Neotypification of *Difflugia biwae* (Amoebozoa: Tubulinea: Arcellinida) from the Lake Biwa, Japan

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**Introduction**

*Difflugia biwae* Kawamura, 1918 has been redescribed. Here, the neotype of *D. biwae*, which was newly collected from its type locality, Lake Biwa, is designated to the species to clarify its taxonomic status. Morphometric characterization of *D. biwae* was performed. A statistically significant correlation between body length and shell collar diameter was identified in the population of the Lake Biwa, but this correlation was not significant in the population from the Mulan Lake. The PCA scatterplot indicates that the Mulan Lake population could be a separate taxon identified by shorter protuberance length and body length.

**Key Words:** Arcellinida, Difflugiidae, morphology, testate amoeba, Tubulinea.
would be extinct in Lake Biwa.

*Difflugia biwae* was also recorded from three Chinese lakes: Qiandao Lake, Zhejiang Province (Li and Yu 2001), Poyang Lake, Jiangxi Province (Wang et al. 2003), and Mulan Lake, Hubei Province (Yang and Shen 2005). Yang and Shen (2005) described the morphological details of *D. biwae* along with biometrical data based on living amoebae from Mulan Lake, where it was found in high abundance. Fortunately, one of the authors (Jun Yang, personal communication) provided raw measurement data for *D. biwae*.

The aims of the present paper are (1) to redescribe *D. biwae* from preserved specimens collected from Lake Biwa and to designate the neotype of this species, and (2) to morphometrically compare the population of *D. biwae* from Mulan Lake (China) with the population from Lake Biwa (Japan).

**Materials and Methods**

**Sample collection.** Collection of regular interval investigations of plankton. The Shiga Prefectural Institute of Fisheries Experimental Station and the Shiga Prefectural Institute of Public Health and Environmental Science carried out regular interval investigations (once in the middle of each month) of plankton from 1952 to 2004, for 57 years in five sites (St. I–V; Fig. 1) in the Northern Basin (Ichise et al. 2004; regular interval investigations have still been performed). Sampling sites were designed as the five dividing points on a line of about 15 km from point St. I (entrance of Hikone port: 35°17′06″N, 136°14′39″E) to point St. V (Funakizaki small peninsula, Adogawa-cho: 35°19′12″N, 136°04′48″E) to three points St. II (35°17′35″N, 136°12′08″E), St. III (35°18′04″N, 136°09′29″E), and St. IV (35°18′36″N, 136°07′09″E), respectively (Ichise et al. 2004). Samples were taken using a plankton net with a NXX14 Muller gauze (sieve size 95 µm: net diameter 25 cm: Rigo Co. Ltd.) in four layers (0–10 m, 10–20 m, 20–40 m, and 40–75 m depth) from the investigation boat. All plankton samples were fixed by 5% formalin solution and stored in the Shiga Prefectural Institute of Fisheries Experimental Station. In the present study, the specimens were mainly obtained from this collection.

Specimens from the collection for this study. The neotype and "voucher specimen series I (VSS-I) and II (VSS-II) (non-type specimens)" were taken from a plankton sample fixed in 5% formalin solution from a 0–10 m depth at St. III (GPS data mentioned above: Fig. 1) on 15 August 1961 by Mr. Kan-ichi Mita and Mr. Kenji Naka; code Measurement#2: 0–10 m depth at St. IV (Fig. 1) on 18 September 1963, by Mr. Kenji Naka, (Ichise et al. 2004).

The raw data measurements of 100 shells of *D. biwae* in Mulan Lake, China [the same raw data of Yang and Shen (2005)] were provided courtesy of Dr. Yang, based on the species collected from Mulan Lake, Hubei Province, China on 24–25 July 2003 and on 28–29 July 2004 (Yang and Shen 2005). The information regarding the lake is given in Yang et al. (2004).

Neotype and voucher specimen series. The neotype and specimens of the series VSS-I were mounted with Euparal on mounted slides under stereoscopic microscope (SMZ745, Nikon). Specimens of the series VSS-II were sorted by hand under the stereoscopic microscope and stored in vials/jars filled with 5% formalin solution (see Appendix 2).

Light micrographs and scanning electron micrographs. Light micrographs of specimens (Morph#1) were taken in 5% formalin solution with an Optiphot I microscope (Nikon). Specimens of the series VSS-II were sorted by hand under the stereoscopic microscope and stored in vials/jars filled with 5% formalin solution (see Appendix 2).
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**Results**

**Taxonomy**

Order **Arcellinida** Kent, 1880  
Suborder **Arcellina** Haeckel, 1894  
Family **Difflugiidae** Wallich, 1864  
Genus **Difflugia** Lederer, 1815  
*Difflugia biwae* Kawamura, 1918  
[Japanese standard name: Biwako-tsubokamuri]  
(Figs 3–5)

**Difflugia biwae** Kawamura, 1918: 114–115, fig. 174;  
Kawamura 1927: 2054, fig. 3886; Kawamura 1952: 1735, fig. 4855; Kawamura and Hada 1965: 33, fig. 98–1; Mizuno 1977: 26, fig. 7; Li and Yu 2001: 117, table 1; Wang et al. 2003: 347, table 1; Yang and Shen 2005: 103–107, figs 3–18.

**Material examined.** Neotype: TNS-AL–63110 (VSS-I-10 in Appendix 1) in TNS (Department of Botany, National Museum of Nature and Science), on mounted slide with Eu-paral, 0–10 m in depth at St. III (35°18′04″N, 136°09′29″E) on 15 August 1961 by Mr. Kan-ichi Mita and Mr. Kenji Naka (Ichise et al. 2004), deposited at Department of Botany, National Museum of Nature and Science, previously known as the National Science Museum.

Voucher specimen series, VSS I: The 19 specimens were individually mounted on slides. Fifteen specimens were deposited at TNS under the catalogue numbers TNS-AL-63101 to 63116 (VSS-I-1 to 16), and the remaining four were deposited at the Lake Biwa Museum in Shiga Prefecture, Japan, under the catalogue numbers LBM 2040000001–2040000004 (VSS-I-17 to 20). The collection data for all the specimens is same as the neotype.

VSS II: TNS-AL-63117 to 63140 in TNS (see Appendix 2 with vial data), a total of 51 specimens kept in 5% formalin solution in vials (see Appendix 2). The collection data is same as the neotype.

The specimens of Morph#1, Morph#2, Measurement#1 and Measurement#2 were lost from a laboratory collection in Shiga Prefectural Institute of Public Health and Environmental Science. Sampling data were shown in Materials and methods part.

