

**A New List of Japanese Freshwater Planarians Based upon  
a New Higher Classification of Planarian Flatworms Proposed by  
Sluys, Kawakatsu, Riutort & Baguñà (2009)**

By

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川勝正治・村山 均・川勝 みゆき・川勝 哲哉 (2009): 高次分類大系の改定  
に基づく日本産淡水生三岐腸類の新分類表 (英文)

摘 要

扁形動物門の三岐腸目に属する動物群は<プラナリア類>として知られており、重要な実験動物を含んでいる。最近、その高次分類体系 (綱・目・亜目・上科・科・亜科・族など) が大幅に改定された (Sluys, Kawakatsu, Riutort & Baguñà, 2009)。従って、日本産淡水生三岐腸類の新分類表が必要になった。本稿では新分類体系を示す系統樹 (Fig. 1, 科以上) と、日本から記録されている淡水生三岐腸類の種類を示す新分類表 (Table 1) を掲げた。各タクサの和名 (新称を含む) も示した。

なお、“渦虫 (ウズムシ綱)”という表現が長い間使われてきたが、それは特定のまとまった高次分類群を指す用語ではない。ただ、通称としては便利な表現でもあり、綱では無く、“渦虫 (ウズムシ) 類” のように表記するのが望ましい。



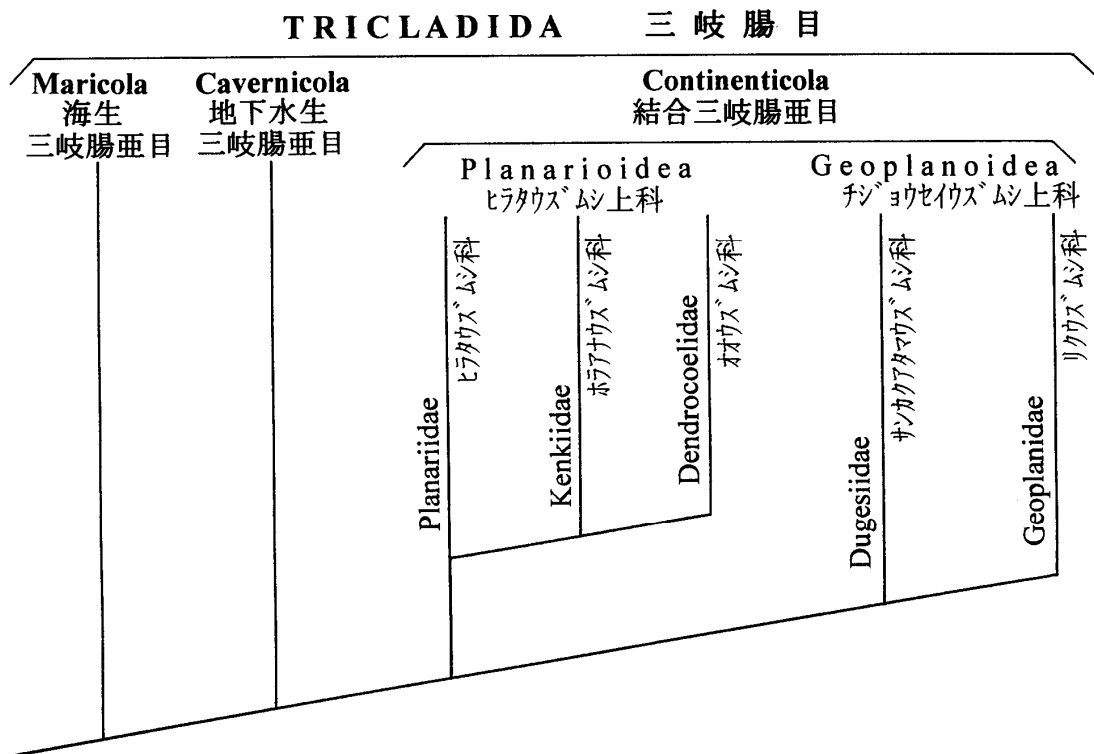


図 1. 高次分類群を示す系統樹 (Sluys, Kawakatsu, Riutort & Baguñà, 2009 から改写)

Fig. 1. Phylogenetic tree of the higher taxa (order, suborders and superfamilies) within the Order Tricladida (after Sluys, Kawakatsu, Riutort, & Baguñà, 2009: 1767, fig. 1; modified). Japanese terms (including new ones) were added by Kawakatsu. See Table 1.

Table 1 (表 1). 高次分類体系の改定に基づく日本産淡水生プラナリア類の新しい一覧表 (Sluys, Kawakatsu, Riutort & Baguñà, 2009 を参照)

扁形動物門 PLATHELMINTHES Schneider, 1873 / PLATYHELMINTHES Claus, 1887  
 桿系統 Rhabditophora Ehlers, 1985  
 新卵黄亜系統 Eulecithophora De Beauchamp, 1961 sence in Sopott-Ehlers, 1997  
 順列上目 Seriata Bresslau, 1933 sence in Sopott-Ehlers, 1997  
 三岐腸目 Tricladida Lang, 1884

I. 地下水生三岐腸亜目 Cavernicola Sluys, 1990

a. メキシコホリアナウスムシ科 Dimarcusidae Mitchell et Kawakatsu, 1972

a). ブラジールウスムシ属 *Rhodax* Marcus, 1946

1. ブラジールウスムシ *Rhodax evelinae* Marcus, 1946? [EX]

II. 結合三岐腸亜目 *Continenticola* Carranza, Littlewood, Clough, Ruiz-Trillo, Bagnà  
et Riutort, 1998

A. ヒラタウス<sup>ムシ</sup>上科 *Planarioidea* Stimpson, 1857

b. ヒラタウス<sup>ムシ</sup>科 *Planariidae* Stimpson, 1857

b). カス<sup>ムシ</sup>メウス<sup>ムシ</sup>属 *Polycelis* Ehrenberg, 1831

2. キタシロカス<sup>ムシ</sup>メウス<sup>ムシ</sup> *Polycelis sapporo* (Ijima et Kaburaki, 1916)

c). キタカス<sup>ムシ</sup>メウス<sup>ムシ</sup>属 *Seidlia* Zabusov, 1911

3. アッケシカス<sup>ムシ</sup>メウス<sup>ムシ</sup> *Seidlia akkeshi* Ichikawa et Kawakatsu, 1963

4. カス<sup>ムシ</sup>メウス<sup>ムシ</sup> *Seidlia auriculata* (Ijima et Kaburaki, 1916)

5. キタカス<sup>ムシ</sup>メウス<sup>ムシ</sup> *Seidlia schmidtii* (Zabusov, 1916)

d). ホソウス<sup>ムシ</sup>属 *Phagocata* Leidy, 1847

6. ソウヤイト<sup>ムシ</sup>ウス<sup>ムシ</sup> *Phagocata albata* Ichikawa et Kawakatsu, 1962\*\*

7. エゾ<sup>ムシ</sup>コカ<sup>ムシ</sup>タウス<sup>ムシ</sup> *Phagocata iwamai* Ichikawa et Kawakatsu, 1962

8. コカ<sup>ムシ</sup>タウス<sup>ムシ</sup> *Phagocata kawakatsui* Okugawa, 1956

9. カントウイト<sup>ムシ</sup>ウス<sup>ムシ</sup> *Phagocata papillifera* (Ijima et Kaburaki, 1916)\*

10. ホクリクホソウス<sup>ムシ</sup> *Phagocata suginoi* Kawakatsu, 1974\*\*

11. ヒタ<sup>ムシ</sup>カホソウス<sup>ムシ</sup> *Phagocata tenella* Ichikawa et Kawakatsu, 1963\*\*

12. トウホクコカ<sup>ムシ</sup>タウス<sup>ムシ</sup> *Phagocata teshirogii* Ichikawa et Kawakatsu, 1962

13. ミヤマウス<sup>ムシ</sup> *Phagocata vivida* (Ijima et Kaburaki, 1916)

c. オオウス<sup>ムシ</sup>科 *Dendrocoelidae* Hallez, 1892

e). オオウス<sup>ムシ</sup>属 *Bdellocephala* De Man, 1875

14. ヒ<sup>ムシ</sup>ワオオウス<sup>ムシ</sup> *Bdellocephala annandalei* Ijima et Kaburaki, 1916\*

15. リシリオオウス<sup>ムシ</sup> *Bdellocephala borealis* Kawakatsu, 1978

16. イズ<sup>ムシ</sup>ミオオウス<sup>ムシ</sup> *Bdellocephala brunnea* Ijima et Kaburaki, 1916

f). キタオオウス<sup>ムシ</sup>属 *Dendrocoelopsis* Kenk, 1930

17. エゾ<sup>ムシ</sup>ウス<sup>ムシ</sup> *Dendrocoelopsis ezensis* Ichikawa et Okugawa, 1958

18. リシリウス<sup>ムシ</sup> *Dendrocoelopsis ichikawai* Kawakatsu, 1977

19. キョウトウス<sup>ムシ</sup> *Dendrocoelopsis kishidai* Kawakatsu, 1978\*

20. キタシロウス<sup>ムシ</sup> *Dendrocoelopsis lactea* Ichikawa et Okugawa, 1958

d. ホアアナス<sup>ムシ</sup>科 *Kenkiidae* Hyman, 1937

g). ホアアナス<sup>ムシ</sup>属 *Sphalloplana* De Beauchamp, 1931

21. ヒメジ<sup>ムシ</sup>メナス<sup>ムシ</sup> *Sphalloplana* sp. of Himeji Ichikawa et Kawakatsu, 1967

22. ヤツガ<sup>ムシ</sup>ダケイス<sup>ムシ</sup> *Sphalloplana* sp. of Mts. Yatsu-gadake Ichikawa et Kawakatsu, 1967

B. チシヨウセイ (地上生) ウズムシ上科 Geoplanoidea Stimpson, 1857

e. サンカクアタマウスムシ科 DugesIIDae Ball, 1974

h). アメリカナミウスムシ属 *Girardia* Ball, 1974

23. アメリカツノウズムシ *Girardia dorotocephala* (Woodworth, 1897) [EX]

24. アメリカナミウスムシ *Girardia tigrina* (Girard, 1850) [EX]

i). ナミウスムシ属 *Dugesia* Girard, 1850

25. トウナンアジアウスムシ *Dugesia austroasiatica* Kawakatsu, 1985 [EX]

26. イズウスムシ *Dugesia izuensis* Katô, 1943\*

27. ナミウスムシ *Dugesia japonica* Ichikawa et Kawakatsu, 1964

28. リウキュウナミウスムシ *Dugesia ryukyuensis* Kawakatsu, 1976

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\*: 絶滅危惧 I 類 (CR+EN); \*\*: 絶滅危惧 II 類 (VU); [EX]: 外来種.

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**INTRODUCTION**

A new revised classification system for the higher taxa within the Order Tricladida Lang, 1884, was published recently (Sluys, Kawakatsu, Riutort & Baguñà, 2009). The backbone of this new classification is shown in a phylogenetic tree printed in that paper (fig. 1 on p. 1767). A slightly modified reproduction of that phylogenetic tree with addition of Japanese names is shown in the present web article (Fig. 1).

According to this new classification system, freshwater planarians (formerly known as “paludicolen triclads”) are now classified into 2 suborders, i.e., Cavernicola Sluys, 1990 (with a single family and 4 genera) and Continenticola Carranza, Littlewood, Clough, Ruiz-Trillo, Baguñà et Riutort, 1998 (with 2 superfamilies, 4 families and 47 genera)(cf. Sluys, Kawakatsu, Riutort & Baguñà (2009: 1767-1771)).

In Japan, the present known freshwater planarians can be classified into 2 suborders, 2 superfamilies, 5 families, 9 genera, and 28 species (including 2 undescribed species)(Japanese Version in Table 1; English Version in Table 2). Among them, one suborder, one family, 2 genera and 4 species are known as exotic ones (according to senior author’s latest knowledge). For comparison, see Sasaki’s taxonomic lists of Japanese freshwater planarians published in 2001 (Japanese Version) and in 2002 (English Version) under supervision of M. Kawakatsu.

