ABSTRACT

A MONOGRAPH OF THE GENUS *MAACKIA*

By Carolyn K. Levings

The genus *Maackia* (Papilionoideae, Fabaceae) comprises trees and shrubs native to China, Japan, Korea, Russia, and Taiwan. Morphologically, *Maackia* appears most closely related to *Cladrastis*. However, molecular data indicate that *Maackia* is distantly related to that genus, being more closely allied to some *Sophora* species, *Salweenia*, and *Euchresta*, whereas *Cladrastis* is basal to the subfamily. Individual floras have mentioned the genus, but none have included all the species in *Maackia*, and no previous monograph exists. Over 600 specimens were obtained on loan from herbaria around the world. Separate analyses of fruiting and flowering specimens were conducted, because flowers and fruit do not occur simultaneously on one plant. From 130 specimens, 77 vegetative characters, 16 pod and seed characters, and 56 floral characters were measured. Data were analyzed using NTSYS – pc and MINITAB. Eleven species are recognized, one of which is new, another newly named, and a new subspecies combination made.

A MONOGRAPH OF THE GENUS *MAACKIA*

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INTRODUCTION

The genus *Maackia* Ruprecht & Maximowicz (subfamily Papilionoideae, Fabaceae) is comprised of small trees and shrubs, and is native to eastern Asia, specifically Korea, China, Russia, Japan, and Taiwan. The earliest known collections were made by Richard Maack and Carl Maximowicz from the Amur region of Siberia in 1855. Ruprecht and Maximowicz (1857) described the genus and type species based on material collected by Maack and by Maximowicz. Maximowicz introduced *M. amurensis* into cultivation in 1864 (Andrews 1996).

Maackia has historically been placed in the tribe Sophoreae (Andrews 1996), and has been thought most closely related to *Cladrastis* Raf. (Duley and Vincent 2003). The Sophoreae was divided into the following groups (the names of which are derived from genera contained in each group) based on floral morphology: *Angylocalyx*, *Baphia*, *Cadia*, *Camoensia*, *Dussia*, *Myroxylon*, *Ormosia,* and *Sophora* (Polhill 1981). *Maackia* was included in the "*Sophora* group" along with *Calpurnia, Cladrastis*, and *Sophora.* The Sophoreae is now widely recognized as being a polyphyletic assemblage of at least four clades: the “core genistoids”, the Mirbelieae/Bossiaeeae, the Hypocalypteae, and the Brongniartieae (Crisp et al. 2000; Doyle et al. 1997). The groups have also been congregated into loose complexes, the genistoid alliance (including the Sophora group, and hence, *Maackia*), and the galegoid complex, based on preliminary molecular information (Polhill 1981). Based on rbcl data, Käss and Wink (1995) split the Sophoreae into “Sophoreae I” (containing *Sophora japonica*, positioned as sister to the rest of the Papilionoideae) and “Sophoreae II” (containing *Sophora davidii, S. flavescens,* and *S. jaubertii*, positioned as sister to the Thermopsidae, at least in part [see their Figs. 3 and 4]). In 1996, the same authors subdivided the Sophoreae into “Sophoreae I” (containing *Castanospermum australe* and *Sophora japonica*, positioned as sister to the Papilionoideae), “Sophoreae II” (containing *Myroxylon balsamum* and *Sophora secundiflora*, positioned as sister to Abreae, Galegeae, Vicieae, Trifolieae, Coronilleae, and Phaseoleae), “Sophoreae III” (containing *Sophora davidii, S. flavescens* and *S. jaubertii*, positioned as sister to Genisteae, Croatalrieae, Thermopsidae, Podalyriae, and *Maackia* [which is basal to this entire clade]) (Käss and Wink 1996). In a third paper, Käss and Wink (1997) showed *M. amurensis* falling out in “Sophoreae III”. In more recent studies, *Maackia* is shown to be only distantly related to *Cladrastis*, and more closely allied to other members of “core genistoids”, specifically *Euchresta horsfeldii* and *Sophora* species (*flavescens*, *jaubertii*, and *microphylla*) (Crisp et al. 2000; Doyle et al. 1997), or to *Salweenia* and *Sophora bhutanica* (Doyle et al. 1997; Kajita et al. 2001), and sister to Thermospsidae (both studies). Other genera grouped with *Maackia* are *Acormium*, *Bolusanthus*, *Bowdichia*, *Clathrotropis*, *Dicraeopetalum*, *Ormosia*, *Platycelyphium*, and *Salweenia* (Crisp et al. 2000). The "*Sophora* group" has recently been treated as more restricted, and *Maackia* is separated from both *Sophora* and *Calpurnia* (Heenan et al. 2004; Lewis et al. 2005). Using matK, *Maackia* falls out in the genistoid clade with a bootstrap value of 81-91%, and with *Piptanthus nepalensis, Baptisia australis, Thermopsis rhombifolia, Ammodendron argenteum, Sophora davidii*, and *S. nuttalliana* (Wojciechowski et al. 2004). Wang et al. (2006) derived a phylogeny of a group of genera (Thermopsidae) and related genera based on ITS sequences, but did not include *Maackia* in the study, so the placement by Wojciechowski et al. (2004) remains to be tested.

GENERAL HABITATS

Most species of *Maackia* inhabit forest regions throughout what is known as East Asia (Figure 1) – the Russian Far East, northeast China, Korea, and Japan, which is generally characterized as a temperate region. *Maackia* also is found in southeast China, Taiwan, and the Ryukyus, which are considered to be subtropical. In some regions, *Maackia* species are found in climax forests, although in other regions, members of the genus are found in understories of secondary forests. A discussion of the habitats in each of the countries in which *Maackia* is found is given below.

Russia. *Maackia* resides in the southern part of the Russian Far East, along the Amur and Ussuri Rivers and Lake Hanka. In Russia, the habitat is generally a mixed forest of broad–leaved deciduous and coniferous trees. Winters are cold, and summers are warm. Precipitation annually in this region is from 550 to 650 mm. *Maackia amurensis* is a member of the middle tree layer (Kolbek et al. 2003).

China. The majority of *Maackia* species dwell in the eastern half of China. Species reside in old growth forests, mountainsides, and near rivers. The genus endures monsoonal climates with hot, rainy summers and cold, dry winters. *Maackia amurensis* is a dominant species in the temperate mixed–forest region, the largest forest type in northeastern China; annual precipitation for this region ranges from 500 to 800 mm. In the northern temperate mixed–forest region where *Pinus koraiensis* is dominant, *M. amurensis* is one of the few deciduous species. Among the *Quercus* dominated temperate deciduous broad–leaved forest, *M. amurensis* is common. In the *P. koraiensis–Picea jezoensis–Abies nephrolepis* forests, *M. amurensis* is a common understory species. In the *Pinus koraiensis–Betula costata–Tilia amurensis* forests, *Maackia amurensis* is one of the dominant species in the upper shrub layer. *Maackia amurensis* is one of the dominant canopy species in the *Quercus mongolica* forests, and is an associated canopy species in the *Q. aliena* forests. Among the *Betula platyphylla* forest and *Populus tremula* var. *davidiana–B. platyphylla* forest, *M. amurensis* is a member of the canopy. *Maackia* is also an important member of the *Tilia amurensis–Acer mono* forest. In *Fraxinus mandshurica–Juglans mandshurica* and *Kalopanax septemlobus* forests, *M. amurensis* is associated with the canopy and tree layer respectively. The genus also extends down to the Korean border along the Changbai Mountains. The annual precipitation is between 500–800 mm. The region is classified as a mixed evergreen coniferous–broadleaved deciduous forest, and *M. amurensis* is a major species in the region (Kolbek et al. 2003).

Korea. The Korean peninsula is characterized by a highly mountainous geography, cold, dry winters, and wet, monsoonal summers. The climate varies greatly from north to south, where temperatures can range from below 0^{o} C to 26^{o} C on the shores of Cheju Island. In the north and interior peninsula, cool temperate and boreal forests cover the region. *Maackia amurensis* occupies mixed forest between 500 and 1100 m in the Changbai mountains, as well as the mixed deciduous forests that cover all of North Korea (Kolbek et al. 2003; Zheng et al. 1997). *Maackia fauriei* is endemic to Mt. Halla on Cheju Island (Kong and Watts 1993).

Taiwan. The only species of *Maackia* in Taiwan, *M. taiwanensis*, is restricted to mountain sides on the northwestern corner of the island in two national parks.

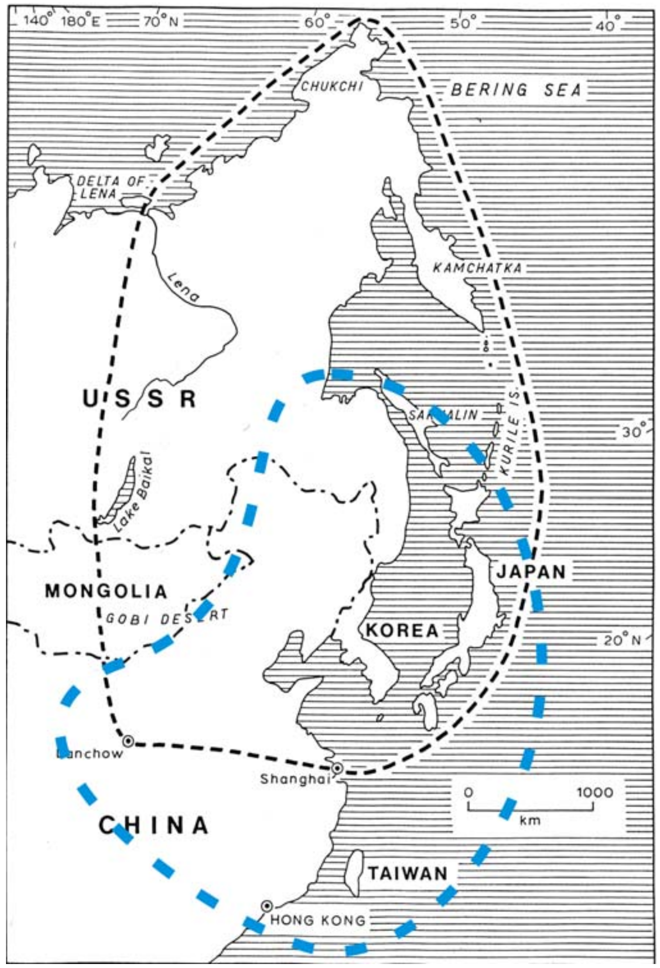


Figure 1. Map of East Asia (black dashed line) with the range of *Maackia* in blue dashed line. Original image from Kolbek et al 2003.

Japan. *Hokkaido*. On this island, the summers are mild and short, the frostless season is less than 150 days, the winters are cold and long; the precipitation is on average 1500 mm per year, and snow covers the ground 130 to 180 days a year; the fog is dense along east coast during summer. Boreal conifer forests are interspersed with mixed broadleaf deciduous forest and corresponds with southern Canada and northern Europe (Hara 1959; Kolbek et al. 2003). *Maackia "buergeri"* is one of the major woody species in the *Quercus mongolica* forests, which are fragmented and now a secondary forest on the island. *Honshu*. Three major mountain ranges intersect on Honshu, creating climatic variation. Generally the climate is of an inland type with precipitation being less than 2000 mm a year and the temperature ranging from 8–12^{o} C. Some of the same vegetational elements that characterize the Amur and Ussuri regions of China also occur on the island. Deciduous broad leaved forests dominate the lower part of the mountains, although subalpine coniferous forests occur on the upper zones (Hara 1959). *Maackia* occurs on volcanic mountain sides in crevices from old lava flows–the Mt. Iwate lava flow from 1686 (Ishizuka et al 1974), which has not grown over and where depressions in lava flow accumulate detritus allowing *M. " buergeri"* to grow, and the Mt. Zao lava flow from 1200 years ago (Ishizuka et al 1974) containing scoriaceous deposits towards north where *Maackia "amurensis"* grows. *Maackia* also grows in the temperate broad–leaved forests. *Shikoku* and *Kyushu*. The islands are grouped together in the Western Japan floral region. There are mild winters and warm summers in the north, with mean annual temperatures ranging from 14–15^{o} C. Forest types are extensions of those found on southern Honshu, including secondary mixed forests and warm temperate broad-leaved evergreen forests. The south has hot summers and mild winters, with 1500–2500 mm annual rainfall. Primary forests are broad leaved evergreen, and secondary forests are mixed deciduous. *Maackia* inhabits volcanoes, forests and seasides (Hara 1959). *Ryukyus.* The northern part of the archipelago shares floral characteristics with Kyushu and Shikoku. Most of the flora is subtropical, but there are some relict temperate species relating to the rest of Japan. Temperate species also occupy the mountainsides. The genus has been reported on seasides and the volcanoes of the northern islands (Hara 1959).

FOSSIL HISTORY

The fossil record for *Maackia* is ambiguous at best. Unfortunately pollen and leaflet data alone are indeterminate when differentiating members of the Sophoreae, because these isolated characters are not differentiated in this group. An example is *Sophora miojaponica* Hu et Chaney (Figure 2, 3 a.–b.) from Miocene China. The authors based their generic placement of this fossil on the fact that the leaflet impressions resemble a *Sophora* leaflet. However, they also resemble leaflets from the other paripinnate and imparipinnate Sophoreae, such as *Cladrastis*, *Maackia*, or woody *Sophora*. The Sophoreae are thought to have existed since as early as the Eocene (Herendeen 1992); however, fossil Sophoreae share features with modern *Haplormosia, Maackia*, *Clathrotropis*, *Bowringia*, *Bowdichia*, *Calpurnia*, *Cladrastis*, and *Sophora* (Crepet and Herendeen 1992), making identifications of the fossils difficult.

Budantsev (2003) hypothesized that legumes migrated to North America to northeastern Asia during an optimal climatic period, and that the migration peaked by the end of the middle Eocene. If this is the case, then *Maackia* evolved as a genus during or after this migration, since there is no unequivocal fossil record for the genus in North America. Below is a geographically-based discussion of fossils attributed to *Maackia*.

Russia. Budantsev (2003) cites specimens that may be *Maackia* from the Tchemurnautian formation of the middle Eocene on the eastern coast of Penzhinskaya Bay, western Kamchatka, Russia.

Japan. *Maackia tanaii* Huzioka (Figure 2, 2 a.–d.) was found in the Ube coal–field on Honshu and is believed to have existed during the Eocene. It most closely resembles *M. tashiroi* in leaflet characters and *M. floribunda* in fruit characters (Huzioka and Takahasi 1970). Huzioka and Takahasi (1970) mention another name, "*Maackia ugoensis"*, dating to the Miocene in Japan. When looking for the protologue, the citation specified for "*M. ugoensis"*, *Tertiary Floras of Japan; Miocene Floras* from 1963, did not mention that name. However, the method of citation for the 1970 text was not specific, so I am looking for other Huzioka papers from 1963 in search of the missing protologue. *Maackia onoei* Matsuo (Figure 2, 1 a–b.) was also dated from the Miocene on Honshu (Huzioka and Takahasi 1970). The description mentions a resemblance to *M. amurensis* and a distribution in Kanmachi and Tsuchikawa (Tanai et al. 1963). Ozaki (1991) described a fossil similar to *Maackia* from Nagano, central Honshu, from the Miocene-Pliocene, late/upper Tertiary.

China. Yu et al.(2000) found fossil pollen attributed to *Maackia* in mid-Holocene deposits (6000-18000 yr bp) in a study of palaeovegetation of China.

North America. Herendeen and Wing (2001) described fossil Papilionoid fruits and leaves which might be similar to *Maackia* from paleocene deposits in northwestern Wyoming. Miocene flora treatments divide the fossil flora into two types, in which Aniai floral type includes *Maackia* (Ishizuka et al. 1974).

Korea. There is no fossil record of *Maackia* in Korea, though there are fossil records of the Sophoreae, specifically *Cladrastis* (See Figure 2, 4.) (Huzioka 1972).

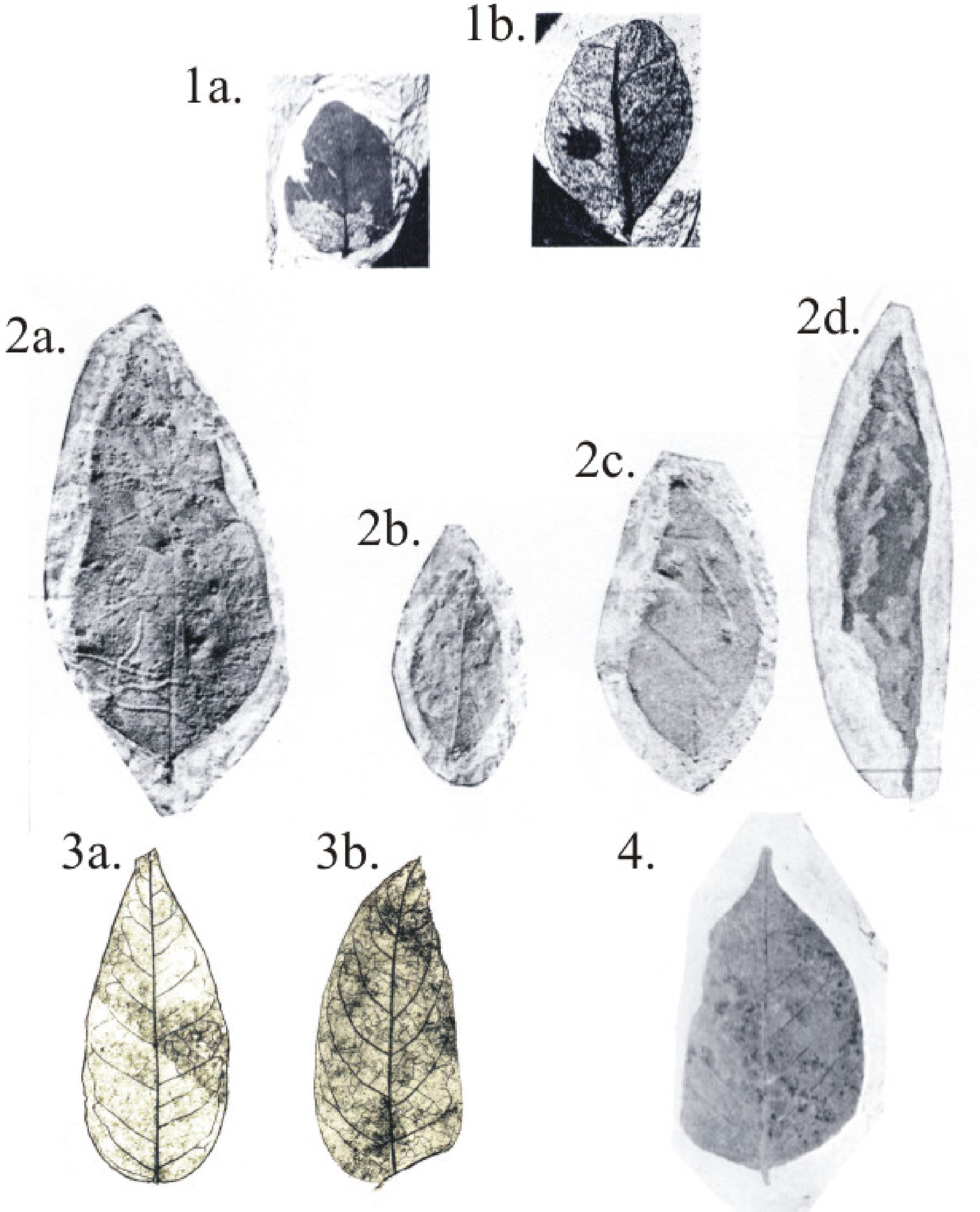


Figure 2. Fossils from temperate East Asia. 1 a.–b. *Maackia onoei* Matsuo (images from Tanai et al 1963); 2 a.–d. *M. tanaii* Huzioka (images from Huzioka and Takahasi 1970); 3 a.–b. *Sophora miojaponica* Hu et Chaney (images from Hu and Chaney 1940); 4. fossil *Cladrastis* from Korea (image from Huzioka 1972).

PHYTOCHEMISTRY

In recent years, the chemical constituents of certain species of *Maackia* have been studied in hopes to find new medical uses for major diseases, such as a variety of cancers, hepatitis, diabetes, Alzheimer's, and HIV. Not all species have been examined.

Chemical constituents of *Maackia amurensis* are well studied. Many unique chemicals have been obtained from the species. Among these have been a polyphenol called maackiasine and a novel stilbenolignan named maackoline (Kulesh et al. 1995). Lectins have been found in the heartwood of *M. amurensis* that have medical potential. MAL, *Maackia amurensis* lectin, binds to sialic acid containing carbohydrates; MAH, *Maackia amurensis* hemagglutinin, is a clotting agent; and MAM, *Maackia amurensis* mitogen, is a mitogenic agent (Brinkman-Van Der Linden et al. 2002; D'avila-Levy et al. 2004; Kawaguchi et al. 1974; Knibbs et al. 1991; Van Damme et al. 1997). The lectins have also been found to bind to certain oligosaccharides (Bai et al. 2001). Isoflavonoids have also been found in the species including: isoflavones, stilbenes, isoflavostilbenes, stilbenolignan, dimeric stilbenes, orobol, tektorigenin, (-)-medicarpin, (±)-vestitol, and (±)-3-hydroxyvestitone (Fedoreyev et al. 2000; Kulesh 2001).

Other Maackia species from which chemical compounds have been isolated include *M. fauriei*, *M. tashiori, M. hupehensis, M. floribunda*, and *M. "buergeri"*. *Maackia fauriei* contains a chemical called MFA, *Maackia fauriei* lectin, a lectin homologous to the lectins found in *M. amurensis* (Kim et al. 2004). The species also contains nine isoflavones, an isoflavone glycoside, and two isoflavonoids in the heartwood (Hwang et al. 1998). *Maackia tashiroi* contains a unique chemical called tashiromine. It accumulates this alkaloid along with lupin alkaloids, as is also the case in *M. "buergeri"*. *Maackia tashiroi* also has a special N_{15}-oxide version of (-)-camoensidine (Ohmiya et al. 1991). *Maackia hupehensis* (*M. chinensis* sensu auct.) also has a unique chemical, hupeol and has been shown to accumulate alkaloids similar to those found in southern Japanese species (Wang et al. 1999). The species *M. floribunda* and *M. tashiroi* accumulate lupinine-type alkaloids (Wang et al. 1999).

Maackia "buergeri" has many of the same chemical constituents that *M. amurensis* has in its seeds, bark and heartwood. One of the unique chemicals in the species is a flavanone called maackiaflavanone (Matsuura et al. 1994). Three pterocarpans have also been found in the heartwood: maackiain, pterocarpin, and homopterocarpin (Maekawa and Kitao 1970). *Maackia "buergeri"* also accumulates maackiamine, camoensidine, and piperidine alkaloids, including a new natural piperidine called (+)-maackiamine (Ohmiya et al. 1990; Saito et al. 1989). Studies indicate that this species differs from the other species in Japan by accumulating sparteine-like alkaloids (Kubo 1997).

USES

Economic uses. *Maackia amurensis* wood is used by the Chinese as pit props because of anti-rot properties and is valued by woodworkers for cabinets, veneers, instruments, and turnery (Shishkin 1945). It is also used for handles, house interiors, furniture, and utensils (Lewis et al. 2005). Japan imports *M. amurensis* timber from China for decorative uses (Anonymous 1992). Wood from *M. "buergeri"* is also used for decorative purposes in Japan, and the indigenous culture of the country, the Inu, were reported to use the tree to ward off evil spirits (Andrews

1996). Other uses of *M. amurensis* include forage, erosion prevention, and bee crop (Lewis et al. 2005).

Medical uses. Chemicals in *Maackia amurensis* have high antiradical and antioxidant activity with low toxicity (Fedoreyev et al. 2004). Maksar is a hepatoprotector derived from extracts of *M. amurensis* that exceed other drugs in performance; the drug prevents the development of acute hepatitis, induces the flow of bile, and has an antioxidant effect in the case of diabetes (Fedoreyev et al. 2004). *Maackia amurensis* lectin, in combination with *Sambucus nigra* lectin, is used to detect fetal fibronectin, which in turn indicates the possibility of premature birth (Hampel et al. 1999). Another chemical associated with the species can detect MGC, microglial cells, which may be a precursor to Alzheimer's (Zambenedetti et al. 1998). Polyphenols from *M. amurensis* have been found to normalize the metabolic function of the liver following hepatitis (Fedoreyev et al. 2000). Researchers have shown that chemicals in the leaves of *Maackia fauriei* have an inhibition of 14% on the HIV–1 protease (Park et al. 2002). There is potential that the lectin found in *M. fauriei*, MFA, can be used in cancer research (Kim et al. 2004). *Maackia hupehensis (chinensis* sensu auct.*)* contains water–soluble extracts that were traditionally used to wash painful swellings (Perry 1980).

NODULATION

Nodulation in legumes has been well–studied, mostly in herbaceous genera. Legume nodules have a stem-like anatomy, even though they occur on the roots (Doyle 1994). *Maackia* is one of the woody legumes that can form rhizobial relationships. Two of the species, *M. amurensis* and *M. "buergeri"* have known to have nitrogen-fixing associations with rhizobia (Corby 1988; De Faria et al. 1989; Foster et al. 1998; Pai and Graves 1995). Pai and Graves (1995) found that 11 strains of *Bradyrhizobium* would form symbiotic relationships with *M. amurensis* if the seedlings were inoculated early in life. It was recently found that *M. floribunda* also forms rhizobial relationships and shares all but one strain with *M. amurensis* (Foster et al. 1998).

HORTICULTURE

Some *Maackia* species have been used horticulturally (Cullen 1995; Griffiths 1994; Kelly 1995; Rehder 1947). The cultivated species of *Maackia* are versatile plants that are underused in the landscape industry. They have qualities that make them valuable to urban forestry and to the garden, including compact shape, drought tolerance, late blooming, disease and pest tolerance, and decorative bark (Phillips 2003). Seven species have been introduced into cultivation (Table 1), and six are currently in limited use around the world, mostly in northeastern North America and Europe.

Maackia amurensis, Amur maackia or pagoda tree, is the most widely cultivated of the species, and has been used in container gardening on decks and patios, in buffer strip plantings, as a highway tree, and as a shade tree in parking lot islands or in urban neighborhoods (Gilman 1997; Manley 2003; Wiersema 1999). *Maackia amurensis* is also used for erosion control

(Wiersema 1999), is pest resistant (Dirr 1990), and its roots do not break up sidewalks or clog drains, making it ideal for urban settings (Graves 1990). This species flowers when other plants stop, is adaptable to many environments (Dirr 1990), and is usually self-fertile (Anonymous 1992). The seeds are easy to germinate, just needing to be soaked in hot water overnight or in sulfuric acid for an hour (Phillips 2003). Some drawbacks to using *M. amurensis* are its slow growth (about 12 feet every 20 years), wind intolerance, and need for good drainage (Dirr 1990). Flowers are reported to have a smell similar to mown grass (Manley 1999), and bumble bees have also been observed near the plant (Manley 1999). Foliage turns yellow in fall (Rushforth 1997). Amur Maackia has been reported to reach an age of 200 to 250 years (Shishkin 1945).

Maackia "buergeri", Japanese maackia or inu-enju, is the second most widely cultivated species of this genus. It was first cultivated in 1892 and survives best in zone 4. Japanese maackia is late blooming (July to September).

Maackia fauriei, Dolbi tree or saishu-inu enju, was introduced into cultivation in 1917 (Andrews 1996; Bean 1973), but has not had the success of *M. amurensis*. It thrives in zone 5, and flowers from July to September (Rehder 1947).

Maackia hupehensis (*M. "chinensis*" of horticultural literature), Chinese maackia, was first cultivated in 1908 and lives in zones 4 to 5 (Kelly 1995). Although cultivated more than *M. fauriei*, *M. hupehensis* also has not reached the success of *M. amurensis*. It flowers from July to August, and fruits in October (Steward 1958). This species is known for having silky silver–grey spring foliage (Stafford 2006).

Maackia tashiroi, shima-enju, was introduced in 1919 and survives in zone 5 (Rehder 1947). After its initial introduction, *M. tashiroi* apparently disappeared from cultivation, except in Japan, from which recently cultivated specimens from Japan have been examined. It also flowers in late summer, July to August (Ohwi 1965).

From comparisons of distributional ranges with published USDA zone maps for China and Japan, other Chinese species of *Maackia* apparently grow in the following USDA zones: *M. australis* in 9 to 10, *M. chekiangensis* in 8 to 9, and *M. hwashanensis* in 6 to 8; in Japan, *M. floribunda* is found in zones 4 to 5. *Maackia taiwanensis* is apparently found in zones 9 to 10.

Table 1. Horticultural information for cultivated *Maackia* species. Data from Andrews (1996), Kelly (1995), Steward (1958), and herbarium materials.

Species	Common name	Habit	Hardiness zone	Native distribution	Flowering time	Fruiting time
M. amurensis	Amur maackia, Pagoda tree	Tree	3 – 7	Manchurian Russia and China, Korea	June to August	September to October
M. "buergeri"	Inu – enju, Japanese maackia	Tree	4	Japan: Hokkaido, northern Honshu	July to September	October
M. chinensis (sensu auct.)	Chinese maackia	Tree	4 – 5	central China	July to August	September to October
M. fauriei	Dolbi tree	Tree	5	Korea: Jeju island	July to September	October
M. floribunda	Hanemi – no – inu – enju	Shrub	Unknown	Japan: southern Honshu, Kyushu, Shikoku	July to September	October
M. tashiroi	Shima – enju	Shrub	5	Japan: Kyushu, Shikoku, Ryukyus	July to August	September to October
M. tenuifolia	Naked – leaf saddle – back tree	Shrub	6	central and south China	April to May	June to July

HERBIVORY AND DISEASES

Looking through horticultural and botanical texts on the genus, one main point keeps cropping up: *Maackia* is incredibly resistant to disease and herbivory. In its native territories, herbivory and disease on the genus has only been documented in the last decade.

In the U. S., there has been one report of Japanese beetle, *Popillia japonica,* herbivory in New Hampshire (Manley 1999). There have also been reports since the 1980's of herbivory by a beetle, Chinese tortrix (*Cydia trasias*), on *Maackia* "*buergeri*". *Cydia trasias* attack the petioles and legumes, overwintering in the legumes, bark fissures and twigs (Zhang et al 2003). However, no tree mortality due to this beetle herbivory has been reported (Enda and Yamazaki 1987; Zhang et al 2003). Preliminary observations also indicate that deer, voracious herbivores in the middle U. S. states, do not eat *M. amurensis* (Vincent, pers. comm.).

A bacterial canker, specific to the genus, belongs to the LOPAT group of *Pseudomonas* and is the first, and only, known bacterial disease of the genus. The cankers appear on the branches and trunk, with longitudinal swellings as initial symptoms. In some cases cankers were observed to form on pruning scars, although other cankers girdled the tree by spreading horizontally. No treatment for the canker has been described in literature on the disease (Sakamoto et al. 2000).

Even with the recent reports of herbivory and disease, the genus is remarkably resistant compared to many other horticultural tree species. It could be inferred that the large amount of polyphenols embedded in the seeds, bark, leaves, and wood have something to do with protection. The other species of *Maackia* should be examined, to determine if this apparent resistance is a generic characteristic.

MORPHOLOGY

Habit. Species of *Maackia* are all woody trees or shrubs. Trees range 6 to 12 meters tall, sometimes reaching 24 meters. Shrubby species can reach 1.8 meters.

Bark. Bark is exfoliating when young, at least in *M. amurensis*. In all species for which data are available, trunk bark is reported to be coppery in color, with green young stems. Older specimens tend to have grey–brown bark. Bark patterns appear to differentiate as the trees age (Figure 4).

Leaves. Leaves of all *Maackia* species are alternate, imparipinnate, and without stipules. Overall leaf shape is elliptical to obovate. Leaves can be pubescent or glabrous. Petioles are green and glabrous to pubescent. The pulvinus is located at base of petiole, becoming wrinkled as leaf dries, and may be pubescent or glabrous.

Leaflets. Leaflets are ovate, elliptical or obovate, with acute to acuminate apices and rounded, acute, or cuneate bases. Leaflets lack stipels. The pulvinus is green, pubescent or glabrous, and barrel-shaped, becoming wrinkled when dry.

Vestiture. *Maackia* specimens may be glabrous to slightly to densely pubescent, often with young growth tomentose, becoming less pubescent to glabrous with age. Leaflets may be glabrous or pubescent adaxially; abaxial surfaces may be glabrous to densely or sparsely pubescent or may be pubescent only along the base of the midrib. Leaflets of *M. tashiroi* are ciliate on the margins when young, but these hairs are lost with age. Pulvini are glabrous to pubescent, sometimes with pubescence persisting only at the juncture between the pulvinus and the rachis. Individual hairs on pubescent species are unicellular, attenuate or acicular to subulate or conical (Figure 5), ranging in length from 150 to 800 μm.

Inflorescence. All species have indeterminate racemes, either compound or simple, without peduncular bracts. The peduncle is pubescent in all species.

Flowers. Flowers are papilionoid, white when fresh and turning yellow in age or when dried. All flowers are bracteolate, these either persistent or deciduous. Pedicels are always pubescent.

Bracteoles. Bracteoles are pubescent, and either long and attenuate or short and lanceolate.

Calyx. Calyces (Figure 6) of all species of *Maackia* are campanulate (slightly bilabiate) and pubescent, persisting on the fruits. The upper 2 lobes (teeth aligned with the banner) can be fused for their entire length or only partially, forming teeth. The lower 3 lobes are only fused partially, forming teeth of approximately the same length. In some cases, calyx teeth are so short as to be practically nonexistent.

Corolla. The banner petal in all species of *Maackia* is emarginate (shallowly to deeply) and reflexed at the point where a thick callus is positioned or a thickened claw joins the lamina. In those species without the thickened callus, a discolored area that is only slightly thicker than the lamina rests where the callus would be. In each species, the banner is shorter than or the same length as the wing, and the banner claw is straight. The wing is oblong with both a spur and an auricle, with a bent claw. The keel is also oblong, with a spur, and is either the same length as the wing or longer. For all species the keel claw is straight, and the two keel petals are slightly fused at the apex. All the petals are white when fresh, and the callus is green when present.

Style and stigma. Styles and stigmas are glabrous in all species. The style is typically straight and half the length of the ovary. Stigmas on all species are minute and terminal.

Ovary. The ovary in all species is pilose and sessile or subsessile.

Stamen filaments. All species have 10 filaments that are fused only at the base. Filaments are typically of two lengths, randomly dispersed around the pistil.

Anthers. Anthers are bilocular, dorsally basifixed, introrse, and dehisce longitudinally.

Pollen. Pollen is typical as for members of the Sophoreae, being small and subspheroidal, lacking any derived characters, with 3 colpi that are equal in length to the polar axis. *Maackia* pollen has a markedly margined os (Chung and Lee 1990), and the ornamentation is finely reticulate (Ferguson et al 1994).

Fruits. Fruits are dry, dehiscent to tardily dehiscent legumes that are sessile to subsessile. The legumes are straight and flat with 1–3(4) seeds. Styles and calyces are generally persistent. Legumes are either pubescent or glabrous. In each species, legumes have wings of varying widths along the ventral suture.

Seeds. Seeds are yellow–brown to red–brown. All species have flat, smooth, asymmetrical seeds with a symmetrically shaped hilum below the radicle notch, followed by a faboid split. The hilum rim color is darker than the rest of the seed. Seeds are connected via the funiculus along the suture side of the legume. The funiculus is the same color as the hilum and is persistent when the legume is open. In all species the cotyledons are smooth and convex. Seeds have seed coat dormancy, as is typical for legumes.

Anatomy. One of the distinguishing features of wood of the species of *Maackia* that have been analyzed is that the wood is ring porous, although most of the Sophoreae have diffuse porous wood (Gasson 1994). The wood has tangential, oblique, radial or wavy associations of latewood vessels, vascular tracheids, axial parenchyma, and earlywood vessel frequency of 2–7 per linear millimeter. Vessel elements that range from 130 to 340 µm long, with fibers that are 630–1400 µm in length, simple perforation plates, and vestured and alternate intervessel pits (Fujii et al. 1994). See figure 8.

Figure 3. Habit of *Maackia* spp. grown in cultivation. 1. *M. amurensis* (image from Missouri Botanical Garden), 2. *M. "buergeri"* (image from Arnold Arboretum), 3. *M. hupehensis* (image from Arnold Arboretum), 4. *M. fauriei* (image from Arnold Arboretum).

Figure 4. Bark images of cultivated *Maackia* species from Arnold Arboretum. All specimens over 50 years old. a. *M. amurensis*, b. *M. "buergeri"*, c. *M. hupehensis*, d. *M. fauriei*.

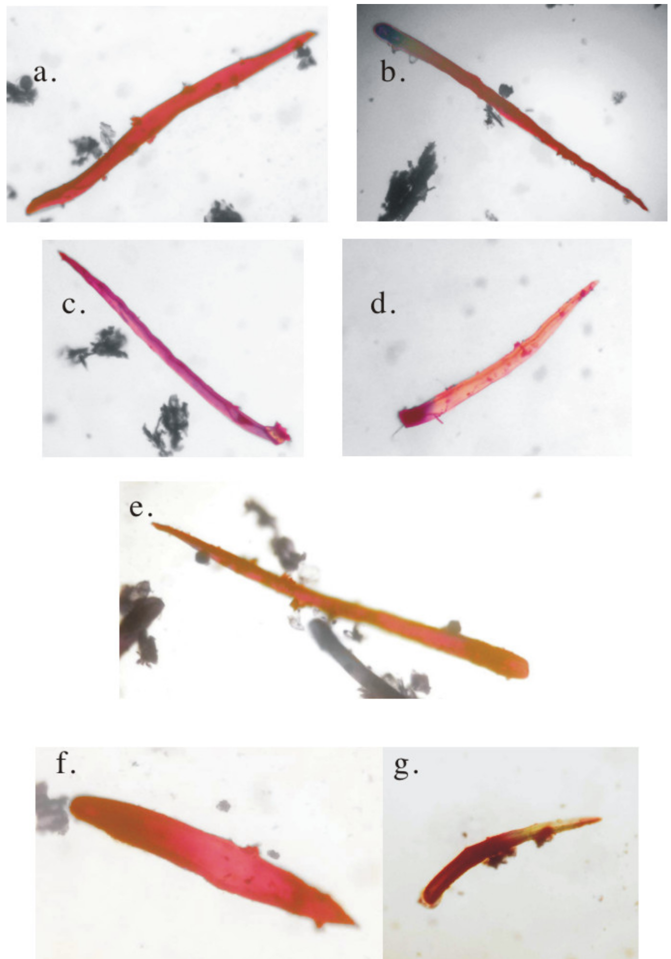


Figure 5. Hairs from leaves of pubescent members of *Maackia*. Photographs taken with light microscope at 20X. a. *Maackia amurensis* var. *pilosella* from *Nakai 5553* (TI); hair length ranges from 250 to 400 µm. b. *M. "buergeri"* from *Hurusawa s.n.* (TI); hair length ranges from 300 to 800 µm. c. *M. hupehensis* from *Steward 4725* (GH); hair length ranges from 250 to 350 µm. d. *M. chekiangensis* from *Yang 10091* (IBSC); hair length ranges from 80 to 375 µm. e. *M. floribunda* from MAK 132034; hair length ranges from 190 to 380 µm. f. *M. hwashanensis* from *Hao 4113* (PE); hair length ranges from 230 to 330 µm. g. *M. tashiroi* from MAK 132057; hair length ranges from 150 to 325 µm.

