玉山國家公園

關山區維管束植物調查

研究報告

委託單位：內政部營建署玉山國家公園管理處

研究單位：國 立 成 功 大 學 生 物 系

目　　錄

摘　要

關山區維管束植物調查研究第二年研究重點及初步成果如下：1.繼續就南部橫貫公路沿線進行調查工作。本次植物調查研究總名錄增加 70 種；包括蕨類 3 種、裸子植物 1 種、雙子葉植物 49 種、單子葉植物 17 種。2.選擇關山嶺步道作為高山植物解說線；提供該線有關植物名錄、分佈、海拔高度、重要特徵與圖譜等解說資料。3.於天池二葉松造林地火災區進行調查；探討火災適存植群及演替機制。

壹、緒言

按玉管處擬訂之中長程之規劃指導原則，長期持續之植物調查工作為各項後續相關研究之基礎；故第二年仍繼續就南橫沿線按月採集、記錄調查；方法與結果詳見報告貳之第一章。

關山嶺步道位國家公園關山區內南橫終點附近、海拔高 3174 公尺，登頂不難、費時不多是遊客駐足頻繁之處。且步道沿線可供解說之資料豐富，是一理想之高山植物解說線。結果詳見報告貳之第二章。

天池為南橫全線東西交通之匯，也是公路客運接駁處。適合設遊憩區，植物調查宜早進行。且該區內二葉松造林地於七六年三月曾遭大火；葉處長及解說課均提示應把握機會進行火災生態之研究。本系有意培養生態研究人才，仍積極配合，由大四同學選為論文，著手調查工作。結果詳見報告參。

國家公園之各項研究為長遠持續之百年大業。調查研究資料與日俱增且得來不易；當有效管理與應用、也即資訊電腦。本研究室選用一資料管理應用軟體於 MacIntosh SE 機器下使用，操作簡單，容易推廣。也於本次報告中介紹。

貳、植物調查與解說

圖與表目錄

第一章　關山區維管束植物調查

第二期計劃自七七年二月起至十月止共採集八次。採集標本共 666 號（表一）所有標本經乾燥、除蟲及滅菌後經鑑定再以台紙付標籤封入塑膠內，存於成大生物系標本館供查證及相關研究之用。

新增植物名錄

本期報告關山區維管束植物總名錄新增種類共 70 種（表二）。大都為本次研究期間所採、少數為上期採集品；均於名錄中登錄採集號以供核對。另一部分系陳玉峰課長來函告知則加註〝 Chen Y. F.〞 以茲識別。

幻燈片解說資料庫

本期調查過程中仍循往例，每次均拍攝彩色幻燈片；保存各季所見景觀和植物特徵。以 Macintosh SE 資料管理應用軟體 File Maker plus 製一 Color Slide 檔；每筆記錄由日期（Date）、地點（Locality）、號碼（Number）、名字（Name）及加註（Note）等欄（fields）構成一資料庫。

各欄中：日期、地點為每一幻燈片之基本資料，按實際拍攝時地登錄。號碼由英文字母及阿拉伯數字組成；分別為幻燈片保存盒代號及其內各張編號。名字係植物學名，而加註則記載解說資料；也即每一幻燈片之主題或內容。當然各欄之設定可隨需要增刪如加借用者（user）或出版情形（Publish）等欄以利管理。

今以實例說明如次；表三為幻燈片資料庫(color slide)之一部份。其中 d13 至 d28 總共 16 筆記錄；以第一筆為例；d13 指 d 盒內第 13 張幻燈片、拍攝時地為 76 年 6 月 29 日、植物是 Dianthus pygmaeus 、主在說明玉山石材之花苞及開花狀態。餘各筆類推。查詢簡便；只需於要查欄內輸入關鍵字即可由 FIND 功能查得。如於 note 欄內輸入〝 shiny〞 找有關陽性植物資料，可查得 d14，d15，d16 及 d17 等四張。操作純熟後極易組合關鍵字查詢各類資訊供應用。

第二章　關山嶺步道解說線植物調查

南橫為台灣南部橫異東西之要道。近年觀光人口急遽增加；西自梅山口東山垭隧道全位玉山國家公園關山區內，遊憩壓力日增，解說點與線之規劃宜盡快進行。前期初勘已擬訂梅山、唯金溪、禮觀橋、天池、進涇橋、檜谷及關山嶺等處。

上述解說點與線以關山嶺海拔最高。一般欣賞、認識台灣高山植物景觀、植被和各類植物、通常均需具有登山負重能力及較長時間；而本區關山嶺因緊鄰橫貫公路邊線（圖一），其步道攀登容易、交通方便、遊客易到（圖二），是極佳之解說線。本期重點為調查該區植物並提供解說資料。

關山嶺步道解說線植物名錄

目前登錄本區維管束植物共計 150 種。表四按科名字母順序、依次將學名、中名及採集號登錄。

關山嶺步道解說線主要景觀為芒草及玉山箭竹草原、雲衫及鐵杉林。蕨類有 30 種；鱗毛蕨科就佔 16 種，是一特色。灌木以小蘗、莢迷、柳等屬及杜鵑花科植物為主。其它大多為高山草本植物、出現於岩隙、小徑傍或斜坡壁上。其中雙子葉植物有 96 種、以菊科植物為最多；達 15 種。單子葉植物有 23 種。以禾本科植物為主；多達 11 種。

關山嶺步道解說線資料

利用 Maclntosh SE 型電腦，以 File Maker plus 應用軟體，將關山嶺步道解說線有關植物之分布、海拔高度、重要特徵與圖譜等解說資料編輯成資料庫。（表五）可供隨時查詢、整合各類資料。此一應用軟體特色，在於資料的輸入和輸出非常靈活、且富變化；可由使用者自行設計、不論增添刪除或修改各項資料均易操作。此外又可經由掃描器（suanner）將影像存入資料庫內。這是 PC 電腦中常用軟體 dBASEIII無法望其項背的。

表一　採集記錄

日　期	號　碼	地　點
02/27/1988	013857-013859	mei-shan 梅山
02/27/1988	013860-013878	112k-113k
02/27/1988	013879-013880	119k-120k
02/27/1988	013881-013900	122k-123k
02/28/1988	013901-013904	132k
01/31/1988	013905-014066	tien-chi 天池
04/04/1988	014177-014230	tien-chi 天池
04/05/1988	014231-014242	guan-shan-lin 關山領
04/05/1988	014243-014259	134k
04/05/1988	014260-014269	131k
04/05/1988	014270-014284	129k
04/05/1988	014284-014301	wei-gin-chi 唯金溪
04/05/1988	014302	li-guan 禮觀
04/05/1988	014303-014315	119k
07/23/1988	014669-014671	mei-shan 梅山
07/23/1988	014672-014682	112-1/2k
07/23/1988	014683-014696	117k

07/23/1988	014697-014708	114k
07/23/1988	014709-014743	133k
07/24/1988	014744-014763	shian-yang-shan 向陽山
09/14/1988	014985-015048	tien-chi to gin-zin-chiao 天池—逕進橋
09/15/1988	015049-015056	tien-chi-136k 天池
09/15/1988	015057-015072	136k-137k
09/15/1988	015073-015081	137k-138k
09/15/1988	015082-015086	138k-139k
09/15/1988	015087-015088	kuai-gu 檜谷
09/15/1988	015089-015090	
09/15/1988	015091-015132	guan-shan-lin 關山嶺
09/14/1988	015132-015204	gin-zin-chiao 天池—逕進橋

表二、關山區新增維管束植物名錄

Aceraceae

Acer albopurpurascens Hay.	樟葉槭 Chen Y. F.
Acer morrisonense Hay.	台灣紅榨槭 14198,
Acer serrulatum Hay.	青楓 14267,

Amaranthaceae

Achyranthes japonica Nakai.	日本牛膝 Chen Y. F.

Anacardiaceae

Rhus succedanea L. 木蠟樹 14258,

Aquifoliaceae

Hex ficoidea Hemsl. 台灣糊雪 Chen Y. F.

Araceae

Arjsaema grapsospadix Hay. 毛筆天南星 Chen Y. F.

Asclepiadaceae

Asclepias curassavica L. 尖尾鳳 Chen Y. F.

Athyriaceae

Athyrium oppositilpinnum Hay. 對生蹄蓋蕨 12838,

Blechnaceae

Woodwardia orientalis Sw. 東方狗脊蕨 12956,

Caprifoliaceae

Viburnum foetidum Wall. 狹葉莢迷 13304, Chen Y. F.

Viburnum sphaerocarpum Y.C. Liu et C.H.

Compositae

Cirsium kawakamii Hay. 玉山薊 15096,

Eupatorium chinense L. 塔山澤蘭 15045,

Microglossa pyrifolia O. Kuntze. 小舌菊 Chen Y. F.

Petasites formosanus Kitamura. 山菊 13728,14223,

Saussurea kanzanensis Kitamura. 關山青木香 15095,

Sonchus oleraceus L. 苦滇菜 13727,14188,

Veronia cinerea Less. 一枝香 13869,

Cyperaceae

Carex phacota Sprengel. 七星斑囊果薹 14287,

Elaeocarpaceae

Elaeocarpus japonicus Sieb. 薯豆 14301,

Sloanea formosana Li. 猴歡喜 Chen Y. F.

Ericaceae

Rhododendron oldhamii Maxim. 金毛杜鵑 14186,

Rhododendron ovatum Planch. 馬銀花 13929,

Euphorbiaceae

Glochidion aequorcum Hance 白樹仔 14311,

Fagaceae

Pasania brevicaudata Schott. 短尾柯 Chen Y. F.

Passania kawakamii Schott. 大葉柯 Chen Y. F.

Pasania ternaticupula Schott. 三斗柯 Chen Y. F.

Labiatae

Glechoma hederaceae L. 大馬蹄金 14675,

Pogostemon formosanus Oliv. 節節紅 Chen Y. F.

Lauraceae

Cinnamomum camphora Nees. 樟樹 14284,

Leguminosae

Crotalaria lanceolate E. Meyer. 長葉豬屎豆 13857,

Liliaceae

Aletris formosana Sasaki. 台灣粉條兒菜 14203,

Aletris spicata Franchet. 束心草 13736,

Ophiopogon formosanum Ohwi. 台灣沿階草 13723,

Lomariopsidaceae

Elaphoglossum yoshinagae makino. 舌蕨 14193,

Magnoliaceae

Michelia compressa Sargent. 烏心石 Chen Y. F.

Menispermaceae

Cocculus sarmentosus Diels 鐵牛人石 14307,

Paracyclea ochiaiana Kudo 台灣土防己 14270,

Myrsinaceae

Ardisia quinquegona Blume 小葉樹杞 13917,

Myrtaceae

Syzygium formosanum Meri 台灣赤楠 Chen Y. F.

Oleaceae

Osmanthus enervius Masam. & Mori 無脈木犀 Chen Y. F.

Osmanthus lanceolatus Hay. 銳葉木犀 Chen Y. F.

Osmanthus matsumuranus Hay. 大葉木犀 Chen Y. F.

Orchidaceae

Bulbophyllum umbellatum Lindl. 纖形捲瓣蘭 14672,

Bulbophyllum umbellatum Lindl. 傘花捲瓣蘭 Chen Y. F.

Calanthe reflexa Maxim. 反捲根節蘭 14750,

Luisia teres Bl. 金釵蘭 14281,

Odontochilus bisaccatus Hay. 二囊齒唇蘭 14673,

Palmae

Arenga engleri Becc. 山棕 14286,

Pinaceae

Pinus morrisonicola Hay. 台灣五葉松 Chen Y. F.

Poaceae

Agropyron formosanum Honda 台灣鵝觀草 15105,

Bromus formosanum Honda 台灣雀麥 15104,15106,

Leptochloa chinensis L. 千金子 14674,

Vulpia myuros Gmel. 鼠茅 15142,

Polygalaceae

Polygala tatarinowii Regel. 小扁豆 15022,

Polygonaceae

Polygonum viscosum Buch. 香蓼 15133,

Rosaceae

Photinia serrulata Lindl. 小櫻桃 Chen Y. F.

Prunus phaeosticta Maxim. 黑心櫻 Chen Y. F.

Rubiaceae

Nertera nigricarpa Hay. 黑果深柱夢草 14715,

Rubia linii Chao 林氏茜草 15111,

Rutaceae

Toddalia asiatica(L.) Lam. 飛龍掌血 14292,

Salicaceae

Salix morii Hay. 台東柳 14209,14213,

Salix takasagoalpina Koidz. 台灣山柳 14232,

Scrophulariaceae

Mazus alpinus Masamune. 高山通泉草 13891,

Smilacaceae

Smilax hayatae T.Koyama. 旱田氏菝契 14201,

Solanaceae

Solanum nigrum L. 龍葵 13964,

Theaceae

Eurya chinensis Brown. 米碎柃木 13699,

Ulmaceae

Ulmus uyematsui Hay. 阿里山榆 14223,

Urticaceae

Lecanthus sasakii Hay. 長梗盤花麻 15016,

Zingiberaceae

Alpinia speciosa K. Schum. 玉桃 13918,

表三、幻燈片解說資料庫之一

d13 nanhen 06/29/76 Dianthus pygmaeus

note : flower buds and open one

d14 nanhen 06/29/76 Lilium formosanum

note : flower blooming, shiny grass slope

d15 nanhen 06/29/76 Lilium formosanum

note : flower blooming, shiny grass slope

d16 nanhen 06/29/76 Bletia formosanum Schltr.

note : roadside slope shiny

d17 nanhen 06/29/76 Miscanthus floridulus

note : full blooming reddish inflorescence

d18 nanhen 06/29/76 Arundo formosana Hack

note : plant pendent, rocky walls along roadside

d19 nanhen 06/29/76 Torenia concolor Lindley var. formosana Yamazaki

note : full blooming reddish inflorescence

d20 nanhen 06/29/76 Bredia gibba Ohwi

note : fruit reddish

d21 nanhen 06/29/76 Bredia gibba Ohwi

note : fruit reddish

d22 nanhen 06/29/76 Pilea sp.

note : roadside shady wet rocky place, flower smal

d23 nanhen 06/29/76 Duchesnea indica

note : fruit reddish, aggregate

d24 nanhen 06/29/76 Derris trifoliata

note : small shrub

d25 nanhen 06/29/76 Pityrogramma calomelanos

note：rocky clef, leaf farinose on back, pterophilous

d26 nanhen 06/29/76 Adiantum malesianum Ghatak.

note：a recentlly noted new record very close to A. caudatum

d27 nanhen 06/29/76 Bletia formosanum Schltr.

note：roadside slope shiny

d28 nanhen 06/29/76 Torenia concolor Lindley var. formosana Yamazaki

note：pink purpulish flower blooming

表四、關山嶺維管束植物名錄

Acanthaceae

Parachampionella flexicaulisis. 曲莖蘭崁馬藍 12934,12950,12955,

Araliaceae

Fatsia polycarpa Hay. 台灣八角金盤 12953,

Hedera rhombea Bean var formosana. 台灣常春藤 11985,

Athyriaceae

Athyrium oppositipinnum Hay. 對生蹄蓋蕨 12490,12503,

Cystopteris moupinensis Franch. 寬葉冷蕨 12450,12480,

Balsaminaceae

Impatiens uniflora Hay. 紫花鳳仙花 11960,12448,

Berberidaceae

Berberis alpicola Schneid. 高山小檗 13422,

Berberis hayatana Mizush. 南湖小檗 12464,

Berberis kawakamii Hay. 台灣小檗 14236,

Mahonia oiwakensis Hay.

Blechnaceae

Woodwardia unigemmata Nakai. 頂芽狗脊蕨 12956,

Campanulaceae

Adenophora uehatae Yamamoto. 高山沙參 12460,

Codonopsis kawakamii Hay. 玉山山奶草 11948,

Caprifoliaceae

Lonicera acuminata Wall. 阿里山忍冬 12435,

Viburnum luzonicum var. 莢迷 15113,

Viburnum luzonicum var. oblongum Li. 長橢圓葉莢迷 12949,

Caryophyllaceae

Cerastium triggnum Vill var. 玉山卷耳 11964,12444,12481,15118

Silene morrisonmontana Ohwi. 玉山繩子草 12443,

Stellaria alsine Grimm. var. 天蓬草 11966,

Compositae

Ainsliaea reflexa Merr. 台灣鬼督郵 11955,13418,

Anaphalis margaritacea Benth. 玉山抱莖籟簫 11933,11989,12465,

Artemisia campestris L. 細葉山艾 11979,15110,

Artemisia kawakamii Hay. 山艾 12499,14238,

Aster lasioclada Hay. 絨山白蘭 12447,15103,

Aster taiwanensis Kitam,ura. 台灣馬蘭 12935, 12944,

Carpesium cernuum L. 杓岩菜 12445,15116,

Cirsium kawakamii Hay. 玉山艾 15096,

Erigeron morrisonensis Hay. 玉山飛蓬 11965,

lxeris transnokoensis Kitamura. 12466,15099

Myriactis humilis Merr. 矮菊 12477,12940,

Petasites formosanus Kitamura. 山菊 14233,

Saussurea kanzanensis Kitamura. 15095

Senecio scandens Ham. ex D. Don. 蔓黃苑 12441,12405,

Vernonia patula Merr. 嶺南野菊 12009

Crassulaceae

Sedum morrisonensis Hay. 玉山 12459,15093,

Cruciferae

Arabis formosana Liu & Ying. 台灣筷子芥 11994,13426,

Arabis morrisonensis Hay. 玉山筷子芥 11971,

Cyperaceae

Carex cruciata Wahl. 煙火臺 12960,

Carex gentilis Franch. subsp. 中原氏二柱臺 12919,12957,

Diapensiaceae

Shortia exappensiculata Hay. 裂綠花 12469,

Dryopteridaceae

Arachniodes rhomboides Ching. 斜方複葉耳蕨 12931,12947,12961,

Dryopteris alpestris Tagawa. 腺鱗毛蕨

Dryopteris barbigera Ktze. 密毛鱗毛蕨 12506,

Dryopteris fibriliosa Hand-Maz. 密鱗鱗毛蕨 12409,

Dryopteris lepidopoda Hayata 厚葉鱗毛蕨

Dryopteris sparsa(Don.)Ktze. 長葉鱗毛蕨

Peranema cyatheoieds Don. 柄囊蕨 12457,

Polystichum falcatipinnum Hay. 鐮葉耳蕨 12505,

Polystichum hancockii Diels. 韓氏耳蕨 12927,12929,

Polystichum ilicifolium Moore. 針葉耳蕨 12507,

Polystichum kodamae Tagawa. 兒玉氏耳蕨

Polystichum nepalense C. Chr. 軟骨耳蕨 12504,

Polystichum parvipinnum Tagawa. 尖葉耳蕨 12928,12952,

Polystichum piceopaleaceum Tagawa. 壬鱗耳蕨

Polystichum stenophyllum Christ 芽胞耳蕨

Polystichum thomsoni Beddome 尾葉耳蕨 11978,12747,12509,

Elaeagnaceae

Elaeagnus obovata L. 小葉胡頹子 12500.

Ericaceae

Gaultheria itoana Hay. 高山白珠樹 12000,12478,13420,

Rhododendron morii Hay. 森氏杜鵑 15120,

Rhododendron taiwanalpinum Ohwi 台灣杜鵑 12001,

Euphorbiaceae

Mercurialis leiocarp Sieb. 山定 12942,

Gentianaceae

Gentiana flavo-maculata Hay. 黃花龍膽 11961,

Tripterospermum cordifolium Satake. 高山肺形草 15097,

Geraniaceae

Geranium hayatanum Ohwi. 單花牻牛兒苗 11960,15131,

Geranium nepalense Sweet. var. 牻牛兒苗 12476,

Geranium suzukii Masamune. 山牻牛兒苗 12430,15091,

Grammitidaceae

Xiphopteris okuboi Copel. 梳葉蕨 12455,

Guttiferae

Hypericum nagasewai Hay. 玉山金絲桃 11981,

Hymenophyllaceae

Mecodium polyanthos Copel. 細葉蕗蕨 12462,

Mecodium wrightii Copel. 萊氏蕗蕨 12456,

Juncaceae

Luzula taiwaniana Satake. 台灣地楊梅 11962

Labiatae

Clinopodium gracile Ktze. 塔花 12937,

Clinopodium laxiflorum Matsum. 疏花塔花 11986,

Mentha canadensis L. 薄荷 12492,

Origanum vulgare L. var. formosanum. 台灣晴薄荷 12494,

Paraphlomis gracilis Kudo. 短柄舞子草 12926,12940,

Salvia arisanensis Hay. 阿里山紫參 12936,

Liliaceae

Disporum kawakamii Hay. 台灣寶鐸花 12498,

Liriope minor Makino. 小麥門冬 12924,

Smilacina formosana Hay. 台灣鹿藥 11972,

Trillium tschonoskii Maxim. 延齡草 11947,12464,

Lycopodiaceae

Lycopodium clavatum L. 石松 12496,

Lycopodium quasipolytrichoides Hay. 反捲葉石松 13431,15128

Lycopodium somai Hey. 相馬氏石松 12510,

Onagraceae

Epilobium amurense Hausskn. 黑龍江柳葉菜 11970,

Epilobium brevifolium Don. subsp. 短葉柳葉菜 12454,12468,

Epilobium platystigmatosum Robins. 闊柱柳葉菜 15702,

Orchidaceae

Appendicula reflexa Blume. 竹節蘭 12467,

Goodyera velutina Maxim ex Rey. 烏嘴蓮 12453,12461,

Platanthera stenosepala Schltr. 狹瓣粉蝶蘭 12439,

Ponerorchis kiraishiensis. 奇萊紅蘭 11954,

Oxaliaceae

Oxalis acetosella L. subsp. japonica. 酢醬草 14234,

Pinaceae

Piceae morrisonicola Hay. 台灣雲杉 12920,

Tsuga chinensis Diels var. formosana. 台灣鐵杉 11952,

Poaceae

Agropyron mayebaranum Honda 前原鵝觀草 11996,12007,

Brachypodium kawakamii Hay. 川上短柄草 11995,

Brachypodium sylvaticum(Huds.) 短柄草 13415,

Bromus morrisonensis Honda. 玉山雀麥 12471,

Deschampsia flexuosa Trin. 曲芒髮草 11975,12003,

Deyeuxia arundinacea Beauv. 類蘆野青茅 12459,

Deyeuxia formosana C. Hsu. 台灣野青茅 12470,

Festuca ovina L. var. ovina L. 羊茅 11990,

Miscanthus floridulus Schum. & Laut. 五節芒 13416,

Yushania niitakayamensis Keng f. 玉山箭竹

Polygonaceae

Polygonum cuspidatum Sieb & Zucc. 虎杖 12473,

Polygonum rucinatum Buch-Ham. 散血草 12422,

Polygonum thunbergii Sieb. & Zucc. 戟狀蓼 11987,

Polypodiaceae

Crypsinus quasidivaricatus Copel. 玉山茀蕨 12491,

Lepisorus pseudo-ussuriensis. 烏蘇里瓦葦 12959,

Primulaceae

Primula miyabeana to & Kawakami. 報春花 11949,

Pteridaceae

Cheilanthes argentaea Kunze. 長柄粉背蕨 12010,

Cryptogramma brunoniana Wall. 高山珠蕨 13432,

Pteris dactylina Hook. 掌鳳尾蕨 13419,

Pyroiaceae

Pyrola morrisonensis Hay. 玉山鹿蹄草 13425,

Ranunculaceae

Aconitum bartletii Vamamoto. 台灣烏頭 12440,

Eriocapitella vitifolia Nakai. 小白頭翁 11999,12959,

Ranunculus matsudi Hay. 疏花毛茛 11956,

Thalictrum fauriei Hay.f 台灣唐松草 15100,

Thalictrum myriophyllum Ohwi. 密葉唐松草 11951,15123,

Thalictrum sessile Hay. 玉山唐松草 12486,

Rosaceae

Cotoneaster morrisonsis Hay. 玉山舖地蜈蚣 12008,

Prinsepia scandens Hay. 假皂莢 15112,

Rosa transmorrisonensis Hay. 高山薔薇 12938,

Rubus calycinoides Hay. 玉山懸鉤子 12487,

Spiraea formosana Hay. 台灣繡線菊 12502,

Rubiaceae

Galium formosense Ohwi. 圓葉豬殃殃 11959,12943,13434, 15092,

Galium fukuyamii Masamune. 福山氏豬殃殃 11977,

Ophiorrhiza japonica Blume. 蛇根草 12922,12954,

Rubia linii Chao. 林氏茜草 15111

Rutaceae

Boenninghausenia albiflora. 臭節草 12495,

Salicaceae

Salix taiwanalpina Kimura. 高山柳 12497,14231,15124,

Salix takasagoalpina Koidz. 台灣山柳 14232,

Salix warburgii O. Seem. 水柳 12002,

Saxifragaceae

Deutzia taiwanensis Schneider. 台灣溲疏 11990,

Mitella formosana Masamune. 台灣喙吶草 12472,

Parnassia palustris L. 梅花草 12446,

Scrophulariaceae

Euphrasia bilineata Ohwi. 雙脈萃雪草 12436,

Euphrasia transmorrisonensis Hay. 玉山小米草 13430,

Pedicularis ikomai Sasaki. 馬先蒿草 11992,

Scrphulariaceae

Ellisiophyllum pinnatum Makino. 海螺菊 12011,

Smilacaceae

Smilax vaginata Decne. 玉山拔契 12493,

Stachyuraceae

Stachyurus himalaicus Hook. 通條木 12933,

Theaceae

Eurya crenatifolia Kobuski. 假柃木 15122,

Eurya glaberrima Hay. 厚葉柃木 12501,

Umbelliferae

Angelica morii Hay. 森氏當歸 12004,12449,

Centella asiatica Urban. 雷公根 12925,

Oreomyrrhis involucrata Hay. 山熏香 11967,

Pimpinella niitakayamensis Hay. 玉山回芹 11963,

Urticaceae

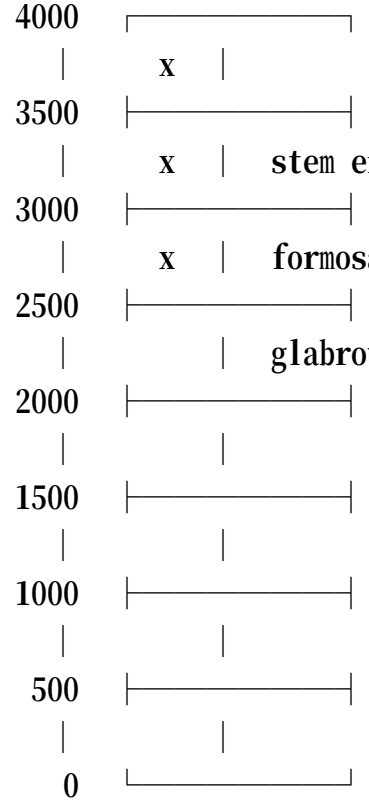
Elatostema sessile Forst var. 樓梯草 12923,

Ualerianaceae

Triplostegia glandulifera Wall. 三蔓花草 12463,15094,

表五、關山嶺植物解說資料庫

altitude

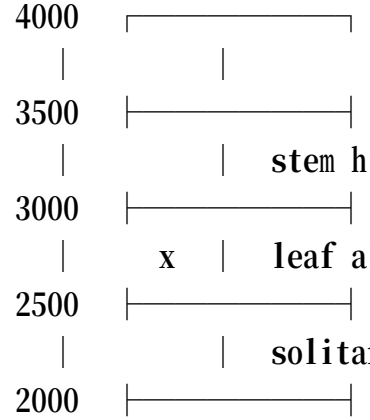


stem erect, carpel hirsute and the habit in var. formosanum is scandent but in var. fukutomei is glabrous.

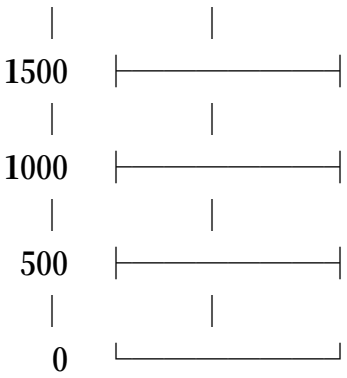
Aconitum bartletii Yamamoto

Ranunculaceae flora 2：0477

altitude



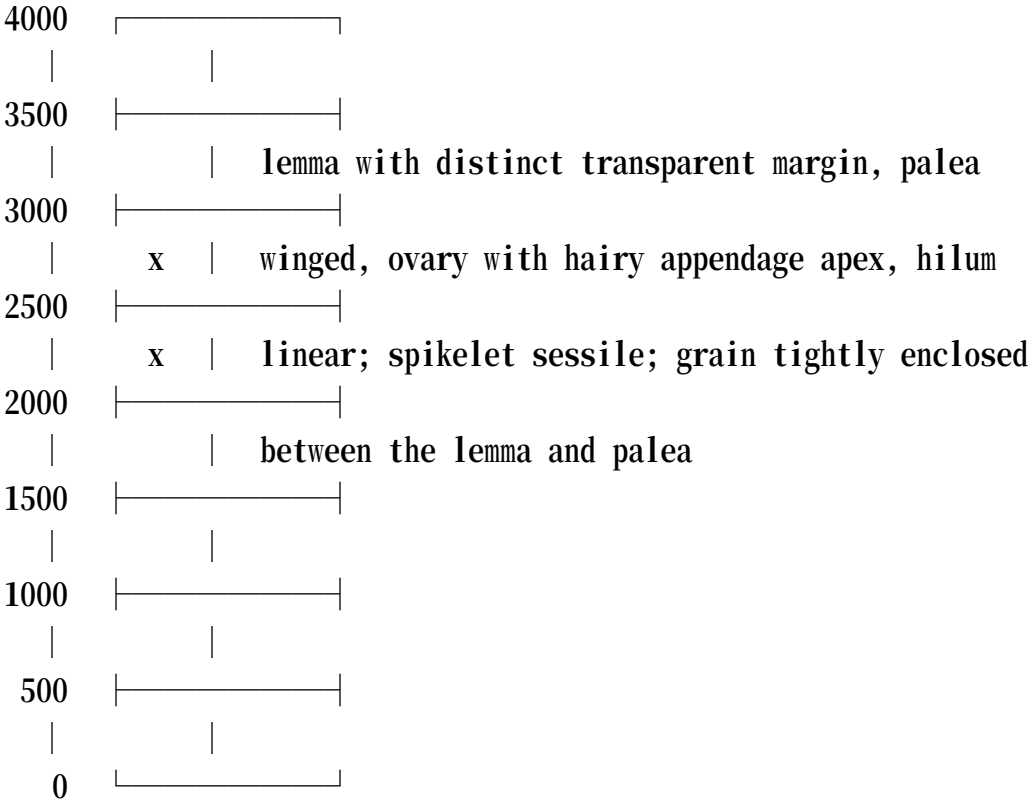
stem hispid with retrorse unicellular hairs, leaf alternate ; flower actionomorphic, terminal solitary or few disc tubular or cup-shaped



Adenophora uehatae Yamamoto

Campanulaceae flora 4 : 0741

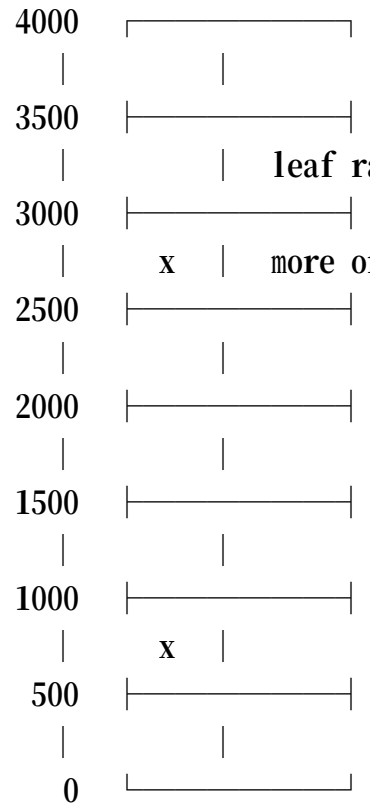
altitude



Agropyron mayebaranum Honda

Poaceae flora 5 : 0456

altitude

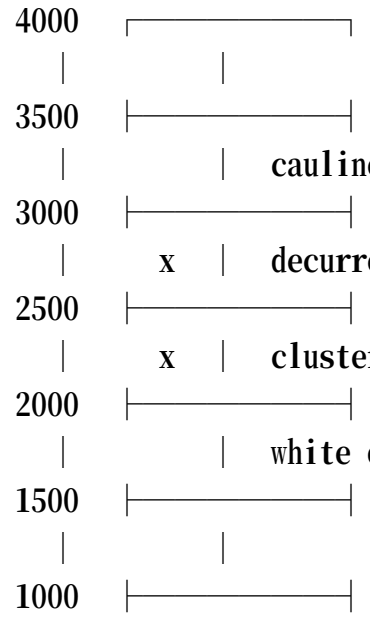


leaf radical rosulate, base rounded; petiole more or less winged.

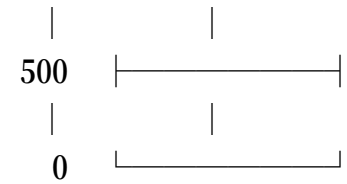
Ainsliaea reflexa Merr.

Compositae flora 4 : 0779

altitude



cauline leaf not or rarely indistinclty decurrent, 3-9cm long; head many in corymbose cluster; involucre bracts 7-8-seriate, imbricate white or yellowish; achene 0.5mm long.

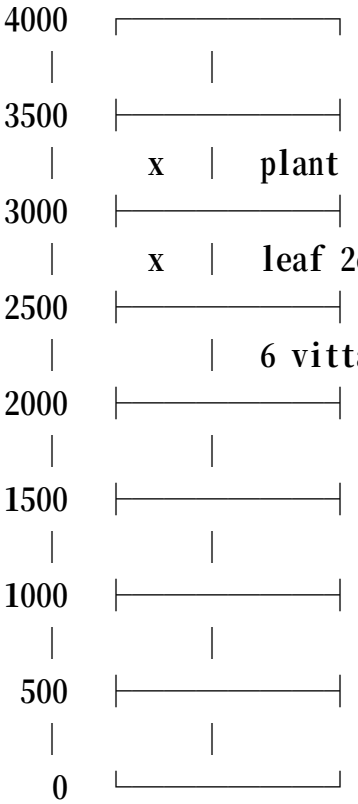


Anaphalis margaritacea Benth. subsp.

morrisonicola Kitamura

Compositae flora 4 : 0781

altitude

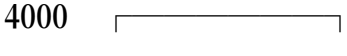


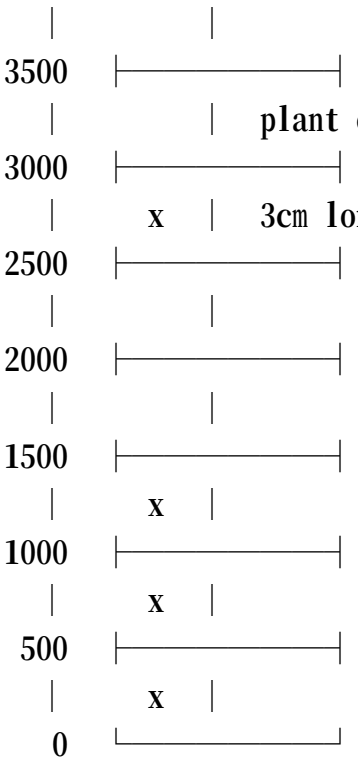
plant less than 1m high, ultimate segment of leaf 2cm long 1cm broad; peta glabrous; carpel 6 vittae.

Angelica morii Hay.

Umbelliferae flora 3 : 0942

altitude



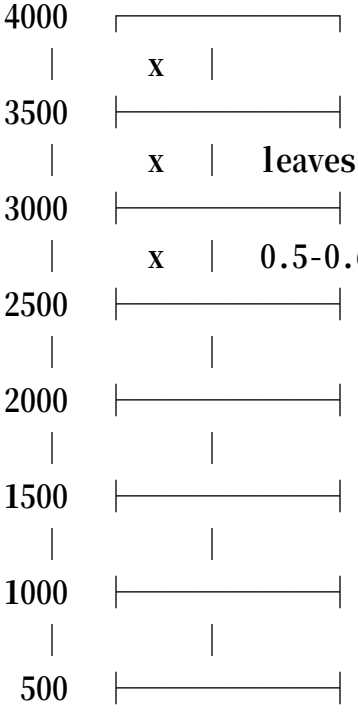


plant epiphyte; leaf elliptic or oblong, about 3cm long; flower greenish fleshy.

