

A NEW SERIES OF STUDIES ON THE FRESHWATER AND LAND PLANARIANS FROM TAIWAN

I. AN ADDITIONAL LIST OF LOCALITIES (1980-1984)^{1), 2)}

by

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INTRODUCTION

Since the publication of the previous papers on the freshwater planarians from Taiwan (cf. ICHIKAWA & KAWAKATSU, 1967; KAWAKATSU & IWAKI, 1968; KAWAKATSU, OKI, TAMURA, YAMAYOSHI, LUE & HAGIYA, 1979), a considerable number of preserved specimens of freshwater and land planarians collected in recent years by LUE and his students from various areas of Taiwan have been sent to KAWAKATSU for taxonomic study. Also sent by LUE to Dr. Iwashiro OKI and Mrs. Sachiko TAMURA were a number of living specimens of freshwater planarians from several localities in Taiwan for chromosomal studies.

In the autumn of 1984, the present five Japanese authors visited Taiwan to collect freshwater planarians in cooperation with LUE under the project of the "Effect of Geographical Isolation on the Evolutionary Rate of Nucleotide Substitutions — 5S rRNA Sequence of Freshwater Planarians in Taiwan". The samples of freshwater and land planarians obtained were also employed for studies of molecular biology, taxonomy and karyology. Japanese authors have obtained valuable knowledge of the ecological nature of planarian habitats in tropical and subtropical regions in Taiwan.

At this time only the results of the taxonomic and karyological studies on planarians from Taiwan will be published in this series. Papers on the molecular biology of the 1984 project will be published elsewhere.

This first report of the present series is primarily an additional list of localities and specimens of freshwater and land planarians collected and now preserved in KAWAKATSU's laboratory, together with eight sketch-maps showing their localities. Photographs showing some of the localities where the samples for the 5S rRNA sequences were collected are also given (see also KAWAKATSU, TAKAI, HORI, MUTO, OSAWA & LUE, 1985, p. 6, figs. 4-9).

AN ADDITIONAL LIST OF SPECIMENS AND LOCALITIES (1980-1984)

The following are the data of the samples obtained from Taiwan after 1980. This additional list follows the previous one (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, LUE & HAGIYA, 1979, pp.

1) This study was supported in part by a Grant-in-Aid for Scientific Research from the Ministry of Education, Japan (No. 59041031).

2) Preliminary report of some of the works in this series was presented at the 56th Annual Meeting of the Zoological Society of Japan held in Tokyo on October 10-12, 1985 (KAWAKATSU, OKI, TAMURA, LUE, TAKAI, HORI, MUTO & OSAWA, 1985).

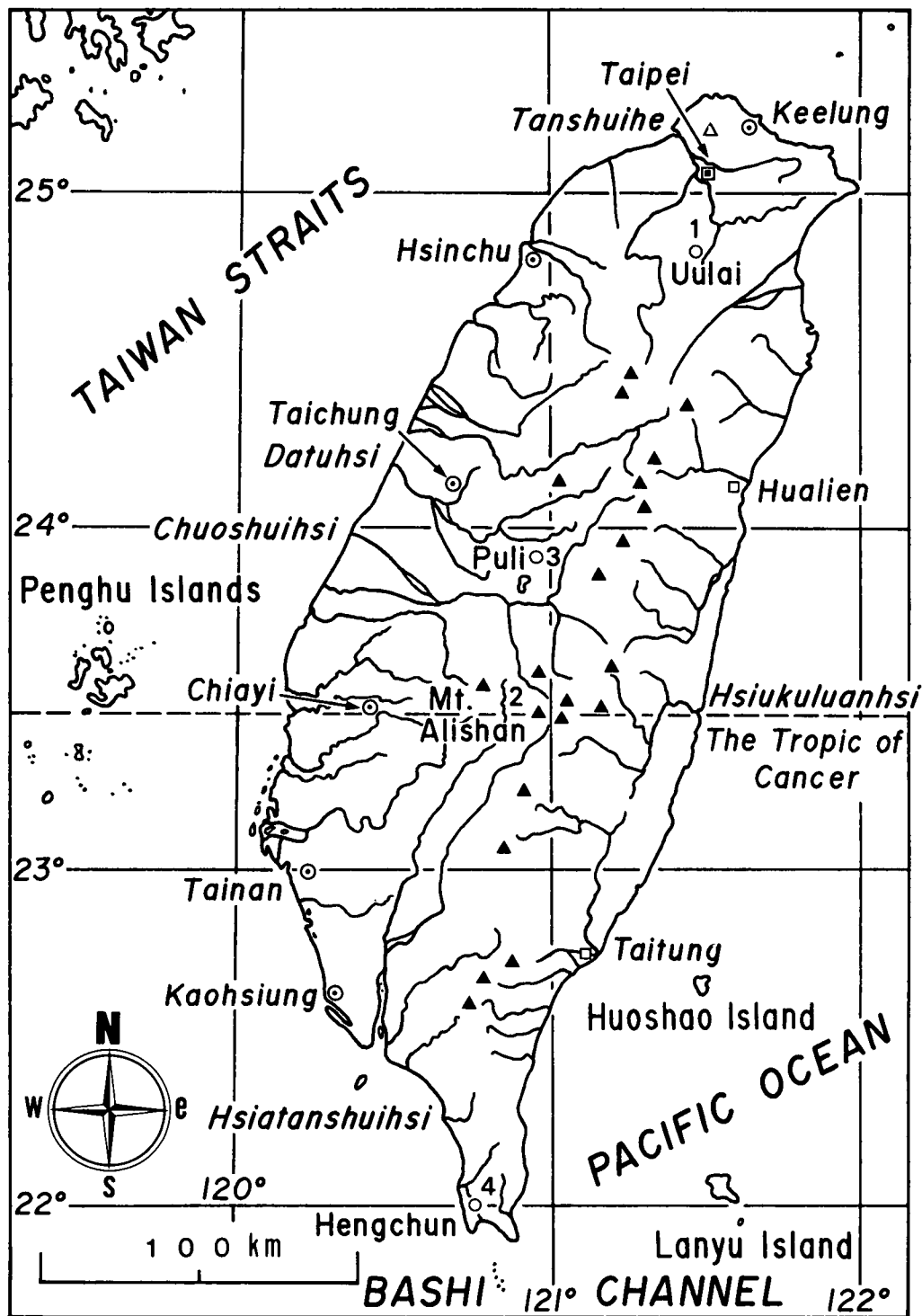


Fig. 1. Sketch-map of Taiwan, showing main rivers and mountains with an elevation of over 2000 meters above sea level (small, solid triangular). Localities of *Dugesia japonica japonica* where the samples for the 5S rRNA sequences were collected are also shown. 1, Uulai; 2, Mt. Alishan; 3, Lushan; 4, the Kenting National Park.