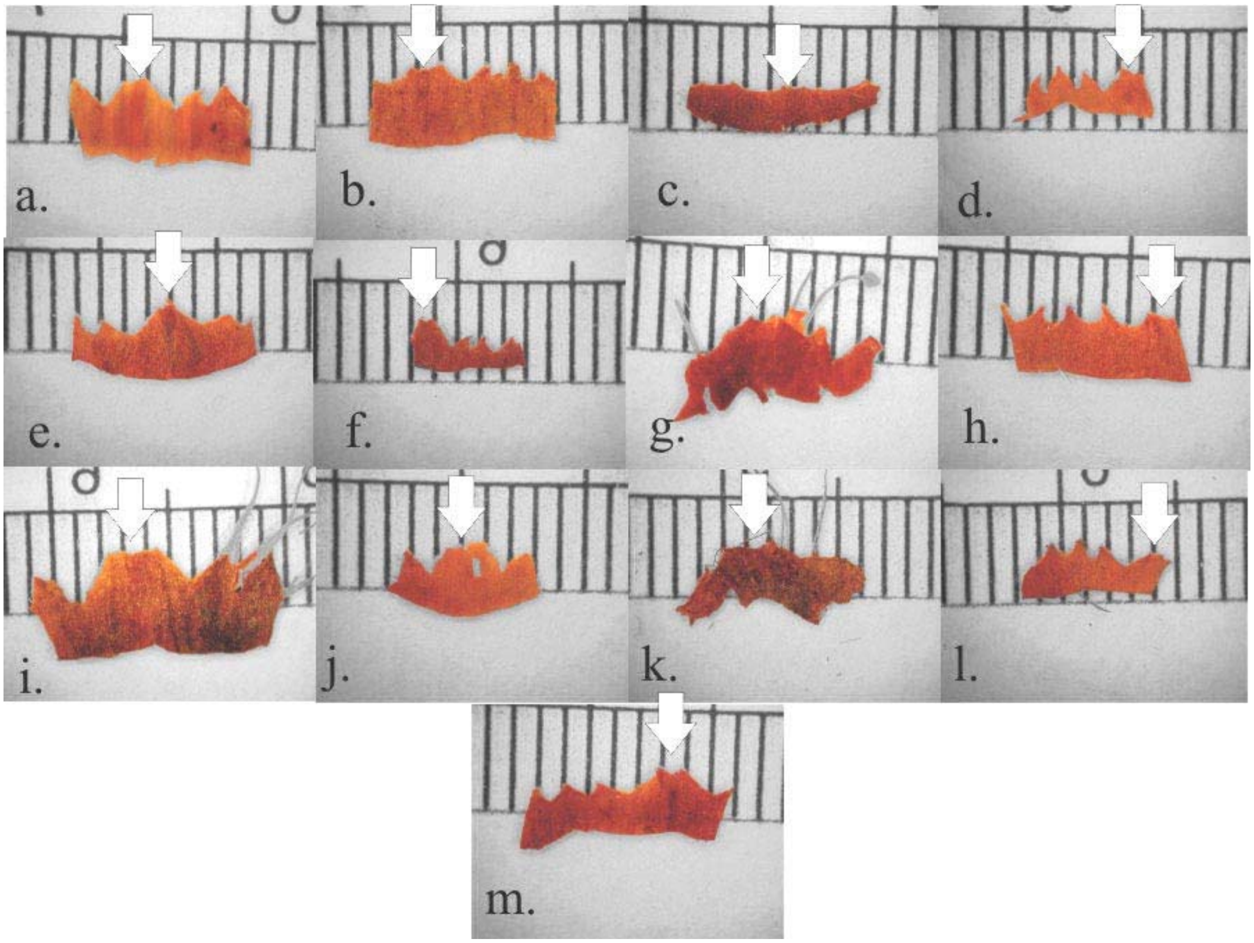


Figure 6. Opened calyces from putative *Maackia* species. Background ruler in millimeters. Arrows indicate location of upper (banner) teeth. a. *Maackia amurensis*, from *Jeong s.n.* (SNU); b. *M. "buergeri*", from *Kurosawa 4525* (GH); c. *M. amurensis* f. *pilosella*, from *Nakai 13014* (TI); d. *M. australis*, from *Luo 1328* (IBSC); e. *M. hupehensis*, from *Steward 4725* (GH); f. *M. chekiangensis*, from *Yang 10091* (IBSC); g. *M. fauriei*; h. *M. floribunda*, from *Makino s.n.* (CAS); i. *M. hwashanensis*, from *Hao 4113* (PE); j. *M. ellipticocarpa*, from *Taam 2134* (UC); k. *Maackia* sp. nov. from Japan, from *Koidzumi s.n.* (TI); l. *M. tashiroi*, from MAK 132057; m. *M. taiwanensis*, from *Chaw 733* (HAST).

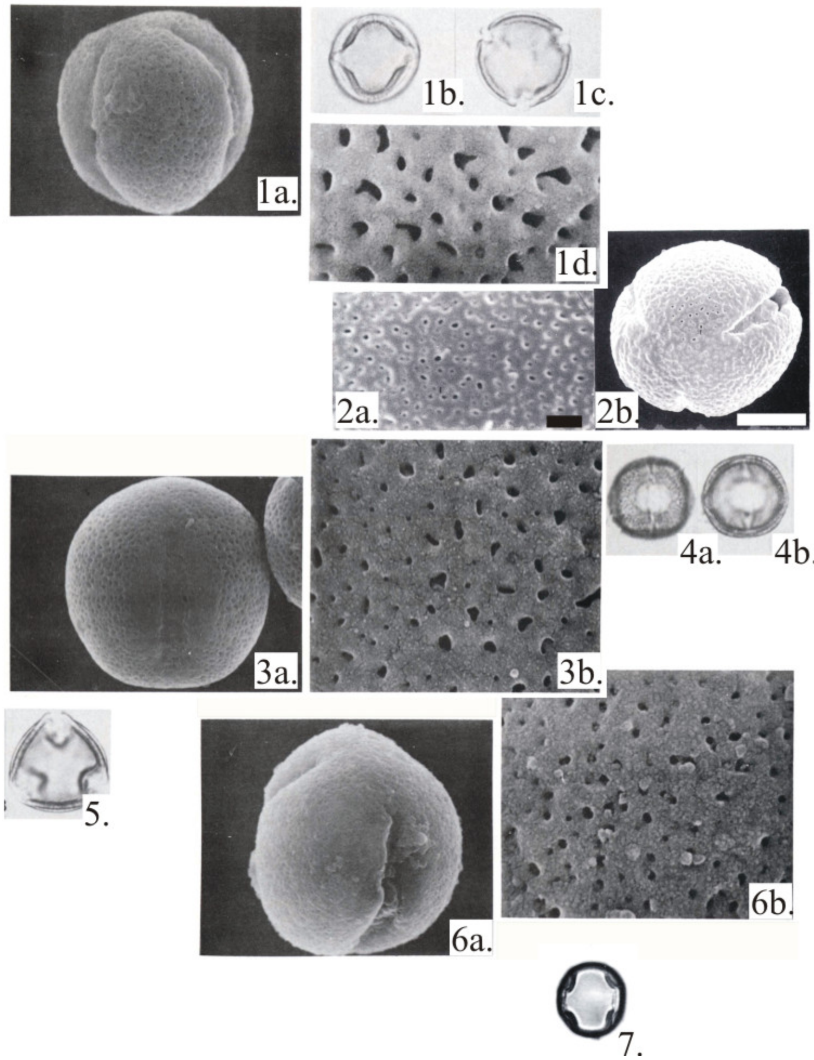


Figure 7. Pollen from *Maackia* species. 1a.–d. *M. amurensis* (images from Chung and Lee 1990), 1a. taken at x3.320, 1b.–c. taken at x1,250, 1d. taken at x16,600; 2a.–b. *M. amurensis* (images from Ferguson et al 1994), 3a.–b. *M. australis* (images from Chung and Lee 1990), 2a. scale bar = 1 µm, 2b. scale bar = 5 µm; 3a. taken at x3.320, 3b. taken at x16,600; 4a.–b. *M. "buergeri"* (images from Chung and Lee 1990), 4a. taken at x3.320, 4b. taken at x16,600; 5. *M. hupehensis*, referred to as *M. "chinensis"* (image from Chung and Lee 1990), taken at x1,250; 6a.–b. *M. fauriei* (images from Chung and Lee 1990), 6a. taken at x3.320, 6b. taken at x16,600; 7. *M. tashiroi* (image from Ferguson et al 1994), taken at x1,000.

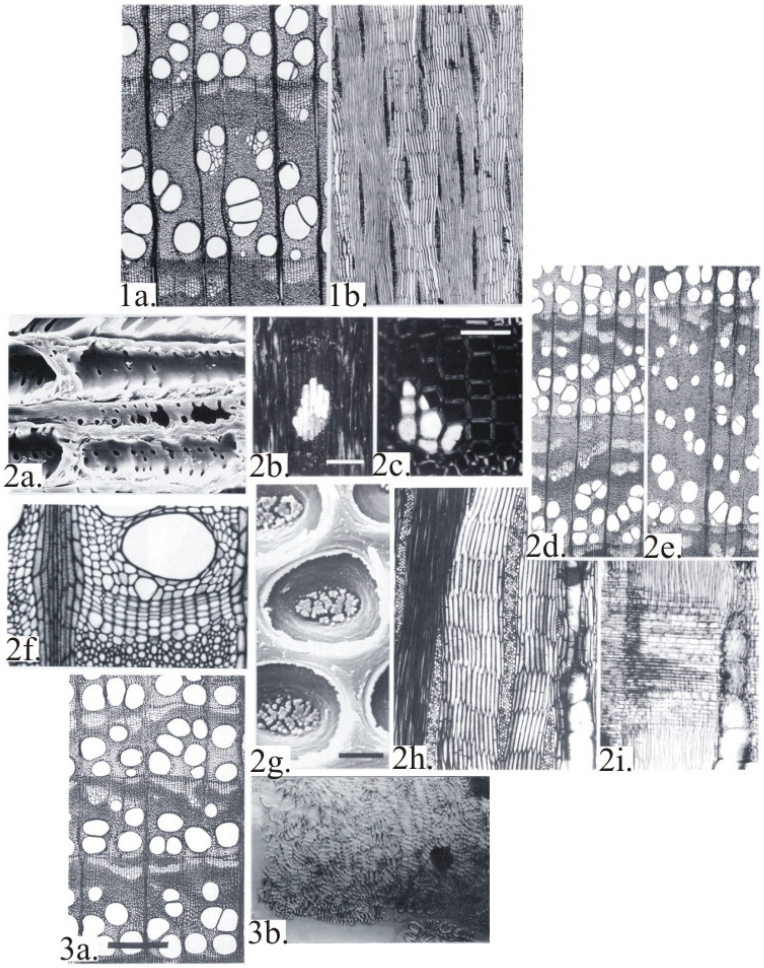


Figure 8. Anatomical images from *Maackia* spp. 1a.–b. *M. amurensis* (images from Gasson 1994). a. TS of latewood, b. TS of storied elements. 2a.–i. *M. "buergeri"* (images from Fuji et al 1994). a. interparenchyma pitting, b. RLS lumen filling crystals emphasized by polarized light , c. TLS lumen filling crystals emphasized by polarized light, d. TS of latewood, e. TS latewood, f. new growth ring boundaries, g. vestured intervessel pits, h. TLS of storied vessels, i. RLS of heterocellular ray. 3a.-b. *M. hupehensis* (as *M. "chinensis*"; a. from Fuji et al 1994, b. from Manning and Stirton 1994). a. TS of latewood, b. endothecial thickening.

CHROMOSOME COUNTS

Several chromosome counts have been made for *M. amurensis*, all of n = 9 (Goldblatt 1981; Goldblatt and Davidse 1977; Probatova and Sokolovskaya 1981; Volkova et al. 1994; Yeh et al. 1986). A chromosome count for *M. hupehensis* (as *M. "chinensis"*), n = 9, was made from a cultivated plant (Goldblatt 1981). The identity of the latter species has been confused with *Maackia amurensis* in cultivation, so this count may not be indicative of the species. *Maackia tashiroi* has had one chromosome count reported as n = 10 (Yeh et al. 1986).

RELATED GENERA

Over the years morphological and molecular investigations have grouped *Maackia* with various genera, including *Ammodendron, Anagyris, Baptisia*, *Bolusanthus, Calpurnia*, *Cladrastis*, *Euchresta, Piptanthus, Podalyria, Salweenia, Sophora, Thermopsis,* and *Virgilia*. Recently, systematists have hypothesized phylogenetic relationships between *Maackia* and other genera, which are listed in Table 2 (Crisp et al. 2000; Heenan et al. 2004; Kajita et al. 2001; Wojciechowski et al. 2004). Below and in Table 2, the differences between related genera and *Maackia* are outlined.

Ammodendron. The main differences from *Maackia* include: paripinnate leaves, 2–4 leaflets, stipules, bracts, yellow to violet flowers, no bracteoles, and wings on both sides of the fruit.

Anagyris. This genus has palmate, stipulate leaves, flowers that are yellow, and no bracteoles. The banner does not reflex back; the wing is not the same length as the keel; the ovary is stalked and glabrous; the legumes are constricted between seeds; there are 6 seeds in a legume; and the length/width ratio of the seed is 1.

Baptisia. This genus is herbaceous.

Bolusanthus. In this genus the bud is enclosed by the petiole base; the flowers are yellow; the calyx is actinomorphic; the keel is free; and the legumes are constricted between seeds.

Calpurnia. *Calpurnia* has 19–21 leaflets and is stipulate. The flowers are yellow.

Cladrastis. This genus has buds enclosed in the petiole base. The inflorescence is a bracteate panicle; there are no bracteoles; the wing is not equal in length to the keel.

Euchresta. In this genus, the leaves are stipulate. The inflorescences have bracts; the wing is not equal in length to the keel; the stamens are diadelphous; the ovary is glabrous. Legumes in this genus are drupaceous.

Piptanthus. This genus has stipulate, palmate leaves. The flowers are yellow and without bracteoles. The calyx is actinomorphic; the banner is reflexed on the sides; the wing is not equal in length to the keel; the stamens are diadelphous. Legumes possess more than 6–8 seeds. Seeds have a length/width ratio of 1.

Podalyria. Leaves in this genus are simple and stipulate. The inflorescences have bracts. Wings in *Podalyria* are not equal in length to the keel. Legumes are terete, wingless, and have more than 4 seeds.

Salweenia. This genus has stipulate leaves. The inflorescence is crowded at the tip of the rachis and is bracteate. Stamens are diadelphous. Legumes are constricted.

Sophora. The woody species have constricted, terete legumes. Buds are partially to fully enclosed by the leaf petiole. Leaves have stipules, and leaflets are smaller and more numerous. The flowers are not bracteolate.

Thermopsis. This genus is herbaceous.

Virgilia. This genus has stipulate leaves, pink to red flowers, no bracteoles, and the legume is not winged.

Table 2. Characters of genera reportedly related to *Maackia*. Characters in bold are differences from *Maackia*.

Genus	Habit	Winter bud	Leaf	Inflorescence	Fruit
Ammodendron	Woody	Exposed	**Paripinnate** **Stipules**	Raceme	Compressed Not constricted **Wing on 2 sides**
Anagyris	Woody	Exposed	**Palmate** **Stipules**	Raceme	Compressed **Constricted** **No wing**
Baptisia	**Herbaceous**	Exposed	**Palmate** **Stipules**	Raceme/**solitary**	**Terete** No constriction **No wing**
Bolusanthus	Woody	**Enclosed**	Imparipinnate No stipules	Raceme	Compressed **Constricted** **No wing**
Calpurnia	Woody	Exposed	Imparipinnate **Stipules**	Raceme	Compressed Not constricted Wing on 1 side
Cladrastis	Woody	**Enclosed**	Imparipinnate No stipules	**Panicle**	Compressed Not constricted Wing on 1 side
Euchresta	Woody	Exposed	Imparipinnate **stipules**	Raceme	**Drupaceous**
Piptanthus	Woody	Exposed	**Palmate** **Stipules**	Raceme	Compressed **Constricted** Wing on 1 side
Podalyria	Woody	Exposed	**Simple** **Stipules**	Raceme	**Terete** Not constricted **No wing**
Salweenia	Woody	Exposed	Imparipinnate **Stipules**	**Crowded at tip**	Compressed **Constricted** **No wing**
Sophora	Woody	**Partially enclosed**	Imparipinnate **Stipules**	Raceme/**panicle**	**Terete** **Constricted** **No wing**
Thermopsis	**Herbaceous**	Exposed	**Palmate** **Stipules**	Raceme	**Terete** **Constricted** **No wing**
Virgilia	Woody	Exposed	Imparipinnate **Stipules**	**Panicle**	Compressed Not constricted **No wing**

RATIONALE FOR THIS STUDY

Although some sources state that *Maackia* contains 8 – 9 species (Hogan 2003; Lewis et al. 2005; Mabberley 1997; Roskov et al. 2005; Wielgorskaya 1995), more than 20 names have been published in the genus (Table 3).

There has never been a monograph written on *Maackia*, though there have been some regional treatments, including *Flora of Japan* (Ohwi 1965), *Flora of Taiwan* (E.C.F.T. 1993), and *Flora of Okinawa and the Southern Ryukyu Islands* (Walker 1976), as well as horticultural treatments, such as *Trees and Shrubs Hardy in the British Isles* (Bean 1973), *Manual of Cultivated Trees and Shrubs Hardy in North America* (Rehder 1947), *Trees and Shrubs in Eastern North America* (Blackburn 1974), *The European Garden Flora* (Cullen 1995), and *Index of Garden Plants* (Griffiths 1994).

In this study I undertake a monograph of the genus, including morphometric analyses of characters derived from herbarium specimens to determine the number of species in the genus and their delimitations, and to update the nomenclature based on my analyses.

Table 3. Comprehensive list of names published in the genus *Maackia*, both extant and fossil taxa.

Maackia amurensis Rupr. & Maxim.
Maackia amurensis Rupr. & Maxim. var. *buergeri* Maxim.
Maackia amurensis Rupr. & Maxim var. *buergeri* (Maxim.) C.K. Schneid.
Maackia amurensis Rupr. & Maxim. ssp. *buergeri* (Maxim.) Kitam.
Maackia buergeri (Maxim.) Tatewaki
Maackia amurensis Rupr. & Maxim. var. *floribunda* Miq.
Maackia amurensis Rupr. & Maxim. var. *pilosella* Nakai
Maackia amurensis Rupr. & Maxim. var. *stenocarpa* Nakai
Maackia australis (Dunn) Takeda
Maackia chekiangensis S. S. Chien
Maackia chinensis (Bentham) Takeda
Maackia ellipticocarpa Merrill
Maackia fauriei (Lévl.) Takeda
Maackia floribunda (Miq.) Takeda
Maackia floribunda (Miq.) Takeda var. *chinensis* (Takeda) Hatus.
Maackia floribunda (Miq.) Takeda f. *pubescens* (Koidz.) Kitam.
Maackia floribunda (Miq.) Takeda var. *pubescens* Koidz.
Maackia honanensis L. H. Bailey
Maackia hupehensis Takeda
Maackia hwashanensis W. T. Wang
Maackia onoei Matsuo
Maackia taiwanensis Hoshi et Ohashi
Maackia tanaii Huzioka
Maackia tashiroi (Yatabe) Makino
Maackia tashiroi (Yatabe) Makino var. *taiwaniana* Kanehira
Maackia tenuifolia (Hemsl.) Hand.–Mazz.
Maackia ugoensis Huzioka

METHODS

Specimens were obtained on loan from the following herbaria: A, B, BH, BM, CAS, CM, E, EWU, F, GH, HAST, IBSC, ILL, K, KWNU, L, LE, MAK, MO, MU, NA, NAS, NY, P, PE, PH, PR, S, SNU, TAI, TAIF, TI, TNM, UC, and US. A complete list of specimens examined is included in Appendix 3.

A data sheet was constructed for recording measurements (Appendix 1). Table 4 lists characters for which measurements were made. Data from specimens in fruit were analyzed separately from data from specimens in flower, because flowers and fruit do not generally occur at the same time on one plant. For each data set (from flowering or fruiting specimens), vegetative data was gathered from each sheet, so that the data set for specimens in flower contains floral and vegetative data (Appendix 1), and the data set for specimens in fruit contains fruit and vegetative data (Appendix 2). See Figures 9, 10, and 11 for diagrams of floral, fruit, and leaf characters measured.

Data were analyzed using NTSYS – pc (Rohlf 2000). NTSYS – pc is a program used by taxonomists as a method for multivariate data analysis – specifically for morphometric data. The program computes various measures of similarity or dissimilarity between pairs of objects, and for this study was used for PCA (principal components analysis). Steps that were taken for this analysis are as follows: standardize raw data (not standardizing data would falsely consider all the variables as having comparable units of measure), derive a similarity matrix, perform Eigen ordination, construct a set of orthogonal coordinate axes so that the projection of points onto them have maximum variance in a few dimensions, run a distance matrix for dendrogram, and run SAHN clustering (sequential, agglomerative, hierarchical, nested clustering). The output is a dendrogram showing similarity relationships. Descriptive statistics were calculated using MINITAB (Minitabinc. 2006).

Since initial analyses indicated that *M. tenuifolia* might not belong with the rest of *Maackia* (see Results), analyses were split into two parts: data sets with *Maackia tenuifolia* and those without. *Euchresta formosana* was added to the analysis of flowering specimens as an outgroup reference in order to determine similarity of *M. tenuifolia* to the rest of *Maackia*.

After preliminary analyses, results concerning the placement of *M. amurensis* f. *pilosella* relative to *M. amurensis* f. *amurensis* were ambiguous. Differences were observed during examination of herbarium sheets, especially in the calyx teeth and pubescence. Data for *Maackia amurensis* and *M. amurensis* f. *pilosella* were analyzed separately using PCA and projected as a tree plot in order to better visualize the morphological relationship between the two entities. *Maackia amurensis* var. *stenocarpa* also differed noticeably from *M. amurensis* var. *amurensis* when examined on herbarium sheets. Key differences were fruit shape and size of the calyx teeth. Data from specimens of *M. amurensis* var. *stenocarpa* were also analyzed with *M. amurensis* var. *amurensis* data using PCA and projected as a tree plot. Data for all three taxa could not be analyzed concurrently since all specimens of *M. amurensis* f. *pilosella* are in flower, while all specimens of *M. amurensis* var. *stenocarpa* are in fruit.

Maackia seeds were obtained from trees in cultivation at the Arnold Arboretum, of *Maackia* "*buergeri*" (accession 610-61-B), *M. fauriei* (accession 661-60-A), and *M. hupehensis* (accession 708-77-B) (vouchers in MU). These were soaked overnight and germinated in petri dishes with wet filter paper. Root tips were harvested, submerged in PDB for an hour, transferred to a vial of Farmer's solution, a 3:1 solution of HCl: acetic acid, and stored in a refrigerator until needed. Next, the root tips were submerged for 10 minutes in a 1:1 solution of 1 N HCl: 95%

ethanol and washed in Farmer's solution. Root tips were then transferred to acetocarmine, stirred with a rusty probe, and stored over night in the refrigerator. Each root tip was then transferred to a glass slide with a few drops of acetocarmine and heated over an alcohol lamp. A drop of diluted Hoyer's was then added to the slide, and the root tip was squashed. Since multiple chromosome counts were performed for *M. amurensis* and reported the same number, so I did not germinate any seeds for this species.

Anthers were collected from each species in order to photograph pollen using the SEM. The anthers used were collected from herbarium sheets and were not rehydrated. Each anther was split open on a double-sticky tab on the stub, and the pollen was spread out. Silver paint was dabbed on the side of the stub, after which it was sputter-coated with gold. Pollen was observed on a JEOL 840A SEM and photographed.

Table 4. Description of measurements taken for analytical and descriptive purposes. ♦ denotes characters used for analyses of flowering specimens; ⊗ denotes characters used for analyses of fruiting specimens.

Character	Description
♦⊗ budscl	length of the outer–most bud scale in millimeters. The outer–most bud scale was chosen for the simple reason that it is the most easily visible.
budscw	width of the outer–most bud scale. Width was measured at the widest point of the scale.
♦⊗ budpub	presence of pubescence on outer–most bud scale. The inner scales and the bud itself are pubescent for all specimens, but the outer–most scale varies in pubescence from species to species.
lfw	width of leaf in centimeters. The width was measured at the widest point of the leaf.
lfle	length of leaf in centimeters. Length was measured from the tip of the terminal leaflet to the attachment point of the lowest basal leaflet.
lfwp	numerical location of widest point of leaf along the length of the leaf.
♦⊗ lfltpr	number of leaflet pairs. Since all species are imparipinnate, number of actual pairs is more informative.
lfpele	length of leaf petiole in centimeters. Length was measured from attachment point of petiole to attachment point of lowest basal leaflet.
lfpepub	presence of petiole pubescence. 0=absence of pubescence, 1=presence of pubescence.
♦⊗ lfltshp	geometric shape of terminal leaflet. 0=oval, 1=ovate, 2=obovate.
⊗ tllle	terminal leaflet length in centimeters. Length was measured from apex of terminal leaflet to attachment point of pulvinus.
tllw	terminal leaflet width in centimeters. Width was measured at widest point of leaflet.
tllwp	numerical location of widest point of terminal leaflet along the length of the leaflet.
♦⊗ lftap	descriptive shape of apex. 0=acute, 1=acuminate.
tllapde	degree created by terminal leaflet apex. Measurements were taken by aligning the midrib along the 90^{o} mark on the protracter and measuring the angle created by the leaflet edge and the protracter.
tllpuba	presence of pubescence on upper surface of leaflet. 0=absent, 1=present.

Table 4 continued.

Character	**Description**
♦⊗ tllpubu	presence of pubescence on lower surface of leaflet. 0=absent, 1=present.
♦⊗ tllpubr	presence of pubescence on midrib of leaflet. 0=absent, 1=present.
tllpubm	presence of pubescence on margin of leaflet. 0=absent, 1=present.
tllpele	length of terminal leaflet pulvinus and rachis in centimeters. Length was measured from the attachment of the pulvinus to the terminal leaflet to the attachment point of the first pair of leaflets.
tllpupub	presence of pubescence on pulvinus. 0=absent, 1=present.
fllle	length of basal leaflet in centimeters. Length measured from apex of leaflet to pulvinus attachment point.
fllw	width of basal leaflet in centimeters. Width measured at widest point of leaflet.
fllwp	numerical location of widest point of basal leaflet along the length of the leaflet.
fllapde	degree created by basal leaflet apex. Measurements taken in same manner as for the terminal leaflet.
fllpuba	presence of pubescence on upper surface of leaflet. 0=absent, 1=present.
fllpubu	presence of pubescence on lower surface of leaflet. 0=absent, 1=present.
fllpubr	presence of pubescence on midrib of leaflet. 0=absent, 1=present.
fllpubm	presence of pubescence on margin of leaflet. 0=absent, 1=present.
♦⊗ fllpule	length of basal leaflet pulvinus in centimeters. Measurement taken from attachment point to attachment point, lamina to rachis.
fllpupub	presence of pubescence on pulvinus. 0=absent, 1=present.
infle	length of longest raceme in millimeters.
infw	width of longest raceme in millimeters.
infpele	length of peduncle in millimeters. Length measured from attachment point of lowest flower to attachment point of entire inflorescence to stem.
♦ flower	length of flower in centimeters. Measurement taken from tip of longest petal to receptacle.
♦ calzy	presence of zygomorphy. 0=absent, 1=present.
♦ cttb	ratio of length of banner tooth to banner sepal length–banner tooth length/banner side sepal length.

Table 4 continued.

Character	Description
calbsw	width of the sepal on the banner side in millimeters.
♦ calbsle	length of the sepal on the banner side in millimeters.
calksw	width of the sepal on the keel side in millimeters.
calksle	length of the sepal on the keel side in millimeters.
calwsw	width of the sepal on the wing side in millimeters.
calwsle	length of the sepal on the wing side in millimeters.
♦ calpub	presence of pubescence on calyx. 0=absent, 1=present.
♦ calpele	length of petiole in millimeters.
calpepub	presence of pubescence on petiole. 0=absent, 1=present.
♦ bshp	shape of banner. 0=round, 1=urn, shaped.
♦ banw	width of banner in millimeters.
♦ banle	length of banner in millimeters.
♦ bancl	length of claw in millimeters.
♦ banin	depth of indentation in millimeters.
wshp	wing lamina ratio. 0=1:1 length: width, 1=greater than 1:1 length:width.
wngw	width of wing in millimeters.
♦ wngle	length of wing in millimeters.
wngcl	length of claw in millimeters.
wngsp	length of spur in millimeters.
kshp	keel lamina ratio. 0=1:1 length: width, 1=greater than 1:1 length:width.
klw	width of keel in millimeters.
♦ klle	length of keel in millimeters.
klcl	length of keel claw in millimeters.
klsp	length of spur in millimeters.
♦ brctle	length of bracteole in millimeters.
brctw	width of bracteole in millimeters.
♦ brctpub	presence of pubescence on the bracteole. 0=absent, 1=present.
stfilles	length of shortest filament in millimeters.
stfille	length of longest filament in millimeters.
stantw	width of anther in millimeters.
stantle	length of anther in millimeters.
♦ pstalk	presence of pistil stalk. 0=absent, 1=present.
ovle	length of ovary in millimeters.
ovw	width of ovary in millimeters.
style	length of style in millimeters.
stigma	width of stigma in millimeters.

Table 4 continued.

Character	Description
⊗ podle	length of pod in centimeters. Length was measured from tip to neck attachment point.
⊗ podw	width of pod in centimeters. Measurement taken at widest point of legume.
noseed	number of seeds in pod.
⊗ seedcl	color of seeds. 0=yellow, 1=red.
seedle	length of seed in millimeters.
seedw	width of seed in millimeters.
hilumle	length of hilum in millimeters.
hilumw	width of hilum in millimeters.
podpub	presence of pubescence on pod. 0=absent, 1=present.
⊗ podwngw	width of wing on pod in centimeters. Measurement was taken at widest point.
podwb	numerical location of widest point of pod along the length of the pod.
dtip	degree created by tip of pod.
dbase	degree created by base of pod.
⊗ pshape	shape of pod. 0=linear, 1=curved.
⊗ pshape2	numerical description of shape based on geometric bases. 0=elliptic, 1=lanceolate.
⊗ symm	symmetry of pod. 0=symmetrical, 1=asymmetrical.
⊗ neck	length of neck on pod in millimeters.

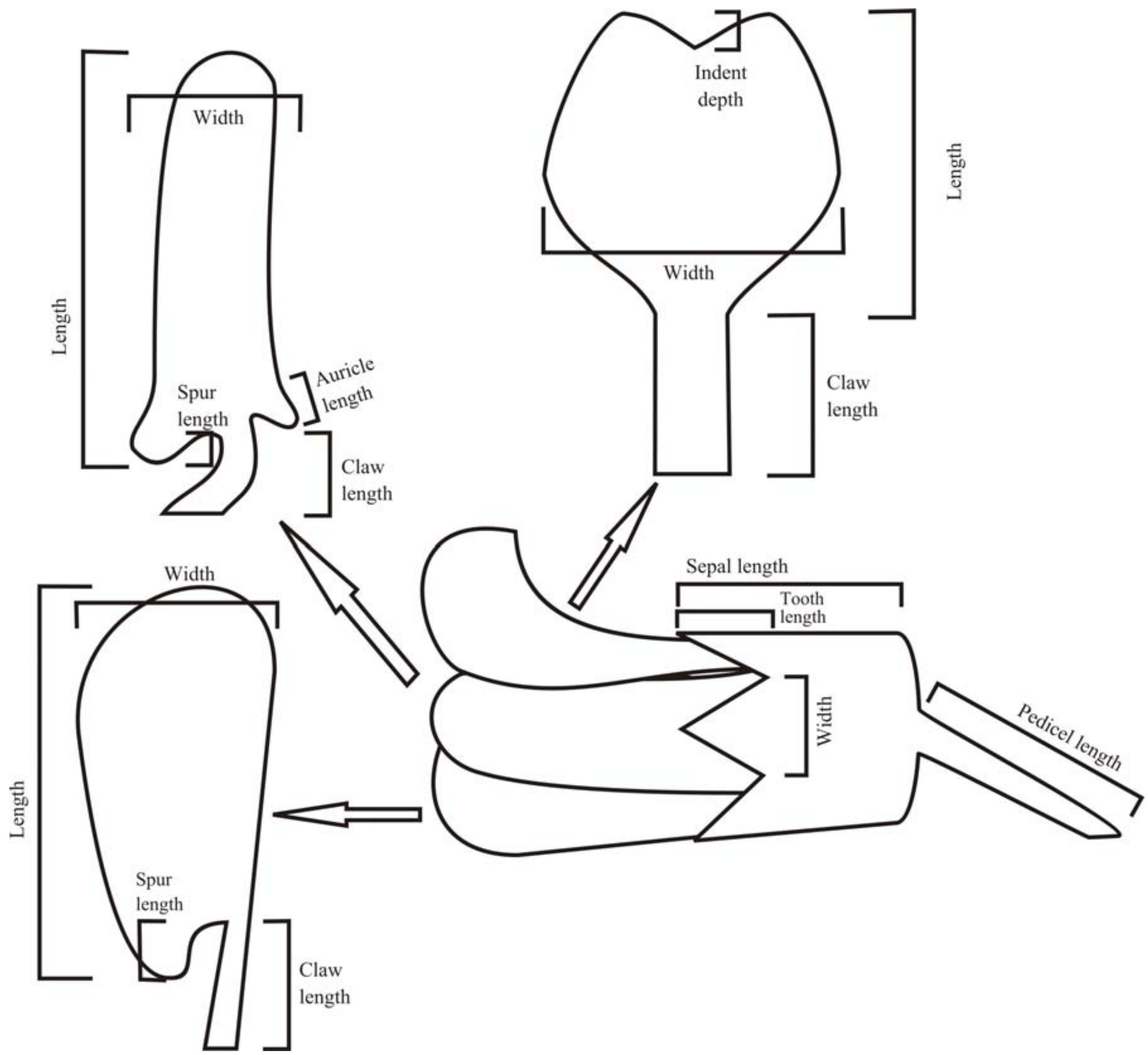


Figure 9. Diagram of floral characters used for data analysis.

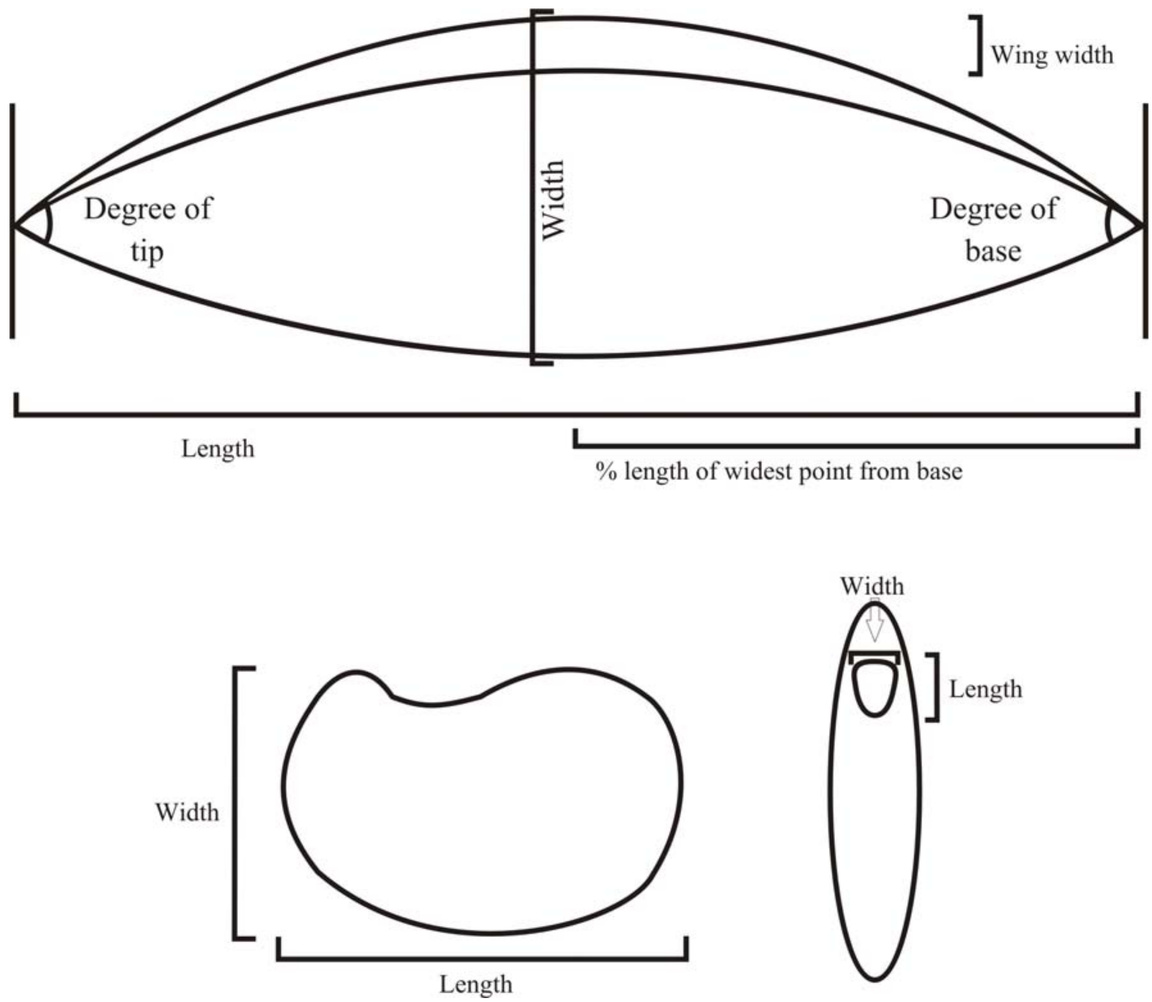


Figure 10. Diagram of fruit characters used for data analysis.

