Drawida japonica* (Michaelsen, 1892). Lake Biwako, Japan specimen (JET1011LBM FY2010-22.3[“*Drawida ashiuranoeri*”), with *in situ* spermatheca and male organs (testis sac, vas deferens and prostates with adjacent GM gland) and gizzards in 12-14 plus ovisacs from 12-18; [boxed enlargement of 8rhs spermathecal atrium], also nephridium from 14/15rhs. It is remarkably similar superficially to both *D. koreana austri* and *D. koreana shindo*, apart from the lack of blue colour, although the DNA data is unequivocal that they are all separate taxa (cf. *D. companio*).

2003; 2005/2007 (syn. *grahami* from China).

*Drawida japonica typica*: Michaelsen, 1910: 49; 1927: 85; Stephenson, 1917: 366, fig. 1; 1922: 126; 1923: 142, fig. 52 (part. syn. *bahamensis* and explaining Michaelsen's initial incomplete description).

*Drawida japonicus typicus*: Michaelsen, 1931: 7.

*Drawida japonicus*: Michaelsen, 1931: 523 (part. syn. *siemsseni* that is sometimes misspelt “siemmseni”).

*Drawida grahami* Gates, 1935: 3; 1939: 408. [From Sui-fu, Szechuan (Sichuan). Type(s) USNM: 20093. Said to have more ventral spermathecal pores in mid-bc otherwise cf. *D. japonica*; three gizzards in 12-14 (as in three of Gates' five subsequent *D. japonica* specimens); one of seven of Gates' types lacked 'genital markings', described in just a dozen lines on a dozen characters].

*Drawida propatula* Gates, 1935: 449. [From China. Types USNM 20179. Said by Kobayashi (1938: 94, 1940: 263) to be similar although Kobayashi (1940: 265) maintained them separately only on extents of the ovisacs]. Syn. nov. Blakemore in Blakemore & Kupriyanova (2010: 9) cf. *D. siemsseni*.

*Drawida japonica*: Blakemore, 2005/2007 (syn. *grahami*); 2008; Blakemore *et al.*, 2010: 1; Blakemore & Kupriyanova, 2010: 8, figs. 3.1-3.7, tabs. 1-3 (syn. *propatula*).

**Note.** *Drawida calebi* Gates, 1945: 211 from India is a similar species, and should probably be combined. Here is it briefly summarized including information from Julka (1976 Mitt. Zool. Mus. Berlin, 52(2): 322): Unpigmented. Length 35-83 by 2-4.5 mm. Segments 115-170. Dorsal line present but no dorsal pores. Spermathecal pores just median to c-lines. Male pores slits at 10/11 in mid-bc. Nephropores close to d lines. GMs small, unpaired and median or closely paired in aa, and widely paired in bc, presetal and postsetal variously in 7-13. Gizzards two or three or four of in some of 12-17 (as shown in a table). Vas deferens short, in a small column of loops in 9, straight in 10 and entering the prostate directly. Prostates are "not quite spheroidal", sessile, smooth. Short penis present internally. Ovaries in conjoined 10/11 and 11/12 with ovisacs to 20. Spermathecal ampulla is small, conical or nearly spheroidal on duct four to five mm long to apex of atrium that may have glands on its anterior wall like those associated with the GMs. From Jubbulpore, Madhya Pradesh (type locality) and Nowgong, Satna, Manikpur and Tanda Falls (Gates) also Jharkhand, Orissa, Uttar Pradesh and Karnataka districts found in forests, pastures, croplands and compost pits.

**Material examined.** Berlin Kat. Nr. 2122 ("*Drawida japonica* Syntype! Japan. Hilgendorf") a dissected specimen 26 mm long with the last 24 of its 95 segments regenerated and probably Michaelsen's '25 segmenten regeneriert Hinterende'- RJB pers. obs. IV.2010; the internal organs are mostly removed although the specimen is otherwise in good condition. Hamburg #403 syntype label states collected by Hilgendorf in Japan but is only a desiccated posterior portion (ca. 8 mm and 25 segments comprising mostly intestinal soil). Five specimens, two from "Aichi" [kanji for the prefecture] (one with dorsal pores and GMs and one without either) plus three from fields at Nagura-shi near Nagoya, Aichi-ken (one with dorsal pores but no GMs, the other two without either) all stored in Kyorin Uni, Hachioji collection (RJB inspected 20.IX.2002); Watarase one specimen without dorsal pores but with GMs in 9lhs posteriorly and 10rhs anteriorly, and male pores in 10/11 on eversible penes with gizzards in 12-14 (coll. IV.2003 by Dr Takafumi Kamitani of YNU and RJB inspected 9.IV.2004); one specimen collected from Kamakura Daibutsu shrine 13.VI.2004 by RJB (iden-

tified tentatively); four specimens from rice fields in Hikone (collected 19.VI.2009 by RJB) – one dissected and figured plus host for mtDNA COI sample (GenBank GQ500902); plus three others, all lacking dorsal pores but having GMs as detailed below (these latter specimen registrations are LBM 1380000085 2009-13-3).

A mature, grey specimen 80 mm long with 133 segments, dissected and figured here obtained beside suiden at Ashiura-cho, Kusatsu, Shiga-ken en route to Kanon complex, collected 18<sup>th</sup> March, 2011 by RJB and registered LBM FY2010-22.3 providing DNA tissue for JET 101-11 initially identified as "*Drawida ashiranoeri*" (COI results in Appendix).

Not found in current Korean studies (cf. genetic barcodes of "*Drawida cf. japonica*", WO21, and *D. koreana shindo*, WO27 below and in Fig. 1).

**Distribution.** Japan, from around Tokyo to Nagasaki and the Ryukyus, southern China, Taiwan, Korea (including Quelpart/Jeju-do), and south-east Asia. Inclusion of *D. propatula* adds central and northeast China. Stephenson (1923: 143), Gates (1939: 413 six specimens also from Murree) and Paliwal & Julka (2005-<http://www.zoosprint.org>) list it outside the normal *Drawida* domain from the western Himalayas, India; and it is reported (as "*Drawida japonica* Michaelsen, 1917") from the famous Punjab beer-district of Solan, Himachal Pradesh (Dhiman & Battish, 2005-<http://www.zoosprint.org/>). [**Note.** Stephenson's (1923) description included *bahamensis* that is now included in *barwelli* as it typically lacks 'genital markings'; cf. Japanese *D. eta* specimens lacking markings that have a male pore on extractible penis rather than external and 'flap-like' and cf. Gate's (1982: 18) *D. bahamensis* held separately].

A recent unpublished report is from Kansas, USA by Dr M. Callam (pers. comm. June, 2013 at SES meeting New Jersey, USA), unconfirmed due to current revisions.

**Remarks.** Full description and distribution is in Blakemore & Kupriyanova (2010) updated by Blakemore (2012b) where it is noted that male pore is superficial lateral of b on porophore on 10 that overhangs 10/11. Both Stephenson (1923) and Gates (1935) mistook a GM in 10 as male pore even though Michaelsen (1892: 232; 1900: 115) had them in 10/11 and overhanging segment 11 after a pair (or unilateral) markings in 10, this repeated by Gates, 1939. Types and current specimens have male pores on 10 posteriorly on protruded 'flaps' overhanging 10/11 and just lateral to b lines (pers. obs. and from types as per Michaelsen and Kobayashi) or as eversible penes in the Watarase specimen that may thus be suspect]; Hikone specimens have ventral region of segments 10 and 11 flared around the male pores to present a flattened area but lack the markings found in *D. impertusa*.

Correct identification is elusive as Fig. 1 phylogram shows "*Drawida japonica*" from KOBIC Korea that



agrees with “*Drawida japonica*” from China although both differ from *Drawida japonica* from Japan as listed in Blakemore & Kupriyanova (2010). In Blakemore *et al.* (2010), it was also noted that COI barcodes (by Huang *et al.* 2007 and Chang *et al.* 2008) from Chinese source material differed by ~17% from a Lake Biwa sample and that conspecificity of these Chinese entities needs to be reexamined.

Results of examination of *D. japonica* types were presented in Blakemore & Kupriyanova (2010) and the London types of *D. barwelli* were reexamined by the author in June, 2013. Resolution yet requires checking of Chinese specimens, at least those still available, for comparison with synonymic *Drawida grahami* Gates, 1935 types (Smithsonian #20093) also with erstwhile sub-species *Moniligaster bahamensis* Beddard, 1893, plus its synonym, *D. propatula* Gates, 1935: 449 from China. The *Drawida nepalensis* (Michaelsen, 1907) species-complex that is reported from Nepal, India, Pakistan, Andamans, Myanmar, China (Yunnan), Java and Sumatra; and *D. ramdadana* (Michaelsen, 1907) is a reminiscent taxon. If *D. burchardi* Michaelsen, 1903 from Andamans and Sumatra is indeed synonymous with *D. nepalensis* – as suggested by Gates 1962: 331; 1972: 244, 256 – then taxonomic priority is another question.

Table 1 presents key morphology characters of similar species, from which:

- *D. japonica* differs from *D. barwelli* mostly in the form of male pores posteriorly on 10 and on its GMs (when present).
- *D. koreana* differs from *D. japonica* mostly in its blue

colour and penile details.

- *D. keikiensis* differs from *D. barwelli* by its accessory spermathecal glands.
- *D. moriokaensis* differs from *D. japonica* mostly on forms of male pores.

Kobayashi (1938: 106) remarked that length of spermathecal duct appeared to separate *D. japonica* from his *D. koreana* – in the former it is long and coiled whilst in the latter it is shorter and thicker (see Fig. 11). *Drawida impertusa* differs from *D. barwelli* in its lack of dorsal pores, and GMs in 10. Lake Biwa’s *Drawida eda* Blakemore, 2010, has eversible male pores on penes, five gizzards in 13-17, lacks both pigment and genital markings, and in has an accessory genital gland near spermathecal atria internally in 7. The same sort of gland is also reported for *D. nemora* (only in some specimens!), *D. keikiensis*, *D. tairaensis* and *D. jeholensis*. Chinese *Drawida jeholensis* Kobayashi, 1940 is unpigmented, has irregular markings in 7-11, male pores on blunt propores overhanging 10/11, and two or three gizzards in 11,12-13; thus, the only major differences from *D. japonica* is presence of a penis rather than a flap and of the accessory gland in 7 near its spermathecal atrium.

Subspecies *Drawida japonica siemsseni* (Michaelsen, 1910) is redescribed below as *D. siemsseni*; other names by Oishi, 1934 (*minuta* and *gigantic*) are absorbed in the nominal species.

### 3. *Drawida siemsseni* Michaelsen, 1910

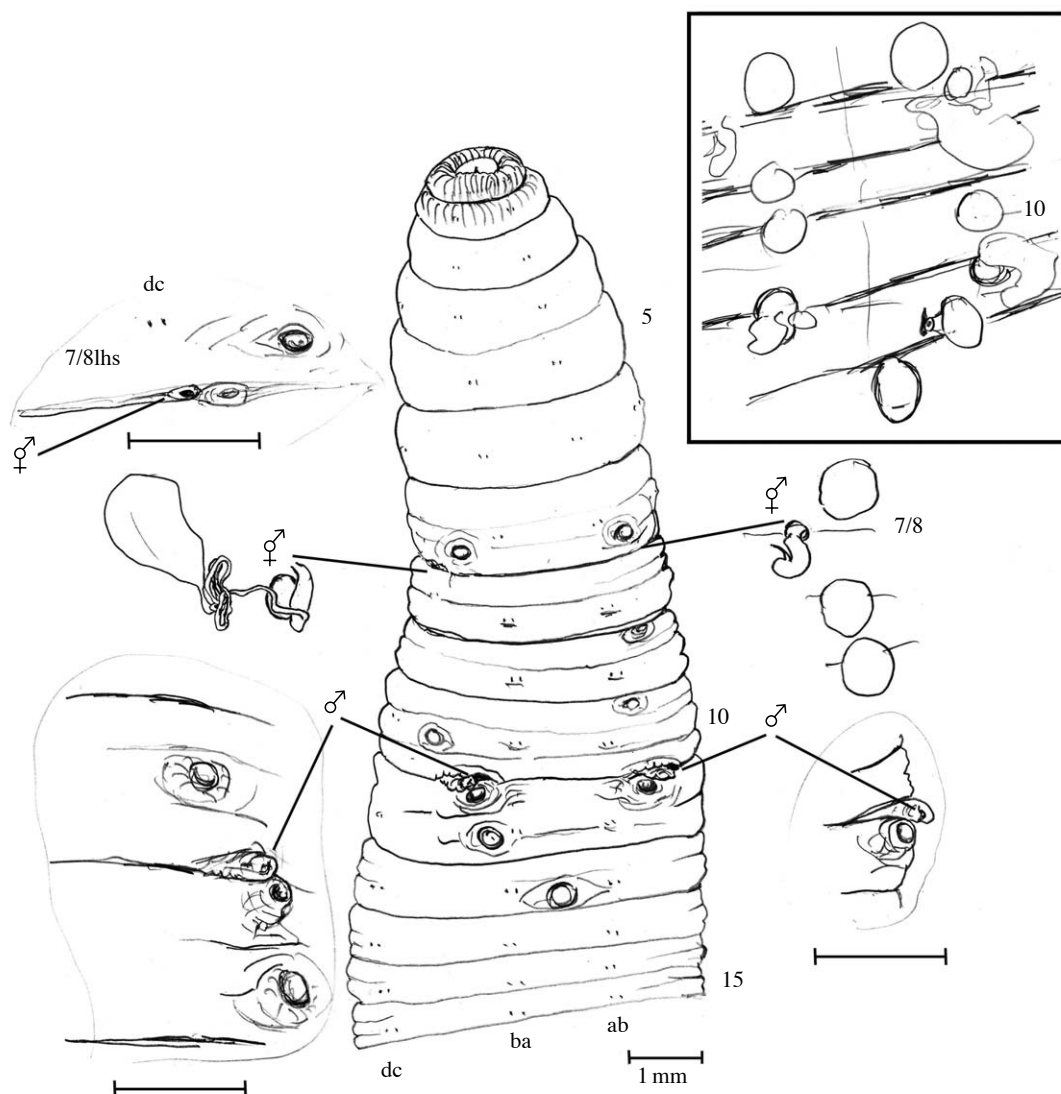
*Drawida F. Siemsseni* Michaelsen, 1910: 50. [From “*Futschou; Konsul G. SIEMSSSEN cm*”. The single type is listed in Hamburg (see Material inspected below)].

**Table 1.** Key characters of prioritized early listings of *Drawida* in Japan and Korea

<i>Drawida</i> spp. / Character	<i>barwelli</i> (Beddard, 1886)	<i>japonica</i> (Michaelsen, 1892)	<i>nemora</i> (Kobay., 1936)	<i>koreana</i> (Kobay., 1938)	<i>keikiensis</i> (Kobay., 1938)	<i>ofunatoensis</i> * (O., 1938)	<i>tairaensis</i> * (O., 1938)	<i>moriokaensis</i> (O., 1938)
Colour	Pale/unpigmented	Grey/pale	<b>Dark blue</b>	<b>Dark blue</b>	Yellow/grey	Dark yellow	Flesh red	Dark grey
Size (mm)	30-65	28-130 (200)	65-185	63-100	40-54	<b>228-283</b>	59-92	65-100
“GM”s	<b>None</b>	7-13 <b>I</b>	6-13 ( <b>I</b> )	7-12 <b>I</b>	<b>None</b>	7-13	<b>8 I</b>	<b>None</b>
DPs	Yes/No	Yes/No	No	No	No	No	?	?
Sperm ducts	Medium long	Long coiled	Long	<b>Short</b>	Long coiled	Medium long	Long coils	Medium long
Gland 7 or 8	No	No	<b>No/Yes</b>	No	<b>Yes</b>	No	<b>Yes</b>	No
Form of Male Pores	Penis in pouch in 10/11	<b>Stubby flap on 10 near 10/11</b>	Penis small pouch 10/11	<b>Penis-like on 10 near 10/11</b>	Penis in pouch 10/11	Penis in pouch 10/11	Penis in pouch 10/11	Penis in pouch 10/11
Gizzards	2-4	2-3	3-5	2-3	3-4	4(?)	4(?)	<b>2-3</b>
In segments	12,13-14,15 (16)	(11)12-13,14	12,13-15,16	12-13,14	12,13-15	12-15,16+?	13-16+?	10,11-12?

Modified from Kobayashi (1938, 1940), Easton (1981: tab. 1), Blakemore & Kupriyanova (2010: tab. 3) cf. *D. barwelli* ‘proper’ (pers. obs.). Kobay. – Kobayashi; O. – Ohfuchi; GM – genital marks; I – irregular ‘markings’ that may be absent or artefactual due to paratitic infection. ? – data not provided, ambiguous/inconsistent by original author. **Bold** options distinguish taxa.

*Drawida hattamimizu* Hatai, 1930 excluded as it is treated by Blakemore *et al.* (2010). \*Kobayashi (1940: 311) thought *D. ofunatoensis* synonymous with *D. nemora* Kobayashi, 1936 and *D. tairaensis* synonymous with *D. anchingiana* Chen, 1933).



**Fig. 4.** *Drawida siemsseni* Michaelsen, 1910. Ventral view of Hamburg type V6333 with spermathecal remnants *in situ*; enlargements are of spermathecal pore 7/8lhs and both male pores in 10/11 (female pores not show). Gizzards missing from this previously dissected specimen. Boxed is internal arrangement of GM glands, including inboard of 8rhs spermatheca; the one acentric in 11 at least was almost detached and resembled a parasitic cyst whereas the more symmetrical pairs in 7 and 10 are more convincingly proper GMs.

*Drawida japonica siemsseni*: Michaelsen, 1931: 157;  
Huang *et al.*, 2006: 10;

*Drawida siemsseni*: Gates, 1939: 414; Blakemore & Kupriyanova, 2010: 12.

**Note.** Publication and page sometimes misquoted as: “*Zool.Jb.Syst.61*: 523.”

**Distribution.** China (Fuchou, currently Fujian).

**Material examined.** Hamburg type V6333 non-original label “*Darawida* [sic] *japonicus* [sic] *Type material*”, a mature specimen previously dissected and highly coiled in preservation. Hamburg V6196 “*Drawida?* *japonica*” also inspected being several small, undissected subadults

and possibly neither types nor same species.

**Description.** Uniform buff in alcohol. Size 120 by 2-4 mm with 300 segments “*sehr ungenau!*” (very inaccurate, Michaelsen, unmeasured by Gates) my current estimate of the highly coiled type is 110 mm and 333 segments. Setae closely paired (ca.  $ab=cd$ ). Clitellum 10-13 at least. GMs in type in 7lhs&rhs, 9rhs, 10lhs&rhs, 11lhs plus two under male pores and one in 12 mid-ventral (total nine plus an accessory spermathecal gland; some possibly parasitic). Spermathecal pores in 7/8 in bc but closer to c. Male pores in 10/11 as overhanging flaps. Nephropores in cd in anterior. Spermathecal atrium present on long coiled duct but accessory glands only present on

8rhs with its own pore. Six gizzards reported (segments?) and other organs removed, “otherwise as the typical form”. The gut contains fine soil (i.e., geophageous).

**Remarks.** *Drawida siemsseni* (Michaelsen, 1910) from Fuchow, China that Michaelsen (1931b: 7) later said “seems somewhat questionable” and which Gates (1939: 414) very briefly redescribed from the Hamburg type [labeled as “V 6333 *Drawida japonicus* Mich. f. *siemsseni*. Tiensin, Futschau”] that was incomplete as the internal organs had been removed in the course of the original dissection and lost; he only said it differed in markings and porophores to *D. japonica*. A similar species from Ootacamund, Naduvatom and Coonoor, India is *Drawida uniuqua* (Bourne, 1887) that was redescribed by Bourne (1894: 363) as unpigmented, 220 mm long with 316 segments and four or five gizzards in some of 15-21. No mention of GMs is made but Bourne (1894) put his longer *Moniligaster papillatus* Bourne, 1887 that has long tubular papillae in connection with the pores in 10/11 in its synonymy. Note that Michaelsen (1907: 146; 1909: 118, 147) thought his *D. nepalensis* was similar but it is much shorter at 60 mm and it has markings typically in 7 and 8 but also near the male pores and a long, annulated spermathecal atrium.

This type specimen of *D. siemsseni* is reinspected and sketched here providing for the first time details and a figure of the body. It is clearly a separate species from *D. japonica* having male pores in 10/11 and 6 gizzards, plus it is 110 mm long with ~333 segments. Unfortunately DNA results for the type were unsuccessful (iBOLD sample JET006-10), and no new material appears to have been recognized from China in recent times for comparison. The type locality is rather confused: Michaelsen had “Futschou” which is present day Fuzhou (福州市) in Fujien province (福建省) adjacent to Taiwan; but Gates gives “Tiensin, Futschau” which may refer to Tianjin City (天津市) in the North; however, since Herr G. Siemssen was the German Consul at Foochow (Fujian (Fukien) 福建) this is the more likely location.

#### 4. *Drawida impertusa* Stephenson, 1920

*Drawida barwelli* var. *impertusus* (sic) Stephenson, 1920: 200. [From Bombay. Types ZSIC Calcutta 301, BMNH 1925:5:12:77].

*Drawida barwelli* var. *impertusa*: Stephenson, 1923: 134; 1930.

?*Drawida* sp. 2 Gates, 1943: 90 (three juvenile specimens from Manila).

*Drawida impertusa*: Gates, 1965: 87; 1982: 18; Blake-more, 2008, 2012b.

**Distribution.** India, originally Bombay but now recognized more widely, e.g. in Bangalore, Coimbatore and, significantly, reported from four sites in the Philippines, (?at

Calayan Island far northern Philippines, possibly found along with 33 specimens of *D. bahamensis* from bank of small river, 23<sup>rd</sup> Oct., 1903 by McGregor of US Natl. Mus. Division of “Marine Invertebrates” Number 28710, or at Manila and elsewhere).

**Material examined.** “S21” (mature, dissected that provided DNA sample P8) longest in batch of four specimens from Kahariam farm at Lipa City, Batangas, Luzon, Philippines, collected from rice paddy near entrance gate 14<sup>th</sup> Nov., 2013 by RJB and Rowena Ocena; a shorter specimen in same “S21” jar; “S8” two larger mature specimens from Kahariam farm collected from rice paddy near entrance gate 13<sup>th</sup> May, 2013 by RJB (one dissected). Specimens: one mature in sample “S18” with *Metaphire bahli*, from Kahariam farm beside rice at gym collected 14<sup>th</sup> November, 2013 by RJB and RO; plus several unregistered specimens from Lipa providing DNA samples (W1, W6, W13, W14, W15, W17) that were unsuccessful due to delay as noted in Appendix. Specimens “P6” and “P7” two mature specimens (P6 an anterior amputee) from Penalosa farm at Hacienda Remedios, Victorias City, Negros, Visayas providing DNA samples P~6 and P~7, respectively, that differ somewhat (Fig. 1, Appendix).