59-65; Station Nos. 1-34). The Specimen Lot Numbers given for each stock are a number registered in KAWAKATSU's fixing notebook according to his permanent recording system. The localities are described according to the Chinese pronunciations (Chinese letters in parentheses).

Figure 1 shows a general topography of Taiwan with the locations where freshwater planarians were collected by the authors in the autumn of 1984. Enlarged sketch-maps showing these localities are also shown in Figures 3 to 7. All of the localities of freshwater and land planarians listed here are shown in the sketch-maps of Figures 2 and 8, respectively. The localities are arranged from north to south and from lowland to highland.

FRESHWATER PLANARIANS

No. 35. Specimen Lot No. 1755. *Dugesia japonica japonica* (asexual specimens). Living specimens were pale brown above; 5~8mm long and 0.5~1mm wide. The animals were fixed with Bouin's fluid. Locality: Two narrow streams of the Yangming Park or Grass Mountain in the vicinity of Taipei (臺北市陽明公園; 草山) (alt. 300~400m). September 28, 1984 (water temp., 23~25°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO and S. OSAWA.

No. 36. Specimen Lot No. 1743. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 8~10mm long and 1mm wide. Locality: A narrow stream at Yenliao, Taipei-hsien County (臺北縣塩寮) (alt. 50m). March 5, 1981. Collected by one of students of LUE's laboratory.

No. 37. Specimen Lot No. 1739. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 5~8mm long and 1mm wide. Locality: A narrow stream at Shenk'eng, Taipei-hsien County (臺北縣深坑) (alt. 100m). March 1, 1981. Coll. K.-Y. LUE.

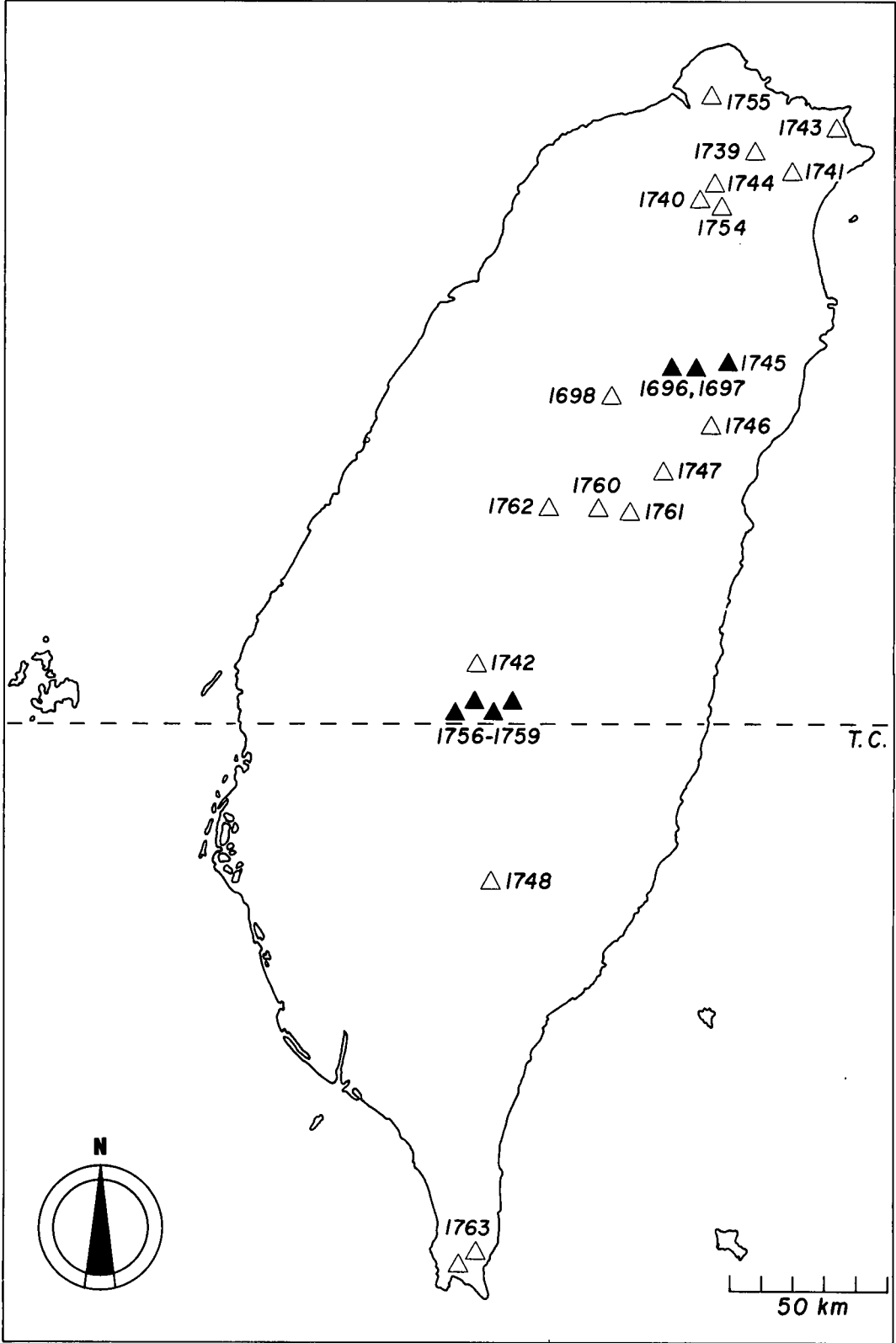
No. 38. Specimen Lot No. 1741. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 5~8mm long and 1mm wide. Locality: A mountain stream at Pinglin, Taipei-hsien County (臺北縣坪林) (alt. 290m). April 12, 1981. Coll. K.-Y. LUE.

No. 39. Specimen Lot No. 1744. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 8~10mm long and 1mm wide. Locality: A mountain stream of Mt. Houk'engtzu-shan, Taipei-hsien County (臺北縣后坑子山) (alt. 200m). April 12, 1981. Coll. K.-Y. LUE.

No. 40. Specimen Lot No. 1740. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were dark brown above with a dark middorsal longitudinal line; 5~10mm long and 1mm wide. Locality: A mountain stream of the Wawa Valley, Taipei-hsien County (臺北縣娃娃谷) (alt. 250m). April 12, 1981. Coll. K.-Y. LUE.

No. 41. Specimen Lot No. 1754. *Dugesia japonica japonica* (asexual specimens). Living specimens were pale brown above with a slightly dark middorsal line; 12~15mm long and 1.5~2mm wide. Several specimens were fixed with Bouin's fluid; the remaining specimens (over 2000) were fixed with 95% ethanol (samples for the 5S rRNA sequence). Locality: A narrow mountain stream alongside of a road at Uulai, Taipei-hsien County (臺北縣烏來) (alt. 420~480m). September 26, 1984 (water temp., 23~24°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and K.-Y. LUE. Cf. Station Nos. 13 and 14 in the previous paper.