**Table 2. A new list of Japanese freshwater planarians (Aug. 20, 2009).**

Phylum **PLATHELMINTHES** Schneider, 1873 / **PLATYHELMINTHES** Claus, 1887

Clade **Rhabditophora** Ehlers, 1985

Subclade **Eulecithophora** De Beauchamp, 1961 sence in Sopott-Ehlers, 1997

Superorder **Seriata** Bresslau, 1933 sense in Soppot-Ehlers, 1997

Order **Tricladida** Lang, 1884

I. Suborder **Cavernicola** Sluys, 1990

a. Family **Dimarcusidae** Mitchell et Kawakatsu, 1972

a). Genus ***Rhodax*** Marcus, 1946

1. *Rhodax evelinae* Marcus, 1946? [EX]

II. Suborder **Continenticola** Carranza, Littlewood, Clough, Ruiz-Trillo, Baguña

et Riutort, 1998

A. Superfamily **Planarioidea** Stimpson, 1857

b. Family **Planariidae** Stimpson, 1857

b). Genus ***Polycelis*** Ehrenberg, 1831

2. *Polycelis sapporo* (Ijima et Kaburaki, 1916)

c). Genus ***Seidlia*** Zabusov, 1911

3. *Seidlia akkeshi* (Ichikawa et Kawakatsu, 1963)

4. *Seidlia auriculata* (Ijima et Kaburaki, 1916)

5. *Seidlia schmidt* (Zabusov, 1916)

d). Genus ***Phagocata*** Leidy, 1847

6. *Phagocata albata* Ichikawa et Kawakatsu, 1962\*\*

7. *Phagocata iwamai* Ichikawa et Kawakatsu, 1962

8. *Phagocata kawakatsui* Okugawa, 1956

9. *Phagocata papillifera* (Ijima et Kaburaki, 1916)\*

10. *Phagocata suginoi* Kawakatsu, 1974\*\*

11. *Phagocata tenella* Ichikawa et Kawakatsu, 1963\*\*

12. *Phagocata teshirogii* Ichikawa et Kawakatsu, 1962

13. *Phagocata vivida* (Ijima et Kaburaki, 1916)

c. Family **Dendrocoelidae** Hallez, 1892

e). Genus ***Bdellocephala*** De Man, 1875

14. *Bdellocephala annandalei* Ijima et Kaburtaki, 1916\*

15. *Bdellocephala borealis* Kawakatsu, 1978

16. *Bdellocephala brunnea* Ijima et Kaburaki, 1916

f). Genus ***Dendrocoelopsis*** Kenk, 1930

17. *Dendrocoelopsis ezensis* Ichikawa et Okugawa, 1958

18. *Dendrocoelopsis ichikawai* Kawakatsu, 1977
19. *Dendrocoelopsis kishidai* Kawakatsu 1978\*
20. *Dendrocoelopsis lactea* Ichikawa et Okugawa, 1958

d. Family **Kenkiidae Hyman, 1937**

- g). Genus ***Sphalloplana* De Beauchamp, 1931**
21. *Sphalloplana* sp. of Himeji Ichikawa & Kawakatsui, 1967
22. *Sphalloplana* sp. of Mts. Yatsu-gadake Ichiukawa & Kawakatsu, 1967

B. Superfamily **Geoplanoidea Stimpson, 1857**

e. Family **Dugesiidae Ball, 1974**

- h). Genus ***Girardia* Ball, 1974**
23. *Girardia dorocephala* (Woodworth, 1897) [EX]
24. *Girardia tigrina* (Girard, 1850) [EX]
- i). Genus ***Dugesia* Girard, 1850**
25. *Dugesia austroasiatica* Kawakatsu, 1985 [EX]
26. *Dugesia izuensis* Katô, 1943\*
27. *Dugesia japonica* Ichoikawa et Kawakatsu, 1964
28. *Dugesia ryukyuensis* Kawakatsu, 1976

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\*: CR + EN (Critically Endangered and Endangered Species); \*\*: VU (Vulnerable Species); [EX]: Exotic species.

The present web article consists of two Sections. In the Section I, a chronological list of previous publications including illustrations of Japanese freshwater planarians is shown. Several taxonomic important publications including illustrations of Japanese freshwater planarians are also shown. Additionally, taxonomic important publications including species lists only are also added. In the Section II (Explanation of Plates I-XV), a total of 74 photographs, illustrations and figures (including assorted ones) concerning the known species of Japanese freshwater planarians are shown (Pls I-III in color; Pls IV-XV in black-and-white).

Note. For the benefit of Japanese readers, a Japanese title, names of authors and an abstract of this web article are given on the frontal pages. A Japanese Version of the present known Japanese freshwater planarians (Table 1 with Japanese names of taxa) is also added. For Figs 1 and 2, Japanese titles are also added.

## Section I. A chronological List of Previous Publications Including Illustrations of Japanese Freshwater Planarians

The following literature listed is arranged chronologically. Publications issued in the same year are arranged according to an alphabetical order of the author(s). A concise explanatory 'Note' is given for each of literature listed. For scientific names cited, the authorship(s) and the date of each scientific name, see Tables 1 and/or 2 in the present web article.

Notice. There are several publications (original papers, books, web articles, blogs, etc.) containing lists and photographs of Japanese freshwater planarians written by non-taxonomists. For avoiding the taxonomic confusion, those publications are not included in the present web article.

The 'APPENDIX' will be added at the end of the Section I. The Appendix contains: 1) Tentative Identification of Dugesiid Planarians Inhabiting Japanese Freshwaters (2 Japanese and 3 exotic species); 2) A Pictorial Key of the Heads of 5 Dugesiid Species from Japan (Fig. 2).

1. **Kaburaki, T. (1922).** On some Japanese freshwater triclads; with a note on the parallelism in their distribution in Europe and Japan. Jour. College Sci. Imp. Univ. Tokyo, 44, Art 2: 1-71 + Pl. I.

Note. Sixteen lithographic figures in color of 9 species (including a single uncertain species from Sakhalin) are shown on Pl. I (figs 1-16). *Planaria gonocephala* Dugès (figs 3-6) is misidentification of *Dugesia japonica* Ichikawa et Kawakatsu, 1964. Generic names used for the other 6 species (*Planaria*, *Sorocelis* and *Polycelis*) are wrong. Cf. Kawakatsu & Sasaki (2002). Kawakatsu's Web Library on Planarians. <http://victorriver.com>. Left Button: planarian.net mirror No. 36.

2. **Okugawa, K. I. (1947).** [Five species of freshwater planarians in the Section Platyhelminthes Turbellaria]. In: Uchida, S. (ed.), Revised Edition of Illustrated Encyclopedia of the Fauna of Japan (Exclusive of Insects), pp. 1486-1487, figs 4188-4191. Hokuryû-kan Publishing Co. Ltd., Tôkyô. (In Japanese.)

Note. Black-and-white sketches of 5 species and their explanations are given. They are: *Bdellocephala annandalei*, *Bdellocephala brunnea*, "*Dugesia gonocephala* (Dugès)" (misidentification of *Dugesia japonica*), *Phagocata vivida* and *Polytcelis auriculata* (now classified as *Seidlia auriculata*). Cf. Kawakatsu (1971: 39-40, table 1).

3. **Okugawa, K. I. (1960).** [Six species of Japanese freshwater planarians in the Section Platyhelminthes Turbellaria]. In: Uchida, S. & Okada, Yo K. (eds.), Encyclopedia Zoologica in Colours, Vol. IV, pp. 23-37 + Pl. 87. Hokuryû-kan Publishing Co. Ltd., Tôkyô. (In Japanese.)

Note. Color sketches of 6 species and their explanations are given. They are: *Bdellocephala annandalei*, *Bdellocephala brunnea*, "*Dendrocoelosis lacteus*"

(*Dendrocoelopsis lactea* is correct), *Polycelis auriculata* (now classified as *Seidlia auriculata*), *Phagocata vivida* and “*Dugesia gonocephala* (Dugès)” (mis-identification of *Dugesia japonica*).

4. **Kawakatsu, M. (1964a).** [Notes on the freshwater planaria of Lake Biwa-ko]. The Heredity (Iden), Tôkyô, 18 (9): 32-35. (In Japanese.)

Note. Black-and-white photographs of 2 preserved specimens of *Bdellocephala annandalei* (fig. 2 A-D on p. 33) and the outline sketch of a live specimen (fig. 3 on p. 33) are shown.

5. **Okugawa, K. I. (1965).** [Ten species of Japanese freshwater planarians in the Section Platyhelminthes Turbellaria]. In: Okada, Yô K., Uchida, S. & Uchida, T. (eds.), New Illustrated Encyclopedia of the Fauna of Japan, Vol. I, pp. 319-321, figs 32-41. Hokuryû-kan Publishing Co. Ltd., Tôkyô. (In Japanese.)

Note. Black-and-white sketches of 10 species and their explanations are given. They are: “*Dugesia gonocephala* (Dugès)” (misidentification of *Dugesia japonica*), *Phagocata vivida*, *Phagocata kawakatsui*, *Polycelis auriculata* (now classified as *Seidlia auriculata*), *Polycelis schmidtii* (now classified as *Seidlia schmidtii*), *Polycelis sapporo*, “*Dendrocoelopsis lacteus*” (should be *Dendrocoelopsis lactea*), *Dendrocoelopsis ezensis*, *Bdellocephala brunnea*, and *Bdellocephala annandalei*.

6. **Kawakatsu, M. (1966a).** [Japanese freshwater planarians]. The Heredity (Iden), Tôkyô, 20 (4): 54-57. (In Japanese.)

Note. This short article contains a list of Japanese freshwater planarians known at that time (3 families, 6 genera and 19 species, of which 2 are undescribed kenkiid species). A pictorial key of the head of those species is given. General outline and a photograph of 3 undescribed species (2 kenkiid species and *Dendrocoelopsis?* sp. of Lake Biwa-ko) are also given. See <Note> of Kawakatsu & Nishino (1993) in the present web article.

7. **Kawakatsu, M. (1966b).** Planaria. Alpha Weekly Encyclopedia, No. 294: 799. Nippon Mail Order Co., Tôkyô. (In Japanese.)

Note. A short explanation of ‘planaria’ is given, together with a few number of figures.

8. **Kawakatsu, M. (1968a).** [Photographs of the preserved specimens of *Bdellocephala annandalei* (Ijima et Kaburaki)]. Collect. & Breed., Tôkyô, 30 (2): cover photograph and its explanation on p. 37. (In Japanese.)

Note. A black-and-white photograph showing many preserved specimens of *Bdellocephala annandalei* (Kawakatsu’s Specimen Lot No. 393 collected from the off Oki-no-shima Island, Lake Biwa-ko). These samples are now keeping in the Zoological Museum, University of Amsterdam. Cf. Kawakatsu’s Web Library on Planarians. <http://victorriver.com>. Left Button: 10th ISFB 2006.



9. **Kawakatsu, M. (1968b).** [Illustrated list of Japanese freshwater planarians]. Collect. & Breed., Tôkyô, 30 (2): 40-45. (In Japanese.)

Note. This article contains a list of Japanese freshwater planarians known at that time (3 families, 6 genera and 19 species, of which 2 were undescribed kenkiid species). The black-and-white sketches of animals used were reproduced from Kawakatsu's water-color paintings.

10. **Kawakatsu, M. (1969).** An illustrated list of Japanese freshwater planarians known at that time (3 families, 6 genera and 19 species, of which 2 were undescribed kenkiid species). For each species section, a map showing its geographical distribution was given. Figures of animals in color (Pls VII and VIII, figs 1-19) were reproduced from Kawakatsu's original water-color paintings. See the 'Note' of foregoing article (Kawakatsu, 1968b).