**Description.** (From Stephenson, 1920; 1923 and pers. obs.). Size 45-90 mm (45-48 mm Stephenson or to 75 mm Gates, 1943) by 2.5-3.5 mm. Segments, 165 current (130-132 Stephenson). Colour a blotchy olive, darker dorsally with still darker mid-D line; or unpigmented (Gates, 1943 and current). Prostomium prolobous. Clitellum 9-13 (current). Dorsal pores absent, indicated in some specimens as small pale dots, but no perforations. Setae aa less than bc except at hind end; Gates’ (1943: 90) specimens often lacked anterior setae to segment 10, thus are similar to *D. zhangetalia* Blakemore, 2006. Nephropores in row below level of c lines. Male pores in 10/11 in mid-bc; bounded fore and aft by prominent lips; with a pair of indefinite but fairly large whitish papillae in segment in front of the male pores [those described by Gates, 1943 from Manila nearly reach from 9/10 to 10/11 and are elliptical, plus male field is depressed anterior and posterior to the male pore just as seen in current Lipa specimens]. Spermathecal pores in 7/8 below c lines. Female pores in 11/12 in b lines. Clitellum 9,10-13.

Gizzards typically four in 14-17 or perhaps five in 13, 14-17 (or sometimes three as Gates, 1943 has 12-14, 14-17 and 15-17 in his three Manila specimens; current specimens four in 13-16 or three in either 14-16 or 15-17). Prostates flat, sessile, almost circular and “furry” glandular (not noted in current specimens cf. pear-shaped in *D. barwelli*). [Vas deferens loops to side of prostate and there are no spermathecal atria - Gates, 1943; or atrium small in current specimens from short, coiled duct]. Ovarian chamber present, annular in 11, ovisacs present, extending back to 13,14,15. Otherwise as *D. barwelli* accord-

ing to Stephenson's (1920) account.

**Remarks.** Similar to Stephenson's concept of *D. barwelli* but with a pair of fairly large whitish papillae on the segment in front of the male pores in 10, and gizzards often in 14-17 and, most distinctively, lack of dorsal pores unlike *D. barwelli* proper. In fact Stephenson said that the specific name alluded to this lack of pores. It is also similar somewhat to *D. bournei* (Michaelsen, 1897: 167) that Stephenson (1920: 202) says Michaelsen thought was itself a variety of *D. pellucida* (Bourne, 1894: 13); but they are easily separable on the form of the prostates. The prostates are flat, sessile, almost circular and 'furry' in *D. impertusa* cf. pear-shaped in *D. barwelli* and "longitudinally ellipsoid body sessile on the parietes" (Gates, 1943) in *D. bournei*.

Resolution now depends on obtaining DNA from topotypic Bombay material that may yield data the same as either current haplotype. Apparently a variable species, with regard to gizzard location, that is somewhat similar to *D. barwelli* although there is no match on Genbank and with the current "*Drawida barwelli*" specimens. Both *D. japonica* and *D. impertusa* are said to have GMs in segment 10 but these are round and intermittent in *D. japonica* but distinctively large, elongated and regular in *D. impertusa*. Current specimens are not close genetically to any tested congeners (Fig. 1, Appendix).

Only three *Drawida* species were hitherto reported from the Philippines: type-species *Drawida barwelli* was originally found at Manila, and Gates (1965, 1982) recorded both *D. impertusa* and *D. bahamensis*. However *D. bahamensis* is usually included with *D. barwelli* and perhaps Gates' only reason to separate it was his assertion that *D. barwelli* was poorly known. Neither of the two previously Philippine species were reported from rice paddy although *Drawida* spp. are known from rice in Japan, Korea and India thus presumably tolerating periodic inundation.

##### 5. *Drawida hattamimizu* Hatai, 1930

*Drawida hattamimizu* Hatai, 1930: 485, figs. 1-7; Blakemore *et al.*, 2010.

**Material inspected.** Neotype LBM1380000078 providing DNA sample (Genbank GQ50089 in 2009): From mud and embankments of rice paddies at Hatta-cho, Kanazawa-shi, Ishikawa-ken, Japan collected 21<sup>st</sup> Aug., 2002 by RJB.

**Distribution.** Japan, Restricted range; may be species introduced from origin unknown.

**Remarks.** Full description and distribution in Blakemore *et al.* (2010) where it is noted that this earthworm species – apparently the largest earthworm in Japan – was thought problematical in rice fields as its burrows in the bunds were said to drain paddy fields.

##### 6. *Drawida gisti gisti* Michaelsen, 1931

*Drawida gisti* Michaelsen, 1931a: 1, 8, figs. 2-3; 1931b: 525. [From Tsinan, Shantung and Beijing, Hopei. Types in Hamburg (examined by Gates, 1940) and Beijing Museums].

*Drawida gisti*: Gates, 1935: 2; 1939: 406; 1940: 406; Kobayashi, 1937: 333, fig. 1; 1938: 85, fig. 2; 1940: 272; Blakemore & Kupriyanova, 2010: 16.

**Distribution.** Central and northern China and central and northern Korea (from Kobayashi, 1935: 95; 1940) abundant in Keijo (Seoul) and its vicinity and from Kinsen.

**Description.** Yellow grey, clitellum pinkish. Size 77-151 mm by up to 6 mm with 180-190 segments Prolobous. Setae small and closely paired (ab=cd). Dorsal pores absent. Clitellum 1/2 9,10-13,14. Nephropores somewhat in line with c or more dorsal. Spermathecal pores 7/8 near to c-lines. Male pore in wide slits on blade-shaped penes in 10/11 b-c lines. Female pores paired on 12 near 11/12 in ab-lines. Genital papillae present, typically with a small pair, presetally on 10, or as larger discs in some of 7-12 with glands internally, or often absent.

Last hearts in 9. Spermathecal ampulla small with convoluted duct to ental end of large atrium in 7/8 with characteristic bulge, no accessory gland nearby. Testis sacs on 9/10 with coiled vas deferens entering ental end of large glandular prostate on penial pouch. Ovarian chamber in 10/11/12 with eggsacs extending to 13 or 14. Gizzards three in 12-14.

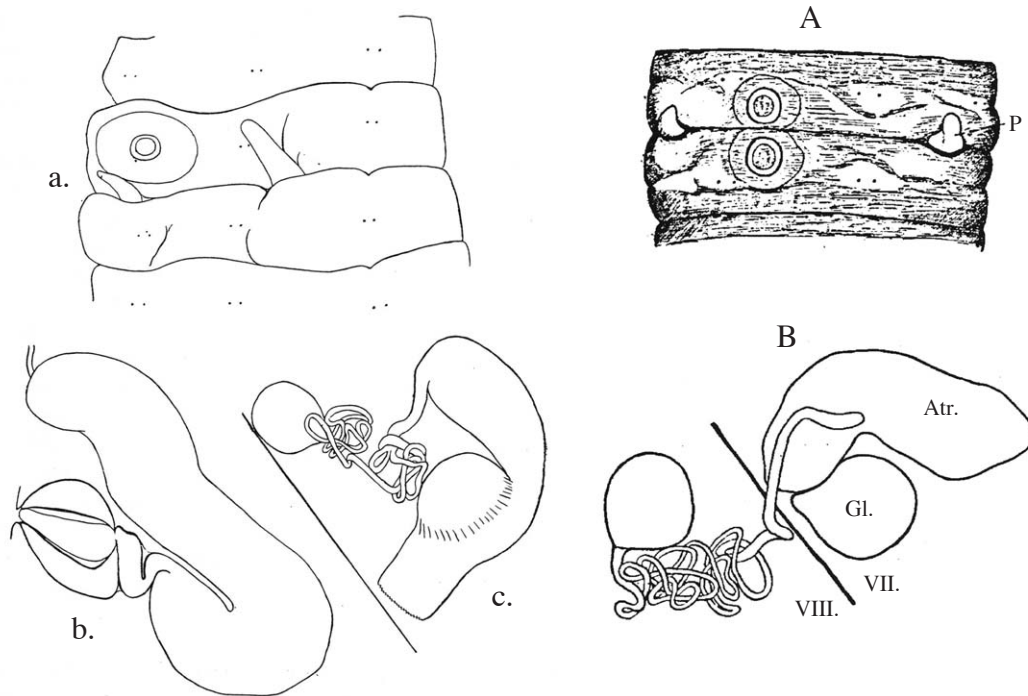
**Remarks.** Its subspecies *D. gisti nanchangiana* Chen, 1933: 200 is from China, the other sub-species, *D. gisti anchingiana* Chen, 1933: 202 was elevated to specific status by Kobayashi (1937: 333). Said by Gates (1940: 408) to be similar to *D. hehoensis* Stephenson, 1924 (from Myanmar) that was later associated with *D. barwelli* but differentiated on the greater size of the prostates and their relation to the penial pouches and the 'urn-shaped' spermathecal atrium plus GMs, when present. *D. cheni* Gates, 1935 was described by mistake by Chen (1933) as *D. gisti f. typica* which introduced some confusion. Genbank's DNA barcode data in the Appendix has no close match.

##### 7. *Drawida anchingiana* Chen, 1933

*Drawida gisti* var. *anchingiana* Chen, 1933: 202, fig. 6. *Drawida anchingiana*: Gates, 1935: 3; Kobayashi, 1937: 333, fig. 1; Blakemore, 2013a.

**Distribution.** Chen (1933) obtained this species from "Anching, Anhwei and Pukow, Kiangsu" in China and Kobayashi (1937) claimed it from Jeju-do whence new sub-species were described by Blakemore (2013a) even though the nominal type is unconfirmed from that island.

**Remarks.** See original, and sub-species descriptions in Blakemore (2013a).



**Fig. 5.** A lhs. *Drawida gisti gisti* Michaelsen, 1931. After Kobayashi (1938: 85, fig. 2) of Korean mainland specimen showing (a) male field, (b) male terminalia and (c) distinctive spermatheca in 8. 5B rhs. *Drawida anchiniana* Chen, 1933. After Kobayashi (1937: fig. 1) of a Jeju Island specimen showing (A) male field, (B) spermatheca with atrium and associated gland in segment 7.

### 8. *Drawida nemora* Kobayashi, 1936

*Drawida nemora* Kobayashi, 1936: 141, text-fig. 1.1-8.

[From Koryo "(N.L. 37°45')" {sic}, Keiki-do, about 30 km distant from Keijo (=Seoul), Korea collected from woodland about 300 m altitude by "Mr Kiujiro Susaki, an assistant expert of the Forest Experimental Station, General Governemnt of Chosen" {sic} in April and July, 1934. Types not known, presumed lost].

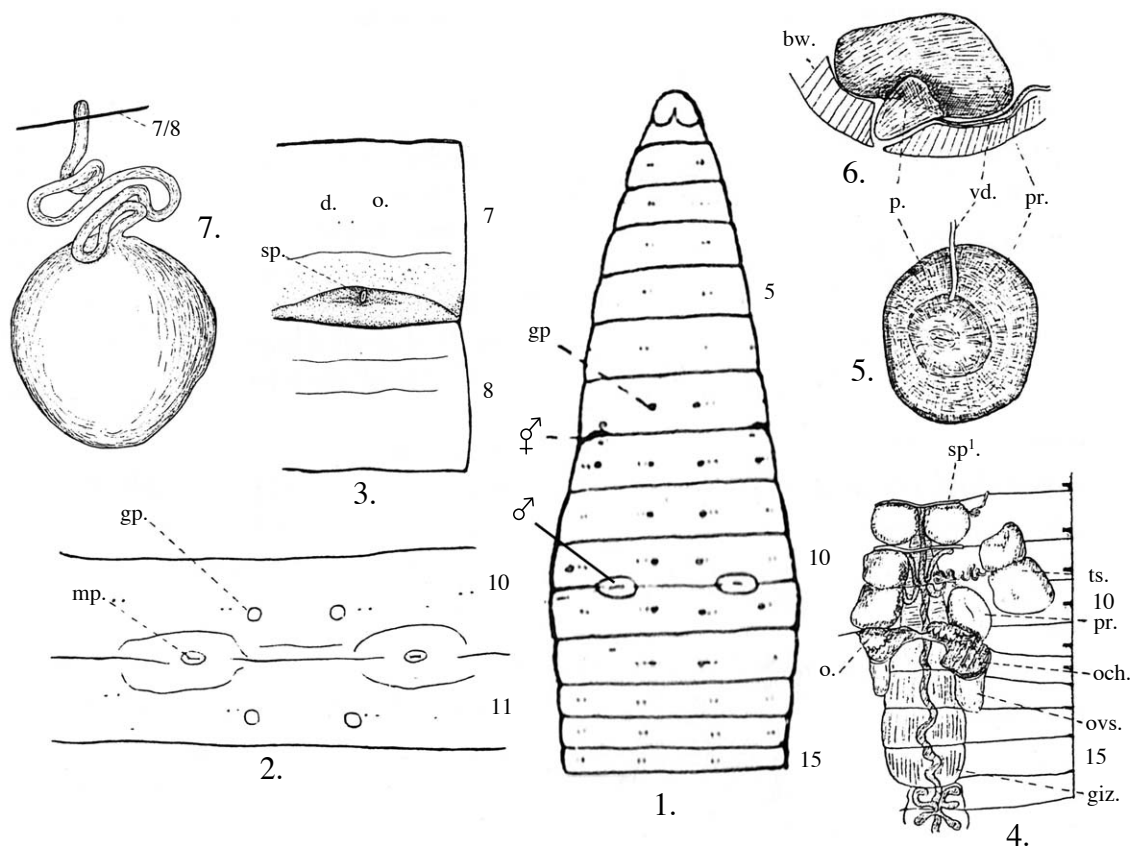
*Drawida nemora*: Kobayashi, 1938: 99-102; 1940: 272; 1941b: 263; Easton, 1981: 39, tab. 1; Blakemore, 2003, 2010, 2014; Blakemore & Kupriyanova, 2010: tab. 3.

**Distribution.** Central and North Korea, 'Manchuria', China and Honshu, Japan. E.g. from Koryo near Keijo (present day Seoul), Korea (Kobayashi, 1936); with many other Korean records by Kobayashi (1938) some from Mt Kambo (at 2,000-2,500 m) and Akashima in the far northeast of the peninsula "found within wet roots of alpine plants such as *Pedicularis manshurica Maximowicz* in the former and under decayed leaved on granite on the latter"; from several central "Manchoukuo" locations by Kobayashi (1940) and a Chubu-Chiho, Japan record by Kobayashi (1941: 236), possibly introduced/transported there or, more likely given its wide definition, a different species.

**Description.** Dorsally a dark blue often with a purplish or yellowish tinge, less distinct ventrally and clitellar seg-

ments yellowish grey in life. Size 65-185 mm by up to 6.5 mm with ca. 162-247 segments Prolobous. Dorsal pores absent. Setae small and closely paired (ab=cd). Nephropores small in d-lines. Clitellum mostly saddle-shaped in 9,10-13,14. Spermathecal pores small in 7/8 (or just anterior to intersegment in 7) in c-lines as transverse slits. Male pore secondarily superficial in 10/11 approximately in mid-bc in transverse slits; primary pores shown by Kobayashi (1936: fig. 1.4) to be on small conical penes. Female pores paired on anterior of 12 near 11/12 approximately in b lines. Genital papillae variously in 6-13 ventrally detectable either externally or internally, or absent; shown by Kobayashi (1936: fig. 1.1) as medial to c-lines in 8 and 9lhs, 11rhs and in regular medial to a-setae in 7-12.

Septa 5/6-8/9 thickened; septa 9/10 and 10/11 fused dorsally with 11/12 to enclose ovaries and funnels. Pharyngeal glands in 3-4. Hearts 6-9; dorsal blood vessel single. Nephridia holoic and vesiculate (absent from first and last segments and from segment 12) with bladders elongate. Spermatheca with ampulla ventral on septum 7/8, spherical to convoluted duct that exits to body wall without atrium nor accessory gland in 7/8 (Kobayashi, 1936: figs. 1.7-8), or (Kobayashi, 1938: 100) sometimes papillae just laterally to the spermathecal pores and "accessory glands" internally (same species?). Testis sacs spherical, intrasegmentally bulging to both sides of 9/10 with vas



**Fig. 6.** *Drawida nemora* Kobayashi, 1936. After Kobayashi (1936: fig. 1). 1. Ventral view. 2. Male field with GMs. 3. Spermathecal pore in 7/8. 4. Internal organs. 5. Ventral view of prostate and penis with vas deferens. 6. Section of prostate and penis. 7. Spermatheca (Codes: bw. Body wall, giz. Gizzard, gp. Genital papilla, o. Ovary, och. Ovarian chamber, ovs. Ovisac, p. Penis, pr. Prostate, sp. Spermatheca, ts. Testis sac, vd. Vas deferens).

deferens slightly coiled and entering body wall under prostate. Prostate described definitively as “thick oval or circular disc, sessile on parietes” mostly in 10 that exits to 10/11 via blunt, conical penis (Kobayashi, 1936: fig. 1.6). Ovarian chamber in 11 with long ovisacs from fused 10/11/12 as far back as 14. Gizzards usually four in 12-15, or sometimes five in 12-16 or three in 13-15 (i.e. three to five of in 12,13-15,16 suggesting either high plasticity of too broad definition). Corresponding to the external ‘markings’ are small, white spherical bodies that are buried in body wall and appear to duct to exterior – however, some may be parasitic artefacts of gregarine sporezoites.

**Remarks.** Despite Kobayashi (1936: 146) saying it was the most predominant in the region in number, *D. nemora* has not since been definitely collected around Seoul (cf. *D. csuzdii* sp. nov.). Location and selection of a typotypic neotype is required, especially since *Drawida dandongensis* Zhong & Sun, 2014 from the Sino-North Korea border is described as being similar. However, there are inconsistencies in their description of *D. dandongensis*,

for example they have “Gizzards 4 in XII-XVII segments” meaning ‘four gizzards in 12-17’ (=six segments, so six gizzards!?) so it cannot be meaningfully compared to any other *Drawida* and thus is here given *sp. inquirenda* status. [These latter authors also mistake the location of the spermathecal pore in *D. nemora* saying it is at “posterior edge of VIII”, while it is clearly shown at extreme edge of segment 7].

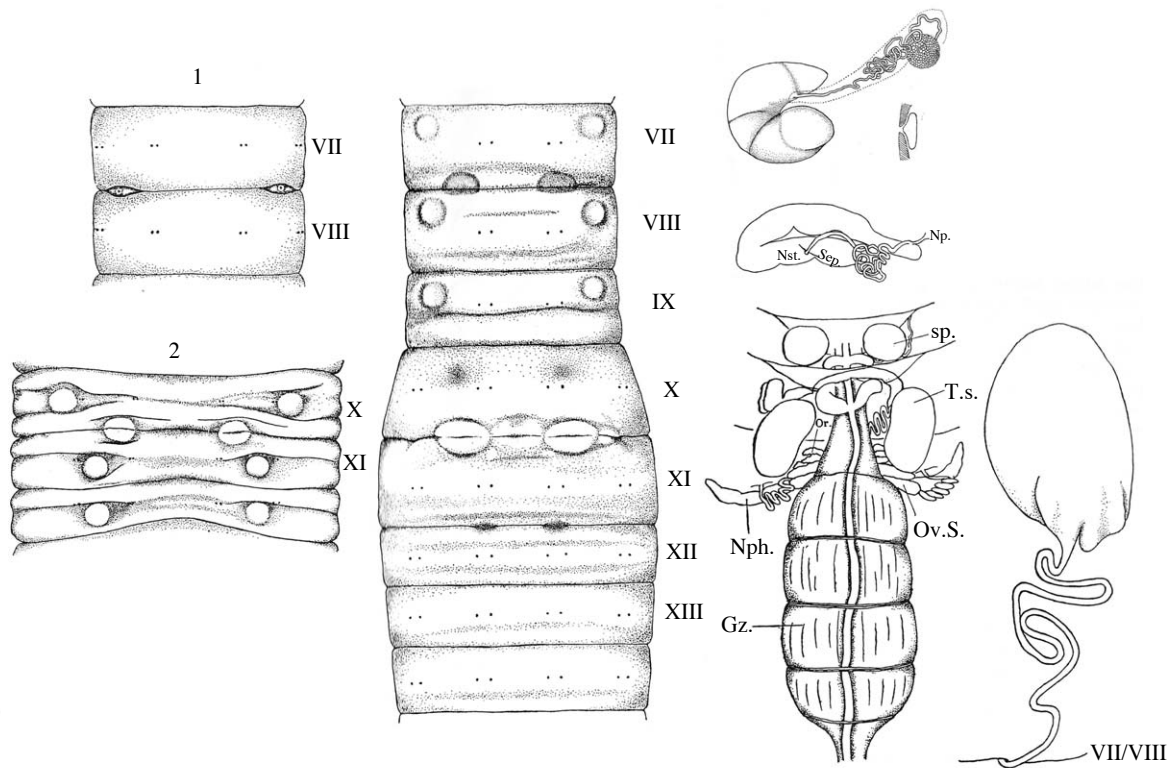
#### 9. *Drawida ofunatoensis* Ohfuchi, 1938

*Drawida ofunatoensis* Ohfuchi, 1938: 33, figs. 1-5. [From Iwate coasts and Islets of Sanriku, and Ojika coast in Miagi-ken. Types not known].

*Drawida ofunatoensis*: Easton, 1981: 39, tab. 1; Blakemore, 2003, 2010, 2014; Blakemore & Kupriyanova, 2010: tab. 3.

**Distribution.** As in original description.

**Description.** Yellowish. Size 228-283 mm by up to 6.5 mm with 189-242 segments Setae small and closely paired (ab=cd). Nephropores minute, lateral. Clitellum 10-



**Fig. 7.** *Drawida ofunatoensis* Ohfuchi, 1938. After Ohfuchi (1938; figs. 1-5) showing spermathecal and male fields of two somewhat different specimens, internal organs and rhs enlargements of male terminalia (testis sac with vas deferend to prostate, and section of stubby penis in pouch), a nephridium and a spermatheca.

13. Spermathecal pores 7/8 eye-shaped ventral of c-lines. Male pore in 10/11 approximately in b-lines in transverse slits; primary pores on small disc-shaped penes. Female pores paired in 11/12 approximately in ab lines. Genital papillae variously paired in 7-13 with glands internally.

Pharyngeal glands in 3-4. Hearts 6-9; dorsal blood vessel single. Spermathecal ampulla with convoluted duct that exits to body wall without atrium nor accessory gland in 7/8. Testis sacs spherical on posterior of 10/11 (9/10?) with vasa deferentia coiled and entering body wall under roundish prostates. Ovarian chamber in 11 with short ovisacs from fused 11/12. Gizzards usually four in 12-17, sometimes 12-18. Nephridia with hairpin vesicles, vestigial in 10 and 11.