No. 42. Specimen Lot No. 1697. *Dugesia japonica japonica* (sexual and asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 13~20mm long and 3.5~4mm wide. Locality: A mountain stream of the Nanhu Creek, Moogan-anbu, Yulan-hsien County (宜蘭縣本托鞍部南湖溪) (alt. 2000m). July 20, 1982. Coll. K.-Y. LUE and Mr. K.-Y. LIN.



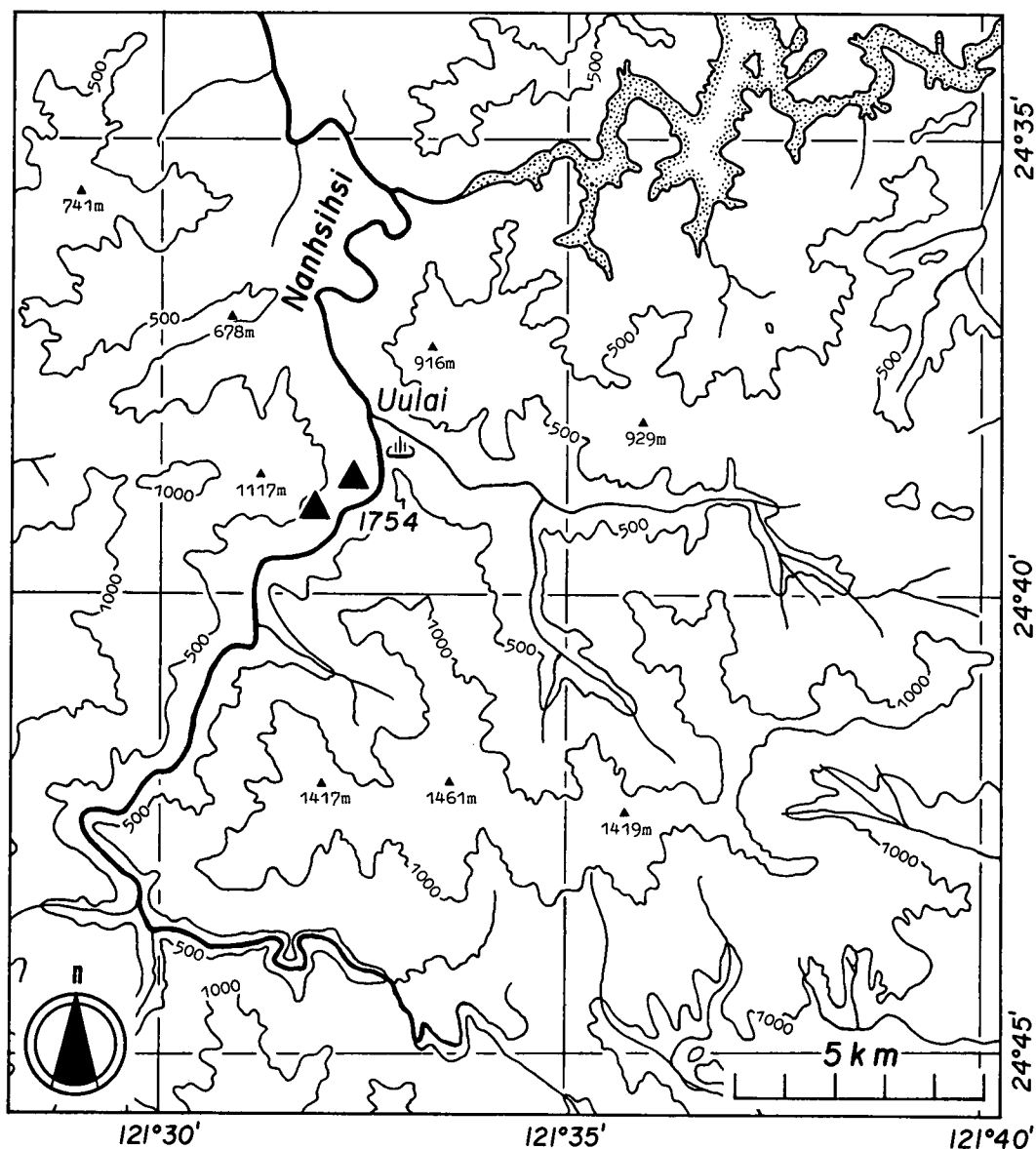


Fig. 3. Enlarged sketch-map of the Uulai region, showing the localities of *Dugesia japonica japonica* (large, solid triangulars, Specimen Lot No. 1754).

Fig. 2. Sketch-map of Taiwan, showing the localities of *Dugesia japonica japonica* obtained after 1980. Large, solid triangulars indicate the localities where sexually mature specimens were obtained; open triangulars indicate the localities where non-sexual specimens were obtained. Specimen Lot Nos. see the section "An Additional List of Specimens and Localities (1980-1984)".

No. 43. Specimen Lot No. 1696. *Dugesia japonica japonica* (sexual and asexual specimens). Fixed specimens with Bouin's fluid were pale brown above with a dark middorsal line; 15 mm long and 4 mm wide. Locality: A mountain stream near Nanhu Cottage, Mt. Nanhu-tashan, Yülan-hsien County (宜蘭縣南湖大山, 南湖山莊) (alt. 3350 m). July 18, 1982. Coll. K.-Y. LUE and Mr. K.-Y. LIN.

No. 44. Specimen Lot No. 1745. *Dugesia japonica japonica* (asexual specimens). Specimens fixed with Bouin's fluid were dried when received. The same locality as Station No. 43. August 8, 1981. Coll. K.-Y. LUE.

No. 45. Specimen Lot No. 1698. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 10~12 mm long and 2 mm wide. Locality: A stream running through the Wulin Farm, a tributary of the Tachia-hsi River, Mt. Hsüeh-shan, Taichung-hsien County (臺中縣武陵農場, 大甲溪支流) (alt. 2000 m). July 21, 1982. Coll. Mr. K.-Y. LIN.

No. 46. Specimen Lot No. 1746. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above; 10~15 mm long and 1.5~3 mm long. Locality: Lianghua Pond alongside of the Central East-West Cross Highway, Hualiang-hsien County (花蓮縣蓮花池, 東西橫貫公路) (alt. 1100 m). June 25, 1983. Coll. K.-Y. LUE.