**Designation of neotype and voucher specimens.** The authors could not confirm the existence of the type series (holotype and paratypes) of *D. biwae*. The type series or any observed specimens are believed to have been lost in the past because no specimens were deposited by Kawamura (1918), which was confirmed by interviews of several of his colleagues (e.g., Kenichiro Negoro, personal communication); this was also the case for his simultaneous studies.

The original very short description of this species is incomplete, and thus its taxonomic status must be clarified. Furthermore, because the population of the type locality is considered to be extinct, a name-bearing type for *D. biwae* is deemed to be needed to verify their conservation status in the long term. Thus, the specimen (TNS-AL–63110), which was collected from Lake Biwa as the type locality assigned by Kawamura (1918) (Fig. 3A), is herein designated as the neotype for *D. biwae*. The species was abundant with morphological variation in Lake Biwa population as the sub-dominant plankton species in August each year in that collection period in 1961. Accordingly, the present neotypification meets the conditions of Article 75 of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999).

**Diagnosis.** Shell fusiform, transparent, and brown in fixed specimens, composed of mineral particles or diatom frustules as xenosomes, from their environment. The circu-
lar oral aperture surrounded by a conspicuous low funnel-shaped collar with a ragged margin. Shell circular in cross-section, narrowest at the base of the collar and gradually swelling to broadest at the posterior, then narrowing gently toward the aboral protuberance. The protuberance gently sinuous and pointed at the tip. One or two pseudopodia extended from the aperture to the back of the shell.

**Redescription.** Shell fusiform, transparent, and brown in fixed specimens, composed of mineral particles (Figs 3B, 4E, 5A–G) or diatom frustules [typically Praestephanos suzukii (A. Tuji and Kociolek, 2000), same one species as previous "Stephanodiscus suzukii" in Ichise et al. (2004)] as xenosomes, captured from their environment (Fig. 5D).

Body length [(TL) in Fig. 2, all measurement in VSS-I, maximum–minimum, followed by the measurement of the neotype in parenthesis, the same hereinafter] 359–230 (312) µm, broadest body width (BW) 79–54 (59) µm, narrowest body width (NW) 52–40 (42) µm, broadest diameter of collar (CD) 97–78 (83) µm, broadest diameter of aboral protuberance (PD) 26–19 (24) µm, length of protuberance (PL) 157–84 (155) µm (Figs 4A–D, 5A). Shell circular in cross-section (Fig. 5B), narrowest below the collar and gradually swelling to broadest 1.98–1.29 (1.40), (BW/NW in Fig. 2, the same hereinafter) in the position of the posterior 0.19–0.27 (0.19), (BW/TL) of the body length, then narrowing
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abruptly toward the aboral protuberance (Figs 4A–D, 5A). A conspicuous low-funnel-shaped collar surrounds the circular oral aperture (Figs 4A–E, 5A–C). Collar margin thin and slightly wavy in the outer periphery (Figs 4E, 5A–C, E, F). Broadest diameter of body 0.90–1.59 (1.41), collar diameter (CD/BW). The aboral protuberance, gently sinuous and pointed in the tip (Figs 4A–D, F, 5A, G). Broadest diameter of the protuberance is in the position of the posterior attachment part of body, at 0.07–0.05 (0.08) of the body lengths (PD/TL) (Figs 4A–D, 5A). All raw measurement data shown in Appendix 1 [one obviously irregular shell (VSS-I-19) excluded from all size discussion and morphometric analyses]. One or two pseudopodia extend from the aperture to the back of the shell (Fig. 3A; Kawamura 1918).

Food predominantly diatoms such as *P. suzukii* (Fig. 5D; *P. suzukii* in shell of this species, as previously in cytoplasm).

**Distribution.** Lake Biwa, Shiga Prefecture, Japan (e.g., Kawamura 1918) and three Chinese lakes: Qiandao Lake, Zhejiang Province (Li and Yu 2001); Poyang Lake, Jiangxi Province (Wang et al. 2003); Mulan Lake, Hubei Province, China. However, Tsugeki et al. (2003) and Ichise et al. (2004) reported that *D. biwae* is extinct in Lake Biwa due to eutrophication caused by nutrient input from its surrounding river systems.

**Remarks.** *Difflugia biwae* resembles *D. delicatula* Gauthier-Lièvre and Thomas, 1958, *D. elegans* Penard, 1890 and *D. oblonga caudata* Štěpánek, 1952 in its shell shape and aboral protuberance. However, *D. biwae* can be clearly distinguished from these species by the feature that its collar diameter is longer than its body width. Additionally, *D. biwae* differs from these species in that it has a long neck (vs. short neck in *D. delicatula* and *D. elegans*) and the smooth appearance of its elongated fusiform shell (vs. rough appearance of elongated oviform shells in *D. elegans* and *D. o. caudata*). Yang and Shen (2005) have discussed the comparisons of these conjugates.

Yang and Shen (2005) referred to “its typical locomotive form on the substrate.” However, the authors did not observe pseudopodia of *D. biwae* in the present study. The description of pseudopodia in the redescription section is based on the original line drawings (Fig. 3A; Kawamura 1918) and the observations of Yang and Shen (2005).

Ichise et al. (2004) reported that when the body of *D. biwae* was crushed, shells of Centrales diatom, mainly *P. suzukii*, exuded from the cells, suggesting that this species mainly preyed predominantly on diatoms, such as *P. suzukii* (Fig. 5D).

In the present paper, we restore the Japanese standard name as “Biwako-tsubokamuri” written in the original description (Kawamura 1918). Although Mizuno (1977) used “Biwa-tsubokamuri” as the Japanese name for the species, it was a miss-spelling at first. “Biwako” and “ko” represent “Lake Biwa” and ”Lake” respectively in Japanese.