Appendicula reflexa Blume

Orchidaceae flora 5：0880

altitude

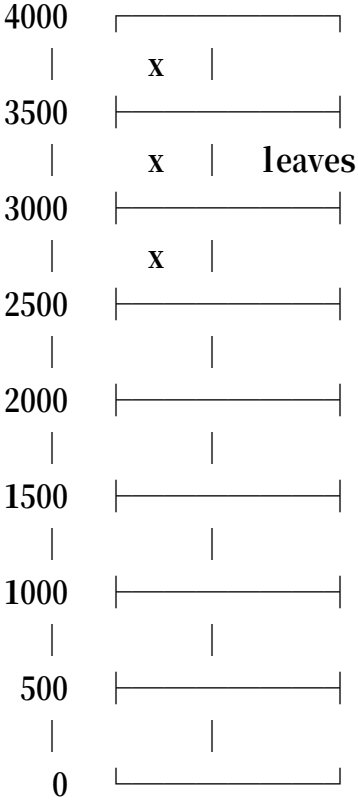


leaves entire, radical leave 2-3cm long 0.5-0.6cm wide.

Arabis formosana Liu & Ying

Cruciferae flora 2：0676

altitude

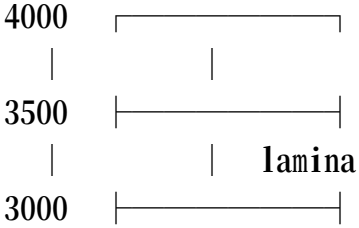


leaves lyrately lobed.

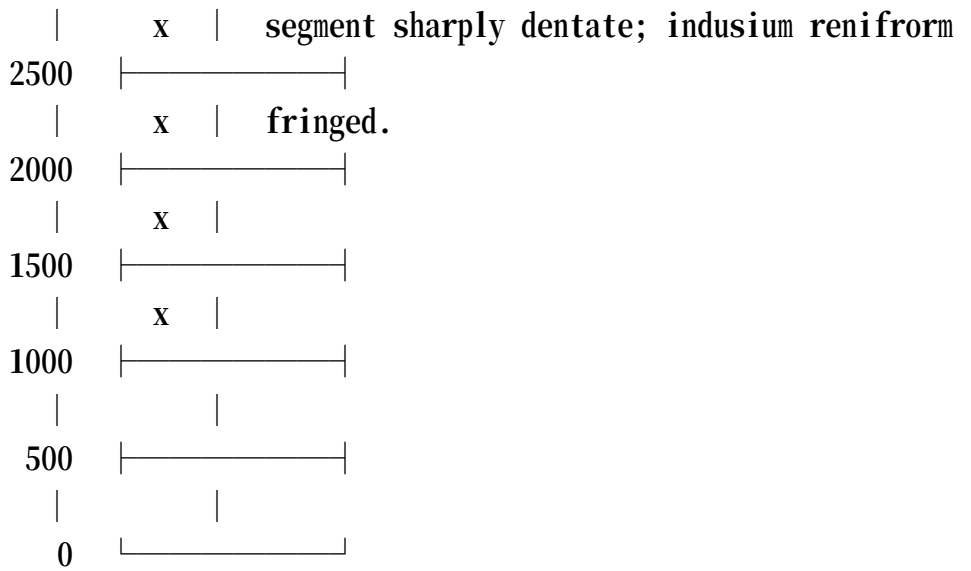
Arabis morrisonensis Hay.

Cruciferae flora 2：0678

altitude



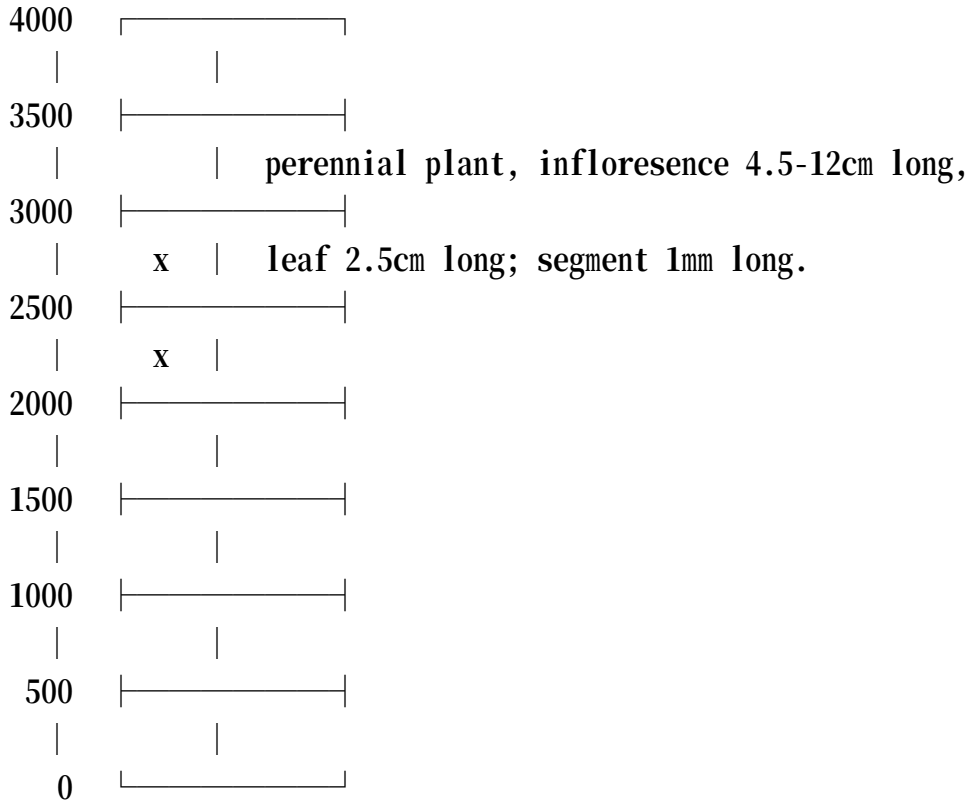
lamina subcoriaceous, bipinnate, pinnule or



Arachniodes rhomboides Ching.

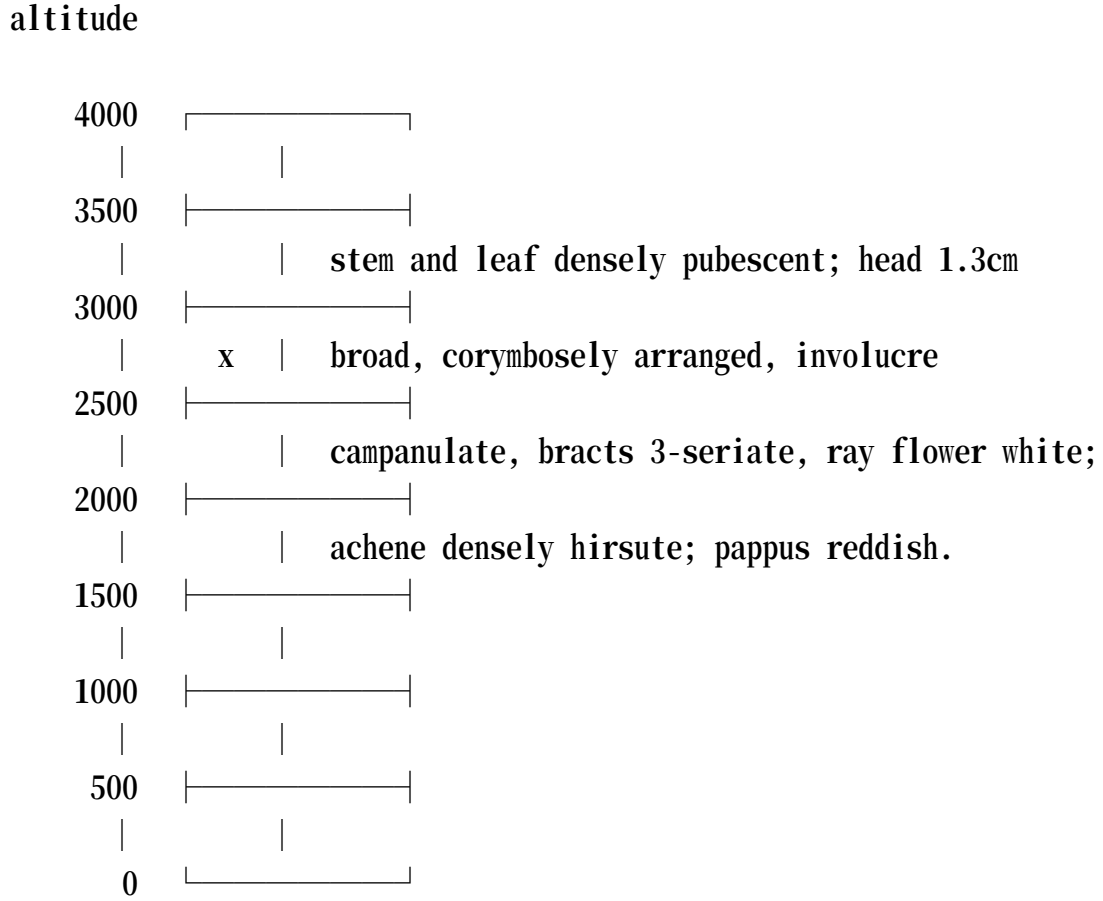
Dryopteridaceae flora 1：0365

altitude



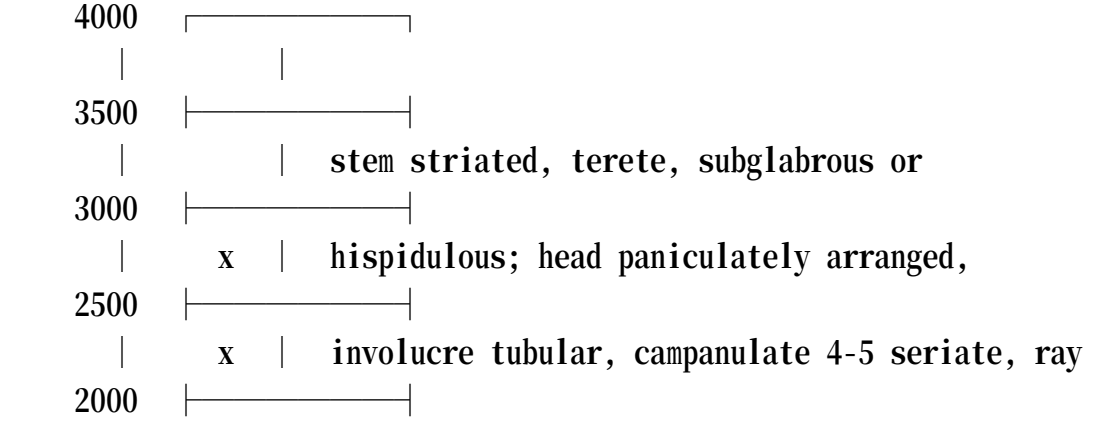
Artemisia kawakamii Hay.

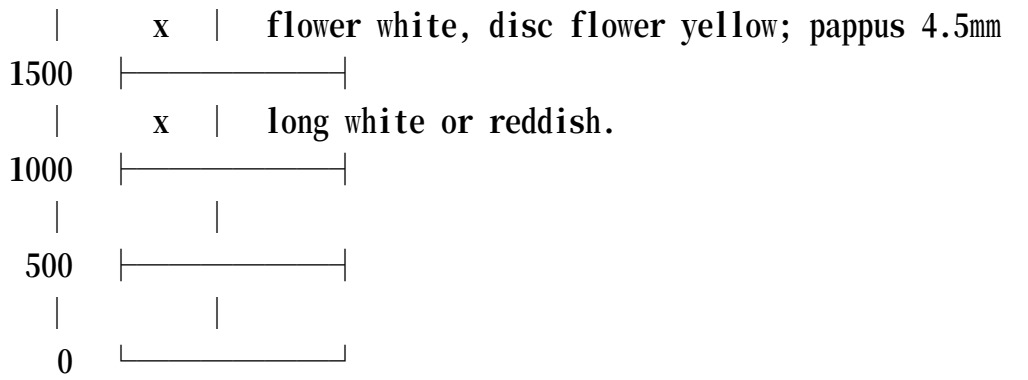
Compositae flora 4：0789



Aster lasioclada Hay.

Compositae flora 4：0797

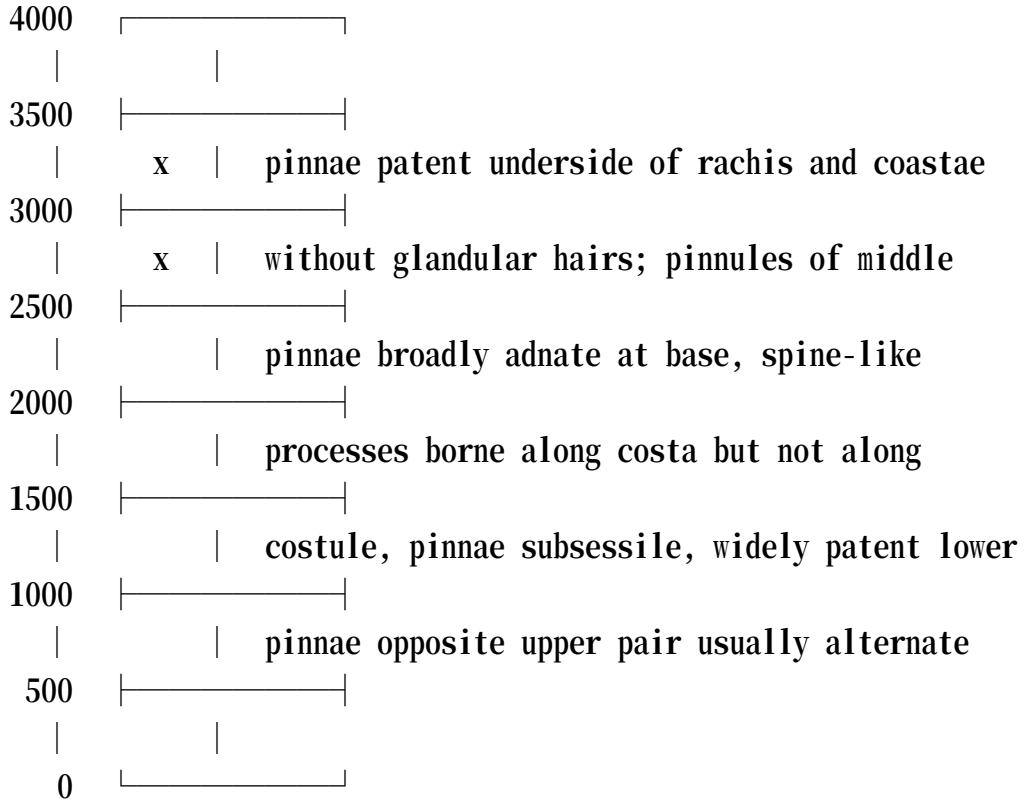




Aster taiwanensis Kitamura

Compositae flora 4：0801

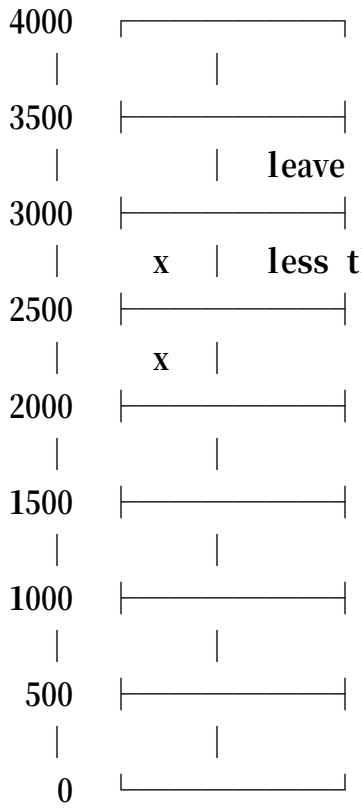
altitude



Athyrium oppositipinnum Hay.

Athyriaceae flora 1：0452

altitude



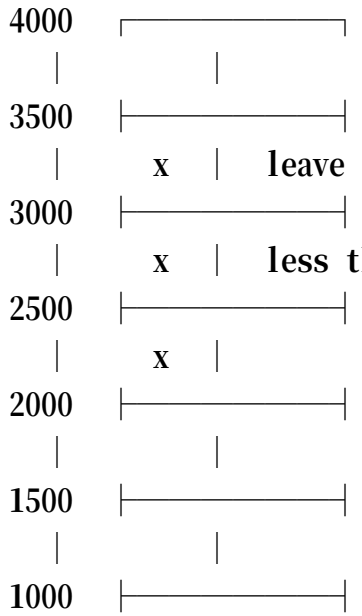
leave 1.5-2.5cm long, marginal teeth spreading,

less than 8 in number.

Berberis alpicola Schneid

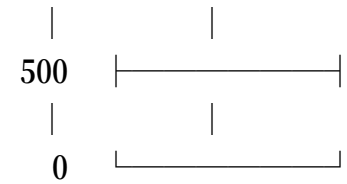
Berberidaceae flora 2：0515

altitude



leave 2-5.5cm long, marginal teeth ascending

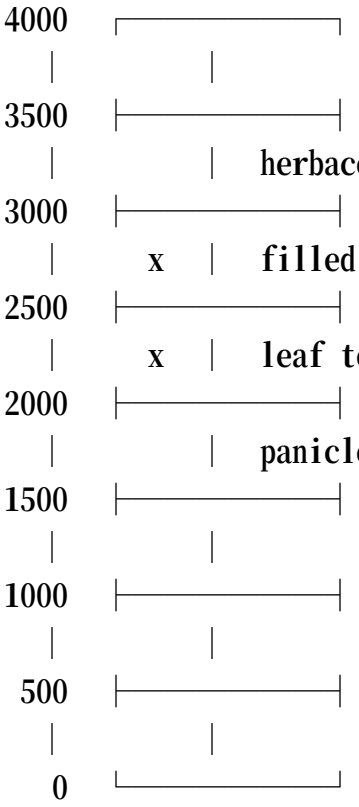
less than 8 in number.



Berberis kawakamii Hay.

Berberidaceae flora 2：0516

altitude

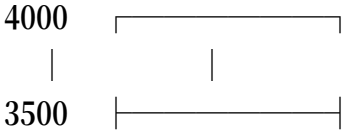


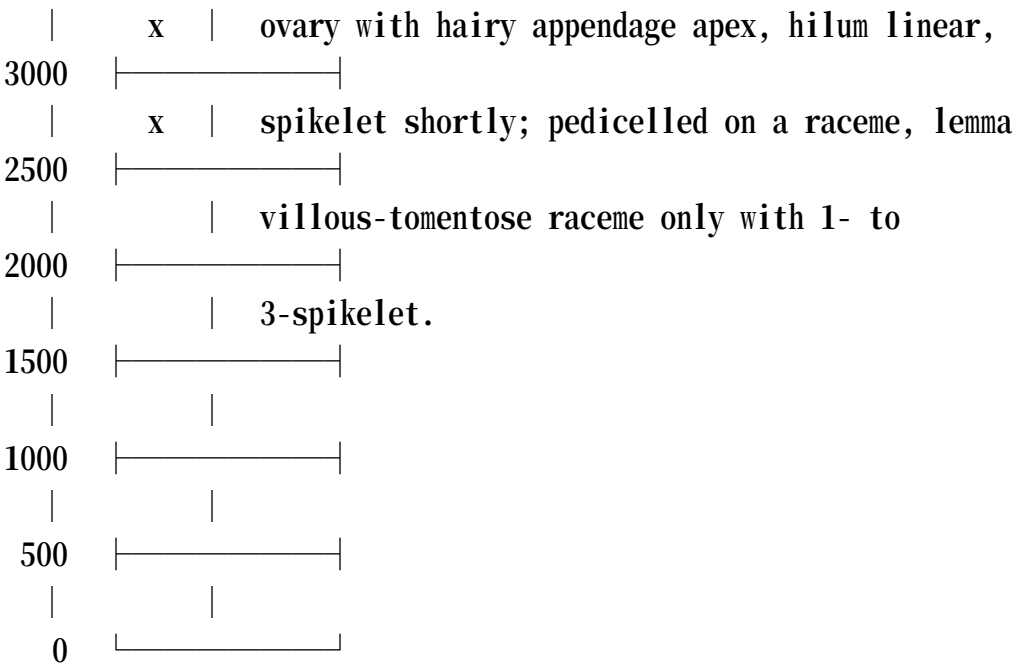
herbaceous plant with abundant pellucid glands filled with essential oil; stem teret branched; leaf ternately 2-3-pinnate, leaflets entire; panicle compound flower white.

Boenninghausenia albiflora

Rutaceae flora 3：0507

altitude

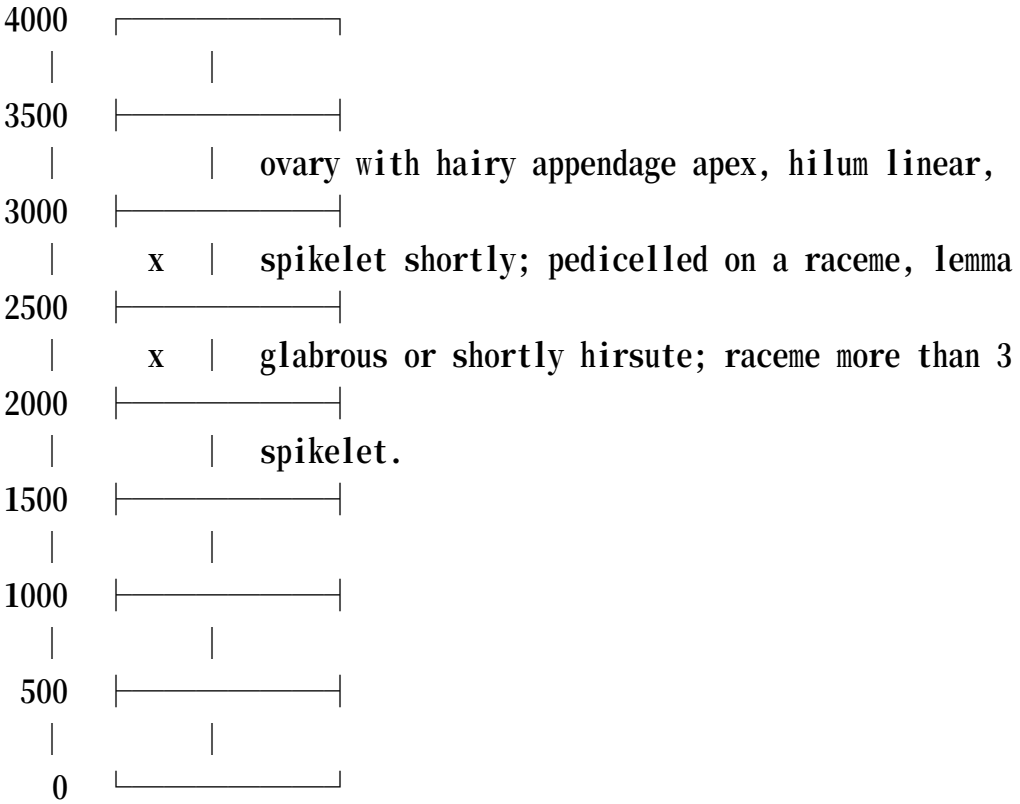




Brachypodium kawakamii Hay.

Poaceae flora 5：0426

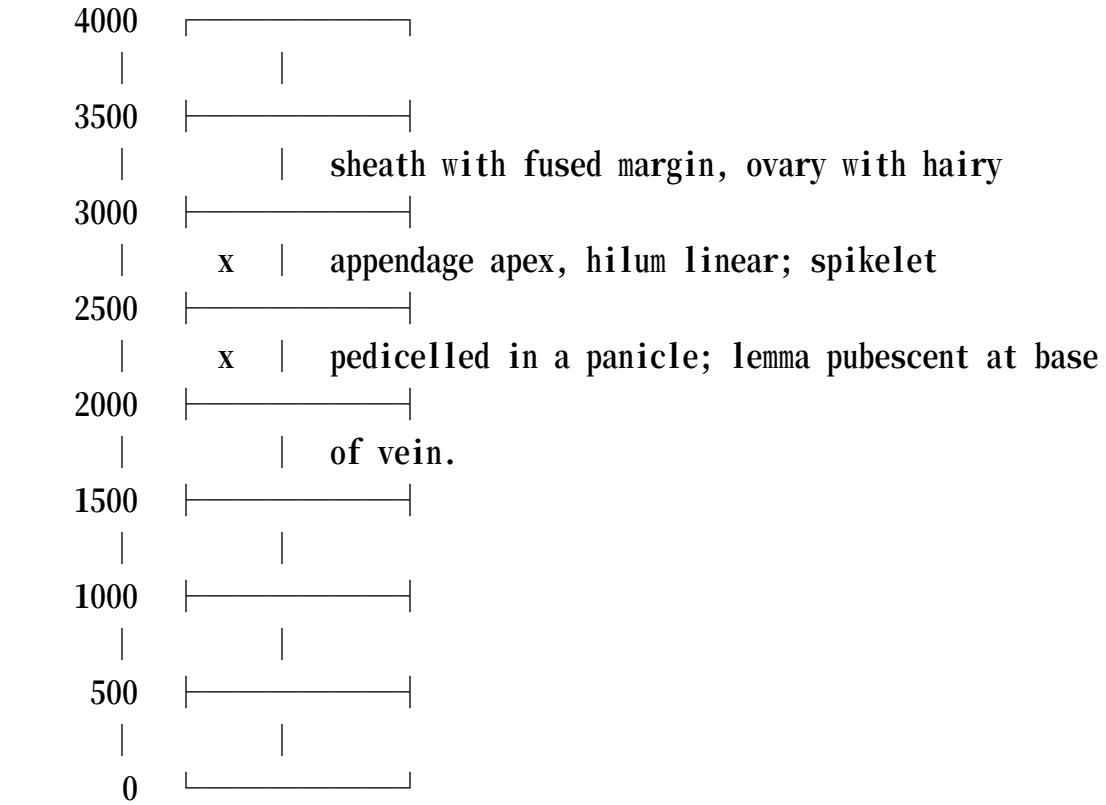
altitude



Brachypodium sylvaticum (Huds.) Beauv. var

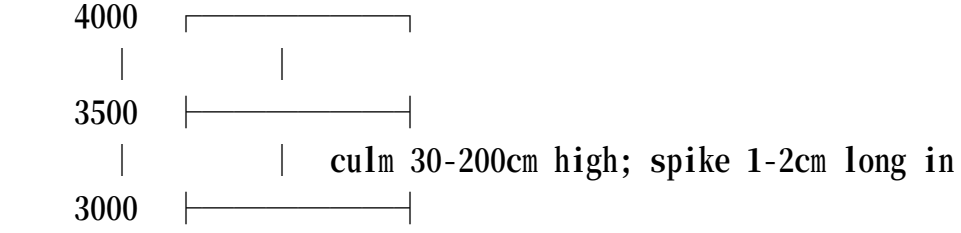
luzoniense Hara

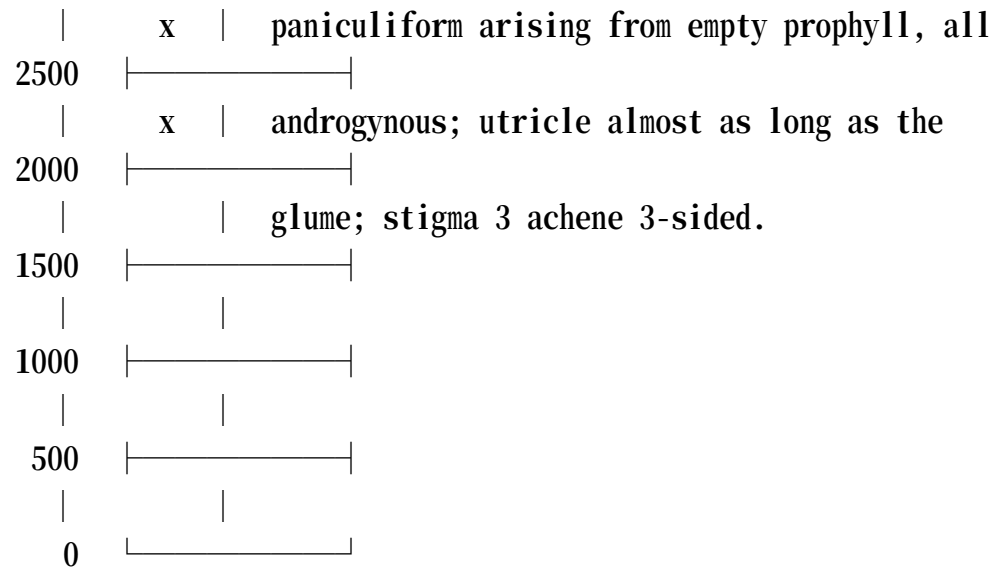
Poaceae flora 5 : 0428



Bromus morrisonensis Honda.

Poaceae flora 5 : 0429

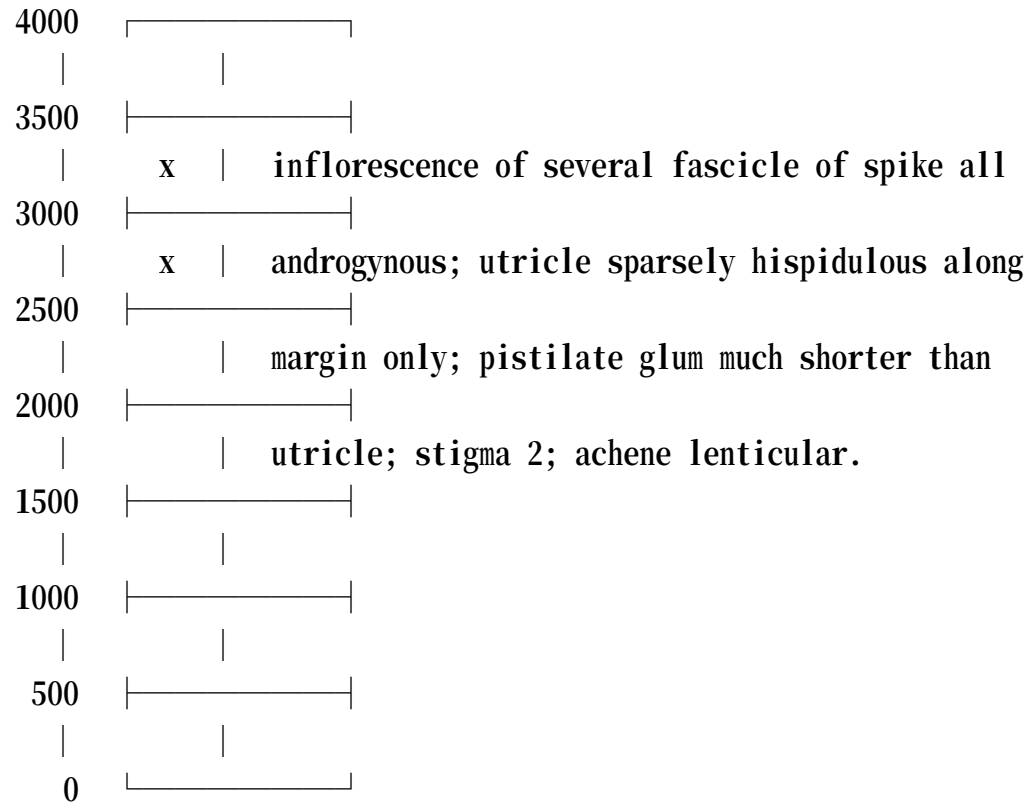




Carex cruciata Wahl.

Cyperaceae flora 5：0310

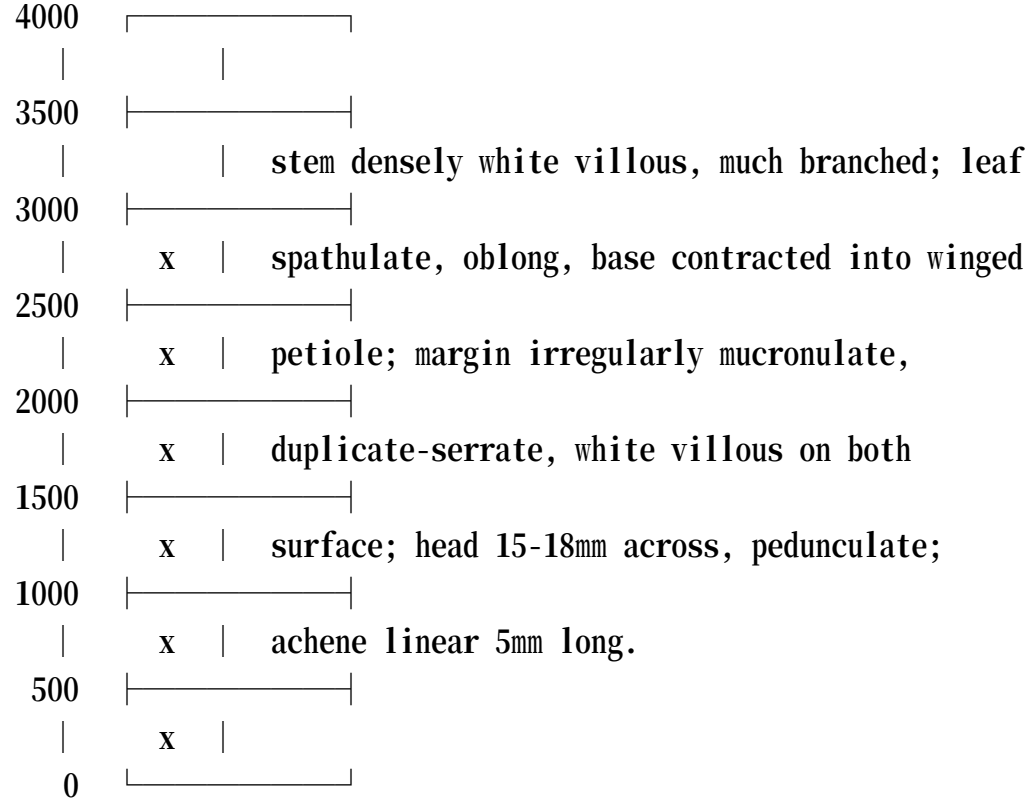
altitude



Carex gentilis Franch. subsp. nakaharai T. Koyama

Cyperaceae flora 5：0322

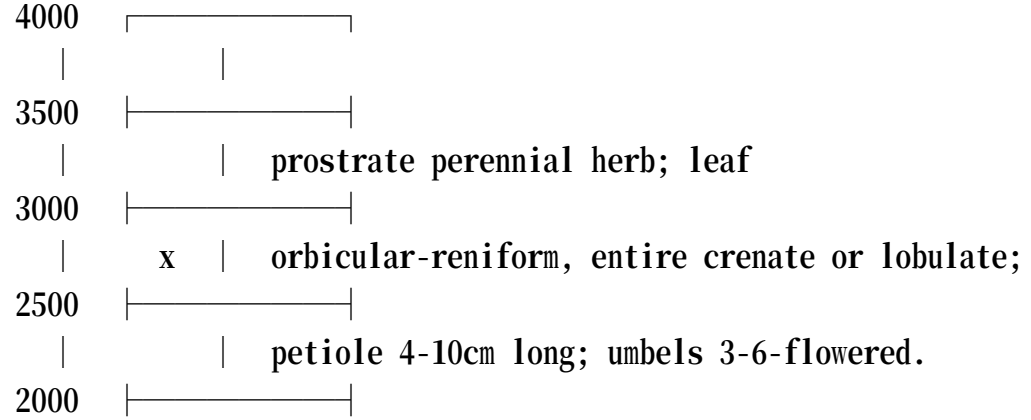
altitude

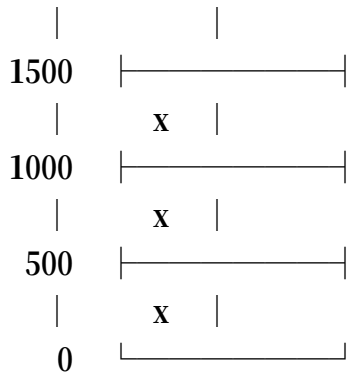


Carpesium cernuum L.

Compositae flora 4：0819

altitude

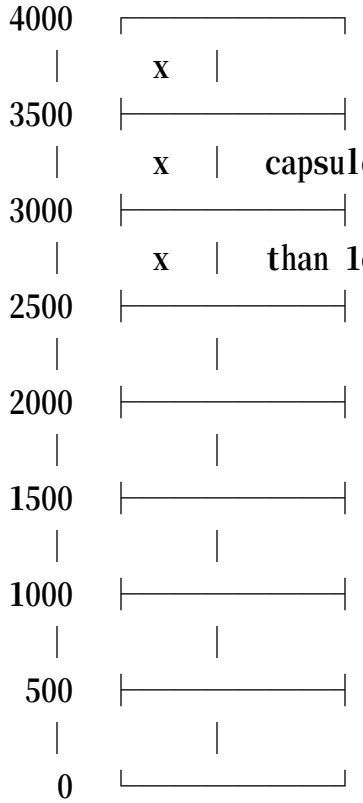




Centella asiatica Urban

Umbelliferae flora 3：0944

altitude

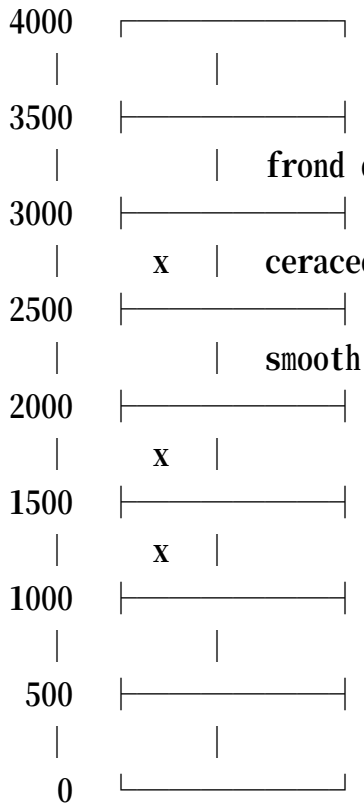


capsule dehiscent by terminal teeth, leaf less than 1cm long; petal double the lenth of sepal.

