

A revision of *Timonius* (Rubiaceae) in Kinabalu Park, Borneo, with notes on typification and species distinction

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Background – *Timonius* is the largest genus within the tribe Guettardeae of the family Rubiaceae. This genus is poorly studied, particularly in West Malesia.

Methods – A revision of the genus in Kinabalu Park was conducted using ordinary practices of herbarium taxonomy. The specimen holdings of the BO, BRUN, K, L, SAN, SING and SNP herbaria were examined.

Results – Thirteen species of *Timonius* are recognised in Kinabalu Park, of which seven are likely to be endemic to the Kinabalu massif including four that appear to occur exclusively on ultramafic substrates. Two lectotypes and two new synonyms are herein designated.

Key words – Borneo, endemics, Kinabalu Park, Malesia, Rubiaceae, *Timonius*, ultramafic substrates.

INTRODUCTION

Timonius DC. is the largest genus within the tribe Guettardeae of the family Rubiaceae (Davis et al. 2009). We estimate that the genus comprises about 300 species, with numerous undescribed species in Borneo. *Timonius* has a paleotropical distribution, encompassing Malesia, Sri Lanka, Seychelles, Micronesia, Taiwan, some regions of tropical Australia, and the south Pacific (Darwin 2010a). Malesia, including the Philippines (Merrill 1923), the Malay Peninsula (Wong 1988), Borneo (Puff & Wong 1993), and Papuasia (Darwin 1993, 1994, 1997, 2010a, 2010b), is its centre of diversity. Preliminary phylogenetic analyses suggest that *Timonius* is monophyletic, but a wider taxonomic sampling is required to increase confidence for this.

Malesia is a phytogeographic region that includes the Philippines, Sundaland, and Wallacea, three of the world's biodiversity hotspots (Myers et al. 2000). Malesia is subdivided according to two included continental-shelf areas (the western Sunda and eastern Sahul shelves) that define West Malesia and East Malesia, separated by a roughly central deep-water region known as Central Malesia or Wallacea (Johns 1995). On Sundaland (or West Malesia), Borneo is a key landmass, with the largest land area and highest plant diversity. The Borneo lowlands ecoregion harbours over 10,000 plant species, rendering it the richest known site in the world (Kier et al. 2005).

Kinabalu Park is the centre of plant diversity in Borneo. Northern Borneo was identified as one of the world's six

global diversity centres, with more than 5,000 species of vascular plants per 10,000 km², and its maximum diversity occurs in the region of Mount Kinabalu (Barthlott et al. 1996). Intensive botanical collecting and herbarium taxonomy have yielded a detailed inventory of the Kinabalu vascular flora (pteridophytes, gymnosperms, and angiosperms) comprising over 5,128 species (Parris et al. 1992, Wood et al. 1993, Beaman & Beaman 1998, Beaman et al. 2001, Beaman & Anderson 2004). With over 5,000 species in an area of merely 1,250 km², Kinabalu Park arguably has the richest known flora (Beaman 2005), comprising 14% of the estimated 42,000 species in Malesia (Beaman et al. 2001). Nevertheless, gaps in our knowledge of the Kinabalu flora persist because certain plant taxa such as the Rubiaceae remain poorly studied.

Our taxonomic studies of *Timonius*, hitherto little-known in Kinabalu Park, have aimed to understand if careful analysis of this poorly studied plant group would still reveal much undiscovered diversity in a locality that has been generally inventoried. Early enumerations of the Kinabalu flora (Stapf 1894, Gibbs 1914) did not capture any *Timonius* species. As herbarium material accumulated, five named and four undetermined species of *Timonius* have been listed by Beaman & Anderson (2004). Most recently, nine new *Timonius* species in Kinabalu Park have been diagnosed in this project and described (Chen et al. 2014).

In Kinabalu Park, *Timonius* species occur primarily in the lower and upper montane forests (900–2200 m). Four of the *Timonius* species recognised here appear to occur exclusively on ultramafic substrates. Ultramafic outcrops oc-

cur as patches along the Southern and Western parts of the Kinabalu massif as well as entirely form the adjacent Mount Tambuyukon within the Kinabalu Park boundary (Collenette 1964). Ultramafic rocks are derived from uplifted seafloor material and the serpentine soil derived from them possesses high concentrations of magnesium and nickel, low concentration of calcium and silica, low water retention capacity, and low concentrations of essential plant nutrients such as phosphorus, nitrogen, and potassium (van der Ent 2011). These extreme edaphic conditions promote differential selection of populations (Beaman & Beaman 1990), resulting in vegetation characterised by low stature and a high composition of endemic species (Proctor & Nagy 1992).

The present contribution is part of a larger ongoing revision of the genus in Borneo, which has allowed an updated appraisal of the genus in Kinabalu Park, where, although the recent checklisting has been instrumental in inspiring more botanical research, there is no detailed flora account of this key protected area. We hope our account provides a more organised profile for supporting conservation management in this protected area, which is also a World Heritage Site, as well as stimulates similar studies of other little-researched plant groups that would add to the floristic and ecological knowledge for this important site. A key for species distinction and notes on typification are provided.

MATERIAL AND METHODS

The study was carried out using conventional practices of herbarium taxonomy. The specimen holdings of the BO, BRUN, K, L, SAN, SING and SNP herbaria (acronyms follow Thiers continuously updated) were examined. Specimens that were identified to species in Beaman & Anderson (2004) were annotated and used as baseline material to recognise further conspecific specimens not documented by them and enable an interpretation of the sorted species against both types and past identifications. Characters examined included morphology of vegetative and reproductive parts as well as those requiring assessment with magnification, including leaf surface hairiness, for which SEM studies of potentially confusing species pairs such as *T. beamanii* and *T. borneensis* have clarified differences and have been reported in Chen et al. (2015).

The Biological Species Concept (Mayr 1942) is employed in this study, in which species are defined as “groups of interbreeding natural populations that are reproductively isolated from other such groups”. Here, species are delimited based on discontinuous gaps in morphological variation because the lack of gene flow prevents two lineages from homogenizing, thereby resulting in a morphological gap (Coyne & Orr 2004, Mallet 2008). Thus, the species delimited are a close approximation to Biological Species despite the absence of gene flow assessments.

TAXONOMIC TREATMENT

Timonius DC. (de Candolle 1830: 461)

Dioecious woody plants, comprising mainly trees but sometimes epiphytes and hemiepiphytes. Stipules paired, triangu-

lar to ovate or lanceolate, free to slightly fused at the bases. Leaves paired, decussate on both stems and branches, glabrous to variously pubescent especially on lower surface and nerves. Inflorescences axillary, paired, cymose, with few to many flowers on staminate plants, single to few flowers on pistillate plants. Flowers with corollas infundibular to salverform, lobes valvate, typically cream to yellow or orange; stamens as many as corolla lobes, anthers included; ovary several- to many-celled. Fruit drupaceous, pyrenes several to many; seed solitary within each pyrene, pendulous.

Thirteen species of *Timonius* are recognised in Kinabalu Park, of which only one (*T. palawanensis*, also in Palawan) is known outside of Borneo. Seven species are likely to be endemic to the Kinabalu massif (of which *T. clementis*, *T. leopoldii*, *T. stenolobus* and *T. tambuyukonensis* appear restricted to ultramafic sites; *T. beamanii* and *T. kinabaluensis* occur facultatively on ultramafics; and *T. pannosus* is currently known only from sedimentary substrate). Two species are known from Kinabalu Park and other localities in Sabah only: *T. bullatus* (also found on Mount Trus Madi) and *T. ophioliticus* (an ultramafic endemic occurring throughout Sabah). All four widespread Bornean species found in the Park (*T. abanii*, *T. borneensis*, *T. mutabilis*, *T. palawanensis*) are also found on ultramafic substrates. The importance of the Kinabalu Park in terms of conservation is re-emphasised, and the necessity for careful management of ultramafic sites within the Park is underscored by the results of the present study.

The key provided here includes *Timonius* species recognised for Kinabalu Park, as well as two others not occurring there (*Timonius esherianus* and *Timonius polyneurus*), the names of which have been mistakenly applied to the Kinabalu taxa.

1. *Timonius abanii* J.Chen in Chen et al. (2014: 139, Fig. 1A, C & E). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, Sosopodon Forest Reserve, Jalan Atas, 22 Jul. 1967 (♀), *Aban* SAN 60600 (holo-: SAN; iso-: L).

Timonius cf. *mutabilis* in Beaman & Anderson (2004: 348) pro parte, quoad *Aban* 60600 et specim. al.

Description – Chen et al. (2014: 140).

