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A synopsis of Thai *Piper* (Piperaceae)

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ABSTRACT

All native and introduced Thai *Piper* are enumerated to include 46 species and two varieties. Typifications for accepted names and synonyms are made where necessary. Family and generic descriptions, based on Thai collections, are provided. A key to species and varieties and relevant synonymy are also presented. Additional morphological characters for *P. smitinandianum* are summarised. Data on the distribution, ecology, vernacular names, utilization and collections of each taxon in Thailand are presented in the standard Flora of Thailand format.

KEYWORDS: distribution, Flora of Thailand, key to species, tropical plants, taxonomy.

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INTRODUCTION

Piperaceae currently comprises five genera, namely *Manekia* Trel., *Peperomia* Ruiz & Pavon, *Piper* L., *Verhuellia* Miq. and *Zippelia* Blume (APG IV, 2016). Two other genera, *Macropiper* Miq. and *Sarcorhachis* Trel. have previously been recognized but are now reduced to the synonymies of *Piper* (Wanke *et al.*, 2007) and *Manekia* (Bornstein, 1996; Arias *et al.*, 2006) respectively. *Manekia* is a genus of climbing plants found in Central and South America. *Peperomia*, with over 1,600 species and *Piper*, with 1,050 species, are richly represented in tropical forests, especially in Asia and tropical America (Mabberley, 2008). *Verhuellia* is distributed in Cuba and Hispaniola (APG IV, 2016) while *Zippelia* is widely distributed in Southern China and Sout East Asia (Yongqian *et al.*, 1999).

In general, Old World species of Piperaceae are dioecious or monoecious whereas New World species are hermaphroditic. In dioecious species, there is some variation in the size and shape of the leaves and inflorescences between male and female plants (Bornstein, 1985).

Members of *Piper* can be easily recognized on the basis of gross morphological characters. All the species are terrestrial and include woody climbers, perennial herbs, scandent shrubs and small, non-scandent shrubs. The nodes are always swollen. Climbing species ascend by means of climbing roots and the scandent shrubs have prop-roots arising from the basal part of the plant. The leaves are always simple and alternate. Many species are extremely polymorphic and have distinctive leaf shapes and sizes depending on whether the leaves are apically or basally positioned on the plant. The inflorescences are either catkins, spikes or spike-like umbels, and are single or fascicled, and compact with minute flowers. The flowers have a simple morphology, comprising a bract, stamens and/or ovary, and they lack a perianth. The infructescences are free or partly or fully connate and the fruits are drupaceous and sessile or stalked (*Suwanphakdee*, 2012).

Although habit and vegetative characters are highly variable, they are useful aids for identification when combined with other characters. Overall, the significant characters for identification are habit, and floral bract, infructescence and fruit morphologies,

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all of which are useful when combined with vegetative characters. Some characters are distinct for individual species identification, such as the spike-like umbels in *Piper umbellatum* L., the semi-circular, conchiform floral bracts in *P. baccatum* Blume or the 3-floral bracts in *P. ribesioides* Wall.

In Thailand *Piper* occurs primarily in a range of forest types at elevations ranging from sea level to 2,500 m. There are several taxonomic accounts for Piperaceae in Asia, covering Bangladesh, India, Myanmar, Nepal, Sri Lanka (Wallich, 1829–1849; Hooker, 1887; Long, 1984; Huber, 1987), China (Yongqian *et al.*, 1999), Indochina and the Philippines (Candolle 1910, 1912 & 1923; Gardner (2006), Indonesia (Blume, 1826; Backer & Bakhuizen van Den Brink, 1963) and the Malay Peninsula (Ridley, 1924; Henderson, 1959). Thailand represents a gap in our knowledge and the present work aims to partially remedy this by providing a checklist of *Piper* for Thailand, including a key to species, together with distribution and utilization data which will be used for the forthcoming Flora of Thailand account.

MATERIAL & METHODS

This study is based on field collections/observations and herbarium specimens. Voucher specimens are deposited in BK, BKF, KKU and QBG. Herbarium specimens and digital images were examined and consulted from the following herbaria (Thiers, 2020): A, AAU, B, BISH, BK, BKF, BM, BO, C, CMUB, DMSC, E, G, G-DC, GH, K, KKU, KEP, L, MEL, MO, NY, P, PSU, QBG, SING, TCD, U, US and WAG.

PIPERACEAE

Giseke, Prael. Ord. Nat. Pl. 123. 1792 [Apr. 1792], nom. cons; Miq., Syst. Piperac. 1: 63. 1843; C.DC., Prodr. 16(1): 235. 1869; Hook.f., Fl. Brit. India 5: 78. 1887; C.DC. in Lecomte, Fl. Indo-Chine 1: 62. 1910; C.DC., J. Asiat. Soc. Beng. 75: 288. 1914; C.DC., Candollea 1: 65. 1923; Ridl., Fl. Malay Penins. 3: 25. 1924; Henderson, Malay. Wild Flowers Dicot. 6(3): 434. 1959; Backer & Bakh.f., Fl. Java 1: 167. 1963; Long in Grierson & Long, Fl. Bhutan 1(2): 342. 1984; Huber in Dassan., Fl. Ceyl. 6: 272.1987; Keng, Con. Fl. Sing. 1: 62.1990; Tebbs in Kubitzki, Fam. & Gen. Vas. Pl. 2: 516. 1993; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 110. 1999.

Annual or perennial, aromatic, epiphytic, lithophytic or terrestial woody climbers, herbs or small shrubs/subshrubs; monoecious, dioecious or hermaphroditic. *Stems* ± winged or not, variously glabrous glabrescent, puberulous, pilose, hirsute, velutinous or woolly; nodes swollen, with or without climbing roots or prop-roots; vascular bundles ± scattered in transverse section in a monocotyledonous, atactostele-like manner. *Leaves* simple, variously alternate, opposite, spirally-arranged, decussate or in whorls of 3–7; stipule present, ± adanate to petioles, or absent; petiole glabrous to glabrescent or pilose to hirsute, velutinous or pubescent; lamina ± fleshy when fresh, chartaceous or subcoriaceous to coriaceous when dry, symmetric to asymmetric, variously orbicular, elliptic, elliptic-ovate, elliptic-oblong, ovate, deltoid, rhomboid or reniform, base variously auriculate, cuneate, rounded-cordate, rounded, acute, oblique to slightly oblique, truncate or overlapping, apex variously acute, aristate, acuminate, apiculate, caudate, obtuse, mucronate or cuspidate, emarginate or 2-cleft, surfaces glabrous to glabrescent, or variously puberulous, pilose, scabrous, hispid, hirsute, velutinous or seriaceous; venation palmate or pinnate. *Inflorescences* lateral or terminal, leaf-opposed or axillary, single or fascicled, comprising catkins, solitary spikes, spike-like umbels or panicles, erect to pendulous, curved or straight, cylindrical, yellowish-green, green or white; rachis slightly to prominently thickened, glabrous or hairy, with few to many densely crowded flowers. *Flowers* minute, unisexual or bisexual, sessile or pedicellate, immersed, glabrous or pubescent; floral bracts subtending flower 1–6, variously rounded, orbicular, peltate, ovate, elliptic, oblong, spathulate, ovate-lanceolate or conchiform, glabrous or pubescent; sepals and petals absent. *Stamens* 2–12; filament short to very short, theca oblong or "D"-shaped; anthers 2–4-valved, basifixed, exserted or inserted at anthesis, dehiscence lateral or transverse. *Ovary* 1-locular; ovule 1, globose, elliptic, ± rounded or triangular, style short to very short, stigma star-shaped, 1–7-lobed, filiform-like or brush-like, glabrous or hairy. *Infructescences* slightly to markedly pendulous or suberect to erect, cylindrical to ± rounded, glabrous or hairy; peduncle glabrous or hairy. *Fruit* drupaceous, glabrous or variously puberulous, pilose, velutinous, woolly or with glochidiate hairs (*Piper* and *Zippelia*) or a nutlet with ± sticky papillae (*Peperomia*), stipitate or sessile, free or ± concrescent, densely or sparsely arranged

on the rachis, ripe green, dark green, yellow, orange, red, black or dark purple, floral bracts persistent, with or without persistent, spine-like style.

Three genera (*Peperomia*, *Piper* and *Zippelia*) in Thailand.

PIPER

L., Gen. Pl., 5: 18. 1754; Roxb., Fl. Ind. 1: 160. 1820; Blume, Verh. Batav. Gen. 11: 206. 1826; Roxb., Fl. Ind. 1: 166. 1832; Miq., Syst. Piperac. 1: 305. 1843; Miq., Ann. Bot. Mus. Lugd. Bat. 1: 136. 1863; C.DC., Prodr. 16(1): 240.1869; Benth. & Hook.f., Gen. Pl. 3: 129. 1880; Hook.f., Fl. Brit. India 5: 78. 1887; C.DC., Ann. Conserve. Jar. Gen. 2: 272. 1898; C.DC. in Lecomte, Fl. Indo-Chine 1: 74. 1910; Ridl., Fl. Malay Penins. 3: 27. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 436. 1959; Backer & Bakh.f., Fl. Java 1: 173. 1963; Long, in Grierson & Long, Fl. Bhutan 1(2): 345. 1984; Huber in Dassan., Fl. Ceyl. 6: 274. 1987; Keng, Con. Fl. Sing. 1:62. 1990; Tebbs in Kubitzki, Fam. & Gen. Vas. Pl. 2: 518. 1993; Yonqian *et al.* in Wu & Raven, Fl. China 4: 110. 1999.