Cerastium trigynum Vill var. morrisonense Hay.

Caryophyllaceae flora 2：0326

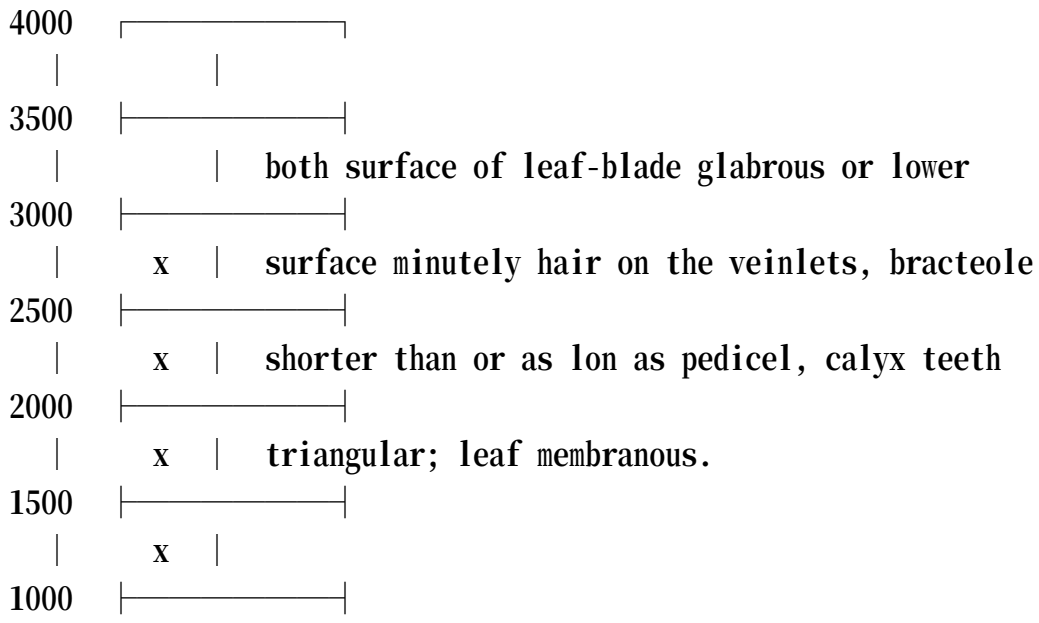
altitude

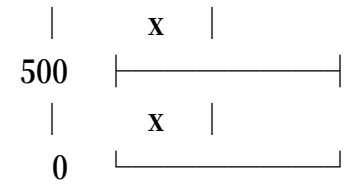


Cheilanthes argentea Kunze

Pteridaceae flora 1：0282

altitude

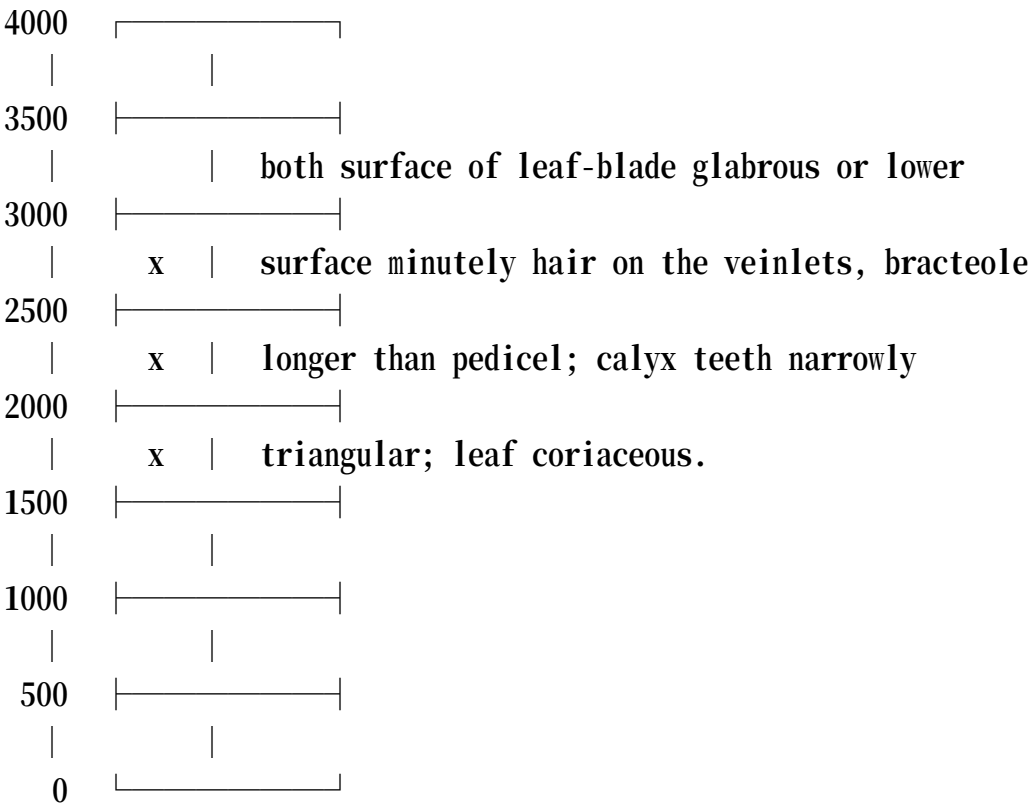




Clinopodium gracile Ktze.

Labiatae flora 4：0453

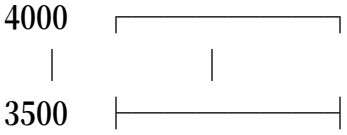
altitude

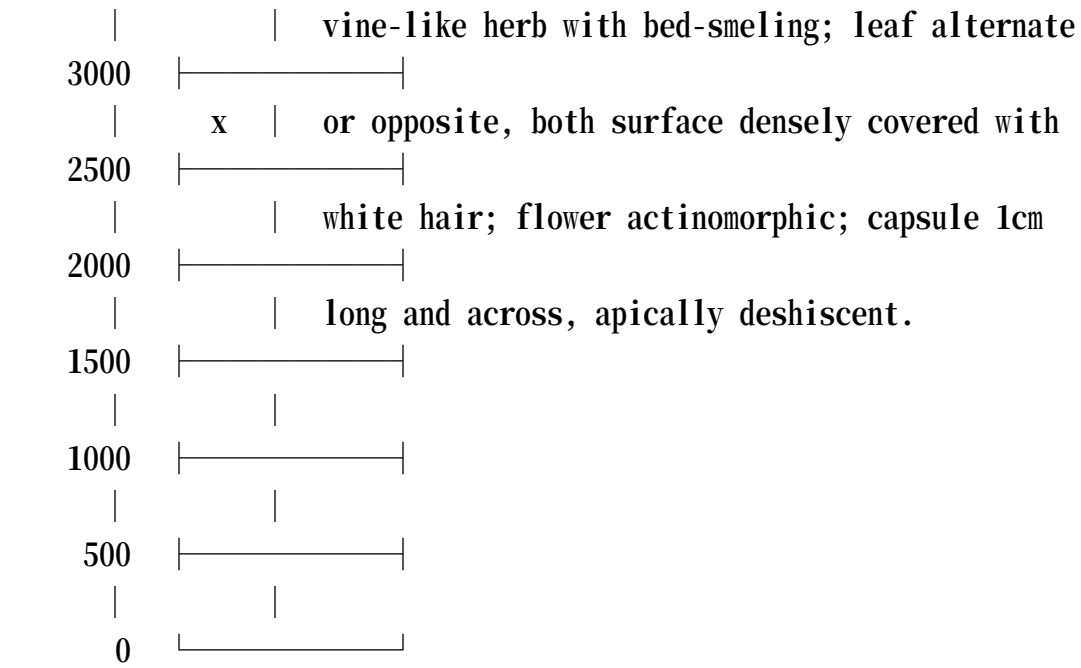


Clinopodium laxiflorum Matsum

Labiatae flora 4：0456

altitude

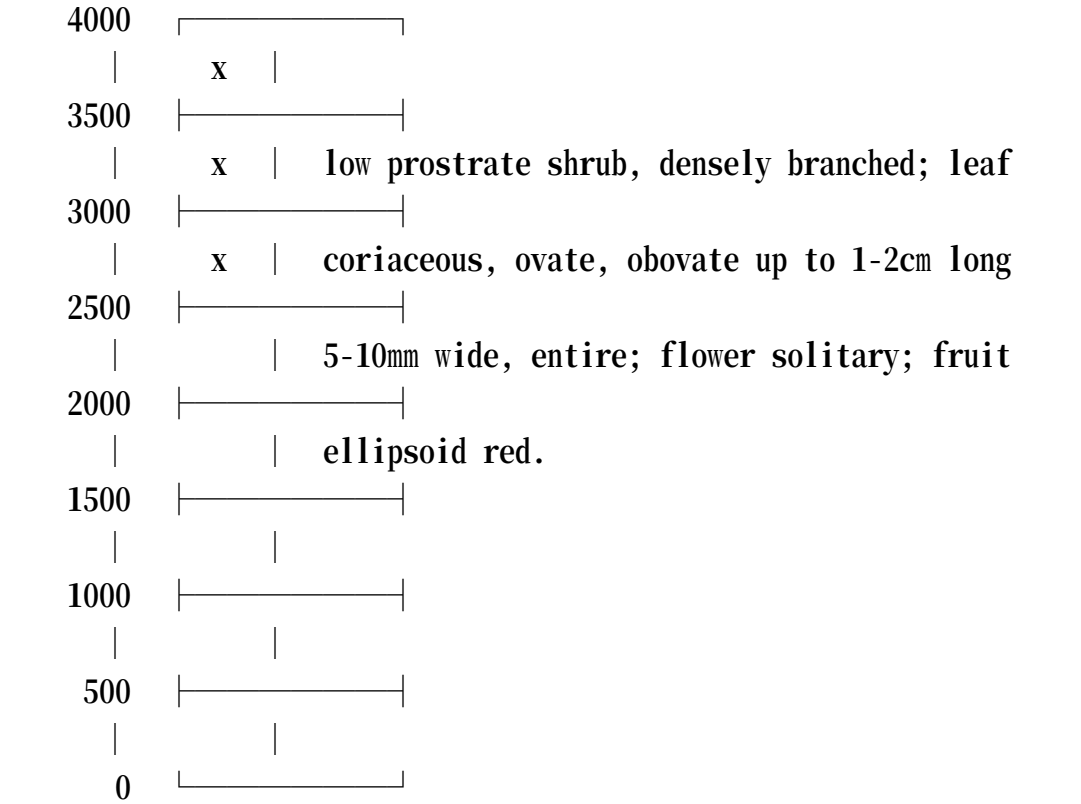




Codonopsis kawakamii Hay.

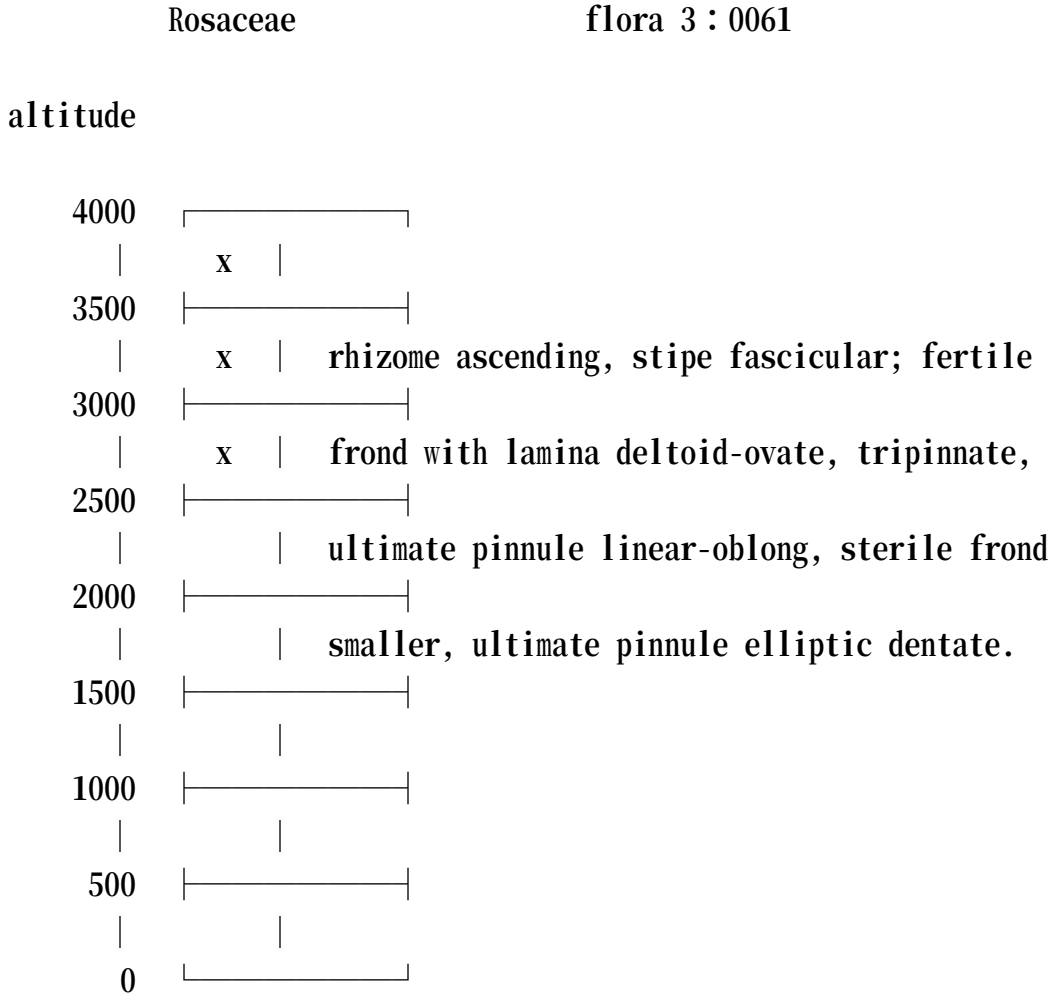
Campanulaceae flora 4：0748

altitude



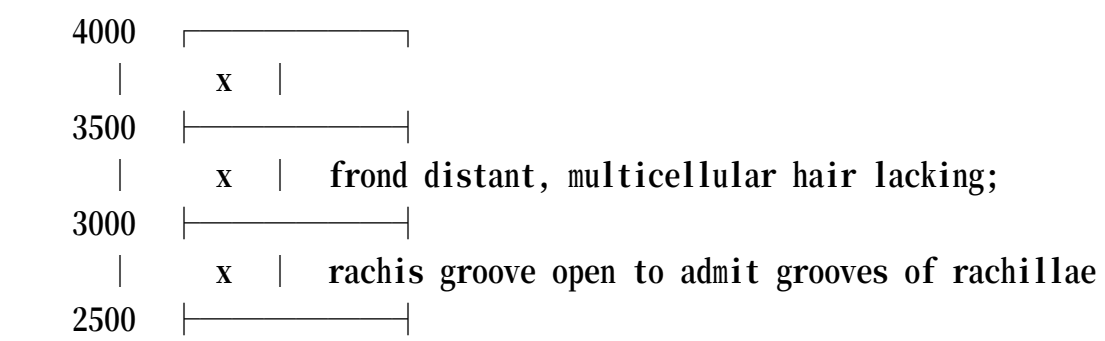
Cotoneaster morrisonsis Hay.

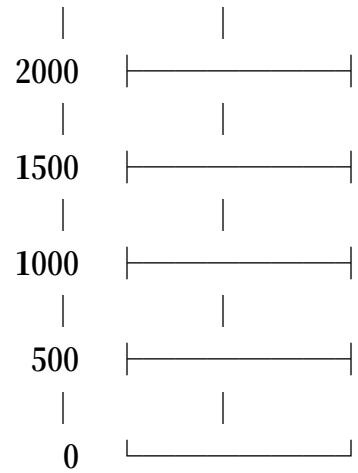
Rosaceae flora 3 : 0061



Cryptogramma brunoniana

Pteridaceae flora 1 : 0284

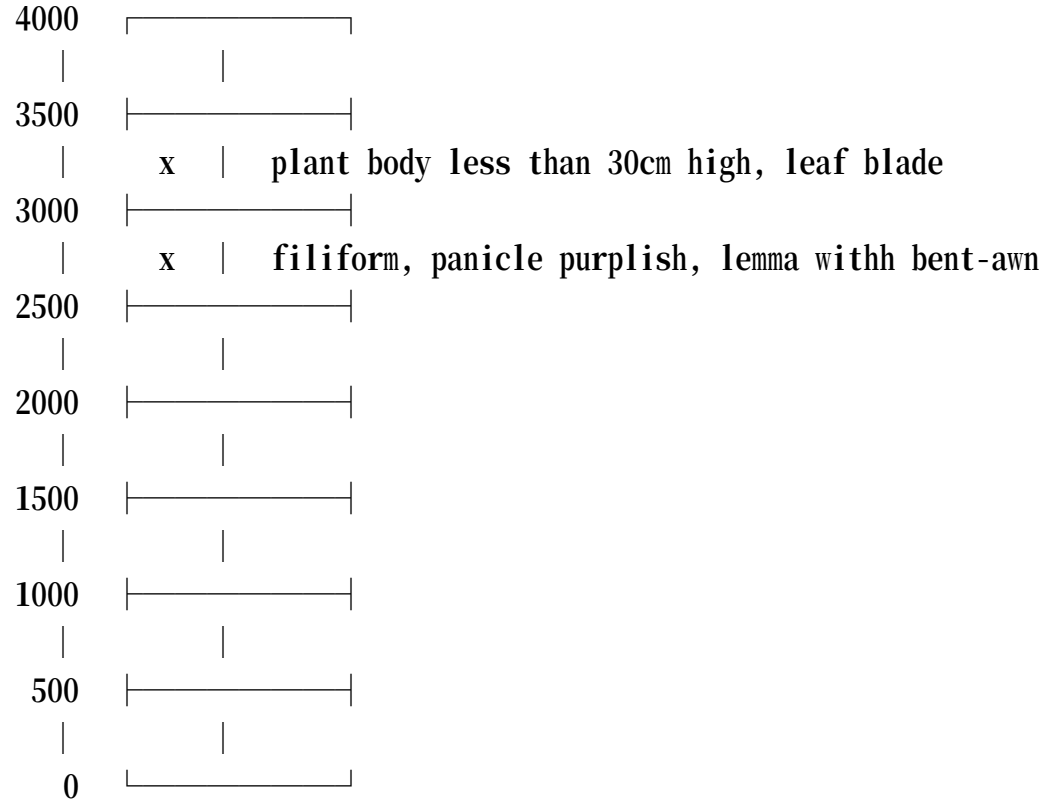




Cystopteris moupinensis Franch

Athyriaceae flora 1：0457

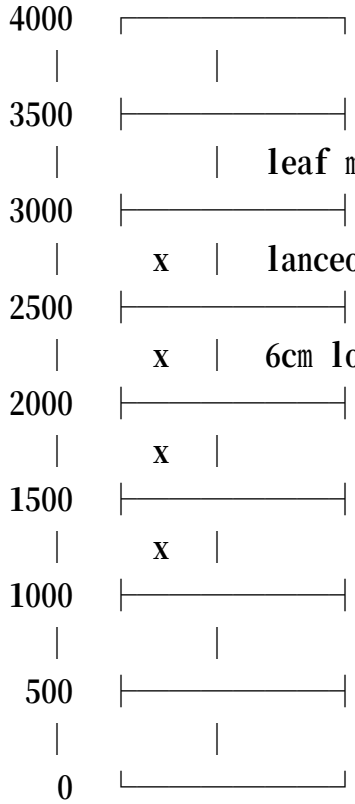
altitude



Deschampsia flexuosa Trin.

Poaceae flora 5：0411

altitude

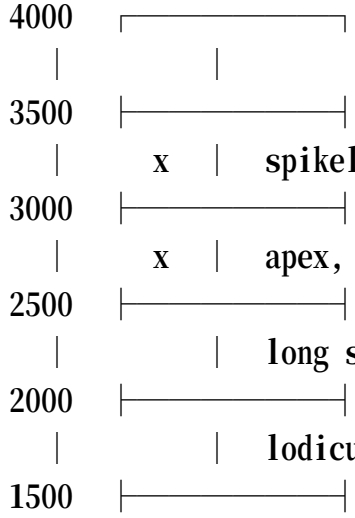


leaf membranceous, chartaceous, oblong-
lanceolate, margin serrulate; inflorescence to
6cm long.

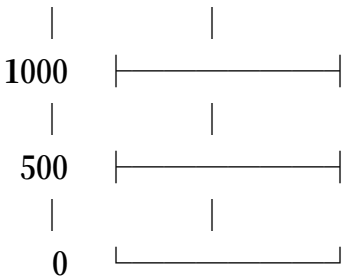
Deutzia taiwanensis Schneider

Saxifragaceae flora 3：0034

altitude



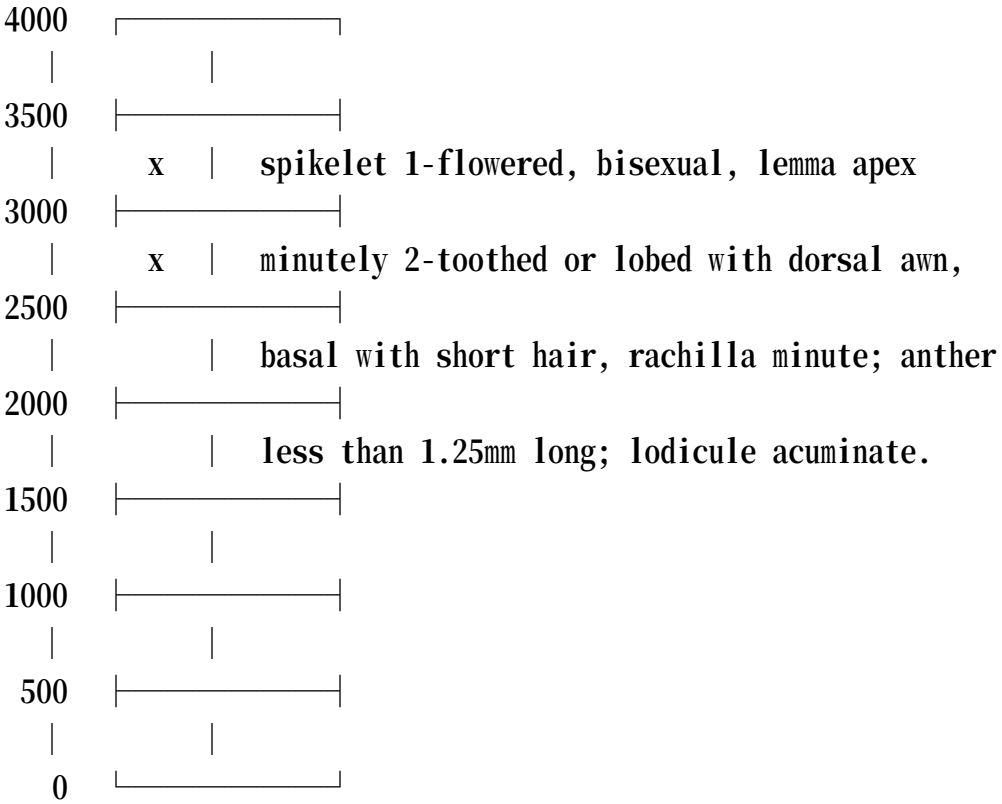
spikelet 1-flowered, bisexual; lemma rounded
apex, with dorsal awn, rachilla 1.2mm long with
long silky hair; anther more than 2mm long;
lodicule bifid at apex.



Deyeuxia arundinacea Beauv.

Poaceae flora 5：0413

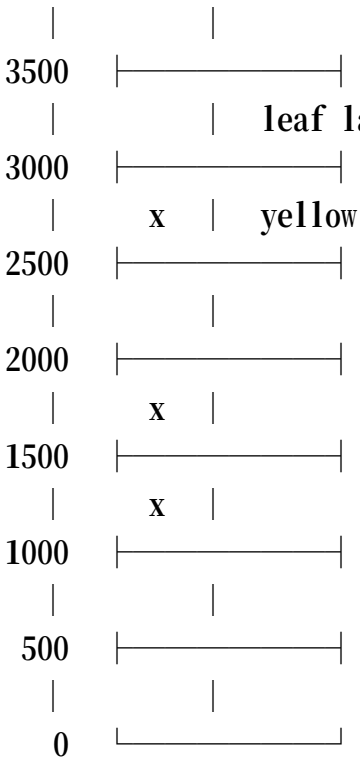
altitude



Deyeuxia formosana C. Hsu

Poaceae flora 5：0415

altitude

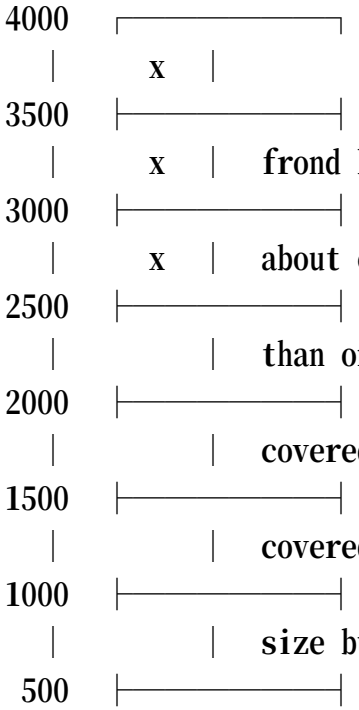


leaf lanceolate 3-4cm wide, petiolate; flower yellowish-white.

Disporum kawakamii Hay.

Liliaceae flora 5：0052

altitude

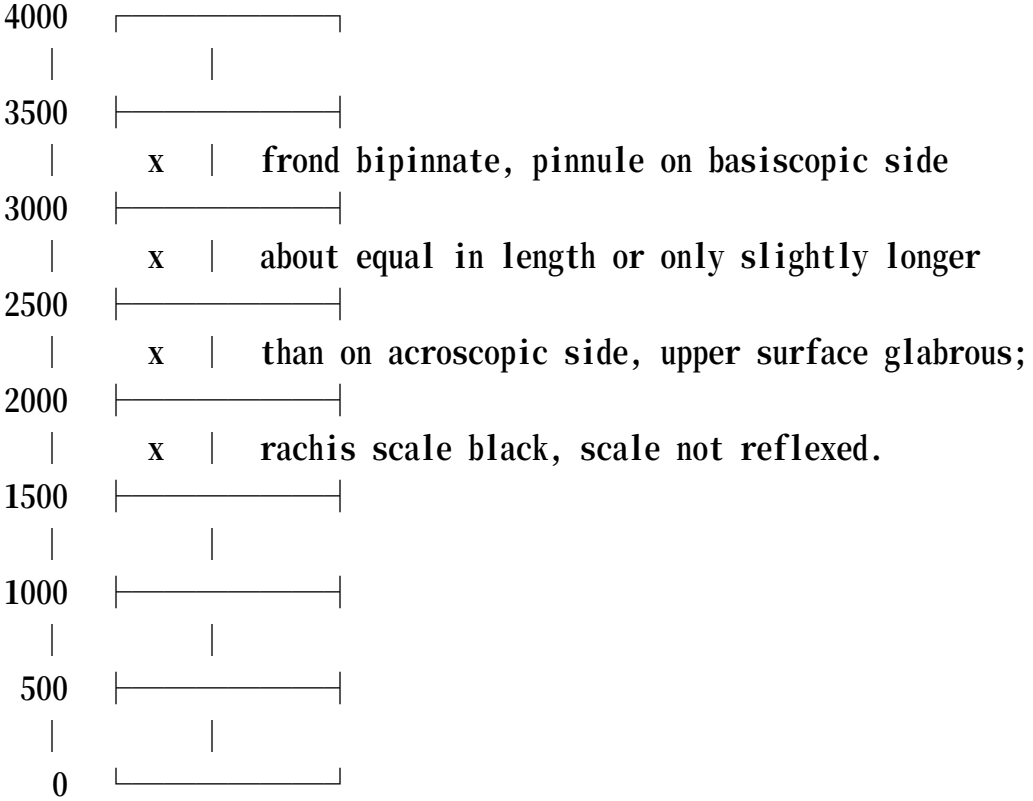


frond bipinnate, pinnule on basiscopic side, about equal in length or only slightly longer than on acroscopic side, upper surface of lamina covered with long hair; stipe and rachis densely covered with reddish-brown scale of dfferent size but not reflexed.

Dryopteris barbigera Ktze.

Dryopteridaceae flora 1：0375

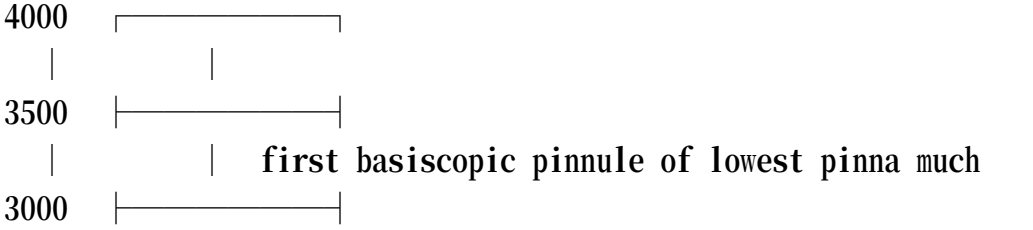
altitude

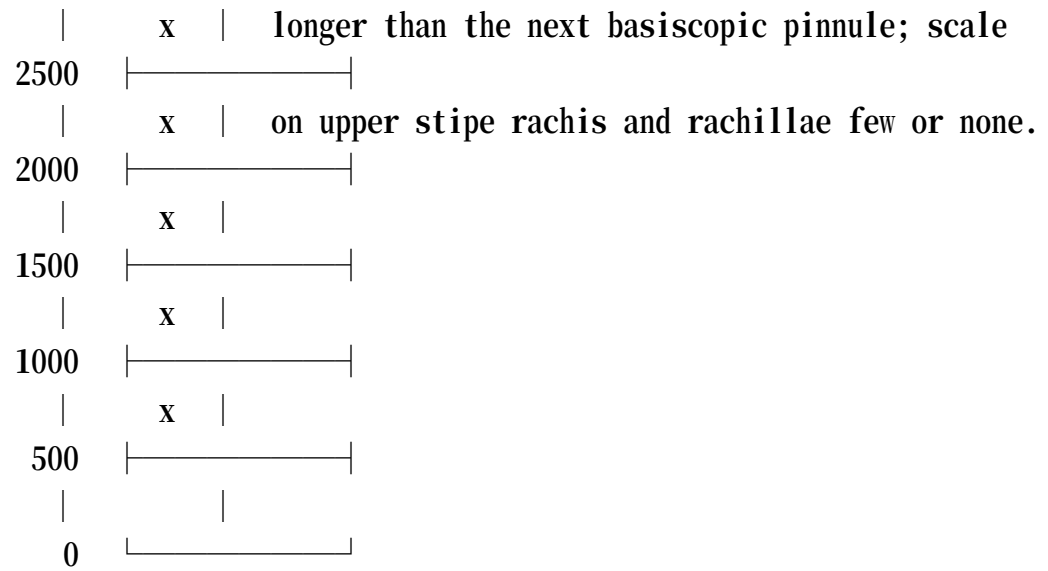


Dryopteris lepidopoda Hayata

Dryopteridaceae flora 1：0378

altitude

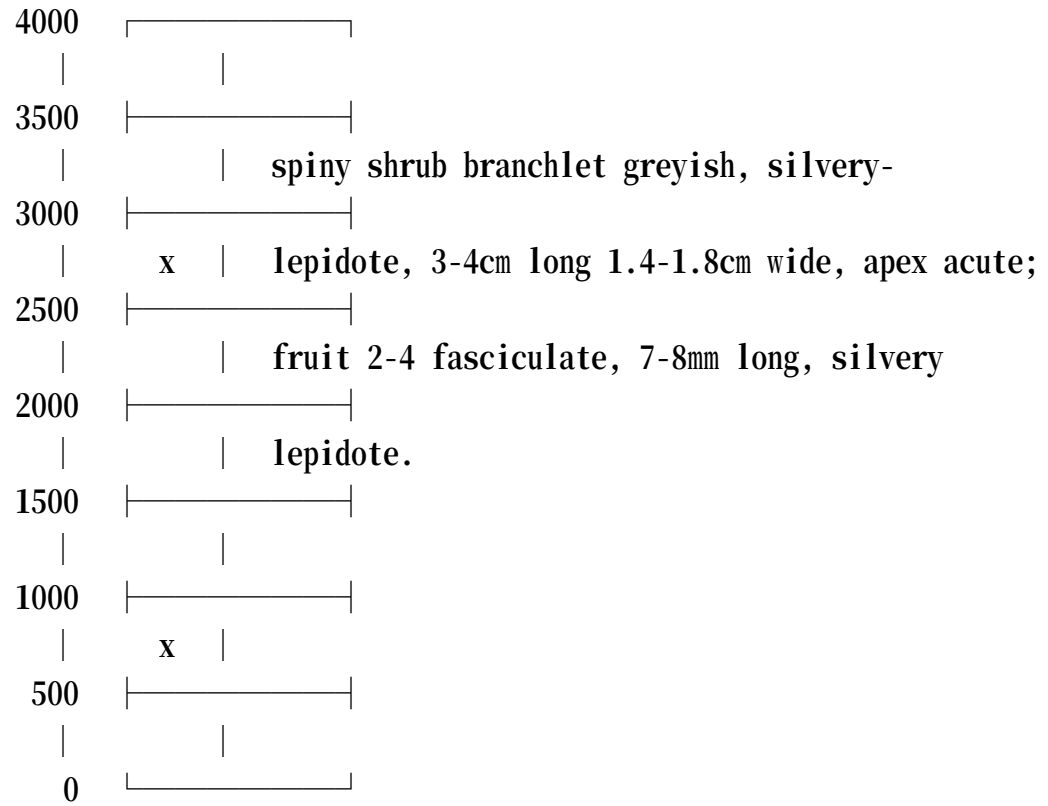




Dryopteris sparsa (Don.) Ktze.

Dryopteridaceae flora 1：0380

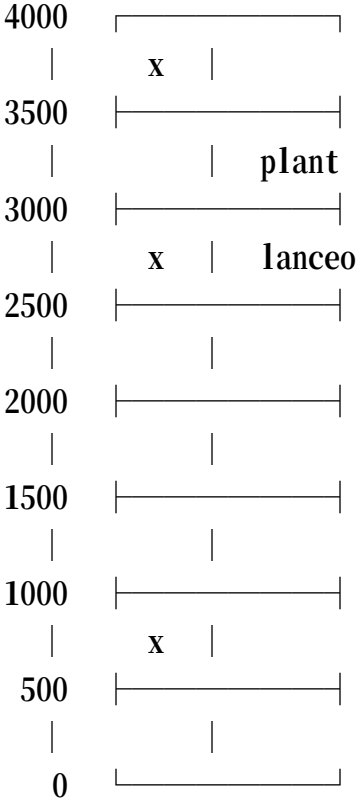
altitude



Elaeagnus obovata Li.

Elaeagnaceae flora 3：0757

altitude

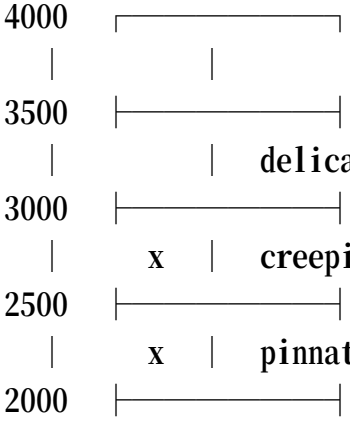


plant less than 25cm high; annual herbs; leave lanceolate.

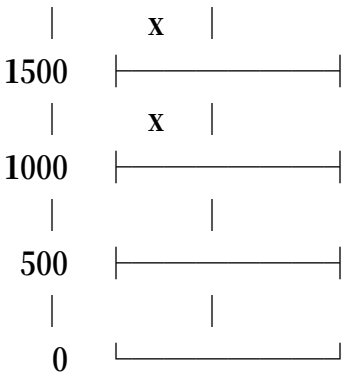
Elatostema sessile Forst var. cuspidatum Wedd.