Habitat and distribution – Tropical lowland rainforest to lower montane forest. Widespread in Borneo.

Additional specimens studied – Chen et al. (2014: 141).

Notes – Specimens of *T. abanii* have been listed as *T. cf. mutabilis* in Beaman & Anderson (2004). This species is similar to *T. mutabilis* but differs in the pubescence of the calyx and fruit (sparsely pale-hairy in *T. abanii* vs. densely brown-hairy in *T. mutabilis*), pubescence of the lower lamina surface (dense appressed-hairy in *T. mutabilis* vs. subglabrous to sparse appressed-hairy in *T. abanii*), number of corolla lobes in pistillate flowers (6 or 7 in *T. abanii* vs. 4 in *T. mutabilis*), and shorter calyx lobes in flowers (0.5–1 mm long in *T. abanii* vs. 1–3 mm long in *T. mutabilis*) and fruits (0.5–1 mm long in *T. abanii* vs. 1.5–5 mm long in *T. mutabilis*).

2. *Timonius beamanii* K.M.Wong & J.Chen in Chen et al. (2014: 141, Figs 1G, 2A & C). – Type: Borneo, Malaysia,

Key to species of *Timonius* documented for Kinabalu Park

1. Leaves whorled (three leaves per node), lamina base narrowing gradually and rounded to auriculate at the very base.....**10. *T. palawanensis***
1. Leaves opposite (two leaves per node), lamina base cuneate.....2
2. Lamina abaxial surface glabrous to subglabrous.....3
2. Lamina abaxial surface with conspicuous hairs.....6
3. Lamina secondary veins 3–6 pairs; pistillate flower and fruit calyx lobes with length < ½ basal width (c. 0.5 mm long), calyx lobes 5 or 6.....4
3. Lamina secondary veins ≥ 7 pairs; pistillate flower and fruit calyx lobes with length > ½ basal width (≥ 1 mm long), calyx lobes 4.....5
4. Leaf secondary veins 5 or 6; corolla lobes in pistillate flowers 6; fruits 5–8 mm wide (ultramafic sites from Kinabalu Park to Gunung Tawai, Mount Silam, and the Darvel Bay islands).....**9. *T. ophioliticus***
4. Leaf secondary veins 3–5; pistillate flower unknown; fruits 11–14 mm wide (ultramafic and non-ultramafic sites in Kinabalu Park).....**6. *T. kinabaluensis***
5. Stipules broadly ovate; laminas 10.2–17.8 cm long; peduncular bracts in pistillate inflorescences broadly ovate, 4–5.5 mm long, 2–2.5 mm wide; fruits globose, 9–13 mm wide.....**5. *T. clementis***
5. Stipules narrowly triangular to lanceolate; laminas 5.8–9 cm long; peduncular bracts in pistillate inflorescences triangular, 2–2.5 mm long, 1–1.5 mm wide; fruits globose to ellipsoid, 5.5–8 mm wide.....**13. *T. tambuyukonensis***
6. Lamina abaxial surface with red-brown patent to sub-erect hairs.....7
6. Lamina abaxial surface with pale to silvery hairs, all appressed or appressed occurring with either lanate or erect hairs.....9
7. Lamina tertiary veins not prominent on abaxial surface (fruits 2 or 3 in a branched infructescence)....**7. *T. leopoldii***
7. Lamina tertiary veins distinctly raised on abaxial surface (fruits solitary in *T. esherianus*, pistillate flowers and fruits unknown for *T. pannosus*).....8
8. Petiole length 4–7 mm; lamina coriaceous, apex obtuse-cuspidate; calyx lobes of staminate flowers densely pubescent, 4–5 mm long.....***T. esherianus***
8. Petiole length 9–20 mm; lamina chartaceous, apex acute-cuspidate; calyx lobes of staminate flowers sparsely pubescent, 0.5–1 mm long.....**11. *T. pannosus***
9. Lamina abaxial surface with a distinct mixture of hair types.....10
9. Lamina abaxial surface with hairs of one uniform type.....12
10. Lanate hairs not occurring, uniform covering of short erect hairs and sparse longer appressed hairs over lamina.....***T. polyneurus***
10. Lanate hairs (manifest as flattened, curly, ribbon-like hairs that are interwoven) present over lamina.....11
11. Lanate hairs on lower lamina surface occurring with stiff, appressed hairs that are mostly as long as the lanate hairs; corolla lobes in pistillate flowers 4 or 5; fruits globose; staminate flowers 12–21 per inflorescence.....**2. *T. beamanii***
11. Lanate hairs on lower lamina surface occurring with stiff, appressed hairs that are distinctly longer (2–3×) than the lanate hairs; corolla lobes in pistillate flowers 8–10; fruits obovoid; staminate flowers 20–70 per inflorescence.....**3. *T. borneensis***
12. Lamina adaxial surface slightly to conspicuously bullate, secondary veins 8–12 pairs....**4. *T. bullatus***
12. Lamina adaxial surface plane, secondary veins 4–8 pairs.....13
13. Calyx lobes of staminate and pistillate flowers linear (5–7 mm long), fruits narrowly ellipsoid.....**12. *T. stenolobus***
13. Calyx lobes of staminate and pistillate flowers narrowly to broadly triangular (≤ 3 mm long), fruits globose.....14
14. Staminate and pistillate flower and fruit calyx lobes 2–3 mm in staminate flowers, 1–2 mm in pistillate flowers, 1.5–5 mm in fruits; corolla lobes in pistillate flowers 4; calyx and fruit surface densely to completely appressed-pubescent; pistillate flowers always 1 per inflorescence; lamina abaxial surfaces densely appressed-hairy.....**8. *T. mutabilis***
14. Staminate and pistillate flower and fruit calyx lobes 0.5–1 mm in staminate flowers, c. 0.5 mm in pistillate flowers, 0.5–1 mm in fruits; corolla lobes in pistillate flowers 6 or 7; calyx and fruit surface subglabrous to sparsely appressed-pubescent; pistillate flowers 1–3 per inflorescence; lamina abaxial surfaces subglabrous to sparsely appressed-hairy.....**1. *T. abanii***

Sabah, Kinabalu Park, Mesilau River, 1520 m, 5 Feb. 1964 (♀), *Chew & Corner* RSNB 4222 (holo-: SING; iso-: K, L, SAN).

Timonius borneensis sensu Beaman & Anderson (2004: 347) pro parte, quoad *Beaman & Perkins* 8491, *Jusimin* 560, *Chew & Corner* RSNB 4143, 4222; non Valetton (Valetton 1909: 48).

Description – Chen et al. (2014: 141).

Habitat and distribution – Lower montane forest. Probably endemic to Kinabalu Park.

Additional specimens studied – Chen et al. (2014: 143).

Notes – Beaman & Anderson's (2004) broader concept of *T. borneensis* included the then unnamed *T. beamanii*. Both species are very similar morphologically as they possess lanate hairs and a silvery sheen on the lower lamina surface, similar number of secondary veins, similar petiole length, relatively large staminate and pistillate flowers (similar corolla tube length and width), 5–6 broad-triangular calyx lobes, and similar fruit size. However, *T. beamanii* differs in having globose fruits, fewer corolla lobes in pistillate flowers (4 or 5), and fewer flowers per staminate inflorescence. They can also be distinguished on the basis of their lower lamina micromorphology: appressed hairs are mostly as long as co-occurring lanate hairs in *T. beamanii*, but appressed hairs are 2–3 times longer than lanate hairs in *T. borneensis* (Chen et al. 2015).

3. *Timonius borneensis* Valetton (Valetton 1909: 48); Merrill (1921: 568); Masamune (1942: 711); Beaman & Anderson (2004: 347) pro parte; Chen et al. (2014: Figs 1H, 2B & D). – Type: Borneo, Indonesia, West Kalimantan, Mount Kenepai, 1893–1894, sin. dat. (♀), *Hallier* 1511 (lecto-: L Sheet 1 barcode 0057778, **designated here**; isolecto-: BO, L Sheet 2 barcode 0057779).

