Tasmannia piperita (Hook.f.) Miers
Winteraceae

Melanie S. Subilla and Zenaida G. Baoanan

Synonyms

Drimys angiensis Kaneh. & Hatus.; *Drimys buxifolia* Ridl.; *Drimys piperita* Hook.f.; *Drimys reducta* Diels; *Drimys versteegii* Diels; *Tasmannia buxifolia* (Ridl.) A.C. Sm. (POWO 2019)

Local Names

Philippines: *Ali* (Bukidnon); *amututin, inototan, pamototen* (Igorot); *bawang* (Manobo); *lupol* (Bontok); *sapal* (Kankanay); *malagus* (Bagobo) *humang an hawili inalahan* (Ifugao) (Madulid 2001), hapal (Tinoc, Ifugao) (Balangcod and Balangcod 2011).
Indonesia: *Akway* (Papuan Malay) (Cepeda et al. 2011).
English: Common mint (De Jesus 2018).

Botany and Ecology

Description: *Tasmannia piperita* (Hook.f.) Miers is a shrub (LaFrankie 2010) reaching 1 m high (Fig. 1) or tree up to 12 m tall, but usually a small tree up to 4 m tall (De Jesus 2018); **trunk** is slender to very slender branches (Vink 1970),

M. S. Subilla
Department of Forestry and Agroforestry, Mountain Province State Polytechnic College, Bontoc, Mountain Province, Philippines

Z. G. Baoanan (✉)
Department of Biology, College of Science, University of the Philippines Baguio, Baguio, Philippines
e-mail: zgbaoanan@up.edu.ph

F. M. Franco (ed.), *Ethnobotany of the Mountain Regions of Southeast Asia*, Ethnobotany of Mountain Regions, https://doi.org/10.1007/978-3-030-38389-3_201

Fig. 1 *Tasmannia piperita* shrub with its slender trunk. (© M.S. Subilla)

but tall, large individuals can reach up to 25 cm diameter, aromatic when cut (De Jesus 2018). The average diameter at breast height (DBH) of *T. piperita* is much smaller (0.6 cm) in reforested areas compared to old growth forests with 4.0 cm as observed in Mt. Apo, Philippines (Anticamara et al. 2012). **Leaves** simple, alternately or spirally arranged. Lamina, 2–15 cm long by 1–4.5 cm wide, lanceolate to elliptic, base cuneate, apex acute to acuminate, young leaves usually reddish, including young stems and petioles (De Jesus 2018), spicy foliage that is glabrous, shiny and dark green above and whitish below (LaFrankie 2010); **flowers** in short fascicles, 1–3 flower, sometimes 5, usually unisexual (De Jesus 2018) to well-stalked solitary flowers (Fig. 2), axillary to a spiral cluster of leaves (LaFrankie 2010); **sepals** of the central flower are always parallel to the bract, both in single-flowered and in three-flowered florescence, although bracteoles are absent, the lateral flowers could be expected to have a similar influence on the orientation of the sepals of the terminal (central) flower; the **flower primordium** is dorsiventrally flattened and slanting adaxially (Vink 1970); **calyx** hood-like, rupturing as the flower opens, petals 5–12, white, spreading; **stamens** in male flowers up to 60 or more in several series; **carpels** in female flowers 3–12, short stalked; **fruit** of 3–12 follicles, each globular to blunt-ellipsoid, pale green, ripening red then purplish-black; **seeds** many per follicle, curved, dark brown to black (De Jesus 2018). Due to the wide distribution of this plant ranging from montane to subalpine rainforests, subpopulations have been formed, corresponding to several subspecies, differing on their ecology and wood anatomy (Carlquist 1989). **Phenology:** Observed to be flowering from October to November in Mt. Pulag, Benguet (Aguilar et al. 2000) and from late April to early June in Hungduan, Ifugao with seeds ripening from October to November (Taguiling and Villena 2017). In the Philippines, it is propagated by seeds only (De Jesus 2018). In the review paper from Feild et al. (2000), *T. piperit*a in New Guniea are reported to reproduce primarily by stem sprouts while other subspecies reproduce by subterranean stolons.