Urticaceae flora 2：0183

altitude



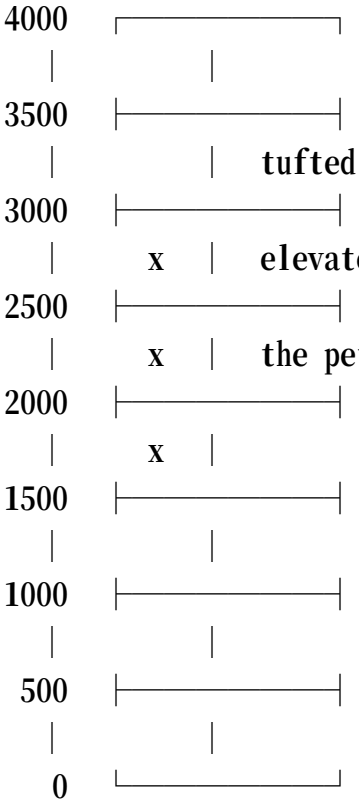
delicate pubescent perennial herbs; stem long-creeping; leaf altenate, long-petiolate, pinnately cleft; flower solitary in axils white.



Ellisiophyllum pinnatum Makino

Scrphulariaceae flora 4 : 0556

altitude

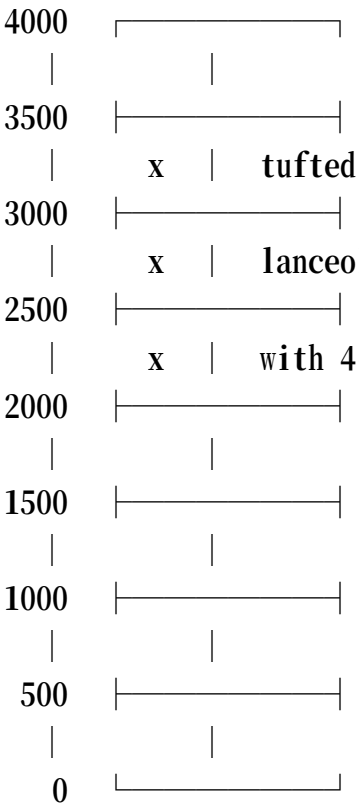


tufted herb; stem pubescent along strongly elevated lines decurrent from the margins of the petioles..

Epilobium amurense Hausskn.

Onagraceae flora 3 : 0885

altitude



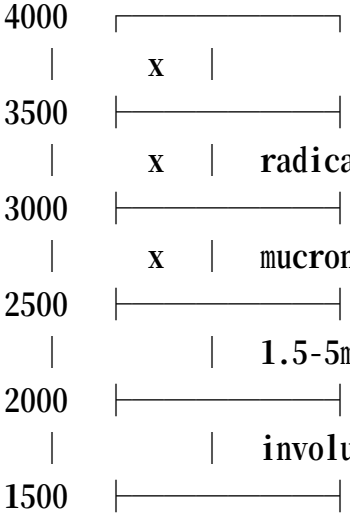
tufted herb; stem pubescent al around; leaf lanceolate or narrowly ovate, 0.4-1.5cm wide with 4-22 teeth on each side.

Epilobium brevifolium Don. subsp. trichoneurum

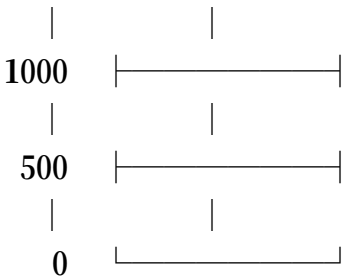
Raven

Onagraceae flora 3：0887

altitude



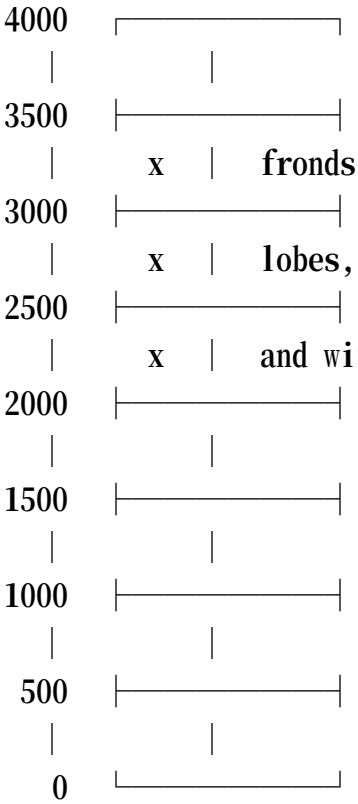
radical leaf linear spathulate, margin sparsely mucronulae to entire, cauline leaf 1-3cm long 1.5-5mm broad; 1-6 head 1.3-1.9cm across, involucre 5mm or more long.



Erigeron morrisonensis Hay.

Compositae flora 4 : 0860

altitude

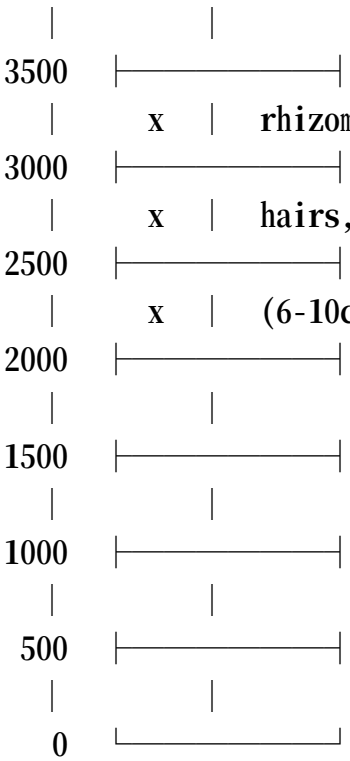


fronds deeply pinnatifid, 2-5pairs of lateral lobes, lowest lobes deflexed, margin serrulate and with a notch between main veins.

Crypsinus quasidivaricatus Copel.

Polypodiaceae flora 1 : 0175

altitude

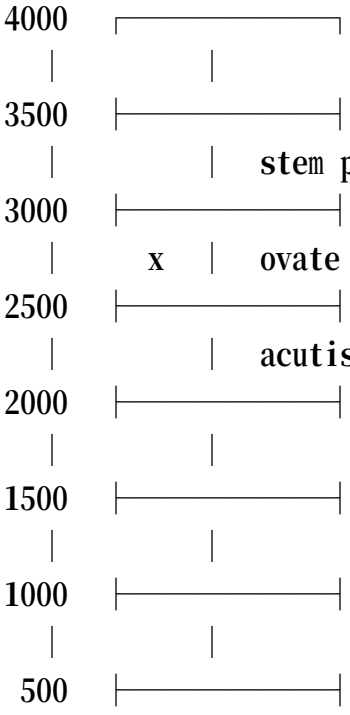


rhizomatous perennial herb; sericeous-tomentouse hairs, radical leave clustered, long-petiolate (6-10cm), trifoliolate, dilate-clasping at base.

Eriocapitella vitifolia Nakai

Ranunculaceae flora 2：0495

altitude

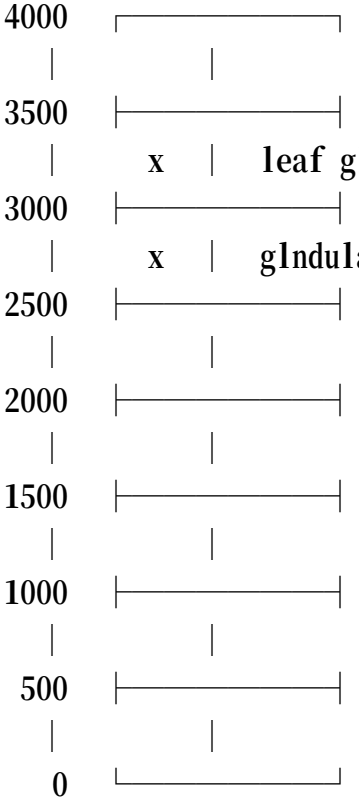


stem pubescent along two line, leaf broadly ovate with 2-3 teeth on either margin; the teeth acutish.

Euphrasia bilineata Ohwi

Scrophulariaceae flora 4：0560

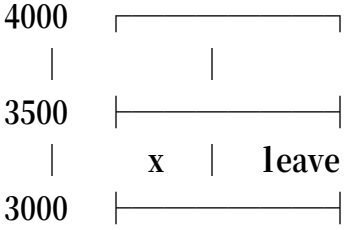
altitude

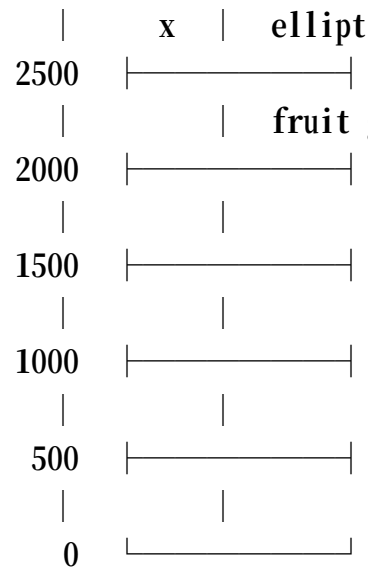


Euphrasia transmorrisonensis Hay.

Scrophulariaceae flora 4：0565

altitude

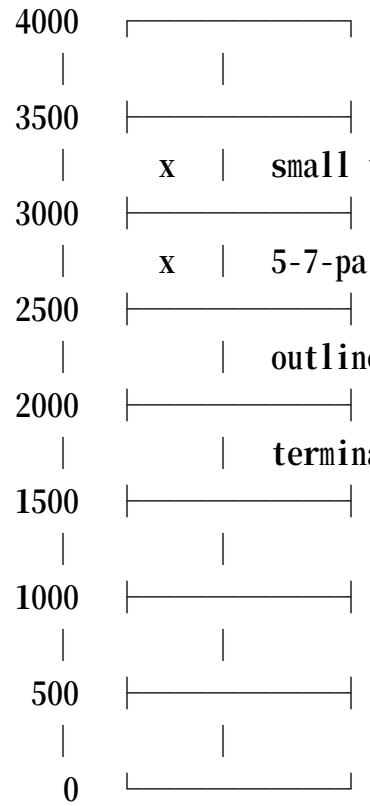




Eurya glaberrima Hay.

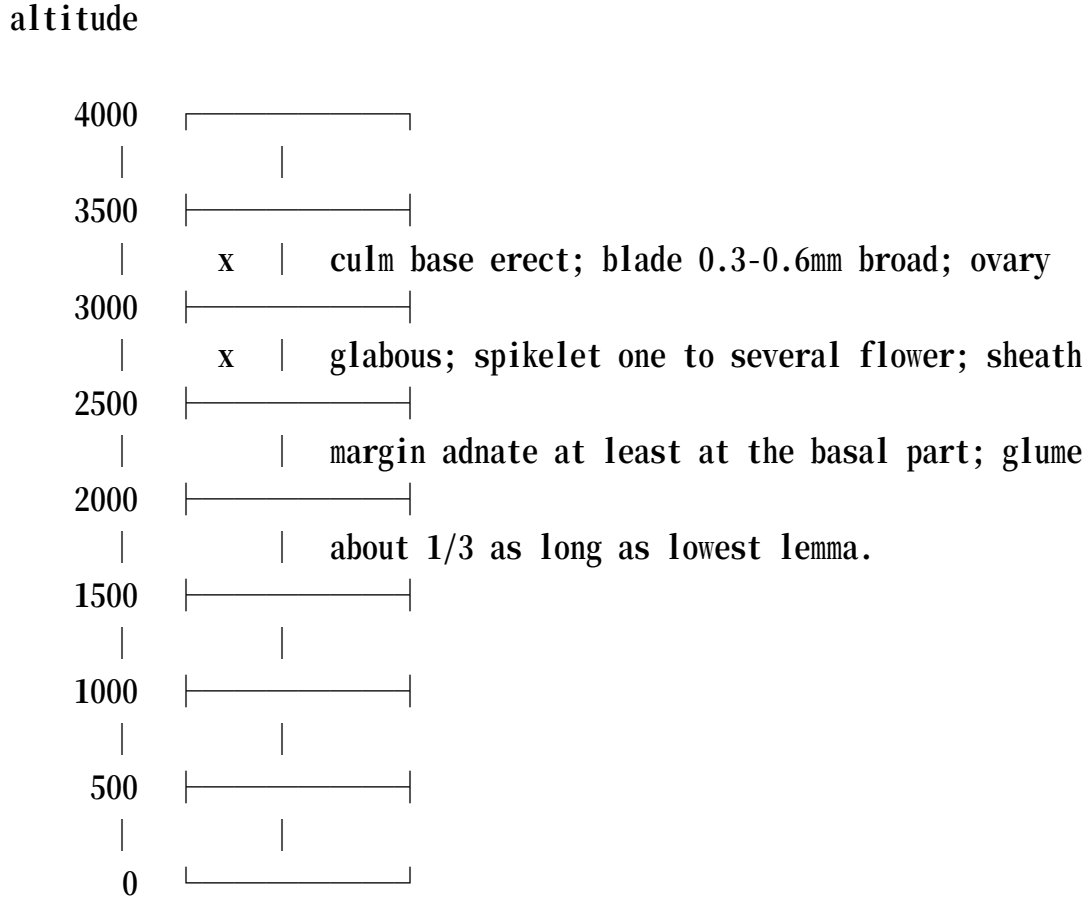
Theaceae flora 2 : 0608

altitude



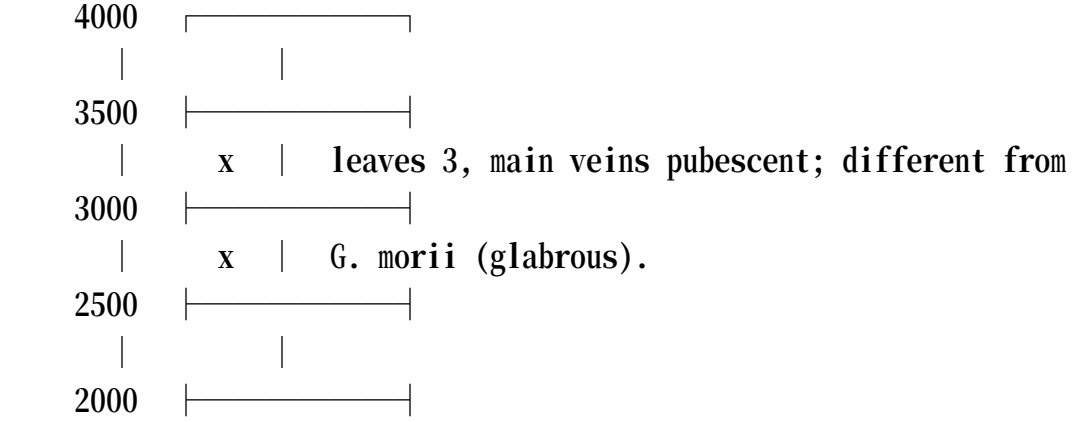
Fatsia polycarpa Hay.

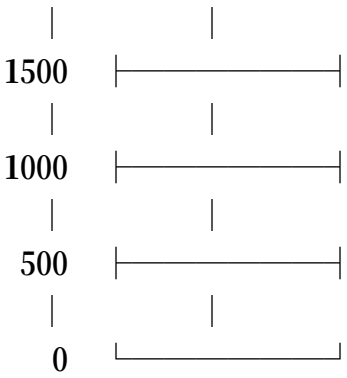
Araliaceae flora 3：0925



Festuca ovina L. var. ovina L.

Poaceae flora 5：0441

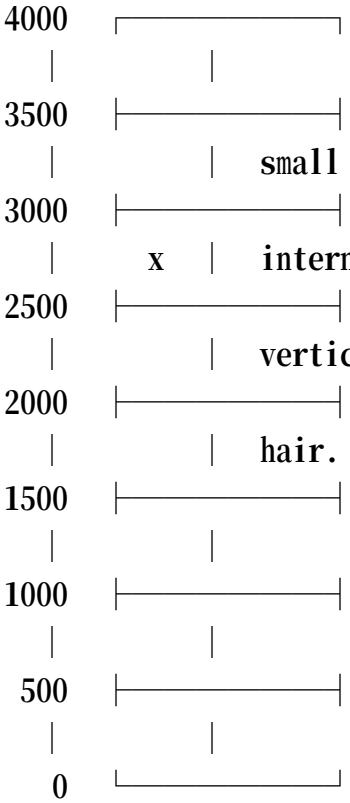




Galium formosense Ohwi

Rubiaceae flora 4：0261

altitude

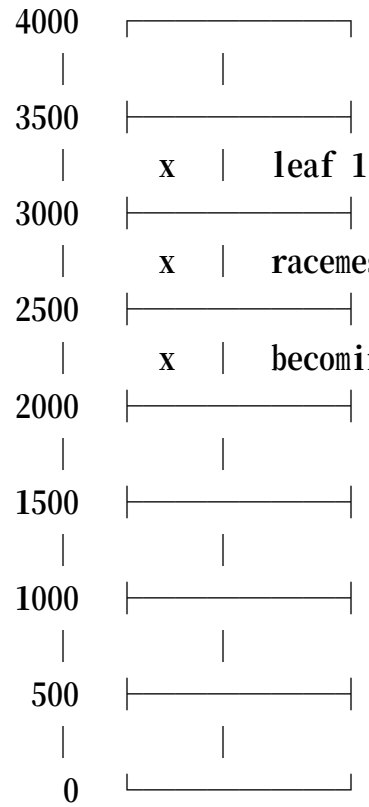


small herb 10-20cm high, branch glabrous, internode longer than 1cm long; leaf 4 verticillate; fruit with short depressed hooked hair.

Galium fukuyamii Masamune

Rubiaceae flora 4：0261

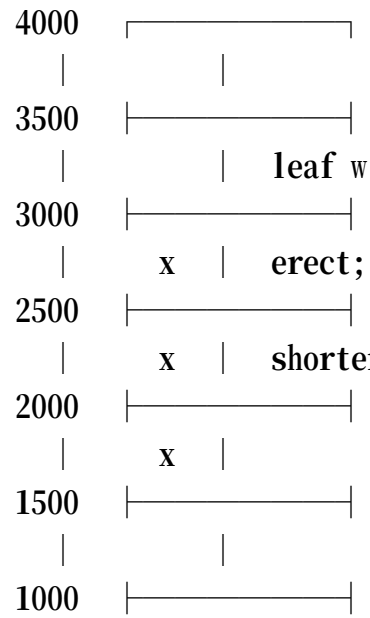
altitude

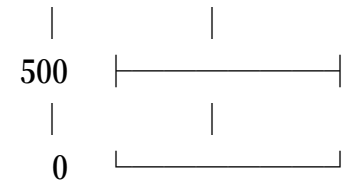


Gaultheria itoana Hay.

Ericaceae flora 4：0016

altitude

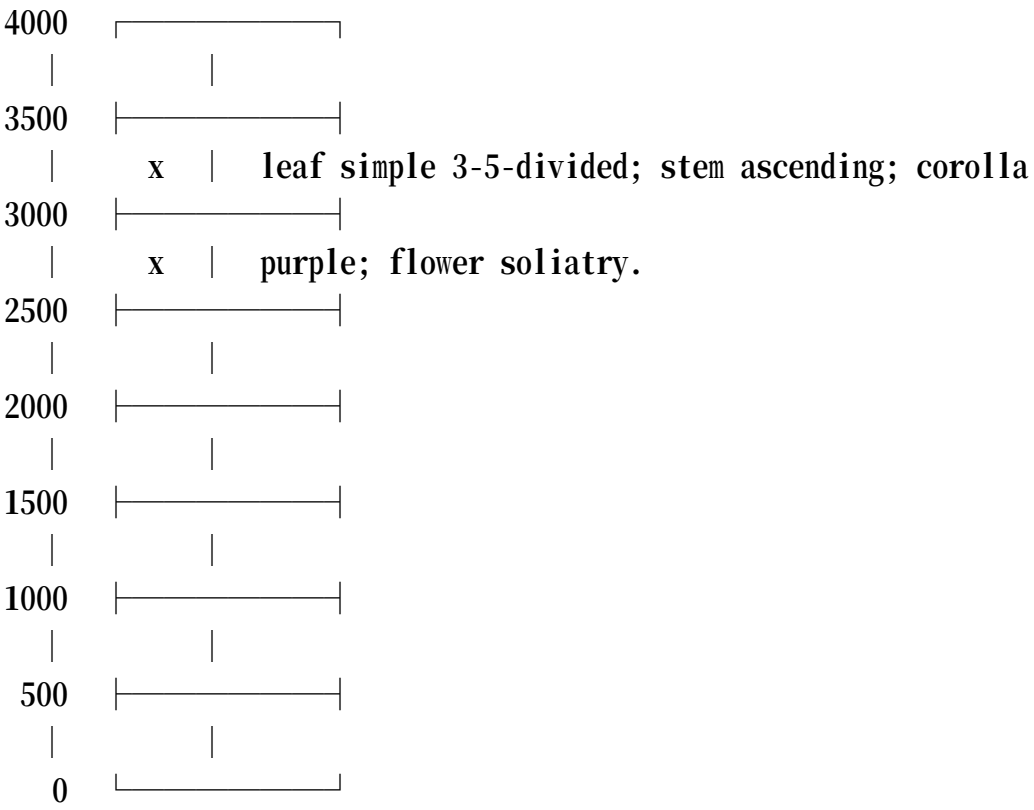




Gentiana flavo-maculata Hay.

Gentianaceae flora 4：0170

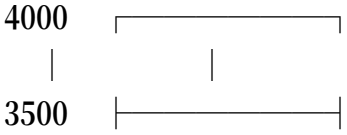
altitude

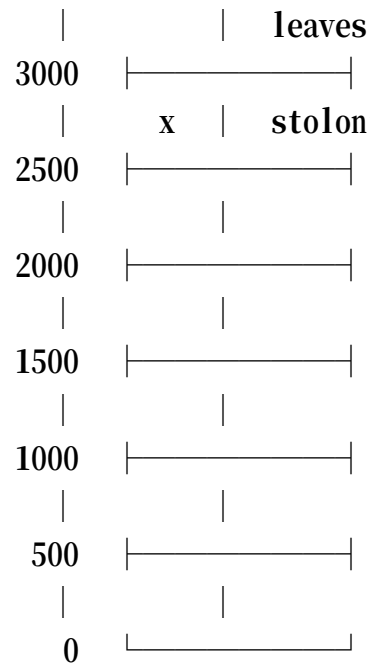


Geranium hayatanum Ohwi

Gentianaceae flora 3：0428

altitude



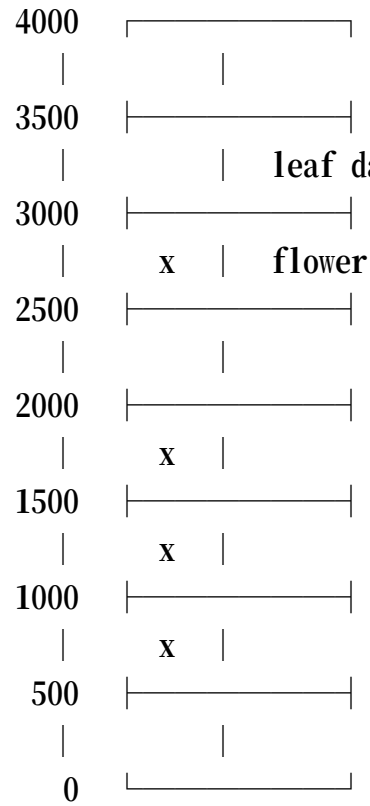


leaves simple, 3-5-divided; flower yellow; stem stoloniferous.

Geranium suzukii Masamune

Geraniaceae flora 3：0430

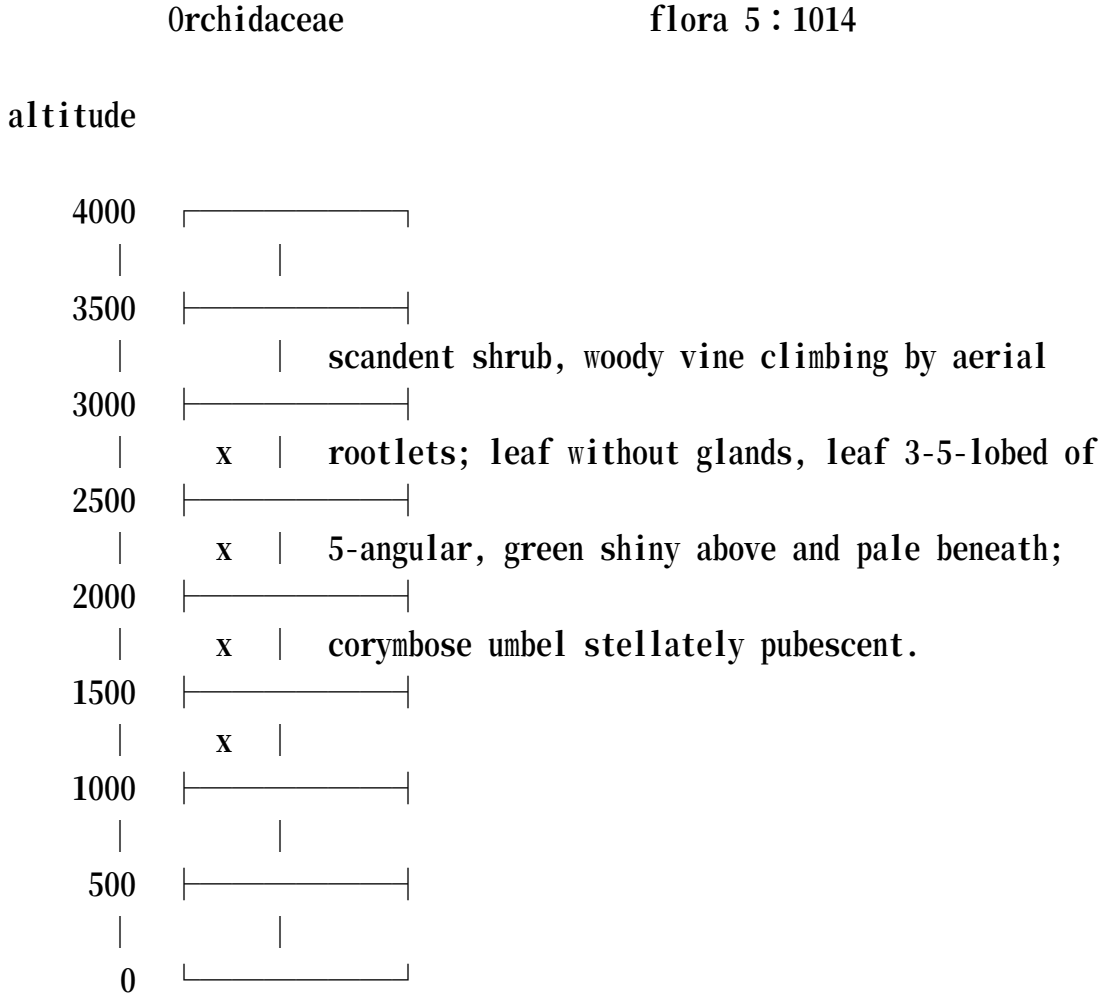
altitude



leaf dark green with a distinct white midrib; flower more than 5 usually erect.

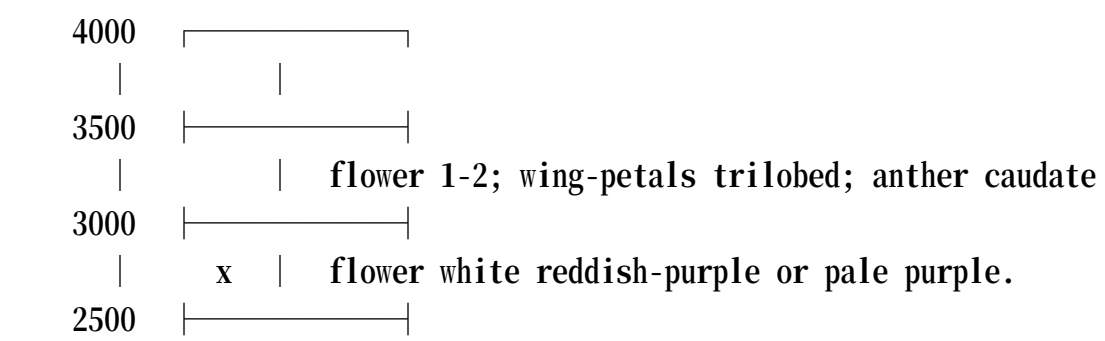
Goodyera velutina Maxim ex Rey

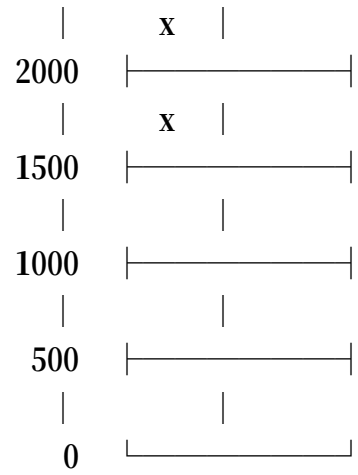
Orchidaceae flora 5 : 1014



Hedera rhombea Bean var. formosana Li.

Araliaceae flora 3 : 0925

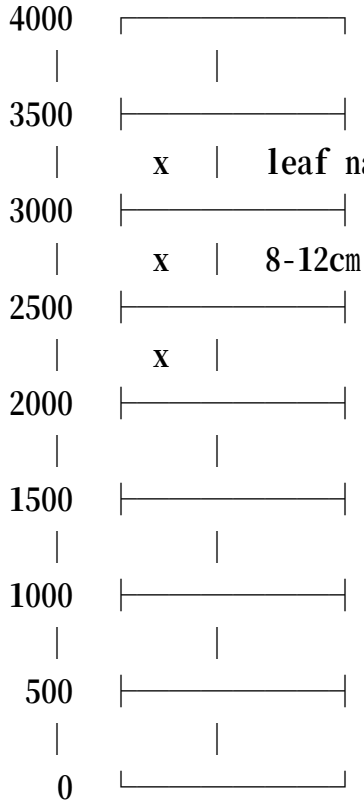




Impatiens uniflora Hay.

Balsaminaceae flora 3：0601

altitude

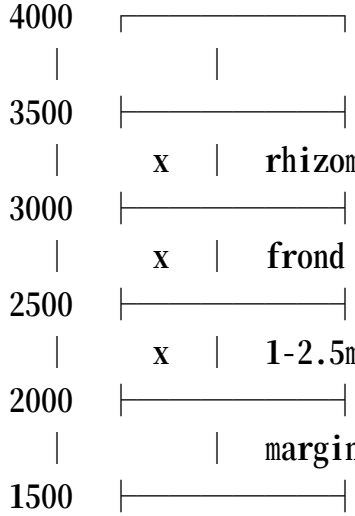


leaf narrow-linear 2-3mm wide 3-7 nerved, scape 8-12cm long with 5-10 flower fascicled at apex.

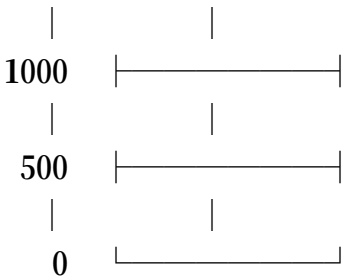
Liriope minor Makino

Liliaceae flora 5：0063

altitude



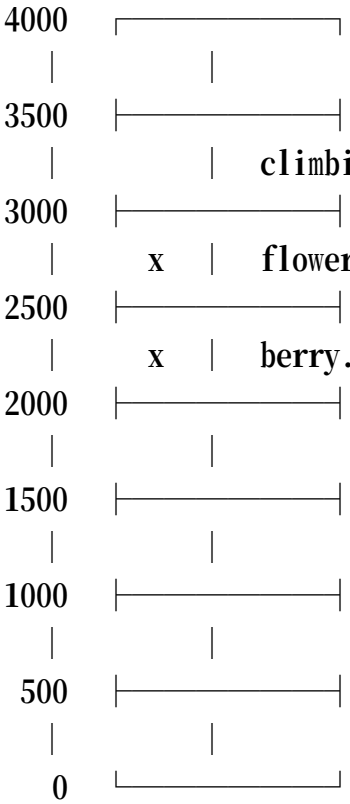
rhizome scale concolorous, lumina all clear; frond narrowly-linear 3-7mm wide; rhizome 1-2.5mm wide; sori oval, reaching from costa to margin; venation of lamina hidden.



Lepisorus pseudo-ussuriensis Tagawa

Polypodiaceae flora 1：0187

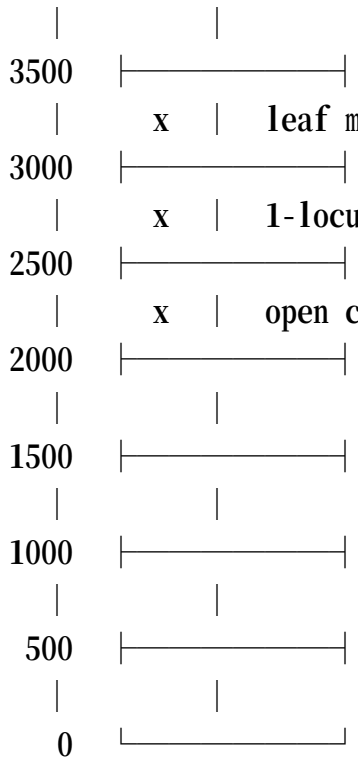
altitude



Lonicera acuminata Wall.

Caprifoliaceae flora 4：0707

altitude

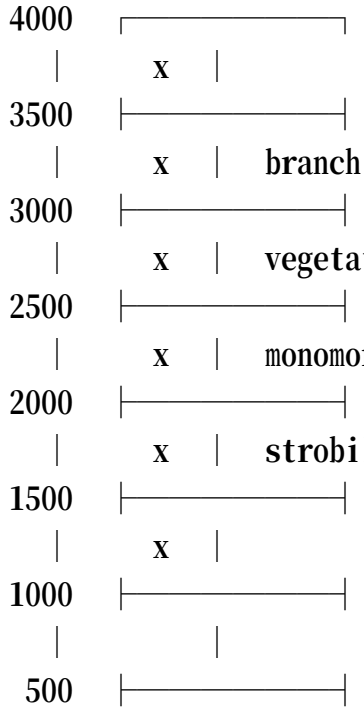


leaf more or less pilose on the margin; capsule 1-locule; inflorescence a spike-like head not open cyme.

Luzula taiwaniana Satake

Juncaceae flora 5：0156

altitude

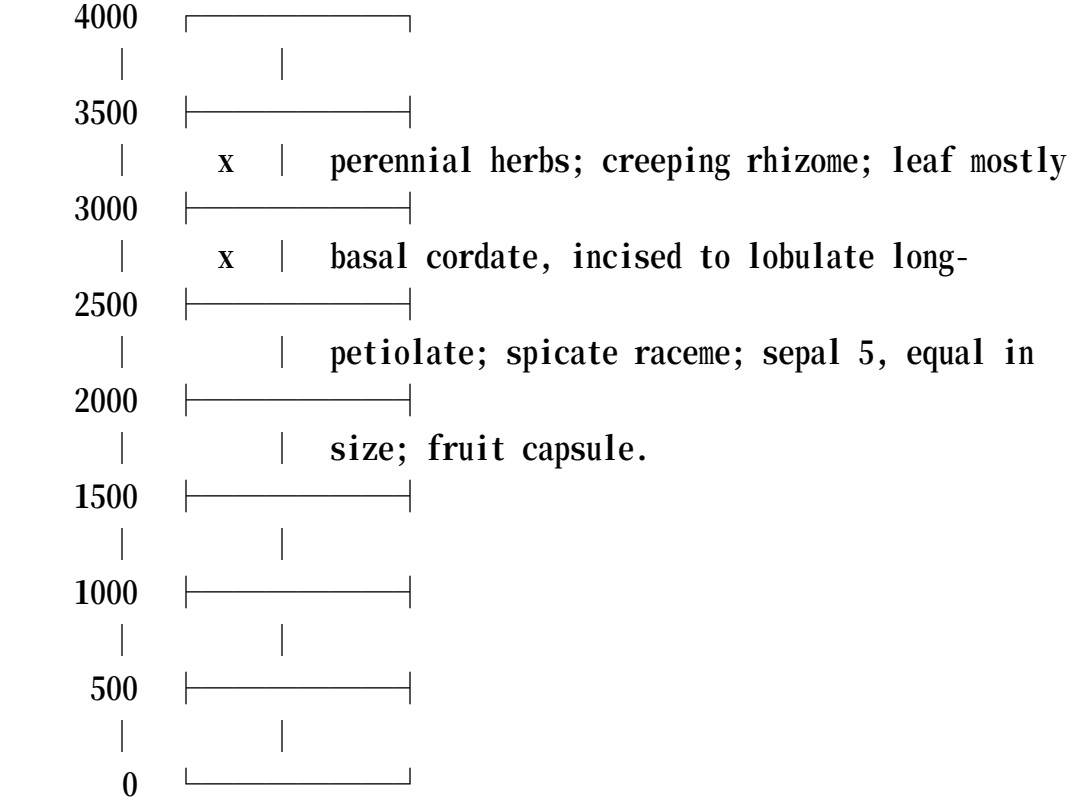


branch terete; sporophyll very different from vegetative leaf, the latter flat spiral monomorphic, ending in a long hair-like tip; strobili stalked 2-serveral.