**Biometry**

**Divergence and correlation of each character.** Table 1 shows the detailed morphometric characterization of *Difflu-
Table 1. Morphometric characteristics of *Difflugia biwae* from Lake Biwa (taken in 1961: neotype and VSS I, n = 19; left, 1961: Measurement#1, n = 161: middle left, 1963: Measurement#2, n = 70: middle right), and from Mulan Lake (n = 100: right). Measurements in µm. Minimum (Min), maximum (Max), arithmetic mean (X), standard deviation (SD), and coefficient of variation in % (CV).

| Characteristics | X | M | SD | SE |
|-----------------|---|---|----|----|
| Total length (TL) | 317.1 | 293.2 | 311.2 | 227.5 |
| Body width (BW) | 63.2 | 60.8 | 81.2 | 82.3 |
| Collar diameter (CD) | 87.8 | 81.2 | 78.2 | 74.6 |
| Neck width (NW) | 43.2 | 40.8 | 45.1 | 47.1 |
| Body length (BL) | 183.7 | 184.8 | 176.1 | 144.1 |
| Protuberance diameter (PD) | 45.3 | 17.5 | 18.3 | 15.6 |
| Protuberance length (PL) | 133.3 | 108.4 | 135.2 | 84.1 |

| Characteristics | X | CV | Min | Max |
|-----------------|---|----|-----|-----|
| Total length (TL) | 7.71 | 10.99 | 11.76 | 269 |
| Body width (BW) | 8.81 | 6.16 | 462 | 534 |
| Collar diameter (CD) | 6.91 | 7.40 | 576 | 86.4 |
| Neck width (NW) | 7.34 | 6.16 | 6.15 | 6.74 |
| Body length (BL) | 8.05 | 8.52 | 907 | 6.82 |
| Protuberance diameter (PD) | 20.80 | 20.61 | 10.26 | — |
| Protuberance length (PL) | 15.21 | 17.12 | 18.45 | 24.52 |

1 Data after Yang and Shen (2005); 2 Alphabetical letters in Fig. 2; 3 Calculated raw dataset provided from Dr. Yang; 4 Data not measured in Yang and Shen (2005); 5 Different italic alphabets after arithmetic means (X) indicate significant differences among means in each row by Tukey–Kramer multiple comparison (α = 0.05).
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D. *biwae* from four sample series: Lake Biwa in 1961 ("the neotype and VSS I" and "Measurement#1"), 1963 ("Measurement#2") and from Mulan Lake. The species shows great diversity in protuberance length (PL), which has high variability (coefficient of variation in %, CV between 15.21 and 24.52). While body width (BW), collar diameter (CD), neck width (NW), and body length (BL) are fairly constant and have low variability (CV between 4.62 and 8.81, between 5.76 and 8.64, between 6.15 and 7.34, and between 6.82 and 9.07, respectively).

In three sample series from Lake Biwa (Tables 2–4), positive correlations (*p*<0.05) were found among the measurement characteristics of *D. biwae* only in two relationships: total length (TL) and body length (BL), and TL and protuberance length (PL). Neck width (NW) was highly positively correlated with CD at *p*<0.01, while TL and BL were positively correlated with CD (at least *p*<0.05) (Tables 3, 4).

**Comparison among sample series.** Tukey–Kramer multiple comparison tests indicated significant differences among each arithmetic mean (X), but did not show a clear trend in each of the sample series (Table 1).

Multiple comparison revealed that all variables of the Mulan Lake sample series were significantly different from the three series of the Lake Biwa population. The PCA scatterplot (Fig. 6) indicated that the Mulan Lake and Lake Biwa populations tended to differ, with some overlaps. Eigen vectors of PC1 and PC2 axes indicated that they are mainly contributed by PL and BL (Table 5).

Overlap rate was evaluated by LDA (Table 6). Three sample series from Lake Biwa ("the neotype and VSS I", "1961: Measurement#1" and "1963: Measurement#2") included many misclassifications. Some samples from Lake Biwa (1961: Measurement#1 and 1963: Measurement#2) were misclassified as samples which belonged to the Mulan Lake population. Conversely, 5% of samples from Mulan Lake were misclassified as samples from Lake Biwa.

**Discussion**

The correlation between BL and CD was statistically significant in the Lake Biwa sample series, but was not significant in the sample series from Mulan Lake (Table 2; Yang and Shen 2005). Slight differences in the values of correlation coefficient were found between Lake Biwa and Mulan Lake individuals.

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**Table 2.** Correlation coefficients between morphometric characteristics in *Difflugia biwae* from Lake Biwa (1961: neotype and VSS I, n=19).

| Characteristics | TL   | BW   | CD    | NW    | BL    | PD    |
|-----------------|------|------|-------|-------|-------|-------|
| TL              | —    |      |       |       |       |       |
| BW              | 0.0042 |      |       |       |       |       |
| CD              | 0.3857 | −0.4987 | —     |       |       |       |
| NW              | −0.2369 | 0.0019 | 0.0889 | —     |       |       |
| BL              | 0.5599* | 0.1233 | 0.4347 | 0.1974 | —     |       |
| PD              | −0.2581 | 0.2785 | −0.1150 | 0.2522 | 0.1477 | —     |
| PL              | 0.7963*** | −0.0850 | 0.1475 | −0.4296 | −0.0553 | −0.4189 |

**Table 3.** Correlation coefficients between morphometric characteristics in *Difflugia biwae* from Lake Biwa (1961: Measurement#1, n=160).

| Characteristics | TL   | BW   | CD    | NW    | BL    | PD    |
|-----------------|------|------|-------|-------|-------|-------|
| TL              | —    |      |       |       |       |       |
| BW              | 0.1792* |      |       |       |       |       |
| CD              | 0.2029** | 0.1893* | —     |       |       |       |
| NW              | 0.1027 | 0.2999** | 0.3028** | —     |       |       |
| BL              | 0.6598** | 0.1466 | 0.2264* | 0.1433 | —     |       |
| PD              | 0.3104** | 0.1555* | 0.1630* | 0.1347 | 0.1038 | —     |
| PL              | 0.7728** | 0.1146 | 0.0786 | 0.0155 | 0.0330 | 0.3236** |

**Table 4.** Correlation coefficients between morphometric characteristics in *Difflugia biwae* from Lake Biwa (1963: Measurement#2, n=70).

| Characteristics | TL   | BW   | CD    | NW    | BL    | PD    |
|-----------------|------|------|-------|-------|-------|-------|
| TL              | —    |      |       |       |       |       |
| BW              | 0.0191 |      |       |       |       |       |
| CD              | 0.2802* | 0.2309 | —     |       |       |       |
| NW              | 0.0814 | 0.1273 | 0.4711** | —     |       |       |
| BL              | 0.7356** | −0.1229 | 0.2649* | −0.0016 | —     |       |
| PD              | 0.1174 | −0.0708 | 0.0365 | −0.0588 | 0.1823 | —     |
| PL              | 0.9011** | 0.1049 | 0.2148 | 0.1127 | 0.3690** | 0.0444 |
The scatter plot based on the PC1 and PC2 in the PCA with five traits excluding TL and Protuberance diameter (PD) shows that the Mulan Lake sample is out of variation among three sample series (“the neotype and VSS 1”, “1961: Measurement#1” and “1963: Measurement#2”) from Lake Biwa, although there is a slight overlap between them. The PC1 and PC2 have the most positive contributions to PL and BL, respectively, indicating that the Mulan Lake population tends to have shorter PL and BL than the Lake Biwa population. Indeed, as shown in Table 1, the arithmetic