Perennial, aromatic, woody climbers, erect herbs or small shrubs,. *Stems* ± winged, glabrous or glabrescent or puberulous or pilose or hirsute, or velutinous or woolly; nodes swollen with or without climbing roots or prop roots. *Leaves* simple, alternate; stipule hood-like, lanceolate or oblong-lanceolate, caducous, glabrous, pilose or velutinous; petiole glabrous or glabrescent or pilose or hirsute or velutinous; lamina chartaceous or subcoriaceous or coriaceous, symmetric to asymmetric, variously elliptic, elliptic-ovate, elliptic-oblong, ovate or reniform, base variously auriculate, cuneate, rounded-cordate, rounded, acute, oblique, truncate or overlapping, apex variously acute, aristate, acuminate, apiculate, caudate, obtuse, mucronate orcuspidate, upper lamina glabrous puberulous or pilose, lower lamina variously glabrous, glabrescent, puberulous, scabrous, pilose, hirsute or velutinous; venation palmate or pinnate. Inflorescences lateral or rarely terminal, leaf-opposed or axillary, single or fascicled, comprising catkins, solitary spikes or spike-like umbels (*Piper umbellatum*), erect, curved or slightly to distinctly pendulous, cylindrical, yellowish-green, green or white; rachis glabrous or hairy, with few to many densely crowded flowers. *Flowers* minute, mostly unisexual, dioecious, less often monoecious or bisexual, minute, dense or sparse on rachis; sepals & petals absent; floral bracts 1–3, higher or covered or lower than androecium or gynoecium, rounded or orbicular, peltate, ovate, elliptic, oblong, spathulate or semi-circular and resembling a bivalve shell, glabrous or hairy. *Stamens* 3–12; filaments very short, hardly visible; anthers 2–4-valved, exserted or inserted at anthesis, dehiscence lateral or transverse. *Ovary* elliptic, ± rounded or triangular, style short or very short, stigma star-shaped, 3–7-lobed, filiform or brush-like, glabrous or hairy. *Infructescences* slightly to markedly pendulous or erect, cylindrical or ± rounded, glabrous or hairy, peduncle glabrous or hairy. *Fruit* drupaceous, glabrous or variously puberulous, pilose, velutinous or woolly, stipitate or exstipitate, free or ± concrescent, densely or sparsely arranged on the rachis, ripe green or yellow or orange or red or black or dark purple, with or without persistent, spine-like style.

Forty-six species and two varieties in Thailand.

Key to the species

1. Inflorescence of spikes grouped in an apparently axillary umbel **44. P. umbellatum**
1. Inflorescence a spike or catkin, leaf-opposed
  2. Flower subtended by a single floral bract
    3. Floral bract oblong during flowering and spathulate during fruiting
      4. Inflorescence a spike, polygamous; plant cultivated **25. P. nigrum**
      4. Inflorescence a catkin, not polygamous; plant not cultivated
        5. Small shrub or perennial erect herb; inflorescence and infructescence erect, or slightly pendulous when fruiting **15. P. kurzii**
        5. Woody climber; inflorescence and infructescence pendulous
          6. Fruit stalked **12. P. griffithii**
          6. Fruit sessile
            7. Leaf broadly cordate or ovate; infructescence 6–15 cm long; fruit ellipsoid, 2–3 mm broad, sparse on rachis **31. P. porphyrophyllum**
            7. Leaf elliptic, ovate or elliptic-oblong; infructescence 12–21 cm long; fruit globose, 3–4mm broad, densely arranged on rachis **18. P. leptostachyum**
    3. Floral bract peltate, elliptic, elliptic-rounded, rounded or elliptic-oblong during flowering and fruiting

8. Inflorescence and infructescence erect
 9. Fruit more or less concrescent
  10. Fruit fully concrescent
   11. Perenial herb and creeping; leaves chartaceous, dimorphic, veins 3 pairs, ripe fruit dark green or black; not cultivated **20. P. longum**
   11. Woody climber; leaves subcoriaceous or coriaceous, monomorphic, veins 4–8 pairs; cultivated **34. P. retrofractum**
  10. Fruit partly concrescent
   12. Leaf subcoriaceous or coriaceous; male inflorescence much longer than female; fruit 1–2 mm broad **28. P. peepuloides**
   12. Leaf chartaceous; male and female inflorescences subequal; fruit 2–3 mm broad **43. P. thomsonii**
 9. Fruit free, stalked or sessile
  13. Fruit sessile
   14. Woody climber, ripe fruit orange or red **42. P. sylvaticum**
   14. Small shrub or perennial erect herb
    15. Fruit without persistent style **38. P. sarmentosum**
    15. Fruit with persistent style looks like spine
     16. Plant with prop roots, leaves 16–27 by 7–16 cm, coriaceous, veins pinnate, 6–8 pairs **39. P. smitinandianum**
     16. Plant without prop roots, leaves 9–13 by 6–10 cm, chartaceous, veins pinnate, 3–4 pairs
      17. Plant glabrous, except rachis **29. P. penangense**
      17. Plant woolly, velutinous or scabrous **37. P. rostratum**
  13. Fruit stalked
   18. Woody climber; inflorescence 0.5–2.5 cm long **17. P. lanatum**
   18. Small shrub or perennial erect herb; inflorescence 7–15 cm long
    19. Fruit longer than stalk **36. P. ridleyi**
    19. Fruit shorter than stalk **24. P. muricatum**
8. Inflorescence and infructescence pendulous
 20. Small shrub or scandent shrub; inflorescence a spike; introduced **8. P. colubrinum**
 20. Perenial erect herb or woody climber; inflorescence a catkin
  21. Inflorescence globose or subglobose, introduced **26. P. ornatum**
  21. Inflorescence cylindrical, native
   22. Fruit partly or fully concrescent
    23. Small shrub or perennial erect herb
     24. Plant glabrous, puberulous, pilose, velutinous except terminal branches woolly; floral bract peltate; inflorescence 9–25 cm long; infructescence 8–14 cm long; ripe fruit red or dark purple or black **5. P. boehmeriifolium**
     24a. Stems hairy; fruits fully concrescent, ripe fruit red **5a. P. boehmeriifolium** var. **boehmeriifolium**
     24b. Stems glabrous; fruits concrescent at the base or to the middle, ripe fruit dark purple or black **5b. P. boehmeriifolium** var. **glabricaule**
     24. Plant woolly, velutinous or pilose; floral bract rounded; inflorescence 1.5–4 cm long; infructescence 2.5–4 cm long; ripe fruit green **45. P. viridescens**
    23. Woody climber
     25. Fruit hairy
      26. Floral bract margins ciliate; fruit apex conical **2. P. argyrites**
      26. Floral bract margin glabrous; fruit apex not as above
       27. Leaf coriaceous; fruit apex acute **23. P. minutistigmum**
       27. Leaf subcoriaceous or chartaceous; fruit apex rounded **4. P. betle**
     25. Fruit glabrous or rarely with hairs only in grooves
      28. Leaf 22–27 by 14–18 cm; inflorescences and infructescences longer than 20 cm **22. P. majusculum**
      28. Leaf less than 22–27 by14–18 cm; inflorescence and infructescence shorter than 15 cm long
       29. Fruit with persistent style looks like spine **11. P. durionoides**
       29. Fruit without persistent style
        30. Plant glabrous or puberulous; fruit fully concrescent **6. P. chantaranothaii**
        30. Plant pilose or ramulose hairy; fruit partly concrescent
         31. Leaf chartaceous, pilose or velutinous with uniseriate hairs; floral bract hairy at base and margin ciliate; infructescence 5–8 cm long **14. P. kongkandanum**
         31. Leaf subcoriaceous or coriaceous, pilose or velutinous with ramulose hairs; floral bract margin glabrous; infructescence 6–13.5 cm long **33. P. ramipilum**
   22. Fruit free
    32. Fruit stalked
     33. Floral bract elliptic or elliptic-oblong, margin with long hairs; stamen transversely dehiscent **16. P. laetispicum**
     33. Floral bract elliptic-rounded or rounded, margin ciliate; stamen laterally dehiscent
      34. Leaf palmately veined, coriaceous and thick; inflorescence 2–3 cm long; infructescence 3–4 cm long **9. P. crassipes**
      34. Leaf pinnately veined, chartaceous and thin; inflorescence 5–12 cm long; infructescence 6–16 cm long **30. P. polycarpa**

32. Fruit sessile
35. Fruit 2–5 mm diam.
36. Stem and petioles winged; fruit with persistent, spine-like style **32. P. quinqueangulatum**
36. Stem and petioles unwinged; fruit not above
37. Floral bract margin ciliate
38. Leaf glabrous, puberulous and glabrescent; fruit globose or subglobose, 3–4 mm broad, ripe orange or red **13. P. khaoyaiense**
38. Leaf pilose or velutinous; fruit ellipsoid, 2–3 mm broad, ripe black or dark purple **1. P. arcuatum**
37. Floral bract margin glabrous
39. Leaf margin ciliate; fruit apex emarginate **41. P. sulcatum**
39. Leaf margin glabrous; fruit apex acute, subacute or rounded
40. Infructescence 2–5 cm long
41. Plant glabrous; fruit 4–5 by 3–4 mm **19. P. lonchites**
41. Plant velutinous or puberulous; fruit 2–3 by 1–2 mm **7. P. chiangdaoense**
40. Infructescence 6–25 cm long
42. Leaf 11–25 by 4–12 cm,glabrescent or glabrous; peduncle puberulous; fruit ±globose, ripe dark orange or red; rugulose when dry **46. P. wallichii**
42. Leaf 5–16 by 3–8 cm, puberulous or pilose; peduncle glabrous; fruit trigonoid or ellipsoid, ripenning dark purple or black; granuloid when dry **40. P. suipigua**
35. Fruit 0.5–1.5 mm diam.
43. Shoot, stipule and petiole puberulous, pilose or hirsute; venation palmate **21. P. macropiper**
43. Shoot, stipule and petiole glabrous; vein pinnate
44. Leaf subcoriaceous or coriaceous; infructescence 5–12 cm long; fruit ellipsoid-subglobose **10. P. doiphukaense**
44. Leaf chartaceous; infructescence 8–16 cm long; fruit globose **27. P. pedicellatum**
2. Flower subtended by 2 or 3 floral bracts
45. Rachis glabrous; floral bracts 2, conchiform; stamens 8–12; fruit sessile **3. P. baccatum**
45. Rachis hairy; floral bracts 3, ovate; stamens 3; fruit with stalk **35. P. ribesioides**

1. Piper arcuatum Blume, Verh. Batav. Gen. 11: 180. 1826; Backer & Bakh.f., Fl. Java 1: 172. 1963; Suwanphakdee *et al.*, Kew Bull. 73, 33: 1. 2018. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1535955!], designated by Suwanphakdee *et al.*, 2018).

— *P. zollingerianum* C.DC., Prodr. 16(1): 351. 1869. Type: Indonesia, Java, *Zollinger 1402* (lectotype **G-DC** [G00206449!], designated by Suwanphakdee *et al.*, 2018).

— *P. melanocarpum* Ridl., J. Malayan Branch Roy. Asiat. Soc. 1: 88. 1923. Type: Indonesia, Sumatra, 8 Feb. 1921, *Ridley s.n.* (holotype **K** [K000820052!]).