Fig. 2 Leaf arrangement and inflorescence of *T. piperita* with solitary flowers. (© M.S. Subilla)

Distribution and Habitat: Distributed throughout Lesser Sunda Islands (Flores), Borneo (Sarawak, Sabah, Brunei, Kalimantan), Philippines, Sulawesi (Pelser et al. 2011; POWO 2019); East Coast of Australia to Tasmania (LaFrankie 2010); Australia (Queensland, New South Wales, Australian Capital Territory, Victoria), Flores, Moluccas, New Guinea. LUZON: Abra, Mountain Province (Mt. Data), Ifugao (Mt. Polis, Kiangan, and Banawe), Benguet (Mt. Pulog and Pauai), Bataan (upper Lamao River and Mt. Mariveles), Rizal (Balacbac, Angilog), Laguna, Camarines Sur (Mt. Isarog), MINDORO: Mindoro Oriental (Mt. Halcon), PALAWAN: (Mt. Mantalingahan), PANAY: Antique (Mt. Madia-as), NEGROS: Negros Occidental (Mt. Malbug), Negros Oriental (Cuernos Mtns), BILIRAN (Mt. Suiro), MINDANAO: Misamis Occidental (Mt. Malindang), Bukidnon (Mt. Kitanglad, Mt. Candoon and Malaybalay), Agusan del Norte (Mt. Hilong-hilong), Davao del Sur (Mt. Batangan; Mt. McKinley; Mt. Apo) (Pelser et al. 2011). Mostly in montane forests, 840–2700 m, on limestone and ultramafic soils (Pelser et al. 2011; De Jesus 2018). The species forms the dominant understory vegetation of the upper montane forest in Sulawesi, Indonesia (Brambach et al. 2017) but is also common in the mossy forest up to 2600 m elevation such as in Mt. Pulag National Park in Benguet (Aguilar et al. 2000). It thrives further in the different elevational gradients up to the summit scrub of Mt. Kinabalu National Park in Malaysia to as high as 3850 m altitude (Smith 1980; Hikosaka et al. 2002) to edges in subalpine rainforests and penetrates into frost-prone grasslands of high altitudes (>3000 m) in New Guinea (Vink 1970).

Conservation Status: Not assessed in the Philippines (De Jesus 2018) but considered as Critically Endangered species of Mt. Jaya, New Guinea (Utteridge and Edwards 2009).

Local Medicinal Uses

Indonesia: The bark is used by some tribes in New Guinea (De Jesus 2018) and the Sougb community of Sururey village in Manokwari (Cepeda et al. 2011) for the same purpose. In addition, the Sougb people also use the essential oil from the bark to enhance the vitality of their body (Cepeda et al. 2011). **Philippines:** In Cordillera Region, the dried fruit and decoction of leaves are used to counter diarrhea and stomach disorders; leaves are also used to remedy cough and colds (De Jesus 2018). The Kalanguyas of Tinoc, Ifugao, consume the plant to relieve muscle pain and muscle cramps during menstruation (Balangcod and Balangcod 2011). The leaves are also used in India for treating malaria (Bahekar and Kale 2013).

Phytochemistry

In a phytochemical survey involving 59 herbarium specimens of the Winteraceae and related families, *T. piperita* (Hook.f.) Miers was found to contain distinctive leaf flavonoid profile including quercetin, luteolin, apigenin, Luteolin 7,3-′-dimethyl ether, Flavone C-glycoside, dihydroquercetin, and procyanidin (William and Harvey 1982). Flavonoids are generally known to be powerful antioxidant agents. Using the charcoal tracing method, the antispasmodic constituents of the leaves of this plant were identified as 15-Nonacosanol and bis(tridecyl) phthalate (Pladio and Villaseñor 2004). The essential oil extract from the bark consisted of 41 compounds of which 80.49% are terpene and its derivatives, and 4.88% are aliphatic compounds (Cepeda et al. 2011). The bark extracts are also found to have potential antibacterial properties (Cepeda et al. 2015, 2019; Zakariyah et al. 2018). Further characterization of bark essential oil reveals the presence of lynalool, β-pinene, α-pinene, nerolidol, and terpineol (Cepeda et al. 2018), with physical properties being light yellowish in color, solubility in 80% alcohol in 1:2 ratio, and a refractive index of 1.4942 (Zakariyah et al. 2018). The free radical scavenging properties of the plant extract is attributed to the presence of biological transition metals namely Mg, Cu, and Fe that bond with the complex organic components (Hutasoit et al. 2019).

