A COLLECTION OF MOSSES FROM BOTEL TOBAGO

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Botel Tobago is one of the islands surrounding Formosa which is the main island of Taiwan (Figure 1). The island lies some 66 km. east of the south point of Formosa. Some 64 km. to the north lies the smaller island of Lutao, and 78 km. to the south lies Batan, the northernmost small island of the Philippines. The island of Botel Tobago is called by the Chinese Lanyü which means "Orchid Island."

The small island of Botel Tobago lies in a geographical position extending latitudinally from 22°00′00″ to 22°05′00″ north latitude and longitudinally from 121°30′08″ to 121°36′32″ east longitude. It is about 36.5 km, in circumference. The area of the island is about 46 sq. km. The principal topographic feature of the island is the rugged mountainous terrain of volcanic origin, the highest point of which is elevated 548 m. above the sea level. The rivers of the island form a radial pattern and there are incise meanders (Figure 2). The coast line is monotonous with no good harbors.

Geologically, the island has a foundation of possibly Tertiary formations consisting of metamorphosed sediments and igneous rocks. In the elevated inland areas lie the Tertiary and Quarternary formations in which Oligocene lava flows and Pleistocene andesite predominate. Among other rocks here may be mentioned Pliocene peridotite and pleistocene basalt. The coastal region is covered with recent alluvial material, i. e. sand, clay, and gravel. These materials appear in alluvial fans and tali, Coral reefs appear all around the coasts of the island. Raised reefs, more or less than a meter high, are connected with the present reefs, a fact which indicates that the island is still rising.

The climatic conditions of the island are characterized by heavy rainfalls and very strong winds throughout the year. It has an average annual rainfall of 3,440 mm., which is fairly evenly distributed through most of the year. Because the island is located on the western edge of the pacific Ocean, here the wind patterns are chiefly determined by the monsoons. The strong northeast monsoon prevails during the winter months, from November to March, while the southwest monsoon, which is usually light and weak, prevails in the summer, from April to September. Aside from the above-mentioned monsoons, strong winds occur during the occasional typhoons which are most frequent from July to October. In fact, there are always strong winds over the island of Botel Tobago because of the lack of friction over the water. The annual mean temperature ever recorded in the moderately elevated area of the island is 22.6°C. For the hottest month the average temperature is 26°C and that for the coldest is 18.3°C. The annual average relative humidity over the island is 90 per cent. As a consequence, Botel Tobage is noted to be the most humid part of Taiwan.

In Botel Tobago, the climate is usually hot and humid and tree growth is a very prominent feature. Vegetation on the island is particularly luxuriant. The island in general is mostly covered

by closed woods resembling the tropical rain forests. Chang (1967), studying the woody flora of Botel Tobago, divided the vegetation on the island into three major types: strand vegetation, mountain forest, and grassland. Ecologically, the strand vegetation appears to be of three minor types. The plant communities thriving on coral reefs are dominated by woody plants of prostrate or shrubby nature, among these being *Pemphis acidula, Crossostephium chinense, Statice arbuscula,* and *Podocarpus polystachys.* The other type of the sea-shore vegetation is characteristic of the sand flats where many other littoral plants adopt a trailing habit. These include *Ipomoea pes-caprae, Canavalia lineata, Vitex rotundifolia, Wedelia biflora,* and *Cassytha filiformis.* Besides, littoral woodlands develop as a belt out of reach of the highest tides. This type of strand vegetation is inclined to be highly characteristic and constitutes the coastal fringe of dense bushes, being more or less comparable with that occurring along the coast of Oluanpi, except for that the trunks of the trees in the littoral forests on the island of Botel Tobago are beset with abundance of epiphytes. Of other noteworthy dominant tree species there may be mentioned *Barringtonia asiatica, Aglaia elliptifolia, Terminalia catappa, Erythrina Variegata* var. *orientalis, Pterospermum niveum, Palaquium formosanum, Ficus cuspidato-caudata,* and *Pandanus odoratissimus* var. *sinensis.* On the island of Botel Tobago damp mountain forests thrive all over the whole island elevated interior region. One of the striking characteristics of the so-called tropical rain forest on the island is the extremely mixed dominance of the component tree species. However, some are of common occurrence on the foothills, as, for instance, *Pometia Pinnata, Artocarpus altilis, Nothapodytes foetida, Leea manillensis, L. philippinensis, Sterculia ceramica, Leucosyke quadrinervia, Maoutia setosa, Pipturus arborescens, Macaranga tanarius, Dysoxylum cumingiana, Syzygium lanyuense, S. claviflorum,* and *Bischoffia javanica.* Others are widespread in the more elevated areas, and among these may be mentioned *Boerlagiodendron pictinatum, Geniostema batanense, Macaranga sinensis, Claoxylum brachyandrum, Linociera ramiflora, Acmena acuminatissima, Schefflera octophylla, Timonius arboreus, Tarenna kotoensis, Alyxia insularis, Diospyros maritima, Persea thunbergii,* and *Frecynetia batanensis.* The grassland occurring on the island of Botel Tobago is known to be of secondary type, developing notably in the northern and eastern parts of the island and mostly in burned-over areas and abandoned fields resulting from shifting cultivation. Such grassland communities are usually dominated by various and often mixed perennial herbaceous species. These include *Miscanthus sinensis, Apluda mutica, Chaetochloa lutescens* var. *genuina, Imperata cylindrica* var. *koenigii, Andropogon kwashotensis* and *Rhaphis aciculatus* of the grass family, and *Emilia sonchifolia, Blumea pubigera, B. lacera, Gnaphalium multiceps, Lactuca indica* and *Artemisia japonica* of the daisy family.