Thailand.— PENINSULAR: Nakhon Si Thammarat [Khao Luang NP, 2 Mar. 1962, *Suvanakoses 1827* (**BKF**); 23 May 1968, *van Beusekom & Phengkhlai 975* (**L**); 10 Mar. 1995, *Thavorn 657* (**BKF**); 20 Mar. 2008, *Suwanphakdee 29* (**BK**, **BKF**, **KKU**); 7 May 2004, *Suwanphakde 135* (**BK**, **BKF**, **KKU**); 18 Mar. 2008, *Suwanphakdee 223* (**BK**, **BKF**, **KKU**); 20 Mar. 2009, *Suwanphakdee* 228 (**BK**, **BKF**, **KKU**); 1 Apr. 2009, *Suwanphakdee 269* (**BK**, **BKF**, **KKU**); Khao Ram Rome, 20 Mar. 2008, *Suwanphakdee 230* (**BK**, **BKF**, **KKU**); *Suwanphakdee 231* (**BK**, **BKF**, **KKU**)]; Yala [Hala Bala WS, 7 Feb. 1997, *Puudjaa 324* (**BKF**)].

Distribution.— India, Sri Lanka, Malaysia. Indonesia (Java, Sumatra).

Ecology.— Uncommon in the wild, occurring near mountain summits, along streams or near waterfalls in evergreen forest; flowering and fruiting in March.

Vernacular.— Phrik khao (พริกเขา)(General).

Notes.— *Piper arcuatum* is native to southern Thailand whereas *P. nigrum* is widely cultivated throughout the country.The two species are superficially similar but *P. acruatum* can be easily recognized by its pilose or velutinous indumentum, the waviness of its leaves when fresh and their aristate apex, and inflorescences that are erect to slightly pendulous when young, becoming markedly pendulous when mature and in fruit. Moreover, the female inflorescence is longer, the floral bract is rounded and the fruits are ellipsoid and smaller (Fig. 1A).

2. Piper argyrites Ridl. ex C.DC., Rec. Bot. Surv. India 6: 25. 1912; Ridl., Fl. Malay Penins. 3: 40. 1924; Suwanphakdee & Chantaranothai, Blumea 56: 239. 2011; Suwanphakdee *et al.*, Nordic J. Bot. 34: 605. 2016. Type: Malaysia, Selangor, Gua Batu Cave, *Ridley 8176* (lectotype **SING!**, designated by

Suwanphakdee & Chantaranothai, 2011; isolectotypes **G-DC** [G00219986!], **K** [K000794914!]).

— *P. nigrantherum* C.DC., Rec. Bot. Surv. India 6: 20. 1912. Type: Singapore, cultivated in Singapore Botanic Garden, 27 Dec. 1920, *Ridley s.n.* (holotype **G-DC** [G00320818!]), *Ridley s.n.* 27 Dec. 1920 (epitype **K** [K000794917!], designated by Suwanphakdee *et al.*, 2016; isoepitypes **BM** [BM000949837!], **K** (2 sheets)[K000794918!, K000794919!]).

— *P. maculaphyllum* A.Chaveer. & R.Sudmoon, Acta Phytotax. Geobot. 59: 120. Type: Thailand, Phuket, Khao Pra Thaeo WS, *Chaveerach 126* (holotype **BK**?; isotype **BKF**?).

Thailand.— SOUTH-WESTERN: Chon Buri [Sriracha, 5 Apr. 1920, *Kerr 4157* (**BK**, **BM**); 8 July 1930, *Kerr 19466* (**BK**); Ban Dan, 13 May 1923, *Marcan 1384* (**BM**); Ban Bung, 18 July 1966, *Phengklai 1272* (**BKF**, **K**)]; Rayong [Ban Kai,11 Aug. 1983, *Paisooksantivatana 1248-83* (**BK**)]; Chanthaburi [Khao Soi Dao WS, 13 May 1974, *Geesink et al. 6715* (**BKF**, **K**, **L**)]; Trat [Ko Chang, Klong Plu Waterfall, 14 Jan. 2005, *Suwanphakdee 167* (**BK**, **BKF**, **KKU**)]; PENINSULAR: Ranong [Punyaban Waterfall, 19 June 2010, *Suwanphakdee 317* (**BK**, **BKF**)]; Surat Thani [Tai Rom Yen NP, 27 Oct. 2008, *Suwanphakdee 245* (**BK**, **BKF**, **KKU**); *Suwanphakdee 246* (**BK**, **BKF**, **KKU**); *Suwanphakdee 247* (**BK**, **BKF**, **KKU**)].

Distribution.— Malaysia, Singapore, Indonesia.

Ecology.— Along streams or near waterfalls in lowland or hill evergreen forest; flowering and fruiting October–December.

Vernacular.— Khan (ค้าน)(Surat Thani); phlu ngoen (พลูเงิน)(General).

Uses.— Has medicinal use and the plants and leaves are attractive enough to be used as ornamentals.

Notes.— Young leaves of *Piper argyrites* have white, silver, pink and purple spots or bands but become plain green when mature. The infructescence is similar to *P. betle* but differs by having fruits that are ¾ to fully connate. The fruit apex has a persistent, conical style. The male and female inflorescences are shorter than in *P. betle*. The floral bract margins are hairy and 2–3 stamens are in dense clusters whereas they form a row in *P. betle* (Fig. 1B).

3. Piper baccatum Blume, Verh. Batav. Gen. 11: 172. 1826; C.DC., Prodr. 16(1): 241. 1869; Backer & Bakh.f., Fl. Java 1: 169. 1963. Gardner, Blumea 51(3): 579. 2006; Suwanphakdee *et al.*, Nordic J. Bot. 34: 607. 2016.— *Muldera baccata* (Blume) Miq., Syst. Piperac. 1: 341. 1843. Type: Indonesia, Java, *Blume 624* (lectotype **L** [L1535860!], designated by Suwanphakdee *et al.*, 2016; isolectotypes **G-DC** [G00203234!], **K** [K000794885!], **U** [U1478540!])

— *P. recurvum* Blume, Verh. Batav. Gen. 11: 176. 1826; C.DC., Prodr. 16(1): 241. 1869; Backer & Bakh.f., Fl. Java 1: 169. 1963. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1547132!], designated by Suwanphakdee *et al.*, 2016).— *Muldera recurva* (Blume) Miq., Syst. Piperac. 1: 342. 1843.

— *P. firmum* (Miq.) C.DC., Prodr. 16(1): 242. 1869; Ridl., Fl. Malay Penins. 3: 31. 1924.— *Muldera recurva firma* Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 140. 1863. Type: Indonesia, Sumatra, *Korthals s.n.* (lectotype **L** [L1545934!] designated by Suwanphakdee *et al.*, 2016; isolectotype **G-DC** [G00314043!], **K** [K000575308!], **L** [L1545936!]).

— *P. ceylanicum* C.DC., Prodr. 16(1): 242. 1869.— Types: Sri Lanka, *Thwaites 2175* (lectotype **G** [G00203250!], designated by Suwanphakdee *et al.*, 2016; isolectotypes **K** [K000794403!], **P** [P02030045!], **P** [P02030046!], **TCD** n.v. [TCD0018339]).

— *P. pachyphyllum* Hook.f., Fl. Brit. India 5: 80. 1886. 1924; Ridl., Fl. Malay Penins. 3: 31. 1924. Type: Malaysia, *Griffith 4427* (holotype **K** [K000575309!]).

— *P. flavimarginatum* C.DC., Rec. Bot. Surv. Ind. 6: 26. 1912; Ridl., Fl. Malay Penins. 3: 31. 1924. Type: Singapore, Bukit Timah, *Ridley 3772* (holotype **SING!**).

— *P. protrusum* Chaveer. & Tanee, J. Syst. & Evol. 49(5): 468. 2011. Type: Thailand, Phangnga, Sriphangnga NP, *Chaveerach 615* (holotype **BK**?).

Thailand.— SOUTH-EASTERN: Trat [Ko Chang, 14 Jan. 2005, *Suwanphakdee 169* (**BK**, **BKF**, **KKU**)]; PENINSULAR: Ranong [Kraburi, 25 Dec. 1928, *Kerr 16348* (**BK**, **BM**, **L**)]; Surat Thani [Ko Samui, 9 Apr. 1927, *Kerr 12569* (**BK**, **BM**); Ko Phangan, 9 Nov. 1927, *Put 1224* (**BK**, **BM**)]; Phangnga [Sri Phangnga NP, 16 Mar. 2004, *Suwanphakdee 108* (**BK**, **BKF**, **KKU**); 26 Jan. 2007, *Suwanphakdee 211* (**BK**, **BKF**, **KKU**)]; Nakhon Si

Thammarat [Ka Rome Waterfall, 11 Nov. 2009, *Suwanphakdee 285* (**KKU**)].

Distribution.— India, Sri Lanka, Malaysia, Singapore, Indonesia, the Philippines.

Ecology.— In evergreen forest, near streams or waterfalls; flowering and fruiting in January.

Vernacular.— Thao khan (เถาค่าน)(Surat Thani); yan phrik nok (ย่านพริกนก)(Trang).

Notes.— The leaves of *Piper baccatum* are highly succulent, shiny green when fresh and coriaceous when dry; fresh petioles have red spots or bands. Based on leaf and fruit characters, this species is similar to *P. ribesioides* but has a glabrous rachis. The semi-circular floral bracts are conchiform in appearance. The stamens are positioned between the floral bracts and the fruits are sessile or shortly pedunculate (Fig. 1C).

4. Piper betle L., Sp. Pl. 1: 28. 1753; Hook.f., Fl. Brit. India 5: 85. 1887; Trimen, Handb. Fl. Ceylon 3: 425. 1895; C.DC. in Lecomte, Fl. Indo-Chine 1: 74. 1910; Ridl., Fl. Malay Penins. 3: 40. 1924; Backer & Bakh.f., Fl. Java 1: 170. 1963; Huber in Dassan., Fl. Ceyl. 6: 287. 1987; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 120. 1999; Gardner, Blumea 51(3): 579. 2006; Suwanphakdee & Chantaranothai, Blumea 56: 239. 2011. Type: *Herb. Hermann 3: 32, No. 27* (lectotype **BM** [BM000621919!], first step designated by Huber, 1987, second step designated here).

— *P. siriboa* L., Sp. Pl.: 29. 1753. Type: *Herb. Hermann 3: 17, No. 29* (lectotype **BM** [BM000621853!], designated here).

— *Chavica auriculata* Miq., Syst. Piperac. 1: 26. 1843. Type: Bangladesh, Sylhet, *Wallich s.n.* [Numer. List 6652B] (lectotype **U** [U1476696!], designated here; isolectotypes **K** [K000794401!], **K-W** (2 sheets)[K001124420!, K001124421!], **U** [U1476698!]).

— *C. betle* Miq., Syst. Piperac. 1: 228. 1843. Type: India orientali, *Willdenow 686* (holotype **B** [B-W00686-000!]).