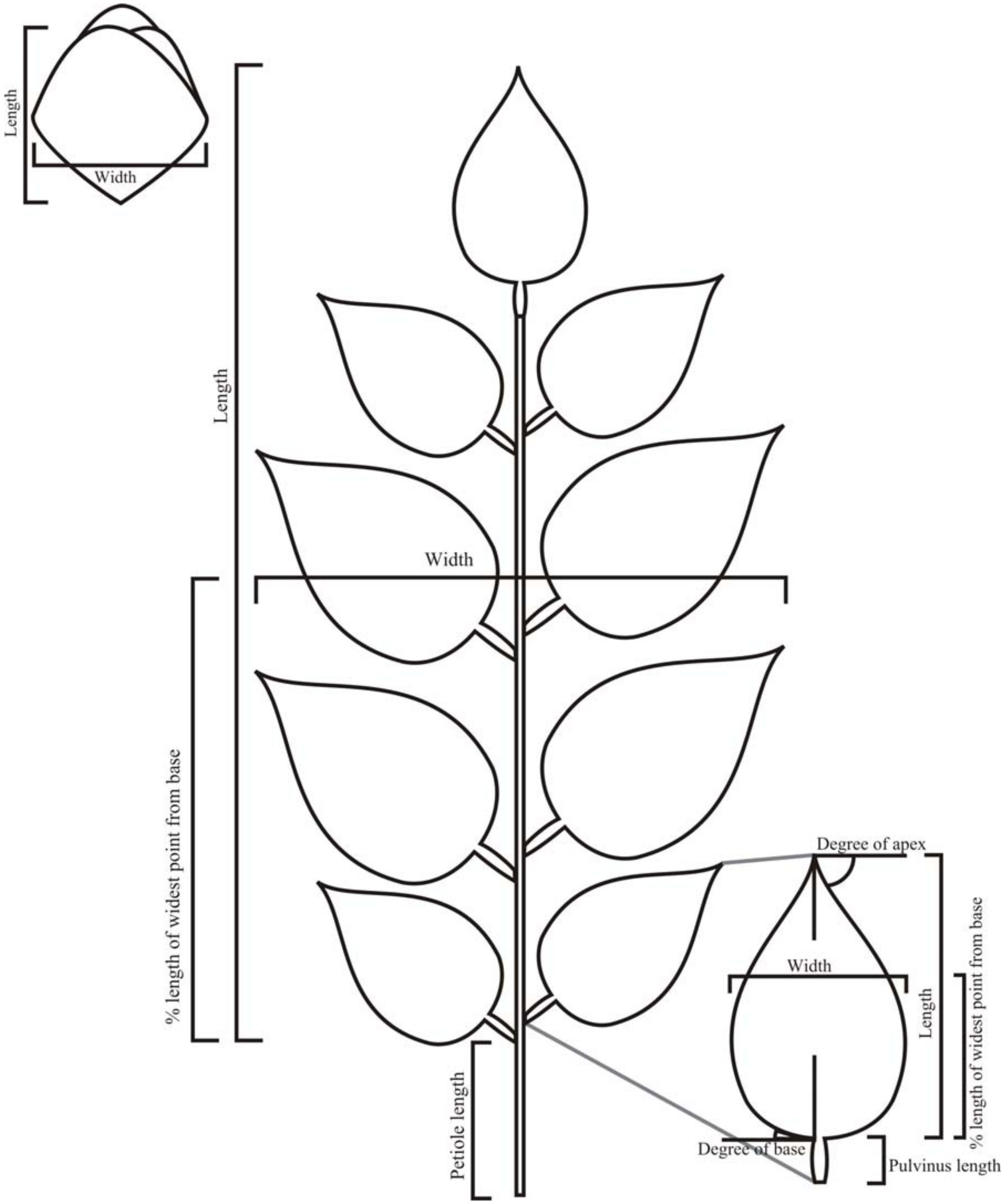


Figure 11. Diagram of vegetative characters used for data analysis.

RESULTS

Morphological analyses performed on both fruiting and flowering specimens support the hypothesis that *M. tenuifolia* does not belong in the genus. Floral and vegetative characters (16 total; Appendix 1) were used in the analysis to determine placement of *Maackia tenuifolia*. Analyses of flowering material included *Euchresta formosana*, a species in a genus closely allied to *Maackia*. Floral characters of this species are similar to both *M. tenuifolia* and the rest of *Maackia*. After study of herbarium specimens, I chose flower length, calyx zygomorphy, banner–side calyx tooth length, banner–side sepal length, calyx pubescence, pedicel length, banner length, wing length, keel length, bracteole length, bracteole pubescence, presence of a pistil stalk, outermost bud scale length and pubescence, number of leaflet pairs, and basal pulvinus length as potentially distinguishing characters. Eigen analysis shows that the nine characters with the greatest impact on the floral-vegetative discriminate analysis are (in order of importance): flower length, calyx zygomorphy, length of the banner–side sepal, pedicel length, banner length, bracteole pubescence, presence of a pistil stalk, and outermost bud scale length and pubescence (Figure 12). The projection plot (Figure 13) supports the hypothesis that both *M. tenuifolia and E. formosana* are morphologically distinct from species of *Maackia*, based on calyx pubescence, flower length, pistil stipe, number of leaflets, absence of bracteoles, and absence of an indentation on the banner apex.

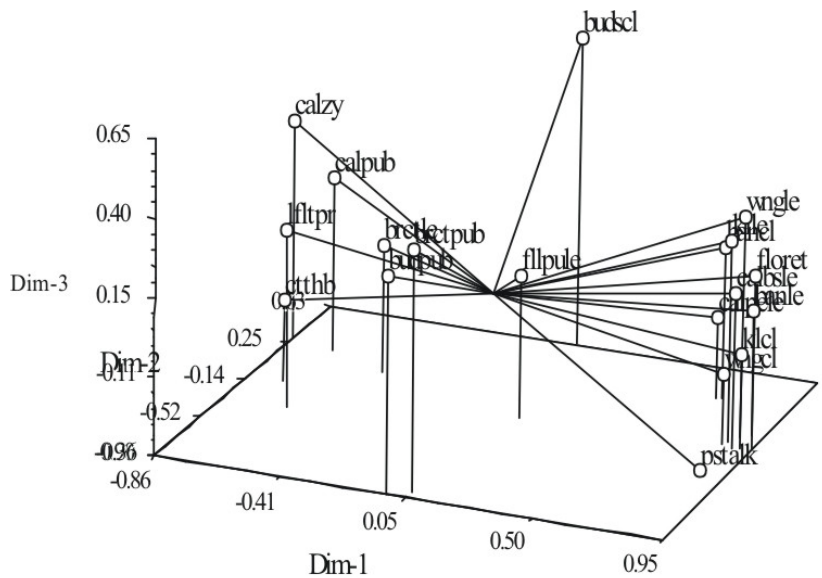
Analysis of fruiting specimens did not contain a species of an allied genus, because the fruits of *M. tenuifolia* do not resemble those of any of the related genera. Preliminary observations indicated that legume length and width, seed color, legume wing width, legume shape, presence of a legume neck, outermost bud scale length and pubescence, number of leaflet pairs, terminal leaflet length, and basal pulvinus length were potentially important characters. Eigen analysis supports the observation that the following characters contribute most to the separation of the taxa (in order of importance): legume length and width, seed color, legume wing width, legume shape, presence of a legume neck, outermost bud scale length and pubescence, number of leaflet pairs, and terminal leaflet length (Figure 14). The projection plot of this data (Figure 15) supports the hypothesis that *M. tenuifolia* is not morphologically similar to the rest of *Maackia*, based on legume shape, seed color, stipe length, number of leaflets, and calyx pubescence.

When *M. tenuifolia* was taken out of the analyses, 11 *Maackia* species were resolved. Characters initially chosen from examination of all the flowering herbarium specimens thought to be potentially useful for analyses were: flower length, banner shape, banner width, banner indentation depth, wing length, keel length, bracteole length, outermost bud scale length and pubescence, number of leaflet pairs, leaflet shape, leaflet apex shape, terminal leaflet length, and leaflet pubescence. After PCA analysis, the following charaters were shown based on Eigen values to be most important in separation of the taxa (in order of importance): flower length, banner shape, banner width, banner indentation depth, wing length, keel length, outermost bud scale length and pubescence, number of leaflet pairs, leaflet apex shape, terminal leaflet length, and leaflet pubescence (Figure 16). Nine species were resolved in the analysis of flowering specimens (Figure 17). From fruiting specimens I observed that legume length, width, wing width, shape, and symmetry, seed color, outermost bud scale length and pubescence, number of leaflet pairs, terminal leaflet length, leaflet apex shape, leaflet shape and pubescence. Figure 18 shows legume length, width, shape, symmetry and wing width, outermost bud scale length and pubescence, leaflet apex shape, leaflet shape and pubescence as being important according to the Eigen analysis. Eleven species were resolved in the analysis of fruiting material (Figure 19).

Data from specimens of *Maackia amurensis* f. *amurensis* and *M. amurensis* f. *pilosella* were analyzed alone using PCA. Because I hypothesized that the other species might be confounding the more subtle differences between *"amurensis"* and *"pilosella"*, I chose to use the same characters as in the previous analysis of flowering specimens without *M. tenuifolia*. Figure 20 shows that flower length, banner–side calyx tooth length, banner–side sepal length, banner length, banner indentation depth, wing length, keel length, bracteole length and pubescence, number of leaflet pairs, terminal leaflet length and pubescence are important morphological features according to the Eigen analysis. Figure 21 shows the separation of *Maackia amurensis* f. *pilosella* from f. *amurensis* based on PCA analyses of these characters. The calyx tooth character is very valuable in separation of these two entities; in f. *pilosella*, upper calyx teeth are so short as to be practically non-existent (calyx is fused more than 81% of its length), while in f. *amurensis*, the upper calyx teeth are longer (calyx fused for less than 61% of its length) (Figure 22). PCA was also performed on data from specimens of *M. amurensis* var. *amurensis* and *M. amurensis* var. *stenocarpa*. The same characters were used in the analysis of fruiting specimens (without *M. tenuifolia*). Figure 23 shows that in Component 1, legume width, terminal leaflet length, legume length, number of leaflet pairs, calyx tooth length contribute most to the Eigen analysis, while in Component 2, upper (banner) calyx length, calyx tooth length, legume width, number of leaflet pairs, and legume length make the largest contribution (in order of value). *Maackia amurensis* var. *stenocarpa* also separated from the typical variety in PCA (Figure 24). Again, the calyx tooth character is very valuable in separation of these two entities; the calyx teeth are short in *M. amurensis* var. *stenocarpa* in the same way and to the same degree as they are in *M. amurensis* f. *pilosella* (Figure 22). This indicates that these two taxa, one in flower and the other in fruit, most likely represent the same entity.

Chromosome counts were made from germinated seeds of *Maackia* "*buergeri*", *M. fauriei*, and *M. hupehensis*. The chromosome count for *M. hupehensis* was confirmed at n=9. Chromosome counts of n=9 were recorded for both *M. buergeri* and *M. fauriei*.

Photographs made of pollen grains (Figure 25) show no distinguishing features between the species or between the genus *Maackia* and *Euchresta*, a reported relative of *Maackia*. Pollen grains examined are tricolpate, as is typical of other Sophoreae, globose to elliptical in shape, with finely reticulate ornamentation. They range in size (based on non-rehydrated grains taken directly from herbarium specimens) from 11 to 18 μm in the longest dimension.



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Floret	0.294	0.048	0.132
Calzy	0.276	0.180	0.307
Ctthb	0.235	0.061	0.082
Calbsle	0.286	0.035	0.120
Calpub	0.220	0.146	0.179
Calpele	0.221	0.217	0.079
Banle	0.306	0.024	0.075
Bancl	0.227	0.224	0.114
Wngle	0.285	0.022	0.304
Wingcl	0.273	0.027	0.111
Klle	0.275	0.006	0.244
Klcl	0.293	0.028	0.049
Brctle	0.145	0.069	0.047
Brctpub	0.015	0.533	0.346
Pstalk	0.276	0.180	0.307
Budscl	0.023	0.395	0.555
Budpub	0.007	0.565	0.281
Lfltpr	0.202	0.196	0.180
Fllpule	0.043	0.058	0.088

Figure 12. Projection plot of floral characters according to their respective Eigen values from PCA. Axes correspond with the three dimensions of greatest data variation: Dim-1 = 50.6964%, Dim-2 = 13.3406%, Dim-3 = 7.2623%.

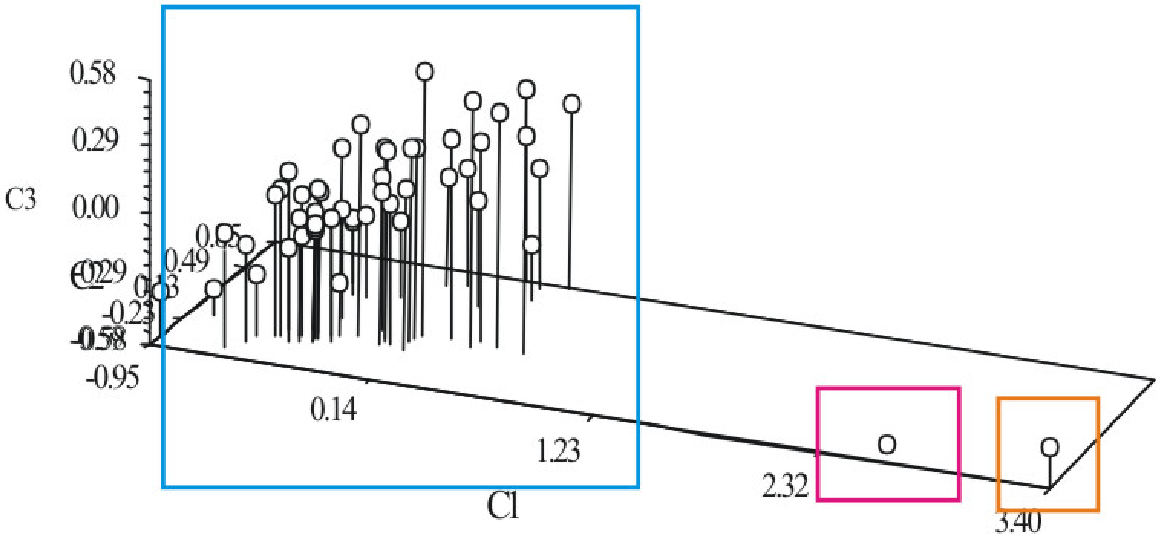
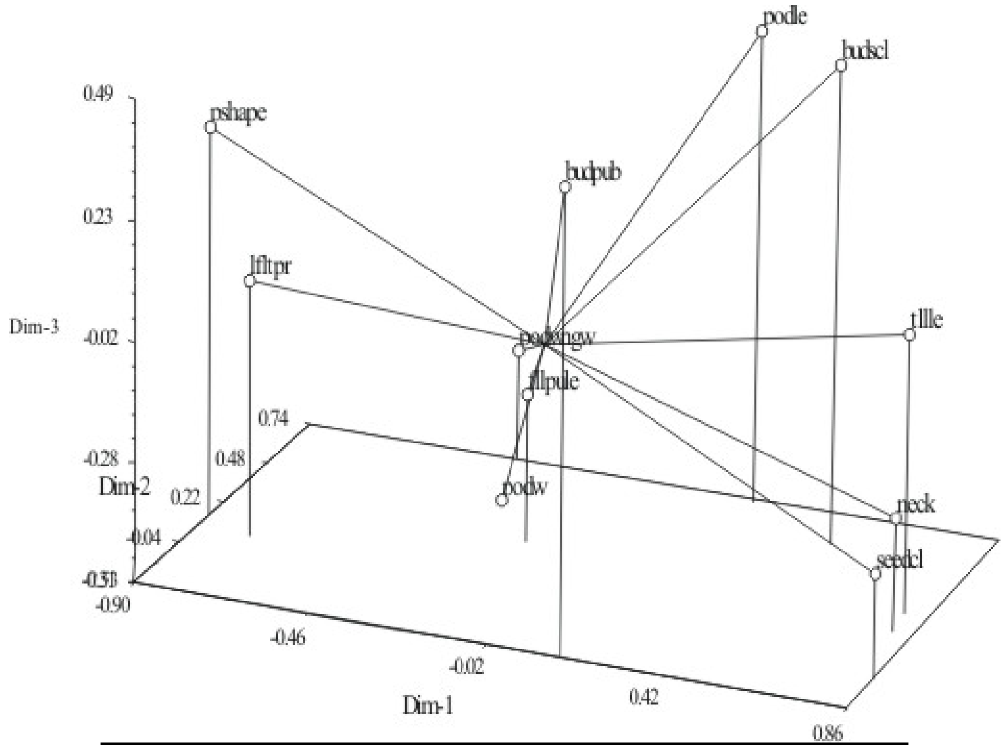


Figure 13. PCA projection plot of flowering specimens. Axes correspond with the three dimensions of greatest data variation: C1 = 50.6964%, C2 = 13.3406%, C3 = 7.2623%. The blue square encompasses *Maackia* (n = 49) except *M. tenuifolia*, the magenta square encompasses *Euchresta formasana* (n = 1), and the orange square encompasses *M. tenuifolia* (n = 1).



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Podle	0.148	0.496	0.438
Podw	0.148	0.385	0.381
Seedcl	0.417	0.106	0.259
Podwngw	0.173	0.566	0.175
Pshape	0.428	0.029	0.257
Neck	0.413	0.083	0.260
Budscl	0.275	0.369	0.432
Pudpub	0.068	0.243	0.435
Lfltpr	0.380	0.071	0.032
Tllle	0.411	0.146	0.056
Fllpule	0.064	0.213	0.229

Figure 14. Projection plot of fruit characters according to their respective Eigen values from PCA. Axes correspond with the three dimensions of greatest data variation: Dim-1 = 36.7463%, Dim-2 = 17.4886%, Dim-3 = 12.2599%.

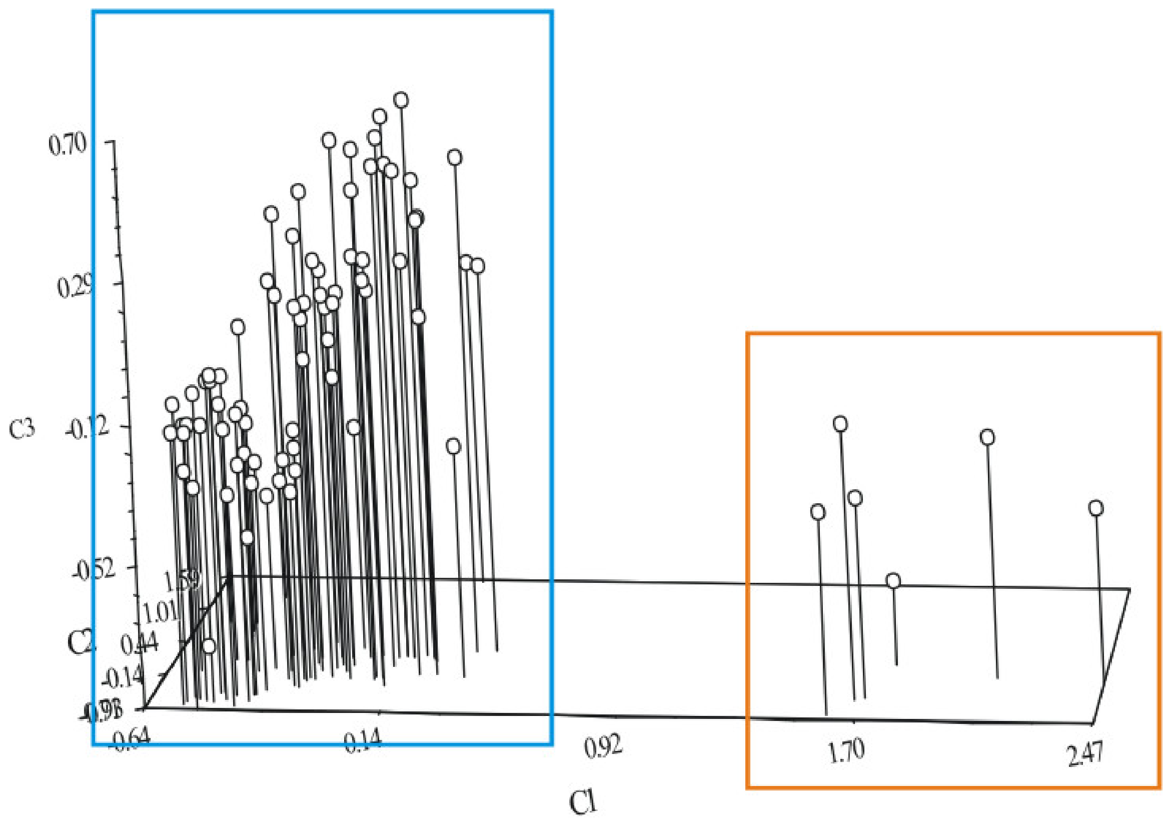
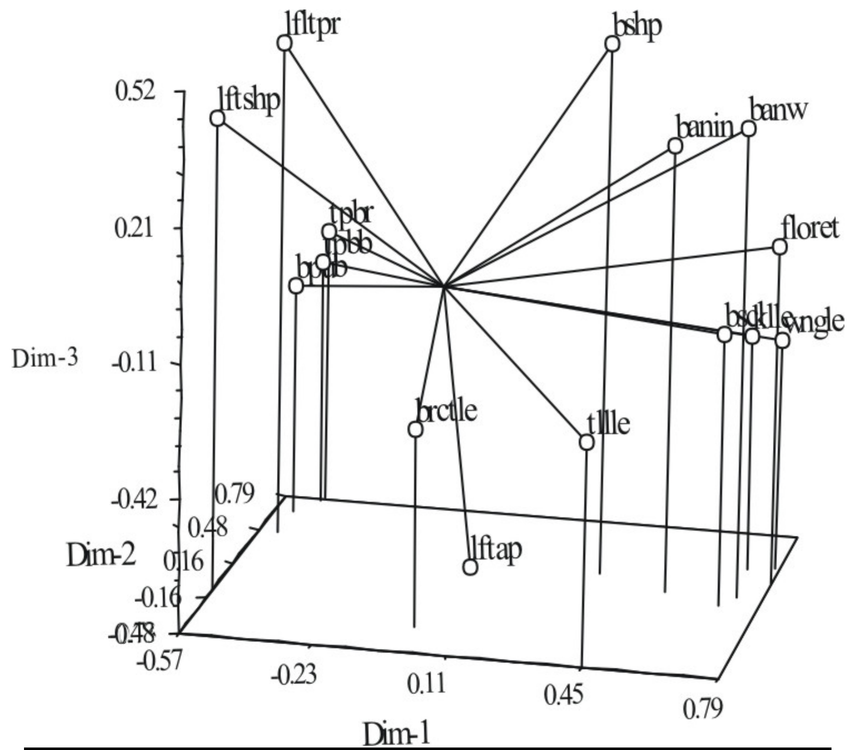


Figure 15. PCA projection plot of fruit specimens. Axes correspond with the three dimensions of greatest data variation: C1 = 36.7463%, C2 = 17.4886%, C3 = 12.2599%. The blue square encompasses *Maackia* (n = 73) except *M. tenuifolia*, and the orange square encompasses *M. tenuifolia* (n = 6).



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Floret	0.366	0.199	0.054
Bshp	0.164	0.189	0.406
Banw	0.337	0.116	0.293
Banin	0.251	0.125	0.250
Wngle	0.363	0.277	0.143
Klle	0.329	0.265	0.135
Brctle	0.006	0.157	0.207
Bscl	0.321	0.079	0.072
Bpub	0.239	0.381	0.144
Lfltpr	0.240	0.265	0.345
Lftshp	0.263	0.053	0.294
Lftap	0.012	0.164	0.571
Tllle	0.210	0.275	0.167
Tpbb	0.216	0.438	0.116
Tpbr	0.214	0.453	0.059

Figure 16. Projection plot of floral characters according to their respective Eigen values from PCA. Axes correspond with the three dimensions of greatest data variation: Dim-1 = 31.1314%, Dim-2 = 20.4390%, Dim-3 = 11.0357%.

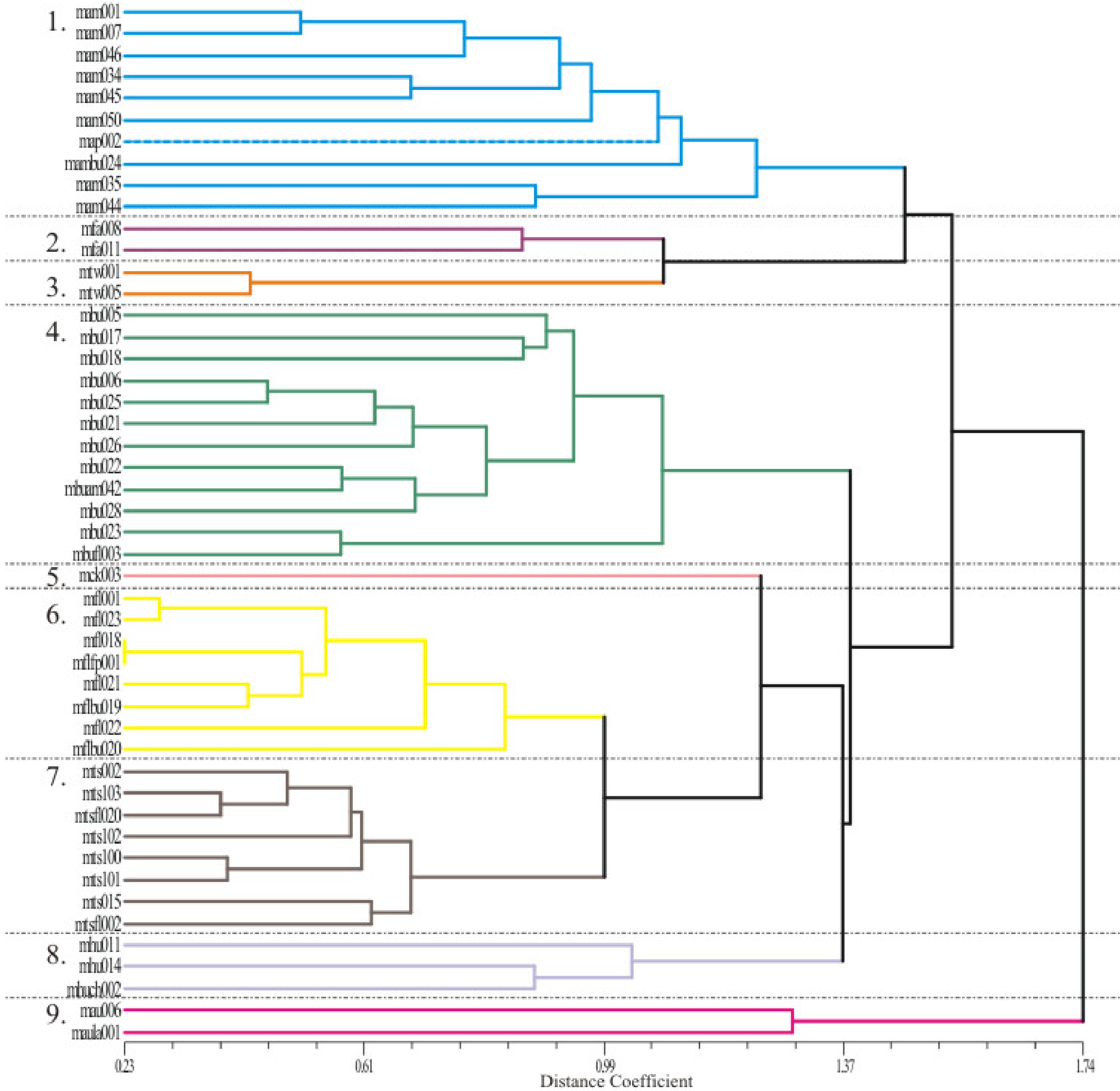
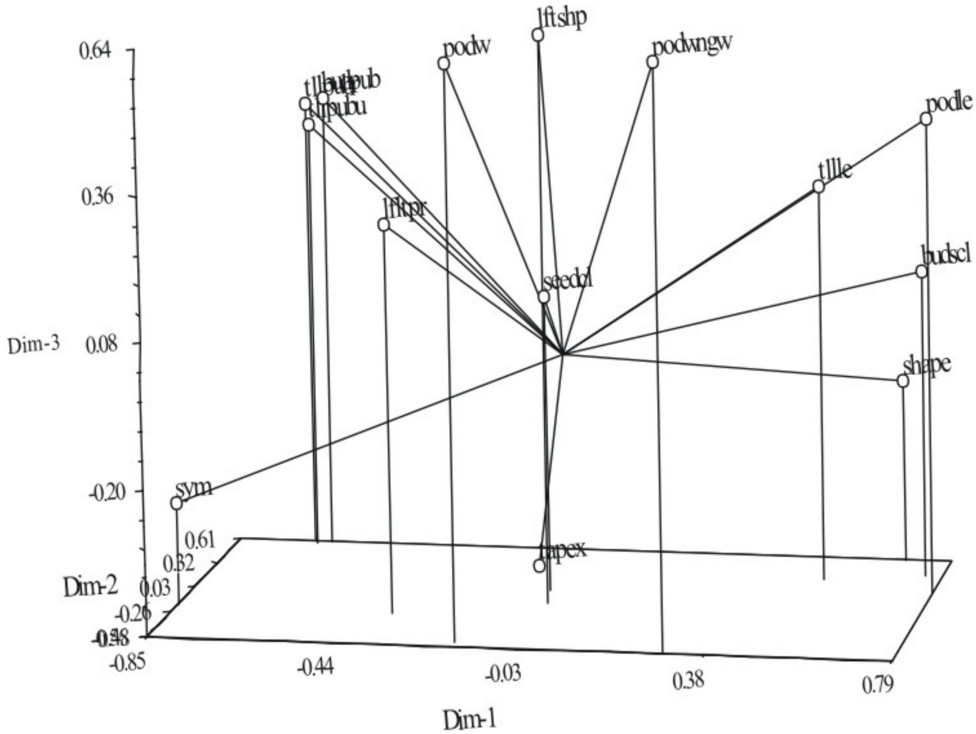


Figure 17. Phenogram resulting from PCA of data from flowering specimens of *Maackia*, excluding *M. tenuifolia*. 1. *M. amurensis* (cyan) with *M. amurensis* f. *pilosella* indicated by dashed line; 2. *M. fauriei* (purple); 3. *M. taiwanensis* (orange); 4. *M. "buergeri"* (green); 5. *M. chekiangensis* (pink); 6. *M. floribunda* (yellow); 7. *M. tashiroi* (dark brown); 8. *M. hupehensis* (powder blue); 9. *M. austalis* (magenta).



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Podle	0.383	0.145	0.291
Podw	0.085	0.312	0.405
Shape	0.334	0.378	0.083
Sym	0.412	0.108	0.187
Seedcl	0.029	0.079	0.060
Podwngw	0.140	0.342	0.419
Budscl	0.367	0.256	0.078
Budpub	0.308	0.378	0.265
Lfltpr	0.176	0.126	0.177
Tllle	0.260	0.208	0.191
Tapex	0.059	0.245	0.316
Lftshp	0.019	0.021	0.408
Tllpubu	0.324	0.369	0.231
Tllpubr	0.327	0.374	0.259

Figure 18. Projection plot of floral characters according to their respective Eigen values from PCA. Axes correspond with the three dimensions of greatest data variation: Dim-1 = 30.5057%, Dim-2 = 18.8326%, Dim-3 = 16.5244%.

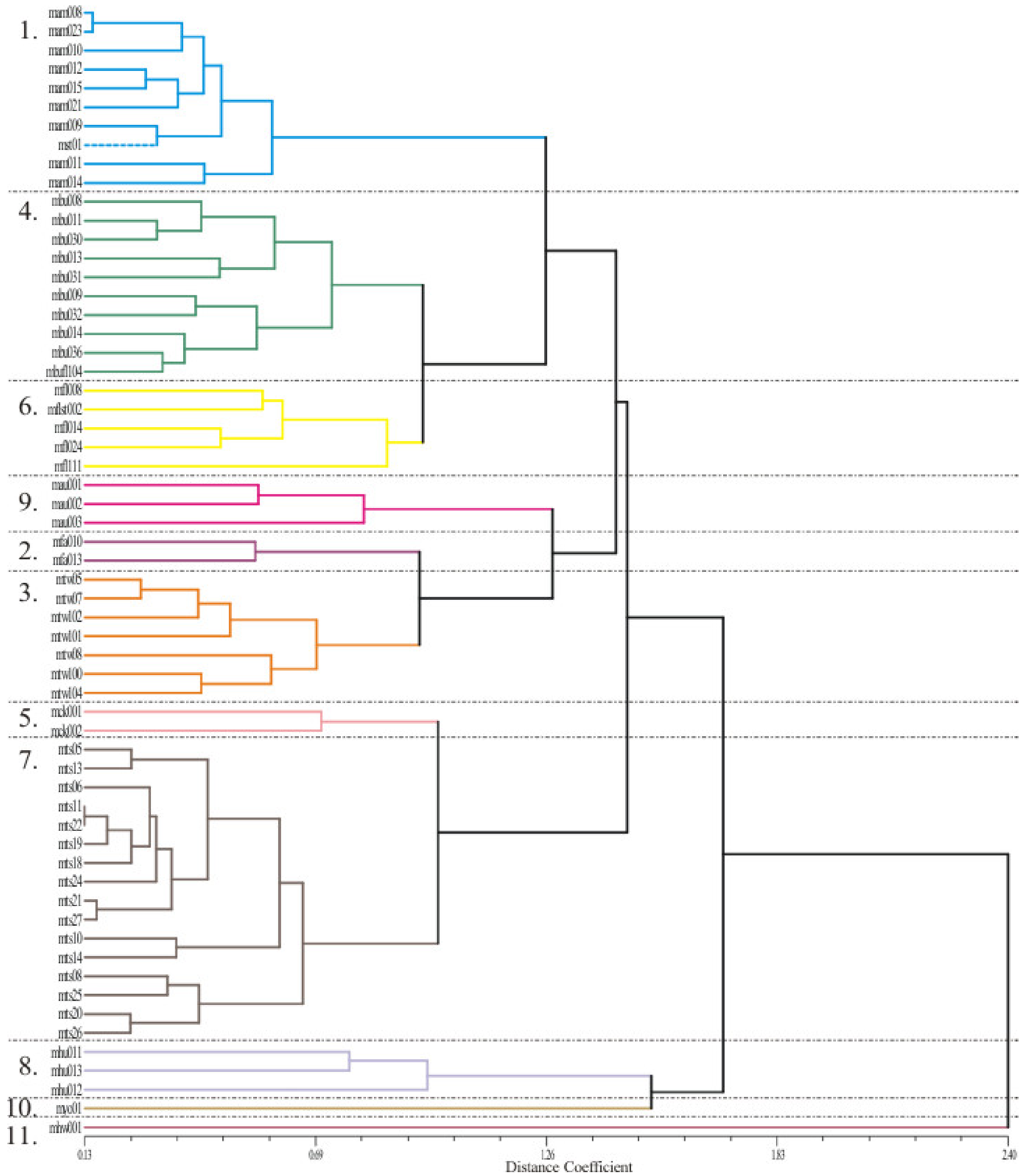
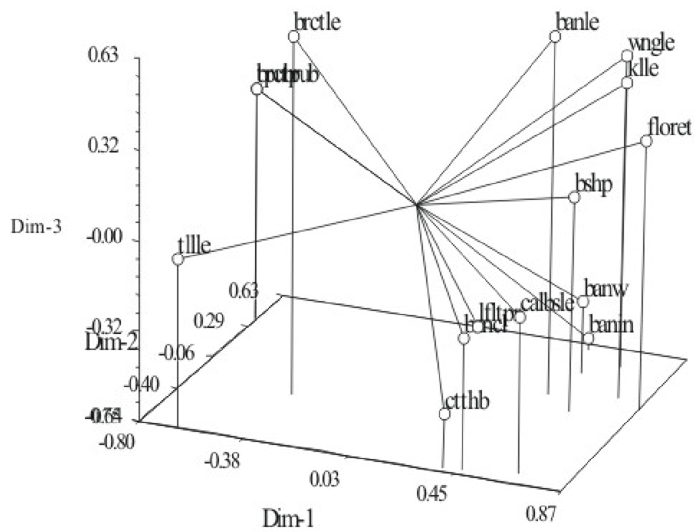


Figure 19. Phenogram resulting from PCA of data from fruiting specimens of *Maackia*, excluding *M. tenuifolia*. 1. *M. amurensis* (cyan) with *M. amurensis* var. *stenocarpa* indicated by dashed line; 2. *M. fauriei* (purple); 3. *M. taiwanensis* (orange); 4. *M. "buergeri"* (green); 5. *M. chekiangensis* (pink); 6. *M. floribunda* (yellow); 7. *M. tashiroi* (dark brown); 8. *M. hupehensis* (powder blue); 9. *M. austalis* (magenta); 10. *Maackia* sp. nov. from Japan (gold); 11. *M. hwashanensis* (deep rose).