No. 47. Specimen Lot No. 1747. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above with an indistinct middorsal line; 10 mm long and 2 mm wide. Locality: A mountain stream near Chilai Cottage No. 1, Mt. Chilai-chushan, Hualiang-hsien County (花蓮縣奇萊主山, 奇萊成功堡) (alt. 2800 m). August 8, 1983. Coll. K.-Y. LUE.

No. 48. Specimen Lot No. 1762. *Dugesia japonica japonica* (asexual specimens). Living specimens were pale brown above with a dark middorsal line; 10~15 mm long and 2~2.5 mm wide. The animals were fixed with Bouin's fluid. Locality: A mountain stream of the Nanshan-hsi Valley, Nantou-hsien County (南投縣南山溪) (alt. 850 m). October 3, 1984 (water temp., 22°C). Coll. M. TAKAI, H. HORI, A. MUTO, S. OSAWA and Mr. M.-C. DO. Cf. Station No. 21 in the previous paper.

No. 49. Specimen Lot No. 1760. *Dugesia japonica japonica* (asexual specimens). Living specimens were pale brown; 10 mm long and 1 mm wide. The animals were fixed with Bouin's fluid. Locality: A wide stream of a tributary of the Choshui-hasi River, near Lushan Hot Spring, Nantou-hsien County (南投縣廬山溫泉, 濁水溪支流) (alt. 1100 m). October 2, 1984 (water temp., 22°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and Mr. M.-C. DO. Cf. Station No. 23 in the previous paper.

No. 50. Specimen Lot No. 1761. *Dugesia japonica japonica* (asexual specimens). Living specimens were dark brown above with a dark middorsal line; 15~18 mm long and 2.5~3 mm wide. Several specimens were fixed with Bouin's fluid; the remaining specimens (over 2000) were fixed with 95% ethanol (samples for the 5S rRNA sequence). Locality: An artificial tank fed by pumped-up underground waters located in a play ground of Lushan Hot Spring, Nantou-hsien County (南投縣廬山溫泉, 地下水抽水場) (alt. 1200 m). October 2, 1984 (water temp., 20°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and Mr. M.-C. DO.

No. 51. Specimen Lot No. 1742. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were dark brown; 8 mm long and 1 mm wide. Locality: A stream of the Shanlin Creek, the Mt. Alishan area, Chiai-hsien County (嘉義縣阿里山杉林溪底) (alt. 1500 m). April 27, 1981. Coll. K.-Y. LUE.

No. 52. Specimen Lot No. 1759. *Dugesia japonica japonica* (sexual and asexual specimens). Living specimens were dark brown above with a middorsal line; 15 mm long and 3 mm wide. The animals were fixed with Bouin's fluid. Locality: A narrow stream near Shouch'en-kung Temple, Mt. Alishan, Chiai-hsien County (嘉義縣阿里山受鎮宮) (alt. 2100 m). September 29, 1984 (water temp., 18°C). Coll. M. KAWAKATSU and M. TAKAI.

No. 53. Specimen Lot No. 1757. *Dugesia japonica japonica* (sexual and asexual specimens). Living specimens were blackish brown above with an indistinct whitish middorsal line; dark below; 15~18mm long and 2.5~4mm wide. Several specimens were fixed with Bouin's fluid; the remaining specimens (over 3000) were fixed with 95% ethanol (samples for the 5S rRNA sequence). Locality: A mountain stream running through a wasabi field near Chiehmei-T'an Ponds, Mt. Alishan, Chai-hsien County (嘉義縣阿里山姊妹潭) (alt. 2200m). September 29, 1984 (water temp., 13~14°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and Mr. S-H. CHEN. Cf. Station No. 25 in the previous paper.

No. 54. Specimen Lot No. 1756. *Dugesia japonica japonica* (sexual and asexual specimens). Living specimens were blackish brown above with an indistinct middorsal line; dark below; 15~18mm