—*C. siriboa* Miq., Syst. Piperac. 1: 224. 1843.— *Piper betle* var. *siriboa* (Miq.) C.DC., Prodr. 16(1): 359. 1869. Type: Indonesia, Java, *Blume s.n.* (lectotype **U** [U1476447!]; designated here; isolectotypes **BO!**, **G-DC** [G00206829!]).

— *C. densa* Miq., Syst. Piperac. 1: 252. 1843.— *Piper betle* var. *densum* (Miq.) C.DC., Prodr. 16(1): 360. 1869. Type: Indonesia, Java, *Miquel s.n.* (lectotype **U** [U1476284!]; designated here; isolectotypes **K** (2 sheets)[K000794877!, K000794878!]).

— *Piper. philippinense* C.DC., Prodr. 16(1): 353. 1869. Type: the Philippines, *Cuming 485* (lectotype **G-DC** [G00328499!]; designated here; isolectotypes **MEL** [MEL2392163!], **P** [P01952148!]).

— *P. blancoi* Merr., Philip. J. Sci. 1: 40. 1906. Type: the Philippines, *Whitford 188* (holotype **G-DC** [G00328531!]).

— *P. rubroglandulosum* A.Chaveerach & P.Mokkamul, Act. Phytotax.Geobot. 59(2): 142. 2008. Type: Thailand, Surat Thani, Khlong Phanom NP, *Chaveerach 314* (holotype **BK**?; isotype: **BKF**?).

Thailand (only wild 'form' specimens included).— SOUTH-EASTERN: Trat [Khao Saming, 14 Jan. 2003, *Suwanphakdee 170* (**BK**, **BKF**, **KKU**)]; PENINSULAR: Chumphon [Khao Talu, 3 Feb. 1927, *Kerr 11806* (**BK**, **BM**, **L**); Thung Tako, 20 Sept. 2002, *Suwanphakdee 13* (**BK**, **DMSC**); 21 Feb. 2007, *Suwanphakdee 197* (**BKF**); Lang Suan, 4 Mar. 1927, *Kerr 12207* (**BK**, **BM**); Bang Son, *Put 1034* (**BK**)]; Nakhon Si Thammarat [Khao Luang NP, 7 May 2004, *Suwanphakdee 132* (**BK**, **BKF**, **KKU**); 15 July 2003, *Suwanphakdee 49* (**DMSC**); 10 Nov. 2003, *Suwanphakdee 68* (**DMSC**); 24 Mar. 2008, *Suwanphakdee 233* (**BK**, **BKF**); 2 Apr. 2010, *Suwanphakdee 268* (**BK**, **BKF**, **KKU**)]; Phangnga [Sri Phangnga NP, 28 Jan. 2007, *Suwanphakdee 218* (**BK**, **BKF**)]; Krabi [Muang, 19 Oct. 2006, *Suwanphakdee 184* (**BK**, **BKF**)]; Trang [Khao Chong, 15 Aug. 1964, *Suvanakoses 2173* (**BKF**); 12 Mar. 1974, *Larsen & Larsen 33211* (**AAU**, **BKF**, **K**, **L**); 4 May 2003, *Suwanphakdee 44* (**BKF**, **KKU**); 16 Mar. 2004, *Suwanphakdee 103* (**BKF**, **DMSC**); 20 Apr. 2010, *Suwanphakdee 313* (**BK**, **BKF**, **KKU**); *Suwanphakdee 314* (**BK**, **BKF**, **KKU**)]; Satun [Kuan Po, 31 Dec. 1927, *Kerr 13793* (**BK**, **BM**, **L**)].

Distribution.— India, Sri Lanka, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Vernacular.— Phlu (พลู)(General), phlu thean (Peninsular)(พลูเถื่อน).

Ecology.— In open areas or near streams in evergreen forest, orchards or disturbed areas; flowering March–June, fruiting May–July.

Uses.— The leaves are chewed with a little lime and catechu (*Areca catechu* L.; Arecaceae) nut. It is used medicinally for treating urticaria and used culturally during religous ceremonies.

Notes.— *Piper betle* is common species in Southeast Asia. Huber (1987) referred to the nomenclatural types as *Herb. Hermann 3: 32* and *4: 9* in BM. Although there are specimens in two volumes of the Hermann Herbarium, they all seem to have been part of a single gathering (Jarvis, 2007) and are accepted as a valid first-step lectotypification. In our second-step lectotypification we have chosen **BM** [BM000621919] in 3: 32 because it is well preserved and has good inflorescences. *Piper siriboa* was wrongly typified by Huber (1987) with a Rumphius plate that is not part of Linneaus' protologue and therefore not original material (Jarvis, 2007). We have lectotypified using original material in the Hermann Herbarium. Miquel (1843) described *Chavica auriculata* based on *Wallich s.n* [Numer. List 6652B] in **U** [U1476696 (female), U1476698 (male)]. We found other spcimens under this number in **K** [K000794401] and **K-W** [K001124420 & K001124421]). We selected the female material in **U** [U1476696] because it matched with original protologue and it has the inflorescence and infructescence which it informative for species identification. Miquel (1843) also described *Chavica siriboa* based on several syntype collections, including *Blume s.n.* (**BO**, **G-DC** [G00206829], **L** [U1476447]), *Wallich s.n.* (Numer. List 6659C)(**K-W** [K001124437]) and *Cuming 485* (**G-DC** [G00328499]). Later, Candolle (1869) treated this species as a variety and transferred it to *Piper*. We selected the Blume collection in **U** [U1476447] as a lectotype because it well preserved and it is likely to be original material as Miquel worked in Utrecht (**U**). Miquel (1843) described *Chavica densa* based on *Miquel s.n.* (**K** [K000794877! & K000794878], **U** [U1476284]), *Zollinger 724* (**G-DC** [G00206825]), *Zollinger 927* (**G-DC** [G00206822!]) and *Zollinger 974* (**G-DC** [G00206840!]). Later, Candolle (1869) treated it as a variety and transferred it to *Piper*. We selected the collection at **U** [U1476284] as the lectotype because it is a good candidate as original material and informative for species identification.

Piper betle is very common and widespread in Asia. Based on field and herbarium specimen collections in Thailand, this plant has two 'forms', namely wild and cultivated. They are minor differences between the two, such as larger and thicker leaves in female plants of cultivated form. The wild 'form' of both female and male plants are found only in south-eastern and southern parts of the country. The cultivated 'form' is common and cultivated throughout the country.

The male inflorescences are longer than female ones. The floral bract is rounded with a glabrous margin and the bracts are spirally arranged in rows alternating with a row of stamens. The fruits are fully concrescent and velutinous or woolly (Fig. 1D).

5. Piper boehmeriifolium (Miq.) Wall. ex C.DC., Prodr. 16(1): 348. 1869, as '*boehmeriaefolium*'; Hook.f., Fl. Brit. India 5: 85. 1887; Ridl., Fl. Malay Penins. 3: 41. 1924; Gilbert & Xia, Novon 9(2): 191. 1999; Yonqian *et al.* in Wu & Raven, Fl. China 4: 123. 1999.— *Chavica boehmeriifolia* Miq., Syst. Piperac. 1: 265. 1843, as '*boehmeriaefolia*'. Type: Bangladesh, Sylhet, *Wallich s.n.* [Numer. List 6654A] (lectotype **U** [U1476700!]; designated here; isolectotype **BM** [**BM**000950692!], **E** [E00313765!], **G-DC** [G00206475!], **K** [K000575313!], **K-W** [K001124423!], **MO** [MO204007!]).

— *P. boehmeriaefolium* var. *tonkiensis* A.DC. in Lecomte, Fl. Indo-Chine 5: 81. 1910. Type: Vietnam, Dans les bois, Vallee de Lankok (Mont- Bavi), *Balansa 3634* (holotype **P** [P00328761!]).

— *P. spirei* C.DC. in Lecomte, Fl. Indo-Chine 5: 87. 1910. Type: Laos, Phon thane, *Spire 258* (lectotype **P** [P01980763!], designated here; isolectotypes **G-DC** [G00322116!], **P** [P01980762!]).

— *P. spirei* var. *pilosius* C.DC. in Lecomte, Fl. Indo-Chine 5: 88. 1910. Type: Cambodia, Frequens in montibus krewahn, *Pierre 4817* (lectotype **P** [P01980769!], designated here; isolectotypes **P** (2 sheets)[P01980768!, P01980764!]).

— *P. terminaliflorum* Y.C.Tseng, Acta Phytotax. Sin. 17: 30. 1979. Type: China, Yunnan, Fengqing, *Yu 16454* (holotype **PE**; isotype **A** [A00005913!]).

a. var. **boehmeriifolium**

Thailand.— NORTHERN: Mae Hong Son [Huai Hi, 4 Feb. 1999, *Triboun s.n.*(**BK**)]; Chiang Mai [Doi Ang Khang, 8 May 1974, *Sadakorn 420* (**BK**); Doi Chang Kien, 5 Apr. 1975, *Sutheesorn 3263* (**BK**); Pang Bo-Tin Tok, 9 Mar. 1965, *Smitinand*

