

PRELIMINARY NOTES ON THE VEGETATION AND FLORA OF MT. TA-TUN, TAIPEI

I. VEGETATION

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Introduction

During the last 2 years, I have made extensive collections of vascular plants on Mt. Ta-tun, which is situated 16.2 km. north of Taipei. This mountain is of volcanic origin and therefore quite different from most mountains on Taiwan. It is covered with luxuriant vegetation. I have been much interested in studying the vegetation and the flora of this mountain, because many of the plants found on this mountain appear at different altitudes than on the other mountain. Beginning at about 800 m. elevation we begin to find alpine plants, while on other mountains we do not come across these alpine plants until we reach 2000 m.

So far as I know, the pioneer botanical collector on Mt. Ta-tun was a Scotsman Robert Fortune. He landed at Tamshui in April, 1854 and botanized around the port. *Tetrapanax papyriferum* was probably first found by him. In 1858, Charles Wilford, from Kew, visited the sulfur-spring area in Peitou and found the plants like *Callicarpa formosana* and *Helicia formosana*. Robert Swinhoe, Consul at Amoy, who was on board the same steamer with Mr. Fortune, also collected many new plants, such as *Rubus Swinhoei* and *Ehretia resinosa*, all of these were named by Hance. In 1864 Richard Oldham came to Formosa and botanized in this area, but unfortunately he died while carrying on his field work. Oldham's collections were studied mainly by Hance as well as by Maximowicz. The new plants which were published in 1867 were *Hypericum formosana*, *Hypericum Sampsoni*, *Liquidambar formosana*, *Rhododendron Oldhamii*, *Elaeagnus Oldhami*, *Titanotrichum Oldhami*.

The next to come to Formosa were William Gregory (1867), J. B. Steere (1873), Thomas Watters (1881-83), William Hancock (1881-82), Charles Ford (1884). The collections of these men were chiefly studied by many prominent European botanists, among them were Hance, Maximowicz and Hemsley.

Soon after Formosa was occupied by the Japanese in 1895, the Japanese botanists began to pay attention to the botany of the Island. At that time,

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The Tokyo Imperial University sent many experienced botanists, such as Makino, Owatari, Miyabe, Hayata, Kawakami, and others to the Island. These men published many reports on the flora of Formosa in the *Botanical Magazine* (Tokyo) and in many other papers, as well as in the monumental works of Dr. B. Hayata *Icones Plantarum Formosanarum*, volumes 1-10 (1911-1921).

These botanists were followed by Kudo, Kanehira, Masamune, Yamamoto, Sasaki, Simada, Suzuki, Hosokawa, Nakamura, and others. The investigations made by these botanists mostly appeared in *Botanical Magazine* (Tokyo), Kudoa, Yamamoto *Supplementa Iconum Plantarum Formosanarum*, *Transactions of the Natural History Society of Formosa*, *Journal of the Society of Tropical Agriculture* (Taihoku), Kanehira *Formosan Trees* (1936) and others.

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Topography

Mt. Ta-tun is a volcanic mass, lying in the northern part of Taiwan, ranging from the northern latitude of 25° 10' to 25° 20' and from the eastern longitude 121° 30' to 121° 45' with an area of nearly 162 sq. km.

The elevation of this area lies between 500 to 1,119 m. above sea level. According to the underground weak dislocation lines, the Ta-tun volcanic masses are arranged in three lines, trending from NE to SW. Of these volcanic masses, the Chu-tze-hu-shan comes out earliest by eruption. This is followed by Kwang-chuei-shan. The eruption of Chi-hsing-shan is the largest. Many craters and sulfur-springs are to be found here and there on slopes of both Chi-hsing-shan and Kwang-chuei-shan.