Tree up to 27 m tall; trunk to over 1.3 m dbh; bark brown to dark grey. **Stipules** triangular to lanceolate, with two lateral ridges converging at the apex. **Leaves** opposite; petioles 1–2.5 cm long, 1.5–2.5 mm diam.; blades broadly elliptic, (9.5–)11.8–25.2 × 4.3–13.6 cm, base cuneate, apex cuspidate, margins plane, chartaceous to coriaceous, lower surface densely appressed-hairy on midrib and secondary veins, lamina with dense lanate hairs mixed with scattered appressed hairs that are distinctly longer (2–3×) than the lanate hairs, upper surfaces plane (not bullate); secondary veins 8–14 pairs, 7–26 mm apart from each other; tertiary veins not prominent on lower surface. **Inflorescences**: pistillate plants with 5–10 flowers per inflorescence, peduncles 5–6 cm long, peduncular bracts lanceolate to linear, 5–12 × 1–2 mm; staminate plants with 20–70 flowers per inflorescence, peduncles 2.5–7 cm long. **Calyx** lobes in pistillate flowers 5 or 6, broad-triangular (length about the same as basal width), 2–3 mm long, sparsely to densely pubescent outside; in staminate flowers 5, broad-triangular, 1–2 mm long, densely pubescent outside. **Corolla** in pistillate flowers with tube 5–6 mm long, c. 4 mm diam., densely pubescent outside, lobes 8–10, lanceolate, 4.5–5 mm long, densely pubescent outside; in staminate flowers with tube 3–6 mm long, 1.5–2 mm diam., densely pubescent outside, lobes 4–5, lanceolate, 4–4.5 mm long, densely pubescent outside. **Fruits**

obovoid, 10–12 mm diam., densely appressed-pubescent; peduncles up to 8.5 cm long, sparsely to densely pubescent; persistent calyx lobes broad-triangular, 2–4 mm long.

Habitat and distribution – Tropical lowland rainforest to 900 m in the highlands. Widespread in Borneo.

Additional specimens studied – **Brunei**: Belait: Andulau Forest Reserve, 8 Jun. 1998 (♀), *Ali* BRUN 18892 (BRUN) 18 May 1993 (♂), *Idris et al.* BRUN 15255 (BRUN, SAN, SING), Sep. 1961 (♂), *Meijer* SAN 26584 (SAN), 24 Jul. 1989 (♂), *Puff* 890724-1/7A (K), 24 Jul. 1989 (♀), *Puff* 890724-1/7B (K), 3 May 1988 (♀), *Wong* WKM 82 (L, SAN, SING), 3 May 1988 (♂), *Wong* WKM 83 (L, SAN, SING); Labi Forest Reserve, 29 May 1995 (♀), *Hussain et al.* BRUN 16485 (BRUN, L, SAN, SING); Labi, Tenajor, Simpang Jalan, 13 Jul. 1995 (♀), *Ariffin et al.* BRUN 16868 (BO, SAN, SING); Sukang, Biadong, Buau, 25 Oct. 2013 (♀), *Wong* WKM 3248 (BRUN, SING); Sukang, Buau, beside Sg Sagat logging track, 23 Oct. 2013 (♀), *Wong* WKM 3231 (BRUN, SING); Sungei Liang, 14 Dec. 1994 (♂), *Salleh* BRUN 16243 (BRUN, SAN, SING); Sungei Liang, Labi Road, near Sungei Lumut, 15 Sep. 1990 (♂), *Puff et al.* 900815-1/3 (K); Sungei Malayan Road, Jalan Labi, 16 Oct. 1995 (♂), *SATC students* BRUN 17147 (L, SING); Ulu Lumut peat swamp forest, Jun. 1959 (♂), *Ashton* BRUN 5515 (L Sheet 1 barcode 0649163, L Sheet 2 barcode 0649164, SING); Ulu Sungei Semburu Stateland, 16 Dec. 1995 (♀), *Ogata et al.* Og-B56 (L). Temburong: Kuala Belalong, 6 Sep. 1957 (♂), *Ashton* BRUN 451 (L, SING); Machang River, 120–250 m, 21 Sep. 1990 (♂), *Puff et al.* 900821-1/2 (L, SAN, SING). Tutong: Lamunin, Hill behind nursery of Forest Department, 23 Apr. 1996 (♂), *Ogata et al.* Og-B147 (L).

Indonesia: Central Kalimantan: Bukit Raya and Upper Katingan River area, 200 m, 18 Dec. 1982 (♂), *Mogea & de Wilde* 4167 (BO, L). Tewah, Kasintu, 11 Oct. 1999 (♀), *Riswan et al.* TWH 011 (BO, L). PBU base camp, 2 Jun. 1990 (♂), *Ridsdale* PBU 276 (BO, K, L), 3 Jun. 1990 (♀), *Ridsdale* PBU 295 (BO; L Sheet 1 barcode 0648635, L Sheet 2 barcode 0648636); Trail Jalang Banbang, 16 Jun. 1990 (♂), *Ridsdale* PBU 43 (K, L Sheet 1 barcode 0648679, L Sheet 2 barcode 0648680). PT Sari Bumi Kusuma, Katingan-Seruyan logging concession area, 23 Nov. 2011 (♂), *Deden Girmansyah* 1603 (BO), c. 242 m, 16 Nov. 2011 (♀), *Modestus Ato Atok* 4 (BO), c. 145 m, 10 Mar. 2011 (♂), *Ruliyana Susanti et al.* RS 222 (BO). Sungei Kahayan, 5 km NE of Haruwu Village, 10 Apr. 1988 (♂), *Burley et al.* 631 (L, SING). East Kalimantan: Central Kutei, Belajan River, Gunung Kelopak near Tabang, 23 Apr. 1955 (♀), *Kostermans* 10589 (K, L, SING). Longbagun, Camp Tikah, 28 Jun. 1975 (♂), *Wiriadinata* 655 (BO, L). West Kalimantan: sin. loc., sin. dat. (♂), *Teysmann* 244 (L), sin. dat. (♀), *Teysmann* 10831 (K, L). Gunung Kenepai, sin. dat. (♂), *Hallier* 1525 (BO, L Sheet 1 barcode 0649159, L Sheet 2 barcode 0649160, L Sheet 3 barcode 0649161, L Sheet 4 barcode 0649162). Kapuas ('Kapoeas'), Sungei ('Soangei') Aja, sin. dat. (detached leaves only), *Teysmann* 7994 (BO Sheet 1 No BO-1568534, BO Sheet 2 No BO-1619758); Rikai, 1893–1894 (♀), *Hallier* 1304 (BO, K, L Sheet 1 barcode 0649132, L Sheet 2 barcode 0649133, L Sheet 3 barcode 0649134, SING). Sanggau, Jangkang, Semirau, Ensibau, 25 Apr. 1994 (♀), *Sudin & Mayer* 31 (K). Serawai, 1 km northeast of Nanga Jelundung, 26 Oct. 1995 (♀), *Church et al.* 2695 (K, L); 8 km northeast of Desa Jelundung, Batu Lintang, 4 Feb. 1995 (♀), *Church et al.* 1742 (BO, K, L, SAN). Singkajang, 100 m, 19 Oct. 1952 (♀), *Soefri Hamzah* 16 (BO).

Malaysia: Sabah: Beaufort, Binunok, 18 Oct. 1979 (♂), *Talib* SAN 84768 (BO, K, L, SAN, SING); Klias, 28 Jul. 1976 (♂), *Talib* SAN 80741 (K, KEP, L, SAN, SAR, SING); Klias Forest Reserve, 23 Jul. 1973 (♀), *Devol & Karim* SAN 77812 (SAN); Saliwangan, Halogilat, 8 May 1973 (♀), *Dewal & Karim* SAN 77570 (K, L, SAN, SING); Weston Forest Reserve, 30 m, 28 Mar. 1987 (♀), *Amin* SAN 103353 (SAN). Kinabalu Park, Dallas, 900 m, 16 Nov. 1931