**Remarks.** Ohfuchi (1938) distinguished his species from Kobayashi's *D. nemora* on the basis of position of gizzards, body length, structures of the penis and prostates. However, the four gizzards are confused since Ohfuchi (1958: 38 vs. fig. 4.1) has them in 12-17 or sometimes in 12-18 but shows them in 12-15 which is more likely the conventional location and the same as in *D. nemora*! It too was not found subsequently. Kobayashi (1940: 311) thought *D. ofunatoensis* synonymous with *D. nemora* Kobayashi, 1936 but it is somewhat larger, average 251

mm in length, and the GMs although relatively regular are not shown mid-ventrally as in *D. nemora*.

#### 10. *Drawida tairaensis* Ohfuchi, 1938

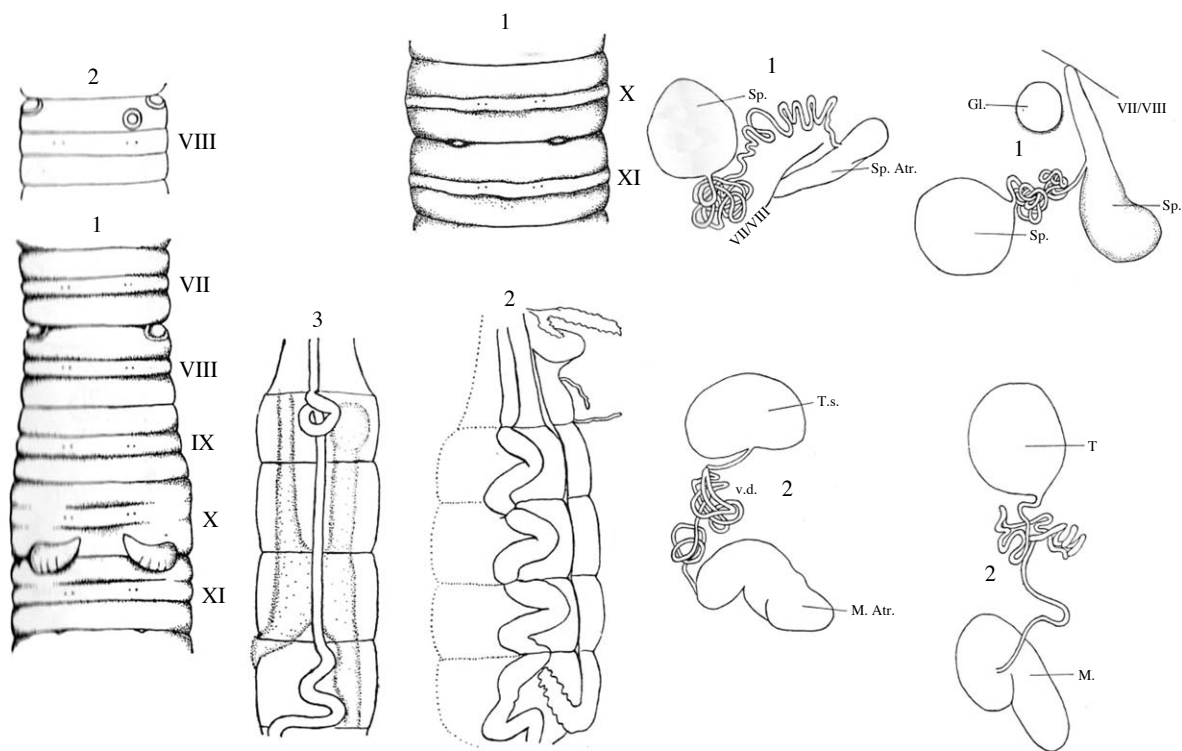
*Drawida tairaensis* Ohfuchi, 1938: 39, figs. 6-9. [From Taira-machi, Iwaki-ku, Fukushima-ken; Tsukinoki, Miyagi-ken; Morioka Iwate-ken, Honjo, Akita-ken. Types not known].

*Drawida tairaensis*: Easton, 1981: 39, tab. 1; Blakemore, 2003, 2010, 2014; Blakemore & Kupriyanova, 2010: tab. 3.

**Distribution.** As in original description.

**Description.** Flesh coloured or pinkish and transparent. Size 60-93 mm by up to 2.7 mm with 110-173 segments. Setae small and closely paired (ab=cd). Clitellum 10-13. Spermathecal pores 7/8 projecting between b and c. Male pore on penes protruded or concealed in 10/11 in mid-bc. Female pores paired on 12 near 11/12 b lines. Genital papillae absent, only one specimen of fifteen had a marking in 8rhs.

Pharyngeal glands in 3-5. Septa 5/6-8/9 thickened. Hearts 6-9; dorsal blood vessel single. Spermathecal ampulla with convoluted duct that exits to atrium in 7/8 with



**Fig. 8.** *Drawida tairaensis* Ohfuchi, 1938. After Ohfuchi (1938: figs. 6-9) showing spermathecal and male field of one specimen and male field of another with male pores retracted; gizzards and dorsal blood vessels from two different specimens with that on rhs also having ovisac plus upper sketches of two sets of spermathecae, that on rhs having accessory gland, and two sets of male organs (T.s. testis sacs and M. Atr. male atria).

accessory gland in 8. Testis sacs spherical on 10/11 (9/10?) with vas deferens coiled and entering apex of male atrium. Ovarian chamber in 10/11/12 with eggsacs said to be “slender and short” but shown to extend from 12-116 (Ohfuchi, 1938: fig. 7.2). Gizzards generally four in 13-19 (but shown by Ohfuchi, 1938: figs. 6.3 and 7.2 in just 13-16). Nephridia absent from first five segments and last two or three.

**Remarks.** Kobayashi (1940: 311) footnoted that *D. tairaensis* seems synonymous with *Drawida anchingiana* Chen, 1933. Ohfuchi (1938: 43) indeed said his species was similar to *D. gisti anchingiana* Chen but was distinguished as it lacked the accessory glands of the male atrium and spermathecal atrium, this despite his showing such a gland near the spermatheca for at least one Honjo specimen (Ohfuchi, 1938: fig. 9.1). The four gizzards were confused (as with the previous species) as he gave them (Ohfuchi, 1938: 42, 43) in 13-19 but showed them in 13-16 (Ohfuchi, 1938: fig. 6.3 and 7.2), the latter being more likely. It has not been found subsequently.

### 11. *Drawida moriokaensis* Ohfuchi, 1938

*Drawida moriokaensis* Ohfuchi, 1938: 44, figs. 10-11.  
[From Morioka, Iwate-ken. Tsukinoki, Miyagi-ken.

Types not known].

*Drawida moriokaensis*: Easton, 1981: 39, tab. 1; Blakemore, 2003, 2010, 2014; Blakemore & Kupriyanova, 2010: tab. 3.

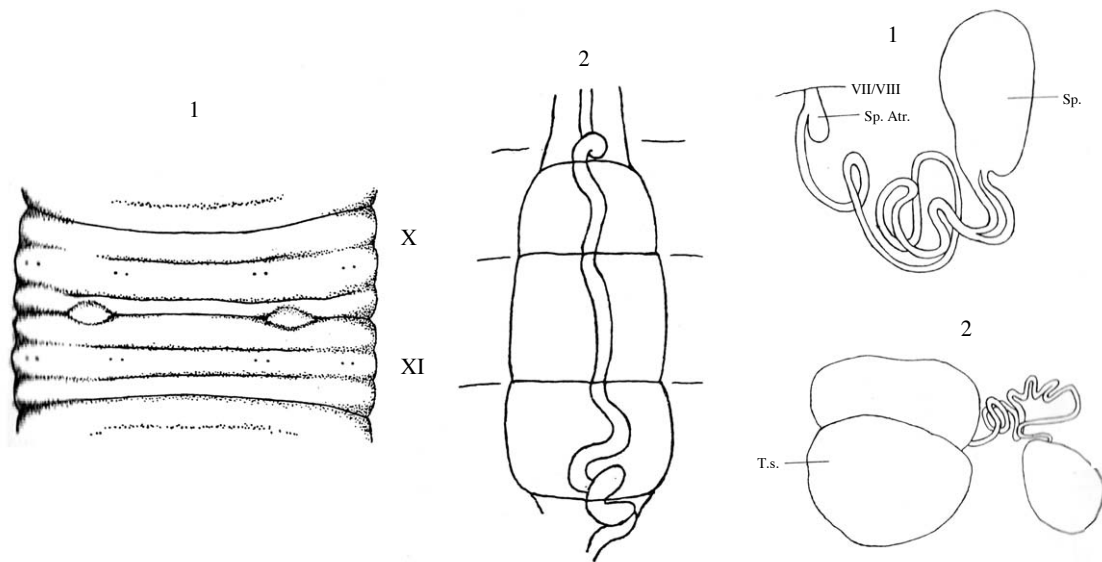
**Distribution.** As in original description.

**Description.** Grey. Size 65-100 mm by up to 3.9 mm with 135-165 segments. Setae small and closely paired (ab=cd). Clitellum 10-13. Spermathecal pores 7/8 nearer to c-lines. Male pore on short, stout penes in 10/11 just lateral to b-lines. Female pores paired on 12 near 11/12. Genital papillae absent.

Pharyngeal glands in 3-5. Hearts 6-9; dorsal blood vessel single. Spermathecal ampulla with convoluted, initially bifurcated duct that exits to small atrium in 7/8 without accessory glands. Testis sacs on 9/10 with vas deferens coiled and entering body wall near base of male atrium. Ovarian chamber in 10/11/12 with eggsacs “usual in shape”. Gizzards usually three, sometimes two, in 10-13. Nephridia vesiculate, vestigial in 9 and 11.

**Remarks.** Ohfuchi (1938: 43) said his species was similar to *D. tairaensis* but was distinguished by having three gizzards and a small spermathecal atrium. *D. moriokaensis* differs from *D. japonica* mostly on forms of male





**Fig. 9.** *Drawida moriokaensis* Ohfuchi, 1938. After Ohfuchi (1938: 44, figs. 10-11) showing male field, gizzards and dorsal blood vessel, a spermatheca (Sp. spermathecal ampulla, Sp.Atr. spermathecal atrium) and male organs (T.s. – Testis sac).

pores and lack of GMs. The gizzards are again confused as Ohfuchi (1938: 46) gives them in either 10,11-13 or perhaps 10-11 but shows them (Ohfuchi, 1938: fig. 1.2) in 10-12! This latter is probably the correct location, i.e., three gizzards in 10-12. It too was not found subsequently.

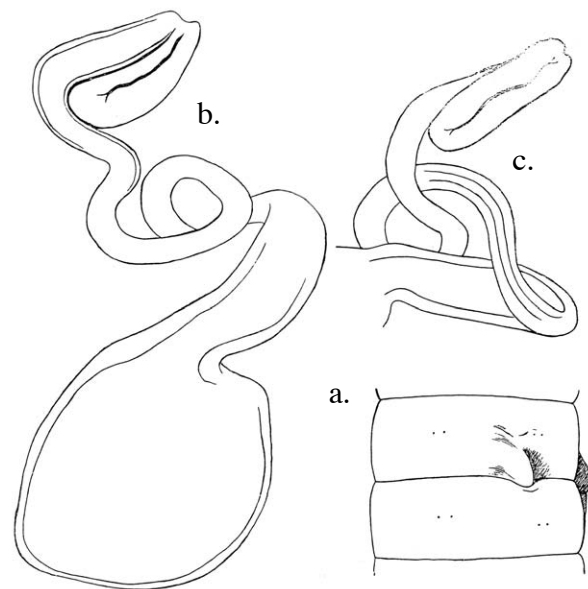
#### 12. *Drawida koreana koreana* Kobayashi, 1938

*Drawida koreana* Kobayashi, 1938: 102, fig. 3 (from Kyôjô, etc. Types not known); Kobayashi, 1940: 268; 1941: 515; Easton, 1981: 35, 39; Blakemore, 2012b; 2013: 125.

**Distribution.** Originally described on 150 or so specimens ranging from “Kyôjô” (present day Kyojo, Hamgyông-Bukto) in NE North Korea to “Ryûjin” which is close to present-day Suwon in Gyeonggi-do which means ‘the area surrounding the capital (Seoul)’ in NW South Korea. Kobayashi (1940: 311) obtained *D. koreana* in “central-eastern district of Manchoukuo [=present day Dongbei]” as well as from northern and central Korea. Kobayashi (1941) reported it from Kyushu, Japan.

**Description.** Dark blue or dark reddish blue dorsally, lighter ventrally, clitellum pinkish. Length 63-100 mm, to 4 mm, with 130-186 segments. Prolobous. Dorsal pores absent. Setae paired (ab=cd). Clitellum 10-13. Spermathecal pores in 7/8 in c-lines. Male pores on nipple-like conical porophore posteriorly on 10 overhanging 10/11 in bc but nearer c-lines. Female pores anterior of 12 in b-lines. GM papillae present irregularly on 7-12 with glands internally.

Septa 5/6-7/8 thickened; 10/11 and 11/12 meet dorsally. Spermathecal ampulla spherical, duct very short and



**Fig. 10.** *Drawida koreana koreana* Kobayashi, 1938. After Kobayashi (1938: fig. 3) showing (a) male field, (b and c) enlarged spermathecae. Note that his sketch of the male field of *D. koreana* is similar to that found in several current specimens.

thick joins side of small atrium near base. Testis sacs in 9/10, vas deferens short entering body wall near thick and short prostate gland (the glandular part easily removed around its tubular body). Ovaries in chamber of 10/11/12, oviducts extend up to 22. Gizzards two or three in 12-13, 14.

**Remarks.** Said by Kobayashi (1938) to differ from pale

coloured *D. japonica* and its synonym *D. propatula* Gates, 1935 in the larger aspect of the male pore (more stubby) and shorter, thicker spermathecal duct. As noted by Blake-more (2013a), *D. koreana* is seemingly a variable species or perhaps a species-complex. Types of *D. koreana* are missing and topotypic neotypification is difficult due to restricted access to North Korea, in particular to the sanctuary of the Ri dynasty mausoleum at Kyojo that Kobayashi (1938: 91) indicated may be the type-locality. Thus a pragmatic solution, pending full determination of the nominal taxon, is to describe new sub-species, such as the next three taxa, that are unambiguously identifiable on their DNA (Appendix, Fig. 1).

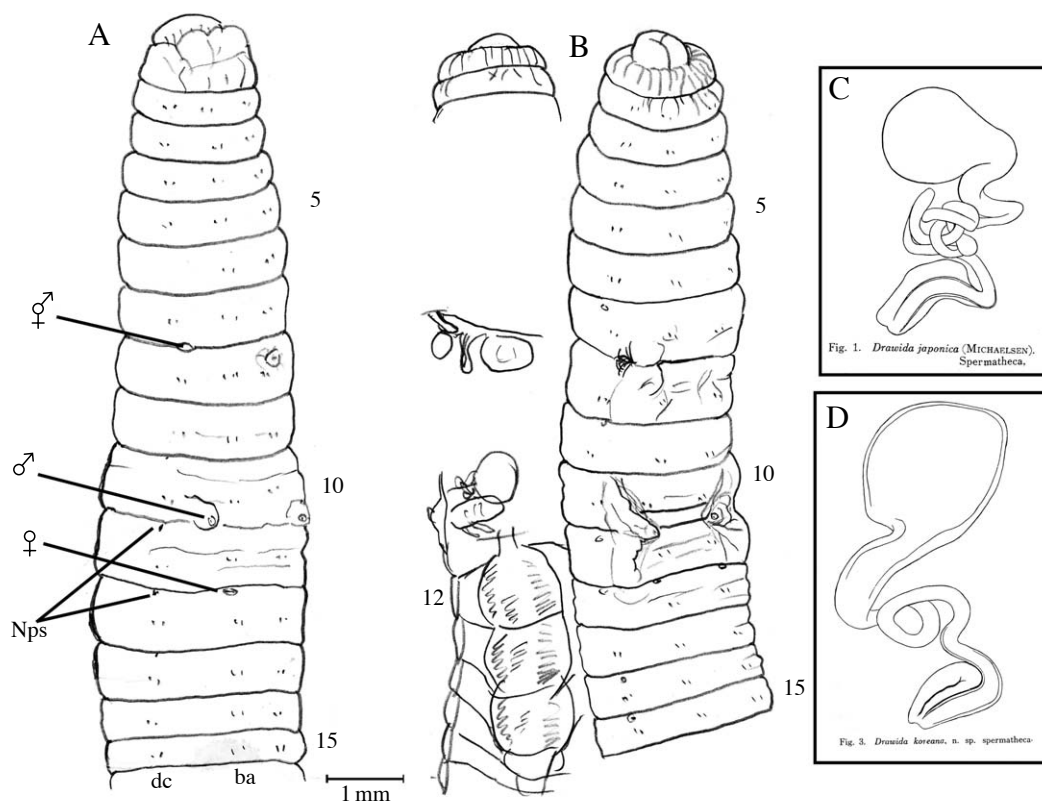
Blue and/or red coloured *Drawida willsi* Michaelsen, 1907 that is ca. 60 mm long is a dominant earthworm in Indian crop fields and rice paddy, also widely distributed as a vermicomposing species there and often used for ecotoxicology studies. [Note that *D. hattamizui* is also reddish when subadult and dark bluish when mature]. It differs only in detail (e.g. spermathecal pores in ab-lines and longer spermathecal duct perhaps, with GMs in 9/10) and requires separation based on its DNA profile too. Gizzards in *D. willsi* were said by Michaelsen (1907: 145; 1909: 144) to occur in 13,14-15, but Gates (1945: 215)

had 1,600 specimens with two to four gizzards in some of 12-16, as in *D. koreana*. Michaelsen (1909: 117, 146) pointed out that it was similar, if not synonymous, to his earlier *D. japonica* that typically had gizzards in 12-13 only. Male pores in *D. willsi* are in b-lines, spherical equally in 10 and 11 with a small conical porophore that may resemble that for *D. koreana* but, unfortunately, no figure is available. Rudimentary male pores are also often present in 9/10 and thus it was thought a transitional species. Resolution of the relationship of these taxa requires further work.

### 13. *Drawida koreana austri* Blakemore sub-sp. nov.

“*Drawida cf. koreana* Kobayashi, 1938: 102” in Blake-more & Lee (2013: 129).

**Material.** Holotype (H) IV0000261283 (DNA sample H7) mature specimen, 26<sup>th</sup> April 2013 from Jungang Pk. (GPS 35.111297, 129.028469), Busan, collector RJB. Paratype (P) IV0000249929 a thin acitellate mature, dissected, from NIBR facility (GPS 37.564379, 126.638011), Incheon, collected by RJB 3<sup>rd</sup> April, 2012 and provisionally identified as “*Drawida cf. koreana*” or “*Drawida sp. 1 thin with penis*” providing DNA sample WO23 that



**Fig. 11.** *Drawida koreana austri* sub-sp. nov. A – Holotype, B – Paratype dissected to show spermatheca, male organs and gizzards in 12-14. Boxed are Kobayashi's (1938: figs. 1 & 3) comparing spermathecae of C – *Drawida japonica* and D – *D. koreana koreana* that differ from those of the current specimens.

agrees 100% with DNA sample H7 (Appendix). Specimens IV0000261282 several matures possibly same from NIBR carpark collected in rain October, 2012 by RJB.

**Etymology.** From Latin *austri* (n) meaning from South-side of Korea.

**Description.** Pale blue-grey colour (both H and P). Length 48 mm (H) or 70 mm (P) with 123-170 segments, respectively. Prolobous. Clitellum 10-13 at least (H). Dorsal pores absent. Nephropores are visible in d-lines, on clitellum at least. Spermathecal pores in atria in 7/8 below c-lines. Male pores on 10 posteriorly in mid-bc-lines protrude on small penes. Female pores in b-lines on 12 near 11/12. Small genital markings are present on 8rhs above setae ab and 10rhs on male pore in H, absent in P.

Spermathecae on short ducts with small glands associated in 8 (present but not related to genital marking which are absent in P). Male pore on long, coiled vas deferens to glandular prostate. Gizzards in 12-14, i.e., three of. Ovisacs present but not extensive.

Displays surface roaming behaviour in rain and active in Feb. – Oct. at least.

**Remarks.** Similarity of the current species to *Drawida koreana koreana* Kobayashi, 1938 is having male pores on 10 and blue colour. Difference from *D. japonica* (Michaelsen, 1892) is shown by the short spermathecal duct, short ovisacs and glands corresponding to markings, even if the markings or their pores are not obvious (parasitic?). *D. koreana* proper has not been confirmed in the present study, but is perhaps a darker blue and slightly larger (“usually 80-90 mm”) with mostly two gizzards in 12-13 in (fifteen cases from twenty syntypic) Kyôjô specimens and as typically found in *D. japonica*, or three in 12-14 – as here – in (fourteen out of twenty) specimens from Ryûjin. Original locations of *D. koreana* in northern and central Korea, are far from the Busan type-locality and the more southerly distribution of the current taxon.

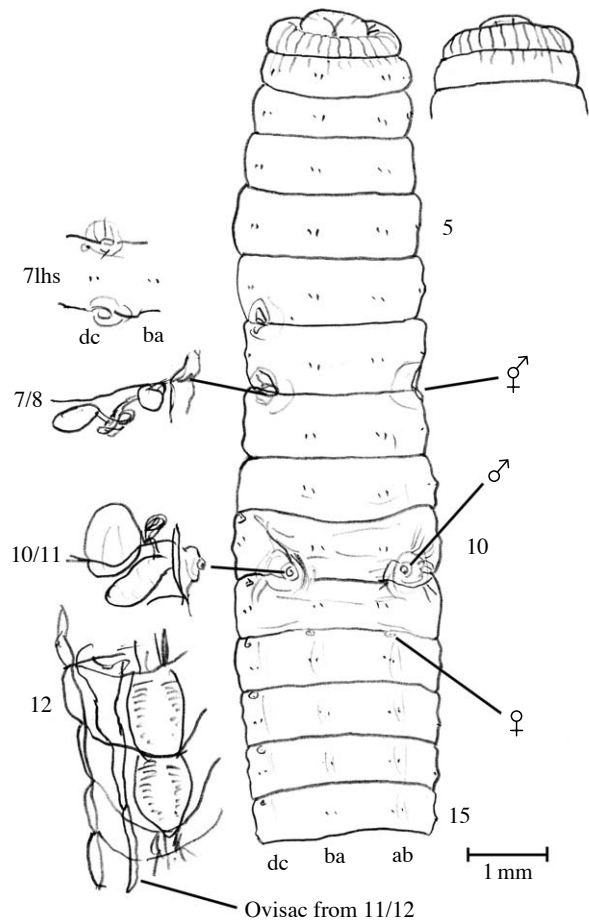
#### 14. *Drawida koreana nanjiro* Blakemore sub-sp. nov.

