

# The Genus *Acer* (Maples) in Formosa and the Liukiu [Ryukyu] Islands

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THE SPECIES of the genus *Acer* in Formosa and the Liukiu Islands are included in the revisional study of the family Aceraceae made by Fang (1939). The Formosan species are also treated by Kanehira in his work on the Formosan trees (1936). The opinions expressed by these two authors are widely divergent. Fang accepts practically all the species originally described from Formosa, whereas Kanehira reduces a large number to synonymy. Neither of the two treatments is exhaustive, as a few names pertaining to Formosan plants are omitted from each.

For purposes of the present study, the works of these two authors, as well as other pertinent literature, have been critically reviewed. Specimens deposited in the U. S. National Herbarium, Smithsonian Institution, and the herbarium of the National Taiwan University, Formosa, have been studied and are cited, with the abbreviations US and NTU, respectively. In the latter case, only selected specimens are listed. As a result of this study, eight species are recognized for Formosa and one for the Liukiu Islands. The Liukiu entity was formerly considered a variety of a Chinese species, but it is here raised to specific rank. Two new varieties are proposed herein, and several new synonyms are noted.

## KEY TO THE SPECIES IN FORMOSA AND LIUKIU ISLANDS

A. Leaves entire.

B. Leaves undivided, rarely indistinctly 3-lobed.

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- C. Leaves glaucous beneath.
  - D. Leaves obtuse or cuneate at base, not 3-nerved. 1. *A. albopurpurascens*
  - DD. Leaves rounded to cordate and distinctly 3-nerved at base. . . . . 2. *A. itoanum*
  - CC. Leaves white-pubescent beneath. . . . . 3. *A. hypoleucum*
  - BB. Leaves 3-lobed. . . . . 4. *A. buergerianum* var. *formosanum*
  - AA. Leaves serrate.
    - B. Leaves undivided to shallowly 3- or rarely 5-lobed.
      - C. Leaves mostly undivided, sometimes shallowly 3- or rarely 5-lobed; inflorescence racemose.
        - D. Fruit 2–2.2 cm. long. . . . . 5. *A. kawakamii*
        - DD. Fruit 2.5–3 cm. long. . . . . 5a. *A. kawakamii* var. *taito-montanum*
        - CC. Leaves distinctly 3–5-lobed; inflorescence cymose. . . . . 6. *A. titcheri* var. *shimadai*
        - BB. Leaves distinctly 5- or 7-lobed.
          - C. Leaves all 5-lobed.
            - D. Leaves shallowly 5-lobed; fruit 1.8–2.3 cm. long. . . . . 7. *A. rubescens*
            - DD. Leaves deeply 5-lobed; fruit 2.5 cm. long. . . . . 8. *A. serrulatum*
            - CC. Leaves all 7-lobed. . . . . 9. *A. palmatum* var. *pubescens*

1. *Acer albopurpurascens* Hay. (1911: 64).

*Acer litseaefolium* Hay. (1913: 66, pl. 14, b).

*Acer oblongum* sensu Matsum. & Hay. (1906: 96); Koidz. (1911b: 55), p. p.;

Kanehira (1936: 506, fig. 361) [non Wall.].

*Acer lanceolatum* sensu Rehder (1905: 180) p. p. [non Molliard].

An evergreen tree to 15 cm. high; branchlets pubescent at first, soon glabrous. Leaves persistent, coriaceous, oblong-lanceolate, 6–13 cm. long, 2.5–5 cm. broad, caudate to acuminate at apex, obtuse to cuneate at base, pale green and glabrous above, white-purplish-glaucous beneath, densely pubescent when young, weakly 3-nerved at base, the basal nerves short, slightly raised or indistinct, the lateral nerves 7–10 per side, slightly raised, divergent at right angles; petioles 1.5–3 cm. long, glaucous. Infructescence cymose; nutlets glabrous, about 3 mm. across; wings with nutlets about 2 mm. long, spreading at obtuse angles.