### Table 5. Eigen vectors of principal component analysis from characteristics of *Difflugia biwae* from Lake Biwa and from Mulan Lake.

|        | PC1     | PC2     | PC3     | PC4     | PC5     |
|--------|---------|---------|---------|---------|---------|
| BW     | 0.0191  | 0.02312 | 0.27602 | 0.48468 | 0.82946 |
| CD     | 0.11336 | 0.13665 | 0.68089 | -0.68987 | 0.17012 |
| NW     | -0.05639 | -0.2593 | 0.6725  | 0.48076  | -0.49619 |
| BL     | 0.27204 | 0.91021 | 0.06174 | 0.23868  | -0.19164 |
| PL     | 0.95373 | -0.29166 | -0.06431 | 0.03264  | -0.0115  |

| Contribution (%) | 73.5 | 13.6 | 6.9 | 3.3 | 2.7 |

### Table 6. Numbers of sample predicted by linear discriminant analysis from characteristics of *Difflugia biwae* from Lake Biwa and from Mulan Lake.

| Sample series     | n  | 1961: neotype and VSS 1 | 1961: Measurement#1 | 1963: Measurement#2 | Mulan Lake |
|-------------------|----|-------------------------|----------------------|----------------------|------------|
| 1961: neotype and VSS 1 | 19 | 11 (58)                 | 1 (5)                | 7 (37)               | 0          |
| 1961: Measurement#1 | 160 | 21 (13)               | 11 (71)              | 22 (14)              | 3 (2)      |
| 1963: Measurement#2 | 70  | 11 (16)               | 11 (16)              | 42 (60)              | 6 (8)      |
| Mulan Lake        | 100 | 1 (1)                  | 1 (1)                | 3 (3)                | 95 (95)    |

* numbers between parentheses are percentage.
means for PL and BL were significantly smaller in the Mulan Lake sample. This PCA indicates that the Mulan Lake population could be a separate taxon identified by shorter PL and BL.

Based on the present measurements (Lake Biwa) and the provided measurement data (Mulan Lake), the multiple comparison tests revealed that all variables of the population from the Mulan Lake were significantly different from the three series of the Lake Biwa population. Morphometric analysis showed that the two populations were differentiated at the subspecies level, with some overlaps.

However, because we could not obtain a living individual of this species in Lake Biwa, we would like to suspend this decision. If living individuals are obtained from Lake Biwa in the future, we could make a taxonomic decision by determining its genetic distance using DNA analysis between the Lake Biwa and Mulan Lake populations.

We have not seen _D. biwae_ from the other two lake populations, Qiandao Lake (Li and Yu 2001) and Poyang Lake (Wang et al. 2003) from China, but we hope that further study on all populations may make the species of _D. biwae_ more clear. However, these three lakes in China are also threatened by pollution (Dr. Jun Yang, personal communication), meaning that the species is at risk of extinction.

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Appendix 1. Measurements, raw data, of neotype and voucher specimen series I (VSS-I, 1961, n=20) on slide glass. Abbreviations, TL, total length; BW, body width; CD, collar diameter; NW, neck width; BL, body length; PD, protuberance diameter; PL, protuberance length.

| Specimen number | Measured axes in Fig. 2 |
|-----------------|-------------------------|
|                 | TL  | BW  | CD  | NW  | BL  | PD  | PL  | BW/NW | BW/TL | CD/BW | PD/TL |
| VSS-I-1         | 322 | 58  | 92  | 41  | 167 | 19  | 155 | 1.41   | 0.18  | 1.59  | 0.06  |
| VSS-I-2         | 341 | 61  | 91  | 40  | 184 | 22  | 157 | 1.53   | 0.18  | 1.49  | 0.06  |
| VSS-I-3         | 330 | 69  | 96  | 42  | 191 | 19  | 139 | 1.64   | 0.21  | 1.39  | 0.06  |
| VSS-I-4         | 328 | 63  | 78  | 41  | 178 | 22  | 150 | 1.54   | 0.19  | 1.24  | 0.07  |
| VSS-I-5         | 269 | 62  | 85  | 46  | 185 | 20  | 84  | 1.35   | 0.23  | 1.37  | 0.07  |
| VSS-I-6         | 308 | 65  | 86  | 49  | 182 | 19  | 126 | 1.33   | 0.21  | 1.32  | 0.06  |
| VSS-I-7         | 341 | 69  | 91  | 52  | 206 | 21  | 135 | 1.33   | 0.20  | 1.32  | 0.06  |
| VSS-I-8         | 338 | 68  | 89  | 40  | 204 | 20  | 134 | 1.70   | 0.20  | 1.30  | 0.06  |
| VSS-I-9         | 351 | 63  | 94  | 41  | 201 | 26  | 150 | 1.54   | 0.18  | 1.49  | 0.07  |
| VSS-I-10 [neotype] | 312 | 59  | 83  | 42  | 157 | 24  | 155 | 1.40   | 0.19  | 1.41  | 0.08  |
| VSS-I-11        | 315 | 60  | 85  | 43  | 182 | 21  | 133 | 1.40   | 0.19  | 1.42  | 0.07  |
| VSS-I-12        | 305 | 61  | 88  | 45  | 166 | 19  | 139 | 1.36   | 0.20  | 1.44  | 0.06  |
| VSS-I-13        | 310 | 60  | 91  | 46  | 198 | 20  | 112 | 1.30   | 0.19  | 1.52  | 0.06  |
| VSS-I-14        | 274 | 62  | 90  | 42  | 156 | 25  | 118 | 1.48   | 0.23  | 1.45  | 0.09  |
| VSS-I-15        | 330 | 60  | 92  | 41  | 196 | 21  | 134 | 1.46   | 0.18  | 1.53  | 0.06  |
| VSS-I-16        | 315 | 79  | 71  | 40  | 172 | 19  | 143 | 1.98   | 0.25  | 0.90  | 0.06  |
| VSS-I-17        | 359 | 54  | 97  | 42  | 199 | 19  | 160 | 1.29   | 0.15  | 1.80  | 0.05  |
| VSS-I-18        | 278 | 58  | 86  | 45  | 178 | 20  | 100 | 1.29   | 0.21  | 1.48  | 0.07  |
| VSS-I-19*       | 230 | 61  | 79  | 43  | 173 | 25  | 55  | 1.42   | 0.27  | 1.30  | 0.11  |
| VSS-I-20        | 298 | 70  | 84  | 42  | 189 | 19  | 109 | 1.67   | 0.23  | 1.20  | 0.06  |

* One obviously irregular shell (VSS-I-19*) removed from Redescription part, all size discussion and morphometric analyses.