“*Drawida* sp. 2 fat no penis NIBR” in Blakemore & Lee (2013: 128, fig. 1)

**Material.** Holotype (H) IV0000249928 (DNA sample WO22) mature specimen, dissected, from NIBR facility Nanji-ro 42, Seo-gu, (GPS 37.564379, 126.638011), Incheon, collected by RJB 3<sup>rd</sup> April, 2012 on path under pergola in rain, provisionally identified as “*Drawida* cf *koreana*” or “*Drawida* sp. 2 fat no penis”. Found with *Amyntas carnosus* (DNA WO24) and the previous, *Drawida koreana austri*. Specimens IV0000261282 several matures possibly same from NIBR carpark collected in rain October, 2012 by RJB.

**Etymology.** Named after type locality (noun in apposition).

**Description.** Dark blue, especially the first 13 segments



**Fig. 12.** *Drawida koreana nanjiro* sub-sp. nov. Holotype showing *in situ* spermathecae in 7/8rhs, testis sac and prostates in 10/11 rhs with lateral view of stubby blunt penis, and gizzards in 12-13 plus ovisac in 11/12-15.

with darker dorsum and faint mid-dorsal line. Length 70 mm with 153 segments. Prolobous. Clitellum not developed. Dorsal pores absent. Nephropores in d-lines or above. Spermathecal pores in atria in 7/8 near c-lines and unilaterally in 6/7lhs (aberration). Male pores on 10 posteriorly in mid-bc-lines protrude on stubby mounds rather than penes. Female pores in b-lines on 12 near 11/12. Genital markings absent.

Spermathecal ducts moderately long to small atria with glands associated in 8. In 6/7lhs is vestigial spermathecal aberration. Male pores on moderately long, coiled vasa deferentia have glandular prostates. Gizzards in 12-13, i.e., two of. Ovisacs present extending from 11 to segment 15. Gut has sandy quartz grits (geophagy).

**Remarks.** The current is similar to both *Drawida koreana koreana* Kobayashi, 1938 and *D. japonica* (Michaelsen, 1892), to the former in its blue colour and to the latter in its stubby penes and to both in its two gizzards in 12-13. It is especially close morphologically and is sympatric to

the *D. koreana austri* Incheon paratype as well as to *Drawida koreana shindo* sp. nov. but is clearly separated from both by characteristics noted and marginally on its DNA data [in Appendix, Fig. 1 where BLAST WO22 (*D. k. nanjiro*) vs. WO27 (*D. k. shindo*) Identities=640/658 (97%), i.e., 3% different with 18 nucleotide bases exchanged; WO22 (*D. k. nanjiro*) vs. WO23 (*D. k. austri*) =596/660 (90%)]. Just 3% is a small genetic difference, here considered sufficient for sub-specific status due to concomitant morphological differences, as remarked on in the Methods section above. Full relationship to nominal *D. koreana* is pending confirmation of that taxon.

### 15. *Drawida koreana shindo* Blakemore sp. nov.

**Material.** Holotype (H) IV0000246437 (DNA sample WO27) mature specimen, dissected, from mud beside creek on north side of Sido Bridge, Shindo (sometimes 'Sindo') Island, Incheon (GPS 37.530490, 126.440730), collected 4<sup>th</sup> May, 2012 by RJB and provisionally identified as "*Drawida cf japonica Shindo* sp. 1". Found with *D. companio* sp. nov.

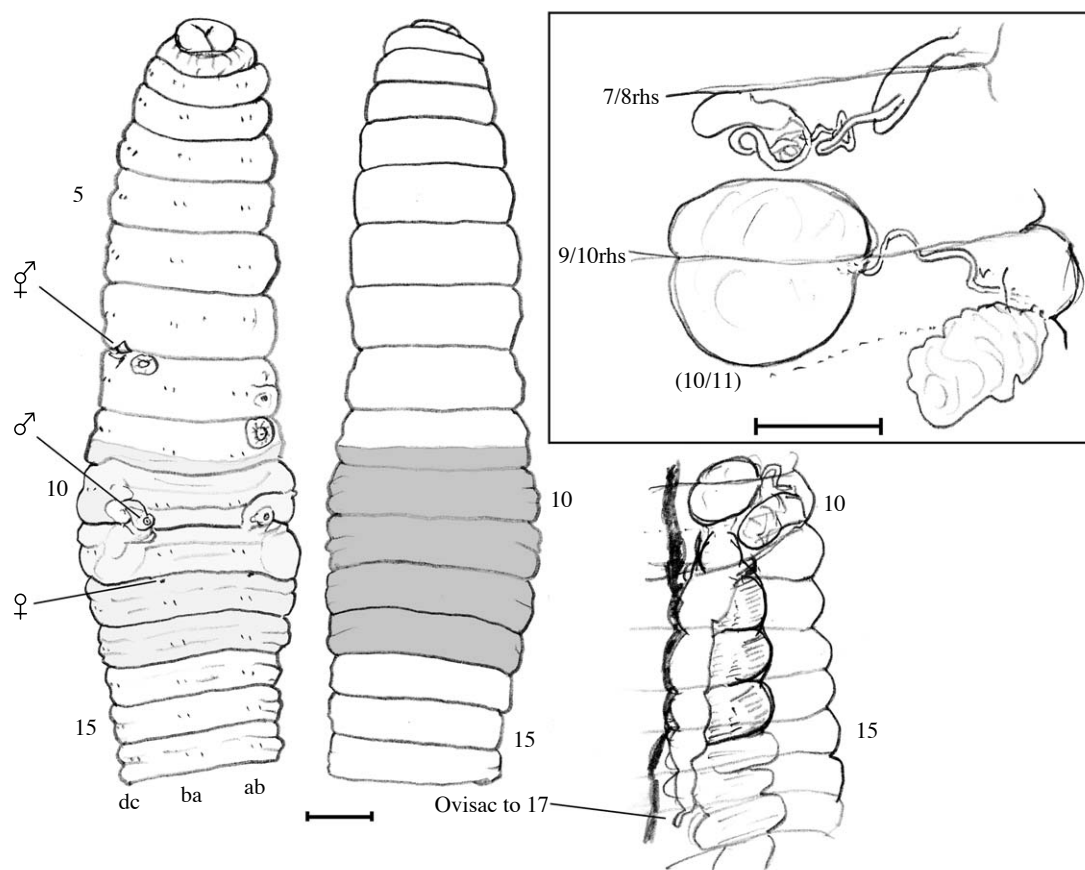
**Etymology.** Named after type locality (noun in apposi-

tion).

**Description.** Light or pale brown colour. Length 80 mm with 140 segments. Prolobous. Clitellum tumid 1/2 9-13. Dorsal pores absent. Nephropores near c-lines. Spermathecal pores small in 7/8 near c-lines. Male pores on small porophores at 10 posteriorly in mid-bc-lines. Female pores in b-lines on 12 near 11/12. Genital marking as unilateral disc presetally in bc on 8lhs and 9rhs and smaller, post-setal in 8rhs in bc.

Septa 5/6-8/9 thick, 10/11 attaches to 11/12 ventrally. Spermathecae have large atria on moderately long ducts from small ampullae attached below septum 7/8, no glands are associated in 7 or 8. Male pores on short vasa deferentia with large glandular prostates. Ovaries are in 11. Ovisacs in 11-17. Gizzards in 12-14, i.e., three of. Intestine in 15-17 distended and rugose, thin in 18-19, then dilated from 20 onwards. Nephridia elongate but avesculate only the ducts thickened. Hearts in 6-9. Dorsal blood vessel single.

**Remarks.** This taxon belongs to the group with male pores in 10 but complies more with *Drawida japonica* sub-spp than with *D. koreana* sub-spp as it lacks the characteristic blue colouration, has GMs, a stubby penis and



**Fig. 13.** *Drawida koreana shindo* sp. nov. Holotype ventrum and dorsum showing extent of clitellum; *in situ* gizzards in 12-14 and ovisac next to dorsal blood vessel; boxed enlargements are of spermatheca in 7/8rhs and male organs in 9-11rhs.

coiled spermathecal duct. The DNA data (Appendix, Fig. 1) show it to be closest to *D. koreana nanjiro*, as already noted, or an unidentified Japanese taxon (Genbank AB5 92437). Since both *D. japonica* and *D. koreana* occur in Japan, this latter comparison is inconclusive. Nevertheless, its distinction from other taxa in the current study, including its sympatric sample WO28 from *Drawida companio* sp. nov., merits its description and naming as a sub-species new to science for similar reasons to *D. koreana nanjiro*.

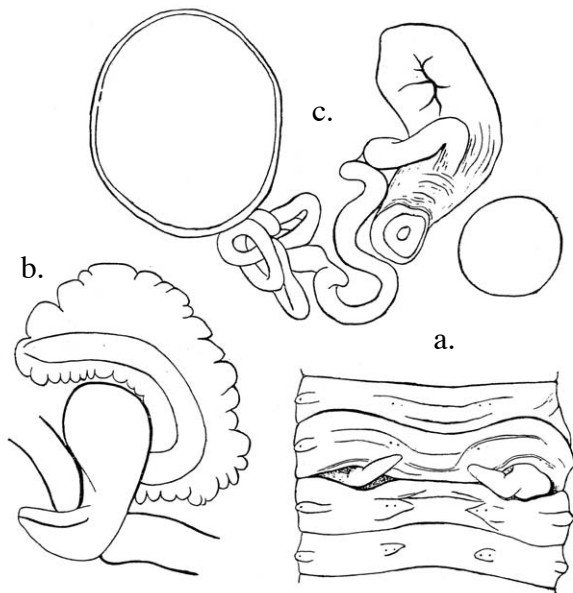
#### 16. *Drawida keikiensis* Kobayashi, 1938

*Drawida keikiensis* Kobayashi, 1938: 107, fig. 4. [From Suigen, Keiki-do (near Suwon, Seoul). Types, two semi-mature specimens now lost].

*Drawida keikiensis*: Kobayashi, 1941: 263; Easton, 1981: 39, tab. 1; Blakemore, 2003, 2010, 2014; Blakemore & Kupriyanova, 2010: tab. 3.

**Distribution.** Korea and Japan (from Kobayashi, 1941: 263) Honshu in Chubu-chiho, Kinki-chiho, Gugoku-chiho and on Shikoku and Kyushu also, i.e. widespread.

**Description.** Grey. Size 40-54 mm by up to 2.5 mm with 138-154 segments Prolobous. Setae small and closely paired (ab=cd). Dorsal pores absent. Clitellum begins to appear on 10-13. Nephropores in line with c. Spermathecal pores 7/8 nearer to c-lines. Male pore on blade-shaped penes in 10/11 a-c lines. Female pores paired in 11/12 in b-lines. Genital papillae absent.



**Fig. 14.** *Drawida keikiensis* Kobayashi, 1938. After Kobayashi (1938: fig. 4) showing (a) male field, (b) male terminalia (prostate and penis but accessory gland not shown) and (c) spermatheca and accessory gland corresponding to a spermathecal papilla (not mentioned in text).

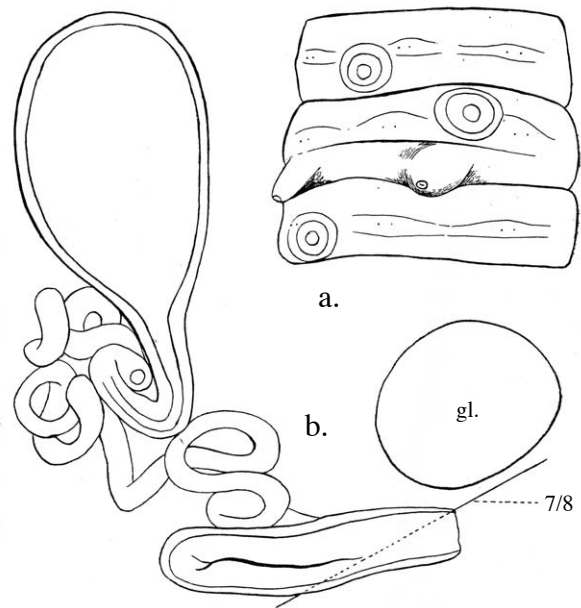
Septa 5/6-8/9 thick; 10/11 and 11/12 combined in 11/12. Hearts last in 9. Spermathecal ampulla with convoluted duct to middle of atrium in 7/8 with accessory gland nearby. Testis sacs on 9/10 with very short vas deferens twisted and entering ental end of prostate. Prostate small, short but broad and warty on surface; medial to the prostate is large ovoid gland (not shown in Kobayashi's fig. 4). Ovarian chamber in 10/11/12 with eggsacs extending to 16 or to 22. Gizzards three in one specimen in 13-15 and four in the other in 12-15. Nephridia vesiculate, vestigial in 9 and 11.

**Remarks.** Kobayashi (1938: 110) said his species was similar to *D. syringa* Chen, 1933 and also to *D. cheni* (Gates, 1935) but differs from the former mainly in the shape of the penis and from the latter by many characters. Its occurrence in Japan has not since been confirmed although this may relate more to lack of study than true situation.

#### 17. *Drawida jeholensis* Kobayashi, 1940

*Drawida jeholensis* Kobayashi, 1940: 268, fig. 1. [From Chihfen, Manchoukuo (=Chifeng, Inner Mongolia). Types unknown].

**Description.** Whitish grey. Size 52-66 mm by up to 3.5 mm with 153-160 segments Prolobous. Setae small and closely paired (ab=cd). Dorsal pores absent. Clitellum 9-14. Nephropores somewhat in line with c or more dorsal. Spermathecal pores minute in posterior of 7 near to c-lines. Male pore minute on blunt porophore in 10 poste-



**Fig. 15.** *Drawida jeholensis* Kobayashi, 1940. After Kobayashi (1940: fig. 1) showing (a) male field, (b) enlargement of a spermatheca.

riorly overhanging 10/11. Female pores paired on 12 near 11/12 in ab-lines. Genital papillae present, as discs in some of 7-11 and in 7/8 with glands internally.

Septa 5/6-8/9 thick. Last hearts in 9. Spermathecal ampulla rounded with convoluted duct to lateral side of large atrium in 7/8 with an accessory gland in 7. Testis sacs on 9/10 with short vas deferens entering body-wall just medial to prostates that are small and rugose externally. Ovarian chamber in 10/11/12 with eggsacs extending to 16-20. Gizzards two or three in 12-13 or 11-13.

**Remarks.** This species was said similar to both *D. japonica* and *D. koreana* supposedly differentiated from the former by its male porophore, and from the latter, which it most closely resembles, mainly by the longer and thinner spermathecal duct and by body colour. The spermathecal pores in 7 appear unique for this species.

#### 18. *Drawida ghilarovi* Gates, 1969 species-complex (stat. nov.)

*Drawida ghilarovi* Gates, 1969: 674. [Siberia. Types in Moscow: 37-38].

*Drawida ghilarovi*: Ganin, 2013.

**Distribution.** Siberia in South Primorye and Khabarovsk neighborhood. Described from southern slopes and spurs of the Sikhote-Alin Mountains, near Ussuriysk and in the Black Mountains. Its wider description by Ganin (2013) appears to show several distinct morphs/(sub-)species with incursion into China and North Korean border.

**Description.** [From Gates' 1969 original, Russian Red Data Book (Anon., 2014 – <http://hunt.rin.ru/html/article/2319-1.html>) and <http://www.zooclub.ru/bezp/35.shtml>]: Body a greenish or dark metallic bluish colour. Length 100-142 mm, width 6 mm. Segments 173-210. Prolobous. Lumbricine. GMs distantly paired discs, usually in bc to cd or sometimes even on the side of d, in 5-13. Clitellum ring-shaped 9-15. Spermathecal pores in 7/8. Male pores in 10/11 medio-lateral in bc, superficial without copulatory organ (i.e., no penes). Female pores in 11/12. Spermatheca with long coiled duct to exit (i.e., no spermathecal atria). Vas deferens long and coiled in 9-10 to hemispherical, sessile prostates. Ovaries in 11 with long egg sacs. Gizzards four of in 13-16. Nephridia vesiculate.

**Remarks.** A. species-complex is suggested by its wide distribution and further refinement is required in relation to several similar regional congeners, especially those with four gizzards in 13-16, such as *D. tairaensis*, *D. guryeensis* Hong, 2002, *D. csuzdii* and *D. jeombongsan* spp. nov. although several of these differ in having penes and arrangement of GMs. Gates compared it to Asian species also lacking spermathecal atria, viz. *D. hattamimizu*, *D. nemora* and *D. ofunatoensis*, the last two similarly lacking penes. Its genetic profile, on topotypes, would be most useful for comparison. Occurring as a litter species

or subsoil geophage in forest soils, meadow-swamp and in peat to depths of 1 m (Ganin, 1023), its cold tolerance is found to be  $-16^{\circ}\text{C}$  in worms to  $-20^{\circ}\text{C}$  for cocoons (Berman *et al.*, 2010). Nematode parasites are also reported (Ivanova *et al.*, 2014) uniquely for two *Drawida ghilarovi* morphs supporting the current suggestion of separate species rather than just morphs or ecotypes.

#### 19. *Drawida iucn* Blakemore, 2013

*Drawida iucn* Blakemore, 2013a: 19, fig. 3.

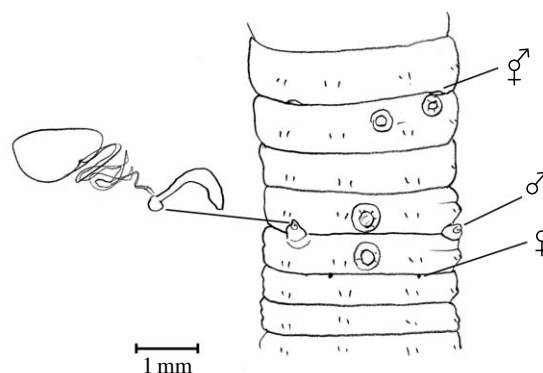
**Material.** Specimen: IV0000261359 mature (dissected and providing DNA sample HY18), from Yeomiji Botanical Gardens (GPS 33.252594, 126.414137), Seogwipo, Jeju Island, collector RJB 5<sup>th</sup> Sept. 2013.

**Description.** Bluish colour. Length 63 mm. Dorsal pores absent but pigmented dots present from 2/3. Genital markings as figured. Spermathecal atrium present but no atrial glands seen. Prostate to male pores joined at base by vasa deferentia. Gizzards in 11-13 (three of).

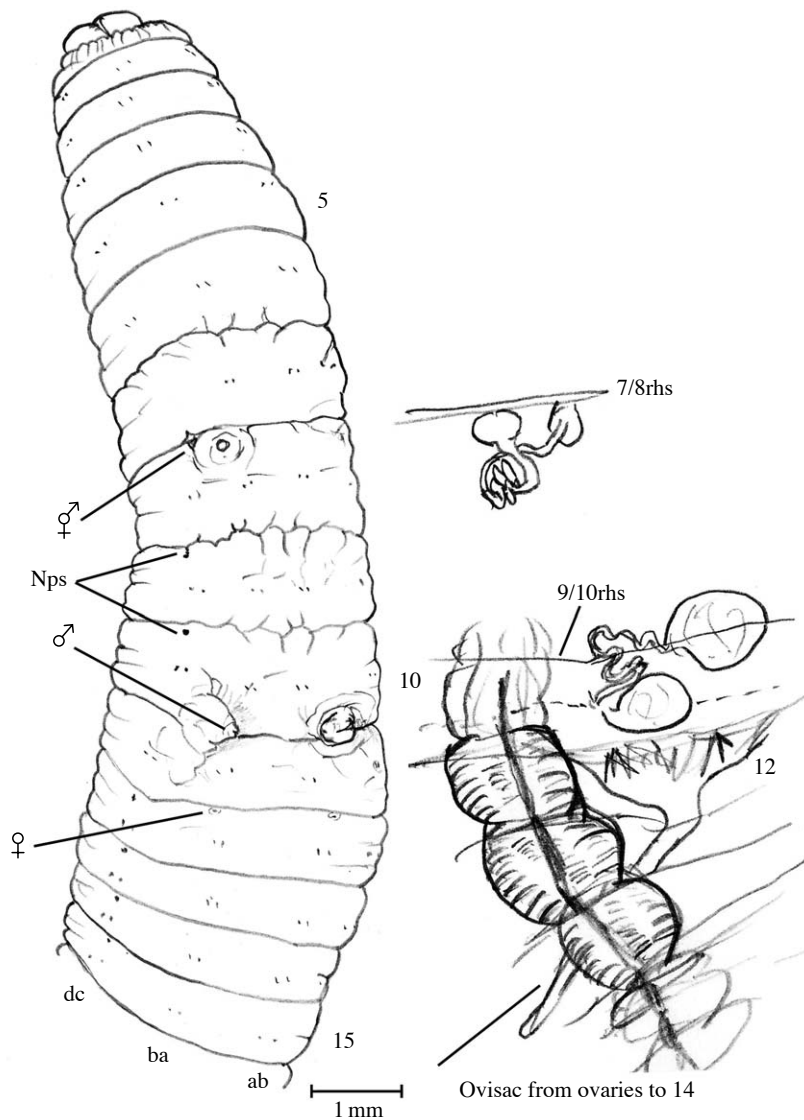
**Remarks.** This specimen is a more bluish hue and has additional markings on 8rhs and mid-ventrally on 10. The main difference from the type description of *D. iucn* is the gizzards given as “in 12-15 with muscular modification in 12 reduced” but shown in Blakemore (2013: fig. 3) to be in 11-14, if the conjoined septum “11/12/13” is taken as the origin of the ovisacs in 12/13. Thus since segments may be counted differently it is perhaps more proper that its classification for the type be augmented as four gizzards in 11,12-14 (15) or, for the new variety morph, as three gizzards in 11-13. DNA barcodes agree 639/643 (99%) thus tolerably conspecific.

#### 20. *Drawida companio* Blakemore sp. nov.

**Material.** Holotype (H) IV0000246438 (DNA sample WO28) mature specimen with tip of tail missing, dissected, from mud beside creek on north side of Sido Bridge,



**Fig. 16.** *Drawida iucn* Blakemore, 2013, sketch of Jeju specimen yielding DNA HY18.



**Fig. 17.** *Drawida companio* sp. nov. Holotype providing DNA WO28, showing verntrolateral view with *in situ* spermatheca in 7/8rhs and male organs around 9/10rhs; gizzards in 12-14 and ovisac extends from feathery ovaries in 11/12 to 14.

Shindo, Incheon (GPS 37.530490, 126.440730), collected by RJB 4<sup>th</sup> May, 2012 and provisionally identified as “*Drawida cf koreana* Shindo sp. 2” – same location as *D. koreana shindo* sub-sp. nov.

**Etymology.** Latin *compāniō* (m. noun), companion (of *D. koreana shindo* on Shindo and to other Japanese/Korean drawidas); literally: one who eats bread with another.

**Description.** Dark bluish. Length 80+ mm with 126+ segments. Prolobous. Clitellum paler 10-13. Dorsal pores intermittently present, e.g. in 15/16, 19/20/21, 25/26/27. Nephropores in cd-lines from 6. Spermathecal pores small in 7/8 near c-lines. Male pores on inward-pointing protuberances at posterior of 10 and impinging in 10/11 in mid-bc-lines. Female pores in b-lines on 12 near 11/12. Geni-

tal marking as unilateral disc presetally on 8 in bc.