Endemic to Formosa; in forests from medium to low altitudes throughout the island.

Formosa: South Cape, *A. Henry* 1257 (US); Musha, Nanto Prov., *E. H. Wilson* 10082 (US); Kizan-gun, Takao-syu, *Y. Yamamoto* & *K. Mori* 808 (NTU).

The concept of *A. oblongum* Wall. in eastern Asia has been considerably modified in recent years. The species is now considered as occurring only in northeastern India and western China, and other plants of this immediate relationship from eastern and southern China are considered to represent distinct species by recent authors, perhaps too many such species being recognized. Hayata earlier established three species of this group in Formosa, namely *A. albopurpurascens*, *A. litseae-folium*, and *A. hypoleucum*, but later workers on the Formosan flora, including Kanehira (1936) and Sasaki (1930: 325), consider them as a single species, to which they refer as *A. oblongum* Wall. Metcalf (1932: 198) and Fang (1939: 145–163) maintain all three as distinct. The Formosan plant, under the current concept, should be specifically distinguished from *A. oblongum* especially because of the weak or indistinct basal nerves. But

probably only one species is present on the island; the identity of *A. hypoleucum* is somewhat uncertain.

A plant from the Liukiu Islands, considered as a variety of *A. oblongum*, has distinct morphological characters and an outlying range. It should be treated as a separate species.

## 2. *Acer itoanum* (Hay.) comb. nov.

*Acer oblongum* Wall. var. *itoanum* Hay. (1911: 67); Metcalf (1932: 196); Fang (1939: 138).

*Acer oblongum* var. *microcarpum* sensu Ito ex Ito & Matsum. (1898: 387) [non Hieronymus].

*Acer oblongum* sensu Koidz. (1911b: 55, pl. 29) p. p.

Tree to 13 m.; branchlets glabrous, the young ones reddish, the older grayish. Leaves thin-coriaceous, glabrous, ovate to broadly ovate, 4.5–6.5 cm. long, 2–4.5 cm. broad, abruptly acuminate at apex, rounded to cordate at base, entire at margins, usually undivided, rarely indistinctly and obtusely 3-lobed, green above, glaucous beneath, distinctly 3-nerved at base, the veins distinct on both surfaces, the basal nerves long and strongly ascending, the lateral nerves 3–5 per side, the veinlets densely reticulate, elevated and distinct on both surfaces; petioles slender, to 2.5 cm. long, glabrous. Flowers unknown. Infructescence terminal, corymbose, pubescent; peduncles about 1 cm. long; pedicels to 1 cm. long, slender, pubescent. Fruit brownish yellow; nutlets convex, 5–6 mm. long, 3–4 mm. broad; wings oblong, with nutlets about 1.5–2 cm. long, 5 mm. broad, spreading at about 45–90°.

Endemic to the Liukiu Islands.

Liukiu Islands: Okinawa, *W. D. Field* & *O. G. Loew* 4 (US); Shuri, *E. H. Wilson* 8172 (US), *C. Wright* 40 (US).

This species differs from *A. oblongum* Wall. in the small, short, ovate leaves, which are abruptly acuminate at apex and distinctly

rounded to cordate at base, as well as in the smaller fruits with pubescent pedicels. The wings of the fruit are oblong rather than ovate in shape. Among the specimens cited, *Field & Loew 4* has the leaves mostly broader and more distinctly cordate, with a few having a tendency toward being indistinctly 3-lobed. The illustration given by Koidzumi, showing leaves with round to cordate bases, evidently refers to the *Liukiu* plant.

3. *Acer hypoleucum* Hay. (1913: 66, pl. 14, c).

Small tree; branchlets slender, tomentose at first, soon glaucous. Leaves persistent, chartaceous to coriaceous, oblong or elliptic-oblong, about 8 cm. long, 3.5–4 cm. broad, obtuse or acutish at apex, rounded or obtuse at base, entire or slightly undulate at margins, green above, whitish-glaucous and densely tomentose beneath, slightly 3-nerved at base, the nerves raised and more or less distinct, the lateral nerves 5 or 6 per side; petioles 2–3 cm. long, slender, tomentose. Inflorescence cymose, terminal; nutlets convex, about 5 mm. across; wings with nutlets about 17 mm. long and 6 mm. broad, spreading at nearly right angles; pedicels 1.5 cm. long, slender, pubescent.