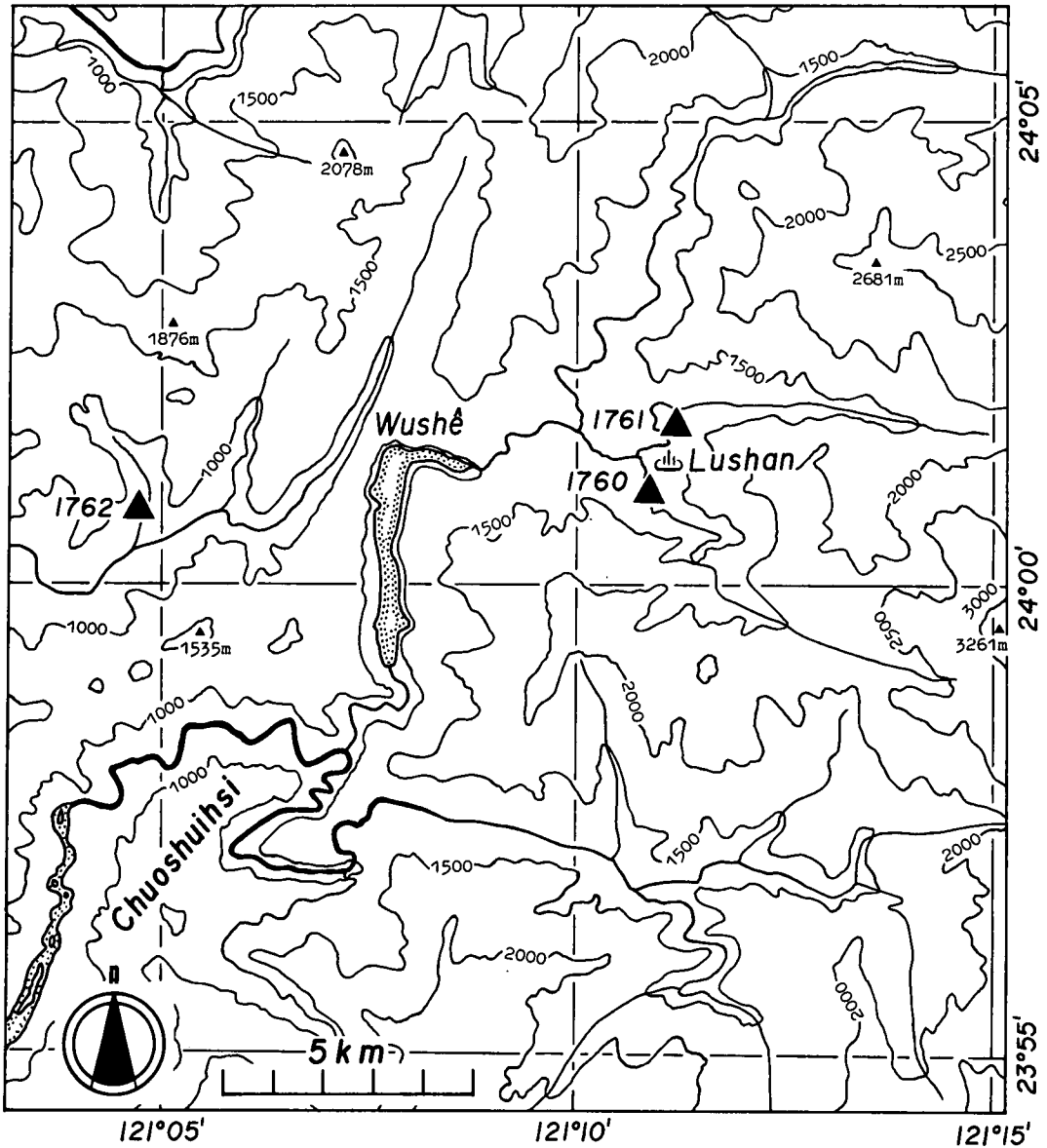
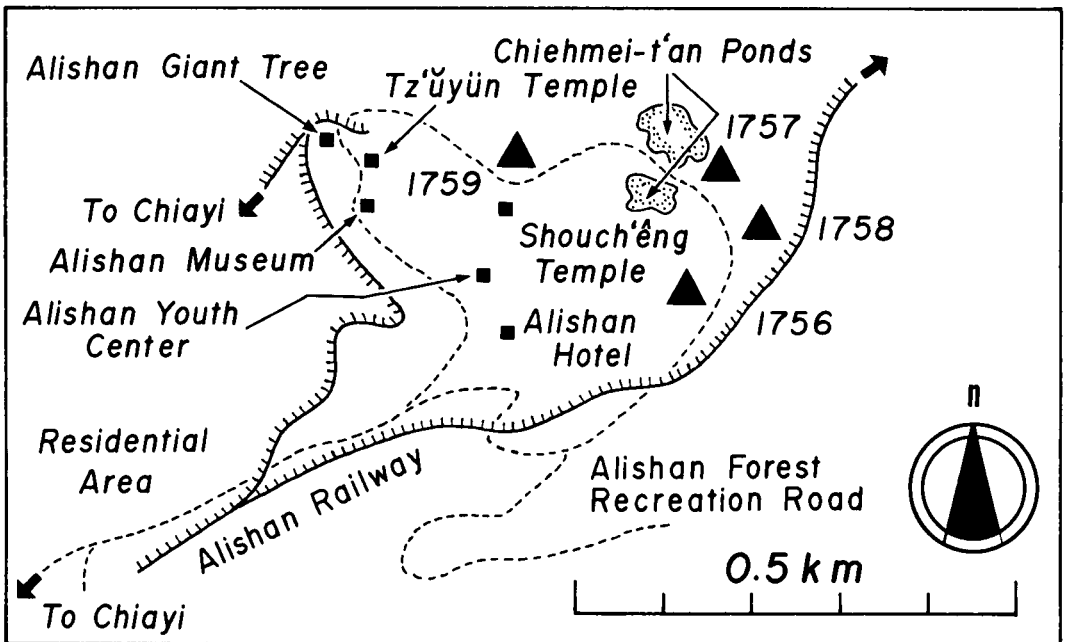
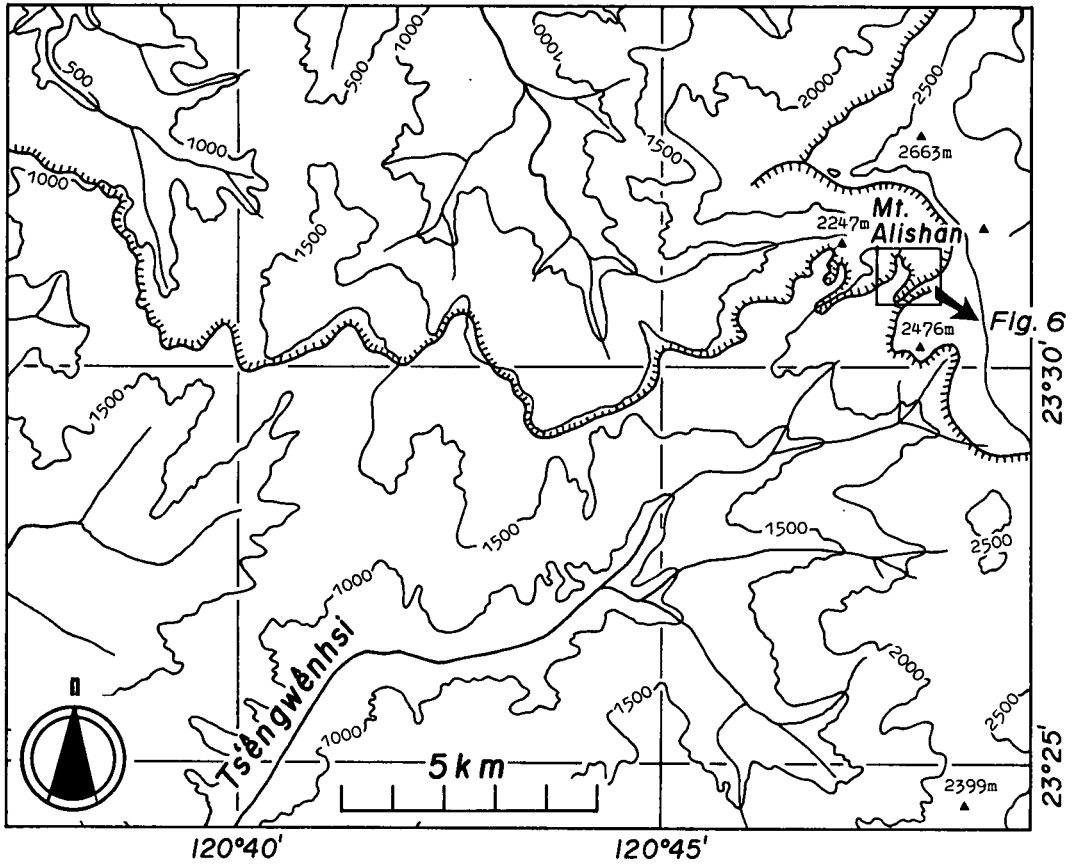


Fig. 4. Enlarged sketch-map of the Lushan area, showing the localities of *Dugesia japonica japonica* (large, solid triangulars, Specimen Lot Nos. 1760-1762).



Figs. 5. and 6. Enlarged sketch-maps of the Mt. Alishan region, showing the localities of *Dugesia japonica japonica* (large, solid triangulars, Specimen Lot Nos. 1756-1759).

long and 2.5~4 mm wide. Several specimens were fixed with Bouin's fluid; the remaining specimens (over 3000) were fixed with 95% ethanol (samples for the 5S rRNA sequence). Locality: A narrow mountain stream alongside of the Alishan Forest Recreation Road, Mt. Alishan, Chia-hsien County (嘉義縣阿里山遊步道溪流) (alt. 2250 m). September 28 and 29, 1984 (water temp., 13~15°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and Mr. S.-H. CHEN. Several live specimens from this locality collected by LUE in December of 1984 were sent to the laboratory of Dr. OKI and Mrs. TAMURA for chromosomal analysis.