11. **Okugawa, K. I. (1970).** [Platyhelminthes]. In: Uchida, T. & Mawatari, S. (eds.), Gendai Seibutsugaku Taikei, Vol. 1. Musekitsui-Dôbutsu A, Chapt. VII, pp. 91-124. Nakayama Shoten, Tôkyô. (In Japanese.)

Note. Black-and-white photographs of live specimens of 7 freshwater planarian species are shown (on p. 102, fig. 73). Since each species is shown only by Japanese names, Kawakatsu gave their modern scientific names here. They are: *Bdellocephala brunnea*, *Seidlia auriculata*, *Phagocata vivida*, *Dugesia japonica*, *Polycelis sapporo*, and *Seidlia schmidtii*. Photographs of preserved specimens (bicephalic and bicaudal specimens of *Dugesia japonica* and a fixed specimen of *Bdellocephala annandalei*) are also given.

12. **Miyazaki, T. & Kawakatsu, M. (1971).** Frequency of the occurrence of supernumerary eyes in a Japanese freshwater planarian, *Dugesia japonica*, observed in the natural populations. Zool. Mag., Tôkyô, 80: 371-377. (In Japanese, with English summary.)

Note. Black-and-white photographs of the head of *Dugesia japonica* (loc. Nîmi City, Okayama Pref., Chûgoku Region, Honshû) with supernumerary eyes are shown (fig. 3 A-I on p. 375).

13. **Uchida, T., Kawakatsu, M. & Minegishi, H. (1972).** [Platyhelminthes-Turbellaria]. In: Uchida, T. (ed.), "Yatsu & Uchida, Dôbutsu-Bunruimei-Jiten (Classification Tables of Animals)", pp. 152-170. Nakayama-Shoten, Tôkyô. (In Japanese.)

Note. Items of the Order Tricladida (pp. 161-166) are responsible for Kawakatsu. In the <Suborder Paludicola (= Probursalia)>, 3 families, 18 genera and 55 species from the world (including 19 Japanese species) are listed with a short comment for each item.

See the following remarks by Kawakatsu (1972a). Corrections of triclads described in a Japanese book, "Yatsu & Uchida, Dôbutsu-Bunruimei-Jiten, 1972." Bull. Fuji Women's College, (10), II: 54-55. (In Japanese, with English explanation.)

Second Edition of this book was published in 1988. Only typographical errors in the First Edition (1972) were corrected.

14. **Kawakatsu, M. & Miyazaki, T. (1972).** Effect of different fixatives on a common Japanese freshwater planarian, *Dugesia japonica* Ichikawa et Kawakatsu. Bull. Fuji Women's College, (10), II: 81-117 (+ Pls VIII-XXXII).

Note. Black-and-white photographs of living specimens showing both the dorsal and ventral sides of the body of *Dugesia japonica* (loc. Nîmi City, Okayama Pref., Chûgoku Region, Honshû) are given on Pls VII and VIII (pp. 92-93). Photographs of the samples preserved with various fixatives are also shown on Pls IX-XXXII (pp. 94-117).

15. **Kawakatsu, M. (1973a).** [Taxonomy and ecology of planarians, 1-4]. The Nature & Animals (Dôbutsu-to-Shhizen), 3 (5): 9-16 + Plate Figure on the prefatory page; 3 (6): 11-16; 3 (7): 8-11; 3 (8): 7-13. New Science Publication Co., Tôkyô. (In Japanese.)

Note. This serial publication contains a reproduction of Kawakatsu's black-and-white sketches of Japanese freshwater planarians (cf. Kawakatsu, 1969). Reproductions of a list of Japanese freshwater planarians and a pictorial key of the head of the known species are also added (cf. Kawakatsu, 1966a).

16. **Kawakatsu, M. (1973b).** [Planarians]. Animal Life, No. 117: 3267-3269. Nippon Mail Order Co., Tôkyô. (In Japanese.)

Note. This is a popular scientific article on Japanese marine, freshwater and land planarians. Photographs of several species are given.

17. **Kawakatsu, M. (1973c).** [Planarians]. In <Grand Gendai Encyclopedia>, Vol. 17, pp. 404-405. Gakushû-Kenkyû-sha, Tôkyô. (In Japanese.)

Note. This section contains general explanation of triclads and polyclads in detail. For Japanese freshwater planarians, general explanations of 10 species were given, together with color photographs of *Dugesia japonica*, *Phagocata vivida*, *Bdellocephala brunnea*, and *Bdellocephala annandalei*. Kawakatsu made a few corrections of the text in the Revised Edition (1983).

<Grand Gendai Encyclopedia> (1-21 vols) is one of the laege volumes of general encyclopedias published in Japan (October, 1970 to July, 1974). Kawakatsu is responsible for about 80 items in this Encyclopedia. The following items on freshwater planarians (with a photograph, or a sketch figure for each species) are included. They are: *Dugesia japonica*, *Dugesia gonocephala*, *Dugesia tigrina* (now classified under the genus *Girardia*), *Polycelis auriculata* (now classified under the genus *Seidlia*), *Phagocata kawakatsui*, *Phagocata teshirogii*, *Phagocata iwamai*, *Dendrocoelopsis ezensis*, *Bdellocephala brunnea*, and *Bdellocephala annandalei*.

See the following remarks by Kawakatsu (1974a). A List of Platyhelminthes Animals Described and Illustrated in <Grand Gendai Encyclopedia>. Bull. Fuji Women's College, (12), II: 64-67. (In Japanese, with English explanation.)

18. **Murayama, H. & Kawakatsu, M. (1973).** Photographs of living specimen of a Japanese giant planarian, *Bdellocephala annandalei* Ijima et Kaburaki. Collect. & Breed., Tôkyô, 35: 163-165. (In Japanese.)

Note. Black-and-white photographs of 2 live specimens of *Bdellocephala annandalei* are shown on p. 165.

19. **Okugawa, K. I. (1973).** [Platyhelminthes-Turbellaria]. In: Uéno, M. (ed.), The Late T. Kawamura Freshwater Biology of Japan. Enlarged and Revised Edition. Pp. 207-249. Hokuryû-kan Publishing Co. Ltd., Tôkyô. (In Japanese.)

Note. Black-and-white sketches of 7 species of freshwater planarians are shown in figs 12(-20)(A-G) on p. 226. They are: *Dugesia gonocephala* (misidentification of *Dugesia japonica*), *Phagocata vivida*, *Phagocata kawakatsui*, *Polycelis auriculata* (now classified as *Seidlia auriculata*), and *Phagocata papillifera* (a modified sketch of Kaburaki's figure published in 1922). Enlarged heads of 5 species are also shown.

Black-and-white sketches of 4 dendrocoelid species are also shown in figs 12(-22)(A-D) on p. 230. They are: *Bdellocephala brunnea*, *Bdellocephala annandalei*, *Dendrocoelopsis ezensis* and *Dendrocoelopsis lacteus* (should be *Dendrocoelopsis lactea*). Their enlarged heads are also shown.

20. **Kawakatsu, M. (1974b).** Further studies on the vertical distribution of freshwater planarians in the Japanese Islands. In: Riser, N. W. & Morse, M. P. (eds.), Libbie H. Hyman Memorial Volume – Biology of the Turbellaria, pp. 291-338. McGraw-Hill Book Co., New York, etc.

Note. Black-and-white figures of Japanese 5 stream-dwelling planarians are shown (on p. 295; reproduced from Kawakatsu, 1969). They are: *Dugesia japonica*, *Phagocata vivida*, *Polycelis sapporo*, *Polycelis auriculata* (now classified as *Seidlia auriculata*) and *Polycelis schmidtii* (now classified as *Seidlia schmidtii*).

21. **Kawakatsu, M. (1977).** [Ecology and distribution of freshwater planarians]. The Heredity (Iden), Tôkyô, 31 (10): 13-24. (In Japanese.)

Note. This is a popular scientific article on the ecology and distribution of Japanese freshwater planarians. The species list known at that time (3 families, 6 genera and 23 species, of which 2 are undescribed kenkiid species) was given.

22. **Murayama, H. (1977).** [Freshwater planarians of Nîgata Prefecture]. In: <Nîgata-no-Shizen>, No. 3: 249-254. (In Japanese.)

Note. Four species of freshwater planarians distributed in Nîgata Prefecture, the northeastern part of the Chûbu Region in Honshû, are shown. They are: *Dugesia japonica*, *Phagocata vivida*, *Phagocata suginoi* (a limited distribution), *Polycelis auriculata* (now classified as *Seidlia auriculata*). Black-and-white photographs of live specimens are shown on fig. 1 (on p. 249). Additionally, *Bdellocephala brunnea* is also recorded from Tsunan-machi, Naka-uonuma Gun, in the southern part of Nîgata Prefecture.

23. **Kawakatsu, M., Teshirogi, W., Sugino, H., Oki, I., Kishida, Y., Yamada, T., Asai, E., Tamura, S., Ôgawara, G., Murayamas, H., Tanaka, I., Miyazaki, T., Horikoshi, I., Takahashi, N., Nîmura, F., Katayama, M., Okafuji, G., Aoki, S. & Shimamura, M. (1978).** [Collecting, breeding, observation and experiments of freshwater planarians]. Live Teaching Materials Information Service, (30 and 31): 427-442; 443-458 (= Collect. & Breed., Tôkyô, 40: (1): 34-54; (2): 95-110). (In Japanese.)

Note. This is a guidebook for observation and general experiments of planarians. Black-and-white photographs of 10 species of freshwater planarians are given (fig. 1 A-J on p. 429). They are: *Dugesia japonica*, *Dugesia ryukyuensis*, *Phagocata vivida*, *Seidlia auriculata*, *Polycelis sapporo*, *Seidlia akkeshi*, *Seidlia schmidtii*, *Bdellocephala brunnea*, *Dendrocoelopsis ezensis*, and *Dendrocoelopsis lactea*.

A pictorial key of the head of 16 species (including 2 undescribed kenkiid species) is also given. Cf. Kawakatsu (1966a) in the present web article.

24. **Okugawa, K. I. (1979).** [Four species of Japanese freshwater planarians in the Section Platyhelminthes-Turbellaria]. In: Uchida, T. (ed.), Illustrated Encyclopedia of the Fauna of Japan. Newly Compiled, pp. 118-119, figs. 410-413. Hokuryû-kan Publishing Co., Tôkyô. (In Japanese.)

Note. Black-and-white sketches of 4 species are given. They are: *Dugesia japonica*, *Phagocata vivida*, *Polycelis auriculata* (now classified as *Seidlia auriculata*), and *Bdellocephala brunnea*.

25. **Kawakatsu, M. (1980).** [Freshwater planarians as the experimental animal]. In: Yamada, T. & Yamagiwa, T. (eds.), <New Experiments of Animals and Plants for Students>, pp. 74-95. Kôdansha Book Co., Tôkyô. (In Japanese.)

Note. This is a guidebook for observation and general experiments of planarians. Black-and-white photographs of live specimens of 6 freshwater planarians are given (figs A-I on p. 74). They are: *Dugesia japonica*, *Phagocata vivida*, *Polycelis auriculata* (now classified as *Seidlia auriculata*), *Polycelis sapporo*, *Dendrocoelopsis ezensis*, and *Bdellocephala brunnea*.

26. **Miyazaki, T. & Kawakatsu, M. (1984).** [A color photograph showing a live specimen of *Phagocata papillifera* (Ijima et Kaburaki, 1916)]. Collect. & Breed., Tôkyô, 46: 50 (bottom). (In Japanese.)

Note. This is the first record of published color photograph of a live specimen of this rare subterranean water inhabitant.

27. **Kawakatsu, M. (1991).** [Entry in the Japanese Red Data Book of Endangered Species]: *Ectoplana limuli* (Ijima et Kaburaki, 1916), *Dugesia izuensis* Katô, 1943, *Phagocata papillifera* (Ijima et Kaburaki, 1916), and *Dendrocoelopsis kishidai* Kawakatsu, 1978. In: Environmental Agency of the Prime Minister's Office (ed.), <The Japanese Endangered Species, Invertebrates other than Insects>, pp. 233, 241, 249, 259. The Research Center of Wild Animals and Plants in Japan, Tôkyô. (In Japanese.)