Endemic to Formosa; no specimen seen.

*Acer hypoleucum* is described as being pubescent on the lower surface of the leaves. It is thus maintained as distinct from *A. albopurpurascens* by Metcalf and Fang; the latter has seen the type. However, Kanehira relegates it, together with *A. albopurpurascens*, to the synonymy of *A. oblongum* (sensu Kanehira non Wall.). In *A. albopurpurascens*, the young leaves are densely pubescent, as shown in *Wilson 10082*. The presence or absence of these hairs may be due to variation in age and environment. Further studies are needed to ascertain the identity of *A. hypoleucum*.

4. *Acer buergerianum* Miquel var. *formosanum* (Hay.) Sasaki (1928: 275); Fang (1939: 128).

*Acer trifidum* Hook. & Arn. var. *formosanum* Hay. ex Léveillé (1906: 593); Koidz. (1911b: 30, pl. 17, 8–9); Kanehira (1936: 409, fig. 364).

Tree to 10 m. high; branchlets glabrescent. Leaves deciduous, membranaceous, ovate to elliptic, 8–10 cm. long, 4–6 cm. broad, rounded or slightly cordate at base, entire or shallowly 3-lobed near apex, 3-nerved at base, the reticulations conspicuous; petioles 2.5–5 cm. long. Inflorescence corymbose. Fruits yellowish brown; nutlets strongly convex, about 6 mm. across; wings falcate, with nutlets 2.5–3 cm. long, 8–10 mm. broad, spreading horizontally.

Formosa: Huki-kaku, *T. Kawakami*, May 1915 (NTU).

The species occurs in southeastern China, the variety is endemic to the coast of northern Formosa, in forests. Fang maintains the variety on the basis of the type specimen, which he examined.

5. *Acer kawakamii* Koidz. (1911a: [102] [March]; 1911b: 15, pl. 5 [Aug.]); Kanehira (1936: 402, fig. 360).

*Acer caudatifolium* Hay. (1911: 65 [June]).

*Acer morrissonense* Hay. (1911: 66, ex Koidz. 1911a: 16, pl. 7).

*Acer ovatifolium* Koidz. (1911a: [102]); (1911b: 16, pl. 6).

*Acer caudatum* sensu Matsum. & Hay. (1906: 96) [non Wall.].

A tree to 20 m. high; branchlets slender, glabrous. Leaves deciduous, chartaceous, ovate to ovate-oblong, 6–10 cm. long, 3–5 cm. broad, caudate-acuminate at apex, rounded or slightly cordate at base, serrate and sometimes shallowly 3- or rarely 5-lobed at margins, 5-nerved at base, the lateral nerves 7 or 8 per side, green above, pale green beneath, slightly pubescent on nerves at first, soon glabrous; petioles 3–4 cm. long, rosy, slender, glabrous. Flowers in glabrous or slightly pubescent racemes about 5 cm. long; sepals 5, emarginate, 2–2.5 mm. long; petals 5,

white, emarginate, 3.5–4 mm. long; stamens 8, shorter than the sepals; ovary glabrous; pedicels 5–6 mm. long, slender, glabrous. Fruit yellowish brown; nutlets about 5 mm. across; wings falcate, with nutlets 2–2.2 cm. long, 8–12 mm. broad, spreading at obtuse angles; pedicels 6–7 mm. long.

Endemic to Formosa, in forests of high mountains in the central range, from 2,000 to 2,500 meters.

Formosa: Mt. Taipinshan, *H. Keng* 1224 (NTU, US); Arisan, *E. H. Wilson* 9643 (US), 10830 (US).