For many reasons, and especially for those connected with theories of phytogeography (Sasaki, 1932; Kanehira, 1935; Merrill, 1946; Li & Keng, 1950), Botel Tobago is one of the most interesting regions in this part of the world. As a matter of fact, the flora of Botel Tobago has long attracted the interests of botanists (Kawakami & Sasaki, 1915; Sasaki, 1918 & 1930; Kanehira & Sasaki. 1934; Liu, Sasaki, & Keng, 1955; Chang, 1967). Also, the floristic relationships between Botel Tobago and her neighboring regions have been discussed, based upon the vascular floras, by a number of botanists (Merrill, 1923; Nakai, 1931; Sasaki 1932; Kanehira, 1935; Li & Keng, 1950). Botel Tobago, however, in reality is a very superficially explored island with respect

to a bryophyte flora. Although the vascular flora of the island has been studied for decades, modern research concerning the island bryology was not initiated until 1935 when the bryophytes of Botel Tobago were first investigated by Horikawa and later by Noguchi (1937 & 1939). Nevertheless, their works on the island bryophytes published so far are very fragmentary and widely scattered. In fact, the bryophyte flora of the island still remains too scantily known. Further exploration will certainly add more species to the island flora and possibly lead to the discovery of new species.

The present paper is based entirely on collections made by Mr. S. S. Lin in October of 1967 on the island of Botel Tobago. His collections of mosses are considerably extensive, only the majority of them are sterile and materials of some of the specimens are too meagre or in poor condition for certain identification. These include a number of mosses apparently not previously recorded as occurring in Botel Tobago.

By the present study 22 species, 11 genera and 4 families are recorded as new to the flora of the island of Botel Tobago. Among the original materials received there are 90 packets of moss specimens, some of which are mixture of species. These include 51 species belonging to 32 genera in 21 families. A dozen of species, however, were omitted from this list on account of the difficulties in identifying them for their scarceness and small size. As has been noted, the following list is not intended to cover species ever reported before from the island but those included in the collections concerned. In the list, species preceded by an asterisk are mosses that have not previously been reported from the island of Botel Tobago.

Fissidentaceae

Fissidens filicinus Dozy et Molkenboer, Musc. Frond. Nov. Spec. ex Archip. Indico et Japonia 7 (1844).

Fissidens japonicus Dozy et Molkenboer, Pl. Jungh. Fasc. **3:** 313 (1854).

Fissidens nobilis Griffith, sensu Sakurai, Bot. Mag. Tokyo **51:** 60 (1937).

Fissidens schismoides Sakurai, Bot. Mag. Tokyo **53:** 60, f. 3 (1939).

Loc. Santaokow, alt. 350 m. (BT-*0012* & BT-*0018a*, Oct. 15, 1967) and Weather Station, alt. 300 m. (BT-*0033*, Oct. 16, 1967).

Hab. On cement wall and damp rocks in shaded place.

Distr. Formosa, China, philippines, Ryukyu, Japan, Thailand, Vietnam, Malay peninsula, Burma, northern India, Ceylon, Sumatra, Borneo, Celebes, Bonins.

Fissidens nobilis Griffith, Not. 427 and Ic. Pl. Asiat. **2,** t. 83 (1841).

Loc. Tienchih, alt. 300 m. (BT-*0053* & BT-*0054*, Oct. 20, 1967).

Hab. On damp rocks by stream in shaded place.

Distr. Hongkong, Philippines, Java, Sumatra, Himalayas.

Ditrichaceae

****Ditrichum pallidum*** (Schreber) Hampe, Flora **51:** 182 (1867).

Bryum pallidum Schreber, Spic. Fl. Lips. 80 (1771).

Trichostomum pallidum Hedwig, Spec. Musc. Frond. 108 (1801).

Leptotrichum pallidum Hampe, Linnaea 74 (1847).

Diaphanophyllum pallidum Lindberg, Oefv. K. Vet.-Akad. Foerh. 605 (1862).

Ditrichum rhynchostegium Kindberg, Rev. Bryol. **37:** 14 (1910).

Loc. Weather Station, alt. 300 m. (BT-*0025*, BT-*0029* & BT-*0030*, Oct. 16, 1967).

Hab. On cement wall in shaded place.

Distr. Formosa, China, Ryukyu, Japan, Caucasus, eastern Europe, North America.

This family is a new addition to the flora of Botel Tobago!

Dicranaceae

Symblepharis reinwardtii (Dozy et Molkenboer) Bosch et Lacoste, Bryol. Jav. **2:** 225 (1870).

Dicranum reinwardtii Dozy et Molkenboer, Ann. Sci. Nat. Bot. **2:** 303 (1844).

Loc. Santaokow, alt. 350 m. (BT-*0014* & BT-*0015*, Oct. 15, 1967).

Hab. On rock in shaded place.

Distr. Formosa, Philippines, Borneo, Java, Burma, Himalayas.

This genus is a new addition to the flora of Botel Tobago!

Leucobryaceae

Leucobryum bowringii Mitten form. ***bowringii,*** Journ. Linn. Soc. Bot. Suppl. 1, 26 (1859).

Leucobryum angustifolium Wilson; Kew Journ. Bot. **9:** 292 (1857).

Leucobryum yamatense Bescherelle; Journ. de Bot. **12:** 288 (1898).

Leucobryum nagasakense Brotherus; Hedwigia **38:** 208 (1899).

Leucobryum pycnophyllum C. Mueller, Gen. Musc. 82

Leucobryum brotheri Cardot, Bull. Soc. Belg. **41:** 361 (1902).

Loc. Weather Station, alt. 300 m. (BT-*0032*, Oct. 16, 1967) and Tienchih, alt. 300 m. (BT-*0063*, BT-*0064c* & BT-*0057*, Oct. 20, 1967).

Hab. On cement wall and damp rocks in shaded place and tree trunk in damp forest.

Distr. Formosa, China, Philippines, Ryukyu, Japan, Malaysia, Ceylon.

Leucophanes candidum (Hornschuch) Lindberg, Oefv. Svensk. Vet.-Akad. Foerh. **21:** 602 (1864).