No. 55. Specimen Lot No. 1758. *Dugesia japonica japonica* (sexual and asexual specimens).

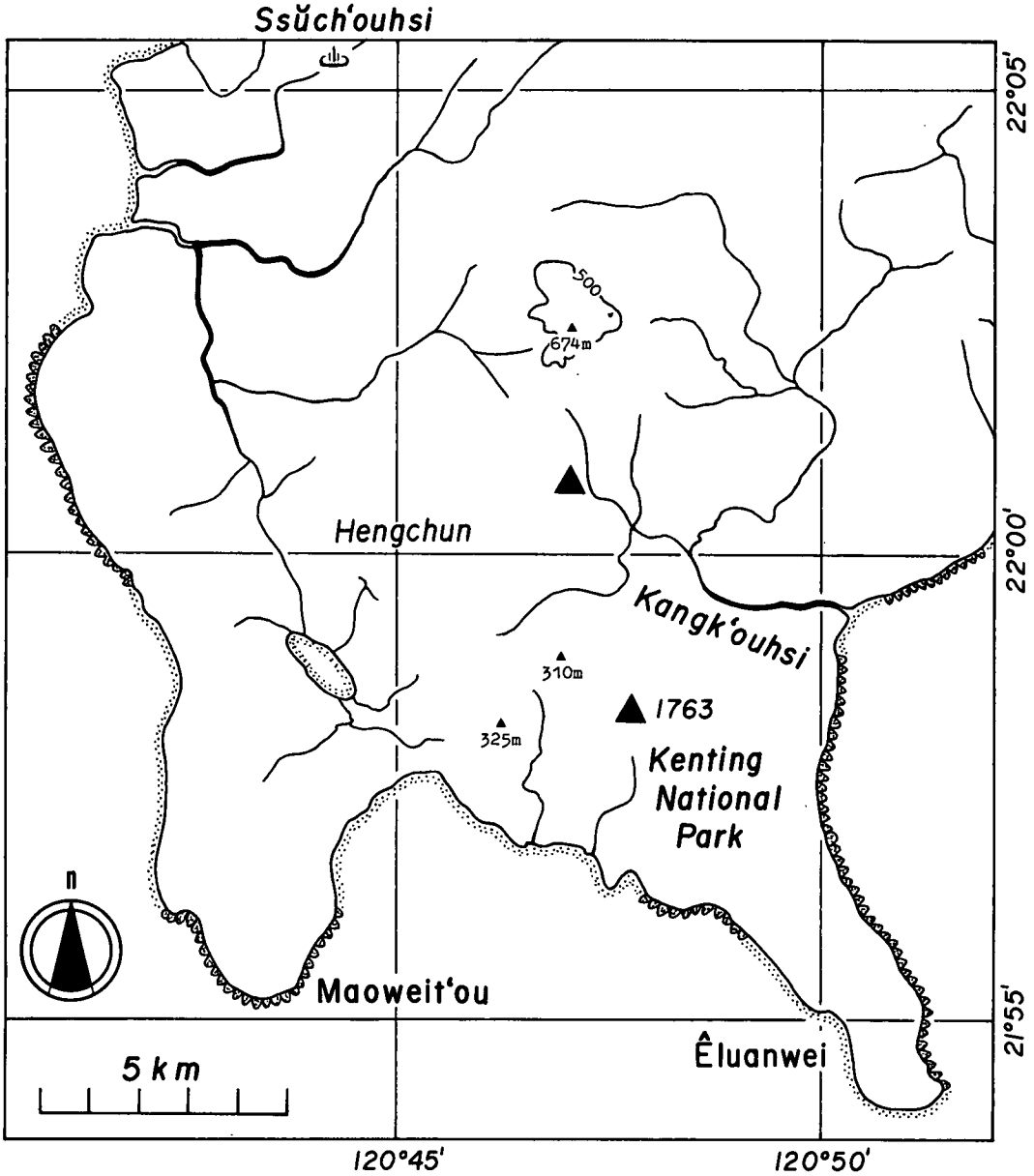


Fig. 7. Enlarged sketch-map of the Kenting National Park region, showing the localities of *Dugesia japonica japonica* (large, solid triangular, Specimen Lot. No. 1763).

Living specimens were blackish brown above with an indistinct middorsal line; dark below; 15~18mm long and 2~4mm wide. They were fixed with Bouin's fluid. Locality: A mountain stream near the Alishan Railway, Mt. Alishan, Chia-hsien County (嘉義縣阿里山登山鐵道橫溪流) (alt. 2270m). September 29, 1984 (water temp., 12~14°C). Coll. M. KAWAKATSU, M. TAKAI and Mr. S.-H. CHEN. Cf. Station No. 26 in the previous paper.

No. 56. Specimen Lot No. 1784. *Dugesia japonica japonica* (asexual specimens). Fixed specimens with Bouin's fluid were pale brown above with an indistinct dark middorsal line; 10mm long and 1mm wide. Locality: A mountain stream of Mt. Peinan-chushan, Kaohsiung-hsien County (高雄縣卑南主山溪流) (alt. 3000m). January 23, 1984. Coll. K.-Y. LUE.

Nos. 57 and 58. Specimen Lot No. 1763. *Dugesia japonica japonica* (asexual specimens). Living specimens were pale brown above with an indistinct whitish middorsal line; 12~13mm long and 1.5mm wide. Several specimens were fixed with Bouin's fluid; the remaining specimens (over 2500) were fixed with 95% ethanol (samples for the 5S rRNA sequence). Localities: A stream of the upper part of the Kangk'ou-hsi River (3 asexual specimens only) (No. 57; 屏東縣港口溪上流); A shallow stream fed by underground waters running through the front garden of Kentingpin-kuan Hotel, Pingtung-hsien County (No. 58; 屏東縣墾丁賓館前庭小流) (alt. 100m). October 6, 1984 (water temp., 24.5~27°C). Coll. M. KAWAKATSU, M. TAKAI, H. HORI, A. MUTO, S. OSAWA and K.-Y. LUE.

The latter of two localities was at first discovered by Mr. Morio HAGIYA in 1975 (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, LUE & HAGIYA, 1979, p. 64, Station No. 31). Several live specimens from this locality were brought into the laboratory of Dr. OKI and Mrs. TAMURA by KAWAKATSU when he returned in Japan (October 8, 1984). The results of the chromosomal analysis of animals from Mt. Alishan and Kentingpin-kuan Hotel localities will be published in the near future as one of the present series (an English abstract of the preliminary note is printed in Zool. Sci., vol. 2, p. 1004).