Septa 5/6-8/9 are thick, 9/10 is thin and 10/11 is displaced to adherently join with 11/12. Spermathecae have small atria on moderately long ducts from small ampullae, no glands are associated in 8. Male pores on moderately long, coiled vasa deferentia with small white prostate glands adjacent to the exit. Ovaries and many egg strings within combined septa 10/11/12 with empty ovisacs extending from 11 to segment 14. Gizzards in 12-14, i.e., three of. Nephridia elongate vesiculate rather than just thickened ducts.

**Remarks.** Unique character combinations are the blue colour as in *D. koreana*, intermittent dorsal pores as in *D. barwelli* (and some *D. japonica*) and with three giz-

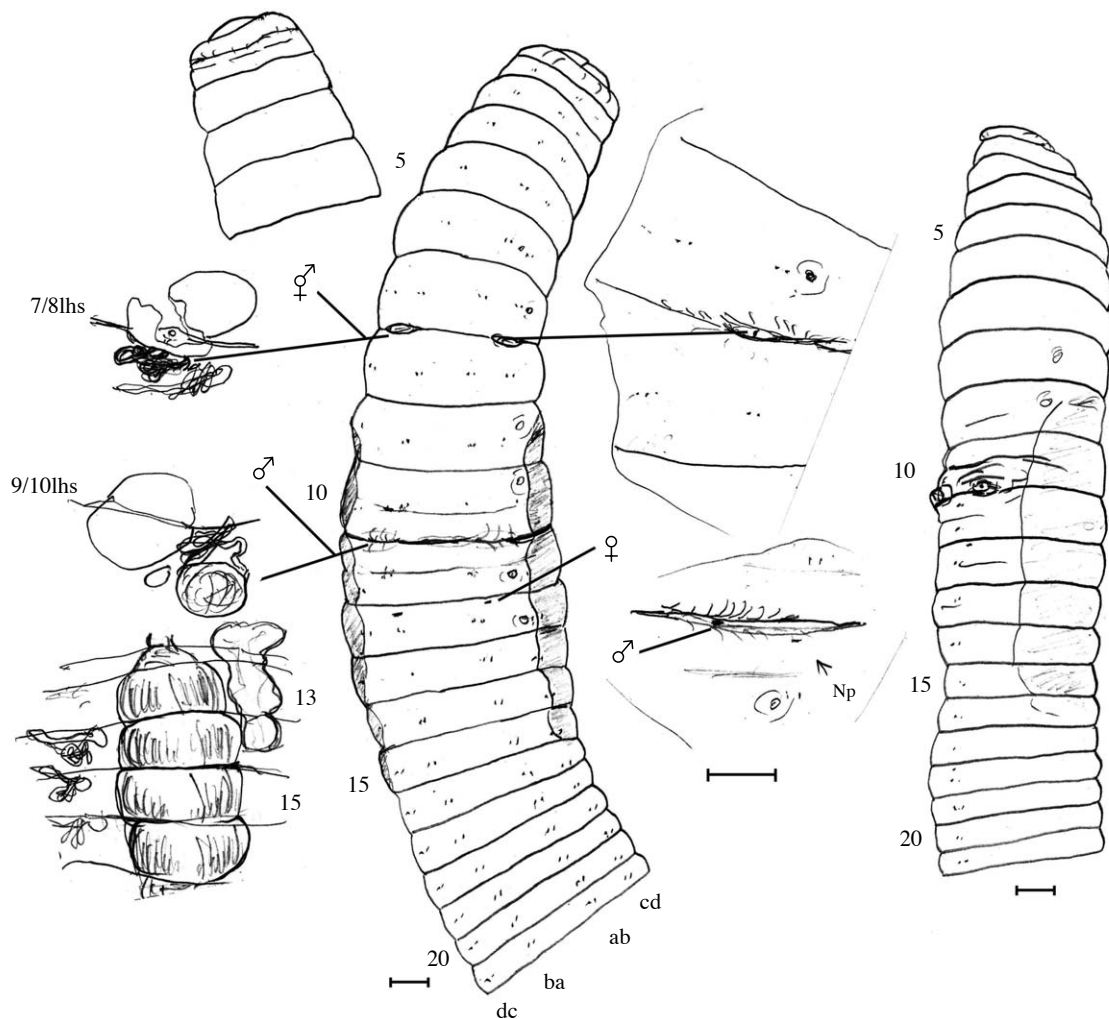
zards in 12-14 as found in these and several other taxa (see Table). This taxon differs morphologically and molecularly from the other *Drawida koreana* sub-species described herein and appears intermediate to Korean species and to previous records of *D. japonica* from Japan (Appendix). None of these are particularly close to "*Drawida japonica*" samples claimed from Korea and China as shown in Fig. 1 and these reports need to be reassessed by the authors. The slight possibility exists that samples WO27 and WO28 were mixed in the genetics lab – as with several others in the WO series in the current studies, a highly regrettable situation beyond my control. It is impractical now to resurvey without substantial investment of time and funds, but this does not detract from the results as just their labels would need to be switched in Fig. 1 for relationships to be mutually swapped; the taxonomic conclusions remain the same.

## 21. *Drawida csuzdii* Blakemore sp. nov.

**Material examined.** Holotype (H) NMST Tokyo An-449, complete mature, figured and dissected providing DNA tissue sample (JET005-6 that unfortunately failed DNA extraction) in container from Dr Cs. Csuzdi (Hungary Museum) with "6/22" on lid and labelled "*Drawida nemora?* North Korea near Pyongyang; Djonjong-san Mts; Taesong-an. Near to Lake Dungshon. Leg. Cs. Csuzdi 06 July 1988"; Paratype 1 (P1) An-452, mature posterior amputee, figured and dissected providing DNA tissue sample (JET107); P2-3 two mature posterior amputees, (An-451 and An-452) undissected.

**Etymology.** Named after collector an authority and specialist on earthworm systematics.

**Description.** Unpigmented in alcohol with reddish clitellum. Size 120 mm with ca. 180 segments. First two seg-



**Fig. 18.** *Drawida csuzdii* sp. nov. Holotype, ventral-view showing prostomium, opened spermatheca in 7/8lhs (with nephridium), testis sac in 9/10lhs with prostate and gland, ovisac from 11-14 and gizzards in 13-16 (with nephridia) plus enlargements of male and spermathecal pores; paratype side-view shows saddle-shaped clitellum.



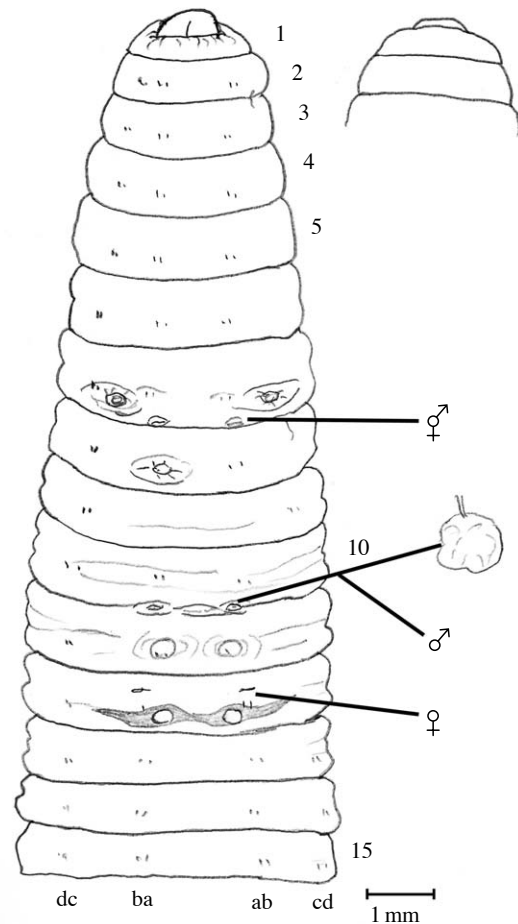
ments almost continuous. Prostomium prolobous with ventral cleft. Dorsal pores absent. Setae small and closely paired (ab=cd). Nephropores small, some near c-lines. Clitellum saddle-shaped 1/2 9-15. Spermathecal pores 7/8 small pores in mid-cd lines in transverse slits. Male pore superficial in 10/11 approximately in mid-bc in transverse slits that in extruded slightly in P1 but not penial. Female pores paired slits on anterior of 12 near 11/12 in b lines. Setae very small and difficult to see. Genital Markings unilateral on rhs in H in 7, 9-12; unilateral in 8-9 in P1, with corresponding glands internally (in 7-12 in H).

Pharyngeal mass to 5 with tendons to 7. Septa 5/6-7/8 thickened; 10/11 and 11/12 fused dorsally to enclose ovaries and egg-sacs in 11. Hearts 6-9 increasingly large; dorsal blood vessel single. Nephridia holoic with convoluted tubule and elongate 'swiss-horn' vesicles. Spermathecae with ampulla ventral on septum 7/8, spherical to convoluted duct that exits to body wall without atrium nor accessory gland in 7/8. Iridescent testis in testis sacs spherical, intrasegmentally bulging to both sides of 9/10 with vasa deferentia slightly coiled and entering body wall under glandular prostates. Prostates spherical, each sessile joining with vas deferens at 10/11 exiting via small male porophore that is not considered penial. Ovarian chamber filled with large eggs within 10/11/12 with long ovisacs as far back as 14. Gizzards four in 13-16 (H, P1).

**Remarks.** Gizzard arrangement of four within 13-16 contrasts to *D. nemora* Kobayashi, 1936 that usually has four in 12-15, or sometimes five in 12-16 or three in 13-15 (i.e. three to five of in 12,13-15,16). Other differences are: weak first segment; arrangement of the GMs – especially lack of paired mid-ventral markings; the clitellum extending into 15-16; and the prostate glands being more spherical rather than flattened disks. No spermathecal accessory glands were found as per Kobayashi's original but unlike in his redescription. *D. nemora* has not been definitely collected from Seoul since Kobayashi's work, neither have any new earthworm species been described from North Korea since *Eisenia koreana* (Zicsi, 1972) as redescribed by Blakemore in Blakemore & Park (2012).

## 22. *Drawida jeombongsan* Blakemore sp. nov.

**Material.** Holotype IV0000261314 (DNA sample HY10), mature specimen, from Jeombongsan Mt., between the counties of Inje and Yangyang, Gangwon-do in South Korea (38° 01' 16.39" N 128° 25' 6.36" E), collector Dr H-Y Seo 25<sup>th</sup> July, 2013. Sample also contains two tail portions, one possibly belonging to this specimen, a mature *Metaphire hilgendorfi* (Michaelsen, 1892) (NIBR261310) and several *Amyntas* sp. (IV0000261311-3, IV0000261315-22). Same location and collector, 11<sup>th</sup> July, 2013 an *Amyntas* sp. (IV0000261308) and a mature blue *Drawida* sp. (possible same, IV0000261309).



**Fig. 19.** *Drawida jeombongsan* sp. nov. Holotype (H, DNA HY10) showing ventral anterior, dorsal view of prostomium and prostate gland in 10/11 rhs.

**Etymology.** After the type locality, noun in apposition.

**Description.** Light blue colour. Prostomium proepilobous, peristomium smooth. Length 60+ mm (posterior amputee). Segments 125+. Clitellum unclear. Dorsal pores absent. Nephropores in cd lines in some segments. Setae small and closely paired. Spermathecal pores superficial in 7/8 near ab-lines. Male pores superficial on 10/11 ab-lines. Genital markings equatorial paired discs in bc on 7, unilateral in ab on 8lhs, and paired in ab in 11 (encompassing ventral setal couples) and 12, the latter slightly more posterior and within common lateral field that tapers to c setae. Female pores paired slits above ab-lines in 12.

No atrium nor glands found near spermathecal pores, spermathecae attach to 7/8. Vasa deferentia go to body wall from testis sacs in 9/10, prostates as small sessile glands, no penes present. Gizzards are in 13-16 (four of). Nephridial bladders are elongate.

**Remarks.** Distinctive characters from its nearest neighbour are the genital markings more ventral than in *D. odaesan* and four gizzards (in 13-16) rather than five (in

13-17) as in *D. odaesan*. The superficial, closely aligned spermathecal and male pores plus four gizzards (but in 14-17) are reminiscent of *D. songae yeongdo* Blakemore, 2013 accorded similarity of only 88% from DNA data (in Appendix, Fig. 1) that objectively separate these three taxa along with several other physical characters.

### 23. *Drawida odaesan* Blakemore sp. nov.

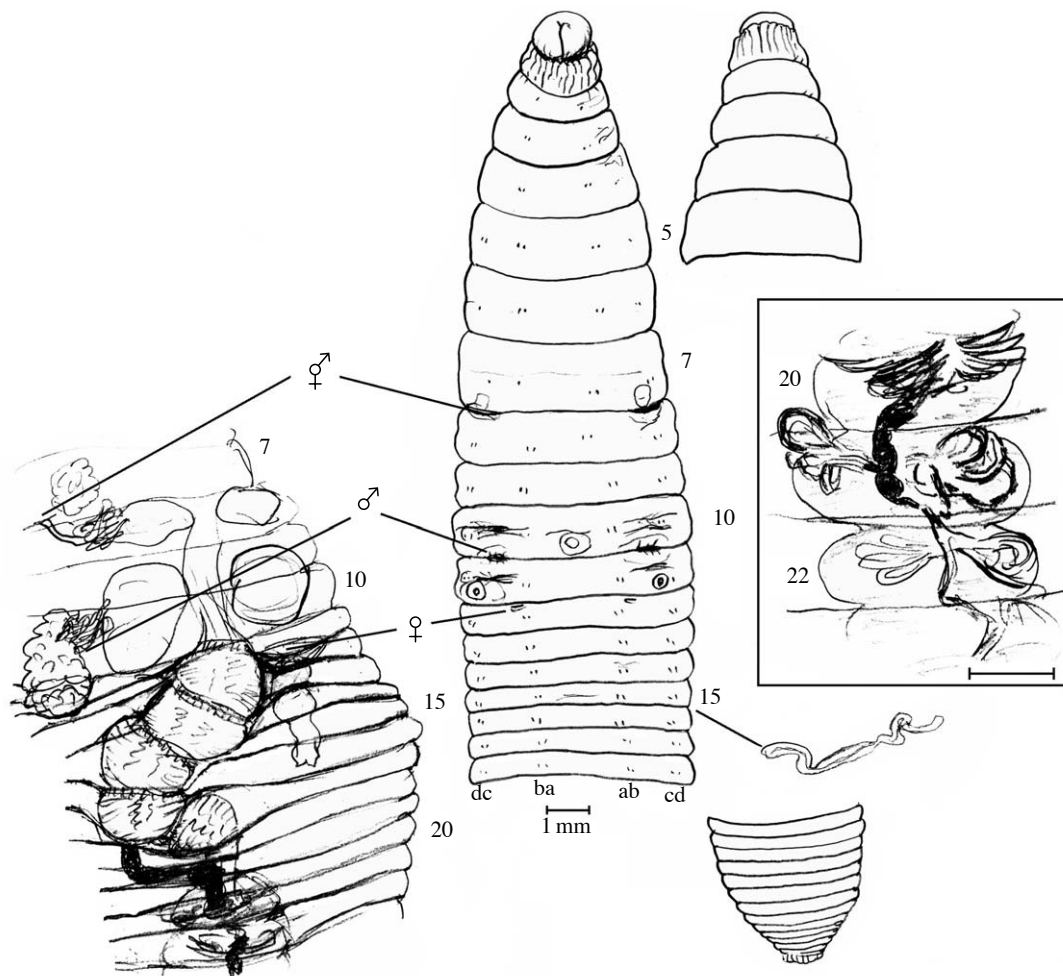
**Material.** Holotype IV0000261295 (DNA sample HY1), mature specimen sketched and dissected, from Odaesan Mt. (alt. 1,563 m), Jinbu-myeon, Pyeongchang-gun, South Korea (ca. 37° 47' 53" N 128° 32' 35" E), collector Dr H-Y Seo 4<sup>th</sup> July, 2013. Two immature *Amyntas* sp. from the same sample in a separate jar.

**Etymology.** After the type locality, noun in apposition.

**Description.** Slight blue-grey colour dorsally, distinctly demarcated cream ventrally. Prostomium proepilobous, peristomium ridged. Length 110 mm. Segments 210.

Clitellum unclear. Dorsal pores absent. Nephropores well above d-lines towards mid-D on each side, most obvious from 12 onwards. Setae small and closely paired. Spermathecal pores in atria in 7/8 near c-lines. Male pores on 10/11 invaginated in bc-lines. Genital markings are postsetal, faintly on 7 above spermathecal pores; mid-ventral on 10 and paired on 11 in c-lines. Distinct equatorial indentations are on 10 and 11 either side of the male pores in 10/11. Female pores are paired anteriorly near b-lines in 12.

Septa 5/6-8/9 are thick. Low, sessile glands correspond to markings in 7 and much larger glands cover markings in 11 crossing 10/11 on each side (not present in mid-10). No atrium nor glands found near spermathecal pores in 8. Spermathecae on long, convoluted ducts in 8. Convoluted vasa deferentia go to body wall under GM glands on each side from testis sacs in 9/10, but no prostates present and penes if present, small. Ovisacs (empty) are elongated from ovaries in 11/12 extending to 16. Gizzards



**Fig. 20.** *Drawida odaesan* sp. nov. Holotype (H, DNA HY1) showing ventral anterior and corresponding internal organization, dorsal view of prostomium and a nephridium in segment 16; boxed are the unusual supra-intestinal vascular loops.

are in 13-17 (five of). Dorsal blood vessel is single but has distinctly arching vascular clusters in 18-21 and 24 and these are present in intervening segments and after 24 although not filled with blood. Nephridial bladders are elongate. Gut contains yellow soil without organic matter (geophagous).

**Remarks.** This species is close to *D. nemora* Kobayashi, 1938 that may also have five gizzards, but in 12-16 (as found in *D. jirisanensis* Hong, 2002) rather than 13-17 as here, and its GM markings at least also differ from both these other taxa. According to the DNA data (in Appendix, Fig. 1), *Drawida odaesan* has closest similarity amongst those tested to *D. hattamimizu* Hatai, 1930 which is interesting since it was considered a possible introduced species to Japan. However, it not particular close genetically (just 80-81%) and it differs on many morphological points, such as size and GMs that, combined with the DNA barcode data (Appendix), serve to separate these taxa.

#### 24. *Drawida* sp. 1 “Gaeun”

**Material examined.** IV0000249935 mature specimen 80 mm long, undissected, from under Gaeun Bridge, Munkyeong, Gyungsanbuk, 6<sup>th</sup> April, 2012 collected by RJB; DNA sample WO21 resampled as w13; and WO21 vs w13=603/603 (100%).

**Remarks.** Identified in the field as “*Drawida* cf. *japonica*”. BLAST analysis indicated < 83% for unidentified Megascolecidae, i.e., DNA confirmed but specimen shown no near relationship in Fig. 1 and is quite anomalous. Further work is required.

#### 25. *Drawida* sp. 2 “Jeju1”

*Drawida* sp. 1 (cf. *D. a. seogwipo*) Blakemore, 2013: 21.

**Material examined.** IV0000261227 posterior amputee specimen collected on walk to Botanic Gardens Seogwipo during IUCN meeting (trip kindly organized by Dr Yeong-Seok Jo) 9<sup>th</sup> Sept. 2012 by RJB (providing DNA sample WO70); plus IV000261229 two complete and fragments with same collection details.

**Remarks.** As noted by Blakemore (2013a), seemingly closest or same as *D. a. seogwipo*. DNA data are provided in the Appendix.

#### 26. *Drawida* sp. 3 “Jeju2”

*Drawida* sp. 2 (cf. *D. koreana*) Blakemore, 2013: 21.

**Material examined.** IV0000249942 mature specimen 80 mm long, undissected, from under bridge on Rt. 516, Mt Halla, 12<sup>th</sup> June, 2012 collected by RJB, (DNA sample WO44 was mixed in the lab, resampled as w17). IV0000249943, two similar semi-matures undissected, possibly

the same taxon, from the same location.

**Remarks.** As noted by Blakemore (2013a), because these specimens were blue coloured they were considered similar to *Drawida koreana* but DNA indicates distant relationship and, on current information, they may be separated from other similar taxa. They remain unidentified pending analysis of *D. koreana* from the mainland. DNA data in the Appendix show wide separation from other Jeju samples, possibly indicating an exotic introduced to the island.

#### 27. *Drawida* sp. 4 “Sammock”

**Material.** Specimen IV0000250891 (DNA WO33), mature specimen, 1<sup>st</sup> May, 2012, from Sammock ferry harbor (GPS 37.499135, 126.450723) on Yeongjongdo, the island on which Incheon airport is situated, collector RJB.

**Description.** Blue-grey colour with tip of tail thinner and reddish (region of growth or regeneration?).

**Remarks.** Yet to be fully described, its DNA indicates a potential new species.

#### 28. *Drawida* sp. 5 “Munsan”

**Material.** Specimens: IV0000261236-7 an immature blue specimen (DNA sample w39) and a mature pale specimen (providing DNA sample w40 that was contaminated in the genetics lab), from Munsan (ca. 37.854398, 126.787945) in Paju-si, Gyeonggi-do, South Korea on the south bank of the Imjin River, close to the edge of the DMZ and to Panmunjom, collector RJB 18<sup>th</sup> July, 2012.

**Description.** Blue colour immature specimen and mature pale specimen with insufficient material and inconclusive DNA results.

**Remarks.** Resources are presently unavailable to complete this description, but DNA data indicates another potentially new species (Appendix, Fig. 1).

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[For brevity, not all taxonomic authorities appended to species binomials are cited here].

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NNATAATTGGTGCAGGCATGAGGTTATTAATTTCGAATTGAGTTAAGGC  
 AACCAGGTTCAATTTTAGGTAGAGATCAGCTTTACAACACTATTGTTACTNN  
 NNN  
 ACTAAATAATTTAAGATTTTGCCTCTCCCTGACCTAATTTCTTTAGTGCTTCGGCAGCAGTGGAAGGTTGCTGGTA  
 CTGGGTGAACAGTTTACCCACCTTAGCTAGTAATTTAGCACATGCGGGCCCATCTGTTGACTTGGCGATTTTTTCTTTACAT  
 TTAGCAGGTGCTTCTTATTTTAGGGGCAATTAATTTTATTACGACTATTATTAACATGCGCTGAGCAGGTATACACTTTGA  
 GCGAATTCCATTATTGTGTGGGGAGTTTTAATTACTGTTNN  
 NNN  
 NNNNNNNNNNNNN

Blast: *Drawida japonica* voucher LBM12800000x4 cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial Identities= 320/320 (100%).