Syrrhopodon candidus Hornschuch, Nov. Act. Acad. **14:** 701 (1826).

Loc. Tienchih, alt. 300 m. (BT-*0046*, BT-*0047*, BT-*0048*& BT-*0049*, Oct. 20, 1967).

Hab. On rocks and rotten wood in damp forest.

Distr. Philippines, Celebes, Borneo, Fiji.

This species may be a new addition to the flora of Botel Tobago. However it is reported also from Taiwan by Chen (1963) without any reference to its locality there.

Leucophanes octoblepharioides Bridel, Bryol. Univ. **1:** 763 (1826).

Loc. Hungtow Chi. alt. 200m. (BT-*0007*, Oct. 13, 1967).

Hab. On bark of tree in damp forest.

Distr. Philippines, Malaysia to Pacific Islands, and Nepal.

Calymperaceae

Calymperes serratum A. Brown, in C. Mueller, Synops. Musc. **1:** 527 (1849).

Calymperes lorifolium Mitten, Journ. Linn. Soc. Bot **12:** 173 (1869).

Calymperes setifolium Hampe, in Bescherelle, Ann. Sci. Nat. Bot **19:** 304 (1895).

Calymperes aeruginosum Hampe, mss.

Loc. Weather Station, alt. 300 m. (BT-*0026.* Oct. 16, 1967).

Hab. On cement wall in shaded place.

Distr. Eastern China, Philippines, Malaysia, New Caledonia, Fiji, Samoa.

Calymperes strictifolium (Mitten) Roth, Hedwigia **51:** 127 (1911).

Syrrhopodon strictifolium Mitten, in Seemann, Fl. Vit. 388 (1873).

Syrrhopodon tuberculosus Dixon et Theriot, Journ. Linn. Soc. Bot. **43:** 303 (1916).

Calymperes tuberculosum (Dixon et Theriot) Brotherus, in E. & P., Nat. Pflanzenfam. ed. 2, **10:** 240 (1924).

Loc. Hungtow Chi, alt. 200 m. (BT-0003, Oct. 13, 1967) and Santaokow, alt. 350 m. (BT-*0016* & BT-*0017b*, Oct. 15, 1967).

Hab. On damp rock and tree trunks in damp forest.

Distr. Formosa, Philippines, Borneo, Fiji, Samoa.

Calymperes tenerum C. Mueller, Linnaea **37:** 144 (1871-73).

Loc. Santaokow, alt. 350 m. (BT-*0008*, Oct. 15, 1967) and Lungtow Shan, alt. 250m. (BT-*0037*, BT-*0038* & BT-*0045*, Oct. 18, 1967).

Hab. On rocks in shaded place.

Distr. Philippines, Malaysia, Pacific Ialands to Hawaii, and India.

Pottiaceae

****Didymodon recurvirostre*** (Dickson) Jennings, Man. Moss. W. Pa. 97 (1913).

Bryum rubellum Hoffmann, Deutchl. Fl. **2:** 33 (1796).

Bryum recurvirostrum Dickson, Pl. Crpt. fasc. 2. no. 7 (1801).

Didymodon rubellus (Hoffmann) B. S. G, Bry. Eur. fasc. 29-30 (1846).

Loc. Yehyu Chi, alt. 100 m. (BT-*0088* & BT-*0089*, Oct. 26, 1967).

Hab. On rocks by stream.

Distr. Asia, Europe, North America Africa, Tasmania, New Zealand, Hawaii.

This genus is a new addition to the flora of Botel Tobago!

Barbula consanguinea (Thwaites et Mitten) Jaeger, Adumbr, **2:** 673 (1877-78).

Tortula consanguinea Thwaites et Mitten, Journ, Linn. Soc. Bot. 300 (1872).

? *Barbula edanoi* Brotherus, Philipp. Journ. Sci. **31:** 282 (1926).

Hydrogonium consanguineum (Thwaites et Mitten) Hilpert, Beih. Bot. Centralbl. **50** (2): 626 (1933).

Loc. Yüjen Chi, alt. 200 m. (BT-*0071a*, BT-*0074* & BT-*0075*, Oct. 24, 1967).

Hab. On rocks by stream in damp forest.

Distr. Philippines.

****Barbula indica*** (Schwaegrichen) Bridel, Bryol. Univ. **1:** 544 (1826).

Trichostomum indicum Schwaegrichen, Suppl. 1, **1:** 142, pl. 36 (1811).

Trichostomum orientale Willdenow, in C. Mueller, Synops. Musc. **1:** 568 (1849).

Barbula orientalis (Weber) Brotherus in, E. & P., Nat. Pflanzenfam. ed. 1, **3**: 409 (1902).

Semibarbula indica (Bridel) Herzog ex Hilpert, Beih. Bot. Centralbl. **50**: 626 (1933) fide Chen; Hedwigia **80**: 229 (1941).

Semibarbula orientalis (Weber,) Wijk et Margadant, Taxon **7** (1958)

Loc. Weather Station, alt. 200 m. (BT-*0031*, Oct. 16, 1967) and Yüjen Chi, alt. 200m. (BT-*0075b*, Oct. 24, 1967).

Hab. On cement wall and damp rocks in shadedplace.

Distr. Formosa, eastern China, Ryukyu, Philippines, Borneo, Java, Ceylon, India, Pakistan.

****Barbula subulata*** Brotherus, Philipp. Journ. Sci. **31**: 282 (1926).

Loc. Yüjen Chi, alt. 200 m. (BT-*0078c*, Oct. 24, 1967).

Hab. On rock in shaded place by stream.

Distr. Philippines.

Mniaceae

Mnium succulentum Mitten var. ***integrum*** Noguchi, Journ. Jap. Bot. **27**: 32 (1952).