Note. The 4 triclad species listed above are designated as Scarce Species. *Ectoplana limuli* (Jijima et Kaburaki, 1916) is a ectosymbiont of horseshoe crab *Tachipleus tridentatus* (Leach, 1819). It is a marine triclad species in the Suborder Maricola Hallez, 1892.

28. **Kawakatsu, M. (1992).** [An article on planarians; Explanation of color photographs; Classification table of the Phylum Platyhelminthes]. In: The Asahi Weekly Encyclopedia. [Animals on the Globe], No. 63, Invertebrates 3, Earthworms, Lungworms, Flatworms, and Others, pp. 2=84-86, 96. The Asahi Newspaper Office, Tôkyô. (In Japanese.)

Note. A general explanation of marine, freshwater and land planarians is given, with color photographs of living specimens from the U.S.A., Brazil, Japan, etc. For Japanese freshwater planarians, *Seidlia auriculata* (Ijima et Kaburaki, 1916) and *Phagocata papillifera* (Ijima et Kaburaki, 1916) are shown.

29. **Kawakatsu, M. & Nishino, M. (1993).** A list of publications on Turbellarians recorded from Lake Biwa-ko, Honshû, Japan. Bull. Fuji Women's College, (31), II: 87-102 (+ Pls I-V).

Note. Black-and-white photographs of live and preserved specimens of *Dendrocoelopsis?* sp. of Lake Biwa-ko and a photograph of its enlarged head are shown on Pl. I (figs G and H). Since the preserved specimen (KSL No. 278a) of this undescribed lake-dwelling inhabitant was lost, its histological and anatomical characters are not known. Thus, it is not listed in Table(s) 1(and 2) in the present web article. See also Kawakatsu (1966a: 57, figs 10 and 11); Kawakatsu & Ohtaka (2008).

30. **Nishino, M. (1993).** Platyhelminthes, Turbellaria, Dendrocoelidae: *Bdellocephala annandalei*. In: Nishino, M. (ed.), Handbook of Zoobenthos in Lake Biwa, III. Polyfera, Platyhelminthes, Annelida, Tentaculata, and Crustacea. Pp. 1-3, 17, 58. Published by the Lake Biwa Research Institute, Ôtsu. (In Japanese.)

Note. *Bdellocephala annandalei*: on p. 17, figs (color photographs of a dorsal view of a live specimen and cocoon). A distribution map of the species is also shown.

31. **Kawakatsu, M. & Nishino, M. (1994).** A list of publications on Turbellarians recorded from Lake Biwa-ko, Honshû, Japan. Addendum I. A supplemental list of publications and a revision of the section Platyhelminthes in the papers by Mori (1970) and Mori & Miura (1980, 1990). Bull. Fuji Women's College, (32), II: 87-103.

Note. This article contains the following Section. It is: The population density of *Bdellocephala annandalei* (pp. 97-100). A reproduction of an article in The Asahi (=Asahi Newspaper: April 18, 1986) is included (on p. 98, fig. 4): the scene of the deepest area of the Lake Biwa-ko (depth, 104m) chaught by the ASAHI TV Camera and live specimens of *Bd. annandalei* found on the surface of a round stone located at the deepest point of the Lake.

32. **Kawakatsu, M., Oki, I., Tamura, S., Takai, M., Yamamoto, K., Nishino, M., Timoshkin, O. A., Kuznedelov, K. D. & Sluys, R., 1996.** Preprint of papers given at the Eighth International Symposium on the Biology of the Turbellaria, Brisbane, Australia, August 19-23, 1996. Occ. Publ., Biol. Lab. Fuji Women's College, Sapporo, Hokkaidô, Japan, (27): 1-16. For *Phagocata kawakatsui*, *Bdellocephala annandalei*, *Polycelis sapporo*, and *Seidlia schmidtii*, see pp. 7-16.

Note. Black-and-white sketches of *Phagocata kawakatsui* and *Bdellocephala annandalei* from Lake Biwa-ko are included (p. 7, fig. 6 A and C). Black-and-white photographs of cocoons of *Ph. kawakatsui* and of a live specimen of *Bd. annandalei* are also found (p. 7, fig. 6 B and D). Cf. Oki, Tamura, Nishino, Takai, Kuznedelov, Timoshkin & Kawakatsu (1998); Kawakatsu, Nishino, Tamura, Takai, Oki, Kuznedelov & Timoshkin (2000).

Black-and-white sketches of *Polycelis sapporo*, *Seidlia akkeshi*, *Seidlia auriculata*, and *Seidlia schmidtii* are also found (p. 12, fig. 14 A-D). Cf. Kawakatsu & Timoshkin (1998).

33. **Kawakatsu, M. (1997).** [An endangered species of Triclad Turbellaria in Hyôgo Prefecture: *Phagocata vivida* (Ijima et Kaburaki, 1916)]. The Nature Protection Association of Hyôgo Prefecture (ed.). "Red Data Hyôgo: Field Animals", pp. 129-130, 221. The Publishing Center of the Kôbe Shinbun (= Kôbe Newspaper). (In Japanese.)

Note. Four black-and-white photographs of live specimens of *Phagocata vivida* are shown on p. 130.

34. **Kawakatsu, M. & Nunomura, N. (1997).** Platyhelminthes-Turbellaria. In: Hidaka, T. (supervised); Okutani, T., Takeda, M. & Imafuku, M. (eds.), <The Encyclopedia of Animals in Japan>. Vol. 7: 50-51, 54. Heibonsha Publ. Co., Ltd., Tôkyô. (In Japanese.)

Note. A color photograph of *Bdellocephala brunnea* is found (p. 50, fig.). Color sketches of 5 Japanese freshwater planarian species (reproduction of sketches in Kawakatsu, 1968b) are also printed (p. 50, figs A-F).

This publication contains a brief list of Japanese "Turbellarians" (p. 54). Freshwater planarians listed are: *Dugesia japonica*, *Dugesia ryuikyensis*, *Phagocata vivida*, *Seidlia auriculata*, *Seidlia schmidtii*, *Polycelis sapporo*, *Bdellocephala brunnea*, and *Bdellocephala annandalei*.

35. **Kawakatsu, M. (1998).** Platyhelminthes: Turbellaria. In: The Environmental Agency of the Prime Minister's Office, Japan (ed.), <A List of Japanese Wild Species of Plants and Animals: Invertebrates III>, Chapt. 42 (Other than Marine Species). Pp. 19-24. The Research Center of Natural Environment, Tôkyô. (In Japanese.)

Note. No figures are included in this publication. It is, however, important because many new Japanese names were given for taxa of "turbellarians": Catenulida, Macrostomida, Lecithoepitheliata, Prolecithophora, Proseriata, Tricladida, Neorhabdocoela, and Temnocephalida.

For the general explanation of Japanese names of animal taxa, see Grygier (1993).

36. **Kawakatsu, M., Nishino, M., Tamura, S., Takai, M., Oki, I., Kuznedelov, K. D. & Timoshkin, O. A. (2000).** Morphology of *Phagocata kawakatsui* Okugawa, 1956, from the bottom of Lake Biwa-ko in Honshû, Central Japan (Turbellaria, Tricladida, Paludicola). *Acta Biol. Leopoldensia*, 22 (1): 27-35.

Note. Black-and-white photographs of 2 preserved specimens of *Phagocata kawakatsui* and its cocoons are shown (p. 32, fig. 1 A-E).

37. **Kawakatsu, M., Sluys, R., Timoshkin, O. A., Naumova, T. V., Nishino, M. & Takai, M. (2000).** Reduced copies of OHP Sheets of the Oral Presentation Given at the Ninth ISBT (Barcelona, Spain; June 27-July 1, 2000). Without pagination (8 pages).

Note. This is a distribution material for the participants of the IXth International Symposium on the Biology of the Turbellaria. Notice: This is not a regular publication.

Black-and-white photographs and a sketch figures of the following Japanese dendrocoelid species are included. They are: *Bdellocephala annandalei*, *Bdellocephala brunnea*, *Bdellocephala borealis* and *Dendrocoelopsis ichikawai*. A reduced sketch of Kamchatkan *Bdellocephala parva* Zabusova, 1936, is also included.

Reproduction of Kawakatsu's unpublished pencil sketches of the sucker (sagittal section) of *Bd. annandalei* and *Bd. brunnea* are shown. Sagittal views of the sucker of *Bd. borealis* and *Den. ichikawai* (after Kawakatsu, Asai & Yamada, 1977, 1978) are also shown. Cf. Kawakatsu, Sluys, Timoshkin, Naumova, Nishino & Takai (2001).

38. **Murayama, H. (2000).** Photographs of two live specimens of *Phagocata suginoi* Kawakatsu, 1974, from the type locality at Kashiwazaki, Niigata Pref., Honshû, Japan. *Shibukitsubo* (Niigata Shell Club), (21): 40. (In Japanese, with English explanation.)

Note. A black-and-white photograph of 2 live specimens is shown. Those specimens were collected on September 18, 1999.

39. **Nishino, M. (2000).** [*Bdellocephala annandalei*]. Red Data Book for Shiga for 2000, p. 149. CD-ROM: *Bdellocephala annandalei* (with a color photograph of a live specimen and a distribution map). Shigen-hogo-ka, Biwako-Kenkyû-bu, Shiga Pref., Ôtsu. (In Japanese.)

Note. *Bdellocephala annandalei* is ranked as 'Threatened Species'.

40. **Kawakatsu, M., Sluys, R., Timoshkin, O. A., Naumova, T. V., Nishino, M. & Takai, M., (2001).** Redescription of Japanese *Bdellocephala annandalei* from Lake Biwa-ko with comparative redescription of the Far Eastern and Kamchatkan *Bdellocephala* species (Tricladida, Paludicola). *Belg. Jour. Zool.*, 131 (Suppl. 1): 205-211.

Note. A black-and-white photograph of a live specimen of *Bdellocephala annandalei* is given (p. 206, fig. 1).

41. **Murayama, H. (2001).** [*Phagocata suginoi* Kawakatsu, 1974, and *Bdellocephala brunnea* Ijima et Kaburaki, 1916, in Nigata Prefecture]. In: <Red Data Book Nigata>, prefatory color page 7, bottom-right (a living specimen of *Ph. suginoi*); pp. 20, 126, 129, 420, 461-462. Kankyô-Kikaku-bu, Kankyô-Seikatsu-bu, Nigata Pref., Nigata. (In Japanese.)

Note. A color photograph of a live specimen of *Phagocata suginoi* is found (p. 7, bottom-right).

42. **Sasaki, G-Y. (2001).** [Japanese freshwater planarians in color (Dr. M. Kawakatsu)]. <http://www2u.biglobe.ne.jp/~gen-yu/plaj-list.html> (In Japanese.)

Note. This is a web list of Japanese freshwater planarians known at that time (3 families, 2 subfamilies, 9 genera, 24 species). Color sketches of the species added are reproduction of Kawakatsu's water-color paintings published in 1969 (Pls VII and VIII). The Ms. of this web article was supervised by Kawakatsu. Cf. Kawakatsu (1969) in the present web article.

43. **Biodiversity Center of Japan / The Ministry of Environment of Japan. (2002).** [Internet Color Illustrations of Rare Wild Plants and Animals]. [Invertebrates Other than Shells, Snails and Insects]. [Kantô-ido-uzumushi: *Phagocata papillifera* (Ijima et Kaburaki, 1916): CR + EN]. <http://www.sizenken.biodic.go.jp/rdb/content/065.html> . Web article only. (In Japanese.)

Note. Although the text of this webpage was written by a member of the editorial board of the Biodiversity Center of Japan, the proof reading was done by Kawakatsu. A color photograph of a living specimen of *Phagocata papillifera* employed was taken from the film collection of Mr. T. Miyazaki and Kawakatsu. Cf. Miyazaki & Kawakatsu (1984) in the present web article.