Appendix 2. Preservation detail of voucher specimen series II (VSS-II, 1961, n=51) stored in vials/jars filled with 5% formalin solution, added the catalogue numbers in TNS (Department of Botany, National Museum of Nature and Science).

| Catalogue number in TNS | Jar number | Vial number | Number of amoeba shells |
|-------------------------|------------|-------------|-------------------------|
| TNS-AL-63117            | J-1        | VSS-II-1    | 1                       |
| TNS-AL-63118            | J-1        | VSS-II-2    | 1                       |
| TNS-AL-63119            | J-1        | VSS-II-3    | 1                       |
| TNS-AL-63120            | J-1        | VSS-II-4    | 1                       |
| TNS-AL-63121            | J-1        | VSS-II-5    | 1                       |
| TNS-AL-63122            | J-1        | VSS-II-6    | 1                       |
| TNS-AL-63123            | J-1        | VSS-II-7    | 1                       |
| TNS-AL-63124            | J-1        | VSS-II-8    | 1                       |
| TNS-AL-63125            | J-2        | VSS-II-9    | 1                       |
| TNS-AL-63126            | J-2        | VSS-II-10   | 1                       |
| TNS-AL-63127            | J-2        | VSS-II-11   | 1                       |
| TNS-AL-63128            | J-2        | VSS-II-12   | 1                       |
| TNS-AL-63129            | J-2        | VSS-II-13   | 1                       |
| TNS-AL-63130            | J-2        | VSS-II-14   | 1                       |
| TNS-AL-63131            | J-2        | VSS-II-15   | 1                       |
| TNS-AL-63132            | J-3        | VSS-II-16   | 1                       |
| TNS-AL-63133            | J-3        | VSS-II-17   | 1                       |
| TNS-AL-63134            | J-3        | VSS-II-18   | 1                       |
| TNS-AL-63135            | J-3        | VSS-II-19   | 1                       |
| TNS-AL-63136            | J-3        | VSS-II-20   | 1                       |
| TNS-AL-63137            | J-3        | VSS-II-21   | 1                       |
| TNS-AL-63138            | J-3        | VSS-II-22   | 10                      |
| TNS-AL-63139            | J-3        | VSS-II-23   | 10                      |
| TNS-AL-63140            | J-3        | VSS-II-24   | 10                      |

Total 51
Appendix 3. Measurements, raw data, of Measurement#1 (1961, n=161) and Measurement#2 (1963, n=70). Abbreviations, TL, total length; BW, body width; CD, collar diameter; NW, neck width; BL, body length; PD, protuberance diameter; PL, protuberance length.

| Specimen number | Shell number | Measured axes in Fig. 2 |
|-----------------|--------------|-------------------------|
| Measurement#1   |              | TL  | BW  | CD  | NW  | BL  | PD  | PL  |
| 1               | 320          | 60  | 90  | 40  | 200 | 20  | 120 |
| 2               | 300          | 60  | 80  | 40  | 170 | 15  | 130 |
| 3               | 320          | 62  | 80  | 45  | 190 | 18  | 130 |
| 4               | 300          | 62  | 90  | 40  | 180 | 20  | 120 |
| 5               | 290          | 60  | 85  | 50  | 200 | 20  | 90  |
| 6               | 320          | 60  | 90  | 40  | 190 | 20  | 130 |
| 7               | 275          | 55  | 80  | 40  | 175 | 10  | 100 |
| 8               | 285          | 60  | 80  | 40  | 185 | 20  | 100 |
| 9               | 295          | 60  | 90  | 40  | 185 | 20  | 110 |
| 10              | 310          | 60  | 90  | 40  | 205 | 13  | 105 |
| 11              | 310          | 60  | 80  | 40  | 170 | 15  | 140 |
| 12              | 290          | 60  | 90  | 42  | 180 | 15  | 110 |
| 13              | 260          | 60  | 80  | 38  | 180 | 15  | 80  |
| 14              | 320          | 60  | 80  | 40  | 200 | 18  | 120 |
| 15              | 320          | 80  | 80  | 40  | 210 | 20  | 110 |
| 16              | 320          | 70  | 80  | 45  | 200 | 20  | 120 |
| 17              | 280          | 60  | 80  | 40  | 180 | 10  | 100 |
| 18              | 270          | 60  | 80  | 40  | 180 | 15  | 90  |
| 19              | 300          | 60  | 90  | 40  | 190 | 15  | 110 |
| 20              | 260          | 60  | 80  | 40  | 160 | 15  | 100 |
| 21              | 260          | 60  | 80  | 40  | 170 | 15  | 90  |
| 22              | 295          | 62  | 90  | 40  | 190 | 18  | 105 |
| 23              | 300          | 60  | 80  | 40  | 180 | 20  | 120 |
| 24              | 320          | 62  | 80  | 40  | 200 | 20  | 120 |
| 25              | 300          | 65  | 80  | 40  | 190 | 20  | 110 |
| 26              | 300          | 60  | 80  | 40  | 190 | 18  | 110 |
| 27              | 300          | 60  | 70  | 35  | 200 | 15  | 100 |
| 28              | 290          | 60  | 80  | 40  | 190 | 18  | 100 |
| 29              | 300          | 60  | 80  | 40  | 190 | 20  | 110 |
| 30              | 330          | 62  | 70  | 40  | 170 | 20  | 160 |
| 31              | 320          | 60  | 90  | 40  | 190 | 20  | 130 |
| 32              | 260          | 60  | 80  | 40  | 170 | 15  | 90  |
| 33              | 280          | 60  | 80  | 40  | 190 | 15  | 90  |
| 34              | 300          | 70  | 90  | 50  | 190 | 20  | 110 |
| 35              | 240          | 65  | 90  | 40  | 160 | 15  | 80  |
| 36              | 280          | 70  | 90  | 50  | 180 | 20  | 100 |
| 37              | 290          | 60  | 80  | 40  | 170 | 15  | 120 |
| 38              | 290          | 65  | 90  | 45  | 190 | 20  | 100 |
| 39              | 280          | 60  | 80  | 40  | 170 | 20  | 110 |
| 40              | 340          | 60  | 80  | 50  | 190 | 20  | 150 |
| 41              | 310          | 60  | 80  | 45  | 200 | 20  | 110 |
| 42              | 300          | 60  | 80  | 40  | 190 | 20  | 110 |
| 43              | 280          | 60  | 90  | 40  | 170 | 20  | 110 |
| 44              | 280          | 63  | 80  | 45  | 190 | 15  | 90  |
| 45              | 240          | 65  | 90  | 45  | 140 | 20  | 100 |
| 46              | 260          | 60  | 80  | 40  | 190 | 15  | 70  |
| 47              | 280          | 60  | 85  | 40  | 200 | 18  | 80  |
| 48              | 330          | 62  | 90  | 45  | 220 | 20  | 110 |
| 49              | 280          | 60  | 80  | 45  | 200 | 15  | 80  |
| 50              | 280          | 60  | 80  | 40  | 170 | 20  | 110 |
| 51              | 350          | 70  | 80  | 45  | 210 | 20  | 140 |
| 52              | 340          | 68  | 90  | 40  | 200 | 20  | 140 |
| 53              | 300          | 65  | 85  | 40  | 190 | 15  | 110 |
| 54              | 320          | 60  | 80  | 40  | 190 | 20  | 130 |
| 55              | 320          | 60  | 90  | 42  | 200 | 15  | 120 |
Neotypification of *Difflugia biwae* from Japan