Loc. Hungtow Chi. alt. 200m. (BT-*0004*, Oct. 13, 1967) and Tienchih. alt. 250 m. (BT-*0021*, Oct. 15, 1967) and alt. 300 m. (BT-*0058*, Oct. 20, 1967).

Hab. On damp rocks in shaded place.

Distr. Formosa, Ryukyu, Japan.

Bartramiaceae

****Philonotis mollis*** (Dozy et Molkenboer) Bosch et Lacoste, Bryol. Jav. **1**: 165, pl. 125 (1861).

Bartramia mollis Dozy et Molkenboer, Ann. Sci. Nat. Bot. **4**: 300 (1844).

Loc. Yüjen Chi. alt. 200 m. (BT-*0081*, Oct. 24, 1967) and Yenyu Chi, alt. 100 m. (BT-*0087* & BT-*0090*, Oct. 26, 1967).

Hab. On rocks by stream.

Distr. Lutao, Philippines, Andaman Islands, Java, Sumatra, southern India, Vietnam.

Orthotrichaceae

****Amphidium papillosum*** Bartram, Philipp. Journ. Sci. **68**: 48, pl. 4, f, 51 (1939).

Loc. Yehyu Chi, alt. 100 m. (BT-*0086*, Oct. 29, 1967).

Hab. On rock by stream.

Distr. Philippines.

This genus is a new addition to the flora of Botel Tobago!

****Macromitrium japonicum*** Dozy et Molkenboer Ann. Sci. Nat. Bot. **3**: 311 (1844).

Macromitrium insularum Sullivant et Lesquereux, Proc. Amer. Acad. Arts Sci. **4**: 278 (1859).

Dasymitrium incurvum Lindberg, Oefv. K. Vet.-Akad. Foerh. **9**: 421 (1864).

Macromitrium giraldii C. Mueller, Nuov. Giorn. Bot. Ital. Nuov. Ser. **3**: 1065 (1869).

*Macromitrium incurv*um (Lindberg) Mitten, Trans. Linn. Soc. London **3**: 162 (1891).

Dasymitrium makinoi Brotherus. Hedwigia **38**: 215 (1899).

Macromitrium makinoi (Brotherus) Paris; Ind. Bryol. Suppl. 239 (1900).

Macromitrium bathyodontum Cardot; Beih Bot. Centralbl. **17**: 13 (1904).

Macromitrium nakanishikii Brotherus ex Okamura; in Matsumura; Icon. Pl. Koish. **4**: 45 (1919)

Loc. Yüjen Chi, alt. 200 m. (BT-*0069*, BT-*0070*, BT-*0072*, BT-*0073*, BT-*0076* & BT-*0077*, Oct. 24, 1967).

Hab. On rock by stream.

Distr. Formosa, China, Ryukyu, Japan.

Rhacopilaceae

Rhacopilum spectabile Reinwardt et Hornschuch, Nov. Act, Acad. Caes. Leop **14**: 721, pl. 40 (1826).

Loc. Weather Station, alt. 300 m. (BT-*0034d*, Oct. 16, 1967).

Hab. On cement wall in shaded place.

Distr. Formosa, Philippines, Borneo, Sumatra, Java, New Guinea, New Caledonia, Fiji, Samoa

Trachypodaceae

Trachypodopsis serrulata Fleischer var. ***crispatula*** (Hooker) Zanten, Blumea **9**: 521 (1959).

Hypnum crispatulum Hooker, Trans. Linn. Soc. Lond. Bot. **9**: 321, pl. 28 (1808).

Neckera crispatula Hooker, Musc. Exot. pl. 152 (1820).

Trachypus crispatulus (Hooker) M.itten, Journ. Linn. Soc. Bot. Suppl. 1, 129 (1859).

Papillaria crispatula Jaeger, Adumbro. **2**: 178 (1874-75).

Trachypodopsis crispatula (Hooker) Fleischer, Hedwigia **45**: 65 (1906).

Trachypodopsis serrulata Fleischer var. *longifolia* Noguchi, Journ. Sci. Hiroshima Univ. B, 2, **3**: 214, f. 2 (1939).

Loc. Santaokow, alt. 350 m. (BT-*0022*, Oct. 15, 1967).

Hab. On rock in shaded place.

Distr. Formosa, China, Philippines, Thailand, Laos, Burma, Himalayas, Nepal, Calcutta, southern India, Ceylon, Andaman Islands, Halmahera, Indonesia, Guatemala, Mexico.

This family is a new addition to the flora of Botel Tobago!

Meteoriaceae

Meteorium miquelianum (C. Mueller) Fleischer, in E. & P., Nat. Pflanzenfam. ed. 1, **3**: 818 (1906).

Neckera miqueliana C. Mueller, Synops. Musc. **2**: 138 (1851).

Meteorium polytrichum Dozy et Molkenboer, Musc. Frond. Ined. Archip. Ind. 131, t. 51-52 (1854).

Papillaria polytricha Jaeger, Adumbr. **2**: 173 (1875-76).

Papillaria miqueliana Renauld et Cardot. Rev. Bryol. **23**: 103 (1896).

Loc. Santaokow, alt. 350 m. (BT-*0023*, Oct. 15, 1967).

Hab. On tree in damp forest.

Distr. Formosa, China, Japan, Philippines, East Indies, New Guinea, Fiji, northern India, Ceylon.

The family is a new addition to the flora of Botel Tobago!

****Aërobryopsis longissima*** (Dozy et Molkenboer) Fleischer, Hedwigia **44**: 305 (1905).

Neckera longissima Dozy et Molkenboer, Musc. Frond. n. sp. Archip. Ind. 18 (1844).

Meteorium lanosuum Mitten, Journ. Linn. Soc. Bot Suppl. 1, 90 (1859).

Loc. Tienchih, alt. 300 m. (BT-*0055* & BT-*0057*, Oct. 20, 1967).

Hab. On trees in damp forest.