8674 (**BK**, **BKF**); Doi Suthep NP, 17 Feb. 1926, *Collins 1208* (**K**), 17 May 1958, *Sørensen et al. 3499* (**BKF**); 3 Feb. 1959, *Sørensen et al. 6840* (**BKF**); 22 Feb. 1987, *Niyomdham & Kubat 1350* (**BKF**, **K**, **L**); 15 Aug. 1987, *Maxwell 87-824* (**BKF**, **L**); 13 Mar. 2000; Doi Inthanon NP, 11 Dec. 1933, *Lakshnakara 1490* (**BK**); 22 Jan. 1969, *Nooteboom et al. 823* (**BKF**); 20 Oct. 1990, *Phengklai 7645* (**BKF**); 4 Feb. 1998, *Konta & Phengklai 3952* (**BKF**); 18 Oct. 2003, *Suwanphakdee 64* (**KKU**); Doi Chang, 23 Oct. 1979, *Shimizu et al. T-20530* (**BKF**, **L**); Doi Chiang Dao WS, 5 June 1921, *Kerr 5616* (**BK**, **BM**, **K**, **L**); 17 Feb. 1958, *Smitinand 4231* (**BKF**); 6 Dec. 1959, *Smitinand & Abbe 6228* (**BKF**, **L**); 29 Nov. 1961, *Bunchuai 28* (**BKF**); 3 Jan. 1962, *Bunchuai 1287* (**BKF**); 4 Jan. 1966, *Tagawa et al. 4179* (**BKF**); 13 Sept. 1967, *Tagawaet al. T-9892* (**BKF**, **L**); 15 Sept. 1967, *Shimizu et al. T-10221* (**BKF**, **L**); 17 Oct. 1979, *Shimizu et al. T-20933* (**BKF**); 9 Feb. 1983, *Koyama et al. T-33241* (**BKF**, **L**), 22 Mar. 1989, *Santisuk 6951* (**BKF**); 15 Jan. 1989, *Maxwell 89-45* (**BKF**); 9 Nov. 1995, *Maxwell 95-1133* (**BKF**); 29 Jan. 1996, *Maxwell 96-133* (**BKF**); 15 Jan. 1998, *Maxwell 89-43* (**BKF**, **L**); 6 Dec. 2002, *Chamchamroon et al. 1756* (**BKF**); 20 Dec. 2003, *Suwanphakdee 77* (**DMSC**); 10 Nov. 2009, *Suwanphakdee* 249 (**BK**, **BKF**, **KKU**); 4 Dec. 2002, *Chamchamroon et al. 1708* (**BKF**); Mae Rim, 22 Dec. 2003, *Suwanphakdee 80* (**BK**); 26 Jan. 2008, *Jatupol 08-206* (**QBG**); Mae Wang, 19 Mar. 2004, *Maxwell 04-166* (**BKF**); 10 Mar. 2005, *Maxwell 05-212* (**BKF**)]; Chiang Rai [Doi Tung, 23 Oct. 1995, *Pooma 1193* (**BKF**); Chiang Khong, Tha Torn, 2 Apr. 1932, *Kerr 20848* (**BK**)]; Nan [Doi Phu Kha NP, 2 July 2004, *Suwanphakdee 150* (**KKU**); 11 May 2006, *Srisanga et al. 2813* (**QBG**)]; Lampang [Doi Luang NP, 26 Mar. 1997, *Maxwell 97-236* (**BKF**); Chae Son NP, 1 Mar. 2003, *Suwanphakdee 25* (**BK**); Doi Khun Tan NP, 20 Oct. 2003, *Suwanphakdee 67* (**KKU**); 12 Feb. 2006, *Suwanphakdee 177* (**BK**, **BKF**, **KKU**)]; Phrae [Mae Krai, 9 Jan. 1972, *van Beusekom et al. 4767* (**BKF**, **L**); 23 Mar. 1961, *Chantanamuk 38* (**BKF**); Mae Kra Ting, 11 Oct. 1995, *Williams 17133* (**BKF**)]; Uttaradit [Phu Soi Dao NP, 12 Mar. 2003, *Suwanphakdee 42* (**BKF**); 12 Feb. 2004, *Suwanphakdee 92* (**DMSC**)]; Sukhothai [Ramkamhaeng NP, 29 Jan. 1995, *Maxwell 95-49* (**BKF**)]; NORTH-EASTERN: Loei [Phu Ruea NP, 17 Sept. 1997, *Pooma & Maxwell 1564* (**BKF**); Phu Suan Sai NP, 10 Feb. 2004, *Suwanphakdee 89* (**BKF**); 12 Feb. 2004, *Pornpongrungreung 439* (**KKU**); Phu Luang WS, 4 Dec. 1965, *Tagawa et al. 1194* (**BKF**)]; SOUTH-WESTERN: Kanchanaburi [Sangkhlaburi, 29 Mar. 1968, *van Beusekom & Phengklai 183* (**BKF**)]; SOUTH-EASTERN: Chanthaburi [Khao Soi Dao WS, 19 Dec. 1924, *Kerr 9712* (**BK**, **BM**, **L**); 26 Nov. 1979, *Shimizu 23715* (**BKF**)]; PENINSULAR: Ranong [Khao Pawta Chongdong, 28 Jan. 1929, *Kerr 16776* (**BK**, **K**); Khao Pawta Luang Kaew, 30 Jan. 1929, *Kerr 16897* (**BK**, **BM**, **K**, **L**)]; Phangnga [Tap Put, 5 Mar. 1930, *Kerr 18434* (**BK**, **BM**, **K**, **L**)].

Distribution.— India, Sri Lanka, Bangladesh, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Ecology.— In lowland or hill evergreen forest, near streams or waterfalls; flowering January–March, fruiting October.

Vernacular.— Phrik kaeng (พริกแกง)(Karen-Chiangdao, Chiang Mai).

Uses.— The young leaves are locally used as a vegetable.

Notes.— Miquel (1843) published *Chavica boehmeriifolia* (as '*boehmeriaefolia*') based on *Wallich s.n.* [Numer. List 6654A], a collection from Sylhet, Bangladesh. The specimens were deposited in **U** [U1476700] and there are other collections in **BM** [**BM**000950692], **E** [E00313765], **G-DC** [G00206475], **K** [K000575313], **K-W** [K001124423] and **MO** [MO204007]. We chose the collection from **U** [U1476700] as the lectotype because this is the only collection deposited in **U** and and it matches with original description in protologue. Later, Candolle (1869) transferred *C. boehmeriifolia* to *Piper boehmeriifolium* (Miq.) C.DC. (as '*boehmeriaefolium*').

Piper spirei and *P. spirei* var. *pilosius* were published by Candolle (1910). The type specimens of *P. spirei* were collected from Phon Thane, Laos PDR and the collections of *Spire 258* were kept in **G** and **P**. We chose the collection from **P** [P01980763] as the lectotype because it is better preserved than the one in **G** [G00322116] which consists of a leaf, fragmented infructescence and line drawings. The type specimen of *P. spirei* var. *pilosius* is *Pierre 4817* which was collected from the Cardamom Mountains (Krâvanh Mountains), Cambodia. We found ten collections in **P** and chose P01980764 as the lectotype because this collection has infructescences

which make it suitable for species identification. The stem of *P. boehmeriifolium* var. *boehmeriifolium* is covered with either dense or sparse hairs. The female inflorescence is shorter than the male, has fragrant flowers, and the stamens or ovaries are covered by floral bracts. The fruits are fleshy and turn red on ripe (Fig. 1E).

b. var. **glabricaule** (C.DC.) M.G.Gilbert & N.H.Xia, Novon 9: 191. 1999; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 123. 1999.— *P. glabricaule* C.DC., Notizbl. Bot. Gart. Berlin-Dahlem 6: 477. 1917. Type: China, Yunnan, Mengzi Xian, Mengzi, *Henry 9482A* (holotype **B** [B100294885!]; isotypes **A** [A00005904!], **G-DC** [G00314823!], **K** [K000575306!], S [SG4897!], **US** [US00106402!]).

Thailand.— NORTHERN: Mae Hong Son [Mae Sariang, 12 July 1968, *Larsen et al. 2392* (**BKF**)]; Chiang Mai [Doi Suthep NP, 10 July 1910, *Kerr 1260* (**BM**, **K**, **TCD**); 22 Feb. 1914, *Kerr 3131* (**BM**, **K**); 22 Dec. 1920, *Kerr 4678* (**BK**, **BM**, **K**); 22 Apr. 1966, *Chermsirivatthana 589* (**BK**); 26 Apr. 1966, *Sukkri 73* (**BKF**); Doi Chong, 18 Feb. 1968, *Hansen & Smitinand 12646* (**BKF**); Doi Inthanon NP, 29 Apr. 1921, *Kerr 5294* (**BK**, **BM**, **L**); 7 Apr. 1925, *Vanadorn 1364* (**BK**, **BKF**, **K**); 11 Dec. 1933, *Lakshnakara 1490* (**BK**); 25 Dec. 1934, *Garrett 919* (**BKF**, **BM**); 14 Apr. 1960, *Smitinand & Alsterlund 6638* (**BKF**); 22 Mar. 1967, *Smitinand 10291* (**BKF**, **K**, **L**); 7 Jan. 1983, *Koyama et al. T-32039* (**BKF**); 19 Dec. 1983, *Fukuoka & Ito T-35301* (**BKF**); 28 July 1988, *Phengklai 7112* (**BKF**); 4 Feb. 1998, *Phengklai et al. 10850* (**BKF**); 21 Dec. 1998, *Konta et al. T-4994* (**BKF**); 14 July 1990, *Phengklai 7502* (**BKF**); 16 Oct. 2003, *Suwanphakdee 62* (**BK**); Doi Ang Khang, 8 Dec. 1974, *Sadakorn 420* (**BK**); 18 Oct. 2003, *Suwanphakdee 64* (**BKF**); Doi Chiang Dao WS, 17 Mar. 1950, *Garrett 1284* (**K**, **L**); 29 Dec. 1953, *Garrett 1424* (**K**, **L**); 26 Feb. 1958, Bunchuai 747 (**BKF**); 2 Dec. 1961, *Smitinand 7261* (**BKF**); 29 Nov. 1961, *Bunchuai 28* (**BKF**), 21 Dec. 1961, *Bunchuai 85* (**BKF**), 5 Nov. 1963, *Adisai 597* (**BK**); 15 Sept. 1967, *Shimizu & Hutoh T-1022* (**BKF**); 18 Feb. 1968, *Hansen & Smitinand 12646* (**BKF**, **L**); 16 July 1968, *Larsen et al. 2542* (**AAU**, **BKF**, **L**); 3 June 1973, *Geesink et al. 5670* (**BKF**, **L**), 4 Jan. 1979, *Bjørland & Schumacher 573* (**BKF**); 2 Mar. 1979, *Koyamaet al.15597* (**BKF**); 29 Jan. 1996, *Maxwell 96-133* (**BKF**); 4 Feb. 1998, *Phengklai 10850* (**BKF**); 5 Apr. 2014, *Prommanut & Inthachub 460* (**BK**)]; Chiang Rai [Mae Fang, 2 Mar. 1928, *Winit 1871* (**BK**, **BM**, **L**); 22 June 2002, *Chamchamroon et al. 1609* (**BKF**); Doi Chong, 18 Feb. 1968, *Hansen & Smitinand 12646* (**BKF**); Doi Tung, 23 Oct. 1995, *Pooma 1193* (**BKF**); Mae Chan, 25 Jan. 1970, *Sutheesorn 1503* (**BK**); Khun Korn Waterfall, 15 Feb. 2004, *Suwanphakdee 99* (**KKU**)]; Nan [Doi Phu Kha NP, 3 Dec. 1999, *Srisanga 1204* (**QBG**); 14 Feb. 2004, *Suwanphakdee 95* (**BKF**); 2 July 2004, *Suwanphakdee 150* (**DMSC**); 12 Feb. 2006, *Suwanphakdee 176* (**BK**)]; Tak [Mae Sot, Huai Hoi Creek, 26 Jan. 1985, *Paisooksantivatana 1531-85* (**BK**); Thi Lo Su Waterfall, 16 Jan. 2004, *Suwanphakdee 82* (**KKU**); 11 Feb. 2006, *Suwanphakdee 176* (**BK**, **BKF**, **KKU**)]; Sukhothai [Ramkamhaeng NP, 29 Jan 1995, *Maxwell 95-49* (**BKF**); 18 Jan. 2004, *Suwanphakdee 83* (**DMSC**)]; NORTH-EASTERN: Loei [Phu Luang WS, 4 Dec. 1965, *Tagawa et al. T-1188* (**BKF**); 19 Feb. 1983, *Koyama et al. T-33708* (**BKF**, **L**); 16 Mar. 2002, *Chamchamroon & Puff 1417* (**BKF**); Phu Ruea NP, 5 May 1997, *Pooma 1564* (**BKF**)]; SOUTH-WESTERN: Uthai Thani [Ban Rai, 3 May 1963, *Kasem 384* (**BK**); 25 Mar. 2004, *Suwanphakdee 117* (**DMSC**)]; Kanchanaburi [Chalerm Rattana Kosin NP, 26 Sept. 2001, *van de Bult 483* (**BKF**); Si Sawat, 4 Feb. 1962, *Larsen & Smitinand 9459* (**BKF**, **L**); Thong Pha Phum NP, 8 Aug. 2000, *Triboun 1821* (**BK**);10 May 2003, *Suwanphakdee 70* (**BK**, **BKF**, **DMSC**, **KKU**); 13 Jan. 2004, *Suwanphakdee 85* (**DMSC**); 1 Feb. 2004, *Suwanphakdee 88* (**BK**); 14 Apr. 2004, *Suwanphakdee 126* (**BK**); 23 Aug. 2004, *Nielson et al. 1882* (**BKF**); Sangkhlaburi, 30 Jan. 1926, *Kerr 10340* (**BK**, **BM**, **K**, **L**); 29 Mar. 1968, *van Beusekom & Phengklai 183* (**BKF**, **L**); 1 Aug. 1968, *Sangkhachand 1488* (**BK**); 7 Aug. 1968, *Nimanong 250* (**BKF**)]; Phetchaburi [Kaeng Krachan NP, 13 Dec. 2002, *Middleton et al. 1614* (**BKF**, **K**); 26 Jan. 2005, *Williams et al. 1125* (**KEP**, **SING**); 30 Jan. 2005, *Williams et al. 1218* (**BKF**)]; Prachuap Khiri Khan [Pa La U, 19 Jan. 2004, *Middleton et al. 2254* (**BKF**)]; PENINSULAR: Chumphon [Kao Long, 10 Jan. 1927, *Kerr 11514* (**BK**, **BM**, **K**, **L**); 7 Apr. 2004, *Kaewsri 73* (**BKF**)]; Ranong [Nam Chut, 20 Jan. 1927, *Kerr 12898* (**K**, **L**); Kraburi, 24 Dec. 1928, *Kerr 16323* (**BK**, **BM**, **K**, **L**); Khao Pawta Luang Kaew, 21 Jan. 1929, *Kerr 16774* (**BK**, **BM**); Khao Pawta Chongdong, 21 Jan. 1929, *Kerr 16800* (**BK**, **BM**, **K**, **L**); Khao Sai Daeng, 4 May 1968, *van*