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Floret	0.367	0.057	0.193
Bshp	0.269	0.017	0.079
Ctthb	0.169	0.384	0.276
Calbsle	0.282	0.352	0.057
Banw	0.229	0.189	0.234
Banle	0.121	0.056	0.391
Bancl	0.197	0.373	0.113
Banin	0.204	0.314	0.371
Wngle	0.320	0.096	0.355
Klle	0.279	0.250	0.237
Brctle	0.161	0.150	0.387
Brctpub	0.337	0.197	0.123
Lfltpr	0.007	0.340	0.395
Tllle	0.271	0.401	0.028
Tpub	0.337	0.197	0.123

Figure 20. PCA projection plot of floral characters used in analysis of *M. amurensis* f. *amurensis* and *M. amurensis* f. *pilosella*. Dim-1 represents 37.1132% of variation, dim-2 represents 23.2158% of variation, and dim-3 represents 17.5658% of variation.

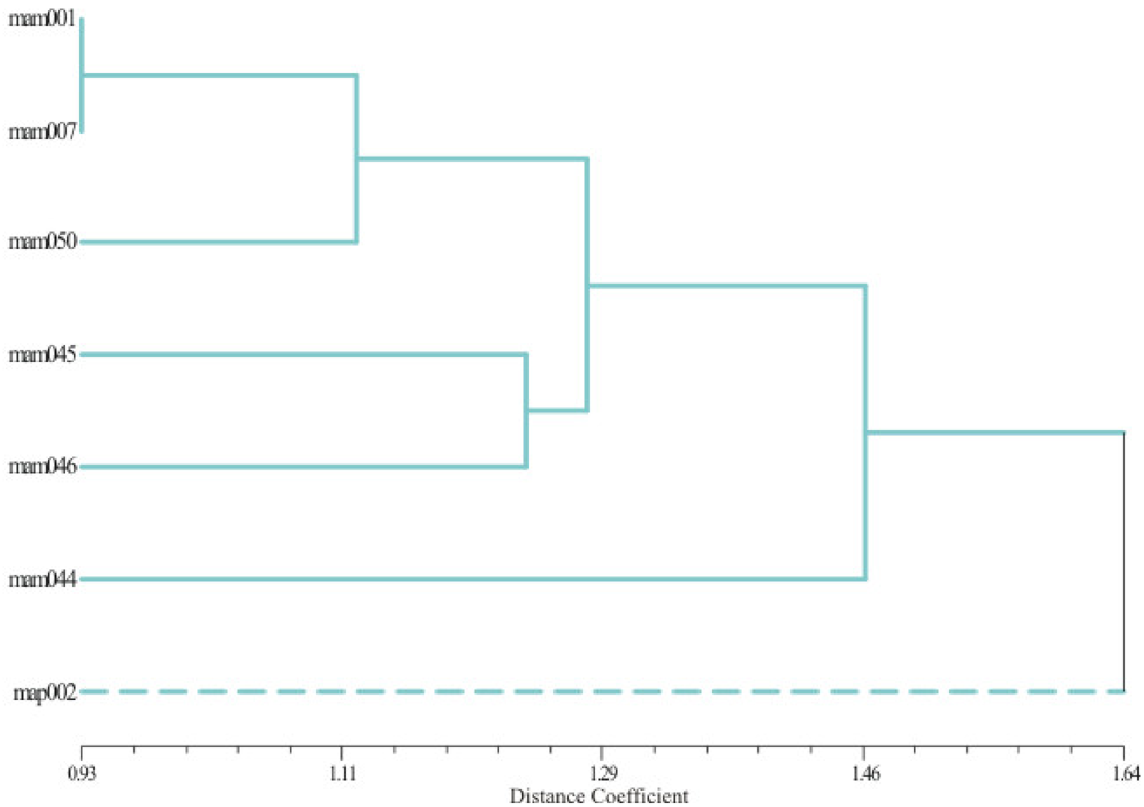


Figure 21. PCA tree plot of *M. amurensis* f. *amurensis* and *M. amurensis* f. *pilosella* based on flowering specimens. *Maackia amurensis* f. *amurensis* indicated with solid line, *M. amurensis* f. *pilosella* indicated by dashed line.

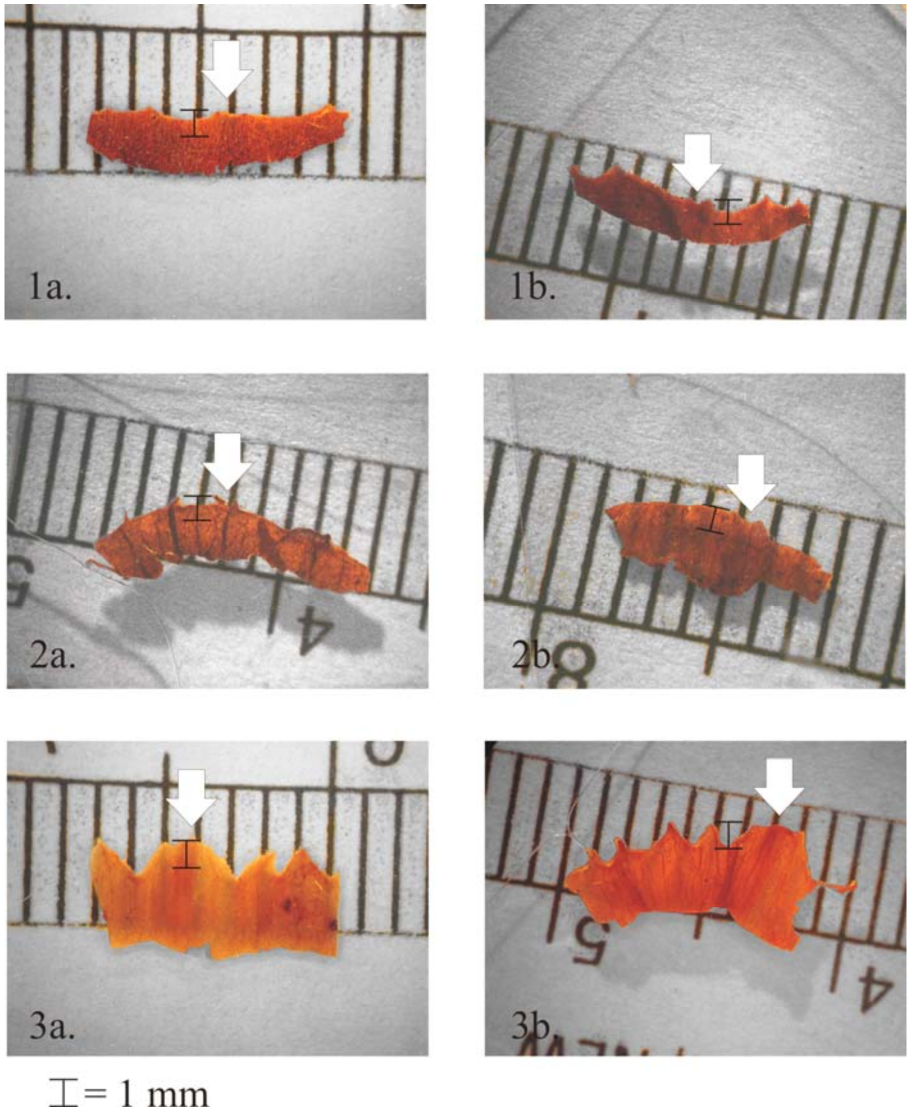
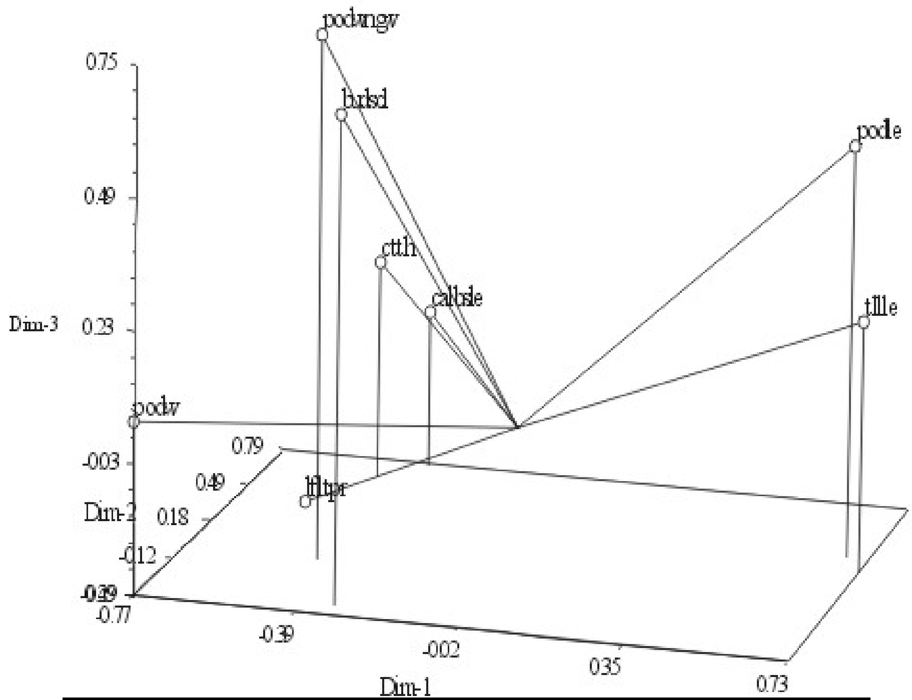


Figure 22. Photographs of opened calyces from *Maackia amurensis* showing greater fusion of teeth in *M. amurensis* f. *pilosella* and var. *stenocarpa*. 1 a.–b. *M. amurensis* f. *pilosella* (*Nakai 13014*; TI). 2 a.–b. *M. amurensis* var. *stenocarpa* (*Utiyama s.n.*; TI). 3 *M. amurensis* var. *amurensis*; a. from *Jeong s.n.* (SNU); b. from *Han s.n.* (EWU). Arrows indicate upper (banner) sepals.



Absolute Eigen Values for Characters			
Character	**Component 1**	**Component 2**	**Component 3**
Podle	0.410	0.297	0.440
Podw	0.468	0.322	0.043
Calbsle	0.257	0.600	0.016
Ctth	0.309	0.501	0.119
Podwngw	0.281	0.012	0.626
Budscl	0.200	0.255	0.555
Lfltpr	0.369	0.298	0.246
Tllle	0.444	0.206	0.174

Figure 23. Projection plot of characters used in analysis of *M. amurensis* var. *amurensis* and *M. amurensis* var. *stenocarpa* according to their respective Eigen values from PCA. Dim-1 represents 33.7077% of variation, dim-2 represents 21.7342% of variation, and dim-3 represents 17.7634% of variation.

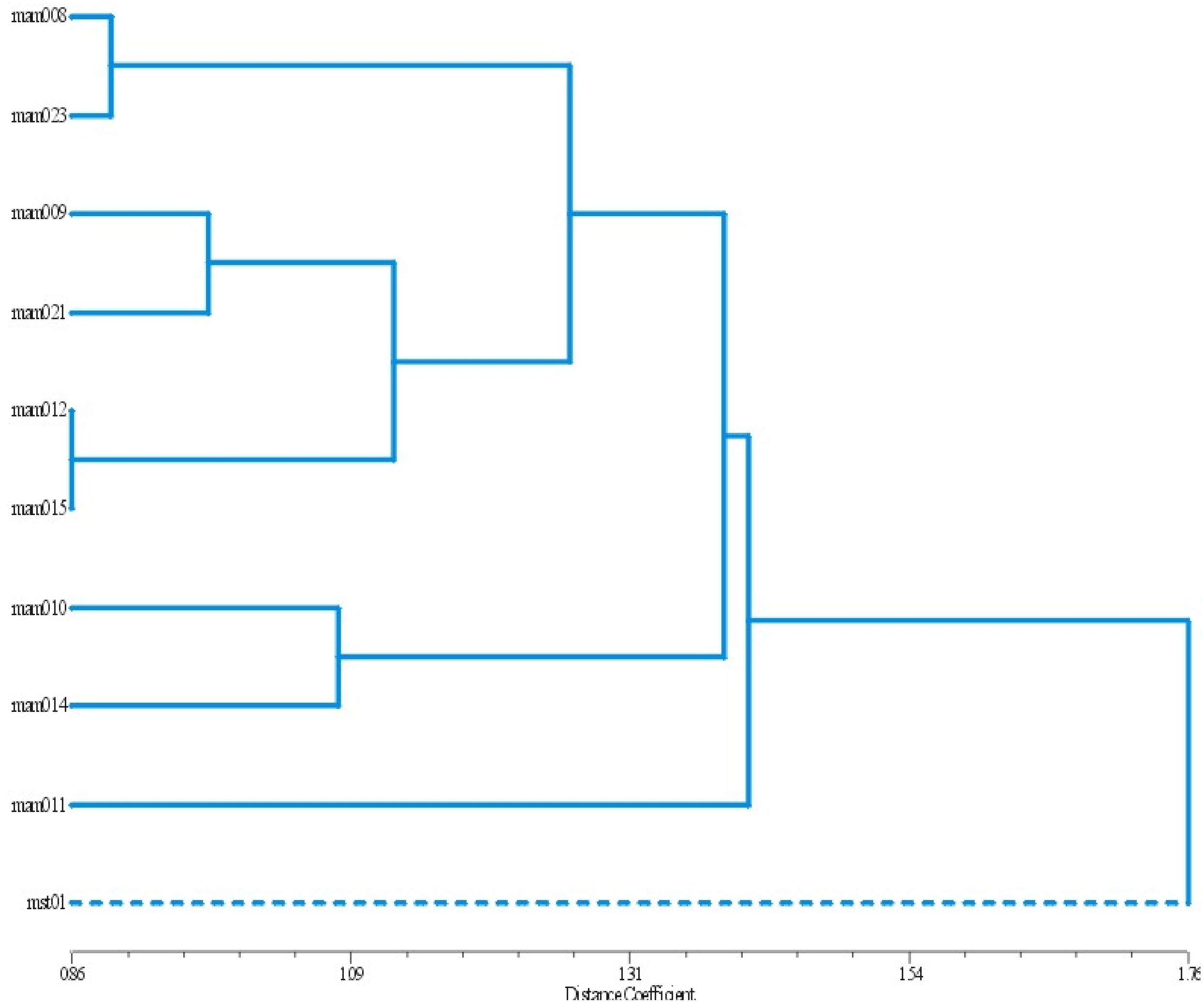


Figure 24. PCA tree plot of *M. amurensis* var. *amurensis* and *M. amurensis* var. *stenocarpa* based on fruiting specimens. *Maackia amurensis* var. *amurensis* indicated with solid line, *M. amurensis* var. *stenocarpa* indicated by dashed line.

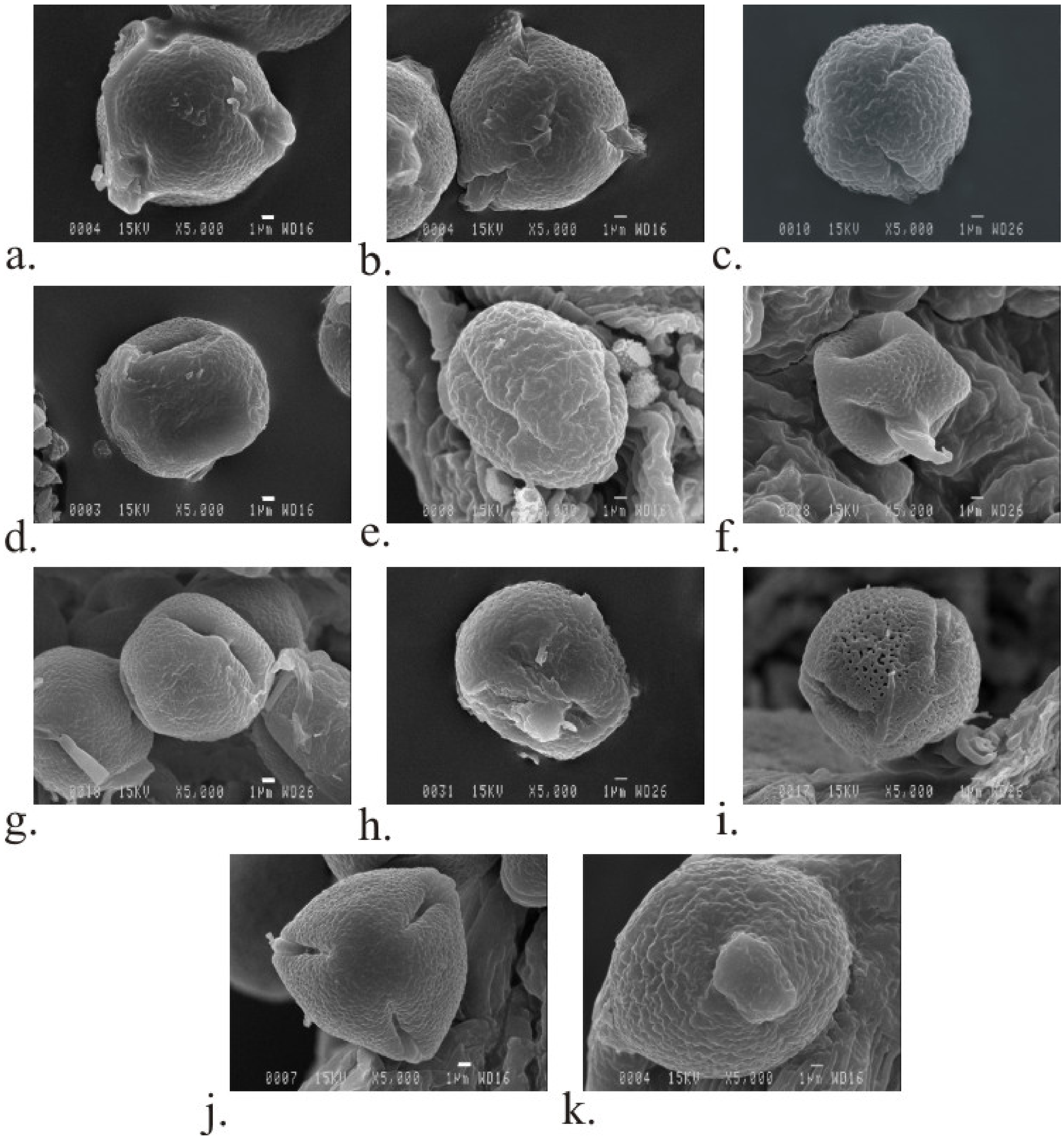


Figure 25. SEM micrographs of pollen of *Maackia* species. Bar 1 µm long. a. *Maackia amurensis* (MU); b. *M. australis* (F); c. *M. "buergeri"* (MU); d. *M. chekiangensis*, from *Yang 10091* (IBSC); e. *M. hupehensis*; f. *M. fauriei*, from *E. J. P. 10791* (GH); g. *M. floribunda* (MO); h. *M. taiwanensis* (MO); i. *M. tashiroi*, from *Yokohama Nursery Co. s.n.* (GH); j. *M. tenuifolia*, from *J. U. McClammer Jr. s.n.* (NA); k. *Euchresta formosana* (MO). Photographs taken by Matt Duley.

DISCUSSION

One of the major questions I was faced with was "Does *Maackia tenuifolia* belong in the genus?" From examination of herbarium specimens, it is obvious that the species is the odd man out of the genus. Flowers of *M. tenuifolia* are twice as long as those of other *Maackia* species, the pistil is stalked while those of other *Maackia* are sessile, and the calyx is campanulate while those of other *Maackia* are slightly bilabiate. Leaflet number in *M. tenuifolia* ranges from 3 to 5, while the remaining *Maackia* species have 7 or more leaflets. Legumes of *M. tenuifolia* are falcate, with bright red to brick red seeds, whereas those of other *Maackia* species are straight, with seeds ranging from yellow to reddish brown.

Maackia tenuifolia was first described in *Euchresta*, based on floral similarities. The main floral difference between *M. tenuifolia* and *Euchresta* is pubescence – the pistil of *Euchresta* is glabrous, whereas the pistil of *M. tenuifolia* is pubescent. In addition, the two differ in fruit characters. *Euchresta* has single-seeded drupaceous legumes that are blue-black in color; *M. tenuifolia* has multiple-seeded, membranous, compressed fruits that are brown. *Euchresta tenuifolia* was transfered to *Maackia* because in fruit, *M. tenuifolia* looks more like *Maackia* than any other genus. However, my analyses show that *M. tenuifolia* does not belong in *Maackia*; the similarities to that genus are tenuous at best. Calyces of *Maackia* are slightly bilabiate, the legumes and pistils are sessile, and the seeds are yellow to reddish brown. Preliminary molecular analysis supports the hypothesis that *M. tenuifolia* does not belong in *Maackia* (Tepe, pers. comm.). The correct generic placement of *M. tenuifolia* is at present unresolved.

The second goal of this study was to determine the number of species in *Maackia*, since literature reports give a range of from 6 to 12 species. After exclusion of *Maackia tenuifolia* from the genus, my results show that there are 11 species in the genus, one of which can be subdivided into 2 subspecies. The species accepted in this study are: *Maackia amurensis* (with subspecies *amurensis* and *stenocarpa*), *M. australis*, *M. chekiangensis*, *M. fauriei*, *M. floribunda*, *M. hupehensis*, *M. hwashanensis*, *M. japonica* (a new species name to replace misapplication of the epithet "*buergeri*"), *M. nakaii* (a new species from Japan), *M. taiwanensis*, and *M. tashiroi*.

The third question addressed involves the validity of varieties reported for *M. amurensis.* The infraspecific taxa described in *M. amurensis*, *M. amurensis* f. *pilosella* and *M. amurensis* var. *stenocarpa*, did not separate cleanly in the analyses that included all *Maackia* specimens studied (Figure 18). However, when specimens of *M. amurensis* were analyzed separately, *M. amurensis* f. *pilosella* separated from f. *amurensis* in analyses of flowering specimens (Figure 21), and *M. amurensis* var. *stenocarpa* separated from var. *amurensis* in analysis of fruiting specimens (Figure 24). Both *Maackia amurensis* f. *pilosella* and *M. amurensis* var. *stenocarpa* have characters that distinguish them from *M. amurensis* f./var. *amurensis* – the upper (banner) calyx teeth of the former are short (the calyx fused for more than 81% of its length), while the upper (banner) calyx teeth of the latter are longer (the calyx is fused for 61% or less of its length); the former have leaflets that are glabrescent on the abaxial surface along the midrib, while those of the latter are glabrous throughout; the outermost bud scales of the former are glabrescent, whereas those of *M. amurensis* f./var. *amurensis* are glabrous. In addition, legumes of *M. amurensis* var. *stenocarpa* are proportionally narrower (8:1 length:width) than are those of *M. amurensis* var. *amurensis* (5:1). Even though the variety and the form were found on different mountains in central Korea and in different stages of development (*"stenocarpa"* is in fruit, and *"pilosella"* is in flower), the similarity in calyces is dramatic. Of all the specimens examined, only these two taxa had bilabiate calyces with such small teeth. The only confounding characteristic is the pubescence, *"pilosella"* is pubescent but *"stenocarpa"* is not. However, pubescence appears to be lost with age, as it is on leaflet margins in *M. tashiroi*, which are ciliate when young and lose these cilia with age.

Given the results of the analyses, I accept 11 species in the genus *Maackia*. In addition, *M. amurensis* is divided into two subspecies, one found in eastern Russia, China, and Korea, and the other restricted to the Korean peninsula. Major morphological features for each species are presented in Table 5, including discriminating characters.

Table 5. Diagnostic characters of *Maackia* species.

Species	Vegetative	Inflorescence	Infructescence
M. amurensis ssp. *amurensis*	Leaflets: glabrous, (7-)9(-11), apices acute to acuminate Outermost budscales: glabrous	Flowers: ≥ 8 mm long, calyx teeth ≥ 40% of sepal length, banner orbicular to urn-shaped Bracteole: glabrous, triangular ovate, apices acute	Legumes: lanceolate to narrowly elliptical, length:width ratio 5:1, wing narrow Seeds: yellow to reddish-yellow
M. amurensis ssp. *stenocarpa*	Leaflets: glabrescent, (7-)9(-11), apices acute to acuminate Outermost budscales: glabrescent	Flowers: ≥ 7 mm long, calyx teeth < 10% of sepal length, banner urn-shaped Bracteoles: glabrescent, triangular ovate, apices attenuate	Legumes: linear-lanceolate to lanceolate, length:width ratio 8:1, wing narrow Seeds: yellow to reddish-yellow
M. australis	Leaflets: glabrous, 7-11, apices acute Outermost budscales: glabrous	Flowers: 6-7 mm long, calyx teeth ≥ 42% of sepal length, banner orbicular Bracteoles: glabrous, narrowly triangular, apices attenuate	Legumes: ovate to broadly elliptical, length:width ratio 2:1, wing narrow Seeds: yellow to reddish-yellow
M. chekiangensis	Leaflets: pubescence yellow, 9-11, apices attenuate Outermost budscales: pubescence yellow	Flowers: 5-6 mm long, calyx teeth ≥ 58% of sepal length, banner orbicular Bracteoles: pubescence yellow, narrowly triangular, apices attenuate	Legumes: ovate to broadly elliptical, length:width ratio 3:1, wing narrow Seeds: yellow to reddish-yellow
M. fauriei	Leaflets: glabrous, 13-15, apices acute Outermost budscales: glabrous	Flowers: ≥ 10 mm long, calyx teeth ≥ 30% of sepal length, banner orbicular Bracteoles: glabrous to pubescence yellow, triangular ovate, apices attenuate	Legumes: lanceolate, length:width ratio 2:1, wing wide Seeds: yellow to reddish-yellow

Table 5 continued.

Species	Vegetative	Inflorescence	Infructescence
M. floribunda	Leaflets: pubescence yellow, 9-15, apices acute Outermost budscales: pubescence yellow	Flowers: 7-8 mm long, calyx teeth ≥ 27% of sepal length, banner orbicular Bracteoles: pubescence yellow, triangular ovate, apices acute	Legumes: lanceolate, length:width ratio 2:1, wing wide Seeds: yellow to reddish-yellow
M. hupehensis	Leaflets: pubescence yellow, 9-13, apices acute Outermost budscales: pubescence yellow	Flowers: 8-9 mm long, calyx teeth ≥ 36% of sepal length, banner orbicular Bracteoles: pubescence yellow, narrowly triangular linear, apices acuminate	Legumes: elliptical, length:width ratio 4:1, wing wide Seeds: yellow to reddish-yellow
M. hwashanensis	Leaflets: pubescence white, 9-1, apices acute Outermost budscales: pubescence white	Flowers: ≥ 10 mm long, calyx teeth ≥ 40% of sepal length, banner orbicular Bracteoles: pubescence white, narrowly triangular linear, apices acuminate	Legumes: elliptical, length:width ratio 3:1, wing narrow Seeds: reddish brown
M. japonica	Leaflets: pubescence yellow, (7-)9-13, apices acute Outermost budscales: pubescence yellow	Flowers: ≥ 10 mm long, calyx teeth ≥ 17 % of sepal length, banner orbicular Bracteoles: pubescence yellow, triangular ovate, apices attenuate	Legumes: lanceolate, length:width ratio 8:1, wing narrow Seeds: yellow to reddish-yellow
M. nakaii	Leaflets: glabrous, 11, apices short acuminate Outermost budscales: glabrous to glabrescent	unknown	Legumes: elliptical, length:width ratio 5:1, wing narrow Seeds: yellow to reddish-yellow

Table 5 continued.

Species	Vegetative	Inflorescence	Infructescence
M. taiwanensis	Leaflets: glabrous, 11-15, apices acute Outermost budscales: glabrous	Flowers: 6-7 mm long, calyx teeth ≥ 30 % of sepal length, banner orbicular Bracteoles: glabrous, narrowly triangular, apices acute	Legumes: elliptical, length:width ratio 4:1, wing wide Seeds: yellow to reddish-yellow
M. tashiroi	Leaflets: pubescence yellow, 9-15, apices acuminate to acute Outermost budscales: pubescence yellow	Flowers: 6-7 mm long, calyx teeth ≥ 30 % of sepal length, banner urn-shaped Bracteoles: pubescence yellow, short triangular ovate, apices long attenuate	Legumes: obliquely elliptical, length:width ratio 3:1, wing narrow Seeds: yellow to reddish-yellow

TAXONOMIC TREATMENT

Maackia Rupr. & Maxim., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 15: 128, 143. 1857. TYPE: *M. amurensis* Rupr. & Maxim.

Trees or shrubs; bark exfoliating. Axillary bud exposed; outermost bud scales glabrous or pubescent. Leaves deciduous, alternate, exstipulate, imparipinnate, ovate to obovate, petiolate; leaflets 7-15, opposite or alternate, entire, ovate, elliptic to obovate, glabrous or pubescent, apices acute to acuminate, bases acute to acuminate, rarely truncate on basal leaflets; pulvini glabrous or pubescent. Inflorescence racemose, compound or simple, erect, terminal, ebracteate. Flowers perfect, papilionaceous, bracteolate; bracteoles persistent or deciduous, glabrous or pubescent. Perianth hypogynous; calyx campanulate, 4-5-lobed, fused for most of its length, pubescent; corolla white, often becoming yellow with age; banner emarginate, reflexed at the point where a thick callus is positioned or a thickened claw joins the lamina, claw straight; wing spurred, auriculate, claw bent, lamina pleated when dry; keel petals slightly fused at apex, spurred, auricle absent, claw straight. Stamens 10, included, unequal, monadelphous, fused only slightly at base; anthers bilocular, dorsally basifixed, introrse, longitudinally dehiscent. Ovary pilose; style glabrous; stigma glabrous. Fruit a legume, pubescent, ovate to elliptical or lanceolate, symmetrical or assymetrical. Seeds 1 to 5, yellow to reddish brown. $x = 9, 10$.

11 species; temperate eastern Asia.

KEY TO SPECIES OF *MAACKIA*

1. Specimens in flower (NOTE: flowers of *M. nakaii* are unknown at present)
    2. Leaflets pubescent (at least along the midrib beneath)
        3. Flowers $\geq$ 1 cm long
            4. Leaflets densely pubescent; bracteoles 1.2-2.3 mm long .... 8. *M. japonica*
            4. Leaflets hirsute; bracteoles 2.9-4.1 mm long............................7. *M. hwashanensis*
        3. Flowers <1 cm long
            5. Flowers 8-9 mm long
                6. Leaflets densely pubescent throughout; leaflet apex acute...... 6. *M. hupehensis*
                6. Leaflets pubescent only along midvein leaflet apex acuminate........................... ....1. b. *M. amurensis* ssp. *stenocarpa*
            5. Flowers < 8 mm
                7. Leaflet apices attenuate; flowers 5-6 mm long....................3. *M. chekiangensis*
                7. Leaflet apices acute to acuminate; flowers 6-7 mm long
                    8. Banners orbicular; terminal leaflet lanceolate to elliptical .... 5. *M. floribunda*
                    8. Banners urn-shaped; terminal leaflet obovate........................11. *M. tashiroi*
    2. Leaflets glabrous
        9. Flowers $\geq$ 8 mm long
            10. Leaflet pairs 6-7; leaflets lanceolate ....4. *M. fauriei*
            10. Leaflet pairs fewer than 6; leaflets oval to obovate .... 1.a. *M. amurensis* ssp. *amurensis*
        9. Flowers < 8 mm long
            11. Leaflets lanceolate; terminal leaflet 2.8-4.2 cm long .... 10. *M. taiwanensis*
            11. Leaflets ovate to oval; terminal leaflet length 3.7-7.6 cm ....2. *M. australis*
1. Specimens in fruit
    12. Leaflets pubescent (at least along the midrib beneath)
        13. Legume $\leq$ 4 cm long
            14. Leaflets densely pubescent; terminal leaflet obovate ....11. *M. tashiroi*
            14. Leaflets hirsute; terminal leaflet lanceolate to oval
                15. Leaflet apex attenuate ....3. *M. chekiangensis*
                15. Leaflet apex acute ....7. *M. hwashanensis*
        13. Legume $\geq$ 4 cm long
            16. Legume wing < 1 mm wide, 0.6-1.0 cm wide; pulvini pubescent... 8. *M. japonica*
            16. Legume wing $\geq$ 1 mm wide
                18. Legume $\leq$ 1.2 cm wide .... 5. *M. floribunda*
                18. Legume > 1.2 cm wide .... 6. *M. hupehensis*
    12. Leaflets glabrous
        19. Legumes $\leq$ 4 cm long ....2. *M. australis*
        19. Legumes > 4 cm long
            20. Legume wings $\leq$ 1 mm wide
                21. Legumes $\geq$ 0.8 cm wide; upper calyx teeth $\geq$ 20% the length of the calyx
                    22. Legume length:width ratio 5:1, legumes lanceolate to narrowly elliptical... .... 1.a. *M. amurensis* ssp. *amurensis*

22. Legumes length:width ratio 4:1, legumes elliptical .... 9. *M. nakaii*

21. Legumes < 0.8 cm wide; upper calyx teeth ≤ 19% the length of the calyx .... 1.b. *M. amurensis* ssp. *stenocarpa*

20. Legume wings > 1 mm wide

23. Legumes lanceolate; pulvini < 0.3 cm long .... 4. *M. fauriei*

23. Legume elliptical; pulvini ≥ 0.3 cm long .... 10. *M. taiwanensis*

Figure 26. Key characters of *Maackia* species. Column 1, fruits; column 2, bud scales, column 3, flowers; column 4, banner petals. a. *M. amurensis*; b. *M. chekiangensis*; c. *M. hwashanensis*; d. *M. fauriei*; e. *M. australis*; f. *M. hupehensis*; g. *M. japonica*; h. *M. floribunda*; i. *M. tashiroi*; j. *M. nakaii*; k. *M. taiwanensis*.


1 cm
1 mm
1 mm
3 mm
a.
1.
2.
3.
4.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.

1. ***Maackia amurensis*** Rupr. & Maxim., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 15: 128, 143. 1857. *Cladrastis amurensis* (Rupr. & Maxim.) Benth., Gen. Pl. 1: 554. 1862. *Cladrastis amurensis* (Rupr. & Maxim.) Koch., Dendrologie 1: 5-7. 1869. LECTOTYPE (designated by Yakovlev [1975]): Amur, Zianka, "Khottolang", 6 Jul 1855, *Maximovicz s.n.* (LE!). Figure 26 a.

Trees to 40 ft. Outermost bud scales 2.7–6.9 mm long, 2.0–4.2 mm wide, glabrous to glabrescent. Leaves ovate to obovate, 15–23 cm long, 9.1–16.3 cm wide, petioles 3–5.8 cm long; leaflets (7 –) 9 (– 11), glabrous to glabrescent along midrib, ovate to elliptical to obovate, apices acuminate to acute, bases acuminate to acute; terminal leaflets 4.2–8 cm long, 2.3–5.6 cm wide, basal leaflets, 2.1–6.6 cm long, 1.3–3.6 cm wide; leaflet pulvini glabrous to glabrescent, 0.2–0.5 cm. Flowers 0.8–1.2 cm long; bracteoles glabrous to pubescent, 0.9–2 mm long, 0.6 mm wide, triangular-ovate, apices acute to attenuate; pedicels 3.2–10 mm long; calyces 2.1–4.2 mm long, banner side teeth 19–35% of calyx length; banner laminas 3.6–6.3 mm long, 2.6–5.4 mm wide, claws 1.1–4.8 mm long, indentations 0.6–1.4 mm, calluses thick and cartilagenous; wing laminas 4.3–7.5 mm long, 1.7–3.2 mm wide, claws 0.9–3.9 mm, spurs 0.3–0.9 mm, auricles 0.2-0.6 mm; keel laminas 4.3–7.3 mm long, 2.2–3.3 mm wide, claws 1–3.5 mm, spurs 0.25–0.7 mm. Stamen filaments 3–7.2 mm long; anther 0.3 mm wide, 0.6 mm long. Ovaries 3.5–5 mm, long, 0.8–1.2 mm wide; styles 0.6–2.4 mm long; stigmas 0.06–0.2 mm wide. Legumes linear-lanceolate to lanceolate to narrowly elliptical, symmetrical, 4–7.3 cm long, 0.8–1.4 cm wide; wings 0.4–1.2 mm wide. Seeds 1–4, yellow, 5.6–8.3 mm long, 3.1–4.6 mm wide; hilum 0.8–1.3 mm long, 0.4–0.7 mm wide. 2n = 18 (Goldblatt 1981; Goldblatt and Davidse 1977; Pavlova et al. 1989; Probatova and Sokolovskaya 1981; Volkova et al. 1994).

Distribution

Manchuria (Russia: southern Siberia; Northern China), Korean peninsula (Figure 27).

Notes

Maackia amurensis differs from *M. japonica* by pubescence characters; both the outermost bud scales of *M. japonica* are moderately to densely pubescent, while those of *M. amurensis* are glabrous or sparsely pubescent only at the tip; leaflets of *M. japonica* are moderately to densely pubescent over the entire abaxial surface, whereas those of *M. amurensis* are glabrous to sparsely pubescent only along the midrib. *Maackia japonica* fruits are less than 1 cm wide, while those of *M. amurensis* are 1 cm or more wide.

Few pollen studies have been done of *M. amurensis*. Chung and Lee (1994) described pollen of *M. amurensis*, based on a Korean specimen; they reported the following measurements: polar axis length 16.8-22.68 μm, equatorial axis length 17.08-19.88 μm. Ferguson et al (1994) gave pollen data for what they were calling "*M. amurensis*" but both vouchers are from Japan and are *M. japonica*.