Distr Philippines, China, India, Ceylon, Malay Peninsula, Malaysia, Pacific Islands to Hawaii.

Neckeraceae

Neckeropsis lepineana (Montagne) Fleischer, Laubmfl. Java **3**: 879, f. 155 (1907).

Neckera lepineana Montagne, Ann. Sci. Nat. Bot. 107 (1848).

Neckera undulata Montagne, Ann Sci. Nat. Bot. 107 (1848).

Loc. Lungtow Shan,alt. 250 m. (BT-*0040*, BT-*0041* BT-*0042*, BT-*0043* & BT-*0044*, Oct. 18, 1967).

Hab. On wet rocks by waterfalls in ravine.

Distr. Formosa, Ryukyu Japan, Philippines, Borneo, Malaysia, Pacific Islands to Hawaii, eastern Africa.

Neckeropsis nitidula (Mitten) Fleischer, Laubmfl. Java **3**: 882 (1907).

Homalia apiculata Dozy et Molkenboer, Musc. Fr. Archip. et Japon 161, t. 52, B (1854).

Omalia nitidula Mitten, Journ Linn Soc. Bot. **8**: 155 (1864).

Neckera nitidula (Mitten) Brotherus, Hedwigia **38**: 228 (1899).

Loc. Hungtow Chi, alt. 200 m. (BT-*0001*, Oct. 13, 1967) and Santaokow, alt. 350 m. (BT-*0011*, Oct. 15, 1967).

Hab. On damp rocks in shaded place.

Distr. Formosa, Philippines Ryukyu, Japan, China, Vietnam.

****Himantocladium plumula*** (Nees) Fleischer, Laubmfl. Java **3**: 889 (1907).

Pilotrichum plumula Nees, in Bridel, Bryol. Univ. **2**: 759 (1827).

Neckera hookeri Dozy et Molkenboer, Ann, Sci. Nat Bot. **4**: 313 (1844).

Neckera plumula C. Mueller, Synops. Musc. **2**: 53 (1851).

Loc. Tienchih, alt. 300 m. (BT-*0050*, BT-*0051* & BT-*0052*, Oct. 20, 196.7).

Hab. On tress in damp forest.

Distr. Formosa, Ryukyu, Philippines, Thailand, Borneo, Java, Sumatra, New Caledonia.

Homaliodendron exiguum (Bosch et Lacoste) Fleischer, Laubmfl. Java **3**: 897 (1907).

? Neckera semperiana Hampe ex C. Mueller, Bot. Zeit. 381 (1862).

Homalia exigua Bosch et Lacoste, Bryol. Jav. **2**: 55, t. 175 (1863).

Neckeropsis pseudonitidula Okamura, Journ. Coll. Sci. Imp. Univ Tokyo **38**(4): 39, f, 17 (1916).

Homaliodendron pseudonitidula Noguchi, Trans. Nat. Hist. Soc. Formosa **24**: 291 (1934).

Homalia laxiretis Sakurai, Bot. Mag. Tokyo **50**: 618, f 8 (1935).

Loc. Tienchih, alt. 250 m. (BT-*0062a*, Oct. 20, 1967).

Hab. On rock in damp forest.

Distr. Formosa, Ryukyu, Japan, Thailand, Vietnam, Malay Peninsula, Burma, Himalayas, Assam, southern India, Ceylon, Sumatra, Java, Borneo, Celebes, Philippines, New Guinea, Australia, Fiji Islands.

Homaliodendron microdendron (Montagne) Fleischer, Hedwigia **45:** 78 (1906).

Hookeria? microdendron Montagne, Voy. Bonite Crypt. 150, f. 3 (1846).

Hypnum microdendron C. Mueller, Synops. Musc. **2:** 231 (1851).

Hypnum spathulaefolium C. Mueller, Synops. Musc. **2:** 231 (1851).

Neckera glossophylla Mitten; Journ. Linn. soc. Bot. Suppl. 1, 119 (1859).

Homalia glossophylla Jaeger; Adumbr. **2:** 198 (1875-76).

Homalia microdendron Jaeger; Adumbr. **2:** 200 (1875-76).

Homaliodendron glossophyllum Fleischer, Hedwigia **45:** 78 (1906).

"*Neckeropsis nitidula* Fleischer" Ihsiba; Trans. Agr. Soc. Taihoku Imp. Univ. **7**(2): 202 (1935).

Loc. Tienchih, alt. 300 m. (BT-*0051a*, Oct. 20, 1967).

Hab. On trees in damp forest.

Distr. Formosa China, Ryukyu, Philippines, Malay Peninsula, Vietnam, Thailand, Burma Bhutan Assam, Khasia, Sikkim, southern India.

Hookeriaceae

Hookeria acutifolia Hooker et Greville, Edinburgh Journ. Sci. **2:** 225 (1825).

"*Pterygophyllum lucens* Bridel" Sullivant, Musc. Allegh. 58 (1846).

Hookeria grevilleana Griffith, Not. Pl, Asiat. 473 (1849).

Hookeria ? sullivantii C. Mueller, in Lesquereux et James, Man. 293 (1884).

Pterygophyllum nipponense Bescherelle, Ann. Sci. Nat. Bot. **17:** 381 (1893).

Hookeria megablastum C. Mueller, Flora **82:** 460 (1896).

Pterygophyllum acuminatum Paris, Index Bryol. ed. 1, **4:** 1051 (1898).

Hookeria nipponensis (Bescherelle) Brotherus, in E. & P., Nat. Pflanzenfam. ed. 2, **11:** 236 (1925).

Loc. Hungtow Chi, alt. 200 m. (BT-*0002*, Oct. 13, 1967) and Tienchih, alt. 300 m. (BT-*0059* & BT-*0068*, Oct. 20, 1967).

Hab. On damp rock and rotten wood in damp forest.