### Appendix 3. Measurements, raw data, of Measurement#1 (1961, n = 161) and Measurement#2 (1963, n = 70).

Abbreviations: TL, total length; BW, body width; CD, collar diameter; NW, neck width; BL, body length; PD, protuberance diameter; PL, protuberance length.

| Specimen number | Shell number | Measured axes in Fig. 2 |
|-----------------|--------------|-------------------------|
|                 | TL | BW | CD | NW | BL | PD | PL |
| Measurement#1   | 56 | 280 | 60 | 70 | 40 | 190 | 15 | 90 |
|                 | 57 | 350 | 60 | 80 | 42 | 210 | 20 | 140 |
|                 | 58 | 330 | 70 | 70 | 40 | 160 | 20 | 170 |
|                 | 59 | 340 | 70 | 80 | 45 | 200 | 20 | 140 |
|                 | 60 | 340 | 65 | 90 | 40 | 210 | 20 | 130 |
|                 | 61 | 320 | 65 | 85 | 45 | 200 | 20 | 120 |
|                 | 62 | 300 | 60 | 90 | 40 | 200 | 20 | 100 |
|                 | 63 | 310 | 60 | 80 | 42 | 180 | 15 | 130 |
|                 | 64 | 340 | 70 | 90 | 40 | 210 | 20 | 130 |
|                 | 65 | 280 | 60 | 85 | 40 | 200 | 15 | 80 |
|                 | 66 | 300 | 60 | 70 | 40 | 185 | 20 | 115 |
|                 | 67 | 300 | 62 | 80 | 38 | 160 | 20 | 140 |
|                 | 68 | 290 | 60 | 92 | 48 | 200 | 20 | 90 |
|                 | 69 | 300 | 60 | 80 | 40 | 180 | 25 | 120 |
|                 | 70 | 290 | 60 | 80 | 40 | 180 | 20 | 110 |
|                 | 71 | 290 | 62 | 90 | 45 | 200 | 20 | 90 |
|                 | 72 | 270 | 60 | 80 | 40 | 180 | 15 | 90 |
|                 | 73 | 330 | 60 | 90 | 42 | 210 | 15 | 120 |
|                 | 74 | 310 | 60 | 80 | 40 | 200 | 20 | 110 |
|                 | 75 | 320 | 60 | 80 | 40 | 190 | 30 | 130 |
|                 | 76 | 280 | 60 | 80 | 40 | 180 | 20 | 100 |
|                 | 77 | 270 | 60 | 80 | 40 | 180 | 20 | 90 |
|                 | 78 | 280 | 60 | 90 | 40 | 190 | 18 | 90 |
|                 | 79 | 250 | 60 | 80 | 42 | 150 | 15 | 100 |
|                 | 80 | 260 | 60 | 80 | 40 | 170 | 20 | 90 |
|                 | 81 | 300 | 60 | 80 | 40 | 190 | 20 | 110 |
|                 | 82 | 310 | 70 | 90 | 42 | 200 | 20 | 110 |
|                 | 83 | 240 | 60 | 70 | 40 | 170 | 20 | 70 |
|                 | 84 | 270 | 60 | 80 | 40 | 180 | 20 | 90 |
|                 | 85 | 280 | 60 | 80 | 45 | 180 | 20 | 100 |
|                 | 86 | 310 | 58 | 80 | 40 | 170 | 20 | 140 |
|                 | 87 | 270 | 60 | 80 | 40 | 120 | 15 | 150 |
|                 | 88 | 300 | 60 | 80 | 42 | 190 | 20 | 110 |
|                 | 89 | 250 | 60 | 80 | 40 | 170 | 15 | 80 |
|                 | 90 | 270 | 60 | 80 | 40 | 170 | 15 | 100 |
|                 | 91 | 310 | 60 | 90 | 40 | 200 | 15 | 110 |
|                 | 92 | 290 | 60 | 80 | 40 | 190 | 20 | 100 |
|                 | 93 | 250 | 60 | 80 | 40 | 165 | 13 | 85 |
|                 | 94 | 290 | 60 | 80 | 40 | 190 | 20 | 100 |
|                 | 95 | 250 | 70 | 70 | 40 | 170 | 15 | 80 |
|                 | 96 | 280 | 60 | 80 | 40 | 190 | 15 | 90 |
|                 | 97 | 270 | 60 | 80 | 40 | 170 | 20 | 100 |
|                 | 98 | 280 | 58 | 70 | 40 | 180 | 15 | 100 |
|                 | 99 | 280 | 68 | 80 | 40 | 180 | 15 | 100 |
|                 | 100| 295 | 60 | 80 | 40 | 195 | 15 | 100 |
|                 | 101| 320 | 60 | 70 | 40 | 200 | 15 | 120 |
|                 | 102| 310 | 60 | 80 | 45 | 190 | 20 | 120 |
|                 | 103| 300 | 60 | 80 | 45 | 180 | 20 | 120 |
|                 | 104| 310 | 60 | 80 | 45 | 190 | 20 | 120 |
|                 | 105| 310 | 58 | 80 | 42 | 190 | 20 | 120 |
|                 | 106| 290 | 58 | 70 | 38 | 170 | 20 | 120 |
|                 | 107| 260 | 60 | 80 | 40 | 160 | 20 | 100 |
|                 | 108| 270 | 60 | 90 | 43 | 180 | 15 | 90 |
|                 | 109| 280 | 60 | 90 | 45 | 170 | 20 | 110 |
|                 | 110| 280 | 60 | 90 | 45 | 170 | 20 | 110 |
|                 | 111| 270 | 60 | 80 | 40 | 180 | 20 | 90 |
Appendix 3. Continued.