44. **Kawakatsu, M. (2002).** [*Phagocata vivida* (Ijima et Kaburaki, 1916) – One of Near Threatened species (NT) in Tottori Prefecture, Chûgoku Region, Honshû, Japan]. In: Tottori-ken Shizen-Kankyô-Chôsa Kenkyû-kai (Delegate for Zoology Section: Tsurusaki, N.)(ed.), <Threatened Wildlife of Tottori Prefecture / Red Data Book: Animals>, pp. 9, 22-23, 189. Kankyô-Seikatsu-ka, Seikatsu-Kankyô-bu, Tottori Pref., Tottori. Chu'ô Insatsu Co., Tottori. (In Japanese.)

Note. Black-and-white photographs of 3 live specimens of *Phagocata vivida* (with an enlarged head) are shown (p. 189).

45. **Nishino, M. & Ohtaka, A. (2002).** [Change of the bottom ecosystem in the profound zone of the Northern Basin of Lake Biwa-ko]. Ômia (Lake Biwa Research Institute News), (73): 1-2. (In Japanese.)

Note. A color photograph of a live specimen of *Bdellocephala amandalei* is found (p. 1, photo 3).



46. **Nishino, M., Ohtaka, A. & Kawakatsu, M. (2002).** [A naturalized population of an exotic freshwater planarian, *Girardia tigrina* (Girard, 1850), found in Lake Biwa-ko, Japan. Ômia (Lake Biwa Research Institute News), (75): the 4th page, top. (In Japanese.)

Note. Many non-sexual specimens of *Girardia tigrina* were found in the Kinohama Beach, the Southern Basin of the Lake. This is the first occurrence record of this exotic planarian species in Lake Biwa-ko. The animal has typical pigment patterns on the surface of the pharynx.

47. **Sasaki, G.-Y. (2002).** Japanese freshwater planarians in color (Dr. M. Kawakatsu). [http://www2u.biglobe-ne.jp/~gen-yu/plaj\\_list.html](http://www2u.biglobe-ne.jp/~gen-yu/plaj_list.html)

Note. This is an English version of Mr. Sasaki's Japanese web article published in 2001. The Ms. of this web article was supervised by Kawakatsu. Cf. Sasaki (2001) in the present web article.

48. **Kawakatsu, M. (2003).** [*Phagocata vivida* (Ijima et Kaburaki, 1916) – One of the vulnerable species (V) in Hyôgo Prefecture, Kinki Region, Honshû, Japan]. In: Kaitei-Hyôgo-ken no Kichô na Shizen / Red Data Book of Hyôgo Prefecture (Rev. Ed. 2003). Pp. 13, 204-205, 304. Shizen-Kankyô-Hozen-ka, Kankyô-Kyôiku-bu, Hyôgo Prefecture, Kôbe. Shima Insatsu Co., Kôbe. (In Japanese.)

Note. This is a Revised Edition of <Red Data Book of Hyôgo> (1997). Photograph of *Ph. vivida* is not given in this volume. Cf. Kawakatsu (1997) in the present web article.

49. **Kawakatsu, M. & Horikoshi, I. (2003).** [*Phagocata papillifera* (Ijima et Kaburaki, 1916)]. In: Mitsukaidô Shizen-kankyô Chôsakai (ed.), <Mitsukaidô no Shizen>. Pp. 317-320. Mitsukaidô, Ibaraki Prefecture. Shinshin-dô Printing Co., Mitsukaidô.

Note. A detailed remark on this rare species inhabiting in shallow underground water was given, together with its black-and-white photographs and a sketch. In the same book, Dr. S. Chinone's short note on this species with a color photograph of a live specimen is also shown (pp. 112 and a photograph on p. 242, right-middle corner).

50. **Tanaka, I. (2003).** [Introduction for Platyhelminthes and Turbellaria]. In: Nishijima, S. (supervised); Nishida, M., Shikatani, N. & Shokita, S. (eds.), <Ryûkyû-Rettô no Rikusui Seibutsu> (Animals of Inland Waters from the Ryûkyû Islands, Japan), pp. 135-140. Tôkai University Publisher, Tôkyô. (In Japanese.)

Note. Mr. Tanaka's article printed in the Book was prepared under the supervision of Kawakatsu. Black-and-white photographs of *Dugesia japonica* (A) and *Dugesia ryukyuenensis* (B) are given (p. 136, fig. 2).

51. **Okugawa, K. I. (2004).** [Ten species of Japanese freshwater planarians in the Section Platyhelminthes-Turbellaria]. In: Okada, Yô K., Uchida, S. & Uchida, T. (eds.),

New Illustrated Encyclopedia of the Fauna of Japan / Reprint Edition. Part I, pp. 319-321, figs 32-41. Hokuryû-kan Publishing Co. Ltd., Tôkyô. (In Japanese.)

Note. The contents of this Reprint Edition are the same with those of the Book published in 1965. Notice for old scientific names used by the late Dr. Okugawa. Cf. Okugawa, K. I. (1965) in the present web article.

52. **Kawakatsu, M. (2006).** Entry in the Threatened Wildlife of Japan – Red Data Book, 2nd Ed.-, vol. 7. CR+EN: *Ectoplana limuli* (Ijima et Kaburaki, 1916); *Dugesia izuensis* Katô, 1943; *Phagocata papillifera* (Ijima et Kaburaki, 1916); *Dendrocoelopsis kishidai* Kawakatsu, 1978. VU: *Phagocata albata* Ichikawa et Kawakatsu, 1962; *Phagocata suginoi* Kawakatsu, 1974; *Phagocata tenella* Ichikawa et Kawakatsu, 1963. In: The Ministry of the Environment of Japan (ed.), <Threatened Wildlife of Japan - Red Data Book 2nd Ed.-, Vol. 7, Invertebrata (except Insecta and Mollusca)>, pp. 25-28, 35-37. For a color photograph of a live specimen of *Ph. papillifera*, see Prefatory Color Page (Pl. 1), middle-right. Japan Wildlife Research Center, Tôkyô. (In Japanese.)

Note. CR+EN = Critically Endangered; VU = Vulnerable. *Ectoplana limuli* is a marine triclad species. Cf. Kawakatsu (1991) in the present web article.

53. **Nishino, M. (2006).** [Threatened Endangered (VU): *Bdellocephala annandalei* Ijima et Kaburaki, 1916]. Red Data Book of Shiga Prefecture 2005, pp. 56 (photograph of a live specimen of *Bd. annandalei*), 537 (text) and 543-544 (references). Shiga-ken Biwa-ko Kankyô-bu, Shizen-Kankyô Hozen-ka. Sunrise Publ. Co., Hikone. (In Japanese.)

Note. Dr. Nishino's article on *Scutariella japonica* (Matjašič, 1990), a temnocephalis species from Lake Biwa-ko, is also included in this Book. Near Threatened (NT).

54. **Kawakatsu, M., Nishino, M. & Ohtaka, A. (2007).** Currently known exotic planarians from Japan. Jap. Jour. Limnol., 68: 461-469. (In Japanese, with English summary.)

Note. Eight species of exotic planarians now known from Japan are reported. Among them freshwater triclad species are: *Rhodax evelinae* Marcus, 1946?; *Dugesia austroasiatica* Kawakatsu, 1985; *Girardia tigrina* (Girard, 1850); *Girardia dorotocephala* (Woodworth, 1897).

*Rhodax evelinae?* is a member of the Family Dimarcusidae Mitchell et Kawakatsu, 1972, Suborder Cavernicola Sluys, 1990. Cf. Kawakatsu, Oki, Tamura & Yamayoshi (1985); Kawakatsu, Tamura, Oki, Takai & Froehlich (1995).

*Dugesia austroasiatica* is an inhabitant of warm waters in Japan (i.e., indoor aquaria, or tanks, and outdoor culture ponds for tropical fishes). This species seems to be a Southeast Asiatic origin. Cf. Kawakatsu, Oki, Tamura & Yamayoshi (1985); Kawakatsu, Oki, Tamura & Takai (1985); Kawakatsu, Takai, Oki, Tamura & Aoyagi (1986); Kawakatsu, Tsuruda, Kimura, Chinone, Murayama & Yamamoto (2008).

Naturalized populations in Japan of *Girardia tigrina* (after 1993) and *G. dorotocephala* (after 2003) have gradually increased. Cf. Kawakatsu, Oki, Tamura & Yamayoshi (1985); Tamura, Oki, Kawakatsu, Ninagawa, Matsusato & Suzuki

(1985); Kawakatsu, Tamura, Takai, Yamamoto, Ueno & Oki (1993); Kawakatsu, Nishino, Ohtaka, Yamamoto & Sasaki (2007); Kawakatsu, Tsuruda, Kimura, Chinone, Murayama & Yamamoto (2008); Chinone, Yamamoto & Kawakatsu (2008); Sluys, Kawakatsu & Yamamoto (2009, In press). See Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Buttons: Matsuyama Mar 07; Flatland FPs; *G. tigrina* Ibaraki; 11th ISFB 2009.

55. **Kawakatsu, M., Nishino, M., Ohtaka, A., Yamamoto, K. & Sasaki, G.-Y. (2007).** Exotic planarians now known from Japan (Preliminary report). Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Button: Matsuyama Mar 07.

Note. This web article consists of two parts: 1) Distribution material for the participants only (pp. (a)-(h)); 2) Explanations of figures and tables – Poster Presentation (pp. 1-8).

In Part 2, color photographs of live specimens of 5 dugesiid species found in Japan are shown. They are: *Dugesia japonica*, *Dugesia ryukyuensis*, *Dugesia austroasiatica*, *Girardia tigrina* and *Girardia dorotocephala*. *D. austroasiatica*, *G. tigrina* and *G. dorotocephala* are exotic species.

56. **Chinone, S., Yamamoto, K. & Kawakatsu, M. (2008).** The first record of a North American freshwater planarian, *Girardia tigrina* (Girard)(Platyhelminthes, Tricladida) from Ibaraki Prefecture, Central Japan. Bull. Ibaraki Nat. Mus., (11): 33-40. (In Japanese, with English summary.)

Note. Natural distribution of an exotic freshwater planarian, *Girardia tigrina* (Girard, 1850), has gradually been including in Ibaraki Prefecture, Kantô Region, Honshû. Black-and-white photographs and a sketch of live specimens of this exotic planarian are shown in fig. 1a-c (on p. 35).

Since sexual specimens of this planarian were not collected from the known localities in Japan, its final identification is impossible. Idiograms of the animals from the Ibaraki population are reported in that paper (fig. 2 on p. 3). Cf. Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Button: *G. tigrina* Ibaraki.

57. **Kawakatsu, M., Tsuruda, E., Kimura, T., Chinone, S., Murayama, H. & Yamamoto, K., 2008.** Dugesiid freshwater planarians found in flatland of Japan: a guide for the identification of two native and three exotic species. Mizube-no-Wa, (26): 1-12. (In Japanese.)

Note. The present knowledge of 5 dugesiid species found in Japan was given in detail with their color photographs and idiograms. They are: *Dugesia japonica*, *Dugesia ryukyuensis*, *Dugesia austroasiatica*, *Girardia tigrina*, and *Girardia dorotocephala*. The latter 3 species are exotic species now found in Japan.

For the reproduction of this article with a newly prepared English explanations of figures, see Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Button: Flatland FPs.

58. **Kawakatsu, M. (2009).** [Entry in the Threatened Wildlife of Japan – Red List (Revised)]. CR+EN: *Ectoplana limuli* (Ijima et Kaburaki, 1916); *Dugesia izuensis* (Katô, 1943); *Phagocata papillifera* (Ijima et Kaburaki, 1916); *Dendrocoelosis kishidai* Kawakatsu, 1978; *Bdellocephala annandalei* Ijima et Kaburaki, 1916. VU: *Phagocata albata* Ichikawa et Kawakatsu, 1962; *Phagocata suginoi* Kawakatsu, 1974; *Phagocata tenella* Ichikawa et Kawakatsu, 1963. In: The Ministry of Environment of Japan. Homepage. <http://www.eic.or.jp/eanet/>. (In Japanese.)