(♂), *Clemens & Clemens* 27082 (BO, K, L); Kampung Melangkap Tomis, 2 Aug. 1996 (♀), *Lorence* 2532 (K, SNP). Lamut, Train plate 51 Lamut, Estate, 20 Jul. 1971 (♀), *Saikeh* SAN 73208 (K, L, SAN). Papar, Ulu Bongawan, 25 Jan. 1990 (♂), *Leopold* SAN 122870 (L, SAN). Penampang, Inobay, 7 Apr. 2010 (♂), *Pereira* SAN 150834 (SAN). Ranau, Mark Pang logging road, 13 Jul. 2003 (♀), *Leopold et al.* SAN 144763 (SAN, SING); Mohd. Gan logging area, Kg. Miruru, 31 May 1979 (♂), *Aban & Petrus* SAN 90094 (K, L, SAN); Ulu Tungud Forest Reserve, Gunung Monkobo, 27 Jul. 2005 (♀), *Saw* SAN 146794 (K, L, SAN); Ulu Tungud Forest Reserve, Ulu Sungei Tungud, 476 m, 27 Jul. 2005 (♀), *Julia* SAN 146246 (K, L, SAN). Telupid, Hutan Simpan Taviu, 11 Sep. 1999 (♂), *Leopold et al.* SAN 129406 (L, SAN); Ranau Road, just before Tampias, 12 Apr. 1992 (♂), *Puff & Buchner* 920412-1/1 (K, SAN). Sarawak: sin. loc., Nov. 1891 (♀), *Haviland* 714 (K), sin. loc., sin. dat. (♂), *Native Collector* 291 (SING). Baram, Perupayang near foot of Apo Duat Range, 14 Nov. 1974 (♀), *Sie* S 35502 (K, L, SAN). Batu Lintang, Simanggang, 3 Dec. 1985 (♀), *Ilias & Munting* S 48615 (K, L, SAN), 4 Dec. 1985 (♂), S 48636 (K, L, SAN). Belaga, left bank of Rajang River, 3 Sep. 1958 (♀), *Jacobs* 5404 (K, L); Long Bangan, Kastima Lumber Coupe 1, 20 Apr. 2001 (♂), *Awang* S 86015 (K, L, SAN). Bintulu, southwest of Bukit Mina Wildlife Corridor, sin. dat. (♂), *Malcom et al.* S 99088 (K, L, SAN). Bukit Sekara, Ulu Balleh, Kapit, 16 Nov. 1979 (♀), *Othman et al.* S 41445 (K, L, SAN). Entalun, Skerang, Sri Aman, 5 Mar. 1986 (♂), *Ilias* S 51886 (K, L, SAN). Gunung Hujan, 10 km Tebakang Road, 25 Jun. 1983 (♀), *Yi & Othman* S 46246 (K, L, SAN). Kapit, Batu Laga, Sungei Khabor, 28 Aug. 1984 (♀), *Abang Mohtar* S 48033 (K, L, SAN); Linau Protected Forest, 18 Apr. 1993 (♂), *Wan Ali et al.* S 66723 (BRUN, K, SAN); Sungei Serani, 5 May 1991 (♂), *Runi et al.* S 63186 (K, L, SAN). Kuching, 23 Mar. 1893 (♂), *Anonymous* s.n. (SING), 8 Apr. 1893 (♀), *Haviland* 2976 (SING), 25 Oct. 1894 (♀), *Haviland & Hose* 3418 (L), 23 Nov. 1894 (♂), *Haviland & Hose* 3419 (BO, K, L); Bau, Dec. 1892 (♂), *Haviland* 219 (L, SING); road to Bau, 1893 (♀), *Ridley* s.n. (SING); Sampadi Forest Reserve, 26th mile, Bau/Lundu Road, 19 Jun. 1968 (♀), *Ilias* S 26198 (BO, K, L, SING). Marudi, Sungei Silat Basin, Sungei Palutan, 3 Apr. 2003 (♂), *Soh* S 91366 (SAN, SING). Miri, Lambir National Park, 1 Jul. 1983 (♂), *Lee* S 46534 (K, L, SAN). Mount Dulit, 15 Aug. 1932 (♂), *Richards* 1280 (L). Mukah, Mukah Hills, 13 Jul. 1997 (♀), *Stephen et al.* S 77356 (K, L, SAN). Pengkulu Ampat, 1889 (♂), *Haviland* BPNE 219 (SING). Serian Road, 70 mile, 13 May 1974 (♀), *Tong et al.* S 34282 (K, L, SAN). Serian-Sri Aman Road, 60th mile, 17 Jan. 1989 (♀), *Abang Mohtar et al.* S 56108 (K, L, SAN). Simanggang, Bukit Temdok, (♂), *Anderson* T19 (K, SAN, SING). Sri Aman, Klinkang Range, Abok, 17 Apr. 1990 (♂), *Rena et al.* S 58385 (K, L, SAN). Sungei Engkabang, 54th mile Kuching/Simanggang Road, 12 Feb. 1969 (♀), *Anderson* S 26892 (L, SING). Tatau, Bukit Kana Field Station, 5 Oct. 2006 (♀), *Julia et al.* S 97040 (SAN, SING); Ulu Anap, 19 Jun. 1982 (♀), *Abang Mohtar* S 44859 (K, L, SAN). Tebakang-Tebudu Road, 27 Apr. 1989 (♂), *Abang Mohtar et al.* S 56198 (BRUN, K, L, SAN). Ulu Kapit, Pelagus Protected Forest, 16 Sep. 1973 (♀), *Chai et al.* S 33184 (K, L, SAN). Upper Rejang River, 1929 (♂), *Clemens & Clemens* 21746 (L).

Notes – Valeton (1909) listed four specimens in his protologue, viz., *Hallier* 1511 from Mount Kenepai, *Nieuwenhuis* 1586 from Sungei ('Soengei') Daho, *Teysmann* 1083 from Sebalau, and *Teysmann* 7994 from Sungei ('Soengei') Aja, all of which are thus considered syntypes. In the selection of a suitable lectotype, it was ensured that there was a good correspondence between Valeton's description and the specimen, presence of reproductive features, availability of duplicates (isolectotypes) and non-ambiguity in the specimen's numbering. *Hallier* 1511 is represented by a fruiting individual and clearly satisfies the aforementioned criteria. The

numbering of the specimen collected by Teysmann from Sebalau is problematic. Firstly, Valeton (1909) missed out the last digit of Teysmann's number in his protologue (the correct number should be 10831 instead of 1083). Secondly, the collection was indexed as "Teysmann 102" at Kew, as well as imaged and curated as such at Global Plants (formerly JS-TOR Plant Science). It turns out that the "102" notation in red ink is a different (probably later) generation of numbering from number "10831" also found on the specimen label. Another syntype, *Teysmann* 7994, is represented by detached leaves only, lacking reproductive features.

Beaman & Anderson's (2004) concept of *T. borneensis* was broader and included three morphologically distinct species, viz., *T. borneensis*, *T. beamanii*, and *T. bullatus*. *Timonius borneensis* is most similar to *T. beamanii* but differs in several characters which are discussed under *T. beamanii* and are also mentioned in the key. *Timonius bullatus* is very distinct from *T. borneensis*, thus the inclusion of a single specimen of *T. bullatus* in their account was probably the result of a misidentification.

4. *Timonius bullatus* K.M.Wong & J.Chen in Chen et al. (2014: 143, fig. 2E & G). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, eastern shoulder, 6°5'N 116°36–40'E, 2440 m, 10 Jul. 1961 (♀), *Chew et al.* RSNB 184 (holo-: SING; iso-: BO, K, L, SAN).

Timonius borneensis sensu Beaman & Anderson (2004: 347) pro parte, quoad *Clemens & Clemens* 50779; non Valeton (Valeton 1909: 48).

Timonius polyneurus sensu Beaman & Anderson (2004: 348) pro parte, quoad *Chew et al.* RSNB 184; non Valeton (Valeton 1909: 59).

Description – Chen et al. (2014: 143).

Habitat and distribution – Lower to upper montane forest. Only known from Kinabalu Park and Mount Trus Madi.

Additional specimens studied – Chen et al. (2014: 143).

Notes – Specimens of this species have been misidentified as *T. borneensis* and *T. polyneurus* in Beaman & Anderson (2004). *Timonius bullatus* is similar to *T. polyneurus* (represented by the sterile type specimen only) but differs in having fewer secondary veins (8–12 in *T. bullatus* vs. 12–17 in *T. polyneurus*) and the slightly to conspicuously bullate upper lamina (vs. plane in *T. polyneurus*). Also, *T. polyneurus* has a mixture of two hair types over its lower lamina (uniform covering of short erect hairs and sparse longer appressed hairs) whereas *T. bullatus* has hairs of a uniform type over its lower lamina (pale, appressed hairs). It should be noted that the inclusion of *T. polyneurus* in Beaman & Anderson (2004) was based on misidentifications, i.e., *T. polyneurus* does not occur in Kinabalu Park.

5. *Timonius clementis* Merr. (Merrill 1917: 244); Merrill (1921: 568); Masamune (1942: 711); Beaman & Anderson (2004: 347); Chen et al. (2014: Fig. 3F). – Type: Borneo, Malaysia, Sabah, Mount Kinabalu, Marai Parai Spur, 2 Dec. 1915 (♀), *Clemens* 11078 (holo-: PNH, destroyed; iso-: A).

Timonius polyneurus sensu Beaman & Anderson (2004: 348) pro parte, quoad Wong & Kambira WKM 2387; non Valeton (Valeton 1909: 59).