Maackia amurensis may be subdivided into two subspecies. Nakai (1939) described two subspecific taxa, *M. amurensis* var. *amurensis* f. *pilosella* (based on flowering specimens) and

M. amurensis var. *stenocarpa* (based on a fruiting specimen). *Maackia amurensis* f. *pilosella* was separated from *M. amurensis* f. *amurensis* by the presence of pubescence on leaves and bud scales. *Maackia amurensis* var. *stenocarpa* was separated from *M. amurensis* var. *amurensis* by the width-length ratio of the legumes: var. *amurensis* legume length-width ratio is approximately 5:1; that of var. *stenocarpa* ranges from 8:1 to 10:1. In addition, the calyces of f. *pilosella* and var. *stenocarpa* are identical, with calyx teeth that are nearly nonexistent (the calyx is fused for at least 81% of its length); those of var. *amurensis* are longer (the calyx is fused to about 60% of its length). The combination of differences in pubescence, fruit length-width ratios, and calyx tooth length allows for clear separation of the entities. Although *M. amurensis* var. *amurensis* and *M. amurensis* with the "pilosella/stenocarpa" morphology both occur on the Korean peninsula, the latter is restricted to Korea (Figure 28) and not found in the rest of the range of *M. amurensis*. We are elevating *M. amurensis* var. *stenocarpa* to suspecific rank and making a new combination: *Maackia amurensis* ssp. *stenocarpa*. *Maackia amurensis* ssp. *stenocarpa* is pubescent along the midrib on the undersurface of the leaf, on the pulvinus, and on the outer bud scales, but *M. amurensis* ssp. *amurensis* is glabrous. *Maackia amurensis* ssp. *stenocarpa* has slightly smaller flowers (though not statistically different), with measurements ranging from 0.7–1.2 cm long; those of ssp. *amurensis* are 0.8–1.2 cm long.

1a. ***Maackia amurensis*** ssp. ***amurensis***

Outermost bud scales glabrous. Leaflets glabrous; pulvini glabrous. Flowers 0.8–1.2 cm; bracteoles triangular-ovate, apices acute; pedicels 3.2–10 mm long; calyces 2.1–4.2 mm long, upper (banner) teeth 22–35% of sepal length. Legumes lanceolate to narrowly elliptical, 4–7.3 cm long, 0.8–1.4 cm wide; wings 0.4–1.2 mm wide.

Distribution

Manchuria (Russian Siberia, northern China), Korean peninsula (Figure 27).

REPRESENTATIVE SPECIMENS. CHINA. Heilongjiang, 21 Jan 1900, *Bohnhof 231* (NY, E, K, P); Manchuria, 18 Jul 1925, *Dorsett et al 3725* (NY, E, UC, US); Su-tchuen, *s.d.*, *Farges 178* (S); Shendong, 16 Aug 1998, *Hou 98139-1* (CAS); Heilongjiang, 30 Jun 1901, *Karo 930* (BM, TI); Manchuria, 12 Jul 1896, *Komarov s.n.* (LE); Manchuria, 19 Jun 1903, *Kopronovich s.n.* (LE); Manchuria, 26 Jul 1903, *Kopronovich s.n.* (LE); Manchuria, 1914, *Kurosch 130* (LE); Manchuria, 30 Jun 1903, *Litvinov 3029* (LE); Heilongjiang, 1858, *Radde s.n.* (LE); Heilongjiang, 1855, *Schrenk s.n.* (GH, LE); Manchuria, Sep1908, *Siuzov s.n.* (LE); Jilin, 1981, *Wan et al 81008* (NY, K, CAS, BM, MO); Tjaonin, 24 Jun 1950, *Wang et al 1011* (LE); Manchuria, 1859, *Wilford 1124* (GH, K); Tjaonin, 9 Aug 1950, *Wu 178* (LE). **KOREA**. Incheon, 1991, *Bae 12157* (EWU); Gyeonggi, 12 Jun 1980, *Chung s.n.* (EWU); Gyeonggi, 29 Jul 1981, *Chung 54329* (SNU); Seoul, 22 Jun 1980, *Han s.n.* (EWU); Gyeonggi, 27 Jul 1993, *Jeong s.n.* (SNU); Gyeonggi, 25 Sep 1966, *Kim s.n.* (EWU); Gyeongsangbuk, 19 Jul 1969, *Kim s.n.* (EWU); North Pyongan, 4 Jul 1895, *Komarov 930* (NY, BM, P, TI); Gangwon, 21 Jul 1977, *Lee s.n.* (KWNU); Jeollanam, 27 Aug 1976, *Lee s.n.* (KWNU); Gyeonggi, 12 Jul 1998, *Lee s.n.* (KWNU); Gangwon, 6 Aug 2000, *Lee et al 12970* (EWU); Gangwon, 6 Aug 2000, *Lee et al 12971* (EWU); Chungcheongnam, 14 Jul 1962, *Nam s.n.* (EWU); Pusan, 1959, *Park 42* (EWU);

Chungcheongbuk, 11 Aug 1957, *Ryu 132* (TAI); Kyongsangnamdo, 26 Jul 1926, *Saito 8848* (MO, TI); Gangwon, 26 Jul 1977, *Sun s.n.* (KWNU); Hamgyengbuk, 23 Jul 1936, *Toh/Do 9267* (SNU); Gangwon, 12 Aug 1943, *Toh/Do 11478* (SNU); Gangwon, 12 Aug 1943, *Toh/Do 11477* (SNU); Gangwon, 28 Jul 1934, *Toh/Do 4252* (SNU); Hamgyengbuk, 16 Jul 1936, *Toh/Do 5093* (SNU); Kangwon, 14 Jul 1918, *Wilson 10498* (GH, US, K, BM, MO); Gangwon, 17 Jul 1932, *Yamasina 3404* (SNU); Cholla Pukto, 3 Oct 1985, *Yinger et al 3673* (NA); Jeollabuk, 23 Jul 2004, *You s.n.* (KWNU); Gangwon, 25 Jul 2003, *You s.n.* (KWNU). **RUSSIA**. Leningrad Oblast, 19 Aug 1904, *Bean 477* (K); Maritime, 8 Jul 1911, *Chersky s.n.* (LE); Khabarovsk, 10 Jul 1902, *Desoulavy 303* (LE); Khabarovsk, 12 Aug 1903, *Desoulavy 687* (LE); Khabarovsk, 19 Jul 1988, *Elias et al 11037* (NY); Siberia, 3 Aug 1913, *Enander s.n.* (S); Khabarovsk, 18 ? 1909, *Fedtschenko 489* (LE); Khabarovsk, 1909, *Fedtschenko 539* (LE); Maritime, 3 Sep 1967, *Grudzinskaya s.n.* (LE); Maritime, 18 Aug 1936, *Koleshirov 57* (LE); Khabarovsk, 1891, *Korshinsky s.n.* (US, LE); Amur, 21 Jul 1914, *Kryshtofovich 979* (LE); Maritime, 1909, *Kuzjuring 1590* (LE); Maritime, 23 ? 1929, *Kuznetzov 280* (LE); Maritime, 20 Jul 1901, *Lipsky s.n.* (LE); Amur, 3 Jul 1855, *Maximowicz s.n.* (LE); Maritime, 27 Jul 1928, *Nekrasova 575* (LE); Amur, 1915, *Pakhtiy s.n.* (LE); Maritime, 1903, *Palczewsky s.n.* (LE); Jewish Autonomous, 1909, *Petrowsky s.n.* (LE); Amur, Jan 1900, *Poleshajew et al s.n.* (LE); Maritime, 20 Jul 1925, *Samoilov 6721* (LE); Maritime, 10 Jul 1925, *Schischkin 218* (LE); Khabarovsk, 2 Aug 1920, *Schischkin s.n.* (LE); Amur, 10 Aug 1926, *Selivanova s.n.* (LE); Jewish Autonomous, 29 Jun 1910, *Semjagin 87a* (LE); Maritime, 23 ? 1928, *Skripka 533* (LE); Khabarovskyi, *s.d*., *Solokhin 1056* (LE); Maritime, 2 ? 1928, *Vorob'ev s.n.* (LE); Amur, 30 Mar 1891, *Yakovlev s.n.* (LE).

1b. ***Maackia amurensis*** ssp. ***stenocarpa*** (Nakai) Levings & Vincent, *comb. nov., ined.*
Maackia amurensis var. *stenocarpa* Nakai, J. Jap. Bot. 15: 682. 1939. TYPE: Korea, Keiki Prov., Mt. Nanzan, Keizyô, 30 Aug 1902, *T. Utiyama s.n.* (holotype: TI!).
Maackia amurensis var. *typica* f. *pilosella* Nakai, J. Jap. Bot. 15: 681. 1939. Lectotype (to be designated): Korea: Prov. Kôkai, in insula Taiseitô, 26 Jul 1929, *T. Nakai 13014* (TI!). Syntypes: Korea: Prov. Kogen, Kongosan, Tunsenkyo mountain, 31 Jul 1916, *T. Nakai 5553* (TI!); Prov.Tyuhoku, Suisyoho mountain of Zokurisan mountains, 11 Aug 1934, *T. Nakai 14996* (TI!); Prov. Zennan, Tinto, 23 Jun 1921, *T. Nakai s.n.* (TI!); Prov. Zennan, Hakuyozan mountain, 3 May 1913, *T. Nakai s.n.* (TI!); Prov. Zennan, in silvis Reisyuzan mountain oppidi Sanzitu Tractus Reisui, *T. Nakai 11508* (TI!); Prov. Zennan, in silvis Taitonzan tractus kainan, *T. Nakai 9843* (TI!); Prov. Keinan, in silvis templi Ryumonzi insulae Nankaito, 16 May 1928, *T. Nakai 11509* (TI!); Prov. Kokai, Tyozankan, 4 Aug 1929, *T. Nakai 13011* (TI!); Prov. Kanhoku, in trajectu Koseturei tractus Kyozyo, 23 Jul 1918, *T. Nakai 7198* (TI!).

Outermost bud scales glabrescent. Leaflets glabrescent along midrib beneath; pulvini glabrescent. Flowers 0.7–1.2 cm; bracteoles triangular-ovate, apices attenuate; pedicels 3.2–3.9 mm long; calyces 1.5–2.1 mm long, upper (banner) teeth 19% or less of sepal length. Legumes linear-lanceolate to lanceolate, 4–7.3 cm long, 0.5–0.7 cm wide; wing 0.4–0.5 mm wide.

Distribution

Korean peninsula (Figure 28).

Notes

Yakovlev (1975) mentions the varietal name "*latifoliata*", which he attributes to Nakai (1939) in the Journal of Japanese Botany publication and on the same page where Nakai described f. *pilosella*. This epithet is not published as cited, and we were unable to locate any publication of the name.

REPRESENTATIVE SPECIMENS. Korea. Kanboho, 16 Jul 1936, *B.-S. Toh 5093*(SNU); Kyongsangnamdo Prov., Mt. Chiri, 24 Jul 1926, *S. Saito 8848* (MO).

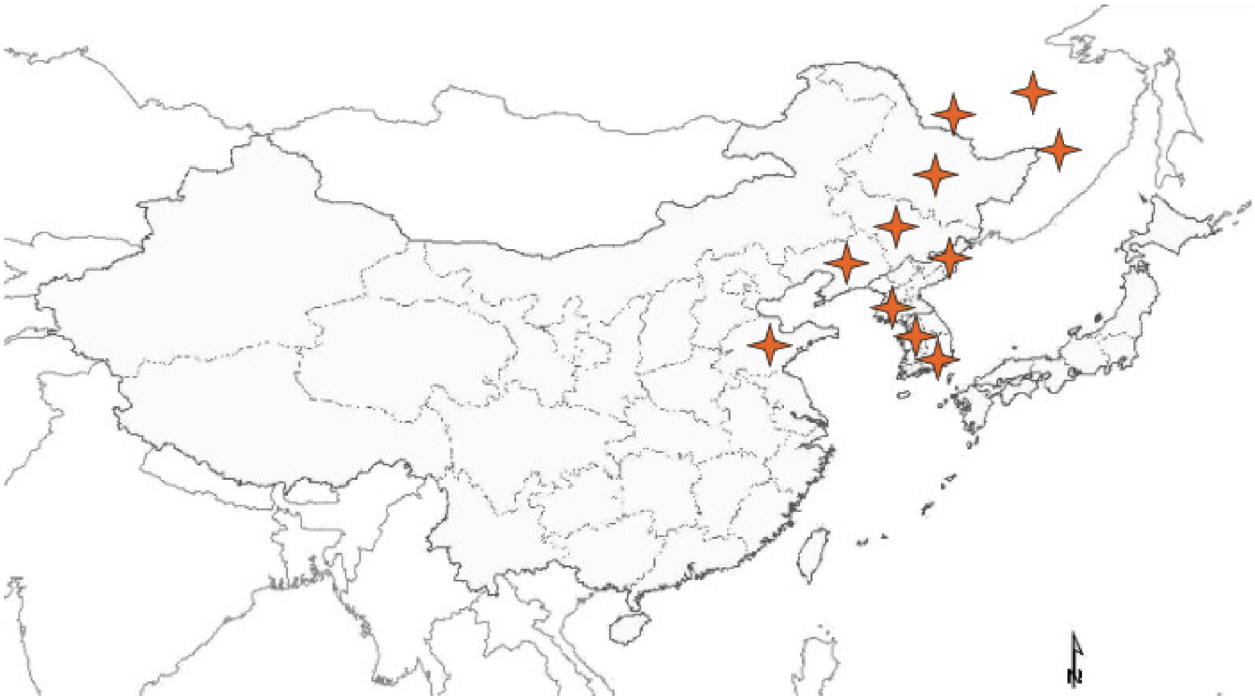


Figure 27. Distribution map of *M. amurensis* Rupr. & Maxim.

Figure 28. Distribution of *M. amurensis* ssp. *amurensis* and *M. amurensis* ssp. *pilosella* on the Korean Peninsula.

2. ***Maackia australis*** (Dunn) Takeda, Notes Roy. Bot. Gard. Edinburgh 8(37): 102. 1913.
Cladrastis australis Dunn, Kew Bulletin 10(86): 86-87. 1912. LECTOTYPE (to be designated): China, 1838, *Millet s.n.* (K ["Herbarium Hookerianum 1867"]!; isolectotype K ["Herbarium Hookerianum 1854"]!). Syntype: China: Guangdong ("Kwangtung"), N.W. River, 4.8.1890, *Lo Quai s.n.* ("herb. Hong Kong"; fragment K!).
Maackia ellipticocarpa Merrill, J. Arnold Arbor. 26(2): 163-165. 1945. TYPE: Hong Kong, Lantao Province, 12 Sep 1940, *Taam 1693* (holotype: NY!; isotypes: F!, UC!, US!). Figure 26 e.

Small trees. Outermost bud scales glabrous, 1.1–2.6 mm long, 0.6–1.6 mm wide. Leaves ovate to obovate, 13.2–22 cm long, 7–17.2 cm wide, petiole 2–3.8 cm long; leaflets glabrous, 7–11, ovate to broadly elliptical, apices acute, bases cuneate; terminal leaflets 3.7–7.6 cm long, 1.5–4.1 cm wide; basal leaflets 2.5–4.5 cm long, 1.3–2.6 cm wide; leaflet pulvini glabrous, 2–2.4 mm long. Flowers 0.6-0.7 cm; bracteoles glabrous, 2.1–2.6 mm long, 0.3–0.4 mm wide, narrowly triangular, apices attenuate; pedicels 2.4–4.8 mm long; calyces 2.1–2.4 mm long, upper (banner) teeth 42–67% of calyx length; banner laminas 2.7–3.3 mm long, 2.1–2.4 mm wide, claws 1.2–1.5 mm long, indentations 0.3–0.6 mm, calluses thin and cartilagenous; wing laminas 3.4–4.8 mm long, 1.5–1.8 mm wide, claws 0.9–2.7 mm, spurs 0.3–0.4 mm, auricles 0.12–0.13 mm; keel laminas 3.4–4.8 mm long, 1.8–2.4 mm wide, claws 1.2–2.1 mm, spurs 0.3–0.36 mm. Stamen filaments 2.4–3.9 mm long; anthers 0.3 mm wide, 0.6 mm long. Ovaries 2.1 mm, long, 0.6–0.9 mm wide; styles 0.7–0.9 mm long; stigmas 0.12 mm wide. Legumes ovate to broadly elliptical, symmetrical to oblique, 2.8–3 cm long, 1.2–1.7 cm wide; wings 0.4–1.1 mm wide. Seeds 1–3, yellow, 7.1–8.6 mm long, 4.05–5.4 mm wide; hilum 0.6–0.8 mm long, 0.6–0.8 mm wide.

Distribution

Southern China: Guangdong, Hong Kong (Figure 29).

Notes

Maackia australis differs from *M. chekiangensis* by lack of pubescence, leaflet apex shape (acute in *M. australis*, acuminate in *M. chekiangensis*), and bracteole shape (narrowly triangular in *M. australis*, attenuate in *M. checkiangensis*).

Only two pollen studies include data on *M. australis*. Ferguson et al (1994) reports a polar axis length of 17-19 µm and an equatorial axis length of 16-17 µm from a Millett specimen (identified as *M. tashiroi*) from China. Chung and Lee (1994) report the following measurements (from *Taam 2134*): polar axis length 16.24-19.32 µm, equatorial axis length 17.08-19.46 µm.

Hemsley (1887) mentioned the Millett collection of *M. australis* in the same paper in which he described *Euchresta tenuifolia*, stating that it could be either a *Cladrastis* species or *Buergeria floribunda*. Chang (1994) recognised *M. australis* and *M. ellipticocarpa* as distinct, separating the two based on what he described as glabrous fruits in *M. australis* versus glandular and pubescent fruits in *M. ellipticocarpa*. However, after examining all of the specimens at our disposal, including the type material, we are unable to accept this distinction. None of the specimens examined had completely glabrous fruits. In his description of *M. ellipticocarpa*, Merrill (1945) described the fruits as "distinctly glandular"; although some of the fruits in the type collection are glandular, some lack these glands. Furthermore, the fruiting syntype of *M. australis* (*Lo Quai s.n.*, K!) has fruits that are hairy and very slightly glandular. Since no consistent differences could be found between the Hong Kong and Guangdong material, we believe that these should be treated as conspecific.

SPECIMENS EXAMINED. CHINA. Guangdong, 14 Nov 1980, *Chen 292* (IBSC); Kwangtung, Nov 1992, *Luo 1328* (IBSC); Guangdong, 5 Aug 1990, *Chen 447* (IBSC).

Figure 29. Distribution map of *Maackia australis* (Dunn) Takeda

3. ***Maackia chekiangensis*** S.S. Chien, Contr. Biol. Lab. Sc. Soc. China 8: 132. 1932. TYPE: China, Chekiang, 15 Jul 1932, *T. S. Chen 3684* (holotype: PE; photograph MU!). Figure 26 b.

Shrubs to 1.5 m tall. Outermost bud scales pubescent, 0.9–1.9 mm long, 0.6–1.9 mm wide. Leaves ovate to elliptical, 12.9–14.5 cm long, 7.5–8.5 cm wide, petioles 2.1–2.6 cm long; leaflets sparsely hirsute, 9-11, ovate to elliptical, apices attenuate, bases acuminate to cuneate; terminal leaflets 3.9–5 cm long, 2.1–3 cm wide; basal leaflets 2.1–3.5 cm long, 1–2.2 cm wide; leaflet pulvini pubescent, 0.3–2.1 cm. Flowers 0.5–0.6 cm long; bracteoles pubescent, 1.3–1.8 mm long, 0.2–0.3 mm wide, narrowly triangular, apices attenuate; pedicels 3 mm long; calyces 2.1–2.4 mm long, upper (banner) teeth 58% of calyx length; banner laminas 3 mm long, 1.2 mm wide, claws 0.6 mm long, indentations 0.3 mm, calluses thin; wing laminas 3.6 mm long, 1.4 mm wide, claws 0.6 mm, spurs 0.3 mm, auricles 0.1–0.13 mm; keel laminas 3.6 mm long, 1.8 mm wide, claws 0.9 mm, spurs 0.3 mm. Stamen filaments 1.8–2.4 mm long; anthers 0.48 mm long, 0.3 mm wide. Ovaries 1.8 mm, long, 0.6 mm wide; styles 0.6 mm long; stigmas 0.12 mm wide. Legumes ovate to broadly elliptical, symmetrical to oblique, 2.8–3.7 cm long, 1.2–1.5 cm wide; wings 0.048–0.08 cm wide. Seed 1, yellow (mature seeds not seen).

Distribution

China: Zhejiang (Chekiang), Jiangxi (Kiangsi), Guangdong (Figure 30).

Notes

There are three pubescent species in mainland China: *M. chekiangensis*, *M. hupehensis*, and *M. hwashanensis*. *Maackia chekiangensis* leaflets and bud scales have short, stiff, scattered hairs, while leaflets and bud scales of *M. hupehensis* have dense, silky pubescence; *Maackia hwashanensis* leaflets and bud scales have white, scattered, silky hairs. Flowers of *M. chekiangensis* are 5–6 mm long, whereas those of *M. hupehensis* are 8–9 mm long, and those of *M. hwashanensis* are at least 10 mm long. Leaflet apices on *M. chekiangensis* tend to be attenuate, while leaflet apices of *M. hupehensis* and *M. hwashanensis* are usually acute. Legumes of *M. hupehensis* are wide–winged, and legumes of *M. chekiangensis* and *M. hwashanensis* are narrow-winged. Seeds of *M. hwashanensis* are reddish–brown, those of *M. hupehensis* are yellow to reddish-yellow, and immature seeds of *M. chekiangensis* are yellow.

SPECIMENS EXAMINED. CHINA. Kiangsi: *Yang 10056* (IBSC); Guangdong, 5 Aug 1990, *Chen 447* (IBSC); Chekiang, Chuchi-hsien, 20 Jul 1933, *M. Chen 889* (IBSC); Kiangsi, *Yang 10091* (IBSC).

Figure 30. Distribution map of *M. chekiangensis*.

4. ***Maackia fauriei*** (Lévl.) Takeda, Notes Roy. Bot. Gard. Edinburgh 8(37): 101. 1913.
Cladrastis fauriei Lévl., Repert. Spec. Nov. Regni Veg. 7(143-145): 230-231. 1909. TYPE: Korea: Jeju Island, Mt. Hallaisan, Aug 1907, *U. Faurie 1692* (holotype: BM!; isotypes: E!, CAS!, TI!, LE!). Figure 26 d.

Trees to 7 m tall. Outermost bud scales glabrous, 3.3–4.2 mm long, 2.1–3 mm wide. Leaves ellitpical, 13.5–17 cm long, 8.2–11 cm wide, petioles 2.6–3.3 cm long; leaflets glabrous, 13 – 15, ovate to elliptical to obovate, apices acute, bases acute; leaflet pulvini glabrous, 3–4 mm long; terminal leaflets 3.1–3.7 cm long, 1.2–1.7 cm wide; basal leaflets 2.5–4.5 cm long, 1.1–2.1 cm wide. Flowers 0.8–1 cm long; bracteoles glabrous to pubescent, 0.9–1.3 mm long, 0.3–0.4 mm wide, triangular-ovate, apices attenuate; pedicels 3.9–5.7 mm long; calyces 2.4–3.6 mm long, upper (banner) teeth 30–33% of calyx length; banner laminas 4.2–4.8 mm long, 3.6–4.8 mm wide, claws 1.2–3 mm long, indentations 0.9–1.2 mm, calluses thin and cartilagenous; wing laminas 4.8–6 mm long, 2.1–2.4 mm wide, claws 1.4–2.4 mm, spurs 0.3 mm, auricles 0.24–0.3 mm; keel laminas 4.8–6.3 mm long, 2.4–3.3 mm wide, claws 1.2–3.6 mm, spurs 0.3–0.6 mm. Stamen filaments 2.7–6 mm long; anthers 0.6 mm long, 0.3 mm wide. Ovaries 3.3–4.8 mm long, 0.9 mm wide; styles 1.2–1.5 mm long; stigmas 0.12 mm wide. Legumes lanceolate, 5–6.7 cm long, 1–1.3 cm wide; wings 1–2 mm wide. Seeds 1–3, yellow, 6.5–7.1 mm long, 3.4–3.8 mm wide; hilum 0.9–1.3 mm long, 0.6–0.9 mm wide. 2n=18.

Distribution

Korea: Jeju (Cheju-do) Island (Figure 31).

Notes

So far, only one pollen study has utilized *M. fauriei*. Chung and Lee (1994) recorded polar axis to be from 18.48 to 20.16 µm and equatorial axis to be from 17.02 to 18.93 µm, from the specimen *Chung s.n.*

Maackia fauriei was considered synonymous with *M. floribunda* by Hatusima (1936) and Ma (1994). It is similar to both *M. floribunda* and *M. taiwanensis*, and in the morphometric analyses of fruiting and flowering specimens, *M. fauriei* and *M. taiwanensis* grouped together. Pubescence on *M. floribunda* is moderate to dense, while *M. fauriei* and *M. taiwanensis* are glabrous. Flowers of *M. floribunda* and *M. taiwanensis* are 6–7 mm long, whereas flowers of *M. fauriei* are at least 10 mm long. Fruits of *M. taiwanensis* tend to be elliptical, and fruits of *M. fauriei* and *M. floribunda* are typically lanceolate.

REPRESENTATIVE SPECIMENS. KOREA. Jeju, Aug 1907, *Faurie 1692* (BM, E, TI, LE); Jeju, 13 Aug 1912, *Islidoya 179* (TI); Jeju, 21 Oct 1988, *Murata et al 27038* (TI); Jeju, 30 Oct 1917, *Nakai 6232* (TI); Jeju, Aug 1909, *Taquet 2798* (E); Jeju, 19 Jul 1935, *Toh/Do 4501* (SNU); Jeju, 19 Jul 1935, *Toh/Do 11475* (SNU); Jeju, 19 Jul 1935, *Toh/Do 4900* (SNU); Jeju, 19 Jul 1935, *Toh/Do 11476* (SNU); Jeju, 15 Aug 1927, *Wilson 9426* (GH, US, BM).

Figure 31. Distribution map of *Maackia fauriei*.

5. ***Maackia floribunda*** (Miq.) Takeda, Notes Roy. Bot. Gard. Edinburgh 8(37): 101. 1913. *Buergeria floribunda* Miq., Ann. Mus. Bot. Lugduno-Batavum 3: 53. 1867. C*ladrastis amurensis* (Rupr. & Maxim.) Benth. var. *buergeri* (Miq.) Maxim., Bull. Acad. Imp. Sci. Saint-Pétersbourg 18: 400. 1878. C*ladrastis buergeri* (Miq.) Kom., Trudy Imp. S.-Peterburgsk. Bot. Sada 22: 571. 1904. *Maackia amurensis* Rupr. & Maxim. var. *buergeri* (Miq.) Schneid., Ill. Handb. Laubholzk. 2: 16. 1907. *Maackia buergeri* (Miq.) Tatewaki., Trans. Sapporo Nat. Hist. Soc. 16: 4. 1939. M*aackia amurensis* ssp. *buergeri* (Miq.) Kitam., Acta Phytotax. Geobot. 25(2-3): 44. 1972. LECTOTYPE (to be designated): Japan, Kiusiu, s.d., *Pierot 761* (L!). SYNTYPE: Japan: Honshu, Nakisima, s.d., *Siebold* (L! [3 sheets]; possible duplicate, K!). Figure 26 h.

Maackia floribunda (Miq.) Takeda var. *pubescens* Koidzumi, Bot. Mag. (Tokyo) 38(449): 98. 1924. *Maackia floribunda* Takeda f. *pubescens* (Koidzumi) Kitam., Acta Phytotax. Geobot. 25(2-3): 44 (1972). LECTOTYPE (to be designated): Japan: Honshu, Okayama Pref., Prov. Bicchu, Kawakami-gun, Hira-Kawa, 10 Aug 1930, *Z. Yoshino s.n.* (TI!). SYNTYPES: Japan: Honshu, Prov. Yamashiro, Mt. Hiyeizan, Nov 1923, *Koidzumi s.n.* (TI). Japan: Honshu, Prov. Bizen, Wakegori, Konemura, Jan 1924, *Koidzumi s.n.* (TI). Japan: Shikoku, Prov. Iyo, Kitagori, Awazumura, 17 Sep 1923, *M. Ogata s.n.*(TI). Japan: Kiusiu, Prov. Hiuga, Nishiusnkigori, Iwadomura, Mt. Kawanotsumeyama, Aug 1923, *M. Ogata s.n.* (TI).

Trees or shrubs. Outermost bud scales pubescent, 2.4–5.1 mm long, 1.6–3.6 mm wide. Leaves ovate, elliptical, or obovate, 2.1–18.7 cm long, 5.5–13.4 cm wide, petiole 1.5–4.6 cm long; leaflets 9 – 15, pubescent, ovate to obovate, apices acuminate to acute, bases acuminate to acute; terminal leaflets 2.9–6.7 cm long, 1.4–2.9 cm wide; basal leaflet ovate to oval, 2.3–4.7 cm long, 1.2–2.6 cm wide; leaflet pulvini pubescent, 0.2–0.6 cm. Flowers 0.7–0.8 cm; bracteoles pubescent, 0.8–1.8 mm long, 0.2–0.6 mm wide, triangular-ovate, apices acute; pedicels 1.2–5.6 mm long; calyces 1.7–4.2 mm long, upper (banner) teeth 27–45% of calyx length; banner laminas 3–5.4 mm long, 2.7–3.6 mm wide, claws 1.2–2.7 mm long, indentations 0.12–2.1 mm, calluses thin and cartilagenous; wing laminas 4.2–6.6 mm long, 1.8–2.4 mm wide, claws 1.2–3 mm, spurs 0.3–0.6 mm, auricles 0.18–0.3 mm; keel laminas 4.2–6 mm long, 2.7–3.6 mm wide, claws 1.5–2.7 mm, spurs 0.3–0.6 mm. Stamen filaments 3–6 mm long; anthers 0.6 mm long, 0.3 mm wide. Ovaries 2.4–5.4 long, 0.6–1.5 mm wide; styles 0.6–2.1 mm long; stigmas 0.12 mm wide. Legumes lanceolate, 3.6–7 cm long, 0.8–1.6 cm wide; wings 1–3 mm wide. Seeds 1–4, yellow, 6.1–7.8 mm long, 3.6–4.1 mm wide; hilum 1.02–1.2 mm long, 0.5–0.7 mm wide.

Distribution

Japan: Lower Honshu, south of Japanese Alps, Kyushu and Shikoku (Figure 32).

Notes

Maackia floribunda has been confused with *Maackia japonica* (*"buergeri"* auct.) for many years. This is hardly surprising, since the nomenclature of these two species became confused with the publication of the varietal epithet *"buergeri"* by Maximowicz (1878). Maximowicz based the epithet "*buergeri*" on *Buergeria floribunda* Miq., taking the generic name and converting it into a varietal epithet. Some of this confusion resulted from Maximovicx's citation of collections from Yokohama (collected by Savatier) and Hakone (collected by Albrecht). If the collections cited by Maximowicz had been of the same species as *Buergeria floribunda*, then the Maximowicz name would merely be a synonym of *Maackia floribunda*. More confusion was introduced because the collections he cited are actually of a different species, which we are calling *Maackia japonica*. Since Maximowicz based *Cladrastis amurensis* (Rupr. & Maxim.) var. *buegeri* on *Buergeria floribunda* Miq., it becomes a homotypic synonym of the latter. The description of *Buergeria floribunda* by Miquel (1867) was based on a specimen from Kyushu, where *Maackia floribunda* is found, but *Maackia japonica* is found on Hokkaido and Honshu, north of the mountain ranges separating the north side of the island from the south. Tatewaki (1939) elevated *"buergeri"* to species rank, making the new combination *Maackia buergeri*, recognizing the species-level distinctions between *M. amurensis* of mainland Asia, and Japanese *Maackia*; he did not distinguish between *M. floribunda* and *M. "buergeri*." Characteristics that distinguish *Maackia floribunda* from *M. japonica* include flower length (6-7 mm long in *M. floribunda* vs. > 9 mm in *M. japonica*) and fruit wing width ($\geq$ 1 mm in *M. floribunda* vs. < 1 mm in *M. japonica*).

REPRESENTATIVE SPECIMENS. JAPAN. Honshu, Aichi, Nagoya, Owari, 1940, *T. Makino s.n.* (MAK); Aichi, Mikawa, Minamishitara-gun, 7 Aug 1955, *Torii s.n.* (GH); Gifu, Gunjo - gun, Aioi – mura, 27 Jul 1923, *Saito s.n.* (TI); Gifu, 26 Jul 1923, *Shiota 1712* (GH); Hiroshima, Saeki, Otake, 17 Aug 1910, *Toyoshima s.n.* (MAK); Hyogo, Awaji, s.d., *J. Hirano TI129* (TI); Hyogo, Kobe City, Kongodaji-yama, Kita-ku, 10 Aug 1986, *Fukuoka 12632* (TI); Hyogo, Kobe, 5 Aug 1936, *Okamoto 20061* (TI); Ishimi Mino, Sandankyo, 30 Jul 1956, *I. Miyamoto s.n.* (MAK); Kyoto, Mt. Jubusen, Ujidawara-cho, Tsuzuki-gun, Sep 1978, *Murata 37098* (MO, L); Kyoto, Mt. Jyubu, Wazuka-cho, Soraku-gun, 17 Sep 1978, *Tsugaru 5127* (CAS); Kyoto, Imamichi, Sogabe-cho, Kameoka-shi, 25 Aug 1994, *Tsugaru et al 20688* (GH, MO); Mie,Yokkaichi, Mt. Tarusaka, 7 Jun 1926, *Y. Murata 37* (MAK); Mie, Waratai, Nanto, 25 Jul 1906, *Y. Kuwana s.n.* (MAK); Okayama, Mt. Maruyama, kawakami-mura, Maniwa-gun, 25-27 Jul 1988, *Suguwara s.n.* (MAK); Okayama, Mt. Takakura, Akaiwagun, Okayamaken, 15 Aug 1952, *Uno 2612* (GH); Osaka, Aug 1910, *Junjiro 193* (MAK); Osaka, Ushitaki-machi, Kishiwada City, 19 Sep 1986, *Shuichi 3970* (TI); Osaka, Kawati, Mt. Kongo, 16 Aug 1950, *Togasi 59839* (TI (3)); Shiga, Takashima-gun, Shinasahi-cho, 25 Aug 1974, *Murata 22308* (GH, MAK, K, TI, CM, L); Shiga, Takashima-gun, Makino-machi, 14 Sep 1982, *Ohashi et al 8710* (MO, TAI); Shimane, Ouchi, Daiwa, 6 Aug 1968, *I. Miyamoto 61* (MAK); Shimane, Misume, 29 Aug 1901, *T. Saito s.n.* (MAK); Shimane, Ota, 12 Aug 1954, *Miyamoto s.n.* (MAK); Shimane, Nita, 3 Aug 1960, *Y. Moriyama 3012* (MAK); Shizouka, Gotenba City Taroubou, SE slope of Mt. Fuji, 30 Jul 1976, *Konta et al 108* (MAK); Nagasaki, Oct 1941, *Greatrex 49/41* (TI); Kumamoto, 17-19 Aug 1963, *Hatusima et al 27795* (MAK); Saga, 12 Oct 1915, *Kimura 43* (TI); Kagoshima, 1914, *Makino s.n.* (CAS, MAK); Kagoshima, 15 Sep 1980, *Murata 9973* (TI); Ohsumi, 4 Sep 1962, *Sako 4324* (MAK); Miyazaki, Aug 1888, *Tschonoski 1652* (TI).

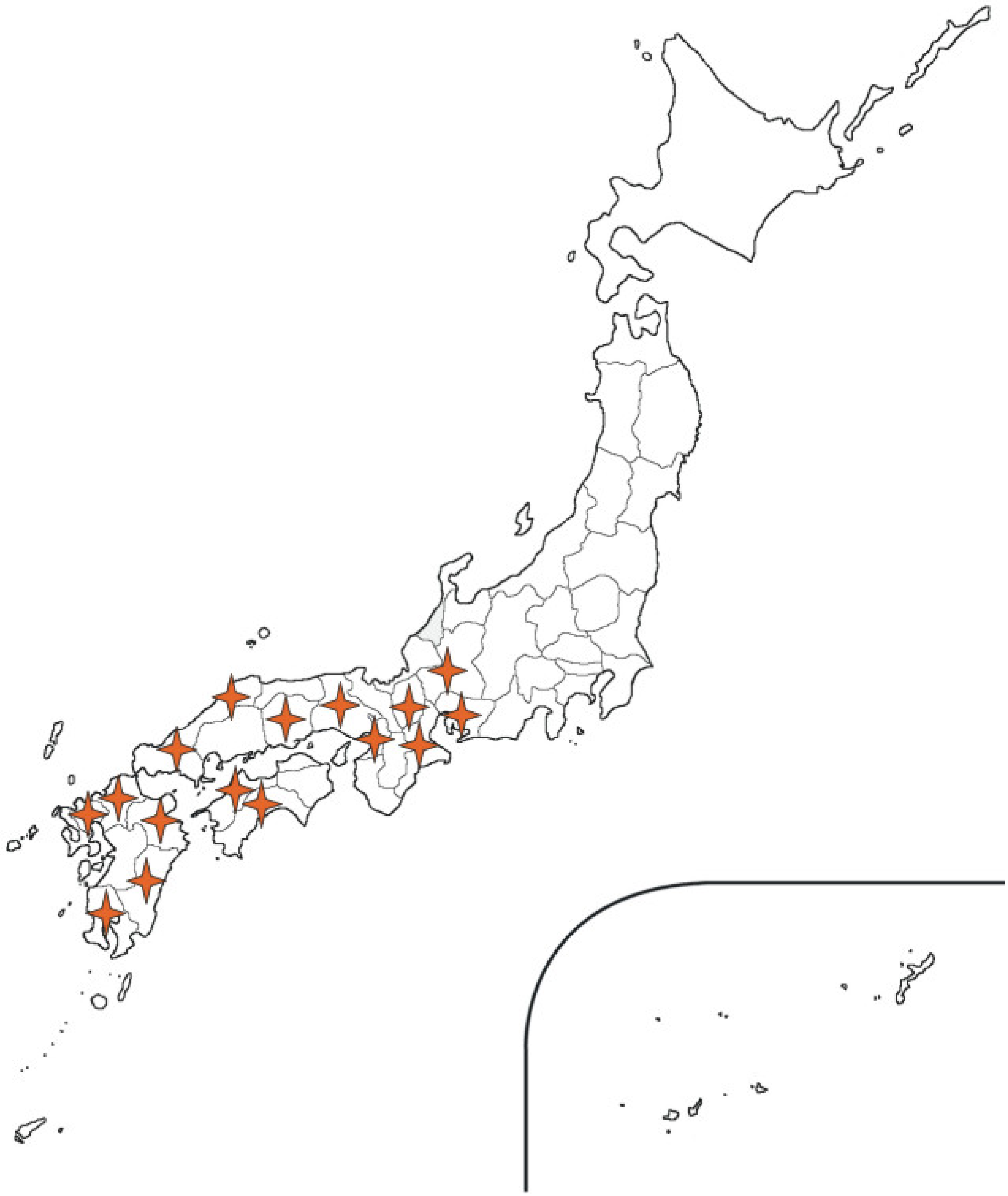


Figure 32. Distribution map of *Maackia floribunda*.