Note. CR + EN = Critically Endangered; VU = Vulnerable.

*Ectoplana limuli* is a marine triclad species. *Bdellocephala annandalei* is a new entry species into the group of CR + EN. A concise Japanese note on this endemic lake-dwelling species in Lake Biwa-ko written by Kawakatsu is given in this Red List. (In Japanese.)

59. **Sluys, R., Kawakatsu, M. & Yamamoto, K. (2009).** Exotic freshwater planarians currently known from Japan. Abstract Book: International Symposium on Flatworm Biology. July 26-31, 2009. Hasselt Univ., Belgium, p. 79.

Note. Exotic freshwater planarians introduced into Japan were studied in detail. They are: *Dugesia austroasiatica*, *Girardia tigrina*, *Girardia dorocephala* and *Rhodax evelinae*? *G. dorocephala* was identified by providing a reconstruction of the copulatory apparatus.

For the reproduction of an abstract and poster used at the ISFB, see Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Button: 11th ISFB 2009. The original paper of this lecture will be published in a recent Special Issue of the Belgian Journal of Zoology (Sluys, Kawakatsu & Yamamoto, In press).

#### **APPENDIX: Tentative Identification of Dugesiid Planarians Inhabiting Japanese Freshwaters**

For the species identification of freshwater planarians, morphological, histological and anatomical examinations of fully sexually mature specimens should be necessary. Especially, a comparative study of the reconstructed copulatory apparatus of the samples examined is an indispensable technique. Chromosomal analysis of the samples is also available for the species identification in some cases.

Five dugesiid species are now known from Japan if *Dugesia izuensis* (CR + EN in the Red Data Book) is excluded. Live specimens of these 5 species (2 native and 3 exotic species) have somewhat different appearance in each other (Fig. 2). We can separate them externally according to characters listed in the following key (1-8). This tentative identification method seems to be available for researchers and their assistants who follow environmental assessments in their field works.

For the related publications on this APPENDIX, see Kawakatsu, Nishino & Ohtaka (2007) and Sluys, Kawakatsu & Yamamoto (2009, In press). See also Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Buttons: Matsuyama Mar 07; Flatland FPs; 11th ISFB 2009.

**Key for 5 Dugesiid Species from Japan  
(2 native and 3 exotic species)**

- 1). **Morphological characters.** Notice the head shape, especially the *shape and size of auricles*, and the *space between two eyes*. The *Dugesia group (3 species)* and the *Girardia group (2 species)* can be separable by the differences of their external morphological characters.
- 2). **Pigmentation of the pharynx.** The *Dugesia group has no pigmented pharynx*; the *Girardia group has a pigmented pharynx*.
- 3). **Two Girardia species.** The *Girardia* species are essentially North American origin. *Girardia tigrina has broad and short auricles*; the distance between 2 eyes is narrow; with numerous pigment spots on the dorsal surface of the body. *Girardia dorotocephala has long and pointed auricles*; 2 eyes are located separately.
- 4). **Chromosome numbers are  $n=7$  and  $2x=14$**  (triploid, mixoploid and heteroploid karyotypes may occur); the karyotype consists of 6 pairs of metacentric chromosomes (**12m**) and 1 pair of subterocentric chromosomes (**2st**) .....*Dugesia ryukyuensis*
- 5). **Chromosome numbers are  $n=8$  and  $2x=16$**  (triploid, mixoploid and heteroploid karyotypes may occur); the karyotypes consists of 8 pairs of metacentric chromosomes (**16m**) .....*Dugesia japonica*
- 6). **Chromosome numbers are  $n=8$  and  $2x=16$** ; the karyotype consists of 7 pairs of metacentric chromosomes (**14m**) and 1 pair of subterocentric chromosomes (**2st**) ..... *Dugesia austroasiatica*
- 7). **Chromosome numbers are  $n=8$  and  $2x=16$** ; the karyotype consists of 8 pairs of metacentric chromosomes (**16m**); triploid karyotype ( $3x=24$ ) may occur .....*Girardia tigrina*
- 8). **Chromosome numbers are  $n=8$  and  $2x=16$** ; the karyotype consists of 7 pairs of metacentric chromosomes (**14m**) and 1 pair of submetacentric chromosomes (**2sm**).....*Girardia dorotocephala*

Pictorial Key of the Head for 5 Dugesiid Species from Japan (2 native and 3 exotic species)

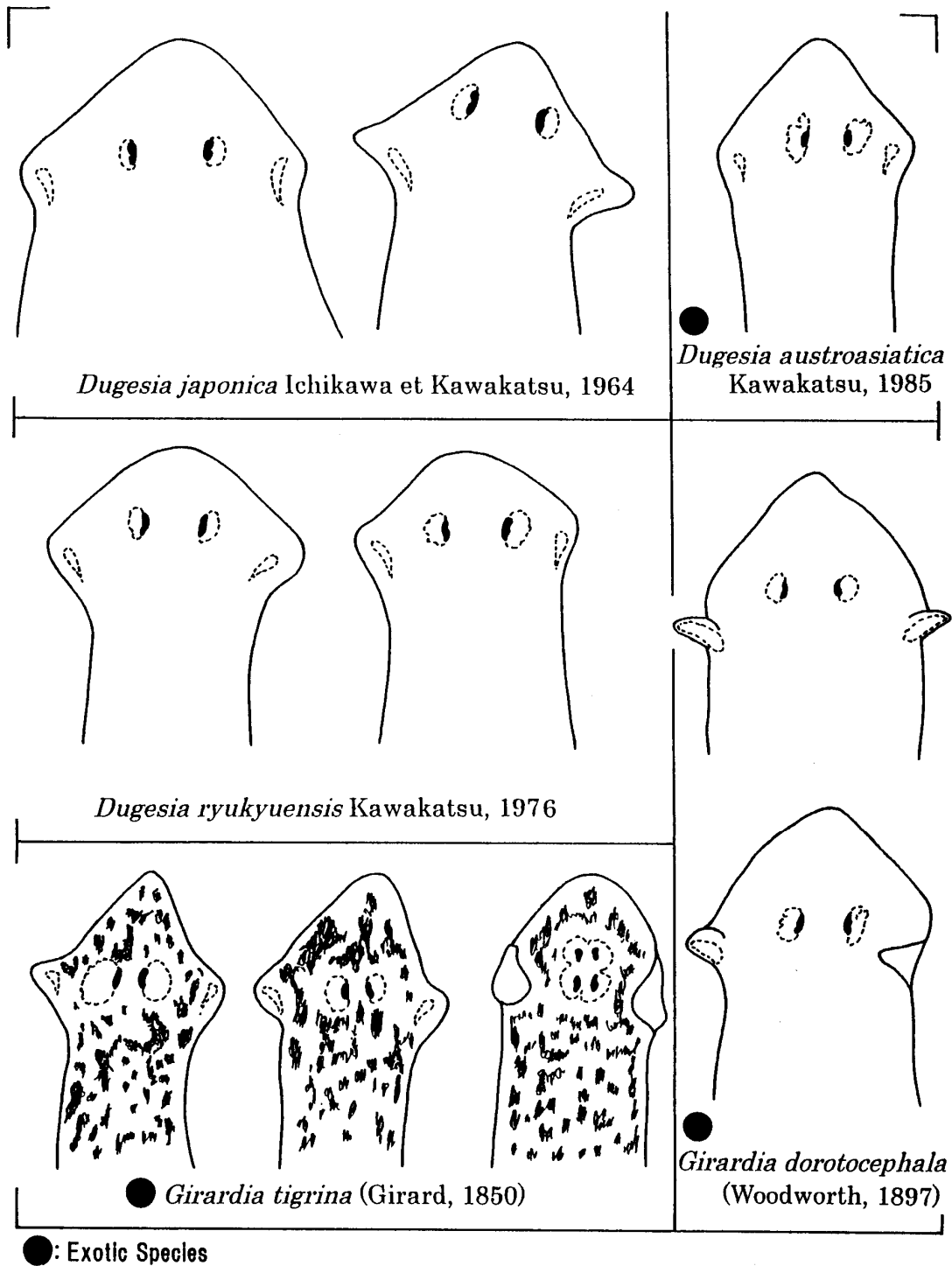


図 2. 日本で見られるサンカクアタマウズムシ科のプラナリア 5 種 (2 在来種と 3 外来種) の頭部の図解検索表 (転載).

Fig. 2. Pictorial key of the heads of 5 dugesiid species from Japan (2 native and 3 exotic ones) (after Kawakatsu, Nishino, Ohtaka, Yamamoto & Sasaki (2007); see also Kawakatsu, Nishino & Ohtaka (2007)).

## References

**Notice 1.** ‘Literature’ listed in the text of the Section I (59 articles) is not included here. They are as follows:

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Uchida, T., Kawakatsu, M. & Minegishi, H., 1972.

**Notice 2.** ‘Literature’ cited in <Notes> of the Section I is given in “References”.

**Notice 3.** ‘Literature’ for Figures (1 and 2) and Tables (1 and 2) in the Sections I and II including descriptive papers of taxa will be given in “References”.

**Notice 4.** ‘Literature’ for the Section II (Explanation of Plates I-XV) will also be given in “References”.

**Notice 5.** Several freshwater planarian species from Japan (Tables 1 and 2) and some Asiatic countries (Pl. XV) were described by Kawakatsu as new species in his serial papers published with his coauthors of non-taxonomists. In these cases, Kawakatsu is directly responsible for the new names (cf. ICZN, 4<sup>th</sup> Ed., 1999, Art. 50, Recommendation 50A). For the citation of those publications in “References”, notice the following reference list.

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Note. It became clear that a culture fish in Saga City is *Oreochromis niloticus niloticus* Linneaus, 1758. English name: Nile tilapia; Japanese name: Izumi-dai or Chika-dai. Cf. Kawakatsu, Tsuruda, Kimura, Chinone, Murayama & Yamamoto (2008: 3, 11).

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Note. For English title, preface and explanations of figures (with a reproduction of the original Japanese article), see Kawakatsu's Web Library on Planarians. <http://victoriver.com>. Left Button: Flatland FPs.

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### Section II. Explanation of Plates I-XV

The majority of the color photographs of planarians used in this Section II are reproductions of gift materials from the senior author's previous coauthors (their names will be shown in the Explanation of Plates I-III).



All of the black-and-white photographs, illustrations and figures of planarians used is reproduced from various taxonomic and educational publications by the senior author's team during the past nearly 50 years. Their sources will also be shown in the Explanation of Plates (IV-XV). For the full of scientific names (with the name(s) of author(s) and publication date(s)) in this Section, see Tables 1 and 2 in the present web article.

### Explanation of Plates I-III

Scale (black, or white, bars) = 5mm.

#### Plate I: Color photographs of live specimens: *Polycelis*, *Seidlia*, *Phagocata*, and *Bdellocephala* (7 species)

1. *Polycelis sapporo* (loc. Chitose City, Ishikari, Hokkaidô: photo by Mr. Miyazaki).
2. *Seidlia auriculata*. **A** (loc. Mt. Yamiozo, Ibaraki Pref., Honshû: photo by Dr. Chinone). **B** (loc. Nîgata Pref., Honshû: a specimen fed by a fresh chicken spleen: photo by Murayama).
3. *Phagocata kawakatsui*. **A** (loc. Bottom of Lake Biwa-ko, Shiga Pref., Honshû: photo by Dr. Nishino). **B** (type loc. Ground of Kawakatsu's country residence in Kameoka City, Kyôto Pref., Honshû: photo by Mr. Miyazaki).
4. *Phagocata suginoi* (type loc. Soji in Kashiwazaki City, Nîgata Pref., Honshû: photo by Murayama).
5. *Phagocata papillifera*. **A** and **B** (loc. A driven well in Mitsukaidô City, Ibaraki Pref., Honshû: photos by Mr. Miyazaki).
6. *Phagocata vivida*. **A** and **B** (loc. Nîgata Pref., Honshû: photos by Murayama). **C** (loc. Mt. Yamiozo, Ibaraki Pref., Honshû: photo by Dr. Chinone).
7. *Bdellocephala annandalei* (loc. Bottom of Lake Biwa-ko: photo by Murayama).