Local Food Uses

In Mountain Province, Philippines, fresh or dried young leaves are boiled in water and drunk as herbal tea, while the dried fruits are chewed or ground (Pladio and Villaseñor 2004). However, due to their bitter and pungent taste, these are only

consumed for medicinal purposes and simply swallowed whole. In Hungduan, Ifugao, the bitterness of the leaves is neutralized with the addition of leaves of *Sarcandra glabra*, another herbal tea popular in the locality for its medicinal value (Taguiling and Villena 2017). The combination of these two herbal tea was formulated to make the taste more acceptable while also maximizing health benefits derived from them.

Biocultural Importance

T. piperita has been considered as an icon for forest restoration in the geothermal areas of the highest mountain in the Philippines, the majestic Mount Apo, through joint efforts of Energy Development Corporation, UP Diliman-Institute of Biology, and the indigenous Manobo and Bagobo communities in Mindanao Island (De Jesus 2018).

Economic Importance

An organic or natural fungicide from leaves of *T. piperita* is being developed by the Central Mindanao University in the Philippines to prevent leaf spot disease of lettuce caused by *Alternaria brassicae,* and the late blight disease of tomato caused by *Phytophthora infestans* (Zaragoza 2019). The antibacterial properties of the bark, suggests that it could be used as preservative for meat products both at room temperature as well as cold storage (Cepeda et al. 2020).

References

Aguilar NO, Cardenas LB, Cajano MAO. Spore- and seed-bearing plants of Mount Pulag, Benguet, Philippines. Philippines: museum of natural history. Laguna: University of the Philippines Los Baños, College; 2000.

Anticamara JA, Pasion BO, Gonzales RS, Duya MRM, Ong PS. Understanding high altitude reforestation in Mt. Apo, Philippines. Eurasian J For Res. 2012;15(1):31–43. https://eprints.lib.hokudai.ac.jp/dspace/handle/2115/49967. Accessed 20 July 2020.

Bahekar S, Kale R. Herbal plants used for the treatment of malaria – a literature review. J Pharmacogn Phytochem. 2013;1(6):141–6. http://www.phytojournal.com/. Accessed 30 July 2020.

Balangcod TD, Balangcod AD. Ethnomedical knowledge of plants and healthcare practices among the Kalanguya tribe in Tinoc, Ifugao, Luzon, Philippines. Indian J Tradit Knowl. 2011;10(2):227–38.

Brambach F, Leuschner C, Tjoa A, Culmsee H. Diversity, endemism, and composition of tropical mountain forest communities in Sulawesi, Indonesia, in relation to elevation and soil properties. Perspect Plant Ecol Evol Syst. 2017;27:68–79. https://doi.org/10.1016/j.ppees.2017.06.003.

Carlquist S. Wood anatomy of *Tasmannia*; summary of wood anatomy of Winteraceae. Aliso. 1989;12(2):257–75.

Cepeda GN, Santoso BB, Lisangan MM, Silamba I. Chemical composition of essential oil from akway (*Drimys piperita* Hook.f.) barks. Bionatura. 2011;13(2):118–24. http://jurnal.unpad.ac.id/bionatura/article/view/7647. Accessed 08 Sept 2020.

Cepeda GN, Lisangan MM, Silamba I. Antibacterial activities of akway (*Drimys piperita* Hook.f.) bark extracts on pathogenic bacteria. Agri. 2015;35(2):170–7. https://journal.ugm.ac.id/agritech/article/viewFile/9403/6977. Accessed 08 Sept 2020.

Cepeda GN, Lisangan MM, Roreng MK, Permatasari EI, Manalu DC, Tainlain W. Free radical scavenging activity and reducing power of akway (*Drimys piperita* Hook.f.) bark extracts. Jurnal Aplikasi Teknologi Pangan. 2018;7(4):168–73. https://doi.org/10.17728/jatp.3239.

Cepeda GN, Lisangan MM, Silamba I. Antibacterial activity of essential oil of akway (*Drimys piperita* Hook.f.) barks on some levels of concentration, acidity (pH) and salt contents. Jurnal Aplikasi Teknologi Pangan. 2019;8(4):149–54. https://doi.org/10.17728/jatp.4692.

Cepeda GN, Lisangan MM, Silamba I, Nilawati N, Syartika E. Antibacterial activity of ethyl acetate extracts of akway (*Drimys piperita* Hook.f.) barks on meatballs during storage. Jurnal Aplikasi Teknologi Pangan. 2020;9(2):50–6. https://doi.org/10.17728/jatp.6097.