Treelet to 4 m tall; trunk dbh c. 1 cm; bark unknown. **Stipules** broadly ovate, plane, not 2-ridged. **Leaves** opposite; petioles 0.5–2.1 cm long, 1.5–3 mm diam.; blades elliptic, rarely obovate, 10.2–17.8 × 4.1–10 cm, base cuneate, apex cuspidate, margins plane, chartaceous, lower surface glabrous to subglabrous, upper surface plane (not bullate); secondary veins 7–13 pairs, 4–20 mm apart from each other; tertiary veins not prominent on lower surface. **Inflorescences**: pistillate plants with a solitary flower per inflorescence, peduncles 0.2–0.8 cm long, peduncular bracts broadly ovate, 4–5.5 mm × 2–2.5 mm; staminate plants with 2 or 3 flowers per inflorescence, peduncles 0.3–0.7 cm long. **Calyx** lobes 4, broad-triangular (length about the same as basal width), 1.5–2 mm long, sparsely pubescent outside. **Corolla** in pistillate flowers with tube c. 6.5 mm long, c. 2 mm diam., densely pubescent outside, lobes 4, lanceolate, 4.5–5 mm long, densely pubescent outside; in staminate flowers with tube c. 11 mm long, c. 1.5 mm diam., sparsely pubescent outside, lobes 4, lanceolate, c. 6 mm long, densely pubescent outside. **Fruits** globose, 9–13 mm diam., glabrous; peduncles 0.7–1.5 m long, glabrous; persistent calyx lobes broad-triangular, 2.5–3.5 mm long.

Habitat and distribution – Exposed sedge-dominated vegetation and old landslides on ultramafic sites at 1500–1800 m. Probably endemic to Kinabalu Park.

Additional specimens studied – **Malaysia**: Sabah: Kinabalu Park, Marai Parai, 1500 m, 24 Mar. 1933 (♀), *Clemens & Clemens* 32334 (BO), 30 Mar. 2011 (♂), *Ent et al.* SNP 23335 (SNP); Marai Parai spur, 1600 m, 16 Sep. 1993 (♀), *Wong & Donggop* WKM 2385 (L, SAN), 1600 m, 16 Sep. 1993 (♂), *Wong & Kambira* WKM 2387 (L, SAN), 1600 m, 16 Sep. 1993 (♀), *Wong & Kambira* WKM 2410 (L, SAN, SING); Upper Kinataki River, “24 Feb., 17 Aug. 1933” (♀) *Clemens & Clemens* 31911 (BO, L).

Notes – This species is mostly collected in Marai Parai, an ultramafic site. *Timonius clementis* is very similar to *T. tambuyukonensis* as both possess glabrous lamina, petioles, stipules, and fruits, similar leaf lamina shape, many secondary veins, same number of flower(s) per pistillate and staminate inflorescence, similar corolla tube dimensions in staminate flowers, and similar calyx lobe number, shape, dimensions and pubescence. However, *T. clementis* differs in having broadly ovate stipules (vs. narrowly triangular to lanceolate in *T. tambuyukonensis*), larger leaf blades (10.2–17.8 × 4.1–10 cm in *T. clementis* vs. 5.8–9 × 3–5 cm in *T. tambuyukonensis*), plane leaf margins (vs. strongly revolute in *T. tambuyukonensis*), larger peduncular bracts in pistillate inflorescence (4–5.5 × 2–2.5 mm in *T. clementis* vs. 2–2.5 × 1–1.5 mm in *T. tambuyukonensis*), and larger fruits (9–13 mm diam. in *T. clementis* vs. 5.5–8 mm diam. in *T. tambuyukonensis*).

6. *Timonius kinabaluensis* J.Chen in Chen et al. (2014: 144, Fig. 3A). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, 4 km from Kampung Melangkap Tomis, 7 Jul. 1996 (♀), *Lorence* 2444 (holo-: K; iso-: SNP).

Timonius cf. *mutabilis* in Beaman & Anderson (2004: 348) pro parte, quoad *Amin* SAN 115990.

Timonius sp. 2 in Beaman & Anderson (2004: 349) pro parte, quoad *Lorence* 387, 2444.

Description – Chen et al. (2014: 145).

Habitat and distribution – Hill forest to low altitude montane forest. Only known from Kinabalu Park.

Additional specimens studied – Chen et al. (2014: 145).

Notes – Specimens of *T. kinabaluensis* have been listed as *T. cf. mutabilis* and *T. sp. 2* in Beaman & Anderson (2004). This species is very similar to *T. ophioliticus* but differs in having larger fruits (11–14 mm diam. in *T. kinabaluensis* vs. 5–8 mm diam. in *T. ophioliticus*) and fewer secondary veins (3–5 in *T. kinabaluensis* vs. 5–6 in *T. ophioliticus*).

7. *Timonius leopoldii* J.Chen & K.M.Wong in Chen et al. (2014: 145, Fig. 2H). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, Bukit Ampuan, 23 Nov. 1978 (♀), *Leopold* SAN 89494 (holo-: SAN; iso-: SAR, SING).

Description – Chen et al. (2014: 145).

Habitat and distribution – Lower montane forest, on ultramafic substrates. Only known from Kinabalu Park.

Notes – This poorly known species is only represented by the type specimens, which were collected from an ultramafic locality. It is most similar to *T. mutabilis* but differs by the pubescence of the lower lamina (brown, patent-hairy in *T. leopoldii* vs. pale, appressed-hairy in *T. mutabilis*), shorter calyx lobes in fruits (1–1.5 mm long in *T. leopoldii* vs. 1.5–5 mm long in *T. mutabilis*), and appearance of the fruit pericarp when dry (wrinkled *T. leopoldii* in vs. smooth in *T. mutabilis*). The type specimens have branched infructescences, each bearing 2–3 fruits, whereas *T. mutabilis* has unbranched infructescences, each with a solitary fruit.

8. *Timonius mutabilis* (Korth.) Walp. (Walpers 1852: 765); Valeton (1909: 42); Valeton (1910: 561); Merrill (1921: 569); Masamune (1942: 712); Chen et al. (2014: Fig. 1B, D & F). – *Bobea mutabilis* Korth. (Korthals 1851: 212). – *Polyphragmon mutabile* (Korth.) Miq. (Miquel 1869: 240). – *Timonius mutabilis* (Korth.) Boerl. (Boerlage 1891: 132). – Type: Borneo, Rikai, sin. dat. (♀), *Korthals* s.n. (lecto-: L, Sheet 1 barcode 0001440, **designated here**).

Timonius cf. *mutabilis* in Beaman & Anderson (2004: 348) pro parte.

Tree to 24 m tall; trunk to 60 cm; bark brown to grey. **Stipules** triangular, with two lateral ridges converging at the apex. **Leaves** opposite; petioles 1–8 mm long, 1–2 mm diam.; blades narrowly to broadly elliptic, 4.4–12(–18) × 1.7–5(–7.4) cm, base cuneate, apex cuspidate to caudate, margins plane, chartaceous, lower surface with dense appressed hairs; upper surface plane (not bullate); secondary veins 4–7 pairs, 5–21(–30) mm apart from each other; tertiary veins not prominent on lower surface. **Inflorescences**: pistillate plants with a solitary flower per inflorescence, peduncles 0.9–1.8 cm long, peduncular bracts triangular to linear, 1–4(–8) × 0.5–1.5 mm; staminate plants with 3–9 flowers per inflorescence, peduncles 1.2–4.5 cm long. **Calyx** lobes in pistillate flowers 4, narrow-triangular (length ≥ 2 times the basal width), 1–2 mm long, sparsely to densely pubescent outside; in staminate flowers 4, narrow-triangular, 2–3 mm

long, densely hairy outside. **Corolla** in pistillate flowers with tube 5–6 mm long, 1–1.5 mm diam., densely pubescent outside, lobes 4, lanceolate to ovate, 2–2.5 mm long, densely pubescent outside; in staminate flowers with tube c. 7 mm long, c. 1 mm diam., densely pubescent outside, lobe number unknown, lanceolate, length unknown, densely pubescent outside. **Fruits** globose, rarely ellipsoid, 4–10 mm diam., densely to completely appressed-pubescent; peduncles 0.9–5.3 cm long, sparsely to densely pubescent; persistent calyx lobes narrow-triangular, 1.5–5 mm long.

Habitat and distribution – Tropical lowland rainforest and montane forest to 1600 m.. Widespread in Borneo.

Additional specimens studied – **Brunei:** Temburong: Bukit Pagon (plot voucher 1268), 1959 (♀), *Ashton* s.n. (BRUN); Mount Retak area, 1300–1400 m, 1 May 1992 (♂), *Puff & Buchner* 920501-1/12 (BRUN, SAN).