| Specimen number | Shell number | Measured axes in Fig. 2 |
|-----------------|--------------|-------------------------|
|                 |              | TL | BW | CD | NW | BL | PD | PL |
| Measurement#1   | 112          | 270| 60 | 80 | 40 | 170| 20 | 100|
|                 | 113          | 270| 60 | 80 | 40 | 170| 20 | 100|
|                 | 114          | 280| 60 | 80 | 40 | 180| 10 | 100|
|                 | 115          | 300| 60 | 80 | 40 | 170| 20 | 130|
|                 | 116          | 310| 60 | 90 | 45 | 190| 10 | 120|
|                 | 117          | 290| 60 | 70 | 40 | 170| 10 | 120|
|                 | 118          | 270| 65 | 92 | 40 | 170| 10 | 100|
|                 | 119          | 310| 60 | 80 | 40 | 200| 10 | 110|
|                 | 120          | 270| 60 | 80 | 40 | 190| 10 | 80 |
|                 | 121          | 330| 55 | 80 | 40 | 200| 20 | 130|
|                 | 122          | 330| 60 | 80 | 40 | 180| 20 | 150|
|                 | 123          | 320| 60 | 80 | 40 | 190| 20 | 130|
|                 | 124          | 280| 60 | 70 | 40 | 200| 10 | 80 |
|                 | 125          | 250| 60 | 70 | 40 | 160| 10 | 90 |
|                 | 126          | 290| 60 | 80 | 40 | 190| 10 | 100|
|                 | 127          | 280| 60 | 80 | 40 | 200| 10 | 80 |
|                 | 128          | 320| 60 | 80 | 40 | 180| 15 | 100|
|                 | 129          | 310| 50 | 80 | 40 | 190| 10 | 120|
|                 | 130          | 310| 60 | 90 | 35 | 180| 20 | 130|
|                 | 131          | 280| 60 | 80 | 40 | 170| 10 | 110|
|                 | 132          | 300| 60 | 80 | 40 | 200| 15 | 100|
|                 | 133          | 270| 60 | 80 | 40 | 190| 18 | 80 |
|                 | 134          | 320| 60 | 55 | 90 | 40 | 200| 20 | 120|
|                 | 135          | 280| 60 | 70 | 40 | 200| 20 | 80 |
|                 | 136          | 320| 60 | 80 | 40 | 200| 20 | 120|
|                 | 137          | 260| 60 | 70 | 40 | 170| 10 | 90 |
|                 | 138          | 280| 60 | 80 | 40 | 180| 20 | 100|
|                 | 139          | 280| 60 | 80 | 40 | 200| 20 | 80 |
|                 | 140          | 270| 55 | 70 | 38 | 170| 15 | 100|
|                 | 141          | 270| 60 | 80 | 40 | 160| 20 | 110|
|                 | 142          | 320| 60 | 80 | 40 | 190| 20 | 130|
|                 | 143          | 270| 60 | 70 | 40 | 180| 20 | 90 |
|                 | 144          | 250| 60 | 70 | 40 | 170| 10 | 80 |
|                 | 145          | 300| 60 | 80 | 40 | 200| 10 | 100|
|                 | 146          | 320| 55 | 80 | 35 | 190| 20 | 130|
|                 | 147          | 270| 60 | 85 | 32 | 170| 20 | 100|
|                 | 148          | 300| 60 | 90 | 35 | 200| 20 | 100|
|                 | 149          | 270| 60 | 80 | 40 | 180| 20 | 90 |
|                 | 150          | 320| 60 | 80 | 35 | 190| 20 | 130|
|                 | 151          | 300| 60 | 80 | 40 | 180| 20 | 120|
|                 | 152          | 350| 60 | 80 | 40 | 220| 10 | 130|
|                 | 153          | 280| 55 | 85 | 32 | 160| 20 | 120|
|                 | 154          | 290| 60 | 80 | 40 | 180| 15 | 110|
|                 | 155          | 280| 60 | 70 | 40 | 170| 20 | 110|
|                 | 156          | 300| 55 | 70 | 40 | 200| 20 | 100|
|                 | 157          | 300| 60 | 80 | 40 | 170| 20 | 130|
|                 | 158          | 250| 55 | 70 | 40 | 150| 15 | 100|
|                 | 159          | 350| 60 | 80 | 40 | 230| 22 | 120|
|                 | 160          | 300| 60 | 85 | 40 | 200| 20 | 100|
| Measurement#2   | 161          | 250| 60 | 70 | 40 | 250| 15 | —  |
|                 | 162          | 380| 58 | 85 | 42 | 200| 20 | 180|
|                 | 163          | 370| 60 | 90 | 42 | 190| 20 | 180|
|                 | 164          | 370| 60 | 92 | 43 | 180| 18 | 190|
|                 | 165          | 320| 58 | 75 | 40 | 180| 15 | 140|
|                 | 166          | 350| 61 | 85 | 42 | 200| 15 | 150|
|                 | 167          | 330| 60 | 82 | 45 | 170| 18 | 160|
Neotypification of *Difflugia biwae* from Japan

Appendix 3. Measurements, raw data, of Measurement#1 (1961, n = 161) and Measurement#2 (1963, n = 70). Abbreviations, TL, total length; BW, body width; CD, collar diameter; NW, neck width; BL, body length; PD, protuberance diameter; PL, protuberance length.