Lycopodium clavatum L.

Lycopodiaceae flora 1 : 0035

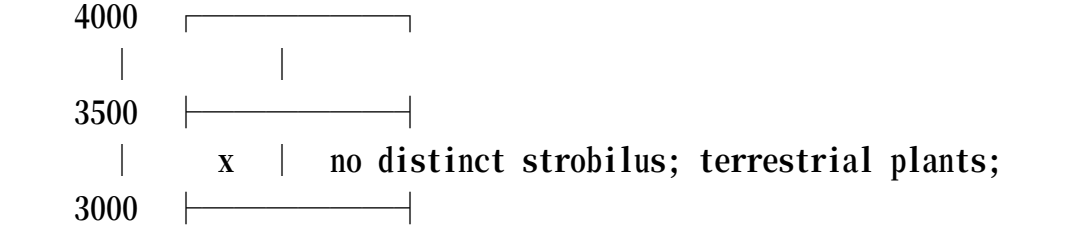
altitude

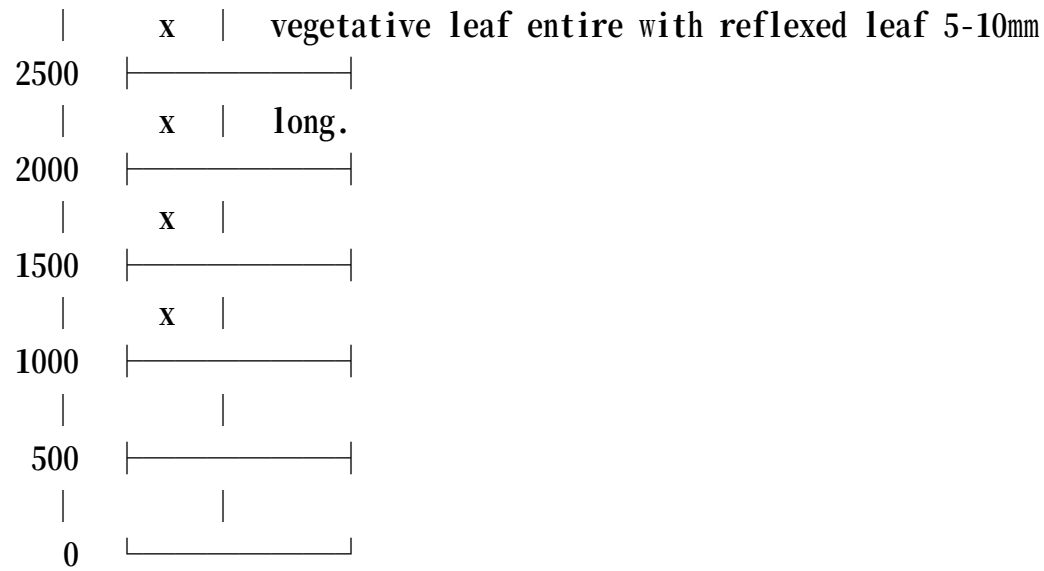


Mitella formosana Masamune

Saxifragaceae flora 3 : 0042

altitude

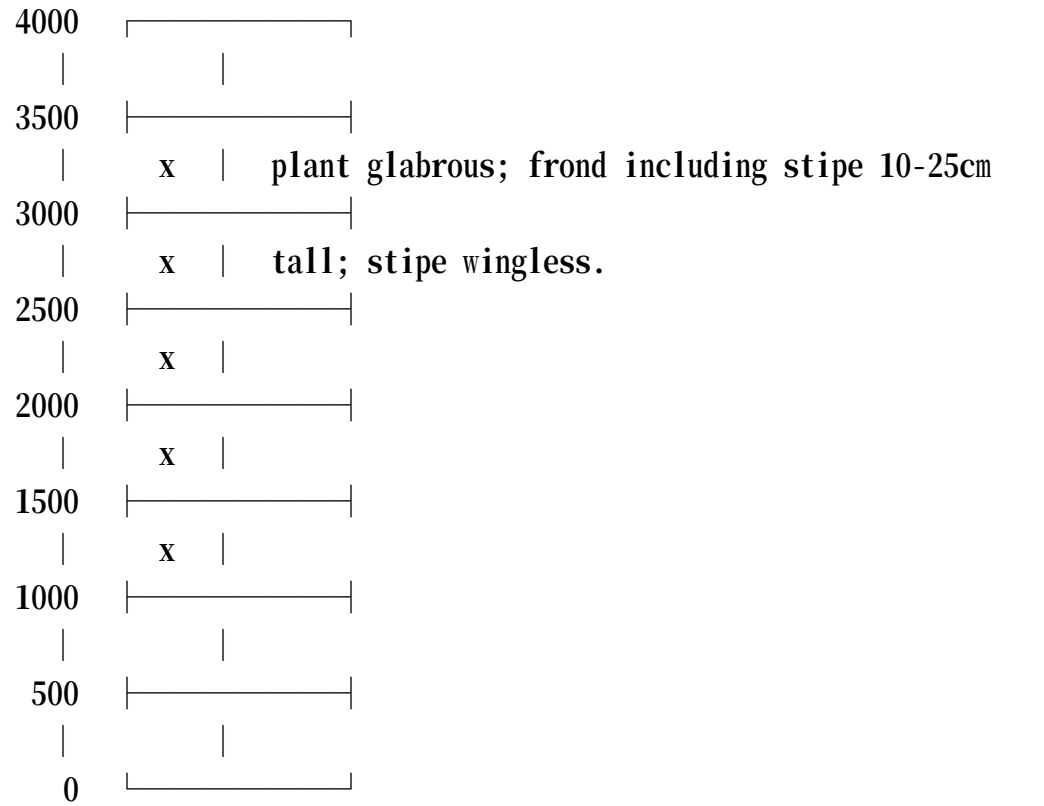




Lycopodium quasipolytrichoides Hay.

Lycopodiaceae flora 1：0029

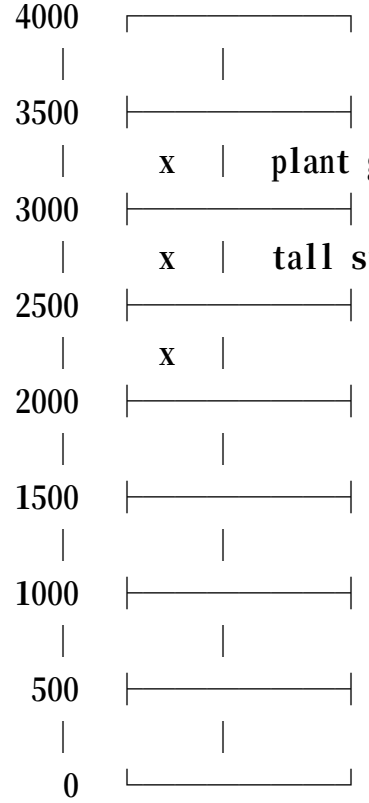
altitude



Mecodium polyanthos Copel.

Hymenophyllaceae flora 1：0127

altitude



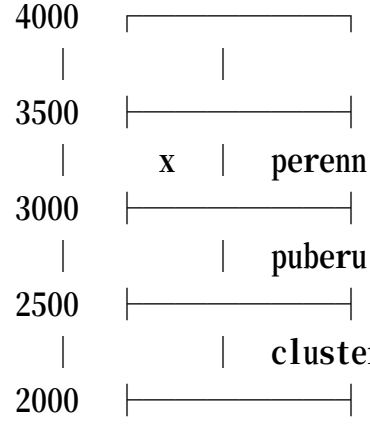
plant glabrous; frond including stipe 1.5-3.5cm

tall stipe wingless.

Mecodium wrightii Copel.

Hymenophyllaceae flora 1：0127

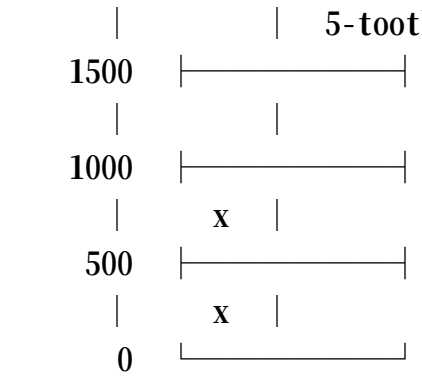
altitude



perennial herb covered with septate hairs; leaf

puberulent covered with glandular dots;

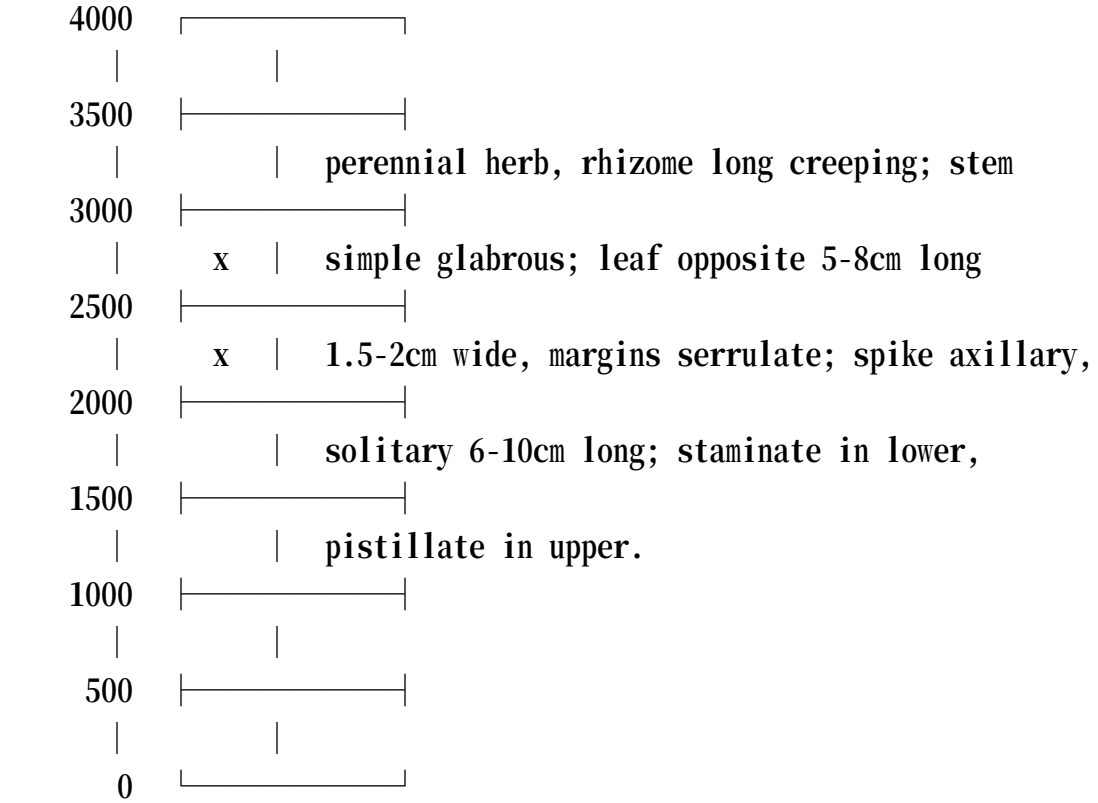
clustered flower in leaf axil; calyx campanulate



Mentha canadensis L.

Labiatae flora 4：0484

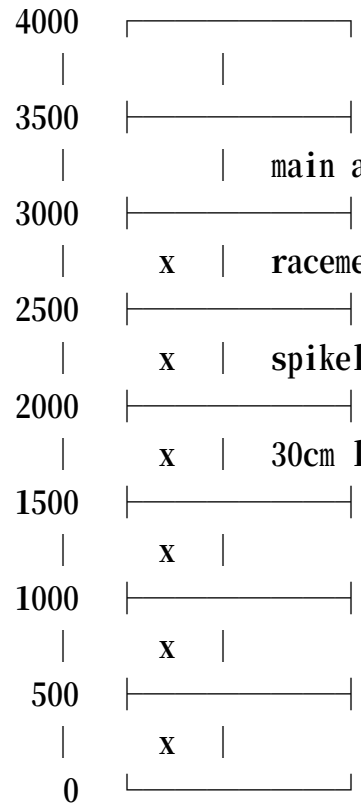
altitude



Mercurialis leiocarp Sieb.

Euphorbiaceae flora 3：0487

altitude

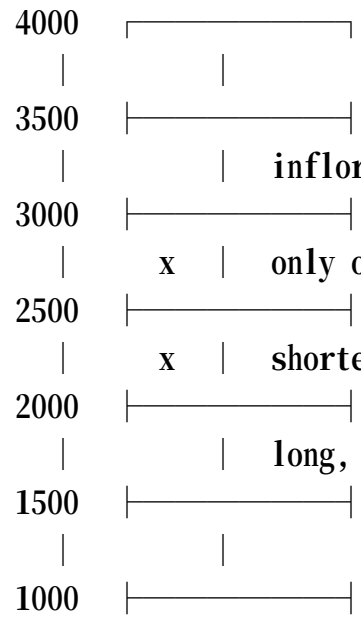


main axis of inflorescence longer than the raceme and raceme more or less branched; spikelets 2-4mm long inflorescence more than 30cm long.

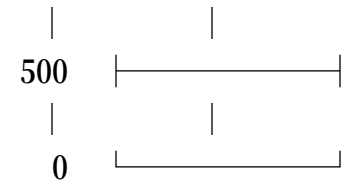
Miscanthus floridulus Schum. & Laut.

Poaceae flora 5：0678

altitude



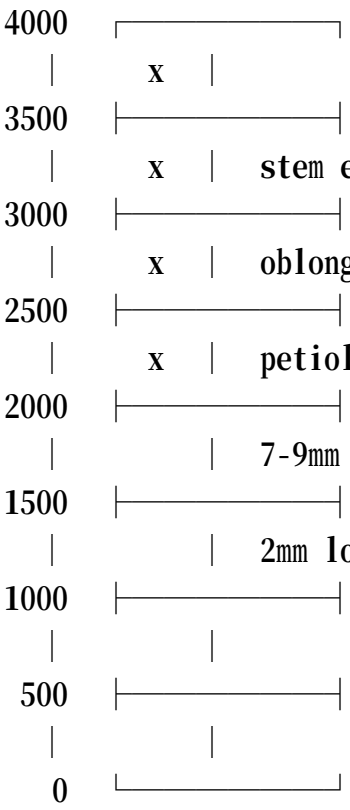
inflorescence in contract panicle, spikelet with only one fertile floret; glume thinner and shorter than lemma, tip of lemma with awn 8mm long, vein distinct; pericarp not free.



Muhlenbergia longistolon Ohwi

Poaceae flora 5 : 0498

altitude



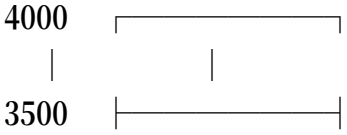
x

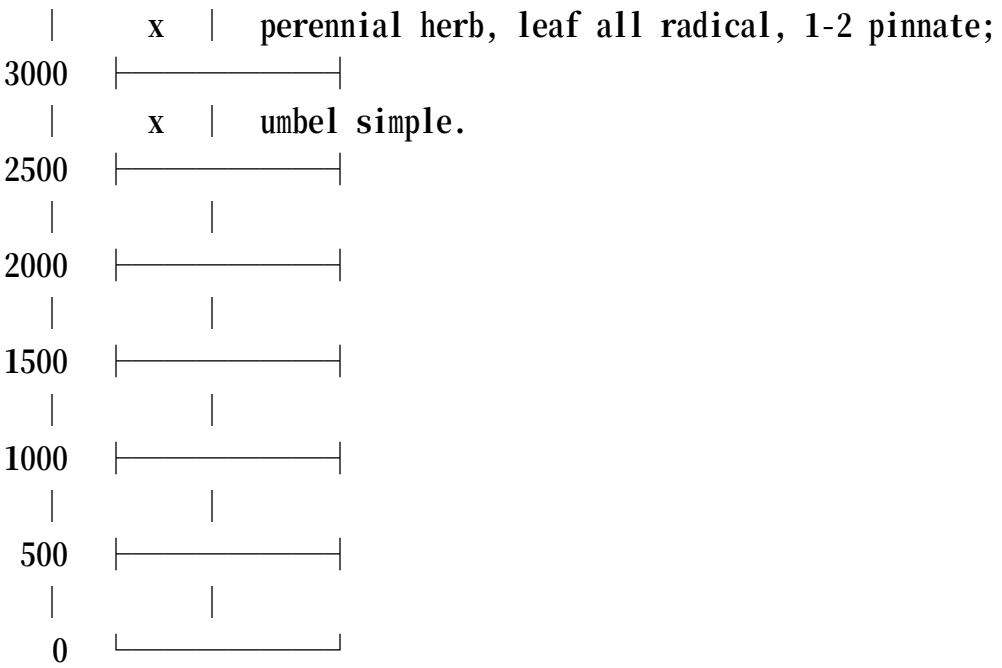
stem erect villous puberulous; radical leaf oblong lyrate-pinnatifid with long winged petiole; segment of 2-3 pairs; head solitary 7-9mm across; involucre bract 2-seriate; achene 2mm long.

Myriactis humilis Merr.

Compositae flora 4 : 0912

altitude

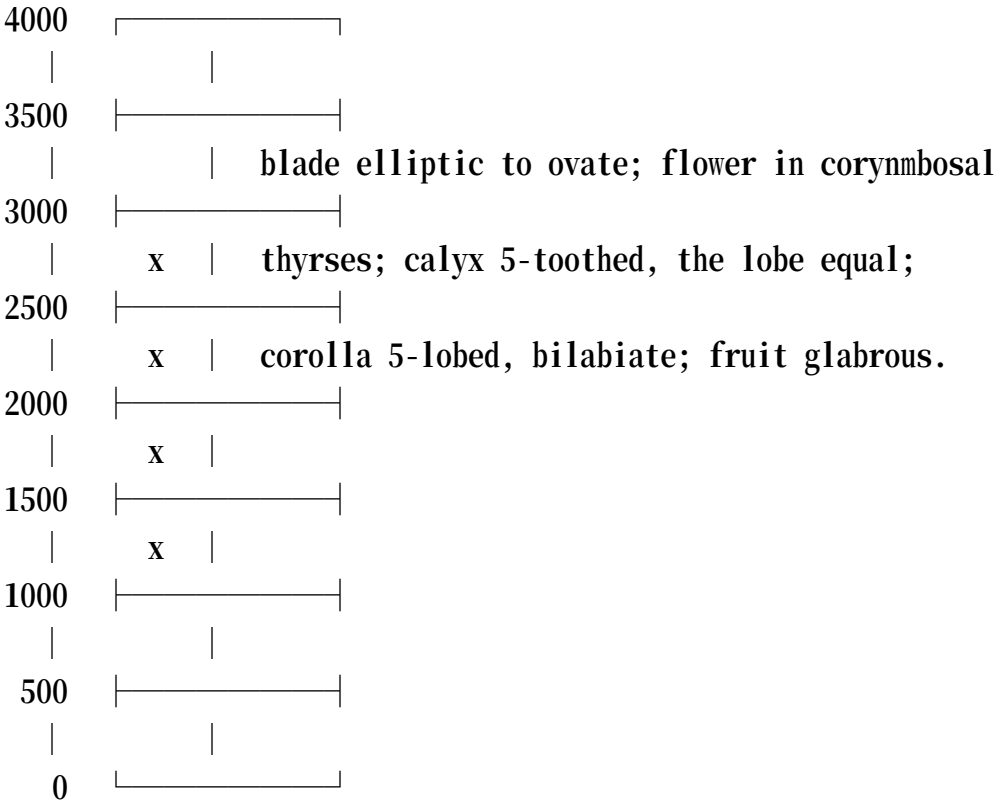




Oreomyrrhis involucrata Hay.

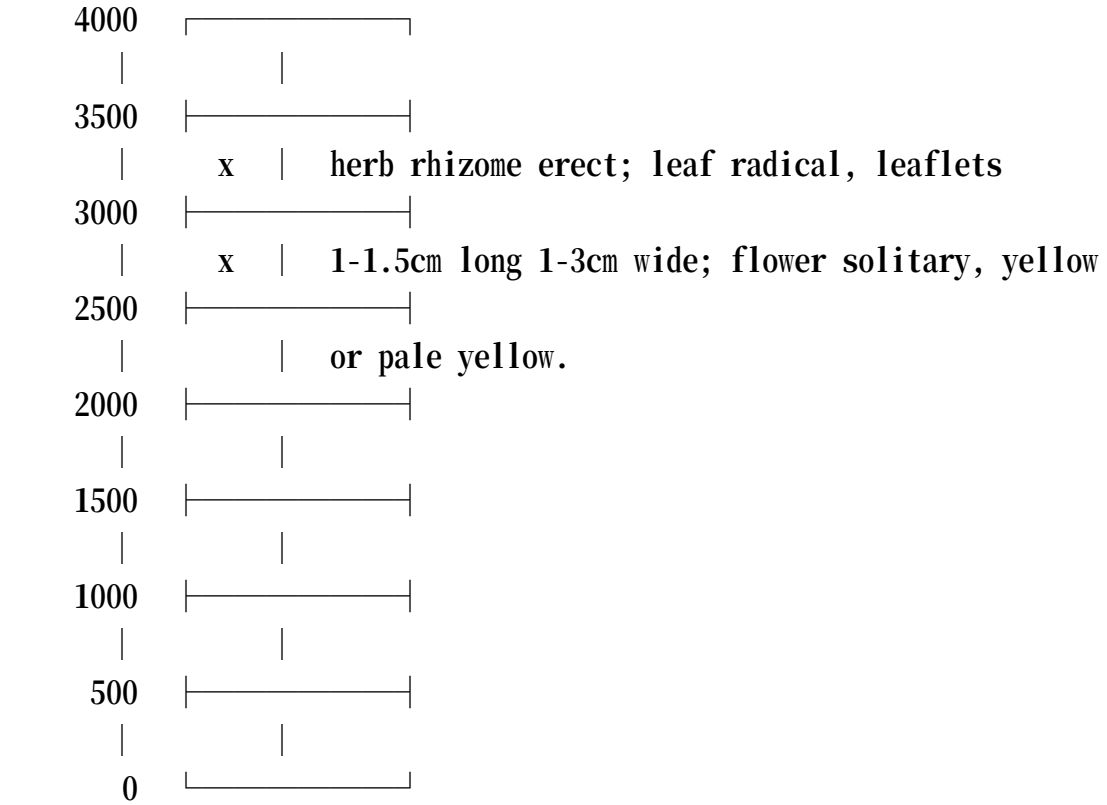
Umbelliferae flora 3：0960

altitude



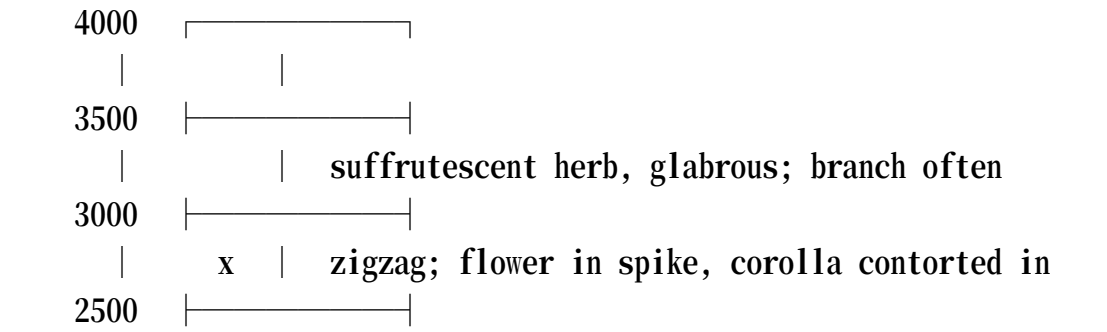
Origanum vulgare L. var. formosanum Hay.

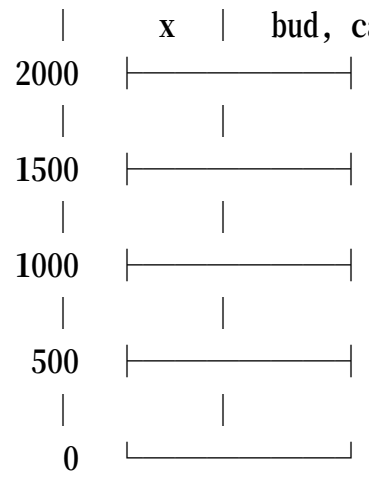
Labiatae flora 4：0494



Oxalis acetosella L. subsp. japonica Hara

Oxalidaceae flora 3：0427

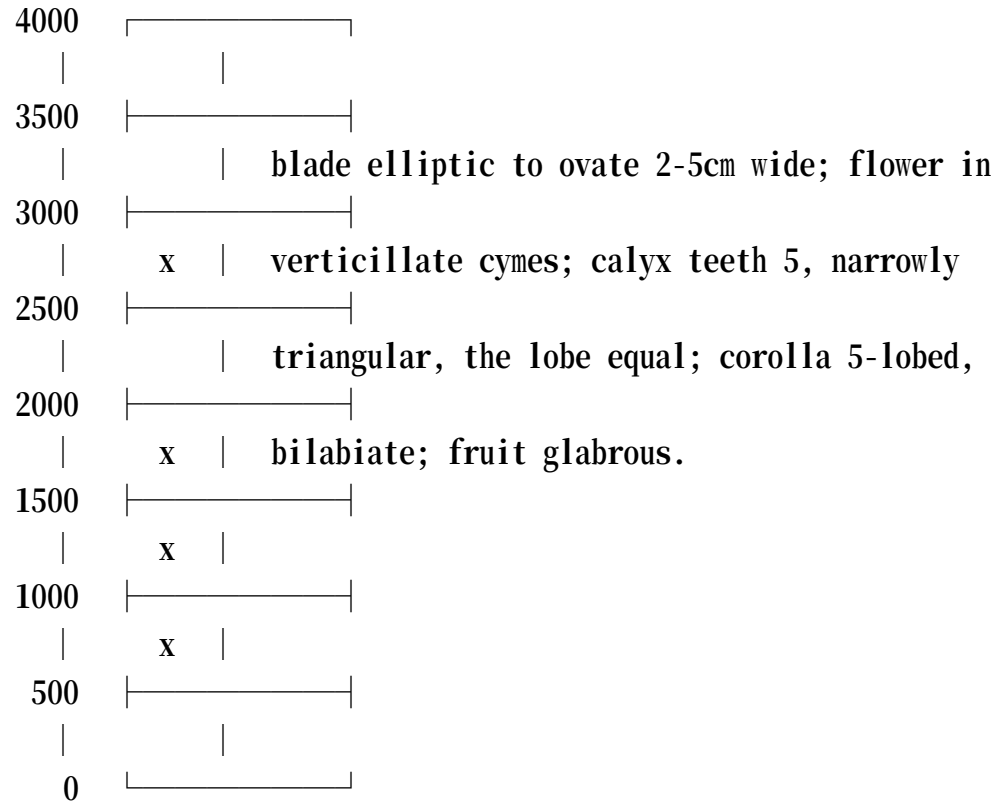




Parachampionella flexicaulisis

Acanthaceae flora 4 : 0652

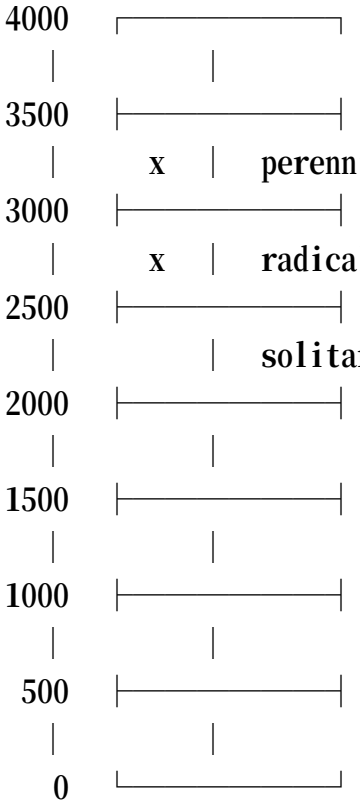
altitude



Paraphlomis gracilis Kudo

Labiatae flora 4 : 0496

altitude

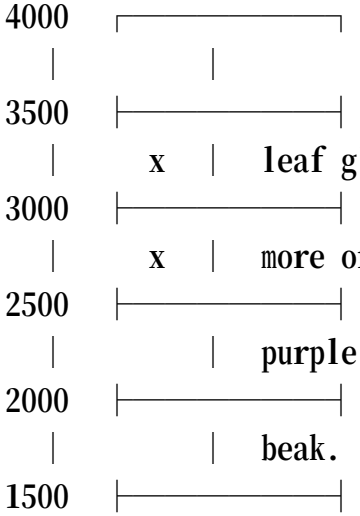


perennial glabrous herbs; rhizomes short; leaf radical, orbicular-cordate entier; flower solitary, white or pale yellow.

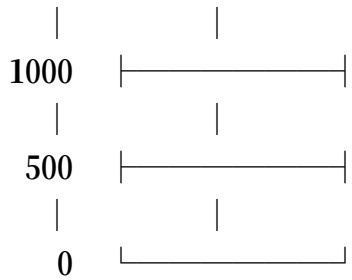
Parnassia palustris L.

Saxifragaceae flora 3：0044

altitude



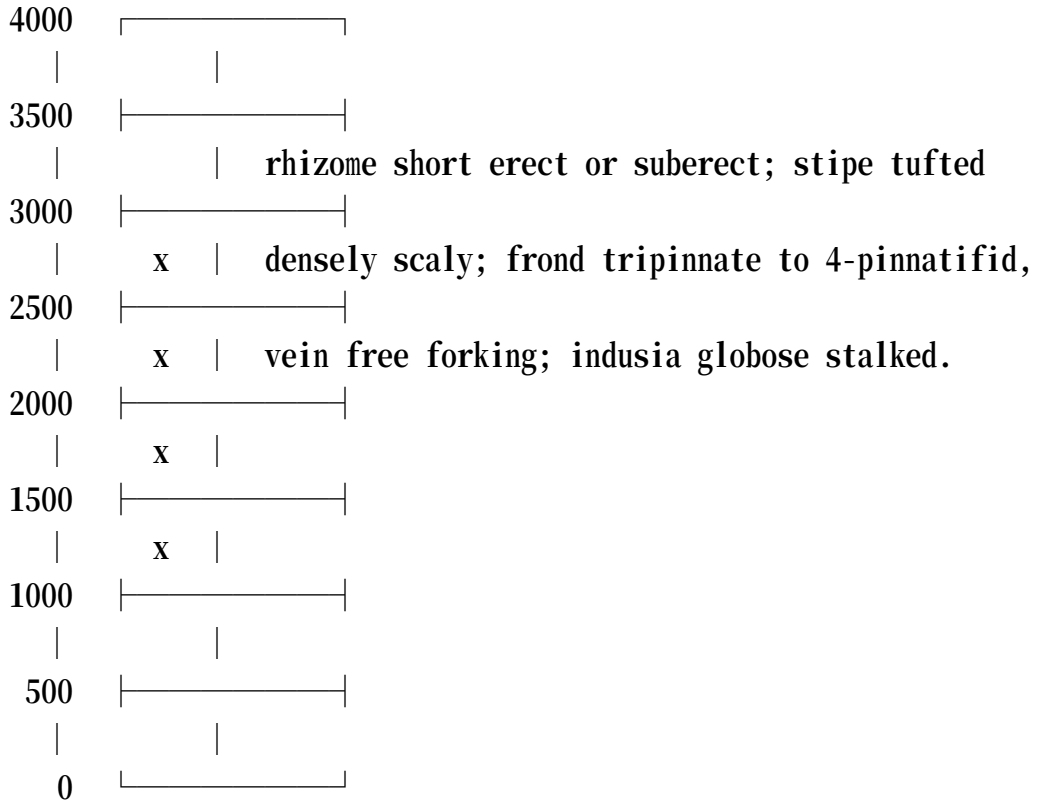
leaf glabrous beneath; beak of corolla-galea more or less entire at apex; opposite corolla purple, the upper galea terminating in a short beak.



Pedicularis ikomai Sasaki

Scrophulariaceae flora 4：0585

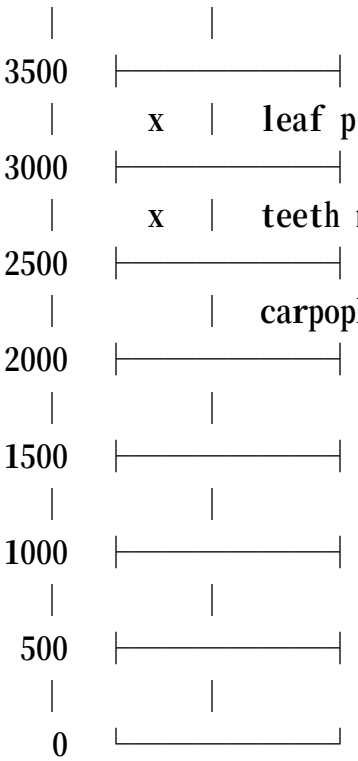
altitude



Peranema cyatheoieds Don.

Dryopteridaceae flora 1：0383

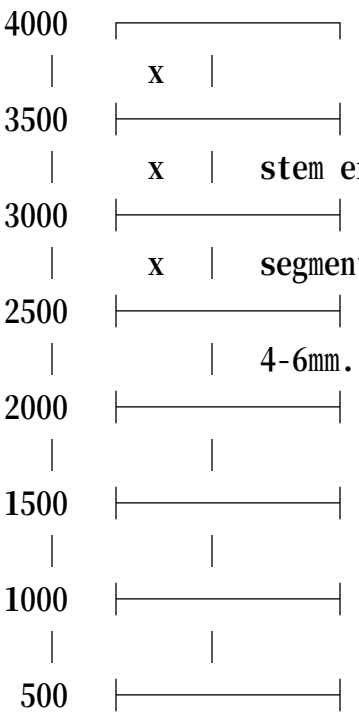
altitude



Pimpinella niitakayamensis Hay.

Umbelliferae flora 3 : 0967

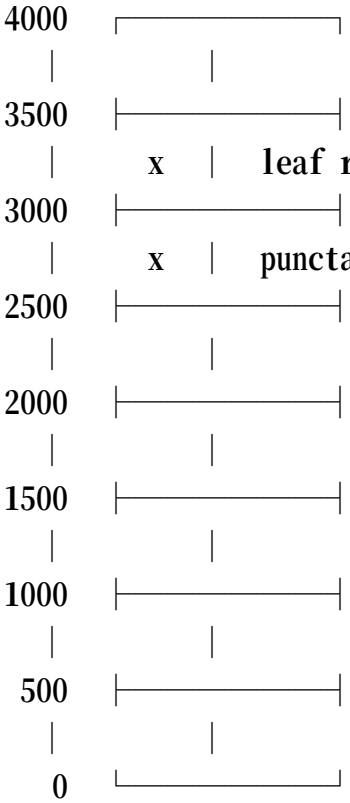
altitude



Polygonum cuspidatum Sieb. & Zucc.

Polygonaceae flora 2 : 0268

altitude

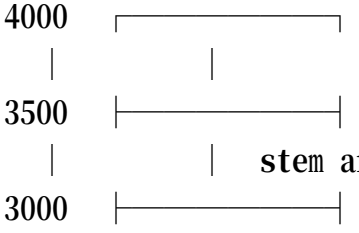


leaf runcinate auricled at base, glandular-punctate beneath; petioles winged.