Fang (*loc. cit.*) maintains *A. morrisonense* and *A. taiton-montanum* as distinct species, but Kanehira reduces both to the synonymy of *A. kawakamii*. *A. taiton-montanum* is here treated as representing a variety of the latter species. *A. ovatifolium* Koidz. is suggested by Fang (1939: 181) as "probably identical with *Acer kawakamii* Koidzumi," and I think this is where it should be referred. As undivided and lobed leaves are often found on the same plant, this character alone is apparently not constant enough for specific distinction.

5a. *Acer kawakamii* Koidz. var. *taitonmontanum* (Hay.) comb. nov.

*Acer taiton-montanum* Hay. (1913: 67).

Leaves chartaceous, triangular-ovate, 5–7 cm. long, 4–5 cm. broad, the margins doubly serrate, undivided or shallowly 3- or 5-lobed. Fruiting racemes to 4 cm. long; nutlets slightly concave, about 1 cm. long and 5 mm. broad; wings with nutlets 2.5–3 cm. long, about 8 mm. broad, spreading at right angles; pedicels 6–7 cm. long, glabrous.

Endemic to Taiton Mountains, northern Formosa, near sulfur hot springs at about 650 meters altitude.

Formosa: Sozan, Taihoku-syu, *T. Tanaka* & *Y. Shimada* 11006 (US), *E. H. Wilson* 11229 (US), *N. Fukuyama* 8010 (NTU).

*Acer taiton-montanum* is treated as a synonym of *A. kawakamii* by Kanehira and as a distinct species by Fang. It is very close to *A.*

*kawakamii*, differing only in the larger fruit. The leaves also vary from undivided to 3- or rarely 5-lobed. The typical variety of *A. kawakamii* occurs in the high central mountains from 2,000 to 3,000 meters, whereas this variety is confined to the Taiton Mountains in northern Formosa at an altitude of about 650 meters, near sulfur hot springs. This is an interesting case of ecological differentiation. There are similar examples in other plants occurring in these two localities.

6. *Acer tutcheri* Duthie var. *shamadai* Hay. (1911: 70); Kanehira (1936: 405).

*Acer oliverianum* subvar. *trilobatum* Koidz. (1911b: 34, fig. 2).

A deciduous tree. Leaves broadly rhomboid, about 15 cm. long and 7 cm. broad, 3-lobed, rounded at base, distinctly 3-nerved, serrulate at margins, subentire toward base, the lobes similar in size or the basal ones slightly smaller, the terminal lobe broadly triangular, about 2.5 cm. long and 3 cm. broad; petioles about 4 cm. long. Infructescence cymose, terminal, about 6 cm. broad and 7 cm. long including the peduncles of 2–3 cm.; fruit glabrous, the nutlets ovoid, about 4.5 mm. long; wings with nutlets about 1.5 cm. long and 6 mm. broad, divaricate at about 40°.

Endemic to Formosa, central mountains, in forests. No specimen seen.

The typical variety of *A. tutcheri* is confined to Kwangtung and Kwangsi. The Formosan plant, as described by Hayata, appears to be very close to it except in the smaller fruit and much less divaricate wings. This variety is not treated in Fang's revision.

7. *Acer rubescens* Hay. (1911: 66); Koidz. (1911b: 21, pl. 11); Kanehira (1936: 405, fig. 363).

A deciduous tree, 10–20 m. high; branchlets glabrous. Leaves chartaceous, roundish-ovate in outline, 6–10 cm. long, 5–8 cm. broad, truncate or subcordate and 5-nerved

at base (lateral nerves 5 or 6 per side), doubly serrate at margins, green above, glabrous beneath, shallowly 5-lobed, the middle lobe shortly ovate, acuminate or caudate-acuminate at apex, the lateral lobes smaller, acute to obtusish at apex; petioles 5–7 cm. long. Fruits yellowish brown, small, racemose; nutlets subellipsoid, about 6 mm. long and 4 mm. broad; wings with nutlets 1.8–2.3 cm. long, 6–7 mm. broad, divaricate at 90–110°; pedicels 7–10 mm. long, slender, glabrous.