Indonesia: Central Kalimantan: Arboretum Nyaru Menteng, 10 Oct. 1996 (♀), *Argent et al.* 9658 (K), 30 Oct. 1996 (♀), *Kessler et al.* PK 1560 (L, SAN), 21 Sep. 1993 (♂), *Sidiyasa & Arifin* 1099 (K, L). Sampit, 7 Oct. 1949 (♂), *Buwalda* 7871 (L), 22 Aug. 1953 (♀), *Kostermans* 8135 (L). East Kalimantan: Balikpapan, Inhutani I Batu Ampar, Bukit Bangkirai, 100 m, sin. dat. (♀), *Agus Ruskandi* ARs 103 (BO). Bukit Bangkirai, 2 Feb. 2001 (♀), *Agus Ruskandi & Rugayah* ARs & R 288 (BO Sheet 1 No BO-1843830, BO Sheet 2 No BO-1843831). Central Kutei, Belajan River, 25 Mar. 1955 (♀), *Kostermans* 10228 (K, L). Loa Janan, west of Samarinda, 15 Apr. 1952 (♀), *Kostermans* 6448 (BO Sheet 1 No BO-1901198, BO Sheet 2 No BO-1901199, K, L). Tanjong Bangko region, near mouth of Mahakam river, 19 May 1952 (♂), *Kostermans* 7023 (K, L, SING). Wanariset Plot Matthys, 21 May 1990 (♂), *Balgooy & Kessler* 5978 (K, L). South Kalimantan: Banjar Baru, Taman Hutan Raya Sultan Adam, Madiangin, Kecamatan Karang, 7 Nov. 1996 (♀), *Kessler et al.* PK 1725 (K, L). Kandangan to Padang Batu, along road, 11 Nov. 1996 (♂), *Kessler et al.* PK 1821 (L). Pagatan-Sembamban Road, 6 Nov. 1996 (♀), *Kessler et al.* PK 1666 (L). Pengaron, along road, 10 Nov. 1996 (♀), *Kessler et al.* PK 1788 (K, L). West Kalimantan: Danau Sentarum Wildlife Reserve, summit of Semujan Hill, 340 m, 9 Jun. 1994 (♀), *Zulkarnain & Giesen* 561 (L). Locality uncertain: Goentaeng Alaban, Riam Kanan, 28 Apr. 1919 (♂), *Ramli* 2044 (L). Sin. loc., sin. dat. (♀), *Korthals* s.n. (K Sheet 1 barcode K000763571), sin. dat. (♀ & ♂) *Korthals* s.n. (L Sheet 2 barcode 0001439), sin. dat. (♂), *Korthals* s.n. (L Sheet 3 No 31909–1386), sin. dat. (♀), *Korthals* s.n. (L Sheet 4 No 31909–1385, L Sheet 5 No 31909–1389).

Malaysia: Sabah: Kinabalu Park, Bukit Kinasaraban above Kundasan, 8 Jun. 1957 (♂), *Sinclair et al.* 8976 (L, SING); Bukit Sosopodon, Jalan Liring, 24 Nov. 1962 (♂), *Lajangah* SAN 33126 (L, SING); Mamut, 19 Nov. 1988 (♀), *Amin et al.* SAN 129372 (SAN); Mamut Hill, south of Mamut Camp, 1400–1650 m, 10 Feb. 1969 (♀), *Shohei Kokawa & Mitsuru Hotta* 5380 (L); Mesilau, 26 Aug. 1988 (♀), *Amin et al.* SAN 123399 (SAN), 30 Sep. 1972 (♀), *Leopold* SAN 76452 (K, L, SAN, SING); Mesilau River, 1500 m, 5 Feb. 1964 (♀), *Chew & Corner* RSNB 4220 (L, SAN, SING), 9 Feb. 1964 (♀), *Poore* H 257 (L, SING); Ranau Road, Kiau Trail, 12 Oct. 1966 (♀), *Aban* SAN 56303 (SAN, SING); route to Mount Tambuyukon, 5 Oct. 1990 (♀), *Jamili et al.* SNP 4803 (SAN, SNP); Sosopodon Forest Reserve, 15 May 1968 (♀), *Aban* SAN 62016 (SAN), 13 Jul. 1968 (♀), *Aban* SAN 64024 (SAN); Sosopodon, near Kundasang, 17 Jul. 1964 (♀), *George* SAN 46775 (L, SAN); Sosopodon, Ranau Road, 3 Nov. 1962 (♀), *Badak* SAN 32286 (SAN), 6 Nov. 1962 (♀), *Badak* SAN 32308 (L, SAN); Tenompok, 27 Jul. 1933 (♀), *Carr* SF 27878 (SING), 2 Feb. 1932 (♂), *Clemens & Clemens* 28196 (BO, K), 1500 m, 28 Apr. 1932 (♀), *Clemens & Clemens* 29294 (L); Ulu Liwagu, 15 Jul. 1963 (♂), *Mujin* SAN 38402 (L, SAN, SING); West Trail, mile 35, near headquarters, 19

Oct. 1965 (♀), *Lajangah* SAN 44612 (L, SAN). Sandakan, Sepilok Forest Reserve, 4 Oct. 1964 (♂), *Kapis Sisiron* 39790 (L, SAN), 1 May 58 (♂), *Nicholson & Patrick* SAN 17702 (BO, L, SING). Tambunan, Trus Madi Forest Reserve above Kionop River, 24 Sep. 1962 (♀), *George* SAN 32073 (L). Tuaran, Gunung Alab, 1300 m, 20 Feb. 1969 (♀), *Nooteboom* 944 (L). Sarawak: Gunung Mulu National Park, 1680 m, 6 Oct. 1976 (♀), (K, L, SAN) *Lee* S 38222; path from Melinau Paku, 30 Jun. 1961 (♀), *Anderson* 4505 (K, L, SING). Lundu, Gunung Keranji, 1350 m, 24 Apr. 1984 (♂), *Awa & Ilias* S 46372 (K, L, SAN).

Notes – Korthals (1851) merely stated “Crescit ad montes Pamatton et Sakoembang: Borneo” in his protologue, which implies two localities and thus two collections. At L, there are indeed two Korthals collections (barcode 0001440 and 0001439) with the type labels attached. The former is a pistillate specimen with “Rikai” annotated on the specimen label. The latter consists of separate staminate and pistillate plants in a single sheet, and lacks any locality information. It is impossible to determine the locality of the specimens, so here we choose the pistillate specimen (barcode 0001440) as the lectotype. In the brief description provided in Korthal’s protologue, he mentioned “floribus hermaphroditis solitariis”. However, the hermaphrodite condition was never observed in any of the specimens studied (only separate twigs in a single sheet, each bearing only staminate or pistillate flowers have been observed).

Beaman & Anderson’s (2004) concept of *T. cf. mutabilis* had a mixture including typical *T. mutabilis*, *T. abanii*, *T. kinabaluensis*, and *T. ophioliticus*. Typical *T. mutabilis* is characterised by a densely brown-pubescent calyx and fruit outer surface, narrow-triangular calyx lobes (> 1 mm long), and densely pubescent lower leaf surface, whereas the other three species have a glabrous to sparsely pubescent calyx and fruit outer surface, shallowly to broad-triangular calyx lobes (usually less than 1 mm long), and glabrous to sparsely pubescent lower leaf surface.

9. *Timonius ophioliticus* J.Chen in Chen et al. (2014: 146, Fig. 3B & C). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, 1 mile NW of Kampung Nalumad, 490 m, 30 May 1973 (♀), *Shea & Aban* SAN 77276 (holo-: SING; iso-: K, L, SAN, SAR).

Timonius cf. mutabilis in Beaman & Anderson (2004: 348) pro parte, quoad *Shea & Aban* SAN 77276.

Description – Chen et al. (2014: 146).

Habitat and distribution – Tropical lowland rainforest to hill forest, on ultramafic substrates. Only known from Sabah.

Additional specimens studied – Chen et al. (2014: 146).

Notes – Specimens of *T. ophioliticus* have been listed as *T. cf. mutabilis* in Beaman & Anderson (2004). This species is very similar to *T. kinabaluensis* but differs in several characters which are discussed under *T. kinabaluensis* and are also mentioned in the key. This species is very likely to be an obligate ultramafic endemic because its numerous specimens were consistently collected from ultramafic sites in Sabah.

10. *Timonius palawanensis* Elmer (Elmer 1912: 1360). – Type: Philippines, Palawan (‘Pelawan’), Brooks Point, Ad-

dison Peak, Feb. 1911 (♂), *Elmer* 12705 (holo-: PNH, destroyed; iso-: A, BISH, BO, F, GH, K, L, NY, U, US).