Beusekom & Phengkhlai 549 (**L**); 27 Feb. 1983, *Koyama et al. T-33810* (**BKF**, **L**)]; Surat Thani [Chai Ya, Nong Wai, 4 Mar. 1927, *Kerr 12215* (**BK**, **BM**, **L**); Khao Sok NP, 26 Feb. 2006, *Middleton et al. 4042* (**BKF**)]; Krabi [Muang, 26 Jan 1928, *Sutheesorn 5221* (**BK**)]; Trang [Khao Chong, 11 Mar. 1976, *Chira 2235* (**BK**), 12 Mar. 1974, *Larsen & Larsen 33239* (**BKF**, **L**)]; Yala [Betong, 12 Aug. 1923, *Kerr 7581* (**BK**, **BM**, **L**)].

Distribution.— India, Sri Lanka, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Vernacular.— Soi hoi (ส้อยห้อย)(Karen-Chiangdao, Chiang Mai).

Ecology.— In lowland evergreen forest, hill evergreen forest or open areas near streams; flowering February–March, fruiting April.

Notes.— *Piper boehmeriifolium* var. *glabricaule* differs from the typical variety by its glabrous stems. The fruits are connate at the base and not fleshy and the ripe fruits are dark purple or black.

6. Piper chantaranothaii Suwanph. & D.A.Simpson, Kew Bull. 67 (4): 707.2012. Type: Thailand, Chiang Mai, Doi Chiang Dao WS, *Suwanphakdee 248* (holotype **BKF!**; isotypes: **BK!**, **KKU!**, **QBG!**).

Thailand.— NORTHERN: Mae Hong Son [Pai, 18 Apr. 1995, *Maxwell 95-322* (**BKF**)]; Chiang Mai [Doi Suthep NP, 15 Nov. 1914, *Kerr 3462* (**BM**, **K**, **L**); Doi Inthanon NP, 1 Feb. 2007, *Suwanphakdee 194* (**BK**, **BKF**, **KKU**, **QBG**); Mae Rim, 4 May 1993, *Maxwell 93-363* (**BKF**) 20 Aug. 1995, *Nanakorn et al. 9539* (**QBG**); 7 May 2012, *Nguanchoo 485* (**BK**); Doi Chiang Dao WS, 2 Dec. 1961, *Smitinand & Anderson 7261* (**BKF**); 20 June 1968, *van Beusekom & Phengklai 1323* (**BKF**); 2 Mar. 1997, *Koyama et al.15603* (**BKF**); 21 Dec. 2003, *Suwanphakdee 78* (**BK**, **BKF**, **KKU**, **QBG**), 10 Dec. 2008, *Suwanphakdee 248* (**BKF**, **BK**, **KKU**, **QBG**); Pang Tawn, May 1881, *Put 3907* (**BK**, **BM**, **L**)]; Chiang Rai [Mae Fa Luang, Doi Bang Nun, 17 Apr. 2008, *Maxwell 08-65* (**QBG**); Doi Tung, 20 May 1991, *Pooma 472* (**BKF**); 17 Mar. 2005, *Pooma et al. 4867* (**BKF**)]; Nan [Doi Phu Kha NP, 11 May 2006, *Srisanga 2807* (**QBG**); 14 Feb. 2004, *Suwanphakdee 98* (**KKU**)]; Uttaradit [Phu Soi Dao NP, 12 Feb. 2004, *Suwanphakdee 93* (**BK**)]; NORTH-EASTERN: Loei [Dan Sai, 3 April 1922, *Kerr 5773* (**BK**, **BM**, **L**)]; EASTERN: Chaiyaphum [Phu Khiao WS, 12 Feb. 2010, *Suwanphakdee 289* (**BK**, **BKF**, **KKU**)].

Distribution.— Endemic.

Ecology.— Uncommon in the wild, occurring in forest or near mountain summits; flowering December–January, fruiting January–March.

Vernacular.— Cha khan (จะค้าน)(Northern); cha khan daeng (จะค้านแดง)(Chiang Mai); cha khan nuea (จะค้านเนื้อ)(Nan).

Uses.— The stem is used as an anti-cancer agent and as a carminative. It is eaten in curries and soups but is not as commonly used as *P. wallichii* (Miq.) Hand.-Mazz.

Notes.— *Piper chantaranothaii* is similar to *P. betle* but differs in its coriaceous and stiff leaves and longer female inflorescence. The infructescences are shiny-green, glabrous or puberulous in grooves, and longer and larger than *P. betle*. This species is much consumed by local people using plants taken from the wild.

7. Piper chiangdaoense Suwanph. & Chantar., Blumea 56(3): 235. 2011. Types: Thailand, Chiang Mai, Doi Chiang Dao WS, *T. Smitinand, M.E.D. Poore & R.G. Robbins 7806* (holotype **BKF!**; isotype: **E!**).

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao WS, 4 June 1921, *Kerr 5549* (**BK**, **BM**); 10 Nov. 1962. *Smitinand et al. 7860* (**BKF**, **E**); 20 Jan. 1968, *van Beusekom & Phengklai 1359* (**BKF**, **L**); 14 Sept. 1967, *Shimizu et al. T-10048* (**L**)].

Distribution.— Endemic.

Ecology.— Lower montane forest, alt. 1,500–2,175 m. Flowering in May, fruiting in June.

Vernacular.— Phrik thai chiang dao (พริกไทยเชียงดาว)(General).

Notes.— *Piper chiangdaoense* is native to Thailand. The plants are very locally distributed in Doi Chiangdao, Chiang Mai province. The morphology is similar to *P. lonchites* but differs in the velutinous or puberulous stems and leaves. The fruits are also smaller (2–3 by 1–2 mm vs 4–5 by 3–4 mm in *P. lonchites*).

8. Piper colubrinum (Kunth) C.DC., Jahrb. 3: 61. 1820.— *Schilleria colubrina* Kunth, Linnaea 13: 684. 1840.— *Artanthe colubrina* (Kunth) Miq. Syst. Piperac. 1: 512. 1843. Type: Brazil, *Gaude-Beaupré 86* (**G-DC** [G00206138!]).

Thailand.— PENINSULAR: Krabi [Muang, Rubber Research Center, 21 Oct. 2006, *Suwanphakdee 183* (**BK**, **BKF**)]; CENTRAL: Nonthaburi [Medicinal Plant Research Institute, 5 Mar. 2002, *Suwanphakdee 1* (**BK**, **BKF**, **DMSC**, **KKU**)].

Distribution.— South America. Introduced into Thailand.

Ecology.— Cultivated; flowering and fruiting all year round.

Vernacular.— Phrik thai kholu (พริกไทยโคลู) (Krabi).

Uses.— Used as grafting stock for *P. nigrum* to protect from root rot.

Notes.— Distinguishing characters include its small shrub or scandent-shrub habit, its prop roots which are produced from the basal stem, its spike-like inflorescences and its 4-valved stamens.

9. Piper crassipes Korth. ex Miq., Comm. Phytogr. 1: 22. 1839; C.DC., Prodr. 16(1): 344. 1869; Suwanphakdee *et al.*, Kew Bull. 73, 33: 5. 2018.— *Cubeba crassipes* (Korth. ex Miq.) Miq., Comm. Phytogr. 2: 45. 1840. Type: Indonesia, Sumatra, *Korthals 1863* (lectotype **K** [K000575314!], designated by Suwanphakdee *et al.*, 2018).

— *Cubeba neesii* Miq., Syst. Piperac.: 292. 1843. Type: not located.