6. ***Maackia hupehensis*** Takeda, Pl. Wilson. 2(1): 98-99. 1914. LECTOTYPE (to be designated): China. Hubei: north of Ichang, 1000-1300 m, May, Aug 1907, *E. H. Wilson 709* (in part) (K!; isolectotypes: CAS!, E!, F!, GH!, MO!, US!,). SYNTYPES: China: Western Hupeh, Aug 1907, *E. H. Wilson 709* (in part) (CAS!, E!, F!, K!, MO!, US!). China: Western Hupeh, Hsing-shan Hsien, alt. 1600 – 2300 m, Aug 1907, *E. H. Wilson 709* (in part) (K!). Figure 26 f.

Maackia chinensis Takeda, Notes Roy. Bot. Gard. Edinburgh 8(37): 103. 1913. *provisional name* (ICBN Art. 34.1). *Maackia floribunda* var. *chinensis* (Takeda) Hatusima. J. Jap. Bot. 12(12): 875-876. 1936.

Trees 5–23 m tall. Outermost bud scales pubescent, 2.4–7.2 mm long, 2–3.2 mm wide. Leaves ovate to elliptical, 11.9–17 cm long, 7.3–14 cm wide, petiole 2–3.3 cm long; leaflets 9 – 13, pubescent, ovate to elliptical, apices acute, bases cuneate, pubescent; terminal leaflets 4–8.1 cm long, 1.9–2.8 cm wide; basal leaflets 2.9–4.8 cm long, 1.3–2.3 cm wide; leaflet pulvini pubescent, 0.03–0.3 cm long. Flowers 0.8–0.9 cm long; bracteoles pubescent, 1.5–2.4 mm long, 0.3 mm wide, narrowly triangular-linear, apices acuminate; pedicels 2.4–4.2 mm long; calyces 1.6–3.3 mm long, upper (banner) teeth 36–55% of calyx length; banner laminas 3.9–6 mm long, 3.6–4.8 mm wide, claws 1.5–2.4 mm long, indentations 0.6 mm, calluses thin and cartilaginous; wing laminas 5.1–6.9 mm long, 1.8–2.4 mm wide, claws 2.4–2.7 mm, spurs 0.3–0.6 mm, auricles 0.3–0.4 mm; keel laminas 5.4–6.9 mm long, 2.4–3.9 mm wide, claws 1.2–2.4 mm, spurs 0.3–0.66 mm. Stamen filaments 3.3–6.4 mm long; anthers 0.6–0.8 mm long, 0.3–0.33 mm wide. Ovaries 3.2–4.8 mm long, 0.9–1.2 mm wide; styles 1.8–3.6 mm long; stigmas 0.12 mm wide. Legumes elliptical, 6–7.4 cm long, 1.3–2 cm wide; wings 2–4 mm wide. Seeds 2–3, yellow, 7.6–8.2 mm long, 4.3 mm wide; hilum 0.9–1.1 mm long, 0.6–0.8 mm wide. 2n = 18 (as *Maackia* "*chinensis*") (Goldblatt 1981; Goldblatt and Davidse 1977; Pavlova et al. 1989; Probatova and Sokolovskaya 1981; Volkova et al. 1994).

Distribution

East central China (Figure 33).

Notes

Maackia hupehensis differs from the other species in China by having dense silky pubescence on the underside of the leaflets, a flower length of 8–9 mm, and a wide-winged fruit. So far, one pollen study has included *M. hupehensis*. Chung and Lee (1994) reported a polar axis of 16.8-20.16 µm and an equatorial axis of 16.52-20.30 µm, from *DeWolf and Bruns 2148*.

The name *Maackia chinensis* was used for this species for many years, even though Takeda (1913) only used the name provisionally, validly publishing the name *M. hupehensis* a year later for the same entity (Takeda 1914). Although the combination "*M. chinensis* (Bentham) Takeda" (based on *Derris chinensis* Bentham) is attributed to Takeda in horticultural literature (e.g., Bean 1973; Kelly 1995), no such combination was ever made, and Takeda (1913) makes no mention of Bentham's name. *Maackia hupehensis* bears no resemblance to the description by Bentham (1860) of *Derris chinensis*. Takeda (1914) rightly recognized that *Derris chinensis* was not a valid name for this *Maackia* species, and stated that the Hance material was the same as *Millettia pulchra* Bentham. The Wright syntype, from Oosima, Japan, is the same as *Maackia tashiroi* Takeda. The epithet "*chinensis*" is correctly applied only to a species of *Millettia* or more likely, *Indigofera* (see Excluded Species).

REPRESENTATIVE SPECIMENS. CHINA. Hupei-Szechuan, 1948, *Cheng et al 1146* (UC, K); Hunan, 23 Jul 1935, *Fan et al 346* (P); Jiangsu, 1906, *Nacklin 15a* (F); Anhwei, 18 Oct 1933, *Cheng 4094* (IBSC); Sichuan, *s.d*., *Farges 178* (P); Shensi, 13 Aug 1938, *Tsoong et al 3468* (PE); Anhwei, 3 Oct 1933, *Chen 1212* (IBSC); Kiangsi, 28 Nov 1974, *Guan 74158* (PE); Jiangxi, 23 Jul 1913, *Bailey s.n.* (BH); Kiangsi, 27 Jul 1933, *Chung et al 681* (GH); Hunan, 10 Sep 1947, *Hsiung 5811* (GH); Jiangxi, Aug 1923, *Steward 4725* (GH, UC, ISBC); Hupeh, Jul 1900, *Wilson 1576* (NY, K); Sichuan, Jul 1900, *Wilson 1582* (NY, K).

Figure 33. Distribution map of *Maackia hupehensis*.

7. ***Maackia hwashanensis*** W.T. Wang, Fl. Tsinling. 1(3): 444. 1981. TYPE: China. Shaanxi., Huashan Mountain, 8 May 1981, *K. S. Hao 3884* (holotype: PE; photograph MU!). Figure 26 c.

Small trees. Outermost bud scales pubescent, 3.6-4.8 mm long, 1.4-2.4 mm wide. Leaves elliptical, 18-22 cm long, 7.5-9 cm wide, petiole 2-3.7 cm long; leaflets 9-11, pubescent, ovate to elliptical, pubescent, apices acuminate to acute, bases acuminate to cuneate; terminal leaflets 6-7.4 cm long, 2.5-3.4 cm wide; basal leaflets 3.5-4.3 cm long, 1.8-1.9 cm wide; leaflet pulvini pubescent, 0.2-0.3 cm. Flowers 1–1.2 cm long; bracteoles pubescent, 2.9–4.1 mm long, 0.3-0.6 mm wide, narrowly triangular-linear, apices acuminate; pedicels 7–8 mm long; calyces 4.0–5.9 mm long; upper (banner) teeth 40–59.5% of calyx length; banner laminas 6–8.8 mm long, 3.9–4.8 mm wide, claws 4.5–5.4 mm long, indentations 0.6-0.9 mm, calluses thin and cartilaginous; wing laminas 6–8.8 mm long, 2.6–2.7 mm wide, claws 3.6–4.2 mm, spurs 0.3–0.6 mm, auricles 0.3–0.6 mm; keel laminas 4.2–5.4 mm long, 3–3.7 mm wide, claws 4.2–4.5 mm, spurs 0.5–0.6 mm. Stamen filaments 6–8.8 mm long; anthers 0.9 mm long, 0.4–0.6 mm wide. Ovaries 4.8–5.7 mm long, 0.9 mm wide; styles 1.8 mm long; stigmas 0.12 mm wide. Legumes elliptical, 4-5.5 cm long, 1.3-1.5 cm wide; wing 0.4 mm wide. Seeds 1-2, reddish – brown, 9.1-10 mm long, 5-5.3 mm wide; hilum 1.1-1.2 mm long, 0.6-0.7 mm wide.

Distribution

China Shaanxi (Shensi) (Figure 34).

Notes

Maackia hwashanensis differs from other pubescent *Maackia* in China by having moderate, silky, white pubescence, a flower length of at least 10 mm, and reddish–brown seeds.

SPECIMENS EXAMINED. CHINA. Shensi, Huashan, 21 Aug 1932, *K. S. Hao 4113* (PE); Shensi, 13 Aug 1966, *Wang 19692* (PE); Shaanxi (Shensi), Taibaishan, 22 Jul 2000, *Zhu et al 3159* (MO, MU).

Figure 34. Distribution map of *Maackia hwashanensis*.

8. ***Maackia japonica*** Levings et Vincent, *sp. nov,. ined.* TYPE: Japan: Honshu, Miyagi Prefecture, Tohoku District, Sendai – shi, S. foot of Mt. Izumigatake, Yoshinodaira Bog, 140’44” E, 38’23”N, alt. 470 – 490 m, 9 Aug 1993, *T. Kurosawa 4525* (holotype: GH!; isotypes: HAST!, MO!, NA!, TUSG). Figure 26 g.

Maackia amurensis β *vidalii* Franchet, Enum. Plant. 2: 327. 1878. TYPE: Japan: Honshu; Fukushima Pref., circa Tomioka, s.d., *Vidal 466* (P, n.v.) *ex char.*

Maackia buergeri sensu Maximovicz 1878, et auct., non Miquel (1867)

[Latin description to be inserted here.]

Trees to 15 m. Outermost bud scales pubescent, 4.2–6.1 mm long, 3.2–6.4 mm wide. Leaves ovate to elliptical to obovate, 12.5–27.2 cm long, 7.2–14.3 cm wide, petiole 1.5–4 cm long; leaflets (7-)9-13, pubescent, ovate to obovate or elliptical, pubescent, apices acuminate to acute, bases acuminate to cuneate; terminal leaflets 3.4–7 cm long, 1.8–4.8 cm wide; basal leaflets 1.2–6.6 cm long, 1.5–3.7 cm wide; leaflet pulvini pubescent, 0.2–3.6 cm. Flowers 1–1.2 cm long; bracteoles pubescent, 1.2–2.3 mm long, 0.2–0.5 mm wide, triangular-ovate, apices attenuate; pedicels 3.6–8 mm long; calyces 1.9–4.5 mm long, upper (banner) teeth 17–44% of calyx length; banner laminas 4.7–6.9 mm long, 3–4.5 mm wide, claws 1.5–5.1 mm long, indentations 0.3–2.4 mm, calluses thick and cartilaginous; wing laminas 5.9–7.8 mm long, 2.1–3 mm wide, claws 1.7–3.3 mm, spurs 0.2–0.8 mm, auricles 0.3–0.4 mm; keel laminas 5.4–7.5 mm long, 2.4–3.3 mm wide, claws 1.8–3.6 mm, spurs 0.3–0.6 mm. Stamen filaments 2.1–7.2 mm long; anthers 0.6–1 mm long, 0.6–0.7 mm wide. Ovaries 3–4.5 mm long, 0.9–1.3 mm wide; styles 0.6–1.6 mm long; stigmas 0.12 mm wide. Legumes lanceolate, 4.1–7.5 cm long, 0.6–1 cm wide; wings 0.2–0.6 mm wide. Seeds 1–3, yellow, 5.5–7.1 mm long, 3.1–3.8 mm wide; hilum 1–1.2 mm long, 0.4–0.8 mm wide. 2n = 18. See Figure 35.

Distribution

Japan: Hokkaido, upper Honshu north of Japanese Alps (Figure 36).

Notes

Maackia japonica differs from *M. floribunda* in flower size and legume wing width; *M. japonica* has a larger flower (> 9 mm long in *M. japonica*, 6-7 mm long in *M. floribunda*) and narrower fruit wing (< 1 mm in *M. japonica*, ≥ 1 mm in *M. floribunda*).

Two pollen studies have included this species. Chung and Lee (1994), using *Licent 13421*, recorded polar axis to be 14.56-20.16 µm and equatorial axis to be 14.28-20.02 µm. Ferguson et al (1994), using *Hisauchi 1768* and *Maximowicz s.n.*(both as *M. amurensis*), recorded polar axis as 17-19 µm and 18-20 µm respectively, and equatorial axis as 16--17 µm and 16-18 µm respectively.

A discussion of the need for a name for this species is given in the notes under *M. floribunda*.

PARATYPES. JAPAN. Hokkaido, Jul 1904, *Faurie 6106* (GH, BM); 3 Oct 1997, *Kirkham et al EHOK 142* (CAS); 16 Sep 1892, *Sargent s.n.* (GH); 29 Jul 1969, *Takahashi 491* (TI); 3 Aug 1929, *Tanaka 208* (S, BM, LE); 17 Sep 1890, *Tokubachi s.n.* (K); 30 Jul 1936, *Uno 15084* (GH, P); 25 Jul 1914, *Wilson 7251* (GH, K); 2 Sep 1977, *Wood et al 3953* (MO, GH, CAS); 21 Sep 1993, *Yamaji s.n.* (TNM); 26 Sep 1994, *Yonekura et al 94865* (MO, GH, NA), Insula Jesso, Hakodate, 1861-1863, *Dr. Albrecht s.n.* (F, GH, K, NY). Honshu, Chiba, Sakura, 1931, *T. Makino s.n.* (MAK); Chiba, Sakura City, 1931, *Makino s.n.* (GH); Fukushima, Minamiaidu, 1940, *T. Makino s.n.* (MAK); Fukushima, 4 Aug 1932, *Suzuki 21* (TI); Iwate, Ichinoseki, 17 Aug 1988, *Tsuchiiya 5006* (MAK); Kanagawa, Yokohama, Tsukiji, Aug 1905, *T. Makino s.n.* (MAK); Kanagawa, Yokohama, 1862, *Forbes 1298* (BM, GH); Kanagawa, Miyagino, Hakone, 28 Aug 1925, *Kobayashi s.n.* (TI); Kanagawa, Miyagino, Hakone, 8 Oct 1925, *Kobayashi s.n.* (TI (2)); Kanagawa, Yumoto, Nakone-machi, Ashigarashimo-gun, Sep 1941, *Makino 131122* (MAK, UC); Kanagawa, Yokohama, 1862, *Maximowicz s.n.* (S, NY (2), GH, US, BM (3), P, LE (2), L); Kanagawa, Hakone, Sokokura, 22 Aug 1926, *Sawada s.n.* (S, TI); Miyagi, Shibata, Kawasaki, Mt. Kakesugamine, Sasaya Pass, 23 Aug 1993, *Azuma et al 448* (GH, HAST, NA); Miyagi, Tohoku, Yoshinodaira Bog, Sendai-shi, ft of Mt. Izumigatake, 9 Aug 1993, *Kurosawa 4525* (GH, HAST, MO, NA); Miyagi, Sendai City, Mts. Zao, Izumi-ku, Nijinooka, 12 Sep 1993, *Ohashi 91201* (CM, GH, HAST, MO, NA, TNM); Miyagi, Mt. Zaou, Kattadake, 2 Aug 1931, *Saito s.n.* (TI); Nagano, Chiisagata, 17 Aug 1966, *S. Kobayashi 2703* (MAK); Nagano, Usui-toge, 10 Aug 1971, *Hara et al s.n.* (TI); Nagano, Shinano, Kamgatake, 20 Aug 1905, *Hayakawa s.n.* (S); Nagano 7/12/1936, *Hisauchi 1484* (TI); Nagano, Sarashina, Ooka, Mt. Hijiri, 11 Aug 1961, *Minemura 1464* (MAK); Nagano, Fujimi-cho, Suwa-gun, Mt. Yatsuga-dake, Aug 15 1971, *Togashi 7101* (NY, GH (2), E, UC, MAK, PR, US, TAI (2), K, BM, NA (2), P, LE (2), TI, L); Niigata, Itogawa, Mt. Hakuma, 21 Aug 1922, *Y. Shimokawa s.n.* (MAK); Niigata, Kitaonuma, Hirose, 6 Sep 1915, *S. Iwata 69* (MAK); Niigata, Sekigawa-mura, Iwahune-gun, 21 Jul 1965, *Togashi et al 9999* (L); Shimousa, Tsudanuma, 2 Aug 1958, *Hisauchi 1768* (B (2), BH, BM, E, GH, K, MO, NA, NY, S, TI, UC); Shinano, Gamata, Urigamura, Shimoinagun, 23 Aug 1956, *Asano 2081* (TI); Shizouka, Mt. Fuji, 1939, *T. Makino s.n.* (MAK); Tokyo, Daikyo, Ueno, 1910, *T. Makino s.n.* (MAK); Tokyo, Daikyo, Ueno, 10 Jul-14 Aug 1908, *T. Makino s.n.* (MAK (2)); Tokyo, Asahigaoka, Lake Yamanaka, Mt. Fuji, 17 Sep 1960, *Kanai 6009* (GH, TI); Tokyo, Mt. Fuji, 29 Aug 1927, *Karasawa et al s.n.* (TI); Tokyo, 19 Aug 1895, *Makino s.n.* (CM); Tokyo, s.d., *Savatier s.n.* (P(2), K); Yamanashi, Kai, 1926, *T. Makino s.n.* (MAK); Yamanashi, 19 Oct 1947, *Hurusawa s.n.* (TI); Yamanashi, Kai Province, 1926, *Makino s.n.* (CM); Yamanashi, Fujiyoshida-shi, near Sengen Jinja, 22 Aug 1977, *Mimoro et al 1291* (CAS).

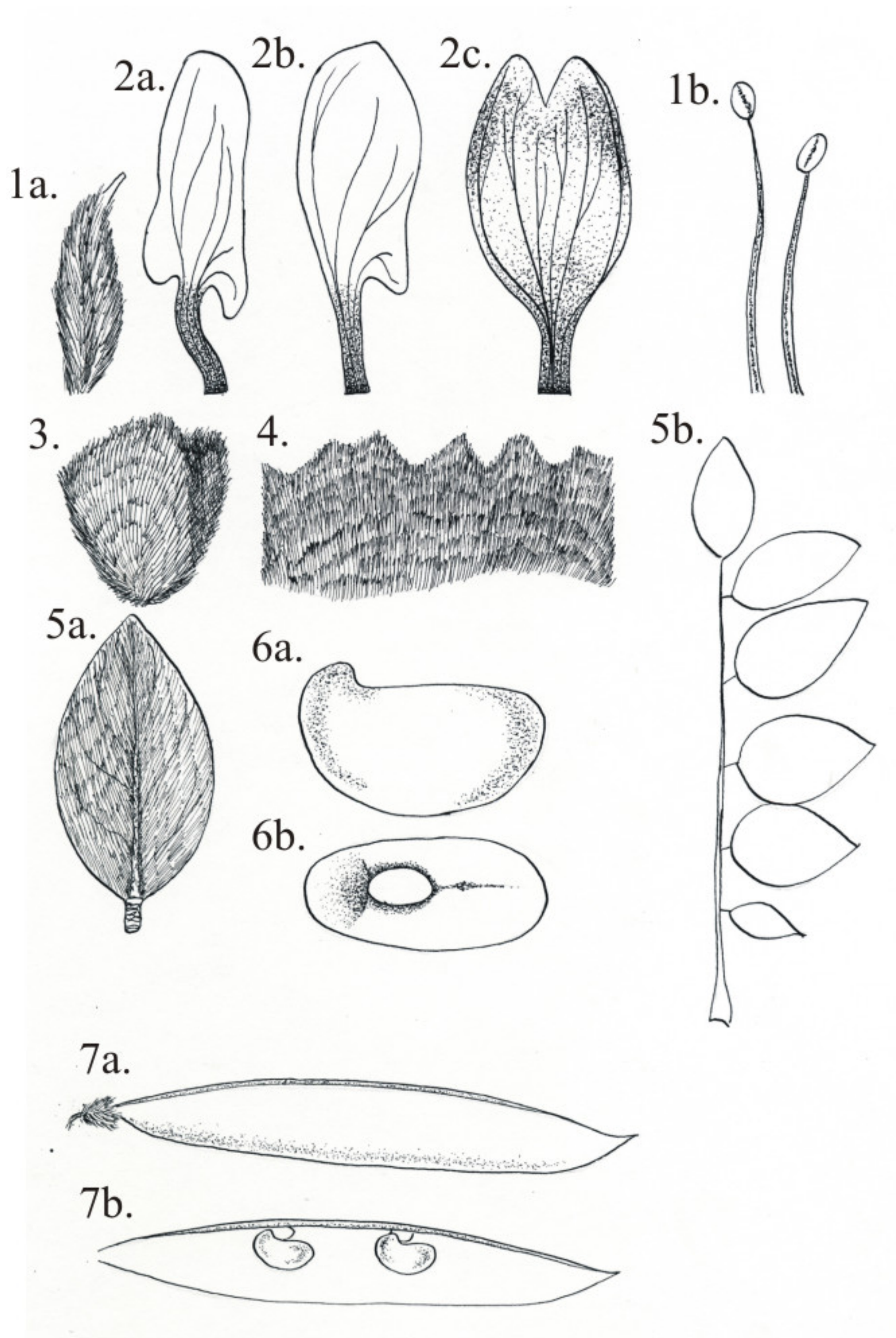


Figure 35. Diagnostic characters of *Maackia japonica*. 1. reproductive structures; 2. petals; 3. outermost bud scale; 4. opened calyx; 5. leaf and leaflet; 6. seed; 7. fruit.

Figure 36. Distribution map of *Maackia japonica*.

9. ***Maackia nakaii*** Levings et Vincent, *sp. nov., ined*. TYPE: Japan: Honshu, Yamagata Prefecture (Uzen province), Aug 1911, *Koidzumi s.n.*(holotype: TI!). Figure 26 j.

[Latin description to be inserted here.]

Tree? Outermost bud scales glabrous or very slightly pubescent at base, 2.8-3 mm long, 1.8-2.7 mm wide. Leaves elliptical to obovate, 16-17 cm long, 10-11 cm wide, petiole 2.1-3 cm long; leaflets 11, glabrous, ovate to elliptical to obovate, apices short-acuminate, bases acuminate to cuneate; terminal leaflets 4.8-5 cm long, 2.6-3 cm wide; basal leaflets 2.9-3.2 cm long, 1.7-2 cm wide, leaflet pulvini glabrous, 0.2-0.24 cm. Flowers unknown; bracteoles unknown; fruiting pedicels 5.7–6 mm long; fruiting calyces 2.4–3 mm long, upper (banner) teeth 20–25 % of calyx length. Legumes elliptical, 3.5-5.7 cm long, 1-1.3 cm wide; wings 0.3-0.5 mm wide. Seeds 1-3, yellow, 6-6.4 mm long, 3.6-4 mm wide; hilum 1-1.1 mm long, 0.7-1 mm wide. See Figure 37.

Distribution

Japan. Honshu. Yamagata prefecture (Figure 38).

Notes

In Japan, there are four species of *Maackia*: *M. floribunda*, *M. japonica*, *M. nakaii*, and *M. tashiroi*. *Maackia nakaii* differs from *M. floribunda* in having a narrow fruit wing (< 0.5 mm in *M. nakaii*, ≥ 1.0 mm in *M. floribunda*) and leaflet pubescence (*M. nakaii* is glabrous and *M. floribunda* is pubescent). *Maackia nakaii* differs from *M. japonica* by its wider fruit (legume length-width ratio is approximately 5:1 in *M. nakaii* vs. 8:1 in *M. japonica*), outermost bud scale size (≤ 3 mm in *M. nakaii* vs. ≥ 4.2 mm in *M. japonica*), and leaflet pubescence (glabrous in *M. nakaii* and pubescent in *M. japonica*); *Maackia nakaii* also has sharply mucronate leaflet apices; both *M. floribunda* and *M. japonica* tend to have gradually acuminate to acute leaflet apices. *Maackia nakaii* differs from *M. tashiroi* in fruit shape (elliptical in *M. nakaii*, with a length:width ratio of 5:1, obliquely elliptical in *M. tashiroi*, length:width ratio 3:1) and in pubescence characters (*M. nakaii* is glabrous, *M. tashiroi* is pubescent).

PARATYPE. Japan. N. Honshu, Yamagata Pref., Asahi-mura, Yachihaba to Wasada-gawa River, 3 Jul 1990, *T. Kurosawa et al. 3648* (A, MO).

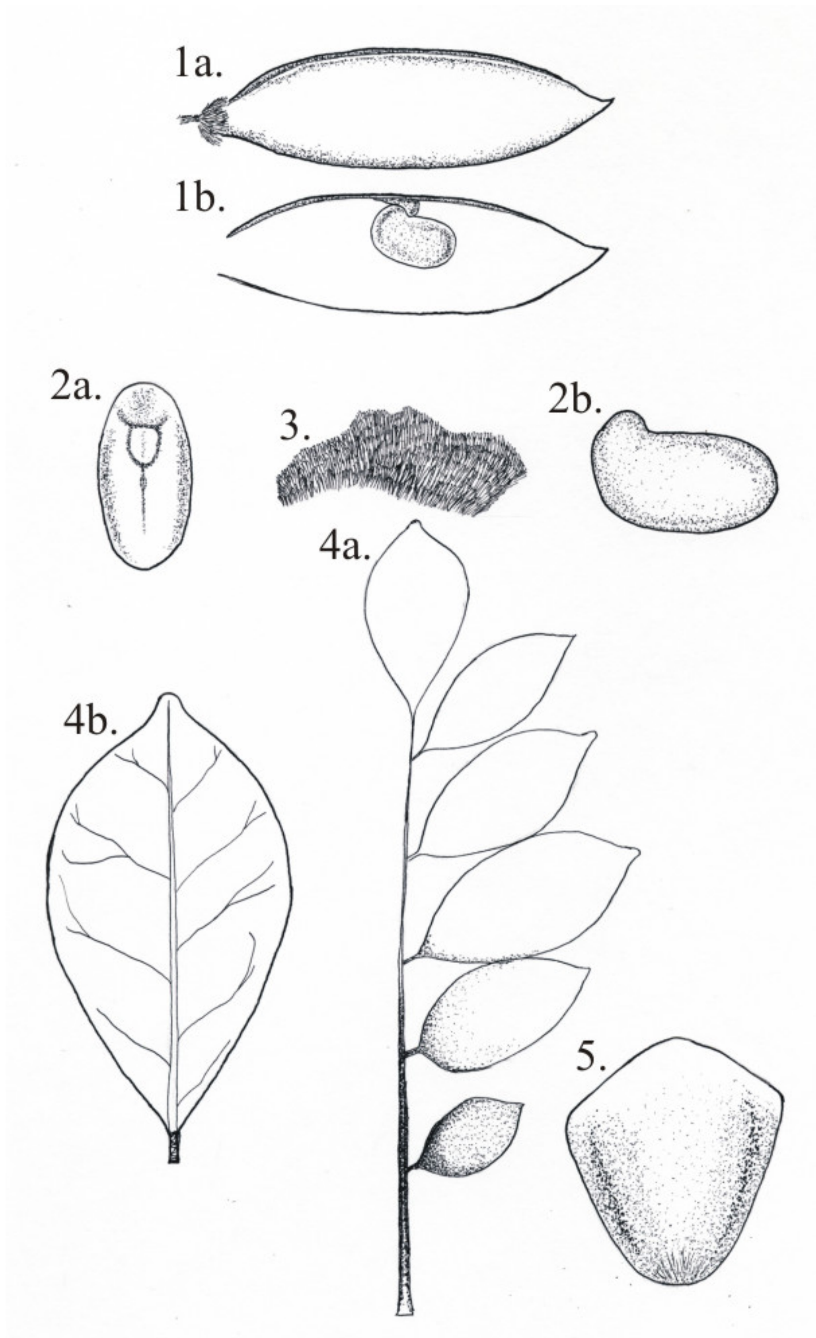


Figure 37. Diagnostic characters of *Maackia nakaii*. 1. fruit; 2. seed; 3. opened calyx; 4. leaf and leaflet; 5. outermost bud scale.

Figure 38. Distribution map of *Maackia nakaii*.

10. ***Maackia taiwanensis*** Hoshi & Ohashi, J. Jap. Bot. 62(4): 98 .1987. TYPE: Taiwan, Taipei Co., 22 Aug 1984, *Y.Tateishi & T. Nemoto 18053* (holotype: TUS, photograph MU!; isotypes: TUS, TI, TAI, A, E). Figure 26 k.

Maackia tashiroi var. *taiwaniana* Kanehira, Woody Flora of Taiwan 301. 1936. NEOTYPE (to be designated): Taiwan, Taipei Co., Da-twen-shan, 21 Aug 1984, *S.Y. Lu s.n.* (TNM!; isoneotypes: TAIF [3 sheets]!, MO!).

Trees to 10 m tall. Outermost bud scales glabrous, 1.5–4.2 mm long, 1.2–3.84 mm wide. Leaves ovate to elliptical, 10.7–15.3 cm long, 5.2–9.6 cm wide, petiole 1.8–3.2 cm long; leaflets 11 – 15, glabrous, ovate to elliptical, apices acute, bases cuneate; terminal leaflets 2.8–4.2 cm long, 1.1–1.9 cm wide; basal leaflets 2–3.5 cm long, 0.9–1.7 cm wide; leaflet pulvini glabrous, 0.3–0.6 cm long. Flowers 0.6-0.7 cm long; bracteoles 1.1–1.2 mm long, 0.3 mm wide, narrowly triangular, apices acute, glabrous; pedicels 3–4.2 mm long; calyces 0.2–3.3 mm long, upper (banner) teeth 30–33% of calyx length; banner laminas 3.9–4.2 mm long, 3.6–3.9 mm wide, claws 1.8–2.1 mm long, indentations 0.9 mm, calluses thin and cartilaginous; wing laminas 4.8–5.4 mm long, 2.4–3.6 mm wide, claws 2.1–3 mm, spurs 0.3–0.6 mm, auricles 0.2–0.3 mm; keel laminas 5.1–5.7 mm long, 2.7–3.6 mm wide, claws 2.1–2.4 mm, spurs 0.4–0.6 mm. Stamen filaments 3–4.8 mm long; anthers 0.6 mm long, 0.3 mm wide. Ovaries 2.7–4.2 mm, long, 1.2 mm wide; styles 0.9–2.4 mm long; stigmas 0.12 mm wide. Legumes elliptical, 3.3–6 cm long, 1–1.5 cm wide; wings 1–4 mm wide. Seeds 1 – 2, yellow, 4.6–6.8 mm long, 2.9–3.9 mm wide; hilum 0.9–1.1 mm long, 0.6–0.7 mm wide.

Distribution

Taiwan. Yangmingshen National Forest (Figure 39).

Notes

Maackia taiwanensis differs from other species by having (5-) 6–7 leaflet pairs, flowers 6–7 mm long, and fruits with wings 2 mm or more wide. Originally it was described as a variety of *M. tashiroi*. It differs from *M. tashiroi* by fruit shape and pubescence. *Maackia taiwanensis* has symmetrical, elliptical, glabrous legumes with wide wings. Legumes of *M. tashiroi* are typically asymmetrical, oval, pubescent, and with narrow wings.

A new population of *M. taiwanensis* was recently found in Hsia-ke-luo Ancient Trail in Hsinchu Hsien (Wufeng Hsiang/Jianshih Hsiang) (Ching-I Peng, pers. comm.).

REPRESENTATIVE SPECIMENS. REPUBLIC OF CHINA: TAIWAN. Taipei, 5 Sep 1988, *Chaw 733* (HAST, TNM); Taihoku, 4 Oct 1931, *Hosokawa s.n.* (PH); Taipei, 26 Sep 1980, *Huang s.n.* (TAI); Taipei, 31 Aug 1981, *Huang s.n.* (TAI); Taipei, 10 Aug 1980, *Huang s.n.* (TAI); Taipei, 7 Sep 1992, *Liao et al 503* (MO, HAST, US, CAS, TI); Taipei, 21 Aug 1984, *Lu s.n.* (TAIF, TNM, MO); Taipei, 3 Oct 1989, *Peng 12969* (HAST); Taipei, 2 Oct 1991, *Wang et al 612* (MO, GH, TI).

Figure 39. Distribution map of *Maackia taiwanensis*.

11. ***Maackia tashiroi*** (Yatabe) Makino, Bot. Mag. (Tokyo) 16: 34. 1902. *Cladrastis tashiroi* Yatabe. Bot. Mag. (Tokyo) 6: 345. 1892. TYPE: Japan, Kyushu, Oshima, Osumi, Sep 1887, *Tashiro s.n.* (holotype: TI!; isotype: TI!). Figure 26 i.

Derris chinensis Benth., J. Linn. Soc. iv. Suppl. 104. 1860. (*pro parte*, not as to lectotype [see Excluded Species]) SYNTYPE: Japan, Ryukyu Islands, Oosima, 1853-1856, *C. Wright 68* (K!; = *Maackia tashiroi*).

Littoral shrubs. Outermost bud scales pubescent, 1.1–3.1 mm long, 0.6–3 mm wide. Leaves ovate to elliptical, 9.0–15.9 cm long, 4.2–10 cm wide, petiole 1.3–2.8 cm long; leaflets 9–15, hirsute, ovate to elliptical to obovate, apices acuminate to acute, bases acuminate to acute; terminal leaflets 2.2–4.9 cm long, 1.3–2.9 cm wide; basal leaflet ovate to oval, 1.3–3.8 cm long, 0.8–2.5 cm wide; leaflet pulvini pubescent, 0.1–0.4 cm long. Flowers 0.6–0.7 cm; bracteoles pubescent, 1–2.1 mm long, 0.2–0.6 mm wide, short triangular-ovate, apices long-attenuate; pedicels 2.1–4.2 mm long; calyces 1.8–3.3 mm long, upper (banner) teeth 33–61% of calyx length; banner laminas 2.1–5.1 mm long, 2.1–2.7 mm wide, claws 1.2–2.7 mm long, indentations 0.1–0.3 mm, calluses thick and cartilaginous; wing laminas 4.2–5.1 mm long, 1.8–2.4 mm wide, claws 1.5–2.7 mm, spurs 0.18–0.6 mm, auricles 0.1–0.6 mm; keel laminas 4.5–6.3 mm long, 2.4–3 mm wide, claws 1.8–2.1 mm, spurs 0.3–0.6 mm. Stamen filaments 3–7.5 mm long; anthers 0.6 mm long, 0.3 mm wide. Ovaries 3–4.2 mm, long, 0.9–1.5 mm wide; styles 0.6–1.5 mm long; stigmas 0.12 mm wide. Legumes obliquely elliptical, 2.1–4 cm long, 1–1.4 cm wide; wings 0.2–1.6 mm wide. Seeds 1–2, yellow, 6.3–8.1 mm long, 4.1–5.3 mm wide; hilum 1.2–1.6 mm long, 0.5–0.9 mm wide. 2n = 20 (Yeh et al. 1986).

Distribution

Japan: Kyushu, Shikoku, and Ryukyus (Figure 40).

Notes

Yakovlev (1975) named a series within *Maackia* after this species, based on its asymmetrical fruits. He included *M. chekiangensis* and *M. australis* in this series, since they have similar fruit shapes. *Maackia tashiroi* differs from *M. floribunda* by having asymmetrical fruits and obovate terminal leaflets, from *M. australis* by having densely pubescent leaflets, and from *M. chekiangensis* by having acuminate leaflet apices.

REPRESENTATIVE SPECIMENS. JAPAN. Kyushu, Nagasaki, 1899, *T. Makino s.n.* (MAK); Kyushu, Nagasaki, 7 Sep 1908, *T. Makino s.n.* (MAK); Shikoku, Kouchi, 3 Aug 1934, *T. Makino s.n.* (MAK); Kyushu, Kagoshima, 10 May 1912, *T. Makino s.n.* (MAK); Kyushu, Nagasaki, 5 Aug 1915, *T. Makino s.n.* (MAK); Kyushu, Kumamoto, 15 Jul 1904, *Murakami s.n.* (MAK); Ryukyus, Okinawa, 8 Aug 1951, *Amano 6715* (NY, GH, MO, TI); Kyushu, Kagoshima, 17 Jul 1979, *Amino et al 183* (TAI); Ryukyus, Oshima, Jul 1900, *Faurie 3910* (GH, BM, P); Kyushu, Ohsumi, 9 Aug 1957, *Furuse s.n.* (S); Kyushu, Nagasaki, 19 Jul 1941, *Greatrex 48/41* (TI); Kyushu, Nagasaki, Oct 1941, *Greatrex 113a/38* (TI); Ryukyus, Amami-oshima, *s.d.*, *Hatusima s.n.* (TAI); Kyushu, Ohsumi, 2 Nov 1950, *Hatusima 14903* (GH); Kyushu, Ohsumi, 4 Oct 1958, *Hatusima et al 48226* (MAK); Kyushu, Ohsumi, 11 Aug 1965, *Hatusima et al 29707* (MAK); Kyushu, Ohsumi, 5 Aug 1963, *Hatusima et al 27726* (MAK); Kyushu, Ohsumi, 1 Aug 1964, *Hatusima et al 28143* (MAK); Kyushu, Nagasaki, 28 Sep 1975, *Inoue 4408* (TI); Ryukyus, 20 Jul 1894, *Ito 721* (TI); Ryukyus, 16 Jul 1894, *Ito 560* (TI); Kyushu, Kagoshima, 11 Sep 1940, *Kimura & Hurusawa s.n.* (TI); Shikoku, Tosa, 3-4 Sep 1934, *Koidzumi s.n.* (MAK, TI); Ryukyus, Okinawa, Aug 1898, *Kuroiwa s.n.* (MAK); 4 Aug 1928, *Masamune s.n.* (TI); Kyushu, Kagoshima, 31 Jul 1927, *Masamune s.n.* (TI); Ryukyus, Okinawa, *s.d.*, *Matsumura s.n.* (TI); 9 Aug 1969, *Miyamoto s.n.* (TI); 28 Feb 1968, *Nakajima s.n.* (TI); Kyushu, Nagasaki, 27 Oct 1973, *Ohashi et al 256* (GH, US); 14 Oct 1928, *Saito 2379* (TI); 11 Aug 1933, *Tagawa 1819* (TI); Ryukyus, Okinawa, 28 Jul 1968, *Takushi 11336* (TI); Kyushu, Kagoshima, 8 Sep 1920, *Togashi 494* (TI); Ryukyus, Okinawa, 7 Aug 1951, *Walker et al 6485* (MO, NY, US); Kyushu, Oosima, 1853-56 *Wright 68* (K); Ryukyus, Amami, 23 Jun 2001, *Yamazaki et al 5925* (TI); Ryukyus, Amami, 24 Jun 2001, *Yamazaki et al 6938* (TI); Kyushu, Kagoshima, 15 Jul 1979, *Yamazaki et al 2258* (TI); Tanegashima, Kagoshima, 31 Jul 1939, *Yano s.n.* (MAK); Kyushu, Nagasaki, 17 Aug 1997, *Yonekura 97420* (HAST).