Distr. Formosa, Ryukyu, Japan, China, Indochina, Himalayas, Nepal, Sikkim, India, Ceylon, Java, Borneo, Oceania, North & South America,

Leucomiaceae

****Leucomium aneurodictyon*** (C. Mueller) Jaeger, Adumbr. **2:** 539 (1877-78).

Hypnum aneurodictyon C. Mueller, Synops. Musc. **2:** 681 (1851).

Leucomium philippinense Brotherus, Philipp. Journ. Sci. Bot. **8:** 91 (1913).

Loc. Santaokow, alt. 350 m. (BT-*0009*a, BT-*0019*a, BT-*0020* & BT-*0021*a, Oct. 15, 1967); Weather Staion, alt. 300 m. (BT-*0034*a, Oct. 16, 1967); Lungtow Shan, alt. 250 m. (BT-*0036*,

Oct. 18, 1967) and Yüjen Chi. alt,. 200 m. (BT-*0074a*, BT-*0075a* & BT-*0078a*, Oct. 24, 1967).

Hab. On damp rocks by stream or on cement wall in shaded place; rarely on bark of tree in damp forest.

Distr. Philippines, Malaysia, New Caledonia, Fiji, Samoa, Marquesas.

This family is a new addition to the flora of Botel Tobago!

Thuidiaceae

Pelekium bifarium (Dozy et Molkenboer) Fleischer, Laubmfl. Java **4:** 1513 (1922).

Thuidium bifarium Dozy et Molkenboer, Bryol. Jav. **2:** 123 (1865).

Loc. Hungtow chi, alt. 200 m. (BT-*0003a*, Oct. 13, 1967); Santaokow, alt. 350 m. (BT-*0009b*, Oct. 15, 1967) and Weather Station, alt. 200 m. (BT-*0034c*, Oct. 16, 1967).

Hab. On tree trunk in damp forest and on earth wall in shaded place.

Distr. Formosa, Philippines, Java, Sumatra, Amboina.

****Thuidium minutulum*** (Hedwig) Bruch et Schimper, Bryol. Eur. fasc. 49—51 (1852).

Hypnum minutulum Hedwig, Spec. Mus. Frond. 260 (1801).

Loc. Santaokow, alt. 350 m. (BT—*0010*, Oct. 15, 1967) and Weather Station, alt. 300 m. (BT—*0027* & BT—*0028*, Oot. 16, 1967).

Hab. On cement wall in shaded place.

Distr. Formosa, Japan, Europe, eastern North America.

Brachytheciaceae

****Eurhynchium celebicum*** (Bosch et Lacoste) Bartram, B. P. Bishop Mus. Bull. **101:** 217 (1933).

Hypnum celebicum Bosch et Lacoste, Bryol. Jav. **2:** 159 (1867).

Rhynchostegium celebicum (Bosch et Lacoste) Jaeger, Adumbr. **2:** 440 (1876—77).

Loc. Santaokow, alt. 350 m. (BT—*0019*, Oct. 15, 1967).

Hab. On damp rocks in shaded place.

Distr. Formosa, Philippines, Thailand, Vietnam, Celebes, Java, Sumatra, New Guinea, Hawaii.

The genus is a new addition to the flora of Botel Tobago!

****Rhynchostegium vagans*** (Harvey) Jaeger, Adumbr. **2:** 435 (1876—77).

Hypnum vagans Harvey, in Hooker, Ic. Pl. Rar. t. 24, f. 2 (1841).

Oxyrrhynchium distantifolium Williams, Bull. N Y. Garden **8:** 375 (1914).

Eurhynchium vagans (Harvey) Bartram, B. P. Bishop Mus. Bull. **101:** 213, f. 158 (1933).

Loc. Santaokow, alt. 350 m. (BT—*0018* & BT—*0024*, Oct. 15, 1967).

Hab. On damp rocks in shaded place.

Distr. Formosa, Philippines, Thailand, Laos, Ceram, Borneo, Java, Ceylon, southern India, Himalayas, Hawaii.

The genus is a new addition to the flora of Botel Tobago!

Sematophyllaceae

****Trichosteleum boschii*** (Dozy et Molkenboer) Jaeger, Adumbr. **2:** 487 (1876—77).

Hypnum boschii Dozy et Molkenboer, Ann. Sci. Nat. Bot. **4:** 306 (1844).

Hypnum thelidictyon Sullivant et Lesquereux, Proc. Amer. Acad. Arts Sci. **4**: 280 (1859).

Trichosteleum basilanense Brotherus, Philipp. Journ. Sci. Bot. **13**: 220 (1918).

Loc. Tienchih, alt. 300 m. (BT—*0065*, Oct. 20, 1967).

Hab. On damp rocks close to a tarn.

Distr. Formosa, Philippines, Vietnam, Thailand, Malay Peninsula, Borneo, Java, Sumatra.

Taxithelium instratum (Bridel) Brotherus, Rev. Bryol. **28**: 110 (1901).

Hypnum instratum. Bridel, Bryol. Univ. **2**: 394 (1827).

Taxithelium petrophila Williams, Bull. N. Y. Bot. Garden **8**: 370 (1914).

Loc. Tienchih, alt. 300 m. (BT—*0064a*, Oct. 20, 1967).

Hab. On damp rock in shaded place.

Distr. Philippines, Borneo, Celebes, Java, Sumatra, New Guinea, Malay Peninsula, Vietnam.

Hypnaceae

Ectropothecium buitenzorgii (Belanger) Jaeger, Adumbr. **2**: 524 (1877—78).

Hypnum buitenzorgii Belanger, Voy. Ind. Or. Bot. 2, Crypt. 94 (1835).

Ectropothecium subintorquatum Brotherus; Philipp. Journ. Sci. Bot. **3**: 27 (1908).

Ectropothecium brachyphyllum Brotherus; Philipp. Journ. Sci. Bot. **13**: 216 (1918).