— *Piper pedicellosum* Wall. ex C.DC., Prodr. 16(1): 343. 1869; Suwanphakdee & Chantaranothai, Trop. Nat. Hist. 8(2): 205. 2008. **nom. superfl**. Type: Singapore, *Wallich s.n.* [Numer. List 6646A] (holotype **K-W** [K001124404!]).

Thailand.— PENINSULAR: Surat Thani [Tha Chana, Khanthuli, 20 Jan. 1957, *Peerapat s.n.* (**BK**)]; Nakhon Si Thammarat [Tha Samet, 29 Jan. 1928, *Kerr 14336* (**BK**, **BM**, **L**)].

Distribution.— India, Myanmar, Malaysia, Singapore.

Ecology.— In swamp forest; flowering and fruiting April–May.

Vernacular.— Ta khan (ตะค้าน)(Surat Thani).

Uses.—The stems are used as a medicine.

Notes.— Based on inflorescence and infructescences morphologies, *Piper crassipes* is similar to *P. polycarpa* but it differs by having coriaceous and thick leaf. The palmately veins are differ. The inflorescences and infructescences are shorter (2–3 vs 5–12 cm long in *P. polycarpa*) and (3–4 vs 6–16 cm long), respectively. It is similar to *P. ribesioides* based on gross morphology but differs by having smaller leaves and fruit, rounded floral bracts and a non-rugulate dry fruit.

10. Piper doiphukaense Suwanph. & Chantar., Thai Forest Bull., Bot. 40: 31. 2012. Type: Thailand, Nan, Doi Phu Kha NP, 24 Aug. 2001, *P. Srisanga & C. Maknoi 2095* (holotype **QBG!**).

Thailand.— NORTHERN: Nan [Doi Phu Kha NP, 24 Aug. 2001, *Srisanga & Maknoi 2095* (**QBG**)].

Distribution.— Endemic.

Ecology.— Shaded and slightly open areas or near waterfalls in dry evergreen forest.

Vernacular.— Phrik thai phu kha (พริกไทยภูคา).

Notes.— *Piper doiphukaense* is distinguished from *P. pedicellatum* by its subcoriaceous or coriaceous and stiff leaves. The petiole is mostly glabrous. The fruits are ellipsoid to subglobose and 0.5–1 mm in size. The specific epithet refers to Doi Phu Kha NP, Nan province, where the specimen was collected.

11. Piper durionoides Suwanph. & Chantar., Novon 23: 230. 2014. Type: Thailand, Kanchanaburi, Thong Pha Phum NP, 10 Nov. 2003, *Suwanphakdee 69* (holotype **BKF!**; isotypes **BK!**, **KKU!**).

Thailand.— SOUTH-WESTERN: Kanchanaburi [Sisawat, 14 Aug. 1968, *Sangkhachand 1510* (**BK**); Khao Chalat, 7 Aug. 1923, *Collins 927* (**BK**); Thong Pha Phum NP, 15 Apr. 2004, *Suwanphakdee 128* (**BK**, **BKF**, **KKU**); 11 Aug. 1968, *Nimanong & Phusomsaeng 269* (**BKF**)]; Phetchaburi [Kaeng Krachan NP, 15 May 2003, *Suwanphakdee 38* (**BK**, **BKF**, **KKU**); 3 Apr. 2004, *Suwanphakdee 119* (**BK**, **BKF**, **DMSC**, **KKU**); 7 Apr. 2004, *Suwanphakdee 122* (**BK**, **BKF**, **KKU**)].

Distribution.— Endemic.

Vernacular.— Phlu thurian (พลูทุเรียน).

Ecology.— In evergreen forest by streams or waterfalls; flowering November–April, fruiting December–April.

Notes.— *Piper durionoides* has puberulous, pilose or velutinous branchlets, and is puberulous or pilose on both leaf surfaces. Based on infructescence and fruit morphologies, *P. durionoides* is similar to *P. chantaranothaii* but differs by having persistent style that resembles a spine. *Piper durionoides* is also similar to *P. majusculum* but differs from the latter by having smaller leaves. The inflorescences and infructescences are shorter (shorter than 15 cm vs longer than 20 cm in *P. majusculum*) and the fruits have a persistent, spine-like style. The specific epithet refers to its characteristic coalescent fruits and persistent style which are similar to *Durio zibethinus* Merr. (Fig. 1F).

12. Piper griffithii C.DC., J. Bot. 4: 166. 1866; Hook.f., Fl. Brit. India 5: 81. 1887. Suwanphakdee *et al.*, Kew Bull. 73, 33: 5, 2018. Type: Bangladesh "East Bengal", *Griffith 4402* (lectotype **K** [K000794378!], designated by Suwanphakdee *et al.*, 2018; isolectotype **P** [P02025591!]).

— *P. longibracteum* C.DC., Rec. Bot. Surv. Ind. 6: 16. 1912; Ridl., Fl. Malay Penins. 3: 37. 1924. Type: Malaysia, Perak, Maxwell hill, *Wray 101* (lectotype **K** [K000794925!]; isolectotype **SING!**, designated by Suwanphakdee *et al.*, 2018).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep NP, 25 Jan. 1988, *Maxwell 88-76* (**BKF**); *Maxwell 88-78* (**BKF**)]; Nan [Doi Phu Kha NP, 27 Feb. 1921, *Kerr 4956* (**BK**, **BM**, **L**)]; Lampang [Chae Son NP, 31 Jan. 1921, *Kerr 4749* (**BK**, **BKF**, **BM**)]; Tak [Umphang WS, Thi Lo Su Waterfall, 16 Jan. 2004, *Suwanphakdee 81* (**BK**, **KKU**); 16 Feb. 2008, *Suwanphakdee 221* (**BK**, **BKF**, **KKU**, **QBG**)]; SOUTH-EASTERN: Loei [Phu Paek, 13 Jan. 1970, *van Beusekom & Phengkhlai 3014* (**L**)]; SOUTH-WESTERN: Kanchanaburi [Sangkhlaburi, 6 Aug. 1968, *Sangkhachand 1476* (**BK**); 20 May 1946, *Kostermans 714* (**BK**); 1 Apr. 1968, *van Beusekom & Phengklai 249* (**BKF**, **L**)]; Phetchaburi [Kaeng Krachan NP, 27 June 2000, *Newman et al. 1089* (**BKF**); 10 Aug. 2002, *Middleton et al. 937* (**BKF**, **K**); 15 Dec. 2002, *Middleton et al. 1684* (**BKF**, **K**); 30 Mar. 2003, *Middleton et al.1823*(**BKF**, **K**); 17 May 2003, *Suwanphakdee 41* (**BK**, **DMSC**, **KKU**); 27 Jan. 2005, *Williams et al.1147* (**BKF**, **KEP**); 3 Apr. 2004, *Suwanphakdee 118* (**BK**, **BKF**, **KKU**); 26 Dec. 2008, *Suwanphakdee 255* (**BK**, **BKF**, **KKU**); *Suwanphakdee 256* (**BK**, **BKF**, **KKU**); *Suwanphakdee 257* (**BK**)]; Prachuap Khiri Khan [Khao Luang, Huai Yang Waterfall NP, 5 July 1924, *Kerr 10865* (**BK**, **BM**); 12 Apr. 2010, *Suwanphakdee 303* (**BK**, **BKF**, **KKU**)]; PENINSULAR: Ranong [Ngao Waterfall NP, 20 Feb. 2007, *Suwanphakdee 195* (**BK**)]; Surat Thani [Khao Sok NP, 21 Mar. 2004, *Suwanphakdee 112* (**BK**, **DMSC**); 9 Nov. 2010, *Suwanphakdee 281* (**BK**, **BKF**, **KKU**)]; Phangnga [Khao Pawta Luang Kaew, 27 Nov. 1974, *Geesink et al. 7640* (**BKF**, **K**, **L**)]; Krabi [Tham Suea Temple, 22 Feb. 2001, *Chayamarit et al. 2641* (**BKF**)].

Distribution.—India, Bangladesh, Malaysia.

Ecology.— Shaded areas by streams or mountain summits in evergreen forest; flowering January–April, fruiting March–May.

Vernacular.— Phrik thai kan yao (พริกไทยก้านยาว).

Notes.— The general morphology of *Piper griffithii* is superficially similar to that of *P. guineense* Schum. & Thonn., a species endemic to Africa. However, *P. griffithii* differs by having glabrous nervation, a longer inflorescence and infructescence, and a glabrous floral bract, which is oblong when flowering and spathulate when fruiting. The number of stamens ranges from 5–8 and the ripe fruits are dark purple or black (Fig. 1G).

13. Piper khaoyaiense Suwanph. & D.A.Simpson, Thai Forest Bull., Bot. 40: 32. 2012. Type: Thailand, Nakhon Ratchasima, Khao Yai NP, 9 Apr. 2003, *Suwanphakdee 153* (holotype **BKF!**; isotypes, **BK!**, **KKU!**).

Thailand.— EASTERN: Nakhon Ratchasima [Khao Yai NP, 16 July 1962, *Smitinand 7443* (**BKF**); 9 Apr. 2003, *Suwanphakdee 52* (**BK**, **BKF**, **KKU**)]; SOUTH-EASTERN: Prachin Buri [Khao Yai NP, 10 July 2004, *Suwanphakdee 153* (**BK**, **BKF**, **KKU**); 8 Mar. 2009, *Suwanphakdee 264* (**BK**, **BKF**, **KKU**)].

Distribution.— Endemic.

Ecology.— In slightly open or shaded areas, by streams or waterfalls in evergreen forest; flowering May–August, fruiting August–September.

Vernacular.— Ta khan khao yai (ตะค้านเขาใหญ่) (Nakhon Ratchasima).

Uses.— The stems are used as a medicine.

Notes.— The vegetative parts of *Piper khao-yaiense* are similar to *P. betle* whereas the morphology of the infructescence is similar to *P. nigrum* but differs in that the inflorescence is a catkin and the bracts are rounded, ciliate and sometimes peltate with a stalk. Its fruits are smaller than those of *P. nigrum*.

14. Piper kongkandanum Suwanph. & Chantar., Novon 23: 232. 2014. Types: Thailand, Kanchanaburi, Sangklaburi, 5 July 2008, *Suwanphakdee 239* (holotype **BKF!**; isotypes **BK!**, **KKU!**).