#### Plate II: Color photographs of live specimens: *Phagocata*, *Bdellocephala* and *Girardia* (3 species)

8. *Phagocata papillifera* (loc. Mitsukaidô City, Ibaraki Pref., Honshû: photo by Dr. Chinone).
9. *Bdellocephala brunnea*. **A** and **B** (loc. Downstream of the Amagase Dam, the Uji-gawa River (approximately 18km downstream from the outlet of the Lake Biwa-ko), Uji City, Kyôto Pref., Honshû: photos by Dr. Nishino). **C** (loc. Tsunan-machi, Naka-uonuma-Gun, Nîgata Pref., Honshû: photo by Murayama).
10. *Girardia dorotocephala* (loc. The Asakawa River, a tributary of the Tama-gawa River, Hino City, Tôkyô-to, Honshû: photos by Mr. Tsuruda).

#### Plate III: Color photographs of live specimens: *Girardia* and *Dugesia* (4 species)

11. *Girardia tigrina*. **A** (loc. Aquarium in Yokohama City, Honshû) and **B** (loc. Aquarium in Nagoya City, Honshû): photos by Dr. Tamura; **C** (loc. Downstream of

- the Urakami-gawa River, Nagasaki City, Kyûshû: photo by Mr. Yamamoto).
12. *Dugesia austroasiatica* (loc. Aquarium in Tôkyô-to, Honshû: photo by Mr. G.-Y. Sasaki).
  13. *Dugesia japonica*. **A** (loc. Upper stream of the Urakanmi-gawa River, Nagasaki City, Kyûshû: photo by Mr. Yamamoto). **B** (loc. Bisai City, Aichi Pref., Honshû: photo by Mr. Hotta). **C** (loc. Izuhara City, Tsushima Islands, Nagasaki Pref., Kyûshû: photo by Mr. Yamamoto). **D** (loc. Tsunan-machi, Naka-uonuma-Gun, Nîgata Pref., Honshû: photo by Murayama). **E** (loc. Tamano City, Okayama Pref., Honshû: photo by Mr. Miyazaki).
  14. *Dugesia ryukyuensis*. **A** and **B** (Downstream of the Urakami-gawa River, Nagasaki City, Kyûshû: photos by Mr. Yamamoto).

#### Explanation of Plates IV-XV

Scale (black, or white, Bars) = 5mm. A black solid line is also used in some cases.

#### Plate IV. *Rhodax evelinae?* and *Polycelis sapporo*

15. *Rhodax evelinae?* (after Kawakatsu, Tamura, Oki, Takai & Froehlich (1995)). **A-E**: Five live specimens (loc. Aquarium in Sapporo City, Hokkaidô).
- 16, 17 and 18: *Polycelis sapporo* (after Kawakatsu, Yanagita, Teshirogi & Ichikawa (1974)).
16. **A** and **B**. Two live specimens (loc. Jôzankei, Sapporo City, Hokkaidô). **C** and **D**: Intestine variants from stained whole mount (loc. Jôzankei).
17. The arrangement of eyes (whole mounts). **A-E** (loc. Mt. Muine, Sapporo City, Hokkaidô); **F** and **G** (loc. Jôzankei); **H** (loc. Okushiri Island, Hokkaidô); **I** (loc. Mt. Bonju, Aomori Pref., Honshû).
18. General view of a sexually mature specimen (loc. Mt. Muine, Sapporo City; whole mount).  
bs, bursa stalk; cb, copulatory bursa; e, eye-band; gp, genital pore; m, mouth; o, ovary; od, ovovitelline duct; pb, penis bulb; ph, pharynx; pp, penis papilla; sv, spermiducal vesicle.

#### Plate V. *Polycelis sapporo*, *Seidlia akkeshi* and *Seidlia schmidtii*

- 19, 20 and 21: *Seidlia akkeshi* (after Ichikawa & Kawakatsu (1963)).
19. Three live specimens (loc. Mt. Apoi, Hidaka, Hokkaidô).
20. **A** and **B**. Intestine variants from stained whole mounts (loc. Mt. Apoi).
21. The arrangement of eyes. **A** and **B** (type loc. Akkeshi-chô, Kushiro, Hokkaidô); **C** (loc. Mt. Apoi); **D** (loc. Kaminayoro, Kamikawa, Hokkaidô).
22. **a**: Sketch of a live specimen (type loc. Akkeshi-chô, Kushiro, Hokkaidô); **b**: general view of a sexually mature specimen (loc. Mt. Apoi; whole mount).  
cb, copulatory bursa; e, eyes; mz, muscle zone surrounding the male antrum; od, ovovitelline duct; ov, ovary; pb, penis bulb; ph, pharynx; sv, spermiducal vesicle; te, testis.

23. The arrangement of eyes in *Polycelis sapporo* (**a-d**), *Seidlia akkeshi* (**e-g**) and *Seidlia schmidti* (**h** and **i**). Pen-and-ink drawings (**a-i**) are newly prepared by Kawakatsu based upon photographs in his collection. **a** and **b** (loc. Mt. Muine, Sapporo City, Hokkaidô); **c** (loc. Jôzankei, Sapporo City, Hokkaidô); **d** (loc. Mt. Bonju, Aomori Pref., Honshû). **e** and **f** (type loc., Akkeshi-chô, Kushiro, Hokkaidô), **g** (loc. Mt. Apoi, Hidaka, Hokkaidô). **h** (loc. Kamikoshi, Kamikawa, Hokkaidô); **i** (loc. Rausu in the Shiretoko Peninsula, Nemuro, Hokkaidô).
24. The arrangement of eyes in *Seidlia schmidti* (**A-F**)(after Kawakatsu (1964)). **A-C** (loc. Rishiri Island, Hokkaidô); **D** and **E** (loc. On'nenai, Kamikawa, Hokkaidô); **F** (loc. Mt. Wenshiri, Abashiri, Hokkaidô).

**Plate VI. *Seidlia auriculata* and *Seidlia schmidti***

25. *Seidlia auriculata* (after Kawakatsu (1973a)). **A** and **B** (loc. Kamikôchi, Nagano Pref., Honshû). **A** (stained whole mount); **B** (pen-and-ink drawing from the photo **A**).  
cb, copulatory bursa; e, eye-band; go, genital pore; in, intestine; m. mouth; od, ovovitelline duct; ov, ovary; pb, penis bulb; ph, pharynx; sd, sperm duct; t, testis; te, tentacles.
- 26, 27 and 28: *Seidlia schmidti* (after Kawakatsu (1964b)).
26. **A** and **B**. Photograph and sketch of a live specimen (loc. Rishiri Island, Hokkaidô). **C**. Enlarged sketch of the head (loc. Rishiri Island, Hokkaidô).
27. **A** and **B**: Intestine variants from stained whole mounts (loc. On'nenai, Kamikawa, Hokkaidô).
28. *Seidlia schmidti* (after Kawakatsu & Yamada (1966)). The arrangement of eyes. **a** and **b** (loc. Kamikoshi, Kamikawa, Hokkaidô); **c** and **d** (loc. Akan, Kushiro, Hokkaidô); **e-h** (loc. Rausu, Nemuro, the Shiretoko Peninsula, Hokkaidô).

**Plate VII. *Seidlia auriculata*, *Phagocata albata* and *Phagocata iwamai***

29. *Seidlia auriculata* (**a-d**) and *Seidlia schmidti* (**e-h**) (after Kawakatsu & Yamada (1968)). The arrangement of eyes. **a** (loc. Kamikôchi, Nagano Pref., Honshû); **b** (loc. Mt. Hakkôpda, Aomori Pref., Honshû); **c** (loc. Mt. Tottabetsu, Hidaka, Hokkaidô); **d** (loc. Mt. Teshio-dake, Kamikawa, Hokkaidô). **e** (loc. Mt. Teshio-dake, Hokkaidô); **f** (loc. Akan, Kushiro, Hokkaidô); **g** (loc. Rausu, Nemuro, the Shiretoko Peninsula, Hokkaidô); **h** (loc. Rishiri Island, Hokkaidô).
30. *Phagocata albata* (after Ichikawa & Kawakatsu (1962)). **a**, **b** and **c** (type loc. Near Toyotomi Hot Spring, Sôya, Hokkaidô). Sketches of a live specimen, enlarged head and cocoon.  
ec, egg capsule (= cocoon); js, jelly substabce surrounding the cocoon.
- 31, 32 and 33: *Phagocata iwamai* (after Ichikawa & Kawakatsu (1962b)).
31. **A** and **B**. Photographs of 2 live specimens (type loc. Nayoro, Kamikawa, Hokkaidô).
32. **A** and **B**. Intestinal variants from stained whole mounts (type loc.).
33. General view of a sexually mature specimen (type loc.).  
e, eye; ov, ovary; ph, pharynx; pp, penis papilla; sv, spermiducal vesicle; te testis.
34. Photographs of 2 live specimens (loc. Takamatsu City, Shikoku).

35. General view of a sexually mature specimen (loc. Takamatsu City).  
e, eye; cb, copulatory bursa; o, ovary; od, ovovitelline duct; pb, penis bulb; ph, pharynx; sd, sperm duct; sv, spermiducal vesicle; t, testis.

**Plate VIII. *Phagocata kawakatsui* and *Phagocata suginoi***

- 36, 37 and 39: *Phagocata kawakatsui* (after Kawakatsu, Oki & Tamura (1986)).  
36. **A** and **B**. Photographs of 2 live specimens (loc. Hiruzen Heights, Okayama Pref., Honshû).  
37. **A** and **B**. Photographs of dorsal (**A**) and ventral (**B**) views of a specimen (loc. Kanazawa City, Ishikawa Pref., Honshû).  
39. Four cocoons (type loc., Kameoka City, Kyôto Pref., Honshû).  
38. Enlarged photographs of heads of 3 live specimens. **A**: *Phagocata kawakatsui* (loc. Takamatsu City, Shikoku); **B**: *Phagocata teshirogii* (loc. Hirosaki City, Aomori Pref., Honshû); **C**: *Phagocata iwamai* (loc. Nayoro City, Kamikawa, Hokkaidô).  
40 and 41: *Phagocata suginoi* (after Kawakatsu, Murayama & Nîmura (1974)).  
40. A photograph of a live specimen (type loc. Kashiwazaki City, Nîgata Pref., Honshû).  
41. **A** and **B**. A photograph taken from a whole mount (**A**) and its general view (**B**: type loc.)  
bs, bursa stalk; e, eye; gp, genital pore; m, mouth; o, ovary; ph, pharynx; pl, pharynx lumen; sv, spermiducal vesicle; t, testis.

**Plate IX. *Phagocata papillifera*, *Phagocata tenella* and *Phagocata vivida***

- 42 and 43: *Phagocata papillifera* (after Kawakatsu, Sugino, Oki, Tamura & Horikoshi (1984)).  
42. **A** and **B**. Photographs of the dorsal view of 2 preserved specimens (type loc. A driven well in Mitsukaidô City, Ibaraki Pref., Honshû). Notice the papillae located along the middorsal line of the body. **42C** and **D**. Side views of papillae (taken from a live specimen)(**C**) and a photomicrograph of papillae (**D**).  
43. **a** and **b**. General appearance in life. **a** and **b**: Two normal specimens. **c**: A deformed specimen having papillae in two longitudinal rows. **d-f**: Enlarged sketches of the head with supernumerary eyes.  
44. *Phagocata tenella* (after Ichikawa & Kawakatsu (1963)). **a-d**: Sketch of a live specimen (**a**) and enlarged heads with variant eyes (**b-d**)(type loc. Mt. Apoi, the Horoman-gawa River system, Hidaka, Hokkaidô).  
45, 46 and 47: *Phagocata vivida*.  
45. **A-C** (after Kawakatsu (2002)). Photographs of 2 live specimens (**A** and **B**) and a head (**C**) (loc. northern part of Kyôto Pref., Honshû).  
46. **A-C** (after Kim (& Kawakatsu)(1967)). Photographs of preserved specimens (loc. The Sobaek Mountains, South Korea). **A** and **B**: Dorsal view; **C**: ventral view.  
47. (after Sluys, Kawakatsu & Timoshkin (2001)). Ventral view of a preserved specimen (loc. Khor River, near Khabarovsk, Siberia, Russia)..