> JET101-11|LBM FY2010-22.3|*Drawida* "*ashiuranoeri*"|COI-5P

GACTCTTATTTTATTTTAGGTGTTTGGAGCTGGAATAATTGGTGCAGGCATGAGGTTATTAATTTCGAATTGAGTTAAGGCAAC  
 CAGGTTCAATTTTAGGTAGAGATCAGCTTTACAACACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTGGTAATAC  
 CGGTATTTATTGGCGGTTTTGGTAATTGATTGCTCCCATTAATACTTGGTGCCCCAGATATGGCTTTTCTCCTCGACTAAATAAT  
 TTAAGATTTTACTTTTGCCTCTGCCCTAATTTCTTTTACTGCTTCGGCAGCAGTGGAAGGTTGCTGGTACTGGGTGAAC  
 AGTTTACCCACCTTAGCTAGTAATTTAGCACATGCGGGCCCATCTGTTGACTTGGCGATTTTTTCTTTACATTTAGCAGGTG  
 CTTCTTCTATTTTAGGGGCAATTAATTTTATTACGACTATTATTAACATGCGCTGAGCAGGTATACACTTTGAGCGAATTCCA  
 TTATTTGTGTGGGGAGTTTTAATTACTGTGGTACTATTGCTTCTATCTTTACCTGTGTTGGCTGGCGCAATTACTATGCTTTTA  
 ACCGATCGAAATTTAAATACTTCATTTTTTGTATCCGGCTGGTGGAGGAGATCCTATTTTGTATCAACATTTGTTT

BLAST *Drawida japonica* voucher LBM1280000 615/615 (100%)

BLAST JET101 vs. JET116-01=658/658 (100%)

BLAST JET101 vs. JET007-01=320/320 (100%).

> JET102-11|LBM FY2010-22.4|*Drawida* "*ashiuranoeri*"|COI-5P

GACTCTTATTTTATTTTAGGTGTTTGGAGCTGGAATAATTGGTGCAGGCATGAGGTTATTAATTTCGAATTGAGTTAAGGCAAC  
 CAGGTTCAATTTTAGGTAGAGATCAGCTTTACAACACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTGGTAATAC  
 CGGTATTTATTGGCGGTTTTGGTAATTGATTGCTCCCATTAATACTTGGTGCCCCAGATATGGCTTTTCTCCTCGACTAAATAAT  
 TTAAGATTTTACTTTTGCCTCTGCCCTAATTTCTTTTACTGCTTCGGCAGCAGTGGAAGGTTGCTGGTACTGGGTGAAC  
 AGTTTACCCACCTTAGCTAGTAATTTAGCACATGCGGGCCCATCTGTTGACTTGGCGATTTTTTCTTTACATTTAGCAGGTG  
 CTTCTTCTATTTTAGGGGCAATTAATTTTATTACGACTATTATTAACATGCGCTGAGCAGGTATACACTTTGAGCGAATTCCA  
 TTATTTGTGTGGGGAGTTTTAATTACTGTGGTACTATTGCTTCTATCTTTACCTGTGTTGGCTGGCGCAATTACTATGCTTTTA  
 ACCGATCGAAATTTAAATACTTCATTTTTTGTATCCGGCTGGTGGAGGAGATCCTATTTTGTATCAACATTTGTTT

> JET105-11|An-449.1|*Drawida nemoral* nil result on older, foralin material.

> JET106-11|An-449.2|*Drawida nemoral* nil

> JET107-11|An-450|*Drawida nemoral* nil

> JET116-11|An-462.1|*Drawida cf. japonical*|COI-5P

GACTCTTATTTTATTTTAGGTGTTTGGAGCTGGAATAATTGGTGCAGGCATGAGGTTATTAATTTCGAATTGAGTTAAGGCAAC  
 CAGGTTCAATTTTAGGTAGAGATCAGCTTTACAACACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTGGTAATAC  
 CGGTATTTATTGGCGGTTTTGGTAATTGATTGCTCCCATTAATACTTGGTGCCCCAGATATGGCTTTTCTCCTCGACTAAATAAT  
 TTAAGATTTTACTTTTGCCTCTGCCCTAATTTCTTTTACTGCTTCGGCAGCAGTGGAAGGTTGCTGGTACTGGGTGAAC  
 AGTTTACCCACCTTAGCTAGTAATTTAGCACATGCGGGCCCATCTGTTGACTTGGCGATTTTTTCTTTACATTTAGCAGGTG  
 CTTCTTCTATTTTAGGGGCAATTAATTTTATTACGACTATTATTAACATGCGCTGAGCAGGTATACACTTTGAGCGAATTCCA  
 TTATTTGTGTGGGGAGTTTTAATTACTGTGGTACTATTGCTTCTATCTTTACCTGTGTTGGCTGGCGCAATTACTATGCTTTTA  
 ACCGATCGAAATTTAAATACTTCATTTTTTGTATCCGGCTGGTGGAGGAGATCCTATTTTGTATCAACATTTGTTT

> JET117-11|An-462.2|*Drawida cf. japonical*|COI-5P

GACTCTTATTTTATTTTAGGTGTTTGGAGCTGGAATAATTGGTGCAGGCATGAGGTTATTAATTTCGAATTGAGTTAAGGCAAC  
 CAGGTTCAATTTTAGGTAGAGATCAGCTTTACAACACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTGGTAATAC  
 CGGTATTTATTGGCGGTTTTGGTAATTGATTGCTCCCATTAATACTTGGTGCCCCAGATATGGCTTTTCTCCTCGACTAAATAAT  
 TTAAGATTTTACTTTTGCCTCTGCCCTAATTTCTTTTACTGCTTCGGCAGCAGTGGAAGGTTGCTGGTACTGGGTGAAC  
 AGTTTACCCACCTTAGCTAGTAATTTAGCACATGCGGGCCCATCTGTTGACTTGGCGATTTTTTCTTTACATTTAGCAGGTG  
 CTTCTTCTATTTTAGGGGCAATTAATTTTATTACGACTATTATTAACATGCGCTGAGCAGGTATACACTTTGAGCGAATTCCA  
 TTATTTGTGTGGGGAGTTTTAATTACTGTGGTACTATTGCTTCTATCTTTACCTGTGTTGGCTGGCGCAATTACTATGCTTTTA  
 ACCGATCGAAATTTAAATACTTCATTTTTTGTATCCGGCTGGTGGAGGAGATCCTATTTTGTATCAACATTTGTTT

> JET171-11|Berlin 2122|*Drawida japonical* nil

> JET172-11|LBM138000078|*Drawida hattamimizul* nil

> JET177-11|LBM138000083|*Drawida hattamimizul*|COI-5P

AACACTATATTTCAATTTTAGGTGTATGAGCTGGAATAATCGGGGCTGGTATAAGACTTCTTATTTCGAATTGAACTAAGACAG  
 CCTGGAACATTTTAGGGAGTGATCAGTTATATAACTATTGTTACAGCACATGCATTTATATAATTTTTCTTCTTAGTTAT



ACCAGTATTTATTGGGGGGTTTGGTAACTGACTTCTTCCTTTAATACTGGGGGCACCAGATATAGCATTCCACGACTTAATA  
 ATTTAAGATTTTGGATTACTTCCACCATCTTTAATTTTATTAGTTTCTCAGCTGCTGTTGAAAAGGGGGCAGGAACAGGTTGA  
 ACTGTATACCCCATAGCCAGAAATATTGCACATGCTGGTCCGTCGGTAGACCTAGCTATTTTTCTCTTCATTGGCAGG  
 TGCCTCATCTATCTTAGGAGCTATTAATTTTATTACAACAGTGATTAATATACGATGAGCTGGACTCCAGTTAGAGCGTATTC  
 CACTTTTTGTGTGGGGAGTATTTATCACTGTAATTTCTTCTTTTATCTCTCCAGTATTAGCCGGAGCCATTACAATACTAC  
 TAACAGATCGTAATTTAAATACATCATTTTTTTGACCCTGCTGGTGGGGGCGATCCTATTTTATACCAACATCTATTT

> WM8 Korea 1<sup>st</sup> Survey site #3 *Drawida cf. barwelli* dissected [BLAST=spider contamination] redone as WO10.

> WO10 (redo of WM8) *Drawida cf. barwelli* from Korea

AACACTATATTTTATTTTGGGTGTCTGGGCAGGCATAGTTGGAGCCGGCATAAGGATATTAATTCGTATTGAGCTTAGGCAA  
 CCCGGCACATTTTGGGAAGCGATCAATTATATAACACTATTGTAAGTGGCATGCTTTTATTATAATTTTCTTTTTAGTGAT  
 GCCTGTGTTTATTGGGGGCTTTGGAAATTGGTTGCTACCTCTGATGCTGGGAGCACCAGATATAGCTTTCCCGTTTAAATA  
 ATTTAAGATTTTGGATTACTTCTCCGCCCCCTATTTTATTAGTTTCTTCTGCTATAGTAGAAAAGGGGGCAGGCACTGGTTGA  
 ACTGTGTATCCCTCCCTAGTAATATGGTCCAGCAGTCTTCTGTTGACTTAGCTATTTTTCTTGCATTTAGCGGGT  
 GCATCTTCCATTCTAGGATCATTAATTTTATTACCAGCTTATTAATATGCGATGAGTTGGAATGAATATGGAGCGCTCCC  
 ATTTATTGTATGGGGGTTTAAATTACTGTAATTTCTTTTATTATCTTTACCCGACTAGCGGGTGAATCACTATGCTTTT  
 AACAGATCGAAACCTAAATACCTTCAATTTTCGATCTCGGGAGGAGGGGATCCAATTTATATCAGCACTTATTTT  
 BLAST WO10 vs. WM8 Identities=658/658 (100%), i.e., same taxon! (See w2 & w3 too). BLAST of WO10 vs. >LK186-1871*Drawida*-  
*eda*-Holotype; Identities=651/660 (99%), i.e., 9 from 660 bases differ, showing high similarity.

> WO17b redo of Jeju #1 pale *A. caliginosa*

TTTATTTTAGGTGTATGAGCTGGGATAATTGGTGGCGGAATGAGGCTATTAATTCGAATTGAGTTAAGACAACCAGGTTTCGT  
 TTTAGGCAGAGATCAGCTTTATAACTATTGTTACTGCACATGCTTTTATTATAATTTTTCTTAGTAATACCCGATTTA  
 TTGGTGGCTTTGGTAATTGATTATTACCCTAATACTTGGGGCTCCAGACATGGCTTTCCCTCGACTTAATAATTTAAGATTT  
 TGGCTTACCAGCGGCTTTAATTTAGTGTGCTGAGCAGCAGTGGAAAAGGGTGTGTTACCGGGTGAACAGTTTATC  
 CGCCTCTGGCTAGTAATTTAGCACATGCGGGCCATCAGTGCAGCTAGCGATTTTTCTTTACATTTGGCAGGAGCATCTCT  
 ATTTTAGGGGCCACTAATTTTATTACAAGTATTAAACATACGATGGGTTGGCATACTTTGAGCGAATTCGCTATTTCGT  
 GTGGGGAGTTTAAATTACTGTAGTACTATTACTTCTATCTTTGCCTGTGTTGGCCGGCGCAATTACTATGCTTTTAAACCGATC  
 GAAACTTAAATACCTTCAATTTGATCCGGCCGAGGCGGAGACCCTATTTTATACCAGCATT  
 BLAST “99% *Drawida* sp. Watarase” i.e. mixed sample again! – maybe first WO17a is correct. Data is same as WO28 *D. koreana* from  
 Shindo and WO32a “*P. sanctaehelena*” types! I.e., earthworm sample of unknown origin mixed in genetics lab.

> WO21 Korea 3<sup>rd</sup> Survey 6<sup>th</sup> April, 2012 *Drawida cf. japonica* under bridge in town #3 – redone as w13!

CGCCGCTGCTGGATCAAAGAAGGATGTGTTTAAATTACGATCTGTTAAAAGCATAGTAATTGCTCCAGCTAAAACAGGCA  
 GCGATAAAAGTAAAAGTACTACAGTGATTAATACTCCCAATACAAATAAAGGAATACGTTCAAAATGTATACCTACTCAAC  
 GTATATTAATTACAGTTGTAATAAAATTAATTGCTCCTAAAATAGAAGAGGCTCCAGCTAAATGAAGAGAAAAAATTGCCA  
 AGTCTACAGATGGACCGCGTGAGCCAAATTAAGTGTGTTGATAAACTGTTTATCCTGTACCTGCACCTTTTCCAC  
 TGCAGCAGAAGAAACCAGAAGAATTAGGGCGGAGGCAACAGTCAAAAATCTCAAGTTATTAGGCTGGAAAGCTATAT  
 CAGGAGCCCCAATATAAGAGGAAGAAGTCAATTTCCAAATCCACCAATAAAATACTGGTATAACTAAGAAGAAAAATTATAA  
 TAAATGCATGAGCAGTTACAATAGTATTATAAAGTTGATCTCTACCAAGAAAAGCACCAGGTTGTCTTAACTCAATTTCGAAT  
 TAAAAGTCTTATACCTGCTCCAATTATCTGCTC  
 BLAST no better than 83% for random megadriles or 81% for *D. hattamimizu*.

> WO22 NIBR 3<sup>rd</sup> April fat *Drawida no penis* – redone!

CAAAACAAATGCTGATATAAAATAGGGTTCGAGACGGAAAAACACCGGGGGGAAAAAAACTTTAAATTTTCGATCAGTTAA  
 AAGCATAGTAATTGCACCAGCTAGCACGGGTAAGATAAAAGTAATAGTACTACAGTAATTAATAACTCCTCACACAAATAA  
 TGGAAATTCGTTCAAAGTGTATACCCACTCAACGCATATTAATAACAGTTGTAATAAAATTAATAGCTCCTAAAATAGAAGAT  
 GCACCCGCAAGTGTAAAGAAAAATCGCCAAATCAACAGATGGGCTGCTGCTAAATTAAGTCCAGTGGGGGATAA  
 ACTGTTTATCCGGTACCAGCACCTTTTCCACTGCTGCTGATGATACTAACAGAATCAAGCCGGCGTGGAAAGTCAAAATC  
 TTAATTTAATTAAGTTCGAGGGAAAGCCATGCTGGGGCACCAAGTATTAAGGTTAGCAATCAATTACCAAAGCCGCAATAA  
 ATACAGGCATTACCAAGAAAAAATTATAATAAAGCATGTGCAGTAACAATAGTATTATAAAGCTGATCCCTACCTAAAA  
 ATGAACCCGGTTGTCTTAACTCAATTTCGAATTAATAGTCTCATACCCGCACCAATTAATTCGGCTCACACACCTAAAATAA  
 ATAAAGAGTCC

BLAST no better than 97% for Genbank AB592437 an unidentified Japanese *Drawida* or 90% for Genbank GQ500902 my *D. japonica*  
 from Biwa.

BLAST WO22 vs. WO27 (*D. koreana shindo*) Identities=640/658 (97%); WO22 vs WO23 (*D. koreana austri*)=596/660 (90%).

Note: Reverse complements needed for MEGA5 or Geneious 6 alignment.

> WO23 NIBR 3<sup>rd</sup> April thin, longer *Drawida* small penis

ACTCTTTATTTTATTTAGGTGTGTGGGCCGGTATAATTGGCGCCGGCATGAGACTATTAATTCGAATTGAGTTAAGACAGCC  
 GGGCTCATTTTATAGGTAGATCAGCTTTATAACTATTGTTACTGCACATGCTTTTATTATAATTTTTCTTTAGTAATGCC  
 CGTATTTATTGGTGGCTTTGGTAATTGATTGCTACCTTTAATGCTTGGTGGCCAGACATGGCTTTTCTCGACTAAAATAATTT  
 AAGATTTTACTTTTACCTCCGGCCTTGATCCTATTAGTATCTTCAGCAGCAGTGGAAAAGGGGGCCGGTACCGGATGAACA  
 GTTTATCCTCCGCTAGCTAGTAATTTAGCACATGCAGGTGCATCTGTTGATCTGGCAATTTTTCTTTACACTTAGCAGGTGC

ATCTTCTATTTTAGGGGCTATTAATTTTATTACAACCTGTTATTAATATGCGTTGAGTGGGCATGCATTTTGAACGAATTCCAT  
TATTTGTATGGGGAGTTTAAATTACTGTAGTATTACTACTTCTATCTTTGCCCGTGTAGCTGGTGAATTACTATGCTTTTAA  
CTGACCGAAATTTAAACTTTCATTCTTCGACCCCGCTGGCGGAGGCGATCCTATTTTATATCAACATTTATTT

BLAST no better than 92% for Japanese *Drawida* sp. or 88% for my Biwa *D. japonica*; WO22 vs WO23=Identities=596/660 (90%),  
Gaps=6/660 (1%) i.e. different taxa. Cf. WO23 vs. WO28 – Id=569/651 (87%) also different. See WO27 & WO28 & WO32-1 too.

> WO27 Shindo 4<sup>th</sup> May, 2012 *Drawida cf. japonica* pale

TCTTTATTTTATTTTAGGTGTGTGAGCCGGAATAATTGGTGCGGGTATGAGACTATTAATTCGAATTGAGTTAAGACAACCG  
GGTTCATTTTATTTAGGTAGGATCAGCTTTATAATACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTGGTAATGCCT  
GTATTTATTGGCGGCTTTGGTAATTGATTGCTACCTTAATACTTGGTGGCCAGACATGGCTTTCCCTCGACTTAATAATTT  
AAGATTTTGACTTTTGGCGCCGCTTGATTCTGTTAGTATCATCAGCAGCAGTGGAAAAAGGTGCTGGTACCGGATGAACA  
GTTTATCCCCACTGGCTAGTAATTTAGCACATGCAGGCCATCTGTTGATTGGCGATTTTTTCTTTACACTTGGCGGGTGC  
ATCTTCTATTTTAGGAGCTATTAATTTTATTACAACCTGTTATTAATATGCGTTGAGTGGGTATACACTTTGAACGAATTCCAT  
TATTTGTGTGAGGAGTTTAAATTACTGTAGTACTATTACTTTTATCTTTACCCGTGCTAGCTGGTGAATTACTATGCTTTTAA  
CTGATCGAAATTTAAACTTTCATTCTTCGACCCAGCTGGTGGGGCGACCTATTTTATATCAGCATTGT

BLAST 99% unid *Drawida* sp. from Japan, cf. WO22 & WO23.

> WO28 Shindo 4<sup>th</sup> May, 2012 *Drawida cf. koreana* Shindo sp. 2 blue

TCTTTATTTTATTTTAGGTGTATGAGCTGGGATAATTGGTGCGGGAATGAGGCTATTAATTCGAATTGAGTTAAGACAACCA  
GGTTCGTTTTTATTTAGGCAGAGATCAGCTTTATAATACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTAGTAATACCC  
GTATTTATTGGTGGCTTTGGTAATTGATTACTTACCCTTAATACTTGGGCTCCAGACATGGCTTTCCCTCGACTTAATAATTT  
AAGATTTTGGCTCTTACCGCCGCTTTAATTTCTTTTAGTGTGCTCAGCAGCAGTGGAAAAAGGTGCTGGTACCGGGTGAACA  
GTTTATCCGCTCTGGCTAGTAATTTAGCACATGCGGGCCCATCAGTCGACCTAGCGATTTTTTCTTTACATTTGGCAGGAGC  
ATCCTCTATTTTAGGGGCCACTAATTTTATTACAACCTGTTATTAACATACGATGGGTGGCATAACACTTTGAGCGAATTCCGC  
TATTCGTGTGGGAGTTTAAATTACTGTAGTACTATTACTTCTATCTTTGCCTGTGTTGGCCGGCGCAATTACTATGCTTTTAA  
CCGATCGAAACTTAAACTTTCATTCTTTGATCCGCGCGAGGCGGAGACCTATTTTATACCAGCATTGT

BLAST 99% Watarase *Drawida* of < 89% my *D. japonica* from Biwa

BLASTn WO27 vs. WO28=Identities=582/653 (89%), i.e. different spp.

> WO32-1 BMNH *P. sanctaehelenae* type – MIXUP with WO32+CONTAMINATION as=100% *Drawida* same as WO28! and 81% to  
WO33

CTCTTATTTTATTTTAGGTGTATGAGCTGGGATAATTGGTGCGGGAATGAGGCTATTAATTCGAATTGAGTTAAGACAACC  
AGGTTTCGTTTTTATTTAGGCAGAGATCAGCTTTATAATACTATTGTTACTGCACATGCTTTTATATAATTTTTTCTTAGTAATACC  
CGTATTTATTGGTGGCTTTGGTAATTGATTATTACCCTTAATACTTGGGGCTCCAGACATGGCTTTCCCTCGACTTAATAATTT  
AAGATTTTGGCTCTTACCGCCGCTTTAATTTCTTTTAGTGTGCTCAGCAGCAGTGGAAAAAGGTGCTGGTACCGGGTGAACA  
GTTTATCCGCTCTGGCTAGTAATTTAGCACATGCGGGCCCATCAGTCGACCTAGCGATTTTTTCTTTACATTTGGCAGGAGC  
ATCCTCTATTTTAGGGGCCACTAATTTTATTACAACCTGTTATTAACATACGATGGGTGGCATAACACTTTGAGCGAATTCCGC  
TATTCGTGTGGGAGTTTAAATTACTGTAGTACTATTACTTCTATCTTTGCCTGTGTTGGCCGGCGCAATTACTATGCTTTTAA  
CCGATCGAAACTTAAACTTTCATTCTTTGATCCGCGCGAGGCGGAGACCTATTTTATACCAGCATTGT

> WO33 *Drawida cf. koreana* “Sammock” coll. Sammock, 1<sup>st</sup> May, 2012 by RJB

CATTATATTTTATTTTAGGCGTATGAGCTGGTATAATTGGTGTGCTGGAATAAGTCTTCTTATTCGTATTGAATTAAGACAACCC  
GGAACTTTTTATTTAGGCAGAGATCAACTTTATAATACTATTGTTAACTGCTCATGCTTTTATATAATTTTTTCTTTTAGTAATACCA  
GATTTTATTGGAGGATTTGGAACCTGATTATTACCATTAACTTGGAGCTCCTGATATAGCATTCCCGCAGCTTAATAATCT  
TAGATTTTGGCTCTTCCCGAGCTCTTATTTTATTAGTCTCTTCAGCAGCAGTGGAAAAAGGAGCTGGTACCGGATGAACAG  
TATATCTCCTTTAGCTAGAAATATTGCCATTTGCCCCATCAGTAGATCTTGCTATTTTTTCTTTACACTTAGCTGGTGCAT  
CATCAATTTTAGGGGCTATTAACCTTTATTACAACAGTTATTAATATACGATGAACCGGTTTACAATTGGAACGAATTCCTCTA  
TTTGTATGGGCAGTATTTATTACAGTAATCTTCTTTTATCTCTCCAGTCTTGCAGGAGCCATTACCATACTATTAACA  
GACCGAAATCTTAATACATCTTTTTTTGATCCTGCAGGAGGAGGAGATCCAATTCCTATCAACACCTATTTT

BLAST – nothing similar! Cf. *Drawidas* above.