The altitudes of some of the familiar mountains in this area are as follows:

Chi-hsing-shan (七星山)	1,119 m.
Chu-tze-shan (竹仔山).....	1,103 m.
Ta-tun-shan (大屯山).....	1,081 m.
Hsiao-kwang-yin-shan (小觀音山)	1,070 m.
Mien-tien-shan (面天山).....	977 m.
Kwang-chuei-shan (礦嘴山).....	911 m.
Ta-chen-heo-shan (大尖後山).....	882 m.
Hsia-mao-shan (紗帽山)	643 m.

Phytogeography of Mt. Ta-tun

The number of indigenous species and varieties of vascular plants which are enumerated in this paper amounts to 1056. Most of these species are of

wide-distribution except 223 of them which are endemic to this Island.

The relationship between the Flora of Mt. Ta-tun (Formosa) and those in other parts of the Far East is shown in the following table.

	P.	G.	Dicot.	Monocot.	Total	%
Mt. Ta-tun (Formosa)	135	3	666	252	1,056	
China Mainland	92	2	411	142	647	62.2
Japan	85		252	118	454	42.9
Okinawa	62		240	87	389	36.9
Philippines	40		208	86	334	31.5
India	43		192	89	324	30.6
Malaya	42		157	98	302	29.0
Korea	20		101	60	181	11.1
Indo-China	12		80	25	117	11.0
Australia	12		13	18	59	5.6
Endemic to Formosa	10	1	146	66	223	21.1

From the above table we can find the fact that the Flora of Mt. Ta-tun is most closely related to that of China Mainland. Japan and Okinawa come second and third respectively. The Philippines, India and Malaya come successively next in order.

The total number of species of vascular plants is 1056, of which 135 are Pteridophytes, 3 Gymnosperms and 918 are Angiosperms. They belong to 157 families and 609 genera.

Families	Genera	Species	
Archichlamydeae	87	236	422
Metachlamydeae	28	148	246
Dicotyledons	115	384	668
Monocotyledons	24	134	252
Pteridophyta	16	69	135
Gymnospermae	2	2	3
Angiospermae	139	538	918
Total	157	609	1,056

The plant communities

A classification with a brief description of the plant communities of Mt. Ta-tun based upon my observations is given under the following headings:

1. Aquatic and swamp series.

This series includes many kinds of plants which live partly or wholly

in water. I have investigated a few of ponds, brooks and streams in this area and divided them into four formations as follows:

- A) Submerged-plant formation. Plants belonging to this category are those wholly or partly submerged in water. They are *Ceratophyllum submersum*, *Utricularia exoleta*, *Blyxa ecaudata*, *Hydrilla verticillata*, *Potamogeton natans*, *Potamogeton octandra*.
- B) Floating-plant formation. In ponds, streams and paddy fields one can find the following plants floating on water. *Azolla imbricata*, *Salvinia natans*, *Pistia stratiotes*, *Lemma paucicostata*, *Eichhornia crassipes*, *Wolffia microscopica*.
- C) Marsh-plant formation. The marsh-plants include all those which normally have their roots under water or in soaking soil, but like land-plants, have their leaves and branches above the water. This formation develops only on the borders of ponds and rice fields. They are *Marsilea quadrifolia*, *Ceratopteris thalictroides*, *Osmunda japonica*, *Polygonum hydropiper*, *Saururus chinensis*, *Basella rubra*, *Bergia serrata*, *Jussiaea erecta*, *Oenanthe javanica*, *Eriocaulon nantoense*, *Juncus effusus* var. *decepiens*, *Eleocharia pellucida*, *Cyperus radiatus*, *Leersia hexandra*, *Panicum repens*.
- D) Moist-plant formation. The moist-plants occur as undergrowth in damp forests or along stream banks. They are *Osmunda bromeliaefolia*, *Equisetum ramosissimum*, *Selaginella Doederleinii*, *Selaginella remotifolia*, *Diplazium esculentum*, *Onychium japonicum*, *Houttuynia cordata*, *Chloranthus Oldhami*, *Elatostema edule*, *Oreocnide pedunculata*, *Pilea peloides*, *Drymaria cordata*, *Ranunculus Vernyii*, *Alternanthera nodiflora*, *Rotala rotundifolia*, *Ludwigia prostrata*, *Halorrhagia micrantha*, *Centella asiatica*, *Hydrocotyle sibthorpioides*, *Titanotrichum Oldhami*, *Tricyrtis formosana*, *Carex baccans*, *Cyperus pilosus*, *Eleocharis acicularis*, *Scirpus mucronatus*, *Isachne globosa*, *Panicum proliferum*, *Sacciolepis spicata*.