Land Planarians

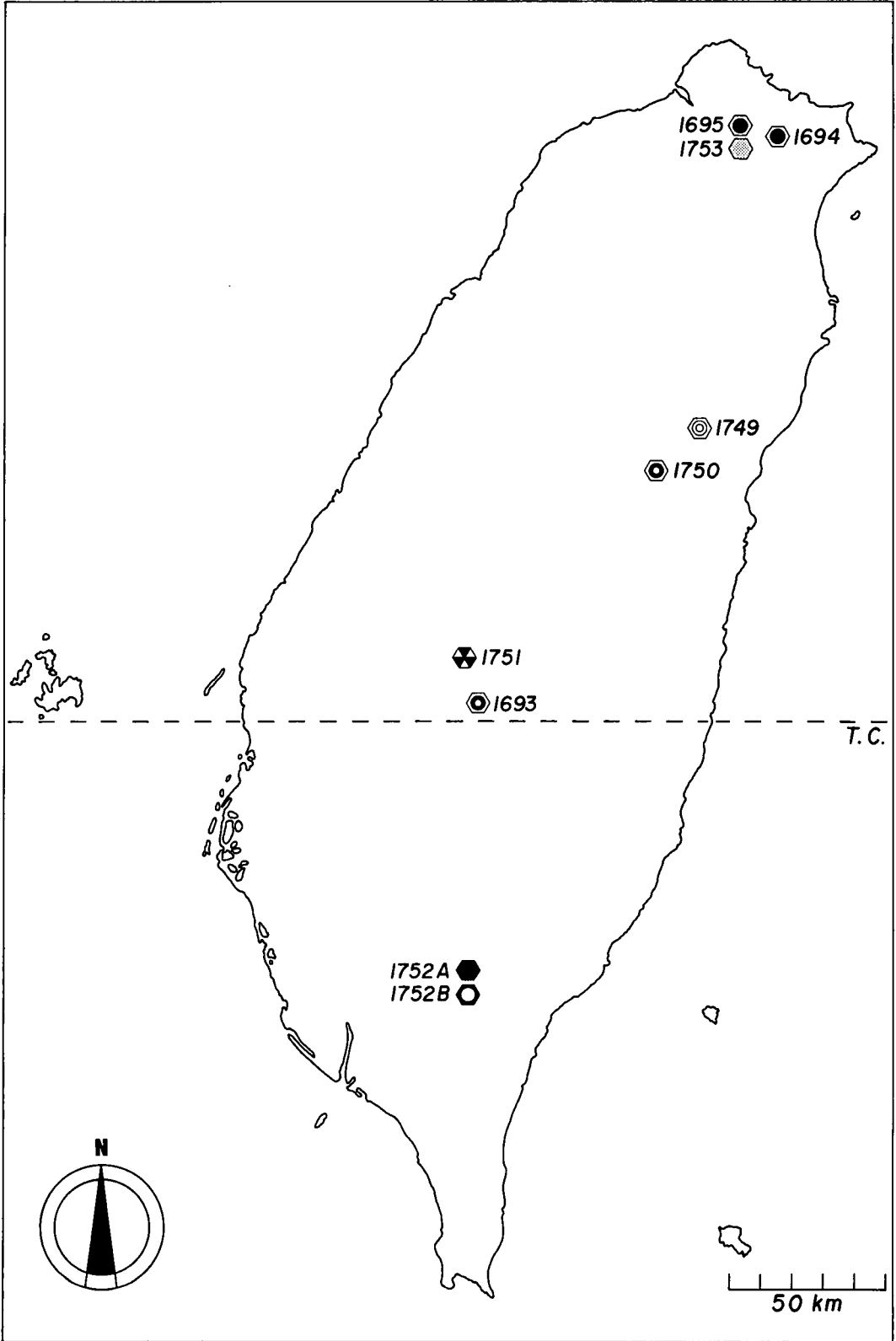
No. 59. Specimen Lot No. 1695. *Bipalium* sp. 1 (a single asexual specimen). Fixed specimen with Bouin's fluid was pale yellowish brown above with 3 longitudinal stripes; with 2 longitudinal stripes below; 32mm long and 2mm wide. Locality: Campus of the College of Science, National Taiwan Normal University, Taipei (臺北市國立臺灣師範大學校園) (alt. 25m). July 9, 1982. Coll. K.-Y. LUE.

Although LUE sent to KAWAKATSU several live specimens of this species in the spring of 1980, they were disintegrated when received.

No. 60. Specimen Lot No. 1753. *Bipalium* sp. 2 (a single asexual specimen). Living specimen was pale yellowish brown above with a single, middorsal longitudinal stripe; without stripes below; lateral margins of the body slightly serrulate; 62mm long and 2.5mm wide. The animal was fixed with Bouin's fluid. The remaining twenty living specimens kept in LUE's laboratory were fixed with 95% ethanol (samples for the 5S rRNA sequence). Locality: Campus of the College of Science, National Taiwan Normal University, Taipei (臺北市國立臺灣師範大學校園) (alt. 25m). September, 1984. Collected by one of students of LUE's laboratory.

No. 61. Specimen Lot No. 1694. *Bipalium* sp. 1 (a single asexual specimen). Externally, this specimen fixed with Bouin's fluid is identical with *Bipalium* sp. 1 from the Station No. 59; 113mm long

Fig. 8. Sketch-map of Taiwan, showing the localities of seven species of land planarians (*Bipalium* spp.). For Specimen Lot Nos. see the section "An Additional List, etc."



and 2.5mm wide. Locality : Shinting, Taipei-hsien County (臺北縣石碇) (alt. 100m). June 27, 1982. Coll. K.-Y. LUE.

No. 62. Specimen Lot No. 1749. *Bipalium* sp. 3 (a single sexual specimen). Fixed specimen with Bouin's fluid was pale yellowish brown above with 5 longitudinal stripes ; with 2 longitudinal stripes below ; 52mm long and 2.5mm wide. Locality : The vicinity of Lianghua Pond alongside of the Central East-West Cross Highway, Hualiang-hsien County (花蓮縣蓮花池, 東西橫貫公路) (alt. 1100m). June 25, 1983. Coll. K.-Y. LUE.

No. 63. Specimen Lot No. 1750. *Bipalium* sp. 4 (a single sexual specimen). Fixed specimen with Bouin's fluid was pale yellowish brown above with 2 wide lateral and 2 thin middorsal longitudinal stripes ; without stripes below ; lateral margins of the body slightly serrulate ; 25mm long and 3.5mm wide. Locality : The vicinity of Chili Cottage at 3260 meters elevation, Mt. Houhuan-shan, Hualiang-hsien County (花蓮縣合歡山奇萊, 3260公尺山屋) (alt. 3200m). August 8, 1983. Coll. K.-Y. LUE.