Timonius villamilii Merr. (Merrill 1917: 240), **synon. nov.**; Merrill (1921: 570); Masamune (1942: 713); Beaman & Anderson (2004: 348). – Type: British North Borneo, “Nov. 1916 and Feb. 1917” (♀), *Villamil* 252 bis (holo-: PNH, destroyed; iso-: A, K, US).

Timonius heterophyllus Merr. (Merrill 1917: 243) **synon. nov.**; Merrill (1921: 568); Masamune (1942: 712). – Type: Borneo, Malaysia, Sabah, Khota Balud to Kibaya, Trail to Mount Kinabalu, 28 Oct. 1915 (♂), *Clemens* 9811 (holo-: PNH, destroyed; iso-: A).

Tree to 22 m tall; trunk dbh to 1.4 m; bark brown to grey. **Stipules** triangular, with two lateral ridges converging at the apex. **Leaves** whorled (3 leaves per node); petioles 2–5(–10) mm long, 2–3 mm diam.; blades obovate, rarely elliptic; 13.9–25(–35.1) × 5.9–10.9(–14.2) cm; base narrowing gradually, rounded to auriculate, apex short-caudate, margins plane, chartaceous, lower surface sparsely to densely appressed-hairy on midrib and secondary veins, lamina with scattered appressed hairs sometimes mixed with patent hairs; upper surface plane (not bullate); secondary veins 7–9(–13) pairs, 11–39 mm apart from each other; tertiary veins not prominent on lower surface. **Inflorescences**: pistillate plants with a solitary flower per inflorescence, peduncles 3–4 mm long, peduncular bracts lanceolate, 3–4 × 1–2 mm; staminate plants with 3–14 flowers per inflorescence, peduncles 1.5–3.5 cm long. **Calyx** lobes in pistillate flowers 5, shallow-triangular (length < ½ basal width), c. 0.5 mm long, densely pubescent outside; in staminate flowers 5, shallow-triangular, rarely broad-triangular (length about the same as basal width), 0.5–2 mm long, sparsely to densely pubescent outside. **Corolla** in pistillate flowers with tube c. 8 mm long, 2–4 mm diam., densely pubescent outside, lobes 6, lanceolate, 4–5 mm long, densely pubescent outside; in staminate flowers with tube 6–9 mm long, 2–3 mm diam., densely pubescent outside, lobes 5, lanceolate, 4–5 mm long, densely pubescent outside. **Fruits** globose to ellipsoid, 12–20 mm diam., sparse appressed-pubescent; peduncles 0.5–1.4 cm long, densely pubescent; persistent calyx lobes shallow-triangular, c. 0.5 mm long.

Habitat and distribution – Tropical lowland rainforest to 1400 m in the highlands. Widespread in Borneo and Palawan Island (Philippines).

Additional specimens studied – **Brunei**: Brunei-Muara: Bukit Subok Forest Reserve, 9 Oct. 1995 (♀), *Ariffin et al.* BRUN 17083 (BRUN, SAN, SING); Jalan Sungei Akar, Kampung Belimbing, JKR Nursery, 17 May 1994 (♂), *Joffre et al.* BRUN 15455 (BRUN, L, SAN, SING); Tekuyong, Jalan Muara, Sungei Lumut, 21 Oct. 1958 (♂), *Hassan* BRUN 5130 (SING).

Indonesia: East Kalimantan: Berau, Mount Njapa on Kelai River, 15 Oct. 1963 (♂), *Kostermans* 21311 (BO, SING). East Kutei, 24 Jun. 1951 (♂), *Kostermans* 5440 (BO). Sangkulirang island, 24 May 1951 (♂), *Kostermans* 4884 (BO, K, SING).

Malaysia: Sabah: Beaufort, Kawang, 23 May 1962 (♀), *George* SAN 30274 (BO, SAN, SING); Klias Forest Reserve, 26 Jul. 1980 (♂), *Talib* SAN 86107 (SAN); Lumat Estate, 19 Jul. 1971 (♂), *Saikeh* SAN 73376 (K, L, SAN, SING); Membakut, Binsulok Forest Reserve, 25 Apr. 1986 (♂), *Amin* SAN 102563 (SAN); Membakut, Kuala Membakut, 25 Feb. 1989 (♂), *Amin* SAN 126782

(SAN). Beluran, Bidu Bidu Forest Reserve, 350 m, 27 Jun. 1996 (♀), *Dewol et al.* SAN 135194 (SAN), 27 Feb. 1991 (♂), *Leopold* SAN 133477 (SAN); Entilibon, 26 Mar. 2009 (♂), *Suzana* SAN 150017 (K, SAN); Kalagan, Sungei Wanyang, swamp forest, 20 May 1965 (♂), *Meijer* SAN 51637 (SAN); Pamol, 13 May 1961 (♀), *Meijer* SAN 25140 (SAN); Sungei Meliau, 26 Jul. 1983 (♀), *Sigin & Rahim* SAN 99670 (SAN). Kinabalu Park, Kampung Melangkap Tomis, 8 Jul. 1996 (♀), *Lorence* 2453 (SNP); Kampung Nalumad, 14 Jun. 1996 (♀), *Daim* 442 (SAN); Poring road, 11 Nov. 1965 (♀), *Lajangah* SAN 44674 (SAN). Kinabatangan, Lamag, Sapa Tali, 1 Jul. 1963 (♀), *Ampuria* SAN 36416 (SAN, SING). Kota Kinabalu, Penampang, Kampung Sugut, 7 Mar. 1993 (♂), *Amin* SAN 115251 (SAN); Pulau Gaya Forest Reserve, 3 Mar. 1964 (♂), *Ampuria* SAN 41400 (SAN, SING); Pulau Manukan, 7 Aug. 1992 (♂), *Meijer* SAN 136565 (SAN). Kuala Penyu, 20 Oct. 1991 (♂), *Amin* SAN 104098 (L, SAN); between Batu Lanting and Mempakul, 22 May 1985 (♂), *Amin & Haya* SAN 86440 (L, SAN); Kepadayan, 19 Feb. 1985 (♂), *Amin & Haya* SAN 86342 (SAN). Kudat, Bak Bak, 29 Jun. 1933 (♂), *Balajadia* 3338 (K); Balambangan Island, limestone near Tanjung Timohing, 27 Apr. 1993 (♀), *Wong & Payne* s.n. (SAN); Banggi Forest Reserve, 22 May 1996 (♀), *Sugau* JBS 199 (K, L, SAN); Banggi Island, Mamang, 25 Aug. 1964 (♀), *Ampuria* SAN 41685 (K, SAN); Kota Merudu, Kampung Marak Parak, 16 Aug. 1983 (♀), (SAN) *Aban* SAN 99956, 16 Aug. 1983 (♂), *Aban* SAN 99957 (SAN); Loro Forest Reserve, 120 m, 15 May 1965 (♀), *Henry* SAN 51063 (SAN); proposed forest reserve Loro Kechil, 23 May 1963 (♀), *Lajangah* SAN 36144 (SAN, SING). Labuk-Sugut, Ulu Tungud, 24 Jan. 1987 (♀), *Mansus et al.* SAN 117019 (SAN). Lahad Datu, between Gunung Silam and Taliwas Camp, 15 Apr. 1992 (♀), *Puff & Buchner* 920415–2/3 (L, SAN); Gunung Silam R.P. 310/6B, 250 m, 8–12 Aug. 1983 (♀), *Proctor* SAN 100616 (SAN); Mostyn Silam Road, 16 May 1970 (♀), *Ahmad* SAN 68333 (SAN, SING); Mount Silam, 15 Sep. 1965 (♀), *Ahmad* SAN 52764 (K, SAN), 13 Mar. 1972 (♂), *Shea* SAN 75225 (SAN, SING); North Borneo Timber Company concession area, 21 May 1954 (♂), *Wood* A 4810 (K); North Pulau Sakar, 4 Apr. 1955 (♂), *Wood* SAN 16170 (SING); Pulau Sakar, 10 Oct. 1961 (♀), *Muin* SAN 26657 (L, SAN, SING); Pulau Sakar, Look Magulang, 29 Jun. 1961 (♂), *Muin* SAN 15519 (SAN); Silam Block 10, 28 May 1963 (♀), *Agama* SAN 36014 (SAN, SING). Papar, Mendahan / Bengawan, 15 Apr. 1986 (♂), *Amin* SAN 103109 (SAN). Sandakan, Arboretum mile 14, 22 Jun. 1971 (♂), *Aban* SAN 72842 (SAN); Bukit Tawai Forest Reserve, Sungei Maliau trail, 7 Apr. 1994 (♂), *Campbell* 378 (L); Dagat Camp, 9 Apr. 1963 (♂), *James* SAN 35491 (SAN); Jalan Ujong Tanjong, 6 May 1960 (♂), *Jaswir* SAN 21356 (BO, SAN, SING); Leila Forest Reserve, 25 Apr. 1967 (♂), *Leopold* SAN 56077 (SAN), 2 Apr. 1963 (♂), *Sayu* SAN 35659 (SAN); Pulau Gaya, Aug. 1895 (♀), *Creagh* s.n. (K), Aug. 1895 (♂), *Creagh* s.n. (K); Sepilok Forest Reserve, 27 Apr. 1960 (♂), *Meijer* SAN 21322 (BO, L, SAN, SING), 29 Aug. 1956 (♂), *Nicholson* SAN 17592 (SING); Sungei Paitan, 17 Jun. 1961 (♀), *Ajik* SAN 23963 (SAN, SING); Sungei Sepilok Kechil, 6 Jun. 1963 (♀), *Patrick & Sam* SAN 37525 (SAN, SING). Tawau, Elphinstone Province, Oct. 1922–Mar. 1923 (♂), *Elmer* 21062 (SING); Kalabakan Forest Reserve, Umas Umas, 15 Sep. 1968 (♂), *Ogata* 10911 (L); Sungei Gading, 26 Apr. 1963 (♂), *Aban* SAN 35903 (SAN); Umas Umas, Sungei Dumpas, 15 Sep. 1968 (♂), *Bongsu* SAN 63898 (K, L, SAN). Telupid, Keramuok, Bukit Tawai, 14 Mar. 1985 (♂), *Langkap* SAN 108338 (SAN); Sungei Meliau, 7 Apr. 1994 (♂), *Zainudin* 4905 (L, SAN); Sungei Ruku Ruku, 25 Aug. 1992 (♂), *Leopold* SAN 133975 (SAN). Tenom, across Sungei Padas, Pangie Forest Reserve, 19 May 1973 (♂), *Dewol & Karim* SAN 77625 (SAN, SING); Crocker Range, 550 m, 2 May 1964 (♀), *Rundi* SAN 43023 (K, SAN); Ulu Tomami, 30 Apr. 1968 (♂), *Pitty* SAN 55728 (SAN). Tongod, road to Kampung Tamoi, 300 m, 11 Jun. 1983 (♀), *Dewol* SAN 96690 (K, L, SAN). Tuaran, Lumas Forest Reserve, 28 Mar. 1963 (♂), *Mujin* SAN 33821 (K, SAN). Sarawak: Kalawar, 10