2. Xerophytic series.

The xerophytes include the plants which live under conditions of scanty available soil moisture, mostly on rocks or epiphytic on trees. Based on the habitat of these plants, this series can be divided again into 2 formations as follows:

- A) Epiphytic formation. This formation, which grows on tree trunks or branches, consists of the following plants. *Trichomanes auriculatum*, *Cyclophorus adnascens*, *Davallia Mariesii*, *Drynaria Fortunei*, *Lemmaphyllum microphyllum*, *Neottopteris nidus*, *Pseudodrynaria coronans*, *Vittaria anguste-elongata*, *Piper kadsura*, *Hedera formosana*, *Hoya carnosa*, *Pothos Seemannii*, *Epipremum mirabile*.

B) Petrophilous formation. The plants that are found covering rocks belong to this category. They are mostly ferns and fern-allies with a few Dicotyledons. *Selaginella tamariscina*, *Hymenophyllum flexile*, *Asplenium normale*, *Blechnum nipponicum*, *Cheilopleuria bicuspis*, *Colysis Wrightii*, *Crypsinus hastatus*, *Dictyocline Griffithii*, *Diplazium lanceum*, *Lepisorus Thunbergianus*, *Lindsaya orbiculata*, *Microsorium Buergerianum*, *Polypodium formosanum*, *Polystichum Honcockii*, *Pilea peploides*, *Kalanchoe spathulata*, *Sedum formosanum*.

3. Mesophytic series.

The mesophytic series comprises most of the vascular plants growing in soils with moderate supplies of available moisture, the following formations are observed in this series.

A) Forests. The forests in Mt. Ta-tun are rather richly developed. They occur from 500 m. to a height of nearly equalling the top of every peak in the mountain mass, except the highest one, namely peak Chi-hsing, and that one is covered by a meadow. According to their ecological peculiarities, the following 2 categories can be divided.

1) Subtropical rain forest. The subtropical rain forest begins as low as 300 m., to a height of 650 m., covering a large part of the area. Although I made no quadrat studies during my visits to this forest, but my observations lead me to conclude that the following 2 associations may exist.

i) *Machilus Thunbergii*, *Myrica rubra* association. *Machilus Thunbergii* and *Myrica rubra* were found to be the dominant trees, but not necessarily the largest. However they grow both to a height of about 8 m. and are the most abundant. *Euscaphis japonica*, which confines to this district and is usually the next in abundance, becomes dominant in some areas. Seedlings of this species are also numerous in certain localities. Other abundant trees which may be locally dominant include *Elaeocarpus sylvestris*, *Macaranga Tanarius*, *Mallotus japonicus*, *Trema orientalis*. Additional conspicuous trees are:

a) Evergreen broad-leaf trees. *Ficus retusa*, *Cinnamomum camphora*, *Glochidion hongkongense*, *Cyclobalanopsis paucidentata*, *Ficus gibbosa*, *Ficus nervosa*, *Helicia formosana*, *Michelia formosana*, *Actinodaphne nantoensis*, *Itea chinensis*, *Eriobotrya deflexa*, *Prunus phaeosticta*, *Adinandra formosana*, *Cleyera japonica*, *Eurya acuminata*, *Gordonia axillaris*, *Saurauia tristyla* var. *Oldhamii*, *Hibiscus taiwanensis*, *Daphniphyllum teijsmanii* var. *Oldhamii*, *Ilex formosana*,

Meliosma rhoifolia, *Meliosma rigida*, *Turpinia formosana*,
Ardisia Sieboldii, *Rapanea nerifolia*, *Symplocos lucida*,
Lasianthus plagiophyllus, *Psychotria rubra*, *Cordia Myxa*.