Endemic to Formosa, in forests at high altitudes of 1,800–2,200 meters, central ranges.

Formosa: Mt. Taihei, Taihoku-syu, *S. Suzuki* 247 (NTU); New Paisienschan, *H. Keng*, Nov. 5, 1950 (NTU, US).

8. *Acer serrulatum* Hay. (1911: 70).

*Acer oliverianum* Pax var. *nakaharai* Hay. (1911: 68); Koidz. (1911b: 33, pl. 20); Kanehira (1936: 405, fig. 362).

*Acer oliverianum* Pax var. *nakaharai* Hay. f. *longistaminum* Hay. (1911: 69).

*Acer oliverianum* Pax var. *microcarpum* Hay. (1911: 69).

*Acer oliverianum* Pax var. *nakaharai* subvar. *formosanum* Koidz. (1911b: 33, fig. 1).

A tree up to 20 m. high; branchlets reddish, glabrous. Leaves rounded-cordate to broadly orbicular, about 7–7.5 cm. long and 9–10 cm. broad, glabrous on both surfaces, cordate at base, the nerves about 5 per side, the veinlets finely reticulate, distinct on both surfaces, palmately 5-lobed, the lobes more or less equal or the lower smaller, triangular-lanceolate to triangular-ovate, irregularly or duplicately crenate-serrate, the terminal lobe about 5–7.5 cm. long and 1.5–2 cm. broad; petioles 2–2.5 cm. long, glabrous. Flowers in terminal cymose inflorescences; peduncles 3–5 cm. long, glabrous; pedicels to 6 mm. long; sepals 5, rounded-oblong, 2 mm. long, hirsute toward the apex on both surfaces, the margins tomentose-ciliate; petals 5, yellow, rounded, 1.25 mm. long, obscurely denticulate to subentire at margins; stamens 5–7,

the filaments 1 mm. long, the anthers oblong, 1 mm. long; ovary 0.6 mm. long, hirsute; styles 2, connate, about 2 mm. long; disc thick, 5–7-lobed, the lobes rounded. Nutlets ellipsoid-oblong, about 14 mm. long; wings obovate, with nutlets 2.5 cm. long, divaricate at 90–120°.

Endemic to Formosa, common in forests at altitudes of 1,000–2,000 meters throughout the island.

Formosa: Sozan, *E. H. Wilson* 10786 (US); Taihoku, *E. H. Wilson* 10129 (US); Mt. Morrison, *H. H. Bartlett* 6297 (US); Bunzan-gun, Taihoku-syu, *T. Suzuki* 18390 (NTU); between Pianan and Sikayo, *G. Masamune* 1082 (NTU), Kiri-yama and Tiponzae, *S. Suzuki* 11019 (NTU).

This species is the largest tree of the genus on the island, widely distributed and very common in forests at altitudes of about 1,000–2,000 meters. Although some variations in the leaves are found, the plants from different localities clearly represent a single species. Kanehira's combination of *A. serrulatum* and *A. oliverianum* var. *nakaharai* is thus followed. The type of *A. serrulatum* is a sterile specimen, and for this reason, Fang (1939: 87), who has examined the type, could not ascertain the identity of the species. Earlier, however, Koidzumi, who also had access to the type, had already listed Hayata's name in the synonymy of *A. oliverianum* var. *nakaharai* Hay.

This species is here considered as distinct from *A. oliverianum* of western China. It differs from the latter in the more deeply serrate leaves, with crenate instead of sharply appressed serrations. The sepals are densely hirsute and the stamens are shorter than in *A. oliverianum*. Furthermore, *A. serrulatum* has the fruit-wings divaricate at about 120°, whereas in *A. oliverianum* the fruit-wings are spreading horizontally.