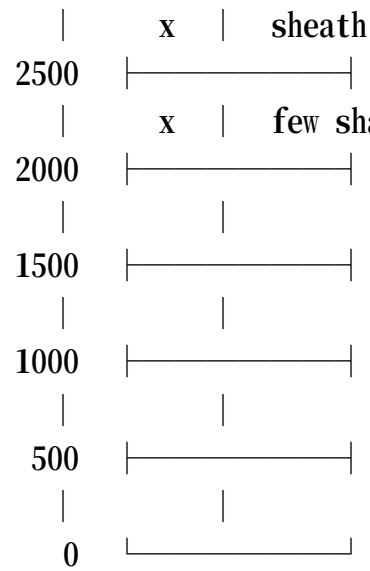
Polygonum runcinatum Buch-Ham

Polygonaceae flora 2 : 0280

altitude



stem armed with recurved prickles; leaf hastate;

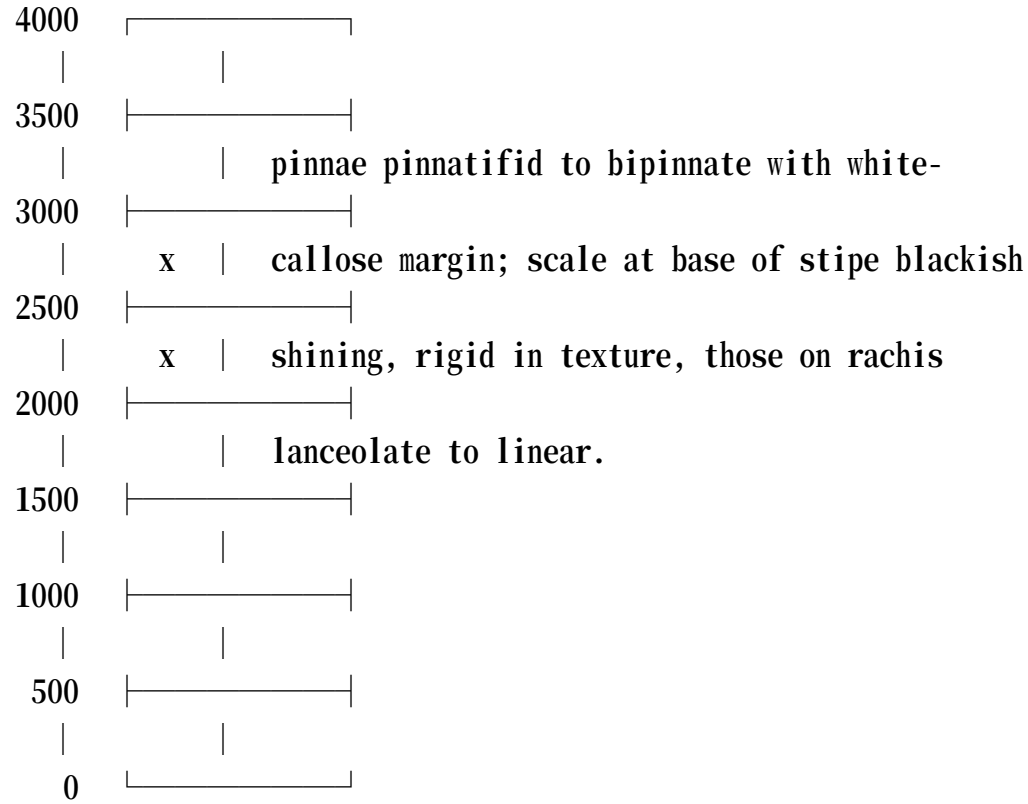


Polygonum thunbergii Sieb. & Zucc.

forma biconvexum Liu

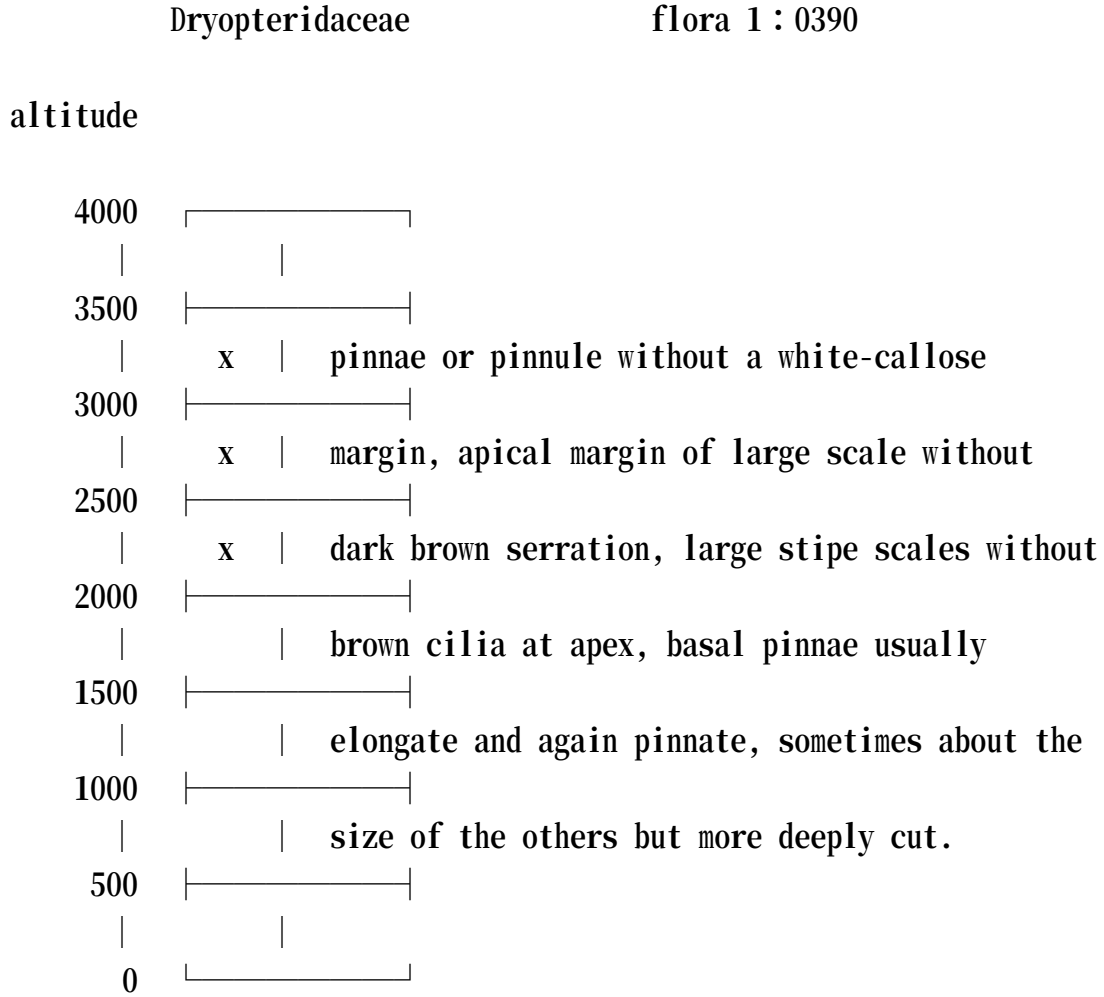
Polygonaceae flora 2：0284

altitude



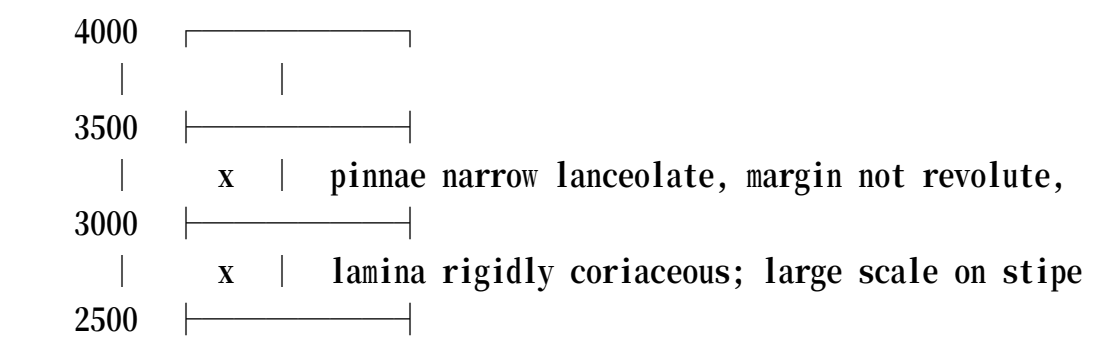
Polystichum falcatipinnum Hay.

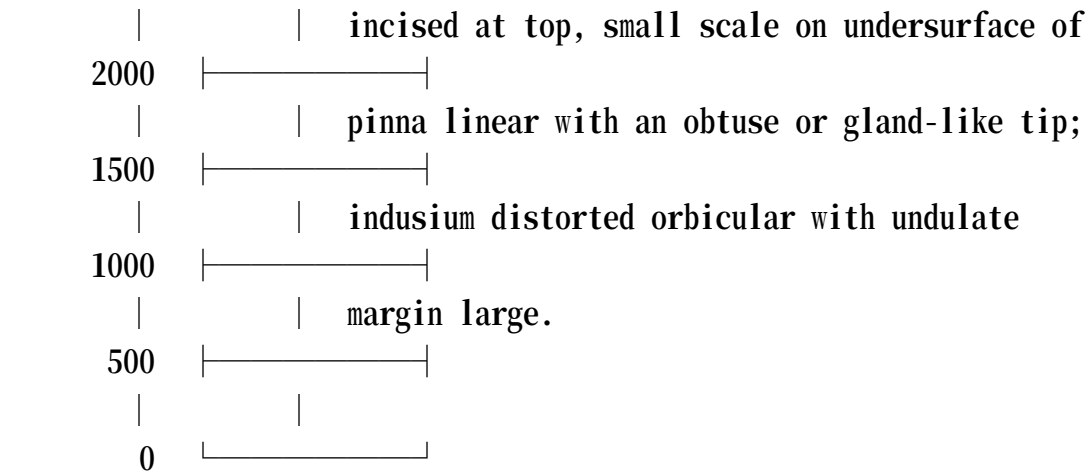
Dryopteridaceae flora 1：0390



Polystichum hancockii Diels

Dryopteridaceae flora 1：0390

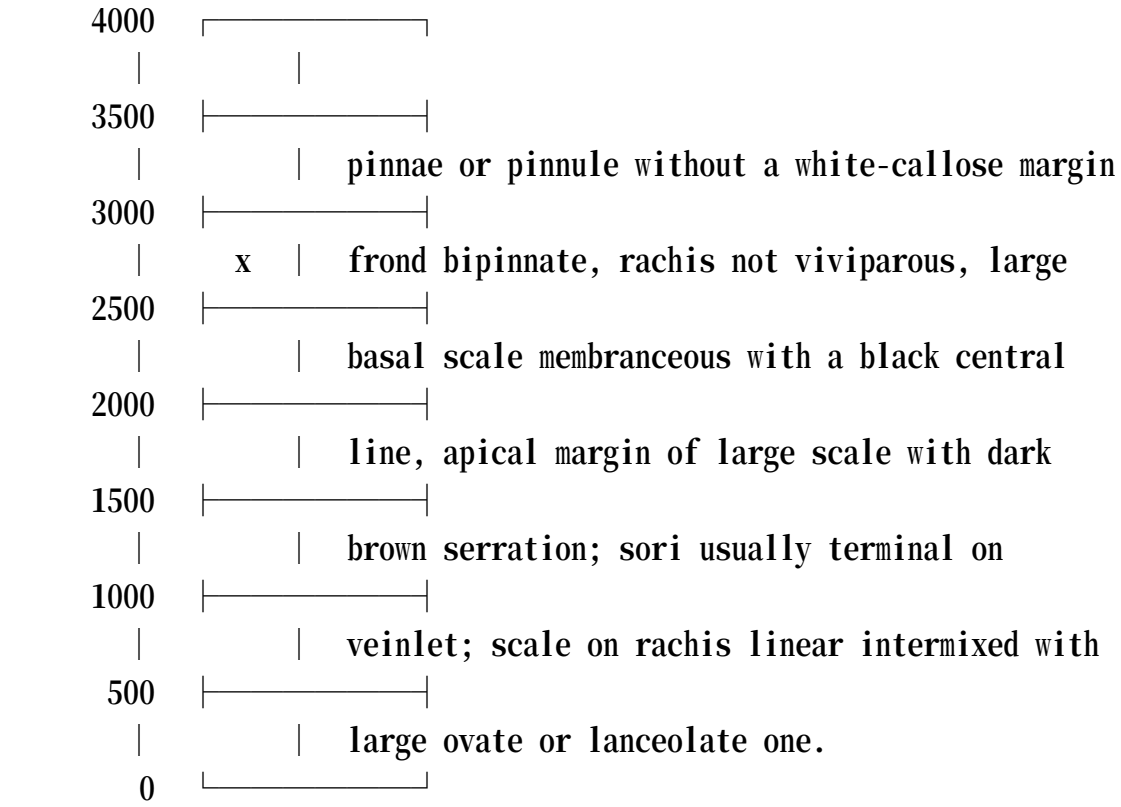




Polystichum ilicifolium Moore

Dryopteridaceae flora 1：0392

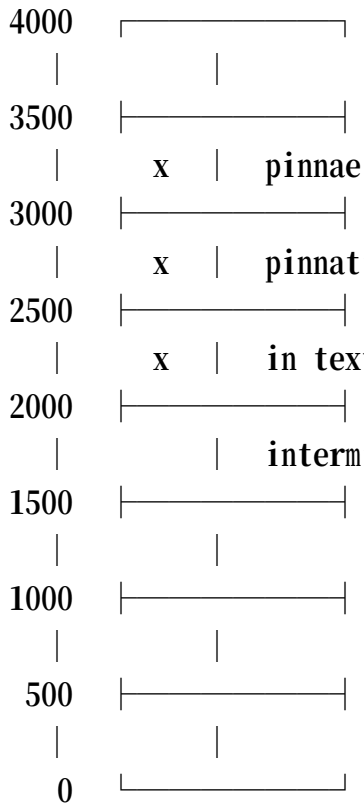
altitude



Polystichum kodamae Tagawa

Dryopteridaceae flora 1：0392

altitude

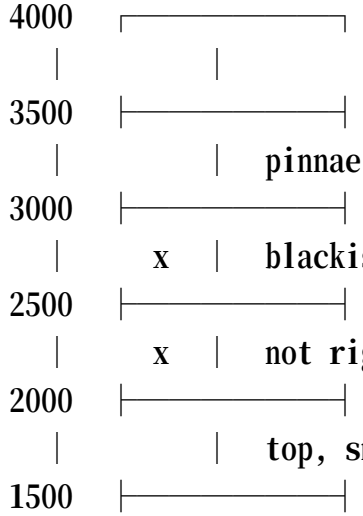


pinnae with white-callose margin but not pinnatifid; scale at base of stipe brown, thin in texture, those on rachis lanceolate intermixed with broadly ovate-acuminate one.

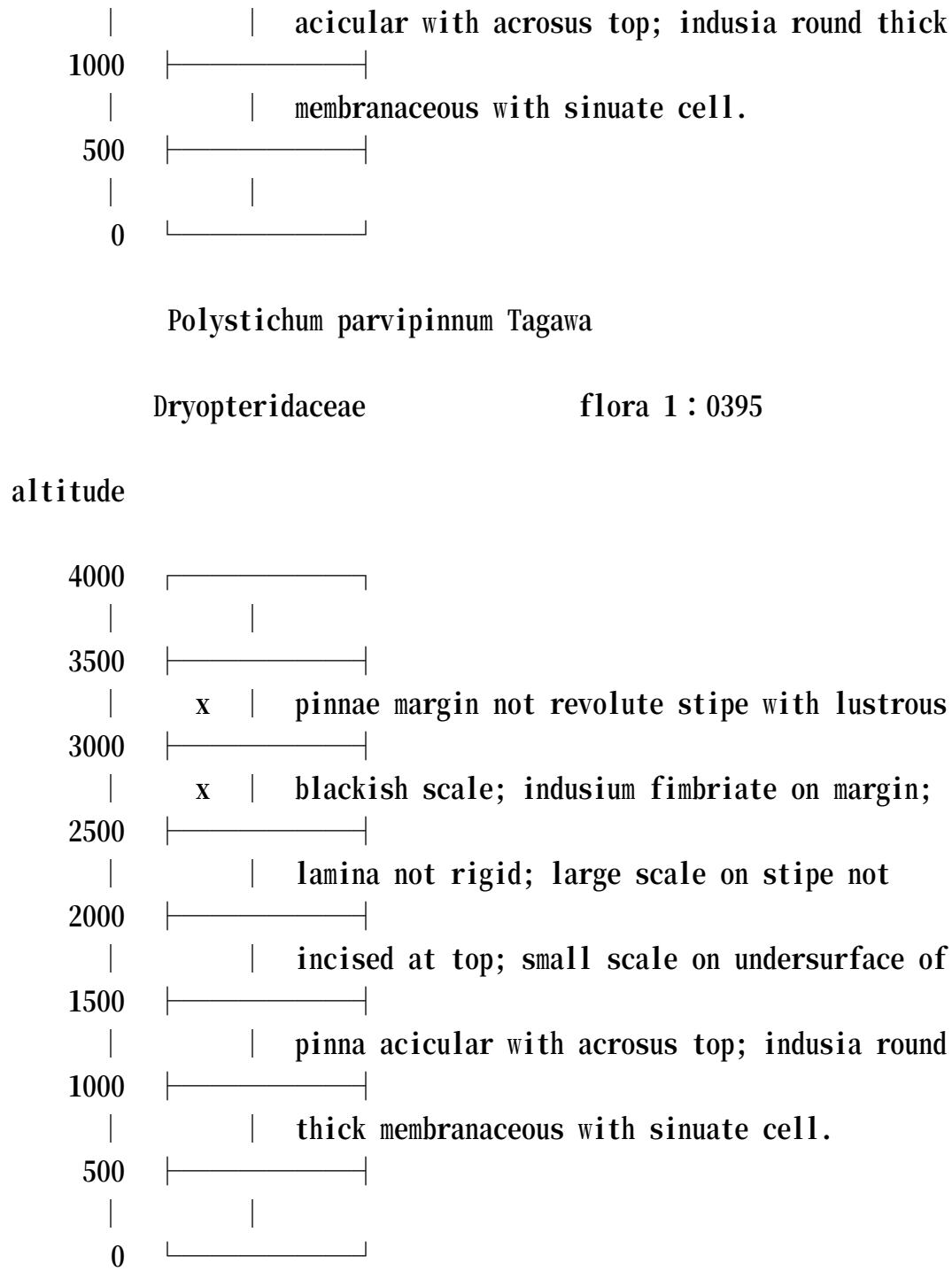
Polystichum nepalense C. Chr.

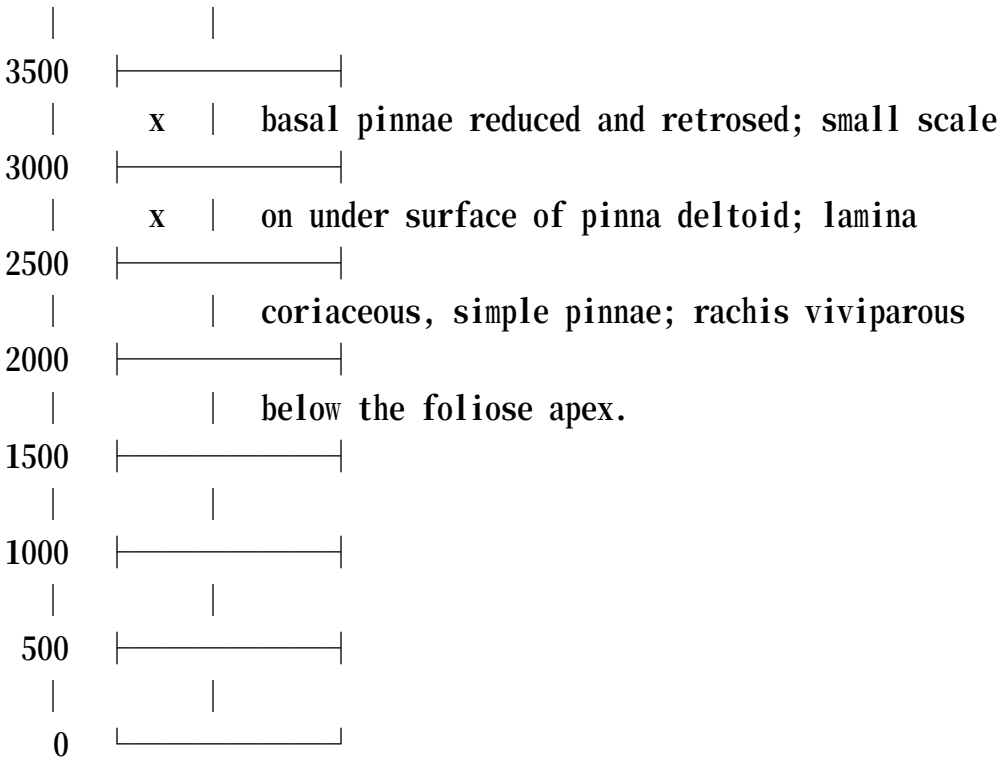
Dryopteridaceae flora 1：0394

altitude



pinnae margin not revolute, stipe without blackish scale; indusium nearly entire; lamina not rigid, large scale on stipe not incised at top, small scale on undersurface of pinna

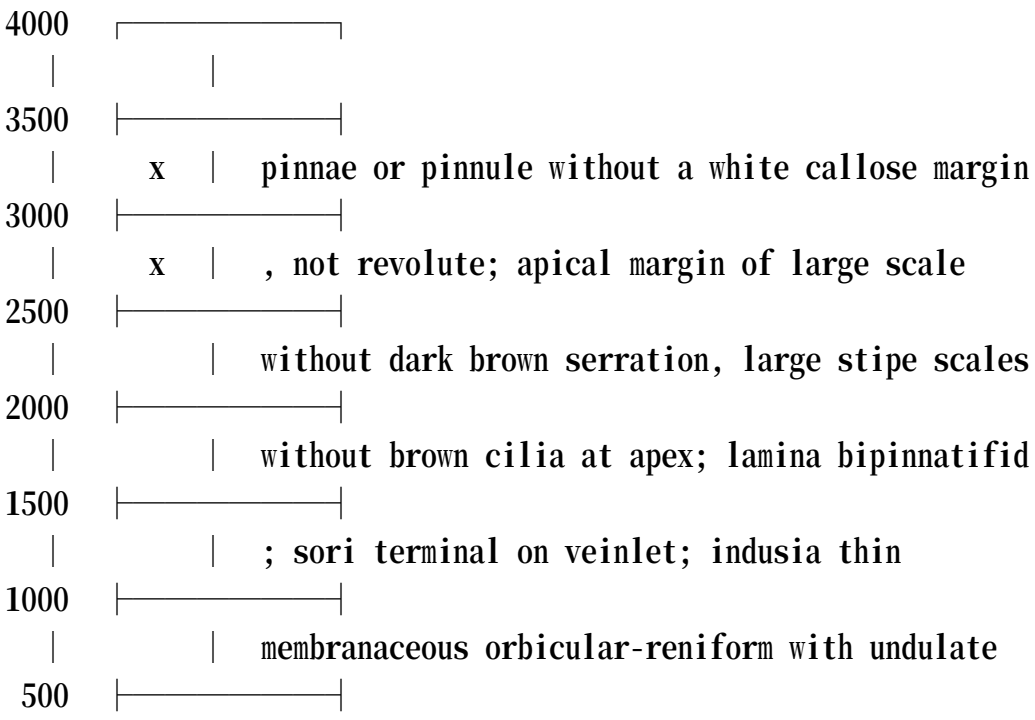

acicular with acrosus top; indusia round thick
1000
membranaceous with sinuate cell.
500
0
Polystichum parvipinnum Tagawa
Dryopteridaceae
flora 1 : 0395
altitude
4000
3500
x
pinnae margin not revolute stipe with lustrous
3000
x
blackish scale; indusium fimbriate on margin;
2500
lamina not rigid; large scale on stipe not
2000
incised at top; small scale on undersurface of
1500
pinna acicular with acrosus top; indusia round
1000
thick membranaceous with sinuate cell.
500
0
Polystichum parvipinnum Tagawa
Dryopteridaceae
flora 1 : 0396
altitude
4000



Polystichum stenophyllum Christ

Dryopteridaceae flora 1：0397

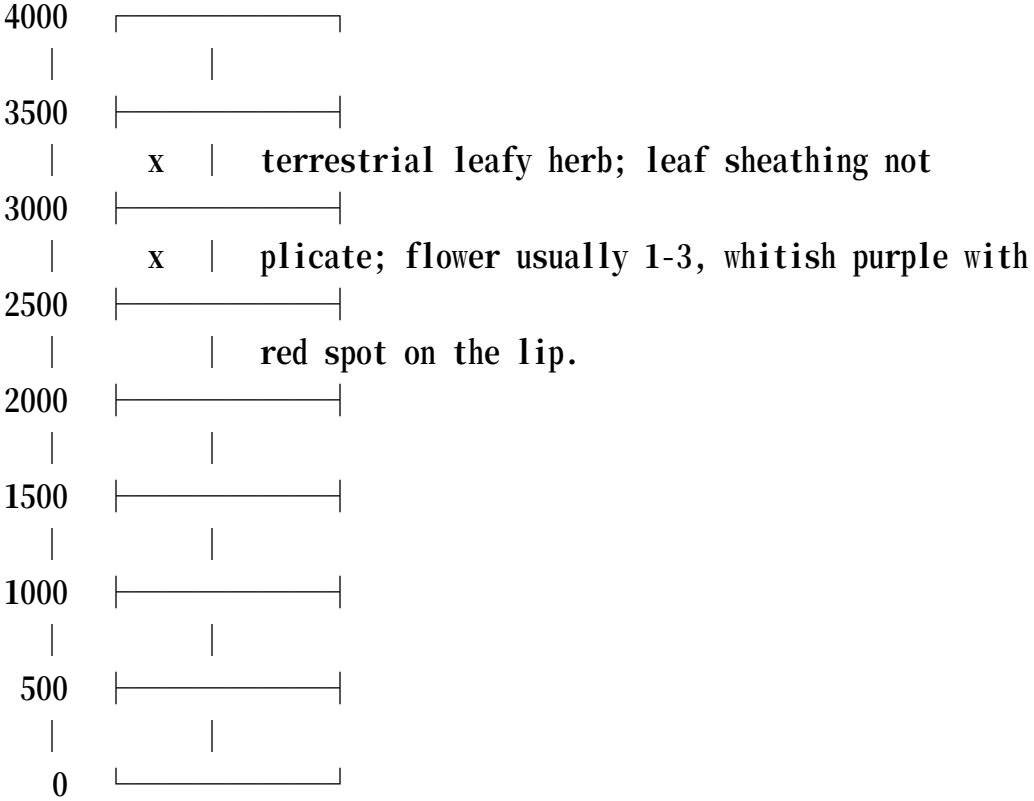
altitude



Polystichum thomsoni Beddome

Dryopteridaceae flora 1 : 0399

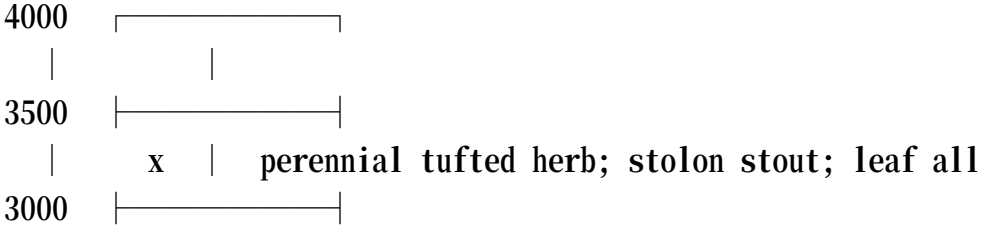
altitude

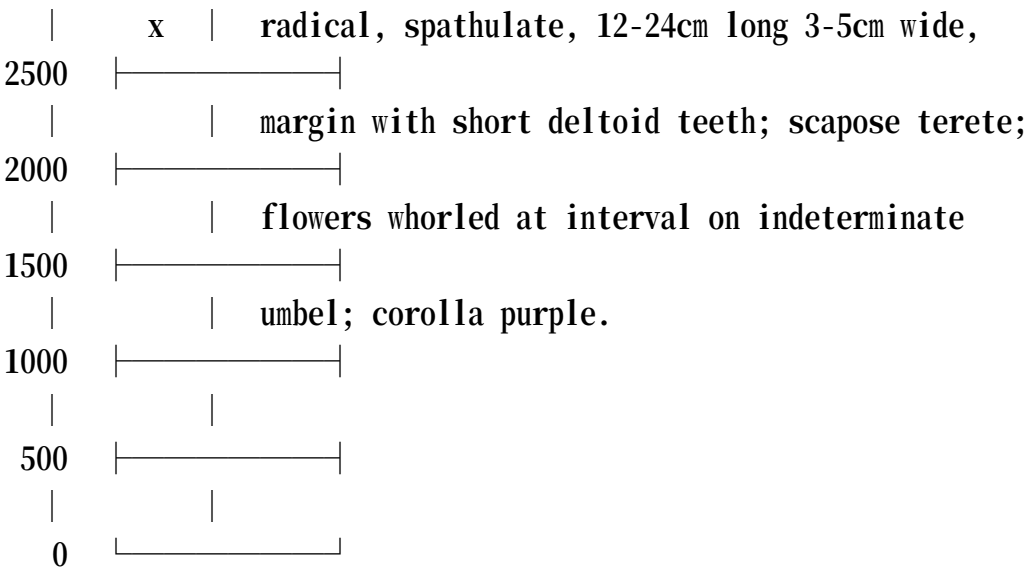


Ponerorchis kiraishiensis

Orchidaceae flora 5 : 1073

altitude

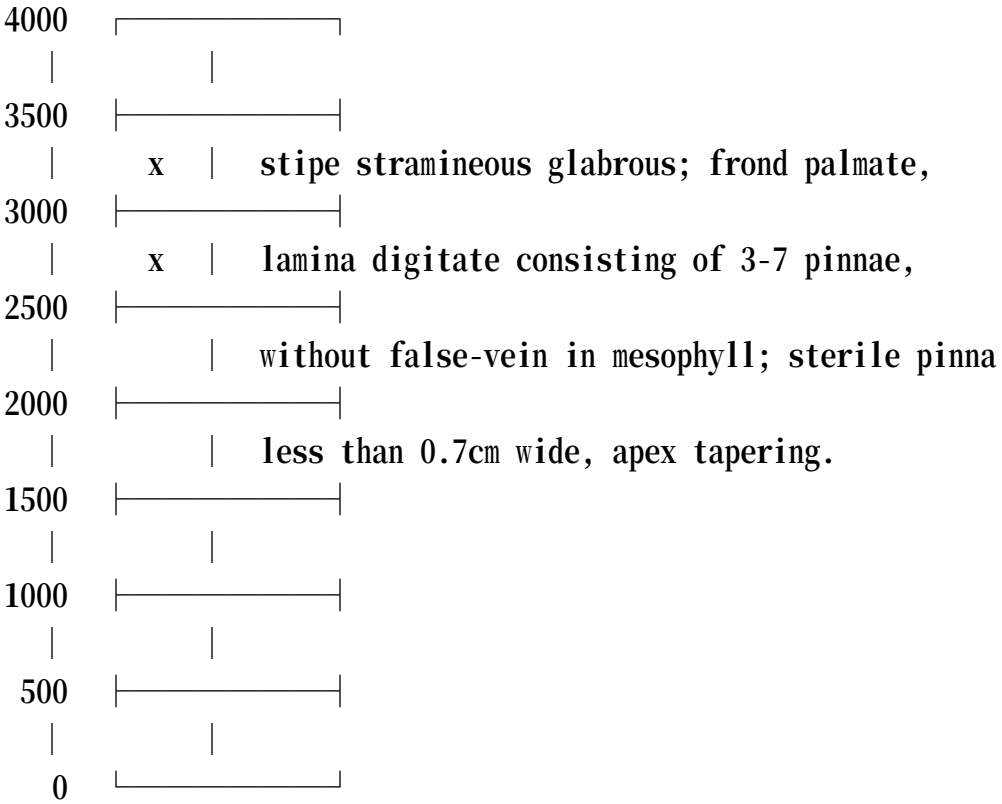




Primula miyabeana Ito & Kawakami

Primulaceae flora 4：0086

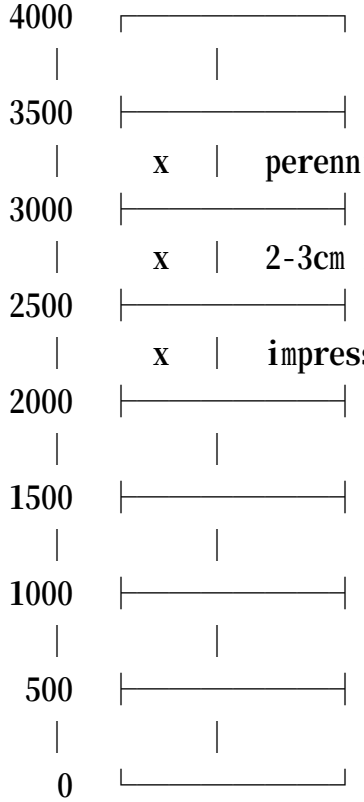
altitude



Pteris dactylina Hook.

Pteridaceae flora 1：0294

altitude

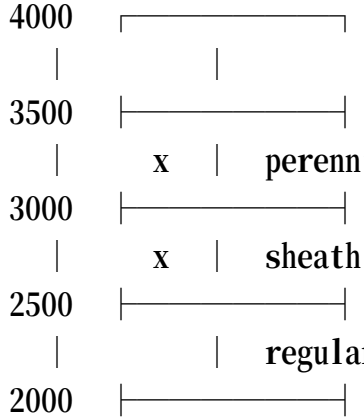


perennial herb 20cm high; leaf ovate-rhomboid 2-3cm long 2-2.5cm broad, upper surface with impressed veins; racemes 10-25cm long.

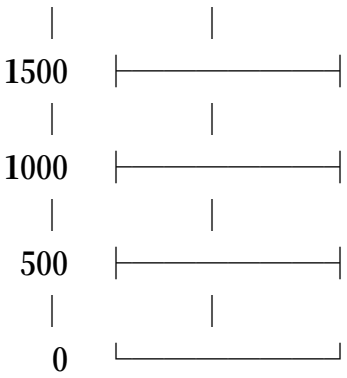
Pyrola morrisonensis Hay.

Pteridaceae flora 4：0011

altitude



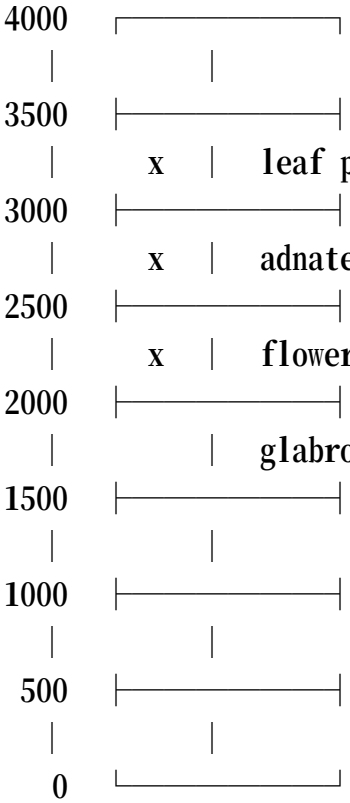
perennial herbs, densely hirsute; stem solid, sheath thickened; middle segment of leaf regularly 3-lobed, spear-like.



Ranunculus matsudi Hay.

Ranunculaceae flora 2 : 0502

altitude

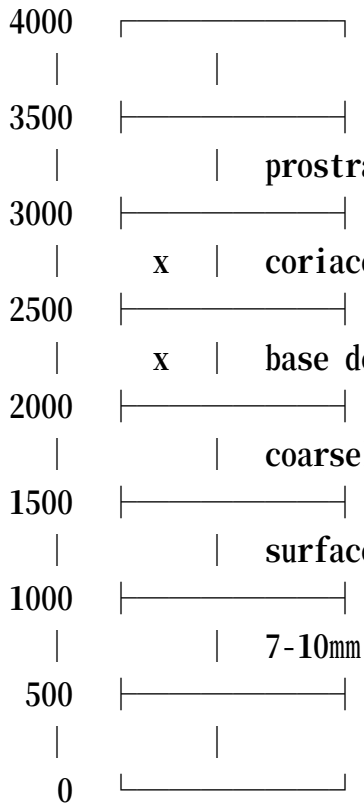


leaf pubescent beneath, glabrous above; stipule adnate to petiole, more than half their length; flower solitary, style united into column, glabrous.

Rosa transmorrisonensis Hay.

Rosaceae flora 3 : 0103

altitude

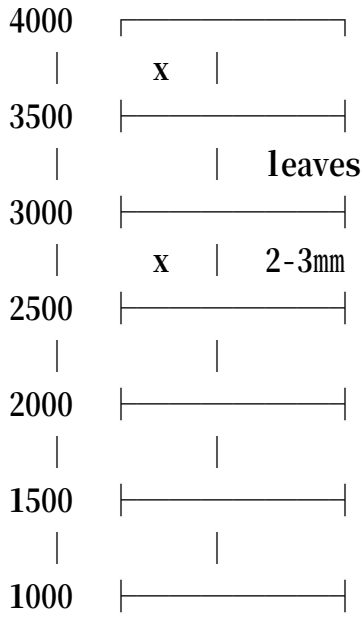


prostrate subshrub; stems rooting at nodes; leaf coriaceous, rounded in outline 2-3.5cm across, base deeply cordate, shallowly 3-4-lobed, margin coarsely dentate, upper surface rugose, lower surface fulvouw tomentose; stipule ovate-oblong 7-10mm long 5mm wide.

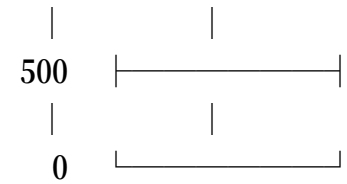
Rubus calycinoides Hay.