- b) Deciduous broad-leaf trees. *Alnus formosanus*, *Aphananthe aspera*, *Ficus Wightiana*, *Liquidamba formosana*, *Lagerstroemia subcostata*, *Bischofia javanica*, *Sapium discolor*, *Salix glandulosa* var. *Warburgi*, *Evodia mediaefolia*, *Fagara ailanthoides*, *Sapindus Mukurosi*, *Acer Oliverianum* var. *Nakaharai*, *Euscaphis japonica*, *Rhus succedanea*, *Alniophyllum Fortunei*, *Styrax formosanum*, *Fraxinus Griffithii*, *Viburnum luzonicum*, *Ehretia longifolia*.

Other woody species or evergreen shrubs entering into the floristic composition include the following.

Chloranthus glabra, *Ficus formosana*, *Ficus Beecheyana*, *Mahonia japonica*, *Barthea formosana*, *Blastus cochinchinensis*, *Bredia Oldhami*, *Hydrangea chinensis*, *Hydrangea angustipetala*, *Rhododendron ellipticum*, *Rhododendron Nakaharai*, *Rhododendron Oldhamii*, *Vaccinium Donianum*, *Maesa japonica*, *Ligustrum japonicum* var. *pubescens*, *Callicarpa formosana*, *Clerodendron cyrtophyllum*, *Vitex cannabifolia*. The most common lianas being found in the forest are *Ficus Aukeotsang*, *Ficus pumila*, *Clematis Meyniana*, *Stauntonia hexaphylla*, *Cocculus trilobus*, *Stephania cephalantha*, *Kadsura japonica*, *Actinidia callosa*, *Hiptage bengalensis*, *Millettia reticulata*, *Pueraria tonkienensis*, *Berchemia lineata*, *Rhamnus formosana*, *Elaeagnus Oldhami*, *Anodendron Benthamianus*, *Ecdysanthera rosea*, *Mussaenda parviflora*, *Senecio scandens*, *Ipomoea cairica*, *Smilax china*, *Pothos Seemanii*, *Dioscorea japonica* var. *kelungensis*.

The most abundant plants covering the ground in the subtropical rain forest are: *Angiopteris suboppositifolia*, *Adiantum caudatum*, *Coniogramme japonica*, *Dennstaedtia scabra*, *Diplazium maximum*, *Microlepia strigosa*, *Plagiogyria euphlebia*, *Rumohra amabilis*, *Lecanthes Sasakii*, *Pellionia scabra*, *Rubus Buergeri*, *Viola diffusa*, *Begonia laciniata* var. *formosana*, *Hydrocotyle javanica*, *Ligularia japonica*, *Crawfordia japonica*, *Commelina nudiflora*, *Polliia japonica*, *Alpinia Shimadai*, *Liriope spicata*, *Paris formosana*, *Tricyrtis formosana*, *Eupatorium formosanum*, *Veratrum formo-*

sanum, *Cyperus diffusus*, *Cyperus haspan*, *Arthraxon hispidus*, var. *typica*, *Eragrostis plumosa*, *Oplismenus compositus*, *Panicum patens*, *Panicum plicatum*.

- ii) *Alsophila pustulosa*, *Cyathea taiwaniana* association. In some areas in the subtropical rain forest *Alsophila pustulosa* and *Cyathea taiwaniana* appear to be the most abundant. Accompanying these fern-trees one can find the following species. *Itea chinensis*, *Adiandra formosana*, *Cleyera japonica*, *Elaeocarpus japonicus*, *Daphniphyllum teijsmanni* var. *Oldhami*, *Meliosma rhoifolia*, *Lagerstroemia subcostata*, *Sapium discolor*, *Ficus Awkeotsang*, *Ipomoea cairica*.