| Specimen number | Shell number | Measured axes in Fig. 2 |
|-----------------|--------------|-------------------------|
|                 |              | TL  | BW  | CD  | NW  | BL  | PD  | PL  |
| Measurement#2   |              | 7   | 290 | 60  | 75  | 40  | 170 | 15  | 120 |
|                 |              | 8   | 320 | 65  | 85  | 49  | 160 | 16  | 160 |
|                 |              | 9   | 310 | 60  | 80  | 43  | 180 | 20  | 130 |
|                 |              | 10  | 330 | 59  | 80  | 40  | 180 | 18  | 150 |
|                 |              | 11  | 310 | 57  | 84  | 45  | 180 | 18  | 130 |
|                 |              | 12  | 320 | 58  | 86  | 47  | 175 | 18  | 145 |
|                 |              | 13  | 320 | 60  | 89  | 48  | 180 | 16  | 140 |
|                 |              | 14  | 310 | 54  | 85  | 45  | 180 | 16  | 130 |
|                 |              | 15  | 320 | 58  | 85  | 46  | 190 | 18  | 130 |
|                 |              | 16  | 310 | 58  | 78  | 40  | 190 | 20  | 120 |
|                 |              | 17  | 290 | 62  | 91  | 48  | 185 | 20  | 105 |
|                 |              | 18  | 290 | 62  | 84  | 42  | 190 | 20  | 100 |
|                 |              | 19  | 380 | 62  | 80  | 40  | 200 | 18  | 180 |
|                 |              | 20  | 270 | 59  | 82  | 42  | 160 | 16  | 110 |
|                 |              | 21  | 300 | 60  | 80  | 40  | 170 | 15  | 130 |
|                 |              | 22  | 270 | 60  | 80  | 40  | 160 | 15  | 110 |
|                 |              | 23  | 320 | 63  | 85  | 45  | 170 | 15  | 150 |
|                 |              | 24  | 350 | 60  | 71  | 42  | 190 | 20  | 160 |
|                 |              | 25  | 320 | 52  | 70  | 45  | 140 | 18  | 180 |
|                 |              | 26  | 270 | 60  | 80  | 40  | 160 | 20  | 110 |
|                 |              | 27  | 300 | 60  | 80  | 40  | 180 | 18  | 120 |
|                 |              | 28  | 290 | 61  | 84  | 42  | 160 | 15  | 130 |
|                 |              | 29  | 270 | 62  | 82  | 42  | 160 | 16  | 110 |
|                 |              | 30  | 310 | 60  | 80  | 40  | 170 | 18  | 140 |
|                 |              | 31  | 320 | 62  | 85  | 45  | 170 | 20  | 150 |
|                 |              | 32  | 270 | 60  | 70  | 40  | 165 | 20  | 105 |
|                 |              | 33  | 310 | 60  | 80  | 42  | 170 | 19  | 140 |
|                 |              | 34  | 320 | 62  | 85  | 45  | 200 | 18  | 120 |
|                 |              | 35  | 315 | 60  | 81  | 42  | 190 | 20  | 125 |
|                 |              | 36  | 350 | 58  | 85  | 43  | 190 | 20  | 160 |
|                 |              | 37  | 305 | 59  | 86  | 45  | 170 | 19  | 135 |
|                 |              | 38  | 350 | 57  | 83  | 43  | 200 | 20  | 150 |
|                 |              | 39  | 350 | 60  | 76  | 40  | 180 | 20  | 170 |
|                 |              | 40  | 350 | 58  | 83  | 43  | 200 | 18  | 150 |
|                 |              | 41  | 370 | 62  | 86  | 52  | 200 | 20  | 170 |
|                 |              | 42  | 310 | 68  | 82  | 45  | 160 | 18  | 150 |
|                 |              | 43  | 310 | 65  | 80  | 45  | 180 | 16  | 130 |
|                 |              | 44  | 270 | 55  | 70  | 40  | 165 | 18  | 105 |
|                 |              | 45  | 300 | 55  | 75  | 40  | 190 | 19  | 110 |
|                 |              | 46  | 280 | 68  | 84  | 42  | 130 | 18  | 150 |
|                 |              | 47  | 300 | 66  | 80  | 40  | 170 | 20  | 130 |
|                 |              | 48  | 250 | 60  | 84  | 45  | 140 | 18  | 110 |
|                 |              | 49  | 270 | 60  | 75  | 42  | 170 | 15  | 100 |
|                 |              | 50  | 262 | 56  | 82  | 45  | 150 | 20  | 112 |
|                 |              | 51  | 370 | 62  | 86  | 42  | 190 | 20  | 180 |
|                 |              | 52  | 300 | 58  | 85  | 42  | 170 | 16  | 130 |
|                 |              | 53  | 285 | 62  | 82  | 45  | 170 | 15  | 115 |
|                 |              | 54  | 280 | 60  | 85  | 45  | 170 | 20  | 110 |
|                 |              | 55  | 300 | 60  | 80  | 40  | 180 | 22  | 120 |
|                 |              | 56  | 310 | 55  | 85  | 42  | 180 | 18  | 130 |
|                 |              | 57  | 285 | 60  | 92  | 45  | 180 | 18  | 105 |
|                 |              | 58  | 310 | 60  | 85  | 42  | 180 | 15  | 130 |
|                 |              | 59  | 310 | 60  | 85  | 45  | 170 | 20  | 140 |
|                 |              | 60  | 370 | 62  | 90  | 42  | 200 | 20  | 170 |
|                 |              | 61  | 350 | 60  | 82  | 40  | 190 | 20  | 160 |
|                 |              | 62  | 325 | 55  | 85  | 40  | 200 | 20  | 125 |
Appendix 3. Measurements, raw data, of Measurement#1 (1961, n = 161) and Measurement#2 (1963, n = 70). Abbreviations, TL, total length; BW, body width; CD, collar diameter; NW, neck width; BL, body length; PD, protuberance diameter; PL, protuberance length.

| Specimen number | Shell number | Measured axes in Fig. 2 |
|-----------------|--------------|-------------------------|
|                 |              | TL | BW | CD | NW | BL | PD | PL |
| Measurement#2   | 63           | 270| 60 | 82 | 42 | 170| 20 | 100|
|                 | 64           | 265| 60 | 80 | 40 | 160| 20 | 105|
|                 | 65           | 250| 60 | 80 | 40 | 150| 20 | 100|
|                 | 66           | 265| 60 | 85 | 45 | 160| 20 | 105|
|                 | 67           | 340| 60 | 85 | 40 | 180| 18 | 160|
|                 | 68           | 380| 60 | 85 | 40 | 195| 18 | 185|
|                 | 69           | 320| 60 | 85 | 45 | 190| 20 | 130|
|                 | 70           | 250| 60 | 80 | 40 | 150| 20 | 100|