> WO44 “*Drawida cf. koreana*” Jeju #2 june 2012 – BLAST 94% some LUMBRICIDS – MIXED! This barcode data is the same as for  
w18b for *Eisenia japonica* from Jeju (cf. WO45). Redone as w17.

> WO45 *Eisenia japonica* Jeju #2 june 2012 ? SAMPLE MIXED IN LAB.

TTATATTTTATTTTAGGTGTGTGGGCGAGGTATAATTGGTGTGCTGGATAAGTCTTTTGGATTCCGATTGAATTAAGACAGCCTGG  
CTCATTTTTTGGGAAGCGATCAGCTCTATAATACTATTGTTACTGCTCATGCTTTTCGTTATAATTTTTTCTTGTAAATACCTGT  
ATTTATTGGTGGCTTCGAAATTTGACTTCTTCTTATACTAGGGCTCCGGATATAGCATTCCCAGTCTTAATAATCTGA  
GATTTTGGCTATTGCCCCAGCATTAATTTCTTTTAGTTTCTTCCGCGCAGTGGAAAAAGGTGCTGGTACTGGGTGAACAGT  
ATACCCACCGCTAGCAAGCAACCTGGCTCACGCCGCTCCCTCAGTTGATTTAGCAATTTTTTCTTCTTCAATTTAGCAGGAGCGT  
CTTCAATTTTGGGCTCAATTAATTTTATTACAACCTGTAATTAATATGCGATGATCTGGGATAAATGTAGAGCGAATTCCACTA  
TTTGTGTTGAGGTGATGTTACTGTAGTACTTTTATTATCTTCTTCCGGTTTTAGCGGGAGCAATTACTATGCTTTTGA  
GATCGAAATCTGAATACGCTTTCTTCGATCCTGCCGTTGGTGGAGACCAATTTCTGTATCAGCACTT

BLAST nothing better than 82% for some Moniligastrid ? MIXED [WO45 vs. WO28 Identities=516/648 (80%), i.e., “*D. cf. koreana*” is  
different species]. Sample “WO45” was mixed in the genetics lab probably with WO44 or WO46. Redone as w18b.

> WO46 *Drawida halla* Jeju #2 june, 2012 BLAST=*Amyntas corticis* - MIXED! Sample "WO46" was mixed in genetics lab probably with WO47 (or with WO50). Redone as w24.

> WO68 *Drawida iucn* H

GGTCAACAAATCATAAAGATATTGGAACCTTTATATTTTCAATTTTAGGTGTGTGGGCAGGTATAATTGGTGCTGGTATGAGTCT  
TTTGATTTCGGATTGAACTAAGACAGCCTGGCTCTTTTTTGGGAGTGATCAGCTCTATAATACTATTGTTACTGCTCATGCTT  
TCGTTATAATTTTTTTCTTGTAAATACCTGTATTTATGGTGGATTTCGAAATTGACTTCTTCTCTTATATTAGGAGCACCGG  
ATATAGCATTTCCACGCTCTTAATAATCTGAGATTTTGGACTATTGCCCCAGCATTAAATTTCTTTAGTTTCTTCGGCAGCAGTG  
GAAAAAGGTGCTGGTACTGGGTGAACAGTATACCCGCCGTAGCAAGAAACCTGGCTCACGCCGGTCCCTCAGTTGATTTA  
GCAATTTTTTCTTCAATTTAGCAGGGGCATCTTCAATTTTGGGCTCTATTAATTTTATTACAACCTGTAATTAATATACGATGA  
TCTGGGATAAATGTAGAACGAATCCACTATTTGTTGAGGTGTAGTTATTACTGTAGTATTACTTTTACTATCTCTTCCAGTT  
TTAGCAGGGGCAATTACTATGCTTTTGACAGATCGAAATCTGAATACGTCTTCTTTCGATCCTGCCGGCGGTGGTGACCCAA  
TTTTGTACCAGCACTATTTTGATTTTTTGGTCACCCTGAAGTTTA

BLAST moniligastridae 81%. WO68 vs. WO69 - Identities=686/709 (97%). Diff sp? [Cf WO46? or rather vs. WO45 mixed Identities =625/650 (96%), i.e., different species?]. Cf. HY18.

> WO69 *Drawida seogwipo* H

GGTCAACAAATCATAAAGATATTGGAACCTTTATATTTTATTTTACGTGTGTGGGCAGGTATAATTGGTGCTGGTATAAGTCTT  
TTGATTTCGGATTGAAATTAAGACAGCCTGGCTCATTTTTTGGGAAGCGATCAGCTCTATAATACTATTGTTACTGCTCATGCTTT  
CGTTATAATTTTTTTCTTGTAAATACCTGTATTTATGGTGGCTTCGGAATTTGACTTCTTCTCTTATATTAGGGGCTCCGGA  
TATAGCATTTCCACGCTCTTAATAATCTGAGATTTTGGCTATTGCCCCAGCATTAAATTTCTTTAGTTTCTTCGGCAGCAGTG  
AAAAAAGGTGCTGGTACTGGGTGAACAGTATACCCGCCGTAGCAAGCAACCTGGCTCACGCCGGTCCCTCAGTTGATTTAG  
CAATTTTTTCTTCAATTTAGCAGGAGCGTCTTCAATTTTGGGCTCTATTAATTTTATTACAACCTGTAATTAATATGCGATGAT  
CTGGGATAAATGTAGAGCGAATCCACTATTTGTTGAGGTGTAGTTATTACTGTAGTATTACTTTTATTATCTCTTCCGGTTT  
TAGCGGGAGCAATTACTATGCTTTTGACAGATCGAAATCTGAATACGTCTTCTTTCGATCCTGCCGGCGGTGGAGATCCAAT  
TTTTGTATCAGCACTATTTTGATTTTTTGGTCACCCTGAAGTTTA

BLAST moniligastridae < 81%? [Cf WO46? or rather WO45 mixed sample, Identities=642/650 (99%), i.e., perhaps same as WO70?]

> WO70 *Drawida* sp 1 from Jeju

GGTCAACAAATCATAAAGATATTGGAACCTTTATATTTTATTTTAGGTGTGTGGGCAGGAATAATTGGTGCTGGTATAAGTCT  
TTTGATTTCGGATTGAAATTAAGACAGCCTGGCTCTTTTTTGGGAAGCGATCAGCTCTATAATACTATTGTTACTGCTCATGCTT  
TCGTTATAATTTTTTTCTTGTAAATACCTGTATTTATGGTGGCTTCGGAATTTGACTTCTTCTCTTATATTAGGGGCTCCGG  
ATATAGCATTTCCACGCTCTTAATAATCTGAGATTTTGGCTATTGCCCCAGCATTAAATTTCTTTAGTTTCTTCGGCAGCAGTG  
GAAAAAAGGTGCTGGTACTGGGTGAACAGTATACCCGCCGTAGCAAGCAACCTGGCTCACGCCGGTCCCTCAGTTGATTTA  
GCAATTTTTTCTTCAATTTAGCAGGAGCGTCTTCAATTTTGGGCTCTATTAATTTTATTACAACCTGTAATTAATATGCGATGA  
TCTGGGATAAATGTGGAGCGAATCCACTATTTGTTGAGGTGTAGTTATTACTGTAGTATTACTTTTATTATCTCTTCCGGTT  
TTAGCGGGGGCAATTACTATGCTTTTGACAGATCGAAATCTGAATACGTCTTCTTTCGATCCTGCCGGCGGTGGAGACCCAA  
TTTTGTATCAGCACTATTTTGATTTTTTGGTCACCCTGAAGTTTA

BLAST Genbank some moniligastridae from Japan no better than 82%.

WO70 vs. WO69 (*D. seogwipo*) - Identities=702/709 (99%) [same-sp?].

WO70 vs. W24 (*D. halla*) - Identities=647/658 (98%) [differs slightly].

[Cf WO46? or rather WO45 mixed, Identities=639/650 (98%) - see WO69].

> w2 Survey site #3 ?*Moniligaster beddardii* Rosa, 1890, synonym of already published Korean *D. barwelli*?

AACACTATATTTTATTTTGGGTGTCTGGGCAGGCATAGTTGGAGCCGGCATAAGGATATTAATTCGTATTGAGCTTAGGCCAA  
CCCGGCACATTTTTGGGAAGCGATCAATTATATAAACAATTTGTAAGTGCATGCTTTTATTATAATTTTCTTTTTAGTGAT  
GCCTGTGTTTATTGGGGGCTTTGGAAATTTGGTTGCTACCTCTGATGCTGGGAGCACCAGATATAGCTTTTCCCGTTTAAATA  
ATTTAAGATTTTGATTACTTCCCTCCGGCCCTATTTTATTAGTTTCTTCTGCTATAGTAGAAAAGGGGGCAGGCAGCTGGTTGA  
ACTGTGTATCCTCCCCTAGCTAGTAATATGGCTCACGCAGGTCCTTCTGTTGACTTAGCTATTTTTTCTTTCGATTTAGCGGGT  
GCATCTCCATTCTAGGATCATTAAATTTTCAATTTACCACCGTTATTAATATGCGATGAGTTGGAATGAATATGGAGCGCGTCCC  
ATTATTTGTATGGGGGGTTTTAATTACTGTAATTTCTTTTATTATTATCTTTACCCGTACTAGCGGGTGAATCACTATGCTTTT  
AACAGATCGAAACCTAAATATTTTCAATTTTTCGATCCTGCGGGAGGAGGGGATCCAATTTTATATCAGCACTTATTT

BLAST 77% *Paraplectana tsushimensis* spider! w2 vs WM8 Identities=657/658 (99.9%); w2 vs. WO10 Identities=657/658 (99%). SO CAN GET < 100% agreement from same samples. But, WM8 vs. WO10 Identities=658/658 (100%) so maybe good!

> w3 Survey site #3 ?*Moniligaster beddardii* Rosa, 1890 syn. of *D. barwelli*.

AACACTATATTTTATTTTGGGTGTCTGGGCAGGCATAGTTGGAGCCGGCATAAGGATATTAATTCGTATTGAGCTTAGGCCAA  
CCCGGCACATTTTTGGGAAGCGATCAATTATATAAACAATTTGTAAGTGCATGCTTTTATTATAATTTTCTTTTTAGTGAT  
GCCTGTGTTTATTGGGGGCTTTGGAAATTTGGTTGCTACCTCTGATGCTGGGAGCACCAGATATAGCTTTTCCCGTTTAAATA  
ATTTAAGATTTTGATTACTTCCCTCCGGCCCTATTTTATTAGTTTCTTCTGCTATAGTAGAAAAGGGGGCAGGCAGCTGGTTGA  
ACTGTGTATCCTCCCCTAGCTAGTAATATGGCTCACGCAGGTCCTTCTGTTGACTTAGCTATTTTTTCTTTCGATTTAGCGGGT  
GCATCTCCATTCTAGGATCATTAAATTTTCAATTTACCACCGTTATTAATATGCGATGAGTTGGAATGAATATGGAGCGCGTCCC  
ATTATTTGTATGGGGGGTTTTAATTACTGTAATTTCTTTTATTATTATCTTTACCCGTACTAGCGGGTGAATCACTATGCTTTT  
AACATGATCGAAA

BLAST 77% *Paraplectana tsushimensis* spider! w2 vs. w3 Identities=594/595 (99%); w3 vs. WM8 Identities=594/595 (99%); w3 vs.

WO10 Identities=594/595 (99% one base different bolded). Ditto w2.

> w13 Korea survey #3 6<sup>th</sup> April “*D. cf. japonica*” under bridge (redo of WO21).

AACTTTATATTTTATTTTAGGGGTGTGAGCAGGAATAATTGGAGCAGGTATAAGACTTTTAAATTCGAATTGAGTTAAGACAA  
CCTGGTGCCTTTCTTGGTAGAGATCAACTTTATAACTATTGTAAGTCTCATGCATTTATTATAATTTTCTTCTTAGTTATA  
CCAGTATTTATTGGTGGATTTGGAAATTGACTTCTTCTCTTATATTGGGGGCTCCTGATATAGCCTTTCCACGCCTAAATAA  
CTTGAGATTTGACTGTTGCCCTCCCGCCCTAATCTTCTGGTTCTTCTGCTGCAGTGGAAAAGGGTGCAGGTACAGGATGAA  
CAGTTTATCCACCTAGCTAGTAATTTGGCTCACGCCGGTCCATCTGTAGACTTGGCAATTTTTTCTTCTTCAATTTAGCTGGA  
GCCTCTTCTATTTTAGGAGCAATTAATTTATTACAAGTGAATTAATATACGTTGAGTAGGTATACATTTTGAACGTATTCC  
TTTATTTGTATGGGGAGTTTTAATCACTGTAGTACTTTTACTTTTATCGCTGCCCTGTTTTAGCTGGAGCAATTACTATGCTTTT  
AACAGATCGTAATTTAAACACATCCTTCTTTGATCCAGCAGGCGGGCGGTGATCCTATTTTATATCAACATTTATTT  
BLAST < 83% for unidentified Megascolecidae. Blast WO21 vs w13=603/603 (100%). Same result so maybe something new or  
anomalous? Specimen not figured and not computed as quite anomalous results.

> w17 *Drawida* sp. 2 (D. cf. koreana) Jeju #2 june 2012 (redo of WO44).

GACTTTATATTTTATTTTAGGTGTGTGAGCTGGTATAAATTGGTCTGGAATAAGCCTACTTATTCGAATTGAGTTAAGGCAGC  
CTGGGGCATTCTAGGAAGTGATCAGCTATAAACACTATTGTTACTGCACATGCTTTTATTATAATTTTCTTCTAGTAATG  
CCTGTTTTTATTGGTGGTTTTGGAAATTGGCTGCTACCACTAATGTTAGGGGCACCAGATATAGCCTTTCCACGGTTAAACAA  
TTAAGGTTTTGACTCTTACCACCCGCACTAATTTATTAGTGTCTTCCGCAGCTGTAGAAAAGGGTGTGGTACTGGTTGAA  
CTGTATACCCCGCTAGCTAGAAACTTAGCTCATGCGGCCCTCTGTTGATTTGGCTATTTTTTCGTTACATTTAGCTGGT  
GCATCTCCATTTTGGGCGCTAATTAACCTTATCACAAGTGTGTAATATGCGATGATCTGGAATGCATTTGGAGCGAATTC  
TTTATTTGTGTAGGGCTAGCTATTACTGTTGTATTACTTTTACTTTCTCTGCCAGTTTTAGCAGGGCGGATTACAATGCTTCT  
GACAGATCGTAATCTTAACTTCTTTTTTCGACCCAGCTGGAGGAGGAGATCCAATTTTATACCAACATTTGTTTC  
BLAST < 80% for unid. Glossoscolecidae.

w17 vs. WO44 Identities=491/647 (76%) – so WO44 was mixed! It is probably a new species as there is no Genbank match.

> w24 *Drawida halla* H (redo of WO46).

AACTTTATATTTTATTTTAGGTGTGTGGGCAGGTATAAATTGGTGTGCTGGTATAAGTCTTTTATTTCGATTGAATTAAGACAGC  
CTGGCTCATTTTTGGGAAGCGATCAGCTCTATAACTATTGTTACTGCTCATGCTTTTCGTTATAATTTTTTTTCTTGTAAATAC  
CTGTATTTATTGGTGGCTTCGGAAATTGACTTCTTCTCTTATACTAGGGGCTCCGGATATAGCATTCCCACGTCTTAATAAT  
CTGAGATTTTGGCTATTGCCCCAGCATTAACTTTTATTAGTTTCTTCCGCAGCAGTGGAAAAGGGTGTGGTACTGGGTGAA  
CAGTATACCAACCCGCTAGCAAGCAACCTGGCTCACGCCGGTCCCTCAGTTGATTTAGCAATTTTTTCTTCTTCAATTTAGCAGGA  
GCGTCTTCAATTTTGGGCTCAATTAATTTTATTACAAGTGTGTAATTAATATGCGATGATCTGGGATAAATGTAGAGCGAATTC  
ACTATTTGTGTAGGTGTAGTTATTACTGTAGTATTACTTTTATTATCTTCTTCCGGTTTTAGCGGGAGCAATTACTATGCTTTT  
GACAGATCGAAATCTGAATACGCTTTTCTTCGATCCTGCCGGTGGTGGAGACCCAATTTCTGTATCAGCACTTATTT  
BLAST < 81% for some Moniligastrid from Japan.

w24 vs. MIXED WO45 - 650/650 (100%) – OK WO46 *Drawida halla* Jeju #2 june, 2012 is same. w24 vs. WO70 Identities=647/658  
(98%), differs slightly.

> w39 IV0000261236 Munsan 18/7/2012 *Drawida* sp blue immature.

TACACTATATTTTATTTTAGGCGTGTGAGCCGGTATAAATCGGTGCTGGTATAAGTCTTCTTATTTCGATTGAATTAAGACAGC  
CCGGAACCTTTTTAGGGAGAGATCAACTTTATAACTATTGTTACTGCTCATGCTTTTATTATAATCTTCTTTTATAGTAATAC  
CAGTATTTATTGGAGGATTTGGAAACTGATTATTGCCATTAATACTTGGAGCTCCAGATATAGCATTTCACGATTAATAA  
TCTTAGATTTTACTTCTTCTCCAGCTCTTATTCTTTTATGTTTCTTCCAGCAGCAGTAGAAAAGGGGGCTGGTACTGGATGAA  
CAGTATATCTTACTTACTAGAAATATTGCTCATTCCGGGCCATCAGTAGATCTTGGCTATTTTCTTACATTTAGCAGGT  
GCATCATCCATTTTAGGGGCTATTAATTTTATTACAACAGTTATTAATATACGATGAGCTGGTTTACAATTAGAGCGAATCCC  
ACTATTTGTATGAGCAGTATTTATTACAGTAATCTTCTTCTTTTATCACTTCCAGTTCTTGGTGGAGCAATTACTATGTTATT  
AACAGATCGAAATCTTAATACATCTTTTTTGTATCCGGCTGGAGGAGCGACCCAATTTTATATCAACATCTATTC  
BLAST < 84% for some earthworms unidentified.

> w40 IV0000261237 Munsan 18/7/2012 pale *Drawida* mature. BLAST 99% *Ischnura asiatica* (a dragonfly from Japan)! NICEM sample  
contaminated (same as for w10 and w12 and w15 and w16 and w18 and w19 and w22 and w23 and w26 and w28 and w35 and w38  
amongst the samples that yielded any results at all).

> w44 *D. anchingiana seogwipo* “GM glands”.

ACTTTATATTTTATTTTAGGTGTGTGGGCAGGTATAAATTGGTGTGCTGGTATAAGTCTTTTATTTCGATTGAATTAAGACAGCC  
TGGCTCATTTTTGGGAAGCGATCAGCTCTATAACTATTGTTACTGCTCATGCTTTTCGTTATAATTTTTTTTCTTGTAAATACC  
TGTATTTATTGGTGGCTTCGGAAATTGACTTCTTCTCTTATATTAGGGGCTCCGGATATAGCATTTCCACGTCTTAATAATC  
TGAGATTTTGGCTATTGCCCCAGCATTAACTTTTATTAGTTTCTTCCGCAGCAGTGGAAAAGGGTGTGGTACTGGGTGAAC  
AGTATACCCCGCCGCTAGCAAGCAACCTGGCTCACGCCGGTCCCTCAGTTGATTTAGCAATTTTTTCTTCTTCAATTTAGCAGGAG  
CGTCTTCAATTTTGGGCTCTAATTAATTTTATTACAAGTGAATTAATATGCGATGATCTGGGATAAATGTAGAGCGAATTTCA  
CTATTTGTTTAGGTGTAGTTATTACTGTAGTATTACTTTTATTATCTTCTTCCGGTTTTAGCGGGAGCAATTACTATGCTTTT  
ACAGATCGAAATCTGAATACGCTTTCTTCCGATCCTGCCGGGCTGGAGATCCAATTTTGTATCAGCACTTATTT  
BLAST result: Moniligastridae sp. from Japan (AB607100.1), 81%; BLAST w44 vs. WO69 Identities=656/657 (99%), i.e. same taxon.

> H1 *Drawida songae yeongdo* H (655bp) Sequence:

TCTTTATTTTATTTTAGGTGTATGAGCTGGAATAATTGGAGCAGGGATAAGTCTTCTTATTCGTATCGAATTAAGACAACCAG  
 GTGCCTTTTLAGGAAGCGATCAACTATATAACACTATTGTAACAGCACATGCTTTTATTATAATTTTTTCTAGTAATACT  
 GTTTTATTGGTGGGTTCCGAAATTGATTACTACCTTTAATATTAGGAGCTCCAGATATAGCTTTCCACGACTTAATAATCT  
 AAGATTTTGACTTCTTCTCCTGCTCTTATTTTATTAGTTTCATCCGCAGCAGTAGAAAAAGGTGCTGGTACAGGATGAACAG  
 TTTATCCTCCACTAGCTAGAAACATTGCTCATGCTGGACCATCAGTAGACCTTGCTATTTTTTTCATTACATTTAGCTGGGGCT  
 TCATCAATTTTAGGCGCCATTAATTTTATTACAACAGTAATTAATATACGTTGATCAGGGCTCAATTAGAACGAATCCCATT  
 ATTTGTATGGGCTGTCTTTATTACAGTAATTTTATTACTTTTATCTTCTCTGTTTTAGCAGGTGCTATTACTATATTATTAAC  
 AGACCGAAATCTAAACACATCATTTTTTGACCCTGCAGGTGGAGGGGACCCAATTTTATACCAACACCTATTC  
 Blast result: *Amyntas* sp. 14 JS-2012 (JQ982486), 83%, i.e. nothing similar on GenBank.

> H2 *Drawida songae yeongdo* P (655bp) Sequence:

TCTTTATTTTATTTTAGGTGTATGAGCTGGAATAATTGGAGCAGGGATAAGTCTTCTTATTCGTATCGAATTAAGACAACCAG  
 GTGCCTTTTLAGGAAGCGATCAACTATATAACACTATTGTAACAGCACATGCTTTTATTATAATTTTTTCTAGTAATACT  
 GTTTTATTGGTGGGTTCCGAAATTGATTACTTTAATATTAGGAGCTCCAGATATAGCTTTCCACGACTTAATAATCT  
 AAGATTTTGACTTCTTCTCCTGCTCTTATTTTATTAGTTTCATCCGCAGCAGTAGAAAAAGGTGCTGGTACAGGATGAACAG  
 TTTATCCTCCACTAGCTAGAAACATTGCTCATGCTGGACCATCAGTAGACCTTGCTATTTTTTTCATTACATTTAGCTGGGGCT  
 TCATCAATTTTAGGCGCCATTAATTTTATTACAACAGTAATCAATATACGTTGATCAGGGCTCAATTAGAACGAATCCCATT  
 ATTTGTATGGGCTGTCTTTATTACAGTAATTTTATTACTTTTATCTTCTCTGTTTTAGCAGGTGCTATTACTATATTATTAAC  
 AGACCGAAATCTAAACACATCATTTTTTGACCCTGCAGGTGGAGGGGACCCAATTTTATACCAACACCTATTC  
 BLAST result: *Glossoscolecidae* sp. (sic!) DPEW100487 voucher EW-SJ-498 (GU013845.1), 83%, i.e., nothing similar on GenBank.