**Plate X. *Phagocata vivida*, *Bdellocephala annandalei* and *Bdellocephala brunnea***

48. *Phagocata vivida*. Sketches of heads showing the supernumerary eyes (after Kawakatsu, Teshirogi & Ishidfa (1982)(loc. Mt. Iwaki-yama, Hirosaki City, Aomori Pref., Honshû. KSL No. 1629). **a** (normal with 2 eyes); **b** (a pair of incomplete eyes); **c** and **d** (3 eyes); **e-h** (4 eyes); **i** (5 eyes); **j** and **k** (6 eyes); **l** (7 eyes).
- 49, 50 and 51: *Bdellocephala annandalei* (loc. Lake Biwa-ko, Shiga Pref., Honshû).
49. Dorsal (**A**) and ventral (**B**) views of a large preserved specimen fixed with Bouin's fluid (after Murayama & Kawakatsu (1973)).
50. Ventral view of a preserved specimen with Nozawa's fluid (after Kawakatsu (1964a)).
51. Sagittal view of the sucker (Kawakatsu's pencil sketch). Cf. Kawakatsu, Sluys, Timoshkin, Naumova, Nishino & Takai (2000).
52. *Bdellocephala brunnea*. A live specimen (photo by Dr. Nishino) (loc. Downstream of the Amagase Dam, the Uji-gawa River, Uji City, Kyôto Pref., Honshû). See **Pl. II** (Photos **9A** and **B**) of the present web article.

**Plate XI. *Bdellocephala brunnea*, *Bdellocephala borealis* and *Dendrocoelopsis lactea***

53. *Bdellocephala brunnea* (loc. Hirosaki City, Aomori Pref., Honshû). Sagittal view of the sucker (Kawakatsu's pencil sketch). Cf. Kawakatsu, Sluys, Timoshkin, Naumova, Nishino & Takai (2000).
- 54, 55, 56 and 57: *Bdellocephala borealis* (type loc. Hime-numa Pond, Rishiri Island, Hokkaidô)(after Kawakatsu, Asai & Yamada (1978)).
54. **A-D**. Dorsal views of 4 live specimens.
55. **A** and **B**. Heads of 2 preserved specimens (whole mounts).
56. **A** (whole mount) and **B** (general view).  
cb, copulatory bursa; gp, genital pore; m, mouth; od, ovovitelline duct; pb, penis bulb; ph, pharynx; sv, spermiducal vesicle; t, testis.
57. Sagittal view of the sucker (Kawakatsu's pencil sketch). Cf. Kawakatsu, Sluys, Timoshkin, Naumova, Nishino & Takai (2000).
58. *Dendrocoelopsis lactea* (loc. School ground of Hokkaidô University, Sapporo City, Hokkaidô)(after Ichikawa & Okugawa (1958)), pl. 1, photos 1-3, 5). **A** and **B** (2 live specimens); **C** (stained intestine, whole mount); **D** (enlarged head showing 2 pairs of normal eyes).

**Plate XII. *Dendrocoelopsis lactea*, *Dendrocoelopsis ichikawai*, *Dendrocoelopsis ezensis*, and *Dendrocoelopsis borealis***

59. *Dendrocoelopsis lactea* (loc. Nayoro City, Kamikawa, Hokkaidô). Stained intestine (whole mount)(after Kawakatsu (1973a)).
60. *Bdellocephala borealis* (type loc. Hime-numa Pond, Rishiri Island, Hokkaidô). Intestine variants (3 whole mounts)(after Kawakatsu, Asai & Yamada (1978)).
61. *Dendrocoelopsis ezensis* (loc. Wakkanai City, Sôya, Hokkaidô)(after Ichikawa & Okugawa (1958, pl. 2, photos 37-40)). **A-C** (3 live specimens); **D** (intestine, whole mount).

- 62, 63 and 64:** *Dendrocoelopsis ichikawai* (type loc. Hime-numa Pond, Rishiri Island, Hokkaidô)(after Kawakatsu, Asai & Yamada (1977)).
- 62.** **A and B.** Dorsal view of 2 live specimens.
- 63.** **A and B.** Dorsal (**A**) and ventral (**B**) views of a single specimen.
- 64.** Sagittal view of the sucker.  
ao, adhesive organ; br, brain; cgl, cyanophilous glands; cml, circular muscle; egl, eosinophilous glands; lml, longitudinal muscle layer; rm, retractor muscle.

**Plate XIII. *Dendrocoelopsis kishidai*, *Dendrocoelopsis?* sp., *Sphalloplana* spp. and *Dugesia japonica***

- 65.** *Dendrocoelopsis kishidai* (type loc. Nishiôji-Shichijô, Kyôto City, Honshû)(after Kawakatsu (1978)). Sagittal view of the sucker.  
ao, adhesive organ; br, brain; cml, circular muscle layers; egl, erythrophilic glands; egld, erythrophilic gland ducts; lml, longitudinal muscle layers; rm, retractor muscle fibers.
- 66.** *Dendrocoelopsis?* sp. of Lake Biwa-ko (loc. Off Tsuzurao-zaki Cape, the northern part of the Lake Biwa-ko: 40m and 50m in depth, respectively). **A.** Dorsal view of the enlarged head (after Kawakatsu, 1966a; see also Kawakatsu & Nishino, 1993: 98, Pl. I, fig. H). **B.** Dorsal view of a live specimen (after Kawakatsu, 1966a; see also Kawakatsu & Nishino, 1993: 98, pl. I, fig. G).
- 67. a-c:** *Sphalloplana* sp. of Mts. Yatsu-gadake (loc. Utsukushi-no-Mori, Nemba-ga-Hara Height, at the southern slope of Mts. Yatsu-gadake, Yamanashi Pref., Honshû). **a** (sketch of a live specimen (Kawakatsu's original sketch is in color)); **b** (dorsal view); **c** (ventral view)(after Kawakatsu (1966a)); Ichikawa & Kawakatsu (1967: 513, fig. 1)).
- 67. d-h and 68:** *Sphalloplana* sp. of Himeji (loc. A driven well at Yatabe, Taishi-chô near Himeji City, Hyôgo Pref., Honshû). **d** (lateral view of the head); **e** (dorsal view of a live specimen); **f** (transverse profile of the body form; **g** (ventral view in a contracted state); **h** (ventral side of the head in a preserved specimen)(after Kawakatsu (1966a); Ichikawa & Kawakatsu (1967: 515, fig. 2)).
- 68.** Sagittal view of the sucker (after Ichikawa & Kawakatsu (1967: 517, fig. 4)).  
br, brain; eg, eosinophilous gland cells; el., eosinophilous lining of adhesive organ; in, intestine; rm, retractor muscle of the adhesive organ.
- 69. A and B.** *Dugesia izuensis* (type loc. Near Shimoda City, Izu, Shizuoka Pref., Honshû). **A.** Preserved specimen (original: Katô (1943)). **B.** A sketch of a live specimen (original: Katô (1950)). These 2 figures are reproduced from Kawakatsu's article (1983: 3, figs 1 and 2).

**Plate XIV. *Dugesia japonica***

- 70, 71, 72, and 73:** *Dugesia japonica* (type loc. Genchi, Matsumoto City, Nagano Pref., Honshû).
- 70.** **A and B.** Dorsal (**A**) and ventral (**B**) views of a preserved specimen from the type locality (after Ichikawa & Kawakatsu (1964)). This sample is kept as a whole mount.
- 71. A and B:** Dorsal view of the body (**A**) and general structure (**B**) (after Sugino, Kawakatsu & Teshirogi (1966)). They were sketched by Kawakatsu from the whole

mount of the sample (70A and B) cited above.

au, auricle; br, brain; cop, copulatory organ; e, eye; gp, genital pore; m, mouth; nc, nerve cords; ov, ovary; ph, pharynx; sv, spermiducal vesicle.

72. Intestine (stained whole mount)(after Ichikawa & Kawakatsu (1964); see also Kawakatsu (1973a)).
73. Photographs showing the dorsal (A) and ventral (B) sides of the fully sexually mature specimens (loc. Nîmi City, Okayama Pref., Honshû)(after Kawakatsu & Miyazaki (1972)).
74. A-I. Heads of 10 live specimens showing supernumerary eyes (loc. Nîmi City, Okayama Pref., Honshû)(after Kawakatsu & Miyazaki (1971)). A-D: 3 eyes; E-G: 4 eyes; H: 5 eyes; I: crossed eyes.

#### Plate XV. *Dugesia japonica* and *Dugesia ryukyuensis*

75. Map of the Far East, showing the revised demarcation lines of geographical distribution of *Dugesia japonica* (an outer solid line: ?-?) and *Dugesia ryukyuensis* (an inside heavy solid line). Geographical distribution records of the other Asiatic *Dugesia* species are also indicated. Cf. Kawakatsu, Oki, Tamura, Takai, Timoshkin & Porfirjeva (1993: 12, fig. 13); Tamura, Yamamoto, Takai, Oki & Kawakatsu (1998: 324, fig. 3).

In the Southwest Islands of Japan (for the detailed map, see Kawakatsu & Sasaki (2004)), *Dugesia japonica* is known from the following islands: Tane-ga-shima Is., Yaku-shima Is., Amami-Ôshima Is., Okinawa Is., Ishigaki-jima Is., Iriomote-jima Is., and Yonaguni-jima Is. *Dugesia ryukyuensis* is common in the Southwest Islands. In the south-western area of Kyûshû in Japan, *D. ryukyuensis* is also found sporadically,

There is a possibility that *Dugesia* sp. 1 from ponds of Taipei City and Wuku Luchon Swamps in Taiwan (cf. Kawakatsu, Oki, Tamura, Yamayoshi, Lue & Hagiya (1979: 79-83)) is *Dugesia austroasiatica*.

**Notice.** The scientific names (with their authorships and dates) of 15 Asiatic dugesiid species (including 2 undescribed species from Taiwan) shown on the map are as follows:

Japan:

*Dugesia izuensis* (Katô, 1943); *Dugesia japonica* Ichikawa et Kawakatsu, 1964; *Dugesia ryukyuensis* Kawakatsu, 1976.

Taiwan:

*Dugesia* sp. 1 (species of Taiwan). Three localities in Taipei. Cf. Kawakatsu, Oki, Tamura, Yamayoshi, Lue & Hagiya (1979: 79-83, figs 10 and 11).

*Dugesia* sp. 2 (species of Lanhsü Island). Cf. Tamura, Oki, Kawakatsu, Lue, Takai, Hori, Muto & Osawa (1987: 60-61, 63, figs 4 and 5).

The Phillipines:

*Dugesia hymanae* (Šivickis, 1928).

Borneo (Sarawak IV) in East Maslaysia:

*Dugesia borneana* Kawakatsu, 1972.

Papua New Guinea in Indonesia:  
*Dugesia novaguineana* Kawakatsu, 1976.  
Thailand:  
*Dugesia siamana* Kaswakatsu, 1980.  
*Dugesia deharvengi* Kawakatsu yet Mitchell, 1989.  
Malaysia (West):  
*Dugesia batuensis* Ball, 1970.  
Myanma-Nainggan-Daw (=Burma):  
*Dugesia burmaensis* (Kaburaki, 1918).  
West Bengal in India:  
*Dugesia bengalensis* Kawakatsu, 1983.  
Andaman Islands in India:  
*Dugesia andamanensis* (Kaburaki, 1925).  
India: *Dugesia lindbergi* De Beauchamp, 1959.

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