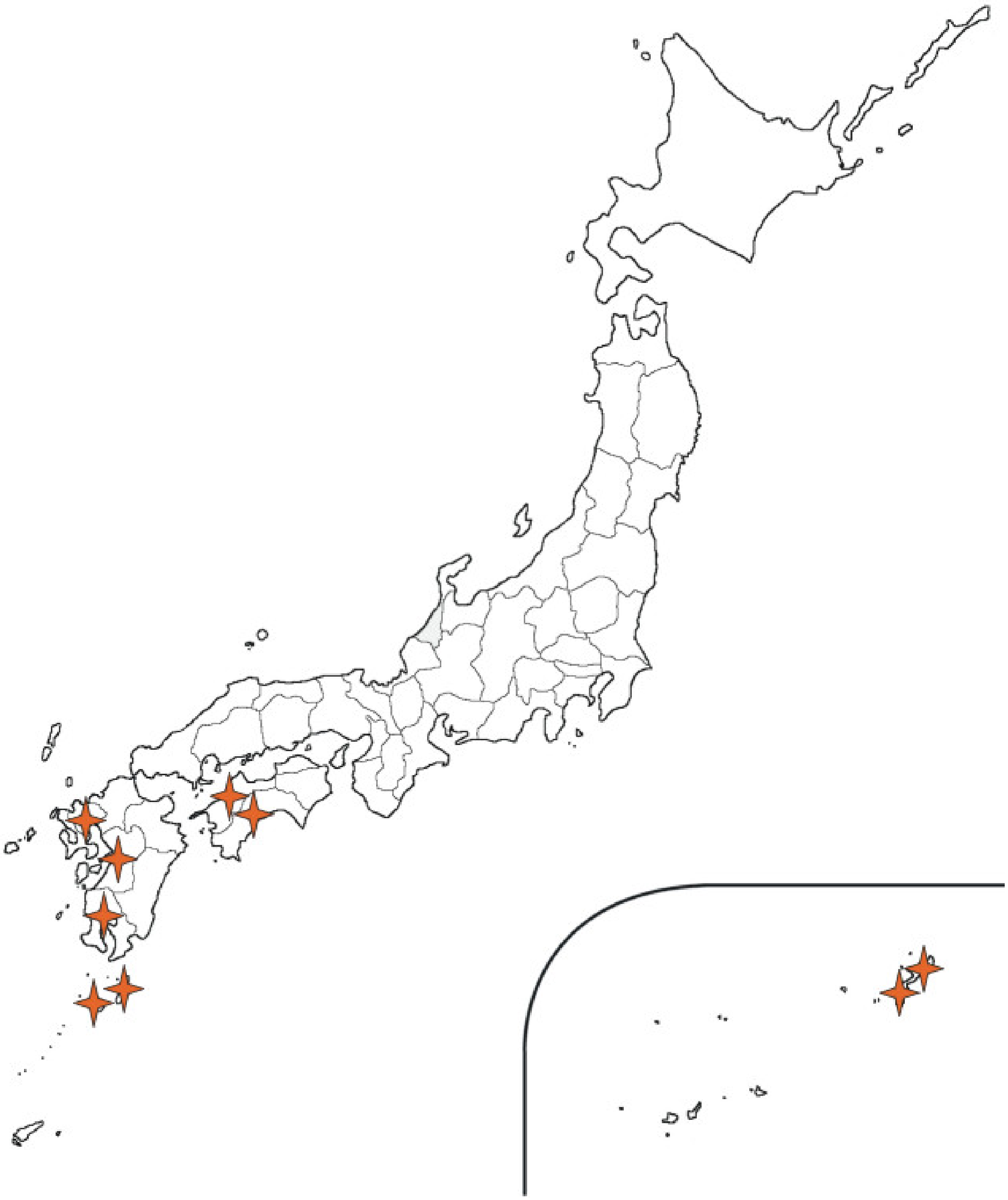


Figure 40. Distribution map of *M. tashiroi*.

EXCLUDED TAXA

Derris chinensis Benth., J. Linn. Soc. iv. Suppl. 104. 1860. LECTOTYPE (to be designated): China, Fujian Province, Amoy, Dec 1857, *Swinhoe s.n. (Herb. Hance 1504)* (BM; photograph MU!; = *Indigofera* sp.?). SYNTYPE: Japan, Ryukyu Islands, Oosima, 1853-1856, *C. Wright 68* (K!; = *Maackia tashiroi*).

In the protologue, Bentham (1860) states that the Hance specimen was from Hong Kong. Although no specimen associated with Hance bearing this name has been found from Hong Kong, one sheet ex. herb. Hance (no. 1504) has been located in BM. In *Flora Hongkongensis*, Bentham (1861) cites the Hance material as from "south China". Hemsley (1887) cites *Hance 1504* as one collection of this species. From the description, it is obvious that *Derris chinensis* Benth. does not belong in *Maackia*; the inflorescences are described as axillary and shorter than the leaves, and the flowers are described as whorled at the nodes of the inflorescence. These characters do not match characters of any known *Maackia* species, but are similar to species of *Indigofera* and *Millettia*. We believe that *Derris chinensis* is an *Indigofera* species.

Maackia tenuifolia (Hemsl.) Hand.-Mazz., Symb. Sin. 7(3): 544. 1933. *Euchresta tenuifolia* Hemsl., Journal of the Linnean Society, Botany 23(154): 200-201. 1887. TYPE: CHINA. Zhejiang, Ningpo: *Cooper s.n.* (holotype: K; photograph MU!).
Maackia honanensis L. H. Bailey, Gentes Herb. 1: 32, f. 9. 1920. TYPE: CHINA. Chikungshan, border of the provinces of Hupeh and Honan, on the divide between the Yang-tze and Hwai-ho Rivers: 30 Jun 1917, *L. H. Bailey s.n.* (holotype: BH!; isotype:E!).

From the standpoint of gross morphology, *M. tenuifolia* is easily distinguishable from the rest of *Maackia*. The leaves of the species have three to five leaflets, the two most basal being sessile on the rachis; the leaflets are ciliate along the margins and only sparsely pubescent on the midrib. No bracteoles were observed on the specimens of *M. tenuifolia* examined. The flowers are twice as long as the largest of any *Maackia* species; the calyx is only pubescent along the tooth margins, unlike those of *Maackia* species, in which the entire calyx is densely pubescent; the banner has little to no indentation; the wing claw is not bent; the pistil is stalked. *Maackia tenuifolia* legumes are falcate, have a long stipe, and contains bright red seeds. All these attributes distinguish *M. tenuifolia* from the rest of *Maackia*. Preliminary DNA analyses also separate *M. tenuifolia* from the rest of the genus (E. Tepe, pers. com.). Placement of this species has not yet been determined.

REPRESENTATIVE SPECIMENS. CHINA. Chekiang, Chiao-kow, 3 May 1929, *Tsoong* 290 (PE); Henan, Chikungshan, divide between Yang-Tze and Hwai-Ho rivers, 29 Jun. 1913, *Bailey* s.n. (BH); Hupeh and Honan, Chikungshan, border of the provinces, on the divide between the Yang-tze and Hwai-Ho Rivers., 30 Jun. 1917, *Bailey* s.n. (BH, E); Kiangsu, Bau hwa Shan, Jun. 1922, *Merrill* 11459 (F, GH, MO, NY, UC); Kiangsu, Bau Hwa Shan, 5 May

1923, *Steward* 5200 (E, K, NY, UC); Kiangsu, Pao Hwa Shan, 22 Apr. 1926, *Tso* 195 (GH, IBSC); Kiangsu, 1926, *Chun* 195 (IBSC); Zhejiang and Anhui, Mt. Tienmu, 1964, *A. K. C.* 18 (MU, PR (2))

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Appendix 1. Floral and vegetative data used in analyses.

O.T.U.	floret	calzy	ctthb	calbsle	calpub	calpele	banle	bancl	wngle	wngcl	klle	klcl	brctle	brctpub	pstalk	budscl	budpub	lfltpr	fllpule
efo001	1.60	0	0.00	7.5	1	8	11	4.5	8.8	6.4	7.2	6.4	0.9	1	1	0.6	1	3	0.3
mam001	0.80	1	0.30	3.4	1	4.8	4.2	2.6	4.8	2.7	5.9	2.1	1.3	0	0	5.10	0	4	0.5
mam007	0.90	1	0.30	4	1	4.2	5.6	4.5	5.9	1	5.3	1.6	1.2	0	0	4	0	4	0.4
mam044	1.20	1	0.26	3.9	1	6	6.3	3.3	7.2	3.3	6.9	2.4	1.5	0	0	6	0	4	0.4
mam045	1.00	1	0.31	4.2	1	4.2	4.8	4.8	5.7	2.7	5.7	2.7	1.8	0	0	5.5	0	3	0.4
mam046	0.90	1	0.22	3	1	7.2	6	2.4	6.6	2.7	6.3	3.3	1.5	0	0	5.1	0	3	0.4
mam050	1.00	1	0.22	2.7	1	7.2	4.5	3.6	6	3.9	6	3.3	0.9	0	0	2.7	0	4	0.4
mambu024	0.80	1	0.35	2.9	1	5.4	3.6	1.2	4.3	1.2	4.3	1	0.8	0	0	4.2	0	5	0.4
map002	0.80	1	0.19	2.1	1	3.9	4.8	2.1	5.1	3.3	5.5	2.7	1.8	1	0	4.2	1	4	0.3
mau006	0.70	1	0.42	2.4	1	2.4	2.7	1.2	3.4	0.9	3.4	1.2	2.1	0	0	1.3	1	5	1.8
maula001	0.70	1	0.67	2.4	1	4.8	3.3	1.5	4.8	2.7	4.8	2.1	2.6	0	0	2.56	0	3	0.2
mbu001	1.00	1	0.25	3.6	1	3.9	5.1	2.1	5.7	2.1	6	1.8	1.2	1	0	2.40	1	4	0.3
mbu005	1.00	1	0.25	4.2	1	3.6	6	4.2	7.8	3.3	7.2	3.6	1.2	1	0	4.38	1	4	3.6
mbu006	1.00	1	0.44	3.7	1	4.3	6.9	1.8	6	3	6.6	2.7	1.4	1	0	2.88	1	5	0.4
mbu017	1.00	1	0.28	4.3	1	5.7	6.2	2.8	6.7	2.9	6.2	2.8	1.3	1	0	4.2	1	4	0.3
mbu018	1.00	1	0.26	3.5	1	5	5	2.3	6	1.9	5.7	2	1.3	1	0	3.8	1	4	2.5
mbu021	1.00	1	0.26	4	1	6	5.4	2.1	6.6	2.7	6	3.3	1.6	1	0	4.3	1	5	0.4
mbu022	1.10	1	0.44	4.5	1	4.8	5.4	2	6.9	2.1	6.3	2.4	1.2	1	0	6	1	6	0.4
mbu023	1.00	1	0.25	3.6	1	4.5	4.8	1.8	6	2.1	5.4	2.1	1.2	1	0	2.7	1	5	0.5
mbu025	1.00	1	0.27	4	1	4.2	5.7	1.5	5.9	1.7	5.8	1.8	1.2	1	0	4	1	5	0.3
mbu026	1.00	1	0.26	3.9	1	3.6	5.1	1.8	6	2.1	6	2.7	2.3	1	0	3.7	1	5	0.4
mbu028	1.10	1	0.29	4.2	1	4.5	6.6	3.6	7.5	3.2	7.5	2.9	1.5	1	0	3.9	1	5	0.3
mbuam042	1.10	1	0.24	4.2	1	5.4	6	2.4	7.8	2.4	7.2	3	1.4	1	0	4.2	1	6	0.4
mck003	0.50	1	0.58	2.4	1	3	3	0.6	3.6	0.6	3.6	0.9	1.8	1	0	0.9	1	5	2.1
mfa008	1.00	1	0.30	3.3	1	3.9	4.2	1.2	4.8	1.4	4.8	1.2	1.3	0	0	3.3	0	6	0.3
mfa011	1.00	1	0.33	3.6	1	5.7	4.8	3	6	2.4	6.3	3.6	0.9	0	0	3.3	0	6	0.4
mfl001	0.70	1	0.27	3.7	1	3.7	3	1.8	4.2	2.7	4.2	1.8	1	1	0	3.00	1	5	0.3
mfl002	0.70	1	0.42	2.4	1	4.2	3.9	2.1	4.8	1.8	4.8	2.1	1.1	1	0	2.40	1	5	0.2
mbufl003	0.80	1	0.31	4.2	1	3.9	5.4	2.7	6.6	2.4	6	2.7	1.4	1	0	3.8	1	5	0.6
mfl018	0.70	1	0.39	2.6	1	4.8	3.3	1.8	5.1	3	5.1	2.1	1	1	0	3.2	1	5	0.4
mfl019	0.70	1	0.42	2.9	1	2.2	4.2	2.1	5	2.9	5.7	1.5	0.9	1	0	3.7	1	5	0.3
mfl021	0.70	1	0.30	3	1	3.3	3.3	1.6	4.5	1.8	5	1.6	1.2	1	0	4.2	1	6	0.3
mfl022	0.70	1	0.24	2.7	1	3.6	3	1.5	4.2	2.4	5.1	2.4	1.3	1	0	3.7	1	6	0.3
mfl023	0.70	1	0.41	2.7	1	4.8	3.6	2.1	4.8	1.8	4.5	1.8	0.8	1	0	3.3	1	5	0.2
mflbu019	0.80	1	0.42	2.9	1	5.6	3.9	1.8	4.8	2.1	4.8	2.1	1.4	1	0	3.5	1	6	0.4
mflbu020	0.80	1	0.45	3.4	1	5.1	5.4	1.2	6	1.2	5.4	2.1	0.8	1	0	4.5	1	6	0.3
mfp001	0.70	1	0.25	2.4	1	3	3.3	1.8	4.8	2.7	5.1	2.4	1.2	1	0	2.64	1	5	0.3
mhu011	0.90	1	0.47	3.2	1	2.7	5.7	2.4	6.9	2.4	6.9	1.2	2.1	1	0	4	1	5	0.03

Appendix 1 continued.

O.T.U.	floret	calzy	ctthb	calbsle	calpub	calpele	banle	bancl	wngle	wngcl	klle	klcl	brctle	brctpub	pstalk	budscl	budpub	lfltpr	fllpule
mhu014	0.80	1	0.40	3	1	4.2	4.2	1.8	5.1	2.7	6	2.4	2.4	0	0	3	1	6	0.3
mhuch002	0.90	1	0.55	3.3	1	4.2	3.9	1.5	5.4	2.7	5.4	1.5	1.5	1	0	2.40	1	5	0.3
mhu015	0.90	1	0.33	3.3	1	3	3.1	2.4	4.8	2.4	5.2	2.1	1.2	1	0	2.40	1	5	0.4
mteho001	1.70	0	0.00	6.9	0	7.2	14	4	10	6.4	11	6.4	0	1	1	2.4	1	2	1.2
mts002	0.70	1	0.33	3.3	1	2.4	3.9	1.8	5	1.8	4.8	2.1	2.1	1	0	3.12	1	6	0.3
mts015	0.60	1	0.41	2.5	1	4.2	3.3	1.5	4.2	2.1	4.5	1.8	1.8	1	0	1.4	1	5	0.3
mts100	0.70	1	0.48	2.7	1	2.1	2.4	1.2	4.8	1.5	5.6	1.8	1	1	0	1.8	1	7	0.3
mts101	0.70	1	0.38	2.4	1	3.6	2.1	2.7	4.2	2.7	5.4	2.1	1.2	1	0	1.8	1	6	0.2
mts102	0.70	1	0.39	2.7	1	2.7	3.6	1.8	4.8	2.1	6.3	2.1	1.5	1	0	2.4	1	5	0.2
mts103	0.70	1	0.56	2.7	1	3	3.3	1.5	5.1	1.8	4.8	2.1	1.5	1	0	1.8	1	6	0.2
mtsfl020	0.70	1	0.37	3	1	3.6	3.9	1.5	5.4	1.2	5.4	1.5	1.8	1	0	2.6	1	6	0.3
mtw001	0.70	1	0.30	3.3	1	4.2	4.2	2.1	5.4	2.1	5.7	2.1	1.1	0	0	3.4	0	5	0.4
mtw005	0.70	1	0.33	3	1	3	3.9	1.8	4.8	3	5.1	2.4	1.2	0	0	4.00	0	6	0.3

Appendix 2. Fruit and vegetative data used in analyses.

O.T.U.	podle	podw	seedcl	podwngw	pshape	neck	budscl	budpub	lfltpr	tllle	fllpule
mam008	5.8	0.9	0	0.12	1	1.60	3.90	0	4	5.3	0.3
mam009	6.3	0.8	0	0.06	0	4	4.44	0	4	7	0.5
mam010	4.4	1	0	0.06	1	1.76	3.00	0	4	4.8	0.3
mam011	5.3	1	0	0.08	1	1.60	6.36	1	4	4.2	0.4
mam012	6	1.1	0	0.08	1	0.80	4.98	1	3	5.7	0.3
mam014	4	1.2	0	0.048	1	0.8	4.8	0	4	4.5	0.2
mam015	5.1	1	0	0.08	1	1.92	4	0	3	6.2	0.22
map100	5.1	1.1	0	0.064	1	1.60	4.8	1	4	6.8	0.3
mam023	5.6	0.9	0	0.08	1	0.32	4.32	0	4	5.5	0.3
mau01	2.5	1.2	0	0.08	1	1.8	3	0	4	4.3	0.15
mau02	3	1.2	0	0.048	1	0.8	1.12	0	4	6	0.2
mau04	3.7	1.5	0	0.08	1	0.48	1.92	0	4	5	0.3
mau05	3	1.7	0	0.112	1	0.8	2.4	1	4	5.3	0.2
mau100	2.8	1.5	0	0.036	1	1.60	2.40	0	5	3.7	2.4
mbu008	4.4	0.7	0	0.042	1	0.96	4.32	1	5	5.9	0.36
mbu009	7.5	1	0	0.06	1	3.2	4.5	1	4	6	0.3
mbu011	4.5	0.9	0	0.06	1	0.80	3.96	1	5	4.1	0.3
mbu012	4.5	0.8	0	0.09	1	3.20	3.6	1	4	4	0.4
mbu013	6.3	0.8	0	0.064	1	1.60	6.08	1	5	5.6	0.4
mbu014	6.6	1	0	0.048	1	2.40	5.6	1	5	4	0.2
mbu030	4.1	0.8	0	0.048	1	2.40	3.6	1	4	4.6	0.2
mbu031	6.3	0.9	0	0.06	1	1.28	4.2	1	5	7	0.5
mbu032	6	0.9	0	0.036	1	0.80	4.2	1	5	6.5	0.4
mbu036	5.8	0.9	0	0	1	0.80	5.28	1	6	5.1	0.5
mbu037	7.3	0.9	0	0.06	1	1.20	4.8	1	4	4.5	0.3
mbu100	5.3	0.6	0	0.06	1	0.80	2.28	1	6	4.9	0.3
mbu103	5.1	0.8	0	0.06	1	1.80	3.84	1	3	5.8	0.4
mck02	2.8	1.2	0	0.048	1	0.8	0.185	0	4	5	0.2
mfa010	6.7	1.3	0	0.2	1	1.60	4.2	0	7	3.5	0.3
mfa013	5	1	0	0.1	1	2.40	5.1	0	7	3.6	0.2
mfl008	4.5	1	0	0.1	1	1.60	3.00	1	4	3.2	0.3
mfl012	4.1	1	0	0.064	1	0.64	3.84	1	5	5.4	0.3
mfl014	4.4	0.9	0	0.096	1	2.08	3.04	1	4	4.3	0.4
mfl024	3.7	1.2	0	0.12	1	2.40	3.6	1	6	5.5	0.5
mfl025	5.2	1.2	0	0.15	1	2.40	3.6	1	5	4.6	0.3
mfl100	4.8	1	0	0.08	1	0.48	2.72	1	5	4.3	0.3
mfl104	5.2	0.8	0	0	1	1.28	5.1	1	5	4.6	0.3
mfl105	5.5	1	0	0.2	1	2.40	3	1	5	5.4	0.3
mfl108	5.5	0.9	0	0.12	1	2.56	1.8	1	6	5.5	0.3

Appendix 2 continued.

O.T.U.	podle	podw	seedcl	podwngw	pshape	neck	budscl	budpub	lfltpr	tllle	fllpule
mfl110	3.6	1.6	0	0.2	1	2.88	3.78	1	5	6.7	0.4
mfl111	6.6	1.1	0	0.02	1	1.12	4	1	7	5.6	0.5
mhu010	7.3	1.3	0	0.2	1	2.4	3.2	1	5	4	0.2
mhu011	7.4	2	0	0.4	1	2.4	7.2	1	4	8.1	0.3
mhu012	6	1.3	0	0.2	1	1.5	2.7	1	5	5	0.3
mhu013	5.3	2.4	0	0.4	1	1.2	4.2	1	6	6.9	0.4
mhw001	4	1.5	1	0.036	1	0.9	3.6	1	5	6	0.3
mst001	5.4	0.8	0	0.012	1	0.90	3.6	0	3	6	0.2
mte005	6.6	1	1	0	0	9.12	4.00	0	3	6.7	0.6
mte006	4.5	0.7	1	0	0	3.68	4.32	1	2	7.9	0.32
mte007	5.5	1	1	0	0	8.96	6.00	1	2	7.9	0.1
mte010	3.1	1	1	0	0	10.4	6.4	1	2	11.8	0.08
mte011	4.5	1	1	0	0	5	3.6	1	2	8	0.1
mte100	4	0.7	1	0	1	4.80	2.4	1	2	7.2	0.08
mts03	2.9	1.3	0	0.06	1	1.80	1.04	1	5	4.8	0.3
mts05	2.5	1.1	0	0.048	1	1.12	2.10	1	5	4	0.4
mts06	2.2	1	0	0.064	1	0.80	2.56	1	6	4.3	0.27
mts08	2.3	1.1	0	0.03	1	1.12	1.20	1	5	2.2	0.1
mts10	3.5	1.4	0	0.08	1	2.40	1.92	1	4	4.1	0.4
mts11	3	1.1	0	0.03	1	0.80	1.44	1	6	3.5	0.2
mts13	2.8	1.1	0	0.048	1	1.28	1.28	1	5	4	0.2
mts14	4	1.4	0	0.156	1	1.28	2.08	0	5	3.7	0.3
mts18	2.7	1.2	0	0.024	1	0.80	2.7	1	6	3.6	0.3
mts19	2.1	1.1	0	0.066	1	0.80	1.8	1	6	3.6	0.3
mts20	2.4	1	0	0.042	1	0.80	2.1	1	6	4	0.2
mts21	2.5	1.1	0	0.042	1	1.28	1.2	1	6	2.6	0.2
mts22	2.5	1.2	0	0.03	1	1.44	1.5	1	6	3.5	0.1
mts24	2.5	1.1	0	0.03	1	1.12	1.7	1	7	3.6	0.2
mts25	2.3	1	0	0.048	1	0.80	1.5	1	5	3.7	0.2
mts26	2.6	1.2	0	0.048	1	0.80	2.7	1	6	3.5	0.2
mts27	3.1	1.1	0	0.08	1	1.92	1.12	1	6	2.4	0.1
mtw05	3.7	1.1	0	0.208	1	1.60	2.64	0	5	3.5	0.4
mtw07	5.2	1.1	0	0.2	1	3.20	2.7	0	5	3.6	0.4
mtw08	5.5	1.5	0	0.3	1	2.40	4.2	0	7	3.2	0.3
mtw100	5.7	1.2	0	0.3	1	1.6	1.5	0	7	4	0.6
mtw101	4.8	1.3	0	0.3	1	2.08	3.52	0	5	2.8	0.4
mtw102	3.3	1	0	0.192	1	1.92	1.80	0	6	3	0.3

Appendix 2 continued.

O.T.U.	podle	podw	seedcl	podwngw	pshape	neck	budscl	budpub	lfltpr	tllle	fllpule
mtw103	4.1	1	0	0.12	1	1.60	2.4	0	5	3.3	0.3
mtw104	5.8	1.3	0	0.4	1	3.04	2.28	0	6	4.2	0.4
mnk01	5.7	1.3	0	0.048	1	1.92	2.88	1	5	4.8	0.2

Appendix 3. Complete list of specimens examined.

Species	Collector	Collection Number	Date	O.T.U.
M. amurensis ssp. *amurensis*	Ag	s.n.	1871	
M. amurensis ssp. *amurensis*	Alanko	17163	21 Jun. 1971	
M. amurensis ssp. *amurensis*	Alm	48	4 Aug. 1940	
M. amurensis ssp. *amurensis*	Atha	514	23 Jul. 1994	
M. amurensis ssp. *amurensis*	Augustinawicz	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Collector Unknown	s.n.	Aug. 1901	
M. amurensis ssp. *amurensis*	Bae	12157	1991	
M. amurensis ssp. *amurensis*	Bean	477	19 Aug. 1904	
M. amurensis ssp. *amurensis*	Bean	477:1893	2 Oct. 1905	
M. amurensis ssp. *amurensis*	Bean	477:1893	20 Aug. 1908	
M. amurensis ssp. *amurensis*	Bohnhof	231	21 Jan. 1900	
M. amurensis ssp. *amurensis*	Bos	10897	6 Aug. 1996	
M. amurensis ssp. *amurensis*	Brooks	589	1884	
M. amurensis ssp. *amurensis*	Cao et al.	1130	14 Jul. 2001	
M. amurensis ssp. *amurensis*	Chaffanjon	1378	1895	
M. amurensis ssp. *amurensis*	Chang et al.	1065	3 Sep. 1950	
M. amurensis ssp. *amurensis*	Chapin	124	25 Feb. 1983	
M. amurensis ssp. *amurensis*	Chen	280	1931	mam14
M. amurensis ssp. *amurensis*	Chersky	s.n.	8 Jul. 1911	
M. amurensis ssp. *amurensis*	Chung	54329	29 Jul. 1981	
M. amurensis ssp. *amurensis*	Chung	s.n.	12 Jun. 1980	
M. amurensis ssp. *amurensis*	Cole	52344	s.d.	
M. amurensis ssp. *amurensis*	Dawsen	s.n.	25 Aug. 1882	
M. amurensis ssp. *amurensis*	Desoulavy	303	10 Jul. 1902	
M. amurensis ssp. *amurensis*	Desoulavy	3336	6 Jul. 1909	mam44
M. amurensis ssp. *amurensis*	Desoulavy	687	12 Aug. 1903	mam25
M. amurensis ssp. *amurensis*	Doi	36	7 Oct. 1923	
M. amurensis ssp. *amurensis*	Dorsett et al.	3725	18 Jul. 1925	
M. amurensis ssp. *amurensis*	Dunn	4270	Sep. 1906	
M. amurensis ssp. *amurensis*	Eames	s.n.	Aug. 1955	
M. amurensis ssp. *amurensis*	Ejp	22337-B	9 Jul. 1940	
M. amurensis ssp. *amurensis*	Ejp	22458-A	26 Aug. 1936	
M. amurensis ssp. *amurensis*	Ejp	341-35-A	9 Jul. 1940	
M. amurensis ssp. *amurensis*	Ejp	5262-B	29 Sep. 1936	
M. amurensis ssp. *amurensis*	Ejp	809-34	25 Sep. 1940	
M. amurensis ssp. *amurensis*	Elias et al.	11037	19 Jul. 1988	
M. amurensis ssp. *amurensis*	Elsik et al.	1387	11 Jul. 1984	

Appendix 3. continued

Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. amurensis ssp. *amurensis*	Elsik et al.	1388	11 Jul. 1984	
M. amurensis ssp. *amurensis*	Elsik et al.	1389	11 Jul. 1984	
M. amurensis ssp. *amurensis*	Elsik et al.	1409	12 Jul. 1984	
M. amurensis ssp. *amurensis*	Elwes et al.	s.n.	1904	
M. amurensis ssp. *amurensis*	Enander	s.n.	3 Aug. 1913	
M. amurensis ssp. *amurensis*	Farges	178	s.d.	
M. amurensis ssp. *amurensis*	Faurie	2913	11 Aug. 1888	
M. amurensis ssp. *amurensis*	Faurie	3303	25 Sep. 1888	
M. amurensis ssp. *amurensis*	Faurie	3909	25 Sep. 1888	
M. amurensis ssp. *amurensis*	Faurie	430	Aug. 1906	
M. amurensis ssp. *amurensis*	Faurie	5460	Aug. 1903	
M. amurensis ssp. *amurensis*	Faurie	6916	7 Aug. 1905	
M. amurensis ssp. *amurensis*	Fedtschenko	489	18 ? 1909	
M. amurensis ssp. *amurensis*	Fedtschenko	539	1909	mam27
M. amurensis ssp. *amurensis*	Ff	s.n.	19 Jul. 1930	
M. amurensis ssp. *amurensis*	Fogg	s.n.	11 Jul. 1968	
M. amurensis ssp. *amurensis*	Fogg	s.n.	18 Jul. 1969	
M. amurensis ssp. *amurensis*	Fogg	s.n.	29 Jul. 1966	mam17
M. amurensis ssp. *amurensis*	Fogg	s.n.	30 Jul. 1973	
M. amurensis ssp. *amurensis*	For R. Wallace & Co.	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Fordham	467/70	18 Jun. 1970	
M. amurensis ssp. *amurensis*	Gibbs	2635	21 Aug. 1901	
M. amurensis ssp. *amurensis*	Glehn	s.n.	1860	
M. amurensis ssp. *amurensis*	Glover	s.n.	21 May 1920	
M. amurensis ssp. *amurensis*	Glover	s.n.	28 Sep. 1920	
M. amurensis ssp. *amurensis*	Goring (Goering)	290		
M. amurensis ssp. *amurensis*	Grudzinskaya	s.n.	3 Sep. 1967	
M. amurensis ssp. *amurensis*	Han	s.n.	22 Jun. 1980	
M. amurensis ssp. *amurensis*	Hawley	s.n.	9 Oct. 1986	mam16
M. amurensis ssp. *amurensis*	Herbarium Committee	572	6 Oct. 1987	
M. amurensis ssp. *amurensis*	Hou	98139-1	16 Aug. 1998	
M. amurensis ssp. *amurensis*	Hulphers	s.n.	1906	
M. amurensis ssp. *amurensis*	Jeong	205	28 Jul. 1997	mam7
M. amurensis ssp. *amurensis*	Jeong	s.n.	27 Jul. 1993	
M. amurensis ssp. *amurensis*	Judd	s.n.	16 Apr. 1929	
M. amurensis ssp. *amurensis*	Kammerer	540-28	23 Jul. 1947	

Appendix 3. continued

Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. amurensis ssp. *amurensis*	Karo	930	30 Jun. 1901	
M. amurensis ssp. *amurensis*	Karo	s.n.	7 Jul. 1905	
M. amurensis ssp. *amurensis*	Karshinsky	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Kim	s.n.	19 Jul. 1969	
M. amurensis ssp. *amurensis*	Kim	s.n.	25 Sep. 1966	mam9
M. amurensis ssp. *amurensis*	Koch et al.	s.n.	22 Jul. 1923	
M. amurensis ssp. *amurensis*	Koleshirov	57	18 Aug. 1936	
M. amurensis ssp. *amurensis*	Komarov	930	12 Jul. 1896	
M. amurensis ssp. *amurensis*	Komarov	930	4 Jul. 1897	
M. amurensis ssp. *amurensis*	Kondo	8939	25 Jul. 1928	
M. amurensis ssp. *amurensis*	Kopronovich	s.n.	19 Jun. 1903	
M. amurensis ssp. *amurensis*	Kopronovich	s.n.	25 Jun. 1903	
M. amurensis ssp. *amurensis*	Kopronovich	s.n.	26 Jul. 1903	
M. amurensis ssp. *amurensis*	Korshinsky	s.n.	1 Jul. 1891	
M. amurensis ssp. *amurensis*	Kramer	s.n.	1 Aug. 1959	
M. amurensis ssp. *amurensis*	Krjukoux	1385	22 Aug. 1904	
M. amurensis ssp. *amurensis*	Kryshtofovich	979	21 Jul. 1914	
M. amurensis ssp. *amurensis*	Kung	2051	9 Aug. 1931	
M. amurensis ssp. *amurensis*	Kung	524	7 December 1930	
M. amurensis ssp. *amurensis*	Kung	686	19 Jul. 1930	
M. amurensis ssp. *amurensis*	Kurosch	130	1914	
M. amurensis ssp. *amurensis*	Kuzjuring	1590	1909	
M. amurensis ssp. *amurensis*	Kuznetzov	20	5 Jul. 1931	
M. amurensis ssp. *amurensis*	Kuznetzov	280	23 ? 1929	
M. amurensis ssp. *amurensis*	Lawrence	1202	9 Aug. 1946	
M. amurensis ssp. *amurensis*	Lawrence	188	15 May 1946	
M. amurensis ssp. *amurensis*	Lee	112	1 Aug. 1997	mam46
M. amurensis ssp. *amurensis*	Lee	9755	12 Jul. 1998	
M. amurensis ssp. *amurensis*	Lee	9757	27 Aug. 1976	mam10
M. amurensis ssp. *amurensis*	Lee	9758	21 Jul. 1977	
M. amurensis ssp. *amurensis*	Lee et al.	12970	6 Aug. 2000	
M. amurensis ssp. *amurensis*	Lee et al.	12971	6 Aug. 2000	
M. amurensis ssp. *amurensis*	Licent	8488	17 Jul. 1928	
M. amurensis ssp. *amurensis*	Licent	8506	18 Jul. 1928	
M. amurensis ssp. *amurensis*	Lipsky	s.n.	20 Jul. 1901	
M. amurensis ssp. *amurensis*	Litvinov	1539	18 Jul. 1902	
M. amurensis ssp. *amurensis*	Litvinov	3029	30 Jun. 1903	

Appendix 3. continued

Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. amurensis ssp. *amurensis*	Lobza	s.n.	1897	
M. amurensis ssp. *amurensis*	Lubazsky	s.n.	29 Jun. 1951	
M. amurensis ssp. *amurensis*	Maack	s.n.	1855	
M. amurensis ssp. *amurensis*	Maack	s.n.	Jul. 1859	
M. amurensis ssp. *amurensis*	Manning	s.n.	8 Jul. 1894	
M. amurensis ssp. *amurensis*	Matono	5577	21 Sep. 1933	
M. amurensis ssp. *amurensis*	Maximowicz	6060	1855	
M. amurensis ssp. *amurensis*	Maximowicz	s.n.	1859	
M. amurensis ssp. *amurensis*	Maximowicz	s.n.	28 Jul. 1856	
M. amurensis ssp. *amurensis*	Maximowicz	s.n.	3 Jul. 1855	
M. amurensis ssp. *amurensis*	Maximowicz	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Maximowicz	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Mazzeo	s.n.	15 Jul. 1965	
M. amurensis ssp. *amurensis*	McCaskill	532	27 Aug. 1957	
M. amurensis ssp. *amurensis*	McEleny	s.n.	9 Jul. 1984	
M. amurensis ssp. *amurensis*	McNaull et al.	9400427	8 Jul. 1994	
M. amurensis ssp. *amurensis*	Meyer	60	29 May 1906	
M. amurensis ssp. *amurensis*	Meyer	6417	25 Jul. 1959	mam5
M. amurensis ssp. *amurensis*	Meyer	s.n.	13 Sep. 1969	
M. amurensis ssp. *amurensis*	Meyer	s.n.	24 Jun. 1906	
M. amurensis ssp. *amurensis*	Meyer et al.	13094	20 Jun. 1972	
M. amurensis ssp. *amurensis*	Meyer et al.	14548	16 Jul. 1974	
M. amurensis ssp. *amurensis*	Meyer et al.	14694	20 Aug. 1974	mam19
M. amurensis ssp. *amurensis*	Meyer et al.	18675	9 Oct. 1981	
M. amurensis ssp. *amurensis*	Mills	141	8 Aug. 1910	
M. amurensis ssp. *amurensis*	Mills	4606	24 Jul. 1922	
M. amurensis ssp. *amurensis*	Moran	2437	14 Aug. 1947	
M. amurensis ssp. *amurensis*	Nakai	102	3 Jun. 1913	
M. amurensis ssp. *amurensis*	Nakai	1987	21 Jul. 1914	
M. amurensis ssp. *amurensis*	Nakai	1988	24 Jul. 1914	
M. amurensis ssp. *amurensis*	Nakai	1989	4 Jul. 1914	
M. amurensis ssp. *amurensis*	Nakai	1990	19 Aug. 1914	
M. amurensis ssp. *amurensis*	Nakai	5533	31 Jul. 1916	
M. amurensis ssp. *amurensis*	Nakai	8016	15 Jul. 1919	
M. amurensis ssp. *amurensis*	Nam	s.n.	14 Jul. 1962	
M. amurensis ssp. *amurensis*	Napec	HLJ-51	8 Sep. 1993	mam11
M. amurensis ssp. *amurensis*	Nekrasova	575	27 Jul. 1928	