> H7 *Drawida koreana austri* Busan Holotype

TCTTTATTTTATTTTAGGTGTGTGGGCCGGTATAATTGGCGCCGGCATGAGACTATTAATTCGAATTGAGTTAAGACAGCCG  
 GGCTCATTTTLAGGTAGAGATCAGCTTTATAACTATTGTTACTGCACATGCTTTTATTATAATTTTTTCTTAGTAATGCC  
 GTATTTATTGGTGGCTTTGGTAATTGATTGCTACCTTTAATGCTTGGTGGCCAGACATGGCTTTTCTCGACTAAATAATTT  
 AAGATTTTGACTTTTACCTCCGGCTTGATCTTATTAGTATCTTAGGAGCAGTGGAAGGGGGCCGGTACCGGATGAACA  
 GTTTATCTCCGCTAGCTAGTAATTTAGCACATGCAGGTGCATCTGTTGATCTGGCAATTTTTTCTTTACTTAGCAGGTGC  
 ATCTTCTATTTTAGGGGCTATTAATTTTATTACAACGTTATTAATATGCGTTGAGTGGGCATGCATTTGAACGAATTCCAT  
 TATTTGTATGGGGAGTTTAATTACTGTAGTATTACTACTTCTATCTTTGCCCGTGTAGCTGGTGAATTACTATGCTTTTAA  
 CTGACCGAAATTTAAATACTTCACTTCTCGACCCGCTGGCGGAGGCGATCTATTTTATATCAACATTTATTT  
 BLAST result: *Drawida* sp. from Japan (AB592437.1), 92%. H7 vs. H

> HY1 *Drawida odaesan* sp. nov. Holotype coll Odaesan 4<sup>th</sup> July, 2012 by Dr Seo.

TTTATTCTAGGTGTATGGGCAGGTATAATTGGTGCCGGAATAAGACTTCTTATCCGTATTGAATTAAGTCAGCCGGGAGCTT  
 TTTGGGTAGGGACCAACTATATAACACAATTGTTACAGCTCACGCTTTATTATAATTTTTTCTAGTAATGCCGGTTTTT  
 ATTGGGGGGTTTGGTAACTGATTGTTACCTCTAATACTAGGTGCTCCAGATATAGCATTCCCACGTTAAATAATCTTAGATT  
 TTGACTACTGCCCATCTCTCATCTTCTAGTGTCTCCGCGCCGTTGAAAAAGGTGCTGGAACTGGTTGAAGCTGATACCC  
 CACCCTTGTAGGAATATTGCACATGCAGGCCATGAGTTGATTTTCTCTCCATTTTCTCTCCATTTTATTACAACAGT  
 ATTTTAGGGGCAATTAATTTTATTACAACGTTATTAACATACGGTGGCCGGCCTCCAGATTGAACGAATTCCTCTCTTTGT  
 TTGGGCAGTATTTATTACAGTTATCTTCTTCTACTATCTTTACCAGTTCTTGCCGGAGCAATTACTATGTTACTTACAGATCG  
 AAATTAATACATCATTTTTGACCCGGCTGGAGGGGGGACCCAATTTTATATCAACATCTATTC  
 BLAST: HY1 vs. GQ500899 *Drawida hattamimizu* Neotype Identities=499/615 (81%); HY1 vs. H1 *Drawida songae yeongdo* Holotype  
 Identities=520/648 (80%).

> HY10 (605bp) *Drawida jeombongsan* Holotype

GAGCTGGTATAAGACTCCTTATTCGTATTGAATTAAGCCAACCAGGCGCCTTTTTAGGAAGTGACCAACTATACAATACCAT  
 TGTTACAGCACACGCTTTATTATAATTTTTTCTAGTCATACCTGTTTTATTGGTGGATTGGAAATGGTTATTACCATT  
 AATATTAGGGGCCCTGATATAGCTTTCCACGACTTAATAATCTGAGATTTTGACTTCTACCCCGCCCTATTTTATTAG  
 TTTCTTCTGCAGCTGTTGAAAAAGGTGCTGGTACTGGGTGAACAGTTTATCCACCTTAGCTAGAAATATTGCTCATGCTGGT  
 CCATCAGTAGATCTGCTATTTTTTTCATTACATCTAGCAGGGGCTTCATCAATTTTTAGGTGCTATCAATTTTATTACAACAGT  
 AATTAATATACGCTGATCTGGGCTCCAATTAGAACGATTCCACTATTTGTATGAGCCGTTTTTATTACGGTAATTTCTTCTAC  
 TTTTATCACTTCTGTTTTAGCAGGCGCTATTACTATATTACTAACAGACCGAAACTTAATACATCATTTTTTGACCCTGT  
 GGGGGGGTGATCTATCTTATAC  
 BLAST result: *Megacoelidae* sp. (sic) (GU014141.1). Id.=82%, i.e., nothing similar on Genbank.  
 HY10 *D. jeombongsan* vs. H1 *D. songae yeongdo* H Identities=532/605 (88%), i.e. again quite separate.

> HY18 (643bp) *Drawida iucn* Jeju specimen 5<sup>th</sup> sept, 2013 NIBR – IV-0000261359

TTAGGTGTGGGCAGGTATAATTGGTGTGATGAGTCTTTGATTCCGATTGAACAAAGACAGCCTGGCTCTTTTTGGG  
 GAGCGATCAGCTCTATAACTATTGTTACTGCTCATGCTTTCGTTATAATTTTTTCTGTAATACCTGATTTATTGGTGG  
 ATTCGGAATTTGACTTCTTCTCTTATATTAGGAGCACCGGATATAGCATTTCCACGCTTAAATAATCTGAGATTTTATTGATT  
 TGCCCCAGCATTAAATCTTTAGTTCTTCCGAGCAGTGGAAAAAGGTGCTGGTACTGGGTGAACAGTATACCCGCGCT  
 AGCAAGAAACCTGGCTACGCCGTCCTCAGTTGATTGATTTAGCAATTTTTTCTCTTCAATTAGCAGGGGCATCTCAATTTGG  
 GCTCTATTAATTTTATTACAACGTAATTAATATACGATGATCTGGGATAAATGTAGAACGAATTCCTACTATTTGTTGAGGT  
 GTAGTTATTACTGTAGTATTACTTTTACTATCTTCCAGTTTTAGCAGGGGCAATTACTATGCTTTTACAGATCGAAATCT

GAATACGTCTTTCTTCGATCCTGCTGGGGGTGGTGACCCAATTTTGTACCAGCACTTATTTT  
BLAST result: Moniligstridae sp. (AB607100.1), Id.=81%, i.e. nothing on Genbank.  
HY18 vs. WO68 *Drawida iucn* Identities=639/643 (99%), tolerably same taxon.

- > W1 27/3/2013 *Drawida* sp? Kahariam from rice paddy at banana tree (2 matures 45 mm) – nil result.
- > W6 28/3/2013 *Drawida* sp. Kahariam two immatures from banana area (S11) – nil result.
- > W13 27/3/2013 *Drawida* sp. Kahariam two dried from rice paddy near entrance gate – nil result.
- > W14 30/3/2013 *Drawida* sp. San Guillermo, Lipa two small specimens from conventional rice soil core – nil result.
- > W15 30/3/2013 *Drawida* sp. San Guillermo, Lipa three small specimens from conventional rice field core – nil result.
- > W17 30/3/2013 *Drawida* sp. Kahariam, 14 spex from rice paddy near entrance gate – nil result.

> P8 14/XI/13 Kahariam rice near gate *Drawida* one of four or five specimens.  
AAGTCTTCTAATTTCGTATTGAACCTAAGACAACCTGGATCCTTTTTAGGGAGAGATCAACTCTACAATACAATCGTAACTGCT  
CATGCTTTTATCATAATTTCTTTTTAGTAATGCCAGTATTTATTGGTGGATTTGGTAATTGATTACTTCCACTAATGCTTGGT  
GCCCCAGACATAGCATTCCACGACTAAACAATTTAAGATTCTGATTATTACCACCTGCCCTAATTCTTCTAGTGCCTCAGC  
CGCGGTAGAAAAGGGTGCAGGAACAGGATGAACAGTCTACCCACCCCTGGCGAGAAATCTGGCACATGCTGGGCCATCAGT  
AGATCTGGCAATTTTTCCCTCCATTTAGCGGGGCCCTCATCTATTCTGGGAGCAATTAACCTTTATTACAACAGTAATTAACA  
TGCGTTGGCCCGAATAACAGTTGAGCGAATCCCCCTATTTGTATGGGGGGTTACAATTACAGTAATTCTTCTTCTTCTATCA  
CTTCTGTTTTAGCGGGGGCTATTACCATACTTCTAACAGATCGAAATCTAAACACATCATTCTTTGACCCAGCAGGAGGA  
BLAST result: *Drawida bullata* (JN887895.1), 82%, i.e., nothing closer currently.

> P~6 29/I/2014 Penalosa Hascienda Remedios farm longish darker *Drawida* sp from paddy and bund (specimen lacking anterior tip one of twelve specimens)  
ACACTATATTTTATCCTCGGCGTATGGGCCGGAATGATCGGAGCTGGTATAAGTCTTCTAATTTCGTATTGAACCTAAGACAAC  
CGGGATCCTTTTTAGGGAGAGATCAACTCTACAATACAATCGTAACTGCTCATGCTTTTATCATAATTTCTTTTTAGTAATG  
CCAGTATTTATTGGTGGGTTTGGTAATTGACTACTTCCACTAATGCTTGGTGGCCCGACATAGCATTCCACGACTAAACA  
TTTAAGATTCTGATTATTACCACCTGCCCTAATTCTTCTAGTGTCTCGGCCGCGGTAGAAAAGGGTGCAGGAACAGGATGA  
ACAGTCTACCCACCCCTGGCGAGAAATCTAGCACATGCTGGGCCATCAGTAGATCTGGCAATTTTTCCCTCCATTTAGCTG  
GGGCTCATCTATTCTGGGAGCAATTAACCTTTATTACAACAGTAATTAACATGCGTTGGCCCGGAATGACAGTTGAGCGAAT  
TCCCCTATTTGTATGAGGGGTTACAATTACAGTAATTTCTTCTTCTTCTATCGCTTCTGTTTTAGCGGGGGCTATTACCATACT  
TCTAACGGATCGAAATCTAAACACATCATTCTTTGACCCAGCAGGAGGGGGAGACCCTATTCTATATCAACATTTATTC  
BLAST result: *Acanthodrilidae* sp. (sic) (GU013988.1), 82%, i.e., nothing known; P~6 vs P8=563/576 (98%), i.e., only 2% different.

> P~7 29/I/2014 Penalosa Hascienda Remedios farm smallish, thin and yellowish *Drawida* sp. one of two spex.  
CTATATTTTATCCTCGGCGTATGGGCCGGAATGATCGGAGCTGGTATAAGTCTTCTAATTTCGTATTGAACCTAAGACAACCGG  
GATCCTTTTTAGGGAGAGATCAACTCTACAATACAATCGTAACTGCTCATGCTTTTATCATAATTTCTTTTTAGTAATGCCA  
GTATTTATTGGTGGGTTTGGTAATTGACTACTTCCACTAATGCTTGGTGGCCCGACATAGCATTCCACGACTAAACAATTT  
AAGATTCTGATTATTACCACCTGCCCTAATTCTTCTAGTGTCTCGGCCGCGGTAGAAAAGGGTGCAGGAACAGGATGAACA  
GTCTACCCACCCCTGGCGAGAAATCTAGCACATGCTGGGCCATCAGTAGATCTGGCAATTTTTCCCTCCATTTAGCTGGG  
CCTCATCTATTCTGGGAGCAATTAACCTTTATTACAACAGTAATTAACATGCGTTGGCCCGGAATGACAGTTGAGCGAATTCC  
CCTATTTGTATGAGGGGTTACAATTACAGTAATTTCTTCTTCTTCTATCGCTTCTGTTTTAGCGGGGGCTATTACCATACTTCT  
AACGGATCGAAATCTAAACACATCATTCTTTGACCCAGCAGGAGGGGGAGACCCTATTCTATATCAACATTTATTC  
BLAST result: *Acanthodrilidae* sp. (sic) (GU013988.1), 82%, i.e., nothing similar; P~7 vs P~6=654/654 (100%), i.e., reasonably the same.

> R6 Kahariam *Drawida* from wet paddy of 1<sup>st</sup> organic rice crop area coll 24/I/2014 RJB and RO – data pending.

> JQ405262.1 *Drawida gisti gisti* cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial. From “China” identified by “Q. Xu and Y. Zhang”.  
TCAAAAAAAGAAGTATTGAGATTTTCGATCTGTTAATAATATAGTAATAGCCCCAGCTAAAACCTGGTAGAGATAGGAGTAAA  
AGTACTACAGTAATAACAACACCTCAAACAATAGTGGAAATCCGCTCTATATGTATCCCCGATCATGTATTAATTACAG  
TAGTAATAAAAATTAATAGCTCCTAAAATAGATGAGGCTCCTGCTAAATGTAAAGGAAAAAATTTGCCAAGTCAACAGAAGGAC  
CTGCATGAGCTAAATTTCTGGCTAGGGGTGGATAAACAGTTCAACCCGTTTCTGCCCCCTTTTCCACAGCTGCGGAAGATAC  
TAATAAAAATTAATGCTGGCGGTAAGTCAAAAACCTTAAATTATTAAGTCTGGGAAAGCTATGTCTGGTGCACCCAACATT  
AAAGGTAGAAAGTCAATTACCAAATCCCCAATAAATACAGGTATTACTAGAAAAGAAAATTATAATAAAAAGCATGTGCTGTT  
ACAATAGTGTTATATAATTGATCTCTACCCAAAAATGCTCCAGGTTGCCTCAATTCAATTCGAATTAGGAGGCTCATACCAA  
CTCCAATTATACCTG  
BLAST result: Glossoscolecidae sp. (sic) DPEW34882 voucher EW-SJ-455. Identity=489/587 (83%), i.e., no close match on Genbank.

#### OUTGROUP

> JET128-11|An-468.1|*Eukerria saltensis*|COI-5P from Lake Biwa, Japan  
-----ATGAGCTGGAATAACAGGTACTGGAATAAGAATAATTATCCGAATCGAACTAAGACAGCCAGGCACATT  
TATAGGGAGGGATCAACTCTACAACCAATTGTAACAGCAGCAGCATTTCTTATAATCTTCTTCTGTTATACCAGTTTTTA  
TTGGGGGATTTCGAAATTGACTCCTACCACTAATACTGGTGTCTGACATAGCATTCCCTCGACTTAACAACATGAGATT  
CTGACTTCTACCACCGTCCATAACGATCCTAATATTCTCCGAGCGGTAGAAAAGGGGCAGGTACAGGATGAACCCATA  
CCCCCCCCCTCGCTAGAAATATAGCACATGCAGGACCATCTGTAGACCTAGCAATCCTATCCCTTCACTAGCTGGGGCATCA

TCAATCCTCGGAGCAATTAACCTTTATCACAACAATAATTAATATACGATGAAATGGAATACGCCTAGAACGTATCCCCTAT  
 TTACATGGGCAGTAATAATTACAGCGATACCTCTACTCTCCCTTCCAGTGCTAGCTGGGGCAATTACCATACTCCTCACA  
 GATCGAAATTTAAATACATCATTCTTCGATCCCGCAGGAGGAGGAGATCCAGTTCTATATCAGCACCTATTC

BLAST nothing better than 80% for *Tonoscolex birmanicus* on Genbank.

JET128 vs. P0 an unidentified ocnetrodrilid from Philippines ocnetrodrilid worm=80%.

NOTE: *Eukerria saltensis* was first described from Japan by the senior author (Blakemore *et al.* 2007) and also from Korea (from Gangnam in Seoul in NIBR collection) by Blakemore *et al.* (2012).

## Appendix 2 – Checklist of valid species of family Moniligastridae in East Asia

### Annelida : Oligochaeta : Megadrilacea : Exquisitellata : Moniligastridae

CHINA (updated from Huang *et al.* 2006, Blakemore, 2008 and Zhang & Sun, 2014; compared to the current list this latter paper incorrectly puts all authorities in braces, disregarding ICZN protocol, mistakes several authors, and lists synonyms as valid taxa).

1. *Desmogaster sinensis* Gates, 1930
2. *Drawida anchingiana anchingiana* Chen, 1933 (stat. nov. Blakemore, 2012: 16)
3. *Drawida barwelli* (Beddard, 1886) [syns. several, including *Drawida glabella* Chen, 1938: 377 from Hainan; syn. nov. Blakemore (2006) – see Blakemore (2012)].
4. *Drawida bimaculata* Zhong, 1992: 268
5. *Drawida changbaishanensis* Wu & Sun, 1996
6. *Drawida cheni* Gates, 1935 [sometimes listed as *Moniligaster cheni*; non *Drawida cheni* Zhang *et al.*, 2006 renamed as *Drawida zhangetalia* Blakemore, 2006 that was described as similar to *Drawida zhongi* Blakemore, 2006 nom. nov. pro *Drawida sulcata* Zhong, 1986 (non *D. sulcata* Michaelsen, 1907). Note that Smithsonian catalogue (eol.org/pages/28635730/details) has USNM 2018 as type for *Drawida cheni* from “*Shu-Chow, Jiangsu, China*” but this number also allocated to a 1966 Antarctic Bryozoan.
7. *Drawida dandongensis* Zhang & Sun, 2014 from Dandong, Liaoning Province; **species inquirenda stat. nov.** (cf. *D. nemora*, *D. csuzdi*).
8. ?*Drawida ghilarovi* Gates, 1969. [Its description by Ganin (2013: pl. 1) shows incursion into Dongbei, China that, if correct, was a new record].
9. *Drawida gisti gisti* Michaelsen, 1931
10. *Drawida gisti nanchangiana* Chen, 1933
11. *Drawida japonica* (Michaelsen, 1892) syns. include *Drawida grahami* Gates, 1935 (syn. nov. from Chen, 1936: 291) from Sichuan, *D. propatula* Gates, 1935 (syn. nov. by Blakemore in Blakemore & Kupriyanova, 2010: 9 cf. *D. siemsseni* from Kui-Kiang Jiangxi, Jilin); from China also reported from Hainan and Taiwan
12. *Drawida jeholensis* Kobayashi, 1940
13. *Drawida koreana* Kobayashi, 1938 from Liaoning
14. *Drawida linhaiensis* Chen, 1933
15. ?*Drawida nemora* Kobayashi, 1936 (misdated as “1940” in Jiang *et al.*, 2003)
16. *Drawida nepalensis* Michaelsen, 1907 spp.-complex **stat. nov.** [syns. *burchardi* Michaelsen, 1903 - PRIORITY!, (?*jalpaigurensis* Stephenson, 1916 listed by Gates, 1961 but not 1972), *trogloodytes*, *hodgarti*, *papillifer* (part.), *cacharensis*, *abscisa*]
17. *Drawida omeiana* Chen, 1946 (et. *omeimontis* Chen, 1946: pl. 1B lapsus)
18. *Drawida siemsseni* (Michaelsen, 1910) from Fujian
19. *Drawida sinica* Chen, 1933
20. *Drawida syringa* Chen, 1933 [misspelt “syring” in Zhang & Sun (2014: 442)]
21. *Drawida zhangetalia* Blakemore, 2006 [replacement name for *Drawida cheni* Zhang *et al.*, 2006 in Zhang, Li & Qiu, 2006: 395 (non *Drawida cheni* Gates, 1935: 446 also from China); mistaken authority in Zhang & Sun (2014: 442)]
22. *Drawida zhongi* Blakemore, 2006 [replacement name for *Drawida sulcata* Zhong, 1986: 28 (non *Drawida sulcata* Michaelsen, 1907); mistaken authority in Zhang & Sun (2014: 442)]

### JAPAN

- 1. *Drawida eda* Blakemore, 2010 (initially labeled as “*Drawida cf. barwelli*”)
- # 2. *Drawida hattamimizu* Hatai, 1930 (as reviewed by BLAKEMORE *et al.* 2010)
- \* 3. *Drawida japonica* (Michaelsen, 1892) (syn. *grahami*)
- # 4. *Drawida keikiensis* Kobayashi, 1938
- # 5. *Drawida koreana* Kobayashi, 1938
- 6. *Drawida moriokaensis* Ohfuchi, 1938
- # 7. ?*Drawida nemora* Kobayashi, 1936
- 8. *Drawida ofunatoensis* Ohfuchi, 1938 (Kobayashi, 1940: 311 footnoted that this seems synonymous with *Drawida nemora* Kobayashi, 1936)
- 9. *Drawida tairaensis* Ohfuchi, 1938 (Kobayashi, 1940: 311 footnoted that this seems synonymous with *Drawida anchingiana* Chen, 1933)

### KOREA

1. *Drawida anchingiana anchingiana* Chen, 1933 (originally *D. gisti* var. *anchingiana*)
2. *Drawida anchingiana halla* Blakemore, 2013

3. *Drawida anchingiana* seogwipo Blakemore, 2013
4. *Drawida* cf. *barwelli* (Beddard, 1886) (new Korean record in Blakemore *et al.*, 2012b, *vide infra*)
5. *Drawida companio* Blakemore **sp. nov.**
6. *Drawida csuzdii* Blakemore **sp. nov.**
7. *Drawida gisti* Michaelsen, 1931
8. *Drawida guryeensis* Hong, 2002
9. *Drawida iucn* Blakemore, 2013#
10. *Drawida japonica* (Michaelsen, 1892)
11. *Drawida jeombongsan* Blakemore **sp. nov.**
12. *Drawida jirisanensis* Hong, 2002
13. *Drawida keikiensis* Kobayashi, 1938
14. *Drawida koreana* Kobayashi, 1938
15. *Drawida koreana austri* Blakemore **sub-sp. nov.**
16. *Drawida koreana nanjiro* Blakemore **sub-sp. nov.**
17. *Drawida nemora* Kobayashi, 1936
18. *Drawida odaesan* Blakemore **sp. nov.**
19. *Drawida koreana shindo* Blakemore **sp. nov.**
20. *Drawida songae songae* Hong, 2002
21. *Drawida songae yeongdo* Blakemore, 2013, in Blakemore & Lee, 2013

#### RUSSIA

1. *Drawida ghilarovi* Gates, 1969 spp. complex **stat. nov.** [From Amur, Siberia, its redescription by Ganin (2013: pl. 1) appears to show several distinct morphs with incursion into Dongbei, China and also at the border with North Korea; recent Russian DNA analyses support separation of this species-complex].