No. 64. Specimen Lot No. 1693. *Bipalium* sp. 4 (a single sexual specimen). Externally, this specimen fixed with Bouin's fluid is identical with *Bipalium* sp. 4 from the Station No. 63 ; 29mm long and 4mm wide. Locality : Mt. Alishan, Chiai-hsien County (嘉義縣阿里山) (alt. 2100m). June 21, 1982. Coll. K.-Y. LUE.

No. 65. Specimen Lot No. 1751. *Bipalium* sp. 5 (a single sexual specimen). Fixed specimen with 3% formalin solution was blackish grey above and below ; 92mm long and 9mm wide. Locality : Mt. Alishan, Chiai-hsien County (嘉義縣阿里山) (alt. 2100m). November 9, 1983. Coll. K.-Y. LUE and Mr. K.-S. CHUANG.

No. 66. Specimen Lot No. 1752A. *Bipalium* sp. 6 (a single sexual specimen). Fixed specimen with Bouin's fluid was yellowish orange brown above with a pair of brown deltaid marks on the head plate and with a blackish brown longitudinal stripe on both sides of the body ; without stripes below ; 31mm long and 4mm wide. Locality : The vicinity of Takui-hu Lake or Big Ghost Lake, Mt. Wut'ou-shan, Pintung-hsien County (屏東縣霧頭山大鬼湖) (alt. 2280m). January 24, 1983. Coll. K.-Y. LUE.

No. 67. Specimen Lot No. 1752B. *Bipalium* sp. 7 (a single sexual specimen). Fixed specimen with Bouin's fluid was pale grey above and below ; lateral margins of the body slightly serrulate ; 23mm long and 3mm wide. Locality : The vicinity of Takui-hu Lake or Big Ghost Lake, Mt. Wut'ou-shan, Pintung-hsien County (屏東縣霧頭山大鬼湖) (alt. 2280m). January 24, 1983. Coll. K.-Y. LUE.

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Fig. 9. Photograph showing one of the Uulai localities of *Dugesia japonica japonica*.

Fig. 12. Photograph showing the Kentingpin-kuan Hotel locality of *Dugesia japonica japonica*. The stream is fed by underground waters.

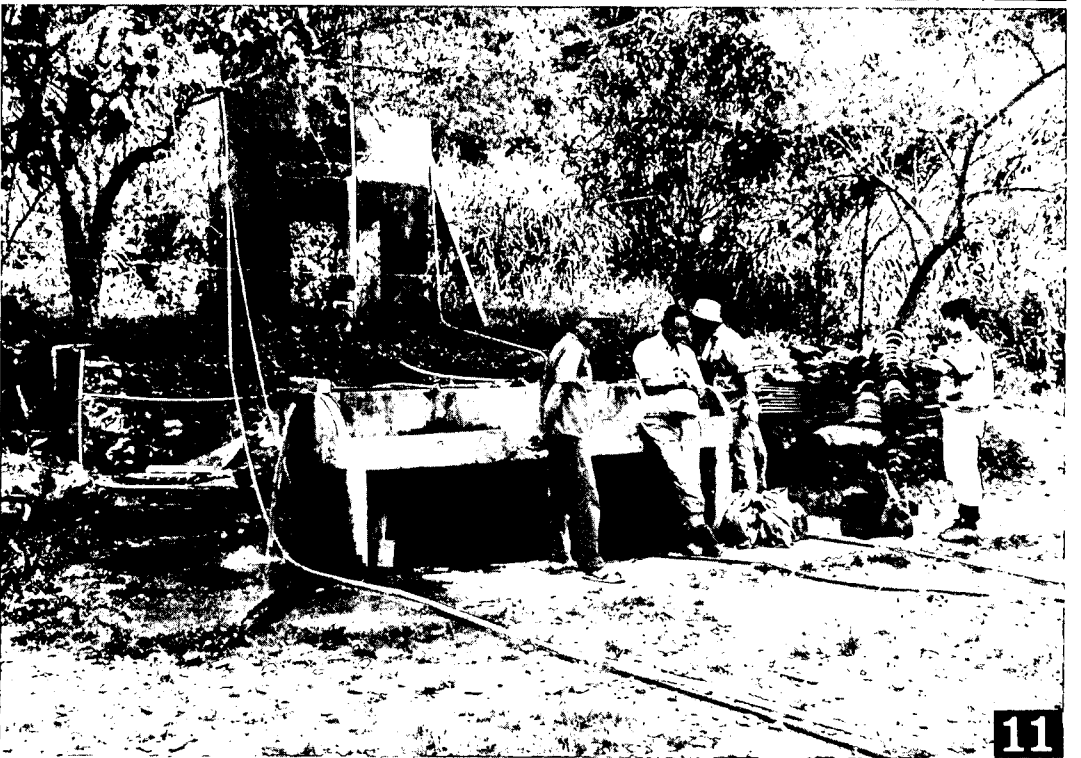


Fig. 10. Photograph showing one of the Mt. Alishan localities of *Dugesia japonica japonica*.

Fig. 11. Photograph showing one of the Lushan localities of *Dugesia japonica japonica*. Planarians were abundant in an artificial water tank fed by pumped-up underground waters.

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中 文 摘 要

臺灣淡水棲和陸棲渦蟲之研究

I. 續新增調查地點 (1980 - 1984)

川勝正治 · 呂 光洋 · 高井成幸 · 堀 寬 · 武藤 昱 · 大澤省三

從 1979 年有關臺灣淡水棲渦蟲之報告發表之後，繼續由陽明山公園，臺北縣之塩寮，深坑，坪林，后坑子山，娃娃谷，烏來，宜蘭縣之南湖溪之本扞鞍部，南湖圈谷水源，臺中縣之武陵農場，花蓮縣之奇萊成功堡，南投縣之南山溪，廬山溫泉，嘉義縣之杉林溪底，阿里山，高雄縣之卑南主山水源，屏東縣之墾丁公園港口溪，墾丁賓館等採集 23 個地點之標本，經組織切片鑑定後都為 *Dugesia japonica japonica* ICHIKAWA et KAWAKATSU, 1964。

至於陸棲渦蟲，由國立臺灣師範大學分部校園，收集到的二組標本，及由臺北縣之石碇，花蓮縣之蓮花池，合歡山奇萊，嘉義縣之阿里山，屏東縣之大鬼湖二組標本，經初步鑑定後都為 *Bipalium* spp.，約可分為七種，有關種之鑑定正進行中。

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