In *A. oliverianum*, Koidzumi described another subvariety, *A. oliverianum* var. *nakaharai* subvar. *trilobum* Koidz., with 3-lobed leaves. This, as noted above, is now known as *A.*

*tutcheri* Duthie var. *shimadai* Hay. Another variety with 3-lobed leaves, described from the neighboring province Fukien, should be considered as a distinct species: *A. jobnedwardianum* Metcalf (1942: 221). (*A. wilsonii* Rehder var. *serrulatum* Dunn in Linn. Soc. London, Jour., Bot. 38: 358, 1908; *A. oliverianum* Pax var. *serrulatum* (Dunn) Rehder in Sarg., Pl. Wils. 1: 90, 1911; non *A. serrulatum* Hay.). *A. oliverianum* occurs from eastern to southwestern China, while *A. jobnedwardianum* is localized in Fukien. It differs from the former in the 3-lobed leaves, which are glabrous and rounded at base, and in the smaller fruits, which are arranged in a slender corymb.

9. *Acer palmatum* Thunb. var. *pubescens* var. nov.

*Acer duplicato-serrulatum* Hay. (1911: 70).

*Acer palmatum* Thunb. subsp. *matsumurae* Koidz. var. *spontaneum* Koidz. subvar. *formosanum* Koidz. (1911b: 50).

*Acer ornatum* Carr. var. *matsumurae* Koidz. a. *spontaneum* (Koidz.) Nemoto subvar. *formosanum* (Koidz.) Nemoto (1936: 454).

*Acer matsumurae* Koidz. var. *formosanum* Sasaki (1930: 324) [nomen nudum].

A typo speciei differt ramulis novellis, foliis utrinque, petiolis, inflorescentiisque molliter pubescentibus.

A small tree, young branchlets slender, white-villose-pubescent, becoming glabrescent and glabrous. Leaves to 5 cm. long, subcordate, deeply 5-lobed, the base cordate, the lobes lance-oblong, acuminate, subduplicately serrate, villose especially on the veins on both surfaces, the lobes parted to beyond the middle; petioles glabrous, slender, 2.5 cm. long, villose-pubescent. Inflorescence in small corymbs, densely villose-pubescent at first; peduncles 1–2.5 cm. long; pedicels 5–6 mm. long; sepals slightly purplish, ovate-oblong, 2–3 mm. long, more or less glabrous; petals slightly smaller than the sepals, white;

stamens short, included, the filaments about 1 mm. long, the anthers about equal in length; ovary densely villose.

Endemic to mountain forests at altitudes of about 1,600 meters, central and northern parts.

Formosa: Taranan, Bunzan-gun, Taihokuyu, T. Suzuki 17859 (NTU, type); Mt. Taihei, S. Sasaki, Sept. 2, 1925 (NTU).

The nomenclature of cultivated and wild forms of *A. palmatum* Thunb., as adopted by several Japanese botanists, is very varied and confusing. The wild plant growing spontaneously in the mountains of Formosa differs from the Japanese plants chiefly in the pubescence being present not only on the young branches and inflorescences, but also on mature leaves and petioles. As it is geographically isolated from other plants of this species, it is here considered as a distinct variety.

*Acer duplicato-serrulatum* Hay. is listed as a synonym of *A. oliverianum* var. *nakabarai* = *A. serrulatum* by Kanehira. This is evidently incorrect, as the former has 7-lobed leaves, while the latter has 5-lobed leaves. This name is not taken up by Fang. However, Koidzumi, who had access to Hayata's type, earlier identified this with the wild form of *A. palmatum* from Formosa. The type, as noted by Koidzumi, is a sterile specimen.

*Acer matsumurae* Koidz. var. *formosanum* Sasaki was published without description or reference, hence is a nomen nudum and invalid.

#### EXCLUDED SPECIES

*Acer taiwanense* Yamamoto, Soc. Trop. Agr., Jour. [Formosa] 5: 180, fig. 6, 1933.

This name, not listed by Kanehira but by S. Suzuki (1936: 129), is, as noted by Fang (1939: 246), actually based upon a specimen collected in Cochin-China. It should be eliminated from the list of plants of Formosa.

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