2) Warm temperate forest.

From approximately 700 m. to 950 m. in a restricted district the warm temperate forest is poorly developed. It comprises, to my observation, the following trees:

Trochodendron aralioides, *Idesia polycarpa*, *Acer Oliverianum* var. *Nakaharai*, *Ilex microcarpa* var. *longifolia*, *Michelia formosana*, *Cyclobalanopsis paucidentata*, *Rhododendron Nakaharai*, *Rhododendron ellipticum*.

Of the trees listed above *Trochodendron aralioides* is apparently the largest and the most dominant one.

B) Upland meadow.

The meadow formation is commonly developed on the tops of mountain peaks, beginning at an altitude of 950 m. The following associations were observed on my several trips.

1) *Sinobambusa Kunishii* association.

The *Sinobambusa Kunishii* association is developed near the tops of mountains, and is characterized by the absence of other dwarf shrubs. The component of this association is represented by following species:

Trochodendron aralioides, *Rhododendron Nakaharai*, *Dendropanax pellucidopunctata*, *Symplocos chinensis*, *Gentiana formosana*, *Alettris formosana*, *Drosera spathulate*, *Viola Nagasawai*, *Asarum macranthum*, *Luzula multiflora*, *Pteridium aquilinum* var. *japonicum*.

2) *Miscanthus sinensis* association.

The *Miscanthus sinensis* association is developed at the very peak of the mountains. The following species make up this association.

Lycopodium clavatum, *Dicranopteris lineare*, *Blechnum nipponicum*, *Cirsium japonicum*, *Eupatorium formosanum*.

The Life Form

The Life-form is an index of the habitat where plants live. For the living forms of enumerated plants in the present paper I followed the widely-used system of C. Raunkiaer. The abbreviation of Raunkiaer's system of Life-forms is as follows:

(S)...Stem succulents, (E)...Epiphytes, (MM)...Megaphanerophyte and mesophanerophyte, (M)...Microphanerophyte, (N)...Nanophanerophyte, (Ch.)...Chamaephyte, (H)...Hemicryptophyte (G)...Geophytes, (HH.)... Helophytes and Hydrophytes, (Th.)...Therophytes.

Based on my investigations, I have made a chart of the living forms of flowering plants on Mt. Ta-tun and classified them into 10 categories. Details are tabulated as follows:

	S	E	MM	M	N	Ch	H	G	HH	Th
Gymnospermae			3							
Dicotyledons	5	6	44	100	104	43	55	5	5	36
1. Archichlamydeae		5	5	36	53	15	77	1	4	53
2. Metachlamydeae										
Monocotyledons		3	2	12	8	2	122	41	22	54
Total	5	14	54	148	167	60	254	47	31	143
% 293 spp.	0.5	1.5	5.9	16	17.9	6.5	27.6	5.1	3.4	15.5
Normal spectrum 1,000 spp.	2	3	8	18	15	9	26	4	2	13

The above table shows that in Mt. Ta-tun Phanerophytes and Hemicryptophytes manifest respectively a higher value than Therophytes.

The fact of the higher value of Phanerophytes and Hemicryptophytes indicates that on Mt. Ta-tun trees and annuals preponderate over all the other classes. The ferns on Mt. Ta-tun is, according to C. Rankiaer's formula, calculated as follows:

Pteridophyte-Quotient (Ptph.-Q.) of Mt. Ta-tun = $\frac{25 \times 135}{923} = 3.65$ This value of Ptph.-Q. shows the habitat is quite favorable for the development of ferns.

Ecological survey on Sulfur-spring region.