Rosaceae flora 3：0109

altitude



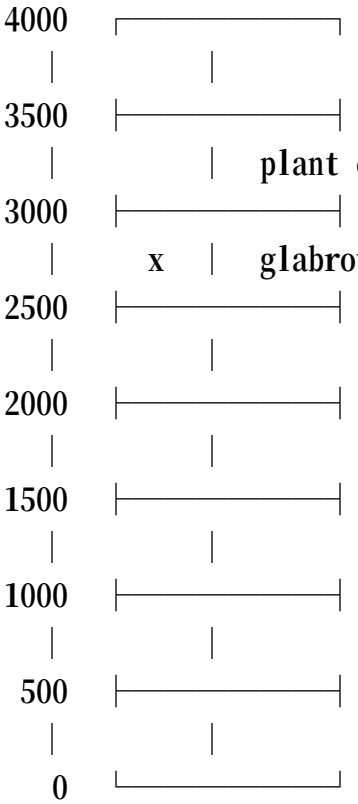
leaves 2-3cm, ovary and capsule pubescent; stalk 2-3mm long.



Salix taiwanalpina Kimura

Salicaceae flora 2：0038

altitude

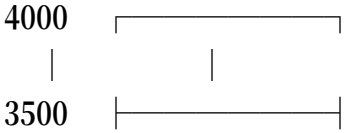


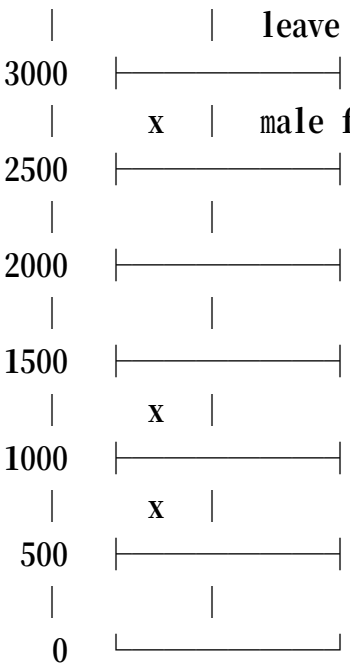
plant creeping; leave 1cm; ovary and capsule glabrous; stalk 0.7mm long.

Salix takasagoalpina Koidz.

Salicaceae flora 2：0039

altitude

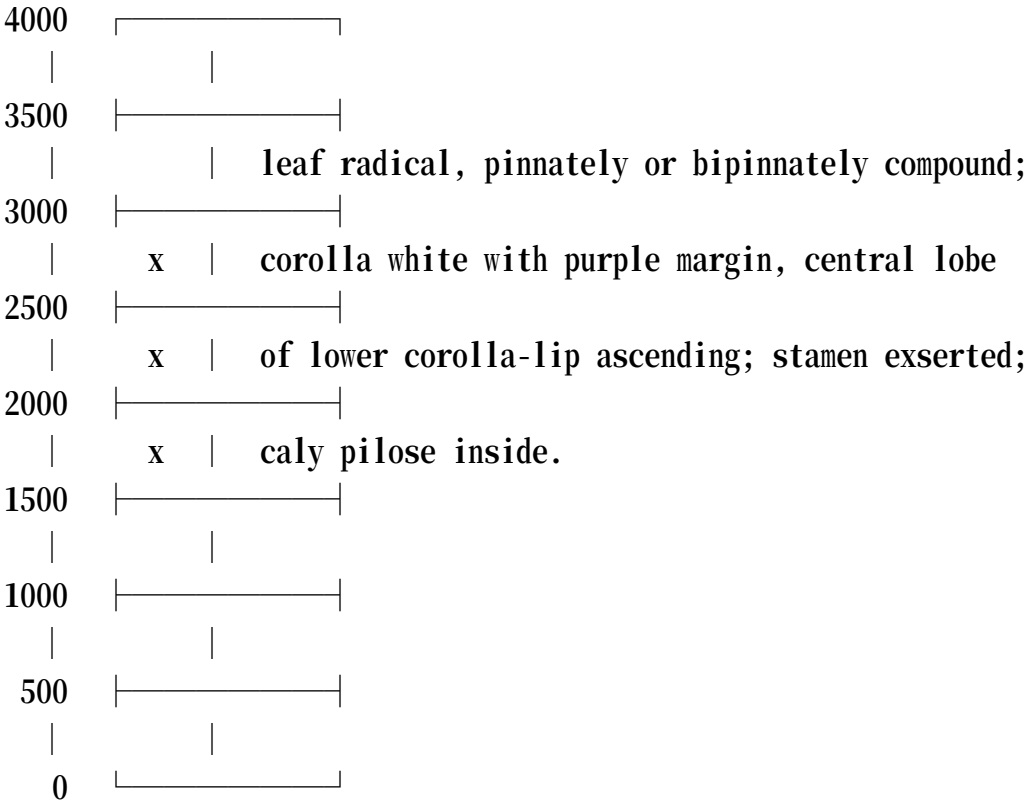




Salix warburgii O. Seem.

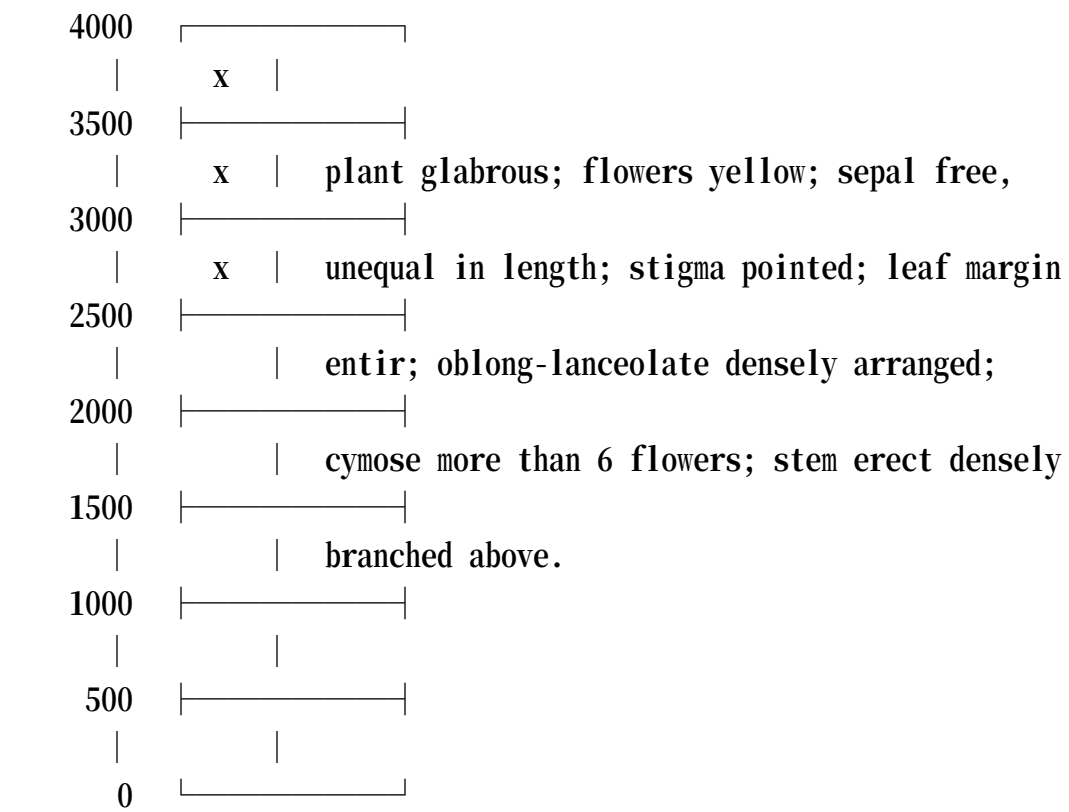
Salicaceae flora 2 : 0039

altitude



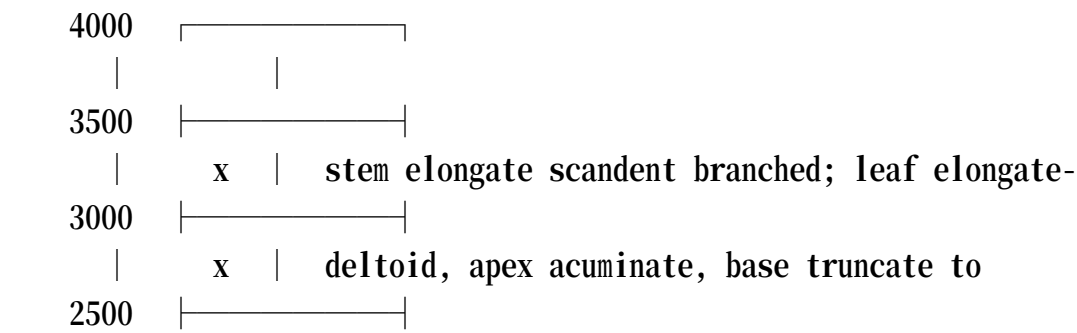
Salvia arisanensis Hay.

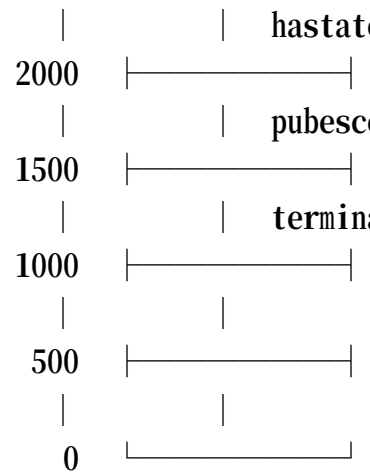
Labiatae flora 4 : 0510



Sedum morrisonensis Hay.

Crassulaceae flora 3 : 0019

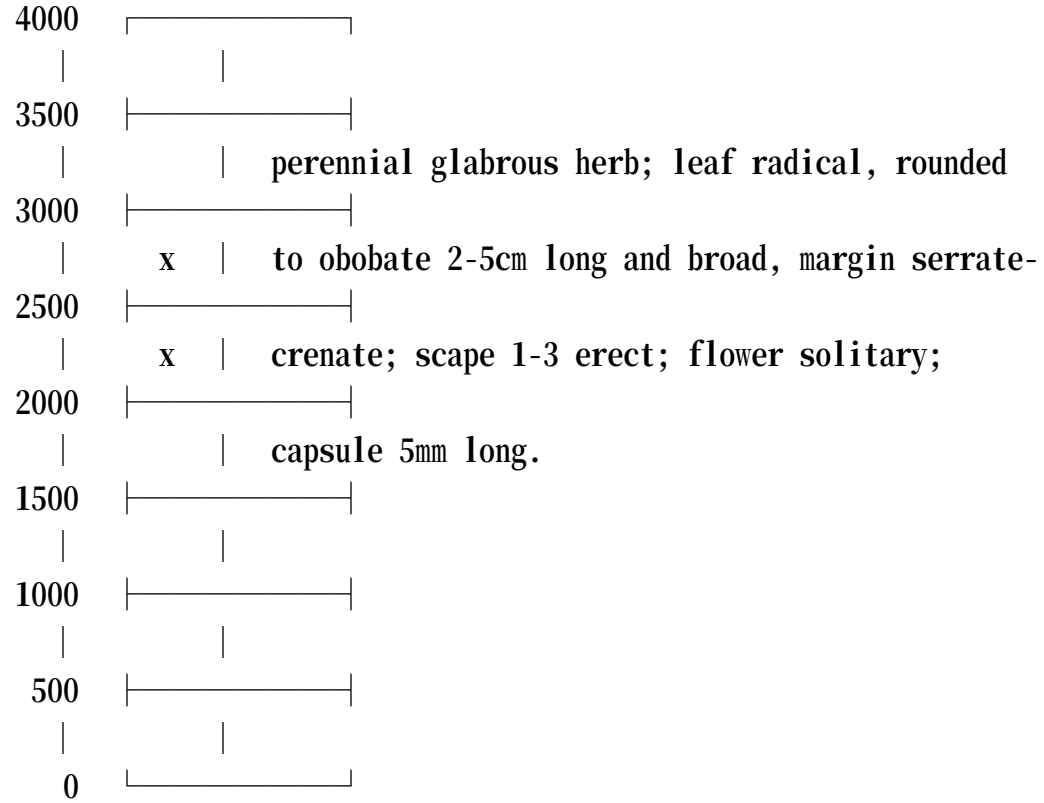




Senecio scandens Ham. ex D. Don

Compositae flora 4：0933

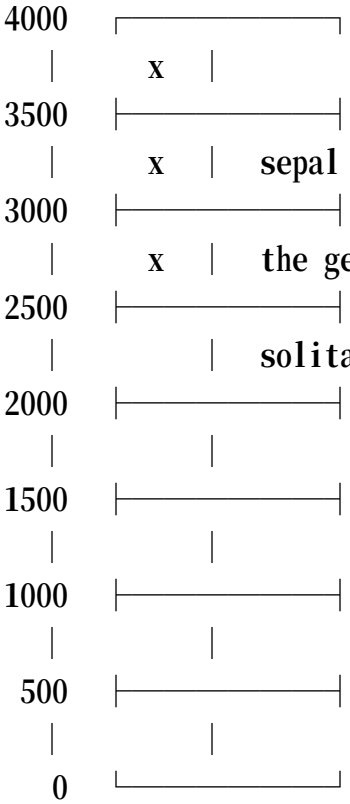
altitude



Shortia exappensiculata Hay.

Diapensiaceae flora 4：0001

altitude

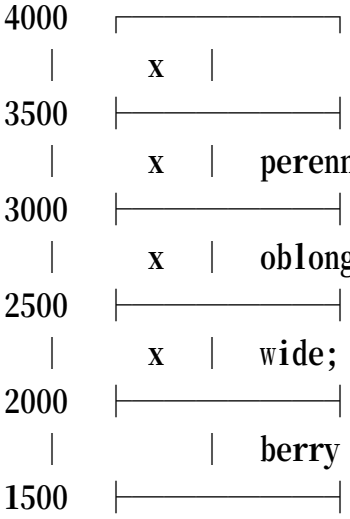


sepal united; petal imbricate; fruit capsule (in the genus Cucubalus the fruit is a berry) flower solitary.

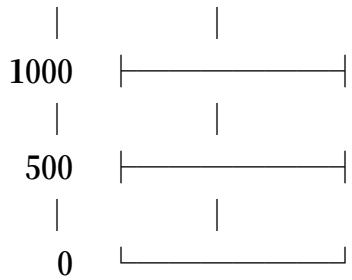
Silene morrisonmontana Ohwi.

Caryophyllaceae flora 2：0342

altitude



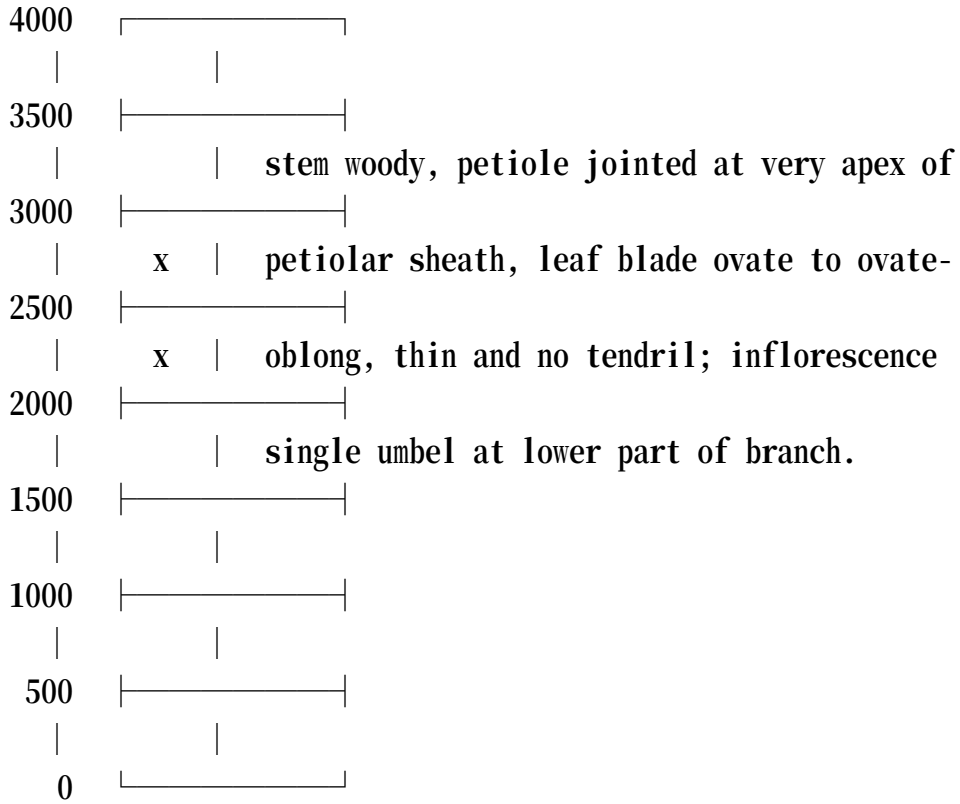
perennial herb; rhizome creeping; leaf ovate-oblong, rounded at base, 7-12cm long 2.5-3.5cm wide; panicle solitary terminal; flower white; berry globose 6-8mm across red.



Smilacina formosana Hay.

Liliaceae flora 5 : 0077

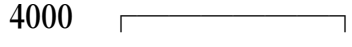
altitude

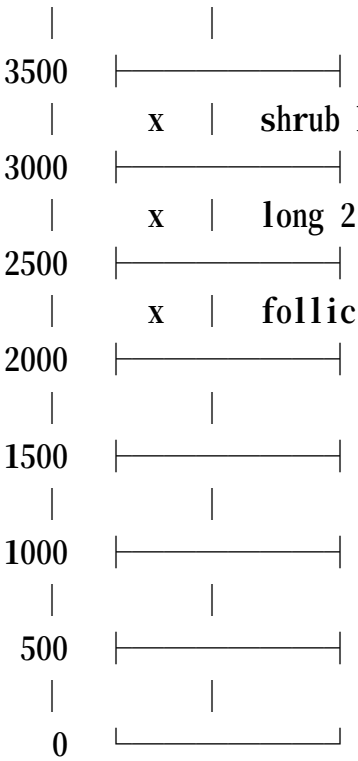


Smilax vaginata Decne

Liliaceae flora 5 : 0126

altitude



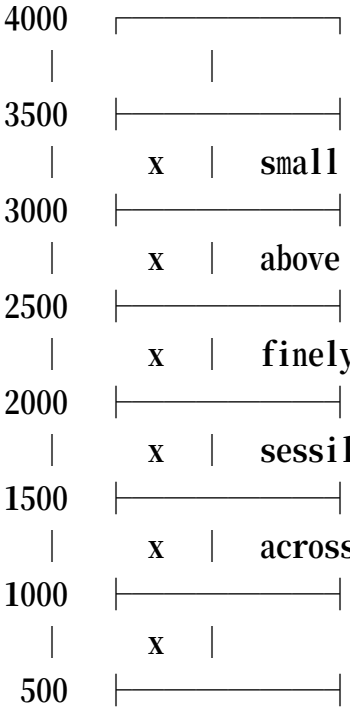


shrub branchelets, densely pubescent; leaf 4-8cm long 2-3cm wide; margin double-serrate, mature follicle spreading.

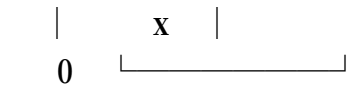
Spiraea formosana Hay.

Rosaceae flora 3：0137

altitude



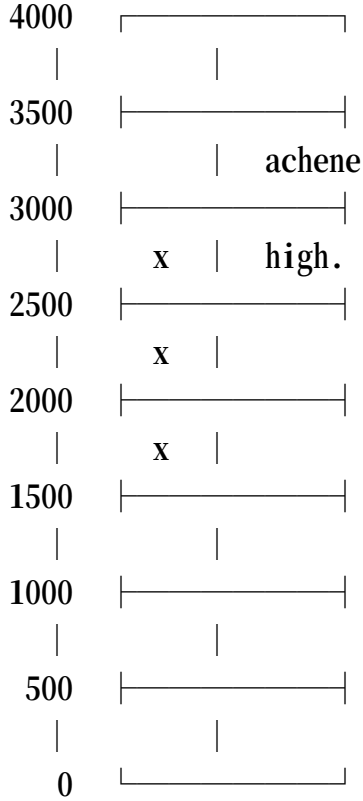
small tree with spreadig branches; leaf greenish above pale beneath, 8-13cm long 3.5-5.5cm broad, finely serrulate, pendulous; raceme 5-10cm long, sessile flower yellow; fruit subglobose 7-8mm across.



Stachyurus himalaicus Hook.

Stachyuraceae flora 3：0786

altitude

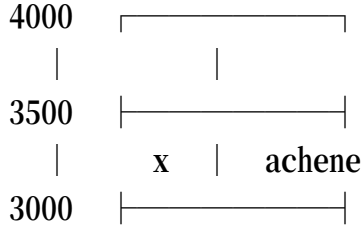


achene distinctly stipitate; stem less than 50cm high.

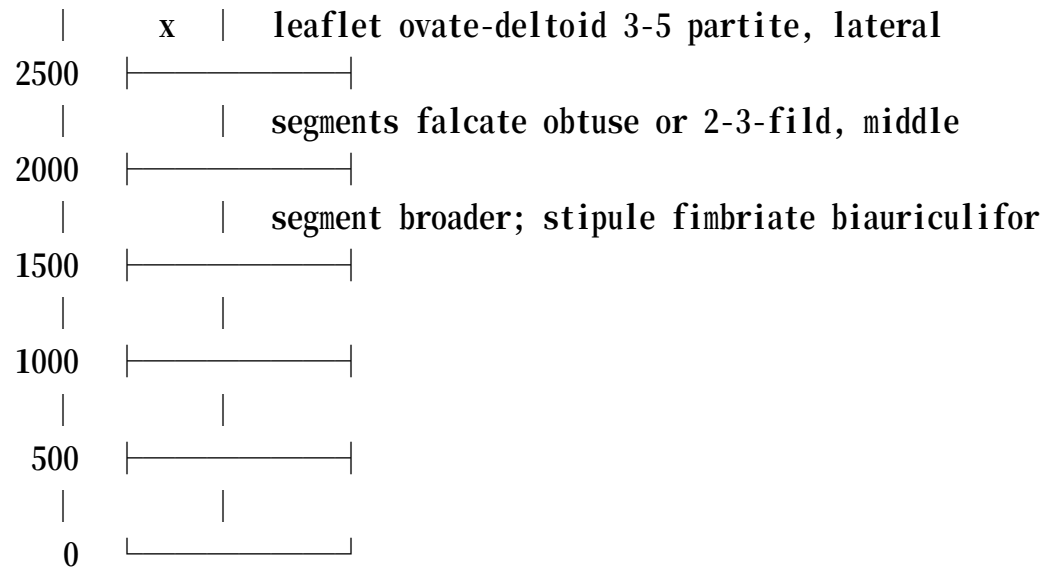
Thalictrum fauriei Hay.

Ranunculaceae flora 2：0510

altitude



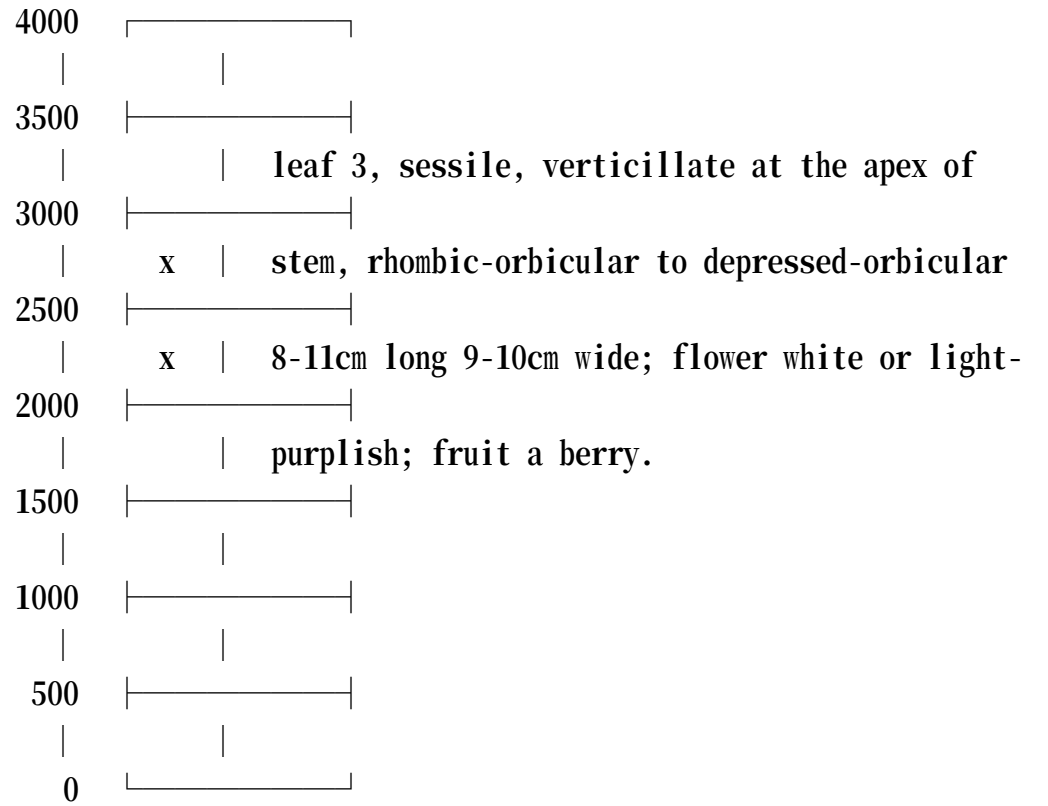
achene subsessile not stipitate; carpels 5-10;



Thalictrum myriophyllum Ohwi

Ranunculaceae flora 2：0510

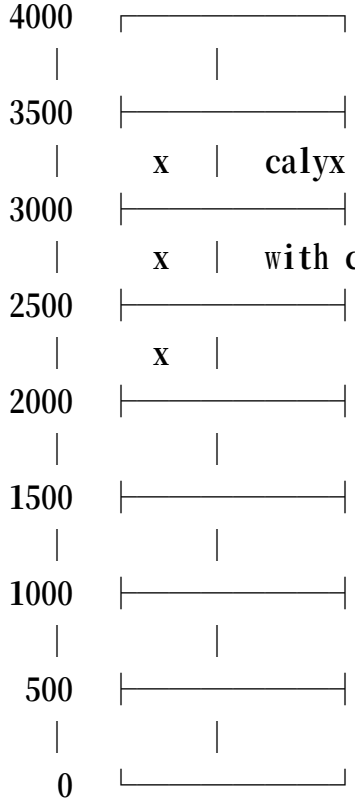
altitude



Trillium tschonoskii Maxim.

Liliaceae flora 5 : 0083

altitude

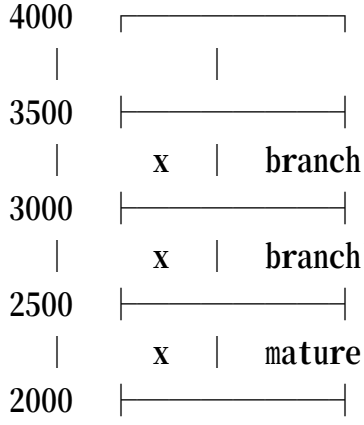


calyx without hairs, not coiled as Valeriana and with curved 4 epicalyx which Partrinia lacking.

Triplostegia glandulifera Wall.

Valerianaceae flora 4 : 0727

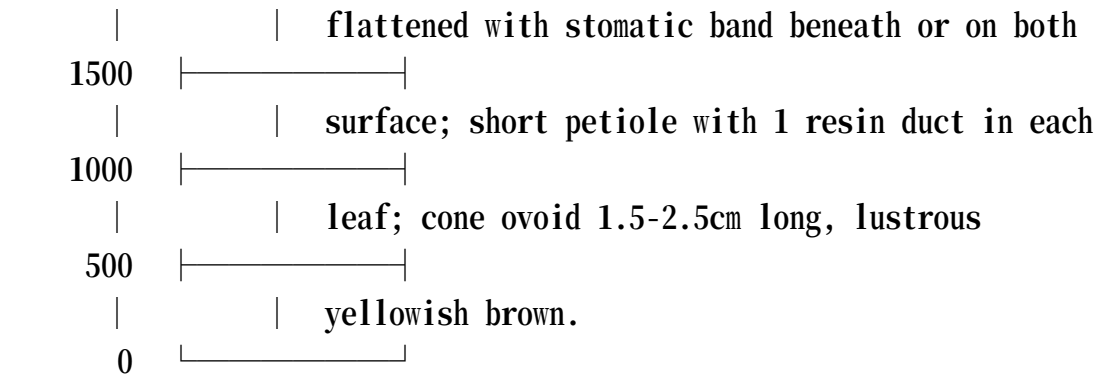
altitude



branch with long shoot only, single leaf

branchlet roughened by persistent leaf-base;

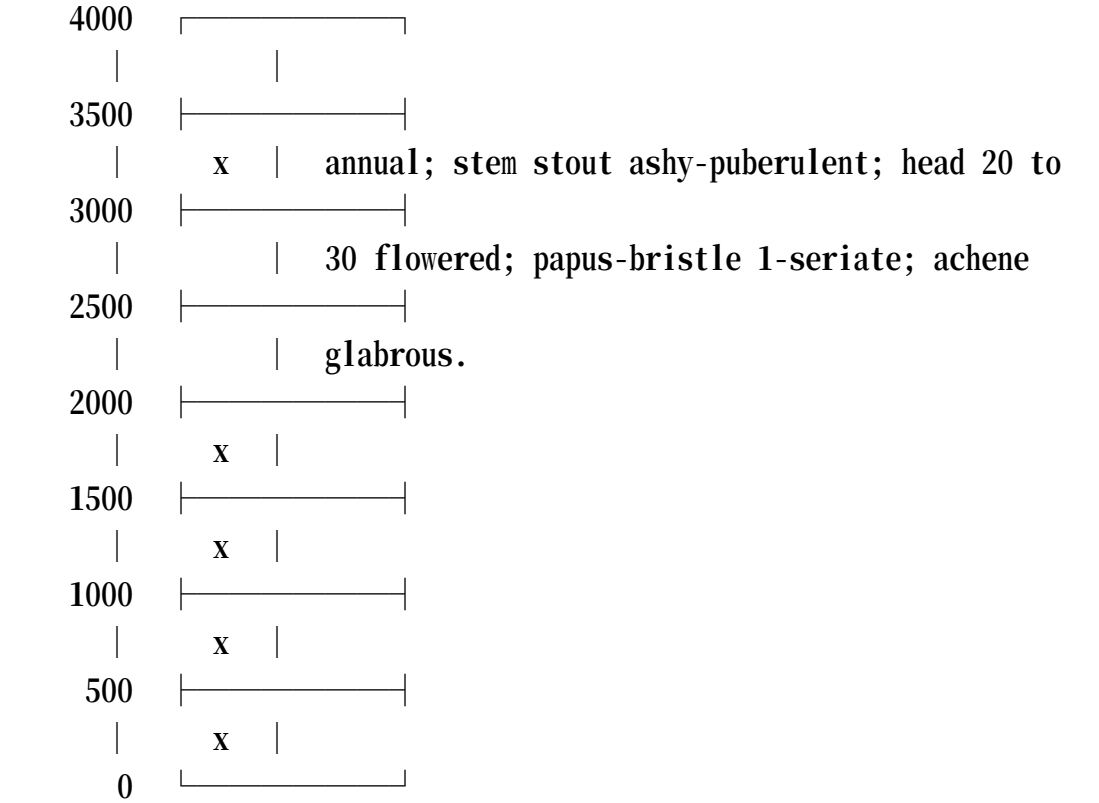
mature cone pendulous scale persistent; leaf



Tsuga chinensis Diels var. formosana Li & Keng.

Pinaceae flora 1：0528

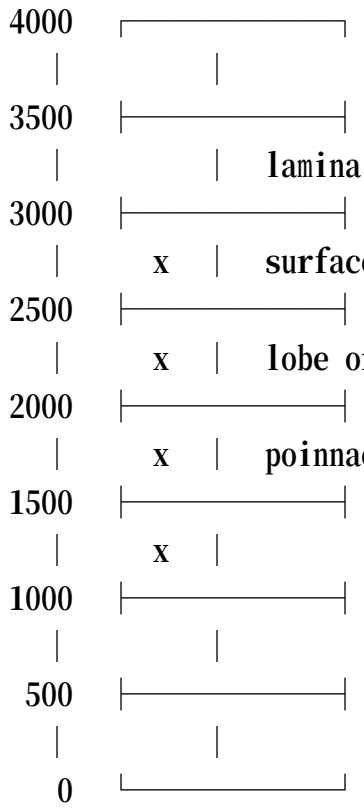
altitude



Vernonia patula Merr.

Compositae flora 4：0958

altitude

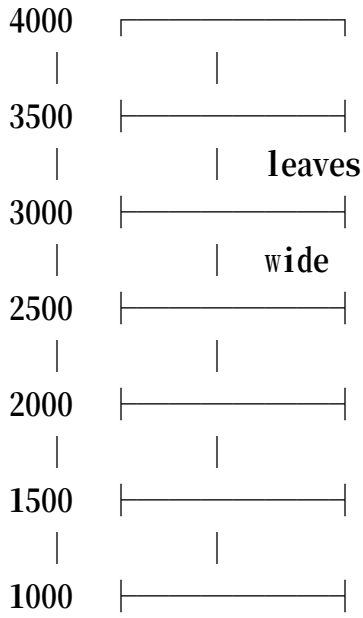


lamina linear deeply pinnatifid, covered on both surface with spreading reddish-brown hair, each lobe or pinna with only a single vein; fertile poinnae flat; sori dorsal.

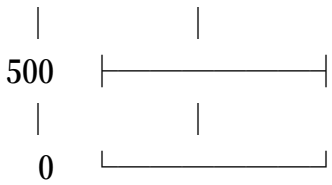
Xiphopteris okuboi Copel.