Apr. 1950 (♂), *Kiah* SF 38975 (SING), 10 Apr. 1950 (♀), *Kiah* SF 38979 (SING); Lawas, Gunung Sari, 10 Jun. 1924 (♀ & ♂), *Omar* CF103 (SING).

Notes – This species is listed as *T. villamilii* in Beaman & Anderson (2004). However, we discovered that the type of *T. palawanensis* is conspecific with the type of *T. villamilii*, and Elmer's name (*T. palawanensis*) is the earliest validly published name for this species. *Timonius heterophyllus* is another new heterotypic synonym, and was interestingly published by Merrill in the same article as *T. villamilii*, albeit on a different page. However, Merrill has provided some useful perspectives in his protologues. He mentioned that *T. heterophyllus* is well characterised by its ternate leaves as he knew of “no other species of the genus that has ternate leaves”, with the exception of one Philippine species. Also, he mentioned that *T. villamilii* “seems to be closely allied to *Timonius palawanensis* Elm., which was described from staminate specimens”. Given that *T. villamilii* was described from pistillate specimens whereas *T. palawanensis* and *T. heterophyllus* was described from staminate specimens, and that all share a rare trait in the genus (ternate leaf arrangement) and many other vegetative and reproductive traits, it is evident that the three names refer to the same species.

This species is immediately distinguishable from other Kinabalu species as it is the only species with three leaves per node. Additionally, its lamina base narrows gradually and is rounded to auriculate at the very base. Its fruits are also the largest among the Kinabalu species. In the herbarium, this species has been frequently confused with *Porterandia*, probably owing to its large obovate leaves. It may be easily distinguished from *Porterandia* by leaf arrangement (whorled in *T. palawanensis* vs. opposite in *Porterandia*), inflorescence type (axillary in *T. palawanensis* vs. terminal in *Porterandia*) and tertiary venation (weak reticulations in *T. palawanensis* vs. much branched network in *Porterandia*).

11. *Timonius pannosus* J.Chen in Chen et al. (2014: 146, Fig. 4A). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, 2 km from Kampung Melangkap Tomis, Sungei Sinopukan, 8 Jul. 1995 (♂), *Lorence* 722 (holo-: K; iso-: SAN, SNP).

Timonius sp. 3 in Beaman & Anderson (2004: 349).

Description – Chen et al. (2014: 147).

Habitat and distribution – Hill forest. Only known from Kinabalu Park.

Notes – This poorly known species is only represented by the type specimen and was previously identified only as *T. sp. 3* in Beaman & Anderson (2004). This species is very similar to *Timonius esherianus* W.W.Sm. (Smith 1915: 327) but differs by the longer petioles (9–20 mm long in *T. pannosus* vs. 4–7 mm long in *T. esherianus*), thinner leaves (chartaceous in *T. pannosus* vs. coriaceous in *T. esherianus*), and acute-cuspidate leaf apex (vs. obtuse-cuspidate in *T. esherianus*). It should be noted that the inclusion of *T. esherianus* in Beaman & Anderson (2004) was based on a misidentification, i.e., *T. esherianus* does not occur in Kinabalu Park.

12. *Timonius stenolobus* J.Chen & K.M.Wong in Chen et al. (2014: 147, Fig. 3H). – Type: Borneo, Malaysia, Sabah,

Kinabalu Park, Penibukan, forest trail above camp, 1220–1520 m, 10 Jan. 1933 (♀), *Clemens & Clemens* 30947 (holo-: K; iso-: L).

Timonius polyneurus sensu Beaman & Anderson (2004: 348) pro parte, quoad *Clemens & Clemens* 40867; non Valetton (Valetton 1909: 59).

Timonius sp. 2 in Beaman & Anderson (2004: 349) pro parte, quoad *Clemens & Clemens* 30947, 31091, 50299.

Description – Chen et al. (2014: 147).

Habitat and distribution – Lower montane forest, on ultramafic substrates. Only known from Kinabalu Park.

Additional specimens studied – Chen et al. (2014: 148).

Notes – Specimens of *T. stenolobus* have been listed as *T. polyneurus* and *T. sp. 2* in Beaman & Anderson (2004). *Timonius stenolobus* can be distinguished from *T. polyneurus* (represented by the sterile type specimen only) by its lower lamina pubescence (single hair type in *T. stenolobus* vs. mixture of hair types in *T. polyneurus*) and number of secondary veins (4–8 in *T. stenolobus* vs. 12–17 in *T. polyneurus*). *Timonius stenolobus* is similar to *T. mutabilis* but differs by the calyx pubescence (sparsely pale-hairy in *T. stenolobus* vs. densely brown-hairy in *T. mutabilis*), mature fruit shape (narrowly ellipsoid in *T. stenolobus* vs. globose in *T. mutabilis*), and longer calyx lobes in flowers (5–7 mm in *T. stenolobus* vs. 1–3 mm long in *T. mutabilis*) and fruits (5–7 mm in *T. stenolobus* vs. 1.5–5 mm long in *T. mutabilis*).

13. *Timonius tambuyukonensis* J.Chen in Chen et al. (2014: 148, Fig. 3D, E & G). – Type: Borneo, Malaysia, Sabah, Kinabalu Park, Mount Tambuyukon, between Camp III to summit, 5 Oct. 1990 (♀), *Jamili et al.* SNP 4799 (holo-: SAN; iso-: SNP).

Description – Chen et al. (2014: 148).

Habitat and distribution – Lower montane forest, on ultramafic substrates. Only known from Kinabalu Park and possibly restricted to Mount Tambuyukon.

Additional specimens studied – Chen et al. (2014: 149).

Notes – The occurrence of this species is restricted to ultramafic geology. It is most similar to *T. clementis* but differs in several characters which are discussed under *T. clementis* and are also mentioned in the key. *Timonius ophioliticus* and *T. kinabaluensis* are also characterised by solitary flower per pistillate inflorescence, and glabrous to subglabrous lamina, petioles, stipules, and fruit. However, both *T. tambuyukonensis* and *T. clementis* differs in having 4 calyx lobes, more secondary veins (≥ 7 pairs), and longer pistillate flower and fruit calyx lobes (≥ 1 mm long).

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