There are many sulfur-springs to be found on Mt. Ta-tun. The plants which grow in these areas are all xerophytic. *Lyonia ovalifolia*, *Melastoma candidum*, *Ilex asprella*, *Miscanthus sinensis*, *Dianella ensifolia*, *Lycopodium cernuum*, *Histiopteris incisa*, are the most common species to be met with.

With a series of 2 quadrats (each quadrat measuring 10 by 10 meters) I have made a clear ecological survey along the sulfur-spring region midway

between Yan-ming-shan and the Chu-tze-hu Police Station, being 621 m., above the sea level.

The results of the survey are as follows:

Area (A)

10 m. on each side.	Total number of species
<i>Lyonia ovalifolia</i> (Wall.) Druce.....	35
<i>Ilex asprella</i> Champ.....	26
<i>Melastoma candidium</i> D. Don.	15
1 m. on each side.	
<i>Lyonia ovalifolia</i> (Wall.) Druce.....	3
<i>Ilex asprella</i> Champ.....	2
<i>Melastoma candidium</i> D. Don.	1
<i>Dianella ensifolia</i> DC.....	15
<i>Miscanthus sinensis</i> Anders.....	9
<i>Drosera spathulata</i> Labill.....	69
<i>Hicriopteris glauca</i> (Thunb.) Copel.	2
<i>Lycopodium cernuum</i> Linn.....	5

Area (B)

10 m. on each side.	
<i>Lyonia ovalifolia</i> (Wall.) Druce.....	56
<i>Ilex asprella</i> Champ.....	4
<i>Melastoma candidium</i> D. Don.....	2
1 m. on each side.	
<i>Lyonia ovalifolia</i> (Wall.) Druce.....	4
<i>Ilex asprella</i> Champ.....	1
<i>Melastoma candidium</i> D. Don.	1
<i>Dianella ensifolia</i> DC.....	8
<i>Miscanthus sinensis</i> Anders.	5
<i>Drosera spathulata</i> Labill.....	10
<i>Hicriopteris glauca</i> (Thunb.) Copel.	1
<i>Lycopodium cernuum</i> Linn.	5

The above facts show that in the sulfur-spring regions *Lyonia ovalifolia*, manifest a higher value of abundance, and *Drosera spathulata* the next. An association of *Lyonia ovalifolia* and *Drosera spathulata* is, thus, formed.



↑ Fig. 1. Distance view of upland meadow on Mt. Chi-hsing, with *Sinobambusa Kunishii* growing on the foreground.



↑ Fig. 3. Forest along roadside showing *Alsophila pustulosa*, *Trema orientalis* and others.



↑ Fig. 2. *Trochodendron aralioides* forming an association at Mt. Chi-hsing at about 800 m. above the sea level.

Fig. 4. Undergrowths in subtro-→
pical rain forest on Mt. Chi-hsing,
showing *Podophyllum pleianthum*,
Chloranthus glaber and *Ligularia
tussilaginea* var. *formosana*.





↑ Fig. 5. Undergrowths in subtropical rain forest on Mt. Chi-hsing, showing *Alpinia Shimadai* and *Chloranthus glaber*.



↑ Fig. 7. *Cinnamomum camphora* an evergreen tree on highway side at Yan-ming-shan.



↑ Fig. 6. *Gymnosphaera poliohylla*, a small tree fern growing in the subtropical rain forest.

Fig. 8. Undergrowths in sub-→ tropical rain forest on Mt. Chi-hsing showing *Histiopteris incisa* and *Alpinia speciosa*.





↑ Fig. 9. *Hicriopteris glauca*, an undergrowth in subtropical rain forest on Mt. Chi-hsing about 750 m. above the sea level.



↑ Fig. 11. A few components of subtropical rain forest, showing *Wendlandia formosana*, and others.



↑ Fig. 10. *Miscanthus chinensis*, in upland meadow on Mt. Chi-hsing at 1,000 m. above the sea level.



Fig. 12. *Sinobambus Kunishii*, → in upland meadow on Mt. Chi-hsing at about 900 m. above the sea level.