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Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. amurensis ssp. *amurensis*	Neumark	75	21 Jul. 1926	
M. amurensis ssp. *amurensis*	Nicholson	1771	18 Jul. 1880	
M. amurensis ssp. *amurensis*	Nicholson	55	1884	
M. amurensis ssp. *amurensis*	Oettingen	1112	23 Sep. 1909	
M. amurensis ssp. *amurensis*	Okada	s.n.	1909	
M. amurensis ssp. *amurensis*	Packard et al.	6819V94	6 Sep. 1994	
M. amurensis ssp. *amurensis*	Pakhtiy	s.n.	1915	
M. amurensis ssp. *amurensis*	Palczewsky	s.n.	10 Sep. 1904	
M. amurensis ssp. *amurensis*	Palczewsky	s.n.	1903	
M. amurensis ssp. *amurensis*	Park	42	1959	
M. amurensis ssp. *amurensis*	Park	99	11 Aug. 1959	
M. amurensis ssp. *amurensis*	Petrowsky	s.n.	1909	
M. amurensis ssp. *amurensis*	Poleshajew et al.	s.n.	Jan. 1900	
M. amurensis ssp. *amurensis*	Radde	s.n.	1858	
M. amurensis ssp. *amurensis*	Radde	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Rogers	171	7 Jul. 1986	
M. amurensis ssp. *amurensis*	Ryu	132	11 Aug. 1957	
M. amurensis ssp. *amurensis*	Sakura	s.n.	2 Aug. 1909	
M. amurensis ssp. *amurensis*	Samoilov	6721	Jul. 1925	
M. amurensis ssp. *amurensis*	Sargent	s.n.	1903	
M. amurensis ssp. *amurensis*	Savatier	404	1866-1876	
M. amurensis ssp. *amurensis*	Schischkin	218	10 Jul. 1925	
M. amurensis ssp. *amurensis*	Schischkin	s.n.	2 Aug. 1920	
M. amurensis ssp. *amurensis*	Schmidt	123	1900	
M. amurensis ssp. *amurensis*	Schmidt	137	1900	
M. amurensis ssp. *amurensis*	Schmidt	58	1900	
M. amurensis ssp. *amurensis*	Schrenk	s.n.	1855	
M. amurensis ssp. *amurensis*	Schwerdtfeger	16581	1 Aug. 1984	
M. amurensis ssp. *amurensis*	Sclintps-Menz	473	8 Jul. 1952	
M. amurensis ssp. *amurensis*	Sclintps-Menz	523	16 Jul. 1952	
M. amurensis ssp. *amurensis*	Selivanova	s.n.	10 Aug. 1926	
M. amurensis ssp. *amurensis*	Semjagin	87a	29 Jun. 1910	
M. amurensis ssp. *amurensis*	Senn	3163	26 Jul. 1941	
M. amurensis ssp. *amurensis*	Serpuchova	s.n.	28 Aug. 1926	mam26
M. amurensis ssp. *amurensis*	Shim	181	12 Aug. 1943	
M. amurensis ssp. *amurensis*	Siegel	s.n.	30 Jul. 1975	
M. amurensis ssp. *amurensis*	Siuzov	s.n.	Sep. 1908	

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Species	Collector	Collection Number	Date	O.T.U.
M. amurensis ssp. *amurensis*	Skortsov(Skvortsov)	s.n.	22 Aug. 1988	
M. amurensis ssp. *amurensis*	Skripka	533	23 ? 1928	
M. amurensis ssp. *amurensis*	Skvortzov	s.n.	10 Aug. 1928	mam23
M. amurensis ssp. *amurensis*	Small	s.n.	23 Aug. 1933	
M. amurensis ssp. *amurensis*	Solokhin	1056	s.d.	
M. amurensis ssp. *amurensis*	Solomon	6537	18 Oct. 1981	
M. amurensis ssp. *amurensis*	Steckbeck	s.n.	20 Jul. 1942	
M. amurensis ssp. *amurensis*	Sun	9761	26 Jul. 1977	
M. amurensis ssp. *amurensis*	Tidestrom	4053	26 Aug. 1912	mam20
M. amurensis ssp. *amurensis*	Tieshan et al.	HLJ-32	2 Sep. 1993	
M. amurensis ssp. *amurensis*	Tieshan et al.	HLJ-51	8 Sep. 1993	
M. amurensis ssp. *amurensis*	Tigerstedt	s.n.	1964	
M. amurensis ssp. *amurensis*	Toh	s.n.	2 Aug. 1954	
M. amurensis ssp. *amurensis*	Toh/Do	11477	12 Aug. 1943	
M. amurensis ssp. *amurensis*	Toh/Do	11478	12 Aug. 1943	mam15
M. amurensis ssp. *amurensis*	Toh/Do	4252	28 Jul. 1934	
M. amurensis ssp. *amurensis*	Toh/Do	9267	23 Jul. 1936	
M. amurensis ssp. *amurensis*	Uljanova	s.n.	24 Jul. 1972	mam50
M. amurensis ssp. *amurensis*	Untranslated	1219	30 Jul. 1959	
M. amurensis ssp. *amurensis*	Untranslated	15151	26 Jul. 1916	
M. amurensis ssp. *amurensis*	Untranslated	2827	24 Jun. 1903	
M. amurensis ssp. *amurensis*	Untranslated	2848	26 Jun. 1903	
M. amurensis ssp. *amurensis*	Untranslated	332-2	28 Oct. 1916	
M. amurensis ssp. *amurensis*	Untranslated	475	24 Jul. 1987	
M. amurensis ssp. *amurensis*	Untranslated	496	17 Aug. 1924	
M. amurensis ssp. *amurensis*	Untranslated	53	9 Jun. 1930	
M. amurensis ssp. *amurensis*	Untranslated	8200	21 Apr. 1978	
M. amurensis ssp. *amurensis*	Untranslated	980	1929	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	10 Aug. 1958	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	12 Sep. 1977	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1870	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1877	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1881	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1916	mam33
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1920	mam45
M. amurensis ssp. *amurensis*	Untranslated	s.n.	1959	mam8
M. amurensis ssp. *amurensis*	Untranslated	s.n.	21 Sep. 1933	

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Species	Collector	Collection Number	Date	O.T.U.
M. amurensis ssp. *amurensis*	Untranslated	s.n.	22-24 Aug. 1988	mam12
M. amurensis ssp. *amurensis*	Untranslated	s.n.	24 Jul. 1916	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	27 ? 1891	mam34
M. amurensis ssp. *amurensis*	Untranslated	s.n.	27 ? 1906	mam30
M. amurensis ssp. *amurensis*	Untranslated	s.n.	28 Jul. 1879	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	7 Jun. 1903	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	8 Sep. 1923	
M. amurensis ssp. *amurensis*	Untranslated	s.n.	s.d.	
M. amurensis ssp. *amurensis*	Vasil'ev	s.n.	19 Jun. 1951	
M. amurensis ssp. *amurensis*	Veitch	s.n.	1892	
M. amurensis ssp. *amurensis*	Vorob'ev	s.n.	2 ? 1928	
M. amurensis ssp. *amurensis*	Wagenknecht	341-35	20 Jul. 1960	
M. amurensis ssp. *amurensis*	Wan and Chow	81008	1981	
M. amurensis ssp. *amurensis*	Wang et al.	1011	24 Jun. 1950	
M. amurensis ssp. *amurensis*	Wheeler	s.n.	12 Sep. 1907	
M. amurensis ssp. *amurensis*	Wheeler	s.n.	Jul. 1909	
M. amurensis ssp. *amurensis*	Wilford	1124	1859	
M. amurensis ssp. *amurensis*	Wilson	10498	14 Jul. 1918	mam21
M. amurensis ssp. *amurensis*	Wilson	10713	1 Sep. 1918	
M. amurensis ssp. *amurensis*	Wilson	7660	19 Oct. 1914	
M. amurensis ssp. *amurensis*	Wilson	8628	18 Jun. 1917	
M. amurensis ssp. *amurensis*	Wilson	8945	18 Aug. 1917	
M. amurensis ssp. *amurensis*	Wilson	s.n.	19 Nov. 1914	
M. amurensis ssp. *amurensis*	Wilson et al.	s.n.	1 Jul. 1917	
M. amurensis ssp. *amurensis*	Wu	178	9 Aug. 1950	
M. amurensis ssp. *amurensis*	Yakovlev	s.n.	30 Mar. 1891	
M. amurensis ssp. *amurensis*	Yamasina	3404	17 Jul. 1932	
M. amurensis ssp. *amurensis*	Yanng	s.n.	8 Aug. 1959	
M. amurensis ssp. *amurensis*	Yinger et al.	3513	7 Sep. 1985	
M. amurensis ssp. *amurensis*	Yinger et al.	3673	3 Oct. 1985	
M. amurensis ssp. *amurensis*	Yoo	205	28 Jul. 1997	
M. amurensis ssp. *amurensis*	Yoo	2449	23 Jul. 2004	
M. amurensis ssp. *amurensis*	Yoo	659	25 Jul. 2003	mam1
M. amurensis ssp. *amurensis*	You	660	25 Jul. 2003	
M. amurensis ssp. *amurensis*	Zabel	s.n.	1886	
M. amurensis ssp. *amurensis*	Zabel	s.n.	23 Jul. 1892	
M. amurensis ssp. *amurensis*	Zabel	s.n.	5 Jul. 1895	

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Species	Collector	Collection Number	Date	O.T.U.
M. amurensis ssp. *amurensis*	Zhao	s.n.	26 Jun. 1995	
M. amurensis ssp. *amurensis*	Zhukova	329	24 Jul. 1929	
M. amurensis ssp. *stenocarpa*	Mori	180	Aug. 1912	
M. amurensis ssp. *stenocarpa*	Mori	s.n.	20 Jul. 1916	
M. amurensis ssp. *stenocarpa*	Nakai	11508	19 May 1928	
M. amurensis ssp. *stenocarpa*	Nakai	11509	16 May 1928	
M. amurensis ssp. *stenocarpa*	Nakai	13011	4 Aug. 1929	
M. amurensis ssp. *stenocarpa*	Nakai	13013	25 Jul. 1930	
M. amurensis ssp. *stenocarpa*	Nakai	13014	26 Jul. 1929	
M. amurensis ssp. *stenocarpa*	Nakai	14996	11 Aug. 1934	
M. amurensis ssp. *stenocarpa*	Nakai	7198	23 Jul. 1918	
M. amurensis ssp. *stenocarpa*	Nakai	9843	Jul. 1921	
M. amurensis ssp. *stenocarpa*	Nakai	s.n.	23 Jun. 1921	
M. amurensis ssp. *stenocarpa*	Nakai	s.n.	3 May 1913	
M. amurensis ssp. *stenocarpa*	Saito	8848	Jul. 1926	
M. amurensis ssp. *stenocarpa*	Toh/Do	5093	16 Jul. 1936	
M. amurensis ssp. *stenocarpa*	Uchiyama	s.n.	30 Aug. 1902	
M. amurensis ssp. *stenocarpa*	You	2450	23 Jul. 2004	
M. australis	Chen	1334	28 Oct. 1992	mau01
M. australis	Chen	292	14 Nov. 1980	mau02
M. australis	Euai	s.n.	4 Aug. 1890	mauB
M. australis	Li	594	22 May 1981	
M. australis	Li	674	25 Nov. 1981	mau05
M. australis	Luo	1328	Nov. 1992	mau06
M. australis	Millett	s.n.	1838	
M. australis	Taam	1693	12 Sep. 1940	melA
M. australis	Taam	2134	7 Jun. 1941	mla1
M. australis	Tang	1258	14 Apr. 1952	
M. chekiangensis	Chen	3684	15 Jul. 1932	
M. chekiangensis	Chen	447	5 Aug. 1990	mckau04
M. chekiangensis	Cheng	889	20 Jul. 1933	mck2
M. chekiangensis	Yang	10056	22 May	
M. chekiangensis	Yang	10091	16 Jun.	mck3
M. fauriei	Faurie	1692	Aug. 1907	mfaA
M. fauriei	Islidoya	179	13 Aug. 1912	mfa014
M. fauriei	Murata et al.	27038	21 Oct. 1988	mfa13
M. fauriei	Nakai	6232	30 Oct. 1917	mfa12

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Species	Collector	Collection Number	Date	O.T.U.
M. fauriei	Taquet	2798	Aug. 1909	mfa11
M. fauriei	Taquet	9938	10 Sep. 1911	
M. fauriei	Toh/Do	11475	19 July 1935	
M. fauriei	Toh/Do	11476	19 July 1935	
M. fauriei	Toh/Do	4501	19 July 1935	mfa8
M. fauriei	Toh/Do	4900	19 July 1935	
M. fauriei	Wilson	9426	15 Aug. 1927	mfa9/10
M. floribunda	Agatsuma	s.n.	22 July 1906	mfl20
M. floribunda	Forbes	1298	1862	
M. floribunda	Fukuoka	12632	10 Aug. 1986	
M. floribunda	Goring (Goering)	290	s.d.	
M. floribunda	Greatrex	245/38	1938	mfl108
M. floribunda	Greatrex	47/31	s.d.	
M. floribunda	Greatrex	49/41	Oct. 1941	mflst02
M. floribunda	Greatrex	H. 2320/51	3 Aug. 1947	
M. floribunda	Hara	50/41	4 Oct. 1941	
M. floribunda	Hatusima	22175	30 Aug. 1955	
M. floribunda	Hatusima	s.n.	1 Oct. 1957	
M. floribunda	Hatusima	s.n.	3 Jul. 1958	
M. floribunda	Hatusima and Sako	27795	17-19 Aug. 1963	mfl19
M. floribunda	Hirano	TI129	s.d.	
M. floribunda	Hoshi	633	23 Oct. 1982	
M. floribunda	Hosokawa	s.n.	4 Aug. 1929	mfl2
M. floribunda	Huang	1756	11 Aug. 1984	
M. floribunda	Huang	3145	1 Sep. 1985	
M. floribunda	Junjiro	193	Aug. 1910	mfl23
M. floribunda	Kasai	23	20 July 1913	
M. floribunda	Kasai	37	7 June 1926	
M. floribunda	Kikitsu		23 Aug. 1941	
M. floribunda	Kimura	43	12 Oct. 1915	mfl24
M. floribunda	Konta et al.	108	30 Jul. 1976	
M. floribunda	Kosinsky	243	1 Aug. 1913	
M. floribunda	Kuwana	s.n.	25 July 1906	
M. floribunda	Leu	s.n.	3 Oct. 1989	mfl11
M. floribunda	Makino	s.n.	1892	
M. floribunda	Makino	s.n.	1914	mfl21
M. floribunda	Makino	s.n.	1914	mfl22

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Species	Collector	Collection Number	Date	O.T.U.
M. floribunda	Makino	s.n.	1931	mfl1
M. floribunda	Makino	s.n.	1931	
M. floribunda	Makino	s.n.	1931	
M. floribunda	Makino	s.n.	1934	mfl18
M. floribunda	Makino	s.n.	1934	
M. floribunda	Makino	s.n.	1940	mfl8
M. floribunda	Makino	s.n.	1940	mflbu38
M. floribunda	Makino	s.n.	s.d.	mfp2
M. floribunda	Makino	s.n.	Sept. 1905	mfl9
M. floribunda	Miyamoto	s.n.	12 Aug. 1954	
M. floribunda	Miyamoto	s.n.	30 July 1956	
M. floribunda	Miyamoto	s.n.	6 Aug. 1968	
M. floribunda	Mizuno	6854	15 Aug. 1933	
M. floribunda	Moriyama	3012	3 Aug. 1960	
M. floribunda	Murata	22308	25 Aug. 1974	
M. floribunda	Murata	37098	Sep. 1978	
M. floribunda	Murata	9973	15 Sep. 1980	mfl26
M. floribunda	Muroi	633	18 Jul. 1953	
M. floribunda	Nikai	3028	s.d.	
M. floribunda	Nikai	3029	s.d.	
M. floribunda	Nishina	74	27 May 1904	
M. floribunda	Ohashi et al.	8705	14 Sep. 1982	mfl12
M. floribunda	Ohashi et al.	8564	12 Sep. 1982	
M. floribunda	Ohashi et al.	8590	12 Sep. 1982	
M. floribunda	Ohashi et al.	8663	14 Sep. 1982	
M. floribunda	Ohashi et al.	8710	14 Sep. 1982	mfl12
M. floribunda	Ohashi et al.	8807	14 Sep. 1982	
M. floribunda	Ohashi et al.	9061	16 Sep. 1982	
M. floribunda	Okamoto	20061	5 Aug. 1936	
M. floribunda	Pierot	761	s.d.	
M. floribunda	Saito	s.n.	27 July 1923	
M. floribunda	Saito	s.n.	29 Aug. 1901	
M. floribunda	Sako	4324	4 Sep. 1962	
M. floribunda	Sato	11	Aug. 1906	
M. floribunda	Sawamura	s.n.	s.d.	
M. floribunda	Shiota	1712	26 Jul. 1923	
M. floribunda	Shiota	7872	29 Aug. 1934	

Appendix 3. continued

Species	Collector	Collection Number	Date	O.T.U.
M. floribunda	Shiota	9259	28 Aug. 1935	
M. floribunda	Shuichi	3970	19 Sep. 1986	
M. floribunda	Siebold	s.n.	1859-1863	
M. floribunda	Suguwara	s.n.	25-27 July 1988	
M. floribunda	Takahashi	1044	13 Jul. 1982	
M. floribunda	Tanaka	100(425)	19 Aug. 1925	mflbu19
M. floribunda	Tanaka	127	13 Aug. 1924	
M. floribunda	Tanaka	183	14 Aug. 1925	
M. floribunda	Tashiro	s.n.	1917	
M. floribunda	Togasi(Togashi)	59839	16 Aug. 1950	
M. floribunda	Torii	s.n.	7 Aug. 1955	
M. floribunda	Toyoshima	s.n.	17 Aug. 1910	
M. floribunda	Tschonoski	1652	Aug. 1888	
M. floribunda	Tsuchiya	4795	17 Aug. 1987	mbu31
M. floribunda	Tsugaru	5127	17 Sep. 1978	mfl14
M. floribunda	Tsugaru and Takahashi	20688	25 Aug. 1994	
M. floribunda	Uno	2612	15 Aug. 1952	
M. floribunda	Untranslated	1652	1888	
M. floribunda	Untranslated	5262	4 August 1917	
M. floribunda	Untranslated	s.n.	13 Sept. 1909	
M. floribunda	Untranslated	s.n.	14 Aug. 1931	mfp1
M. floribunda	Untranslated	s.n.	24 July 1909	
M. floribunda	Untranslated	s.n.	27 Sept. 1894	
M. floribunda	Untranslated	s.n.	9 July 1941	
M. floribunda	Untranslated	s.n.	s.d.	
M. floribunda	Untranslated	s.n.	22 Aug. 1929	
M. floribunda	Untranslated	s.n.	27 Sep. 1894	
M. floribunda	Yamamoto	s.n.	20 Aug. 1917	
M. floribunda	Yoshino	37	Oct. 1930	mfl25
M. floribunda	Yoshino	s.n.	12 Aug. 1934	
M. floribunda	Yoshino	s.n.	13 Sept. 1936	
M. hupehensis	A.K.C.	30191	1964	
M. hupehensis	Atha	516	23 July 1994	
M. hupehensis	Bailey	s.n.	23 July 1913	
M. hupehensis	Bailey	s.n.	24 July 1917	
M. hupehensis	Chen	1212	3 Oct. 1933	mhu11
M. hupehensis	Cheng	4094	18 Oct. 1933	

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Species	Collector	Collection Number	Date	O.T.U.
M. hupehensis	Cheng and Hwa	1146	1948	
M. hupehensis	Chiao	1563	19 Jul. 1928	
M. hupehensis	Chung and Sun	395	6 Jul. 1933	
M. hupehensis	Chung and Sun	681	27 July 1933	mhu15
M. hupehensis	Clark	3675-A	16 Jul. 1941	
M. hupehensis	Clark	6962-A	22 Jul. 1941	
M. hupehensis	Croziat et al.	s.n.	27 Jul. 1939	
M. hupehensis	DeWolf et al.	2172	13 Sep. 1967	
M. hupehensis	EJP	970-34	11 Oct. 1938	
M. hupehensis	Fan and Li	346	23 July 1935	mhu16
M. hupehensis	Farges	178	August	
M. hupehensis	Fu	5091	18 Jul. 1952	
M. hupehensis	Gillis	14344	12 Oct. 1977	mch10
M. hupehensis	Guan	741568	28 Aug. 1974	mhu13
M. hupehensis	Guo	1821	22 Jul. 1952	
M. hupehensis	Herbarium Committee	570	6 Oct. 1987	
M. hupehensis	Herbarium Committee	571	6 Oct. 1987	mch8
M. hupehensis	Hers	651	5 May 1921	
M. hupehensis	Hillier et al.	1362	19 Jul. 1977	
M. hupehensis	Hsiung	5811	10 Sept. 1947	
M. hupehensis	Hu	480	4 Aug. 2002	
M. hupehensis	Jgf	s.n.	1 Aug. 1923	
M. hupehensis	Kung	3690	18 Sep. 1933	
M. hupehensis	Liou	284	27 Jul. 1930	
M. hupehensis	Liu and Father	534	9 Aug. 1948	
M. hupehensis	Macklin	s.n.	1906	
M. hupehensis	Merrill	s.n.	17 Aug. 1921	mch15
M. hupehensis	Robertson	3775	15 Aug. 1985	
M. hupehensis	Steward	4725	Aug. 1923	mch2
M. hupehensis	Tan	9608063	31 Aug. 1996	
M. hupehensis	Tan	9610141	28 Oct. 1996	mhu6
M. hupehensis	Tsoong and Liou	3468	13 Aug. 1938	mhu12
M. hupehensis	Untranslated	1471	20 Jun. 1952	
M. hupehensis	Untranslated	148	28 October 1996	mhu6
M. hupehensis	Untranslated	6982	20 October 1917	
M. hupehensis	Untranslated	s.n.	10 August 1967	

Appendix 3. continued

Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. hupehensis	Wilson	1516	July 1900	
M. hupehensis	Wilson	1576	July 1900	
M. hupehensis	Wilson	1582	July 1900	
M. hupehensis	Wilson	1716	7 Sept. 1907	
M. hupehensis	Wilson	709	Aug. 1907	mhuA
M. hupehensis	Witt	2595-40	8 Aug. 1983	
M. hupehensis	Yang	10055	s.d.	
M. hupehensis	Ye	12773	15 Oct. 1999	
M. hwashanensis	Hao	3884	4 Aug. 1932	
M. hwashanensis	Hao	4113	21 Aug. 1932	mhw1
M. hwashanensis	Liu	H10067	26 Jun. 2005	
M. hwashanensis	Liu	H20088	3 Jul. 2005	
M. hwashanensis	Wang	19692	13 Aug. 1966	
M. hwashanensis	Zhu et al.	3159	22 Jul. 2000	
M. japonica	Albrecht	s.n.	1861	
M. japonica	Untranslated	s.n.	22 August 1893	
M. japonica	Arimoto	s.n.	Sept. 1903	
M. japonica	Asano	2081	23 August 1956	
M. japonica	Azuma and Yonekura	448	23 Aug. 1993	mbu5
M. japonica	Bailey	s.n.	8 Aug. 1932	
M. japonica	Bean	s.n.	21 July 1905	
M. japonica	Bos	10896	6 Aug. 1996	
M. japonica	Boufford and Kato	22335	26 July 1980	
M. japonica	Boynton	8993	4 Oct. 1917	
M. japonica	Brooks	204	1884	mbuam42
M. japonica	Brooks	589	1884	
M. japonica	Clark	3675-A	16 July 1941	
M. japonica	Cowgill	777	17 Jun. 1938	
M. japonica	Ejp	93-29	20 June 1938	
M. japonica	Engley	s.n.	5 Aug. 1971	
M. japonica	Ewan	s.n.	Aug. 1981	
M. japonica	Faurie	2913	11 Aug. 1888	
M. japonica	Faurie	3303	25 Sep. 1888	
M. japonica	Faurie	5460	Aug. 1903	
M. japonica	Faurie	6106	July 1904	mbu13
M. japonica	Faurie	6916	7 Aug. 1905	
M. japonica	Finletter	s.n.	25 Aug. 1970	

Appendix 3. continued

Species	**Collector**	**Collection Number**	**Date**	**O.T.U.**
M. japonica	Fordham	s.n.	6 Nov. 1969	
M. japonica	Freeman	s.n.	29 Oct. 1934	mbu2
M. japonica	Fujino and Jutila	619	24 Jul. 1991	
M. japonica	Fukuoka	s.n.	3 Aug. 1969	
M. japonica	Furuse	s.n.	8 Jul. 1960	
M. japonica	Gibson	908	1 Jul. 1969	
M. japonica	Glover	s.n.	28 Sep. 1920	
M. japonica	Hara	s.n.	7 Aug. 1963	
M. japonica	Hara et al.	s.n.	10 Aug. 1971	
M. japonica	Hayakawa	s.n.	20 Aug. 1905	
M. japonica	Hiroe	14577	3 Aug. 1960	
M. japonica	Hirshfeld	281	23 Aug. 1979	
M. japonica	Hisauchi	1484	12 Jul. 1936	
M. japonica	Hisauchi	1768	2 Aug. 1958	mbu1
M. japonica	Hoshi	604	3 Oct. 1982	
M. japonica	Hoshi	623	3 Oct. 1982	
M. japonica	Hoshi	624	3 Oct. 1982	
M. japonica	Hosoi	s.n.	24 Aug. 1950	
M. japonica	Hurusawa	s.n.	19 Oct. 1947	mbu36
M. japonica	Ikegami	11834	19 Sept. 1948	
M. japonica	Ikegami	16215	3 June 1951	
M. japonica	Inoue	166	5 Aug. 1912	
M. japonica	Iwata	69	6 Sept. 1915	mbu30
M. japonica	Jack	s.n.	23 Aug. 1905	
M. japonica	Jones	s.n.	22 Aug.	
M. japonica	Judd	s.n.	18 July 1920	
M. japonica	Kanai	6009	17 Sept. 1960	
M. japonica	Karasawa and Matsuzaki	s.n.	29 Aug. 1927	
M. japonica	Kirkham et al.	EHOK 142	3 Oct. 1997	mbu8
M. japonica	Kobayashi	2703	17 Aug. 1966	
M. japonica	Kobayashi	s.n.	28 Aug. 1925	
M. japonica	Kobayashi	s.n.	8 Oct. 1925	mbu35
M. japonica	Kurosawa	4525	9 Aug. 1993	
M. japonica	Licent	13421	12 Aug. 1936	mbu24
M. japonica	Logan	285	7 July 1981	
M. japonica	Makino	53	10 July 1924	
M. japonica	Makino	67	June 1914	

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Species	Collector	Collection Number	Date	O.T.U.
M. japonica	Makino	s.n.	10 July-14 Aug. 1908	mbu26
M. japonica	Makino	s.n.	16 June 1902	
M. japonica	Makino	s.n.	19 Aug. 1895	
M. japonica	Makino	s.n.	1910	mbu22
M. japonica	Makino	s.n.	1910	mbu6
M. japonica	Makino	s.n.	1926	
M. japonica	Makino	s.n.	1931	mbu39
M. japonica	Makino	s.n.	1931	
M. japonica	Makino	s.n.	1939	
M. japonica	Makino	s.n.	7 Aug. 1899	
M. japonica	Makino	s.n.	Aug. 1905	
M. japonica	Makino	s.n.	Sep.1941	mbu12
M. japonica	Makino	s.n.	Sept. 1944	mbu37
M. japonica	Matsuki	123026	14 Aug. 1972	
M. japonica	Maximowicz	10964	Aug. 1862	
M. japonica	Maximowicz	10964	Nov. 1862	
M. japonica	Maximowicz	1298	1862	mbu16
M. japonica	Merrill	s.n.	17 Aug. 1921	
M. japonica	Mimoro et al.	1291	22 Aug. 1977	
M. japonica	Minemura	1464	11 Aug. 1961	
M. japonica	Mizushima	2330	27 July 1952	
M. japonica	Muroi	3953	3 Aug. 1955	
M. japonica	Muroi	3982	3 Aug. 1955	
M. japonica	Muroi	4070	4 Aug. 1955	
M. japonica	Muroi	4287	4 Aug. 1955	
M. japonica	Muroi	4498	10 Aug. 1955	
M. japonica	Muroi	4541	11 Aug. 1955	
M. japonica	Naito et al.	s.n.	4 Sep. 1983	
M. japonica	Nash	1467	1907	
M. japonica	Nash	2585	1 Aug. 1907	
M. japonica	Nash	s.n.	1 Sep. 1916	
M. japonica	Ogura	s.n.	2 Aug. 1915	
M. japonica	Ohashi	91201	12 Sept. 1993	
M. japonica	Okada	s.n.	1909	
M. japonica	Okuyama	s.n.	9 Aug. 1937	
M. japonica	Russell	s.n.	9 Jul. 1932	
M. japonica	Saito	s.n.	2 Aug. 1931	

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Species	Collector	Collection Number	Date	O.T.U.
M. japonica	Sakurai	s.n.	17 Aug. 1906	
M. japonica	Sargent	s.n.	10 Sept. 1892	
M. japonica	Sargent	s.n.	16 Sept. 1892	mbu14
M. japonica	Sato	s.n.	18 Aug. 1954	
M. japonica	Savatier	404	1909	
M. japonica	Savatier	s.n.	s.d.	
M. japonica	Sawada	s.n.	22 Aug. 1926	mbu20
M. japonica	Shimokawa	131128	21 Aug. 1922	
M. japonica	Shiota	7559	17 June 1934	
M. japonica	Sugawara	s.n.	15 July 1979	
M. japonica	Suzuki	21	4 Aug. 1932	
M. japonica	Takahashi	491	29 Jul. 1969	
M. japonica	Takahashi	s.n.	15 Jul. 1963	
M. japonica	Takahashi	s.n.	5 Aug. 1967	
M. japonica	Takeda	s.n.	24 Sept. 1907	mbu103
M. japonica	Tanaka	208	3 Aug. 1929	mbu17
M. japonica	Taylor	1467	16 July 1904	
M. japonica	Togashi	7101	15 Aug. 1971	mbu18
M. japonica	Togashi et al.	9999	21 July 1965	
M. japonica	Tokubachi	s.n.	17 Sept. 1890	
M. japonica	Tsuchiya	4795	17 Aug. 1987	mbu31
M. japonica	Tsuchiya	5006	17 Aug. 1988	mbu21
M. japonica	Uno	15084	30 July 1936	mbu25
M. japonica	Untranslated	3675	26 July 1917	
M. japonica	Untranslated	80	s.d.	mbu23
M. japonica	Untranslated	s.n.	30 Aug. 1967	
M. japonica	Wilson	1467	Sept. 1903	
M. japonica	Wilson	7251	25 July 1914	
M. japonica	Wilson	7660	19 Oct. 1914	
M. japonica	Wood and Boufford	3953	2 Sep. 1977	mbu9
M. japonica	Yamaji	5314	22 Sep. 1997	mbu11
M. japonica	Yamaji		21 Sep. 1993	
M. japonica	Yanng	s.n.	8 Aug. 1959	
M. japonica	Yano and Kato	s.n.	11 June 1961	
M. japonica	Yonekura et al.	94865	26 Sep. 1994	mbu32
M. nakaii	Koidzumi	s.n.	Aug. 1911	mnk1
M. nakaii	Kurosawa et al.	3648	3 July 1990	

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Species	Collector	Collection Number	Date	O.T.U.
M. taiwanensis	Boufford et al.	25259	3 Oct. 1989	mtw3
M. taiwanensis	Chaw	733	5 Sept. 1988	mtw1
M. taiwanensis	Hosokawa	s.n.	4 Oct. 1931	
M. taiwanensis	Huang	1756	11 Aug. 1984	
M. taiwanensis	Huang	3145	1 Sep. 1985	
M. taiwanensis	Huang	s.n.	10 Aug. 1980	
M. taiwanensis	Huang	s.n.	26 Sept. 1980	
M. taiwanensis	Huang	s.n.	27 Sep. 1984	mtw101
M. taiwanensis	Huang	s.n.	31 Aug. 1981	
M. taiwanensis	Leu	s.n.	3 Oct. 1989	mtw102
M. taiwanensis	Liao et al.	503	7 Sept. 1992	
M. taiwanensis	Lu	13147	13 Oct. 1983	mtw8
M. taiwanensis	Lu	s.n.	21 Aug. 1984	
M. taiwanensis	Peng	12969	3 Oct. 1989	mtw5
M. taiwanensis	Wang and Liao	612	2 Oct. 1991	mfl7
M. tashiroi	Amano	6715	8 August 1951	mts5
M. tashiroi	Amino et al.	183	17 July 1979	
M. tashiroi	Bailey	s.n.	30 Jun. 1917	
M. tashiroi	Cheng	4443	27 Aug. 1933	
M. tashiroi	Enomoto	s.n.	Jun. 1967	
M. tashiroi	Faurie	3910	Jul. 1900	
M. tashiroi	For L. Boehmer And Co.	s.n.	6 Aug. 1904	mts24
M. tashiroi	For Yokohama Nursery Co.	s.n.	1914	
M. tashiroi	For Yokohama Nursery Co.	s.n.	26 May 1909	
M. tashiroi	For Yokohama Nursery Co.	s.n.	Sept. 1908	
M. tashiroi	Furuse	s.n.	10 Aug. 1961	mts13
M. tashiroi	Furuse	s.n.	9 Aug. 1957	
M. tashiroi	Greatrex	113a/38	Oct. 1941	
M. tashiroi	Greatrex	48/41	19 Jul. 1941	
M. tashiroi	Hamada	146	21 Aug. 1925	
M. tashiroi	Hara	48/41	19 Jul. 1941	
M. tashiroi	Hatusima	14903	2 Nov. 1950	
M. tashiroi	Hatusima	19204	18 Aug. 1955	
M. tashiroi	Hatusima	19979	9 Aug. 1956	

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Species	Collector	Collection Number	Date	O.T.U.
M. tashiroi	Hatusima	20324	14 Aug. 1956	mts20
M. tashiroi	Hatusima			
M. tashiroi	Hatusima and Sako	27359	5 Oct. 1962	
M. tashiroi	Hatusima and Sako	27726	5 Aug. 1963	mts3
M. tashiroi	Hatusima and Sako	29707	11 Aug. 1965	mts22
M. tashiroi	Hatusima et al.	28143	1 Aug. 1964	
M. tashiroi	Hatusima et al.	48226	4 Oct. 1958	
M. tashiroi	Hiyama	s.n.	18 May 1961	mts9
M. tashiroi	Inoue	4408	28 Sep. 1975	
M. tashiroi	Ito	560	16 Jul. 1894	
M. tashiroi	Ito	721	20 Jul. 1894	
M. tashiroi	Kimura and Hurusawa	s.n.	11 Sep. 1940	
M. tashiroi	Koidzumi	s.n.	3-4 Sep. 1934	mts4/21
M. tashiroi	Kudo	7252	Aug. 1907	
M. tashiroi	Kuroiwa	s.n.	Aug. 1898	
M. tashiroi	Makino	s.n.	10 May 1912	
M. tashiroi	Makino	s.n.	1899	mts10
M. tashiroi	Makino	s.n.	1938	mts12
M. tashiroi	Makino	s.n.	3 Aug. 1934	mts15
M. tashiroi	Makino	s.n.	5 Aug. 1915	
M. tashiroi	Makino	s.n.	7 Sept. 1908	
M. tashiroi	Makino	s.n.	Sept. 1909	mts19
M. tashiroi	Mantaro	s.n.	15 July 1904	mts2
M. tashiroi	Masamune	s.n.	31 Jul. 1927	mts103
M. tashiroi	Masamune	s.n.	4 Aug. 1928	
M. tashiroi	Masamune	s.n.	7 Jul. 1925	
M. tashiroi	Matsumura	s.n.	s.d.	mts25
M. tashiroi	Miyamoto	s.n.	9 Aug. 1969	
M. tashiroi	Muramatsu	s.n.	15 Aug. 1935	
M. tashiroi	Naito	s.n.	14 Aug. 1937	
M. tashiroi	Nakajima	s.n.	28 Feb. 1968	
M. tashiroi	Ohashi and Ohba	256	27 Oct. 1973	
M. tashiroi	Saito	2379	14 Oct. 1928	mts26

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Species	Collector	Collection Number	Date	O.T.U.
M. tashiroi	Saito	2494	18 Oct. 1928	mts27
M. tashiroi	Seto	28735	7 Aug. 1982	
M. tashiroi	Shinjo and Tateishi	12006	9 May 1998	
M. tashiroi	Siebold	s.n.	s.d.	
M. tashiroi	Sugaya et al.	s.n.	20 Oct. 1965	mts8
M. tashiroi	Suzuki	s.n.	15 Jul. 1935	
M. tashiroi	Tagawa	1819	11 Aug. 1933	
M. tashiroi	Takushi	11336	28 Jul. 1968	
M. tashiroi	Tanimoto et al.	183	17 Jul. 1979	
M. tashiroi	Tashiro	1904	Sep. 1887	
M. tashiroi	Tawada	18170	21 Jun. 1955	
M. tashiroi	Togashi	494	8 Sep. 1920	
M. tashiroi	Untranslated	30315	1964	
M. tashiroi	Walker et al.	6485	7 Aug. 1951	mts6
M. tashiroi	Wilson	11264	22 Jan. 1919	
M. tashiroi	Wilson	s.n.	1917	
M. tashiroi	Wilson et al.	6485	7 Aug. 1951	
M. tashiroi	Wright	68	1853-56	
M. tashiroi	Yamazaki and Yamazaki	2258	15 Jul. 1979	mts101
M. tashiroi	Yamazaki and Yamazaki	6938	24 Jun. 2001	mts102
M. tashiroi	Yamazaki et al.	5925	23 Jun. 2001	mts100
M. tashiroi	Yano	s.n.	31 Jul. 1939	mts18
M. tashiroi	Yonekura	97420	17 Aug. 1997	mts14
M. tenuifolia	A. K. C.	18	1964	mte5
M. tenuifolia	Bailey	s.n.	29 Jun. 1913	
M. tenuifolia	Bailey	s.n.	30 Jun. 1917	
M. tenuifolia	Chapin	281	6 Mar. 1984	
M. tenuifolia	Chen	3959	6 Apr. 1931	
M. tenuifolia	Cheng	4443	27 Aug. 1933	mte7
M. tenuifolia	Chun	195	1926	
M. tenuifolia	Merrill	11459	Jun. 1922	
M. tenuifolia	Steward	5200	5 May 1923	mte1 mho1
M. tenuifolia	Tso	195	22 Apr. 1926	
M. tenuifolia	Tsoong	290	3 May 1929	

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Species	Collector	Collection Number	Date	O.T.U.
M. tenuifolia	Untranslated	786	14 Aug. 1975	
M. tenuifolia	Zhao	L628	17 Sep. 1996	