Grammitidaceae flora 1：0227

altitude



leaves entire radical leave 2-3cm long 0.5-0.6cm wide



Yushania niitakayamensis (Hay.) Keng f.

flora

圖與表目錄及附錄

前　言

天池位於高雄縣桃源鄉南橫公路上，海拔約 2280 公尺（圖一、二），該地為台灣二葉松人造林地，該土山坡多岩塊土質貧脊，谷地有數處窪地、積雨成池，其中一池最大，終年有水，而池水附近之土層較厚且濕潤，植被變化較。該地曾於十年前（1977）火燒過，去年（1987）3 月下旬又再度火燒，焚燒面積達 10.57 公頃，但時逢春天、植被復育迅速，在高山的雨季（7　8 月）蘇（32,33,34）來臨前，草木植被已將火燒的裸地完全覆蓋。調查時間從 19687 年 9 月至 1988 年 4 月。

一個生態系的發育受許多環境因子所控制，「火」是其中的因子之一（26,29），然而受人口過度膨脹的影響，與人類生活密切的「火」有意無意間成為影響生態系的主要因子。據統計，台灣在 1974　1983 這十年間，共發生森林火災達 309 次，焚燒面積 11378 公頃，主要係由人為所引起（53）。同時呂金誠（23）等研究發現台灣的森林火災以台灣二葉松（Pinus taiwanensis）林發生的頻率最高，並就火對土壤結構、有機層的變化做進一步之研究（21），認為火災對土壤有機層破壞很大，同時也會因林地覆蓋層的消失，增加土壤的沖蝕，Ahlgren(1)及 Isaac（13）亦證實如此的結果。

但是「火」對生態系的影響並非都是負面的，前面已提過，「火」亦為環境因子，有些生態系甚至需要「火」才得以維持(5)，在此所適存的植群稱為火災適存群落(fire adaptative plants)(4,36)。蘇及劉（55）認為台灣小雪山之高山草原係受週期性火災之影響，同時此因造成海拔 2800m間呈高山萱草、蕨過渡群叢及其後之二葉松、華山松過渡臨叢。

除了「火」本身對生態系的影響，不同之地理位置、植被、甚至燃燒的時間等，都可能造成許多不同的結果。如 Wright（39）認為火燒對該地土壤營養的流失影響不大，推測是因春天火燒之故。此外火燒造成植被生理的變化，如生產量的提高（38），促進開花（38），刺激種子萌發（1,6,16,35）等等都是有趣而值得加以探討的現象。

由於火燒之頻繁，國外相關之研究文獻很多，同時多已做深入之探討，反視國內火燒對生態的研究僅在近年來為少數學者（3,23）加以重視及進行研究調查，本研究的目的即在於提供火燒後生態之變化及其影響，以為一種紀錄及資料，供日後國家公園有關生態之保育及應用之參考。

研究地區與方法

3-1　取樣（Sampling）

76 年 9 月 21 日火燒之人造林區設 22 個 4 公尺平方之方形樣區。以天池兩大池水為軸心

，向四方做軸射的人為取樣（如圖三），同時在未火燒之人造林區設兩個對照樣區調查所出現之植物種類、頻度、覆蓋度植物適存特性之採證。

3-2　植被分析

調查各樣區植物之種類及覆蓋度（附錄一）。覆蓋度乃以目測其垂直投影的面積，繪於比例圖上（20×20㎝　）（附錄二）。分析各種植物之頻度及覆蓋度，並轉換為相對值，合計作為重要值（I.V.），再進一步對照樣區做相似度分析以便做進一步之植被分析。各種數值之公式如下（53）：

$$\text{頻度 F.} = \frac{\text{某種出現樣區數}}{\text{樣區總數}}$$

$$\text{相對頻度 R. F\%} = \frac{\text{某種頻度（F）}}{\text{各種頻度總和（Z F）}} \times 100$$

$$\text{覆蓋度 C.} = \frac{\text{某種佔的面積}}{\text{樣區總數}}$$

$$\text{相對覆蓋度 R. C\%} = \frac{\text{某種覆蓋度（D0）}}{\text{各種覆蓋度總和 } \Sigma \text{ D0}} \times 100$$

$$\text{相似度 I. S.} = \frac{2\ MW}{}$$

MA ＋ MB

MA、MB 表 A、B兩區內所有植物之重要值

MW 表此兩區共同種最小重要值之和

重要值ＩＶ＝Ｒ．Ｆ．＋Ｒ．Ｃ．（引用 refrence 3）

為瞭解火燒後初期植群歧異度之改變，並且採用夏農氏公式計算其歧異度指數（Shannon diversity index），公式如下：

$$D = -\Sigma \left(\frac{ni}{N}\right) \log_e \left(\frac{ni}{N}\right) = -\Sigma\, Pi \log_e Pi$$

Ｓ ： 為總數

ｎｉ： 為第ｉ種植物之重要性

Ｎ ： 為所有植物重要值之和

3-3 物理因子分析

為瞭解火燒後環境因子變化的情形，取地層表面 5㎝土壤來分析其ｐＨ值，含水量、有機質、溫度，方式如下（52）：

測ｐＨ值

採 20ｇ均質土壤加 60c.c.之蒸餾水，均勻攪拌後靜置 24hr 後用ｐＨmeter 測。

測含水量

取均質土壤用銘鉑紙密封稱重，於 105 ℃之 oven 烘乾 24hr 後取出置冷稱重。

濕重－乾重

含水量＝————————

乾重－鋁鉑紙重

有機質含量

以 105 ℃烘乾的土壤置於 550℃之 oven 經 20min 後取出置冷稱重。

乾重－烘乾（550℃）種

含水量＝————————————

乾重－鋁鉑紙重

溫度

於中午 12：00 至 PM1：30 內用溫度計插入土中約 15cm 處測每個樣區之土溫。這四種物理因子將配合植被分佈特性、分析其彼此間的相關性。

分析方法以生物統計小樣本的抽樣理論：學生 t 分配檢測火燒影響之顯著性。

圖表分析以電腦 lotus 套裝軟體分析、統計及繪圖。

資料儲存以電腦 dBaseIII 套裝軟體處理。

結果與討論

(a) 土壤分析

森林火災影響土壤之物、化性，已多為前人所深入研究（1,21），惟影響土壤的因素除火燒外，尚因土壤中微生物、坡度、原植被狀態及土壤結構之特性，而有複雜的個別差異（54）。根據調查結果，依未火燒區與火燒區及火燒區之向背陽坡面分　析土溫、土壤濕度（%）、有機質含量（%）及ｐＨ值依月變化（如圖四七）。並以 t（student）test 檢定火燒及坡面影響土壤性質之顯著性（如表一、二）。

由圖四可見土溫從十月開始往下降，在一月達最低溫，然後漸漸提昇，恰與該地季節氣候變化一致，表示氣候影響土溫。比較火燒區與未火燒區，土溫並未達 0.01 及 0.05 以上之顯著水準（見表一），表示火燒並未使土壤溫度造成明顯差異，此結果與 Fujita(7)和 Ahlgren(1) 認為火燒會因土表的裸出而提高土溫相反，推測是因本調查始於火燒後六個月才開始，此時火燒地已覆滿草本及灌木等植被，故土溫的差異已不明顯。此外由圖四向背陽面土溫之變化，經 test 分析得知二者並無明顯差異，原因同上述之推測。

由圖五土壤濕度變化表及表一及表二 t test 分析結果發現火燒後濕度顯著（P ≦0.01）提昇，而坡面則以背陽面為顯著潮濕（P ≧0.01），在前人研究(1) 火燒後土表裸出、有機層之破壞，造成土壤含水量下降，然而由上述土溫得知火燒六個月後的溫度差異已不大，同時由圖六土壤有機質變化表及 t test 分析顯示有機質在火燒後亦無明顯的破壞，以致火燒區的土壤濕度並未降低，但何以反比未火燒區顯著潮濕，主因火燒區的微環境特異（圖一）所致，因調查的火燒區多屬谷地，同時谷底有多處窪地，其中一地常年有水，另一處則會積雨成池，谷中每日下午約 3 至 4 時起霧、空氣中濕度高，而對照組（未火燒區）又恰巧位在稜線上，先天環境卻有差異，加上採土的方法以表土數公分為主，火燒區因火燒去落葉層，採到的土壤已為半腐質土，而未火燒區則多為未為微生物作用的枯枝層，依林昭遠等（21）研究土壤覆蓋層之物理特性，得證落葉層的含水量少於半腐化層。

至於向背陽坡面、濕度及有機質含量背陽坡面皆高於向陽坡面，因土溫在二者並無明顯差異，故推測是因背陽坡面土壤中微生物作用較佳、植被的復育及覆蓋度均較向陽面快且完全，如此不僅提升土壤有機含量，更因封閉的覆蓋保持土壤之濕度。

由圖七及 t test 分析得知平均ｐH值火燒後較高，但並不顯著；在火燒區之向背陽面也是一樣，據 Isaac（13）Lin（22）研究報告指出火燒後因土層裸出受雨水的淋洗發生氫離子與鹼性元素交換，使ｐH值上昇。但據 Chen（2）、Kutiel（19）指出火燒初期因灰份含量高而提高土壤ｐH值，然後因植物之再生吸收了酸性元素和微生物之固氮作用及氧之 mineralization（礦質化），使土壤ｐH漸漸下降，圖七得知背陽面因微生物較旺盛的作用，ｐH值確實比向陽面低（但未達 0.05 以上顯著性），就整體而言，ｐH值變化的範圍不超過一，並且各區值差異不大，表示該火燒並未對土壤ｐH造成明顯改變。

(b) 火燒對植被之影響

火燒後天池台灣二葉松人造林區植物種類共計 93 種（附錄三），火燒區占 85 種，未火燒區占 37 種，二區皆出現者占 28（表三）。表四顯示二區之植物社會結構，

發現火燒區及未火燒區皆以草本植物為主要角色，但以火燒區占百分之 84 為凸顯，表示火燒後次級消長的社會主要以草本為先驅，而未火燒區雖具草生社會的特色，但灌本及木本（含括喬木的幼苗）比例則提高，故推測如無火之干撓，天池人造林區將出現混生有矮灌、闊葉喬木及台灣二葉松之次生林相。底層則由耐陰性強的草本占據。

表五為天池人造林區出現頻度較高之 12 種植物，在火燒及未火燒區的重要值之月變化並以直方圖表示之（如圖八　十一），由於調查始於夏末終於初春，植被之重要值變化受季節影響很大，如在夏季占優勢的球柱草、煙火臺、巒大蕨，卻因無法過冬使其重要值遽降，然後因氣溫回昇而紛紛萌芽生長。但高山芒及玉山箭竹則無顯著之季節性變化，並且一直維持很高的優勢，由圖十可見二者在火燒區及未火燒區的表現相異其趣，高山芒在火燒區有較高的優勢度，而玉山箭竹反而在未火燒區有較高的優勢，其因將於後詳加討論。

在這 12 種頻度較高的植物中，發現白花香清、一枝黃花、台灣油點草及絨山白蘭皆在火燒區表現較大的優勢，其他則在火燒區及未火燒區優勢度相當，表示這些高出現頻度的植物，不是原本即很適應於當地的環境，即是因火燒提供廣闊的生存空間以致使種族散佈開來。

為了了解火燒後植被之生態特性及生存策略，經由定性調查得知火燒區植被多具有分生能力強旺的根莖，如高山芒及玉山箭竹（圖十二），肥大的根莖如：輪葉沙參（圖十三）、巒大蕨（圖十四）、萌蘗能力強的白珠樹及台灣馬醉木（圖十五、圖十六），能自然下種、於隔年春天萌發幼株的台灣二葉松（如圖十七、圖十八）。同時經由收集數種植物之種子及稱其重量並記錄開花期如表六，發現出現頻度高的植物（具＊號者）往往能產生很多種子，或種子很輕易傳播、或開花期很長。表七及針對 12 種出現頻度高的植物，就種子數目、種子重量、及根部做一生存策略之分配比較，由表七可看出火燒後植被的復育主要仍側重根部的繁殖能力，至於種子數目及重量，可能需經一代以上的時才能辨識該種策略的競爭力，但可依種子數目之多需及種子之輕重，推判日後的競爭潛力，一般而言種子多而輕易於占領火燒後破壞的裸地，因此競爭潛力較大，故此表概係以此為準則，對火燒後主要植被生存特性之說明。

至於火燒前後植物社會之變化，乃由計算每月之歧異度（diversity）及相似度（similarity）表示之。由表八結果發現火燒後植物的歧異度雖增加，但不顯著，表示火燒並未影響該植物社會；同時由 Bary 及 Curtis 二紙的相似度指數（index of similarity）公式計算火燒前後之變化（如表九），發現平均相似度達 67%，其間的差異則應屬取樣時微環境之差異，以及對照組未火燒區本身雖為人造林，但位於闊葉林邊界，社會組成自然會受闊葉林的影響而有差異。同時發現在 1 月時有

最高的相似度達 86%，此與上述火燒後植被復育的特性綜合觀之可了解火燒後的植被多屬原有之植被組成。據了解十年前天池人造林區曾被火燒過，生存下的植物必有一套適應的策略，據（3,23）研究指出火燒頻繁的地區往往會形成火災適存植群，今由結果發現火燒後的植被的確有適應火災的方法，同時因草生植被之生產率快，並迅速繁殖，大量之枝葉因不耐冬寒而枯萎，圖十九為 1 月 30 日所攝之天池寫景，圖二十為變山蕨之新葉及去年的枯枝，這些枯枝的累積又將成為下次火燒的誘因。

至於天池台灣二葉松林受火燒的干擾下植被是否真的符合適存植群則尚待長期分析，但對於高山芒及玉山箭竹這二種最優勢的植物，分析結果發現高山芒在火燒後佔有顯著的優勢（t=6.5 **），反之玉山箭竹則相反，在未火燒區較有顯著的優勢（t=4.5 **），圖二十一可看出高山芒和玉山箭竹彼此間有明顯的消長。火燒後高山芒占很高的優勢，但若無火燒之干擾玉山箭竹將逐漸的侵入而與高山芒並列優勢，其主因乃高山芒為C4 植物，能適應乾熱的環境，在火燒後的裸地上以其根莖旺盛之無性繁殖，因此能在短時間內迅速復育並拓展領域，尤其由圖二十二比較，高山芒在向陽面的優勢度來看更顯示出C4 植物的特性。反之玉山箭竹屬C3 植物較不耐熱，對火燒後裸地競爭力較差，尤其是向陽坡面更加凸顯，但因能耐陰，可充份利用覆蓋度高的林床，故能在植被復育之後達到優勢的地位，亦即如果火燒因子消失則玉山箭竹將會轉而超越高山芒的地位。

Table 1. The T test analysis of soil factors between burned and unburned area

	soil temperature		soil-water		organism		pH value	
	burned	unburned	burned	unburned	burned	unburned	burned	unburned
X	11.91	10.78	92.04	52.66	20.28	22.29	5.24	5.18
S	2.16	1.87	18.66	11.61	5.78	13.30	0.16	0.29
S	4.66	3.50	348.29	134.84	33.28	172.30	0.027	0.03
T	0.79		3.58**		0.281		0.504	

** $P \leqq 0.01$

* $P \leqq 0.05$

Table 2. The T test analysis of four soil factor between sunny and shady slope in burned area

	temperature	moisture	organism	pH value

	sunny	shady	sunny	shady	sunny	shady	sunny	shady
X	13.72	11.07	65.35	110.18	15.92	22.97	5.24	5.03
S	2.64	1.78	18.89	23.82	3.45	3.71	0.179	0.212
N	5	5	5	5	5	5	5	5
t	1.67		2.95**		2.787**		1.24	

** P ≦ 0.01

* P ≦ 0.05

Table 3. The vegetation in Tein-chih pinus forest

蕨類植物	8 科	12 種
裸子植物	3 科	3 種
被子植物		
雙子葉植物	24 科	58 種
單子葉植物	8 科	20 種
總　　計	43 科	93 種

Table 4. The burned and unburned vegetation composition in Tein-chih

herb plants (含 fern)	71 種	84 %	26 種	70%
shrub plants	11 種	13 %	7 種	19%
tree	3 種	3 %	4 種	11%
total	85 種	100 %	37 種	100%

Table 5. The dorminant plants at Tien-chih

SPECIES	AREA	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.
7	B	2.28	1.66	2.95	1.92	3.14	2.83
	U	3.31	0.00	0.00	0.00	0.00	0.00
12	B	2.75	2.79	5.89	5.66	6.80	4.49
	U	0.00	0.00	3.85	5.04	8.15	3.29
14	B	7.47	1.48	0.00	0.69	1.23	4.02
	U	0.00	4.00	7.56	4.79	4.07	3.29
15	B	9.62	7.34	10.35	8.28	3.93	4.75

	U	0.00	0.00	3.77	5.26	-------	3.92
17	B	14.87	4.49	5.86	0.00	0.00	0.80
	U	11.67	4.82	0.00	0.00	0.00	0.00
20	B	4.22	2.35	4.92	4.45	4.37	4.77
	U	8.49	16.22	10.51	10.95	11.75	9.80
27	B	47.28	73.36	64.62	70.95	69.37	70.98
	U	47.30	43.89	46.08	57.08	49.20	42.59
28	B	17.57	21.61	29.33	33.44	37.65	34.49
	U	25.66	49.46	48.88	40.30	45.83	48.64
33	B	3.75	1.30	2.75	1.93	0.68	0.64
	U	0.00	0.00	0.00	0.00	0.00	0.00
35	B	3.68	4.81	4.29	5.08	4.26	4.14
	U	-------	4.82	3.85	4.95	-------	-------
55	B	5.02	10.08	6.98	4.52	4.86	4.45
	U	-------	4.31	3.77	0.00	0.00	3.35
61	B	1.51	5.40	6.12	7.20	3.64	7.84
	U	3.38	-------	-------	5.01	4.22	3.48

*B=burned area

*U=unburned area

-------=missing value

Table 6. The seed No., Seed weight. and reproductive perieds of some piants on the burned area in Tien-chih

	seed No.	seed Wt.	reproductive periods	higher frequency	
玉山箭竹	200	0.0012 g	6	3 (月)	
白花香清	700	0.00002	6	12	*
刀傷草	800		7	9	
一枝黃花	300	0.0001	6	3	*
山苦賈	2500	0.001	7	10	
球柱草	1700		6	10	*
煙火苔	350	0.00063	6	10	*
白珠樹	10000	0.000067	6	9	
刺芒野古草	1000	0.00024	6	11	
高山芒	10000	0.00093	8	12	*
鐵掃帚	150	0.0014	6	10	

台灣百合	1800	0.0023	6	9	
玉山小米草	1200	0.00016	6	9	
絨山白蘭	3600	0.00024	6	11	*
台灣澤蘭	1500	0.0003	6	3	
台灣油點草	750	0.0002	6	10	*

Table 7. The analysis of twelve higher frequency platns

	survival competitive potential		
	seed No.	seed Wt.	root/rizhome
百花香清	* *	*	* * *
一枝黃花	*	* *	* * *
球柱草	* *	*	* * *
煙火苔	*	*	* * *
大　蕨			* * *
高山白珠樹	* *	*	* * *
高山芒	* * *	* *	* * *
玉山箭竹			* * *

台灣油點草	* *	*	* * *
地刷子		* * *	
絨山白蘭	* *	*	* * *
苔屬		* * *	

* 表示生存策略著重部位之程度

Table 8. The diversitv of the post-fire vegetation at Tien-Chih

Month	Burned	Unburned	Burned/Unburned
OCT	1.28	1.20	1.08
NOV	1.19	1.14	
DEC	1.32	1.05	
JAN	1.25	1.09	
FEB	1.09	1.05	
MAR	1.20	1.32	
Total	7.35	8.85	
Average	1.23	1.14	

Table 9. The similsrity comparison between burned and unburned*****

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AVER.
VALUE	56%	52%	64%	66%	74%	66%	67%

附錄一　樣區植物覆蓋面積記錄表

地點：　　日期：

No	覆蓋面積　樣 區 species									
1	Araceae Arisaema formosana 台灣天南星									
2	Berberidac Mahonia Oiwaknesis 阿里山十大功勞									
3	Campanulac Adenophora triphylla 輪單沙參									
4	Caryophyll Dianthus pugmaeus 玉山厄竹									
5	Caryophyll Stellaria vestia 疏花繁縷									
6	Commelinac Cyanotis vaga 鴨舌疝									

7	Compositae Anaphalis Margaritaceae 白花香清									
8	Compositae Cirsium 蘇屬									
9	Compositae Eupatorium formosanum 台灣澤蘭									
10	Compositae Ixerislaevigata Var oldhami 刀傷草									
11	Compositae Picris hier acioides 玉山毛蓮菜									
12	Compositae Solidage 一枝黃花屬									
13	Compostiae Sonchus oleraceus 苦滇菜									
14	Cyperaceae Bulbostylis densa 球柱草									
15	Cyperaceae Carex Cruciata subsp. crucuata 煙火苔									
16	Cyperaceae Carex macrandrolepis 和平菱果苔									
17	Dennstaedt Pteridium 鬱大蕨 aquilinum subsp. 碗、蕨科									
18	Elaeagnace Elaeagnus obocata 小單胡頹子									
19	Ericaceae Gaultheria									

	leucocarpa 白珠樹									
20	Ericaceae Gaultheria ifoama 高山白珠樹									
21	Ericaceae Lyonia ovalifolia ovalifolia. 南燭									
22	Ericaceae Pieris taiwanesis 台灣馬醉木									
23	Ericaceae Rhododendron elliptica L. 西施花									
24	Gentianace Gentiana 台灣 atkinsoni Buric var. 龍膽									
25	Gramineae Agrostis davata Trin. subsp. mar 翦股穎									
26	Gramineae Arundinella setosa 刺芒野古草									

附錄二 覆蓋度估算表

樣區代號 植相

植物名稱：

總數：

平均高度（約）：

結論與建議

1.由土壤分析結果得知天池之火燒並未嚴重影響土壤成份及破壞其結構。此與火燒的季節性有關（39），春天發生的火燒往往能在植被旺盛的萌蘗力或萌芽率迅速復育，減少火對該地生態的影響。此外向陽坡面與背陽坡面之土壤溫度及濕度有明顯差異，故火燒後植被復育及種間競爭亦有明顯差異，此亦造成趨異度之增高。

2.台灣高山之森林火災頻傳，光是天池一地十年間已火燒二次，分析該地主要為台灣二葉松次生林，林床以草本為多，灌叢錯落其間，因草本植物每年冬天累積大量的枯枝落葉，外加松林本身富含松脂、材質易燃，極易引發火災。依結果得知，天池人造林區火燒後的植被並無太大的改變，月平均相似度達 67%，1 月甚至高達 86%，可知火燒區植被多為原來植被之再生，分析這些植物生存的策略，發現草本則藉盤生之根莖（如高山芒），多汁、肥大的根莖（如巒大蕨）、鱗莖；灌木則藉強旺之萌蘗能力，且能迅速的開花、結果（如台灣馬醉木）。至於喬木以台灣二葉松為代表，其藉毬果保護種子，並能在火燒後自然下種。此外前人研究指出火燒會提高種子的萌芽率，將生育時間縮短、及增加開花（12），以成為火燒後的適存種，亦有人提出火災適存植群一名詞（4 ），尤其強調在火燒頻繁之地所常見之植群，（3,23）研究指出台灣二葉松應屬火災適存植群，芒草類（Miscanthus spp）及巒大蕨為火燒適存種，綜此研判天池火燒後之植被已有火災適存植群之特色。

3.天池人造林地以高山芒及玉山箭竹為主要優勢種，但火燒地則以高山芒占顯著優勢，此現象除受生理之差異，火災所提供開放的裸地，亦是帶動彼此消長之因。因C4 植物耐乾耐熱，故高山芒能在火燒地，特別是向陽面表現出優勢；C3 植物耐陰故能在遮陰地如背陽面或植被覆蓋層多的未火燒區占到優勢，預期若無火之控制，灌叢及喬木的生長將增加底層的遮閉性，屆時玉山箭竹將會凌駕於高山芒之優勢地位。

4.高山地區之森林，由於林床結構本易引起火災，但由本研究中知道，南橫已有多種火災適存植群，所以火災對林相之破壞不大。因此在火災後若此植物能自然復育，可將火災區保留，供學術單位進行生態研究，其結果極富教育意義，可供遊客了解火災後自然界復育之生態意義。

參考文獻

1.Ahlgren, I.F. and C.E. Ahlgren, 1960, Ecological effects of forest fires. Bot. Rev, 26：483-535.

2.Chen, M.Y. et al. 1987 Using hygrometer to measure the decomposition

status of litter layer of Taiwan red pine forest. The Department of Soil and Water Conservation National Chung Hsing University Taichung, Taiwan, Republic of Chain. 19 : 51-60

3.Chen, M.Y.,K.C. Lu, and C.Y. Lin, 1987. The Early post-fire succession of taiwan red forest. Bulletin of The Experimental forest of National Chung Hsing University. 8 : 1-10

4.Cwynar, L.C. 1987 Fire and forest history of the north cascade range. Ecol , 68(4) : 791-802

5.Cooper, C.F. 1961 The ecology of fire. Sci. Ame, 204 : 150-160

6.Floyd, A.G. 1966 Effect of fire upon weed seeds in the wet sclerophyll forests of northern new south Wales. Aust. J. Bot. 14 : 243-256

7.Fujita, H. 1987 The effects of fire on soil nitrogen mineralization and chlorophyll contents of Miscanthus sinensis, Ecol. Rev. 21(2) : 87-91

8.Gill, A.M. and D.H. Ashton, 1968 The role of bark type in relative tolerance to fire of three central Victorian eucalypts. Aust. J. Bot. 16 : 491-498

9.Grimm, E.C. 1984 Fire and other factors controlling the big woods vegetation of Minnesota in the mid-nineteenth century. Ecol. Mon. 54(3) : 291-311

10.Haney, T.L. 1971 Succession after fire in the chaparral of southern California. Ecol. Mon. 41(1) : 27-52

11.Hare, R.C. 1965 Contributin of bark to fire resistantance of southern trees. J.For. 1965 : 248-251

12.Hulbert, L.C. 1988 Causes of fire effects in tallgrass pairie. Ecology 69 (1) : 46-58

13.Isaac, L.A. 1937 The forest soil of the douglas fir region, and changes wrought upon it by logging and slash burning. Ecology 18(12) : 264-279

14.James, S.W. 1988 The postfire environment and earthworm populations in tallgrass prairie, Ecol, 69(2) : 176-183

15.Keeley, J.E. 1977 Seed production, seed populations in soil, and seedling production after fire for two congeneric pairs of sprouting and nonsprouting chaparral shrubs. Ecology 58(4) : 820-829

16.Keeley, J.E. 1977 Role of fire in seed germination of woody of taxa in California chaparral. Ecology 58(2) : 439-443

17.Kilgore, B.M. 1979 Fire history of a sequoia-mixed conifer forest. Ecology 60(1) : 129-142

18.Krefting, L.W. 1974 Small mammals and vegetation changes after fire in a mixed conifer-hard wood forest. Ecology 55(6) : 1391-1398

19.Kutiel, P. 1987 The effect of fire on nutrients in a pine forest soil. Plan. Soil 104 : 269-274

20.Lewis, W.M. 1974 Effects of fire on nutrient movement in a south Carolina pine forest. Ecology 55(5) : 1120-1127

21.Lin, C.Y. 1985 Effects of fire on the aggregate stability of Taiwan red pine forest soil. Q.J. Chin. For. 18(3) : 45-52

22.Lin, C.Y. 1985 Effects of fire on the soil erosion and nutrient loss of Taiwan red pine forest at MT. Tong-Mao. J. Chinese Soil and Water Cons. 17(2) : 42-49

23.Lu, K.C. 1986 The post-fire succession of Taiwan red pine forest at Jen-Luen. Exp. Forest of National Chung Hsing University 7 : 11-22

24.Mastson, P.A. et al. 1987 Nitrogen transformations following tropical forest felling and burning on a volcanis soil. Ecology 68(3) : 491-502

25.Mutch, R.W. 1970 Wildland fires and ecosystem-A hypothesis. Ecology 51(6) : 1046-1051

26.Odum, E.P. 1971 Basic ecology. Saunders college publishing pp.278-284

27.Payton, E.J. 1984 A post-fire succession in the northern Urewera forest north island. New Zealand New Zealand Bot. 22 : 207-222

28.Smith, R.L. 1977 Fire in the environment Elements of Ecology. 2th, 178-197. Harper & Row publishers, New York

29.Stark, N. and R. Steele 1977 Nutrient content of forest shurbs following burning. Amer. J. Bot. 64(10) : 1218-1224

30.Steward, K.K. and W.H. Ornes 1975 The autecology of sawgrass in the Florida everglades. Ecology 56 : 162-171

31.Stone, E.C. 1951 The stimulative effect of fire on the flowering of the golden brodiaea(Brodiaea ixioides Wats. var. Jugens Jeps.). Eoology 32(3) : 534-537

32.Su, H.J. 1987 Studies on the climate and vegetation types of the natural forest in Taiwan(I) Aalysis of the variations in climatie factors. Q. J. Chin. For. 17(3) : 1-14

33.Su, H.J. 1984 Studies on the climate and vegetation types of the natural forest in Taiwan(II) Altitudinal vegetation zones in relation to temperature gradient. Q.J. Chin. For. 17(4) : 57-73

34.Su, H.J. 1985 Studies on the climate and vegetation types of the natural forest in taiwan(III) A schame of geographical climatic regions. Q.J. Chin. For. 18(3) : 33-44

35.Takahashi, M. and T. Kilcuchi 1986 The heat effect on seed germination of some species in the initial stage of a post-fire vegeattion. Ecol. Rev. 21(1) : 11-14

36.Tsuda, S. et al. 1986 Initial stage of vegetational recovery after Rifu forest fire in April 27, 1983. Ecol. Rev. 27(1) : 1-7

37.Tsuda, S. 1985 Post-fire vegetation compared with cut-over on the subalpine zone in Okahichibu, central Japan. Ecol. Rev. 20(4)：285-290

38.Wein, R.W. and L.C.Bliss 1973 Changes in arctic Eriophorum Tussock communities following fire. Ecology 54(4)：845-852

39.Wright, R.F. 1976 The impact of forest fire on the nutrient influxes to small lakes in northeastern Minisota. Ecol. 57(4)：649-663

40.李瑞宗, 1985

林口紅土台地之植物相調查與邊坡植被分析

台大植研分類組碩士論文。

41.劉儒淵, 1997

恆春半島南仁山區植群生態與植物區系之研究

台大森林學研究所樹木學組。

42.陳玉峰, 1983

南仁山之植被分析

台大植研所碩士論文。

43.楊勝仁, 1987

台灣南部社頂地區放牧草原植群及其演替之研究

台大森林學研究所樹木組。

44.陳明義、蔡進來編著, 1983

植物生態學實驗

中興大學教務處出版組印。

45.陳明義、呂金誠, 1987

森林火災對森林生態系之影響

台灣植物資源與保育, 中華民國自然生態保育協會刊印, 59-76。

46.蘇鴻傑、劉棠瑞, 1979

森林植物生態學

台灣商務印書館發行, pp 378-379

附錄三　天池樣區、植物名錄

NO	FAMI	SPEC	PHYSIO	STRATEGY	BURNED	UNBURNED
1	Araceae	Arisaema formosana Hayata	p.h	rhizome	*	*
2	Berberidaceae	Mahonia japonica (Thunb.) Dence.	p.t	resprout	*	
3	Campamulaceae	Adenophora triphylla (Thunb.)	p.h	resprout	*	
4	Carypophyllaceae	Dianthus pugmaeus Hayata	p.h	rhizome	*	*
5	Caryophyllaceae	Stellaria vestita Hayata	p.h	undetermined	*	
6	Commelinaceae	Cyanotis vaga Hayata	a.h	rhizome	*	
7	Compositae	Anaphalis	p.h	stolon	*	

		margaritaceae (L.) Benth					
8	Compositae	Cirsium arisanense Kitamura	p.h	rhizome	*	*	
9	Compositae	Eupatorium formosanum Hayata	p.h	rhizome	*		
10	Compositae	Ixeris laevigata (Maxim.) Kitamura	p.h	rhizome	*	*	
11	Compositae	Picris bieraciodes L. (Hayata) Kitamura	u.h	undetermined	*		
12	Compositae	Solidago virga-aurea L. (Benth.) A. Gray	a.h	rhizome	*	*	
13	Compositae	Lactuca sororia Miq.	p.h	rhizome	*		
14	Cyperaceae	Bulbostylis dense (Wall) Hand.	p.h	stolon	*	*	
15	Cyperaceae	Carex cruciata Wall	p.h	stolon	*	*	
16	Cyperaceae	Carex nubigena (Hayata) T.Koyama	p.h	stolon	*		
17	Dennstaedtiaceae	Pteridium (Wall.) Shieh	p.f	rhizome	*		
18	Elaeagnaceae	Elaegnus obovata Li	p.s	resprout	*		

19	Ericaceae	Gaultheria leucocapa cumingiana(Vidal) Sleumer	p.s	resprout	*	*	
20	Ericaceae	Gaultheria itoama Hayata	p.w	resprout	*	*	
21	Ericaceae	Lyonia ovalifolia (Wall.) Drude	p.s	unburned		*	
22	Ericaceae	Pieris taiwanensis Hayata	p.s	resprout	*	*	
23	Ericaceae	Rhododendron elliptica L.	p.s	unburned		*	
24	Gentianaceae	Gentiana atkinsonii Buric (Hayata) Yamamoto	p.h	stolon	*		
25	Gramineae	Agrostis clavata Trin.	a.h	undetermined	*	*	
26	Gramineae	Arundinella setosa Trin	a.h	undetermined	*		
27	Gramineae	Miscanthus transmorrisonensis Hayata	p.h	stolon	*	*	
28	Gramineae	Yushania niitakaymensis (Hayata) Keng f.	p.w	stolon	*	*	
29	Juncaceae	Juncus effusus L. Buchen	p.h	stolon		*	

30	Labiatae	Origanum vulagre L. Hayata	u.h	undetermined	*	
31	Leguminosae	Lespedeza cumeata G. Don.	p.h	rhizome	*	
32	Liliaceae	Lilium formosanum Wallace	p.h	bulb	*	
33	Liliaceae	Tricyrtis formosana Bak.	p.h	rhizome	*	
34	Lycopodiaceae	Lycopodium clavatum L.	p.f	rhizome	*	
35	Lycopodiaceae	Lycopodium complanatum L.	p.f	rhizome	*	*
36	Compositae	Ixeris chinensis (Thunb.) Nakai	a.h	rhizome	*	*
37	Orchidaceae	Herminium lanceam var. lomgicrure Hara	p.h.	rhizome	*	*
38	Polygoncaceae	Polygonum runcinatum Buch. Ham	a.h	undetermined	*	
39	Rosaceae	Rosa transmorrisonesis Hayata	p.s	resprout	*	*
40	Salicaceae	Salix fulvopubescens Hayata	p.s	resprout	*	
41	Scrophulariaceae	Euphrasia	a.h	undetermined	*	

		transmorrisonensis Hayata					
42	Smilacaceae	Smilax Hayatae T. Koyama	p.v	undetermined	*	*	
43	Theaceae	Eurya crenatifolia (Yamamoto) Kobuski	p.s	resprout	*	*	
44	Urticaceae	Gonostegia hirta Mig	p.h	undetermined	*		
45	Violaceae	Viola caespitosa D. Don	p.h	rhizome	*	*	
46	Guttiferae	Hypericum nagasawoi Hayata	p.h	undetermined	*		
47	Osmundaceae	Osmunda japonia Thumb.	p.f	rhizome	*		
48	Campanulaceae	Wahlenbergia marginata(Thunb.) A. DC.	p.h	rhizome	*		
49	Dryopteridaceae	Acrophorus stipellatus(Wall.)	p.f	rhizome	*		
50	Athyriaceae	Athyrium reflexipinnum Hayata	p.f	rhizome	*		
51	Scrophulariceae	Hemiphragma heterophyllum	p.h	rhizome	*		
52	Compositae	Gnaphalium hypoleucum DC.	p.h	stolon	*		

53	Scrophulariaceae	Mazus pumilus (Brum.f.) Steemis	a.h	undetermined	*		
54	Urticaceae	Chamabainia cuspidata Might	a.h	undetermined	*		
55	Cyperaceae	Carexfilicina Nees	p.h	stolon		*	
56	Compositae	Aster lasioclada Hayata	p.h	rhizome		*	*
57	Cupressaceae	Chamaecypairs formsensis Matsum.	p.t	resprout	*		
58	Polypodiaceae	Crypsinus taiwanesis (Tagawa) Tagawa	p.f	rhizome	*	*	
59	Rosaceae	Rubus calycinoides Hayata	p.s	resprout	*	*	
60	Oxalidaceae	Oxalis corniculata L.	p.h	stolon		*	
61	Cyperaceae	Carex spp.	p.h	stolon	*		
62	Athyriaceae	Athyrium cryptogrammoides Hayata	p.f	rhizome	*		
63	Polypodiaceae	Leposorus pseudo-ussuriensis Tag	p.f	stolon		*	*
64	Liliaceae	Liriope angustissima Ohwi	p.h	stolon	*	*	
65	Berberiaceae	Berberis spp.	p.s	resprout		*	

66	Salicaceae	Salix okamotoana Koidz	p.s	resprout	*		
67	Gramineae	Cymbopogon nardus (L.) Rendle	p.h	rhizome	*		
68	Polygalaceae	Polygala Japonica Houtti	p.h	stolon	*		
69	Ophiglossaceae	Botrychium termatum (Thunb.) Sw	p.f	rhizome	*		
70	Saxifragaceae	Astilbe longicarpa (Hayata) Hayata	p.h	rhizome	*		
71	Salicaceae	Salix taiwanalpina Kimura	p.s	resprout	*		
72	Smilacaceae	Smilax spp.	p.v	rhizome	*		
73	Aceraceae	Acer morrisonense Hayata	p.t	unburned		*	
74	Pinaceae	Pinus taiwanensis Hayata	p.t	unburned	*	*	
75	Rosaceae	Duchesnea indica (Andr.) Focke	p.v	stolon	*	*	
76	Polypodiaceae	Crypsinus engleri (Luerss) Copel	p.f	rhizome		*	*
77	Caprifoliaceae	Lonicera acuminata Wall. W	c.p	resprout	*		
78	Rosaceae	Spiraea prunifolia (Hayata) Li	p.s	resprout	*		

79	Pinaceae	Tsuga chinensis Li	p.t	unburned	*		
80	Polygonaceae	Pinus taiwanensis Hayata	p.t	unburned	*	*	
81	Gentianaceae	Gentiana flavomaculata Hayata	p.h	stolon	*	*	
82	Gleicheniaceae	Diplopterqium glaucum(Houtt) Nakai	p.f	unburned	*		
83	Polygonaceae	Polygonum chinexe L.	p.h	rhizome	*		
84	Rosaceae	Cotoneaster morrisonensis Hayata	p.h	resprout	*		
85	Compositae	Chrysnathemum arisanense Hayata	p.h	rhizome	*		
86	Compositae	Gynura Bicolor (Willd) D.C.	u.h	undetermined	*		
87	Labiatae	Salvia plebeia R. Br.	u.h	undetermined	*		
88	Liliaceae	Aletris formosana (Hayata) Sasak	p.h	undetermined	*		
89	Trochodendraceae	Trochodendron aralioides Sieb	p.t	unburned	*	*	
90	Campamulaceae	Adenophora urhata Yamamoto	p.h	rhizome	*		

91	Guttiferae	Triadenum breriliflorum Y. Kimura	p.h	rhizome	*
92	Rubiaceae	Galium spp.	u.h	undetermined	*
93	Polygalaceae	Polygala paniculata L.	p.h	rhizome	*

玉山國家公園關山區維管束植物調查研究報告

發　行　人：葉　世　文

計劃主持人：郭　長　生

參 與 人員：王建平　王弼昭　曾景亮　梁素雲

張惠英　翁莉莉　蕭淑娟

出　版　者：內政部營建署玉山國家公園管理處

地址／南投縣水里鄉民生路 112 號

電話／（049）773121

印　刷：台興印刷廠

初　版：中華民國七十七年七月七日