De Jesus AC. *Tasmannia piperita*: our icon for forest restoration. In: Fernando ES, Marciano MR, Galang AP, Angara GM, Berroya LG, Sarmiento IP, editors. Philippine native trees 303: up close and personal. Quezon City: Green Convergence; 2018. p. 426–7.

Feild TS, Zwieniecki MA, Holbrook NM. Winteraceae evolution: an ecophysiological perspective. In: V. Hollowell, editor. Annals of the Missouri botanical garden. 2000; 87(1);323–334. https://www.biodiversitylibrary.org/page/26843288#page/344/mode/1up. Accessed 20 July 2020.

Hikosaka K, Nagamatsu D, Ishii HS, Hirose T. Photosynthesis–nitrogen relationships in species at different altitudes on mount Kinabalu, Malaysia. Ecol Res. 2002;17:305–13.

Hutasoit H, Santjojo DJDH, Sumitro SB, Widjanarko SB. Investigation of paramagnetic character in the complex of akway bark (*Drimys piperita* Hook.f.) as a radical scavenger. Proceedings of the 2nd International Conference on Biosciences and Medical Engineering (ICBME2019) AIP Conf. Proc. 2155, 020052–1–020052-. 2019. https://doi.org/10.1063/1.5125556.

LaFrankie JV Jr. Trees of tropical Asia: an illustrated guide to diversity. Bacnotan, La Union, Philippines: Black Tree Publications, Inc; 2010.

Madulid D. A dictionary of Philippine plant names, vol. 2. Makati/Manila: Bookmark Inc.; 2001.

Pelser PB, Barcelona JF, Nickrent DL, editors. Winteraceae. In: Co's Digital Flora of the Philippines. 2011 onwards. https://www.philippineplants.org/Families/Winteraceae.html. Accessed 17 May 2020.

Pladio LP, Villaseñor I. Anti-spasmodic constituents from *Drimys piperita* Hook.f. leaves. Philipp J Sci. 2004;133(1):17–21. http://philjournalsci.dost.gov.ph/19-past-issue-vol-133-no-1-2004/277-anti-spasmodic-constituents-from-drimys-piperita-hook-f-leaves?fbclid=IwAR0JpE-7thrBFG9XSIjtqN3Lq-auSFT7dtx8oCsGmHU8x8xQsoQoxEWQuhs. Accessed 30 July 2020.

POWO. Plants of the World Online. 2019. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://www.plantsoftheworldonline.org/?q=Tasmannia%20piperita. Accessed 20 July 2020.

Smith JMB. The vegetation of the summit zone of mount Kinabalu. New Phytol. 1980;84(3):547–73. https://www.jstor.org/stable/2432129. Accessed 30 May 2020.

Taguiling MLG, Villena C. Phytochemical, antimicrobial and sensory qualities of herbal tea made from Sarcandra glabra and Drymis piperita. In: 7th international conference on chemical, agricultural, biological and environmental sciences (CABES-2017); 2017. p. 57–66. https://doi.org/10.15242/DiRPUB.C1217132.

Utteridge TMA, Edwards PJ. The subalpine and alpine flora of mount Jaya (New Guinea): status and threats. Blumea. 2009;54:280–3. https://doi.org/10.3767/000651909X476292.

Vink W. The Winteraceae of the old world. Blumea. 1970;18:225–354. https://www.repository.naturalis.nl/document/565886%20. Accessed 17 May 2020.

William CA, Harvey WJ. Leaf flavonoid patterns in the Winteraceae. Phytochemistry. 1982;21(2):329–37.

Zakariyah M, Cepeda GN, Hutasoit H. The physical properties, phytochemicals content and antibacterial activity of essential oil of akway (*Drimys piperita* Hook.f.) stem barks. J Agritech. 2018;1(2):56–65. http://ojs.uho.ac.id/index.php/jstp/article/view/13102. Accessed 08 Sept 2020.

Zaragoza EGC. Organic fungicide developed from Tasmannia piperita (Hook.f.) Miers. Taguig City, Manila, Philippines: Department of Science and Technology; 2019. http://www.pcaarrd.dost.gov.ph/home/portal/index.php/quick-information-dispatch/3548-organic-fungicide-developed-from-tasmannia-piperita-hook-f-miers. Accessed 30 July 2020.