Loc. Tienchih, alt. 300 m. (BT—*0060*, BT—*0061* & BT—*0064*, Oct. 20, 1967).

Hab. On damp rocks and rotten wood in damp forest.

Distr. Formosa, Philippines, Celebes, Borneo, Java, Sumatra, Ceram, Amboina.

****Ectropothecium dealbatum*** (Hornschuch et Reinwardt) Jaeger, Adumb. **2**: 528 (1877—78).

Hypnum dealbatum Hornschuch et Reinwardt; Nov. Act. Acad. Caes. Leop. Carol. 14, Suppl. 2, 729 (1828).

Ectropothecium assimile Brotherus; Philipp. Journ. Sci. Bot. **5**: 158 (1910).

Loc. Santaokow, alt. 350 m. (BT—*0009*, Oct. 15, 1967) and Weather Station, alt. 300 m. (BT—*0034*, Oct. 16, 1967).

Hab. On bark of tree and cement wall in shaded place.

Distr. Philippines, Borneo, Java, Sumatra.

****Isopterygium minutirameum*** (C. Mueller) Jaeger, Adumbr. **2**: 500 (1876—77).

Hypnum minutirameum C. Mueller; Synops. Musc. **2**: 689 (1851).

Loc. Hungtow Chi, alt. 200 m. (BT—*0006*, Oct. 13, 1967).

Hab. On damp stones in shaded place.

Distr. Formosa, Philippines, Borneo, Java, Sumatra, Australia, Fiji, Marquesas.

The genus is a new addition to the flora of Botel Tobago!

****Taxiphyllum taxirameum*** (Mitten) Fleischer, Laubmfl. Java **4**: 1435 (1922).

Stereodon taxirameum Mitten; Journ; Linn. Soc. Bot. Suppl. 1; 105 (1859);

Hypnum teysmanni Lacoste; Bryol. Jav. **2**: 192; pl. 240 (1863).

Isopterygium taxirameum (Mitten) Jaeger; Adumbr. **2**: 505 (1876—77).

Isopterygium teysmanni Jaeger; Adumbr. **2**: 499 (1876—77).

Loc. Santaokow, alt. 350 m. (BT—*0013*, Oct. 15, 1967) and Yüjen Chi, alt. 200 m. (BT—*0078*, Oct. 24, 1967).

Hab. On rocks by stream in damp forest.

Distr. Formosa, Japan, Philippines, Sumatra, Ceylon, Assam, Himalayas, Sikkim, Nepal, Bhutan, Khasia, Coorg,

I wish to express my sincere thanks to Mr. S. S. Lin of Tunghai University for his kind help in providing me with his collections. Also, I should like to acknowledge the financial sponsorship of the National Council on Science Development.

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A COLLECTION OF MOSSES FROM BOTEL TOBAGO

Chung K'uei Wang

Botel Tobago is one of the islands surrounding Formosa, which is located east of Oluanpi and between Lutao and Batan. The island is composed primarily of igneous rocks and coral reefs. It is about 37 km. in circumference, and the area of the island is about 46 sq. km. It is characterised by a rugged mountainous terrain of volcanic origin, the highest peak of which is elevated 548 m. above the sea level. The surface of the island has been dissected by the radiating consequent rivers. The climate of the island is usually hot and humid, being characterised by high temperatures, heavy rainfall, and strong winds. Consequently, tropical rain forests predominate almost all over the island.

The flora of the island has attracted the interests of botanists, and the floristic relationships between the island and her neighbouring regions, based upon the vascular floras, have also been discussed by a number of botanists.

Bryologically, Botel Tobago is a very superficially explored region though the vascular flora of the island has been studied for decades. In the present study, 39 species belonging to 30 genera in 18 families of mosses from the island have been examined and studied. Of thses mosses, as a result, 22 species, 11 genera and 4 families had not previously been found in Botel Tobago.

蘭嶼苔類植物

王 忠 魁

蘭嶼又名紅頭嶼，爲臺灣外島之一，屹立於太平洋中，與鵝鑾鼻東西相望，與綠島南北對峙，隔巴士海峽與巴丹島遙遙相對。該島爲火成岩和珊瑚礁結成的海島，周圍約37公里，面積約46平方公里。島上中部突起，山脈縱橫直迫海岸。芳蘭峯是其最高峰，拔海 548 公尺。四周分佈之溪流則多達十餘條。全島氣候溫高濕重、多風、多雨爲其特色。島上天然植被類屬熱帶雨林。分佈於該島之高等植物及其與臺灣及菲律賓間之植物區系親緣關係歷經中外植物學者研究。惜該島下等植物，諸如藻類與蘚苔，向少調查與研究。

筆者幸承東海大學林善雄君協助，將其在蘭嶼島採集所得全份蘚苔植物標本供爲研究資料。其中包括苔類標本90小包。使筆者對該島苔類植物之研究工作得以如期順利進行，衷心銘感。經年來研究結果，計得苔類18科、30屬、39種。其中包括 4 科11屬及2種、爲初次發現分佈於蘭嶼島的所謂新記錄苔類。

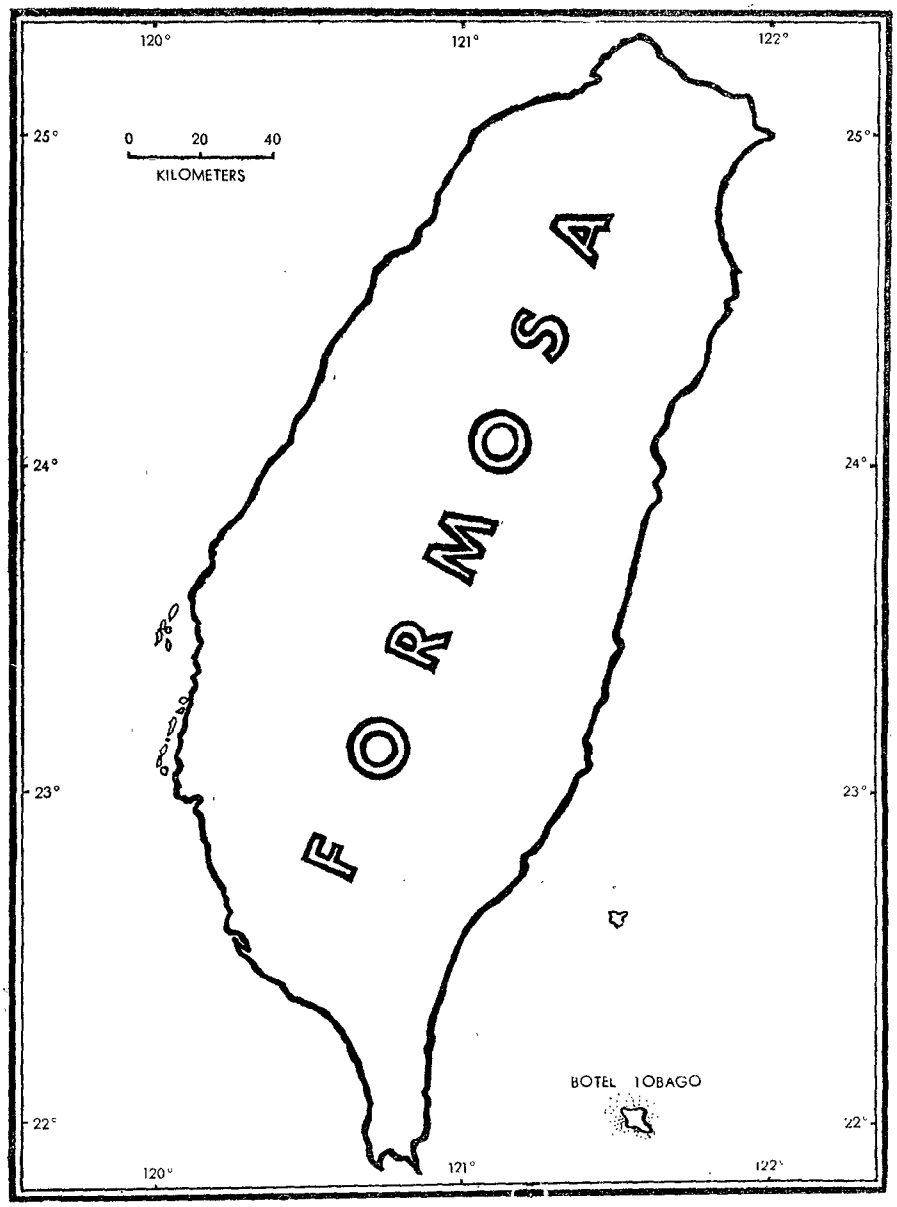

Figure 1. Outline map of Formosa

Figure 2. Map of Botel Tobago

APPENDIX

Africa 非洲
Amboina 安保娜
Andaman or Andaman Islands 安達曼群島
Aopenling 奧本嶺
Assam 阿薩姆
Australia 澳洲
Batan 巴丹
Bhutan 不丹
Borneo 婆羅州
Botel Tobago 蘭嶼
Burma 緬甸
Calcutta 加爾各答
Caucasus 高加索
Celebes 西里伯斯
Ceram 西拉姆
Ceylon 錫蘭
China 中國
Chinghui Shan 清水山
Chinpuchihpi 親不知鼻
Coorg 庫爾格（印度南部的一州）
East Indies 東印度群島
Europe 歐洲
Fan Shan 飯山
Fanglanfeng 芳蘭峯
Fiji or Fiji Islands 斐吉群島
Formosa 臺灣
Guatemala 瓜地馬拉
Halmahera 哈爾馬黑拉
Hawaii 夏威夷
Himalayas 喜馬拉雅山區
Hungtow 紅頭
Hungtow Chi 紅頭溪
Hungtow Shan 紅頭山
India 印度
Indochina 印度支那
Indonesia 印度尼西亞
Japan 日本
Java 爪哇
Khasia 喀西亞（印度阿薩姆州內西北部山區）
Langtao 朗島
Langtao Chi 朗島溪
Langtaotung Chi 朗島東溪
Lanyü 蘭嶼
Laos 寮國
Lingtuan 嶺端
Lotuyen 駱駝岩
Lungtow Shan 龍頭山
Lutao 綠島
Malay Peninsula 馬來半島
Malaysia 馬來西亞
Marquesas 馬爾柯薩斯（南太平洋中法屬群島）
Weather Station 測候所
Mexico 墨西哥
Nepal 尼泊爾
New Caledonia 新喀里島尼亞
New Guinea 新幾內亞
New Zealand 紐西蘭
North America 北美洲
Oceania 大洋洲
Oluanpi 鵝鑾鼻
Orchid Island 蘭嶼
Pacific islands 南太平洋群島
Pacific Ocean 太平洋
Pakistan 巴基斯坦
Philippines 菲律賓
Ryukyu 琉球
Samoa 薩摩亞
Santaokow 三道溝
Shantien Shan 山田山
Shashe Shan 殺蛇山
Shihtze Tsiao 獅子角
Sikkim 錫金
South America 南美洲
Sumatra 蘇門答臘
Tai Shan 臺山
Taiwan 臺灣

Tasmania 塔斯馬尼亞
Thailand 泰國
Tienchih 天池
Tsao Shan 草山
Tsientu Shan 尖禿山
Tungching 東清
Tungching Chi 東清溪
Tungchingtung Chi 東清東溪
Wangnanfeng 望南峯
Wangnantsiao 望南角
Vietnam 越南
Yehyin 野銀
Yehyin Chi 野銀溪
Yehyu 椰油
Yehyu Chi 椰油溪
Yehyunan Chi 椰油南溪
Yüjen 漁人
Yüjen Chi 漁人溪