Thailand.— SOUTH-WESTERN: Kanchanaburi [Kwae Noi River Basin, 28 May 1946, *Kostermans 745* (**BK**, **SING**); Thong Pha Phum NP, 15 Apr. 2004, *Suwanphakdee 128* (**BK**, **BKF**, **KKU**); Khao Laem NP, 1 May 2009, *Suwanphakdee 273* (**BK**, **BKF**, **KKU**); Sangkhlaburi, 25 Jan. 1925, *Kerr 10336* (**BK**, **BM**, **L**); 16 June 1946, *Kostermans 863* (**BK**)]; Phetchaburi [Kaeng Krachan NP, 3 Apr. 2004, *Suwanphakdee 119* (**BK**, **BKF**, **KKU**)].

Distribution.— Endemic.

Vernacular.— Phlu archan kong (พลูอาจารย์ก่อง) (General).

Ecology.— In shaded areas along streams or waterfalls in evergreen forest or hill evergreen forest; flowering January–Febuary, fruiting April–May.

Notes.— *Piper kongkandanum* differs from *P. ramipilum* C.DC. in having pilose or velutinous uniseriate hairs on the branchlets, larger, chartaceous leaves, hairy floral bract bases with ciliate margins and shorter inflorescences and infructescences (Fig. 1H).

15. Piper kurzii Ridl., J. Strait Branch Roy. Asiat. Soc. 82: 188. 1920; Ridl., Fl. Malay Penins. 3: 43. 1924; Suwanphakdee *et al.*, Kew Bull. 73, 33: 7, 2018. Type: Myanmar, Pegu, 21 Feb. 1871, *Kurz 2220* (lectotype **K** [K000794423!], designated by Turner, Gard. Bull. Singapore 64: 253. 2012; isolectotype **CAL**).

— *P. kurzii* C.DC., Candolle 1: 198. 1923 & 2: 205. 1925., **nom. illegit.,** non *P. kurzii* Ridl.

Thailand.— NORTHERN: Chiang Mai [Doi Suthep NP, 8 May 1910, *Kerr 1169* (**BM**, **K**, **TCD**); 13 June 1967, *Bunchuai 601* (**BKF**); 24 Sept. 1987, *Maxwell 87-1037* (**BK**, **BKF**); 15 Oct. 2003, *Suwanphakdee 58* (**DMSC**); Doi Inthanon NP, 31 May 1933, *Garrett 788* (**BKF**, **BM**); 26 June 1978, *Phengklai et al. 4108* (**BKF**); 4 Dec. 1994, *Pooma 900* (**BKF**)]; Chiang Rai [Phu Langka, 24 June 1954, *Smitinand 1733* (**BKF**)]; Lamphun [Mae Tha, 28 Oct. 1994, *Maxwell 94-1131* (**BKF**)]; Lampang [Wang Nua, 21 Apr. 1997, *Maxwell 97-374* (**BKF**)]; Tak [Muang, Maetor Distr, 3 Nov. 1984, *Paisooksantivatana 1448-84* (**BK**)]; Phitsanulok [Nakhonthai, 17 Oct. 1921, *Kerr 5854* (**BK**, **BM**); Thung Salaeng Luang NP, 12 Dec. 1965, *Tagawa & Fukuoka T-2120* (**BKF**)]; NORTH-EASTERN: Phetchabun [Nam Nao NP, 26 Dec. 1982, *Koyama et al. T-31687* (**BKF**); 26 Oct. 1984, *Murata et al. T-51599* (**BKF**); *Murata et al. T-51638* (**BKF**); 18 Jan. 2003, *Kantachote 118* (**KKU**); 25 Jan. 2003, *Suwanphakdee 20* (**BKF**); 30 July 2011, *Suwanphakdee 372* (**BK**)]; Loei [Phu Kradeung NP, 3 Dec. 1965, *Tagawa et al. T-1025* (**BKF**); 3 Sept. 1967, *Shimizu et al. 883* (**BKF**); 30 Nov. 1968, *Tagawa et al. T-918* (**BKF**); 10 Nov. 1970, *Charoenpol et al. 4861* (**BKF**); 9 Sept. 1988, *Takahashi & Tamura T-60626* (**BKF**); 12 June 1992, *Niyomdham 2928* (**BKF**); Phu Luang WS, 3 Dec. 1965, *Tagawa et al. T-1025* (**BKF**)]; EASTERN: Chaiyaphum [Phu Khiao WS, 8 Nov. 1984, *Murata et al. T-41870* (**BKF**)]; Nakhon Ratchasima [Khao Yai NP, 14 Jan. 1925, *Kerr 9980* (**BK**, **BM**); 13 Dec. 1962, *Phengklai 491* (**BKF**); 3 Jan. 1963, *Phengklai 671* (**BKF**); 10 Aug. 1968, *Larsen et al. 3239* (**BKF**, **L**); 9 Sept. 1968, *Santisuk 175* (**BKF**, **L**); Salika Waterfall, 25 Oct. 1971, *van Beusekom & Geesink 3351* (**BKF**, **L**); Ban Tha Chang, 24 Dec. 1930, *Put 3498* (**BK**, **BM**, **L**)]; SOUTH-WESTERN: Uthai Thani [Huai Kha Khaeng WS, 17 Nov. 1989, *Smitinand 89-11* (**BKF**); Ban Rai, 3 May 1963, *Kasem 382* (**BK**)]; Kanchanaburi [Thong Pha Phum NP, 15 Nov. 2003, *Suwanphakdee 71* (**BK**); Sangkhlaburi, 8 Aug. 1968, *Nimanong 253* (**BKF**); 14 Aug. 1971, *Phengklai 2941* (**BKF**); 11 Nov. 1971, *van Beusekom et al. 3702* (**BKF**, **L**); 21 July 2009, *Samprasong & Sonsuphab s.n.* (**BK**)]; Phetchaburi [Kaeng Krachan NP, 7 Apr. 2004, *Suwanphakdee 120* (**KKU**); *Suwanphakdee 121* (**DMSC**)]; Prachuap Khiri Khan [Pa La U, 15 Aug. 2002, *Middleton et al. 1079* (**BKF**); 16 May 2003, *Suwanphakdee 36* (**KKU**)]; CENTRAL: Nakhon Nayok [Khao Yai NP, 26 May 2000, *Chongko 73* (**BKF**); Nang Rong Waterfall, 13 Aug. 1968, *Larsen et al. 3372* (**AAU**, **BKF**, **L**)]; SOUTH-EASTERN: Prachin Buri [Khao Yai NP, 11 July 1966, *Larsen et al. 277* (**BKF**, **L**)]; Chanthaburi [Khao Soi

Dao WS, 29 June 2001, *Chamchamroon & Puff 1103* (**BKF**); Khao Chamao NP, 22 Aug. 1972, *Larsen et al. 32988* (**BKF**); Pong Nam Ron, 14 May 1974, *Maxwell 74-491* (**BK**); 5 July 1974, *Maxwell 74-665* (**BK**, **BKF**, **L**); 25 Dec. 1984, *Paisooksantivatana Y-1512-84* (**BK**, **BKF**)]; PENINSULAR: Surat Thani [Ban Kawp Kep, 7 Apr. 1927, *Kerr 13190* (**BK**, **BM**, **L**); Ko Samui, 15 Mar. 1928, *Kerr 15743* (**BK**)]; Phangnga [Sri Phangnga NP, 29 Apr. 1973, *Geesink & Santisuk 5073* (**BKF**); 22 Mar. 2004, *Suwanphakdee 116* (**BKF**)]; Trang [Khao Chong, 14 Apr. 1928, *Kerr 15207* (**BK**, **BM**); 14 June 1974, *Geesink et al. 7236* (**BKF**, **K**, **L**); 17 Dec. 1979, *Shimizu et al. T-27460* (**BKF**, **L**); 4 Sept. 1982, *Shimizu et al. T-29067* (**BKF**); 25 Jan. 1957, *Smitinand 4102* (**BKF**); 14 July 1969, *Sangkhachand 1988* (**BK**)]; Satun [Thale Ban NP, 3 June 2001, *Pooma et al. 1995* (**BKF**)]; Songkhla [Tone Ngachang WS, 18 Sept. 2003, *Suwanphakdee 12* (**BK**); Boripat Waterfall, 18 Dec. 1979, *Shimizu et al. T-27669* (**BKF**)]; Pattani [Khao Kala Khiri, 3 Mar. 1928, *Kerr 14925* (**BK**, **BM**)]; Yala [Bunnung Star, 28 July 1928, *Kerr 7384* (**BK**, **BM**)]; Narathiwat [Sri Sakorn, 26 Apr. 2001, *Puudjaa 883* (**BKF**)].

Distribution.— India, Myanmar, Malaysia.

Vernacular.— Phrik nok (พริกนก)(Penninsular).

Ecology.— Common in shaded areas on foothills to mountain summits or along streams or waterfalls in evergreen or hill evergreen, pine and oak forest; flowering March–May, fruiting July–October.

Uses.— The stems are used as a carminative.

Notes.— The reproductive parts are similar to *Piper nigrum* but *P. kurzii* differs in its habit which is either a perennial erect herb or small shrub. It has an erect inflorescence with a terminal curve-like hook and erect infructescence which becomes slightly pendulous when mature (Fig. 2A).

16. Piper laetispicum C.DC., Notul. Syst. (Paris) 3: 42. 1914; Tseng, Xia & Gilbert in Wu & Raven, Fl. China 4: 117. 1999. Type: China, Hainan, Lo-Tai, *Chinese collector 469* (holotype **K** [K000794355!]; isotypes: **G-DC** [G00315972!], **P** [P02025532!]).

— *P. maclurei* Merr., Philip. J. Sci. 21: 339. 1922. Type: China, Namfung, Lo Tai, *Maclure 8531* (lectotype **C** [C10016564!]; designated here; iso lectotype **G** [G00438868!]).

Thailand.— NORTHERN: Chiang Rai [Thoeng, 7 Feb. 1970, *Sutheesorn 1644* (**BK**); Khunkorn Waterfall, 26 Mar. 2010, *Suwanphakdee 292* (**BK**, **BKF**, **KKU**)]; Nan [Doi Phu Kha NP, 7 Mar. 1921, *Kerr 5032* (**BK**, **BM**, **L**); 27 May 2000, *Srisanga 1478* (**QBG**); Tham Sakoen NP, 12 May 2006, *Srisanga et al. 2858* (**QBG**)].

Distribution.— China.

Vernacular.— Kua toi (เกือต่อย)(Nan).

Ecology.— In shaded areas along streams or waterfalls or mountain summits in hill evergreen forest; flowering and fruiting in May.

Notes.— Merrill (1922) described *Piper maclurei*, with *Maclure 5831* designated as the type, without indicating where specimens were deposited. We found collections of this number in **C** [C10016564] and **G** [G00438868]. We designate G00438868 as lectotype because it is well preserved and C10016564 as an isolectotype. *Piper laetispicum* is similar to *P. polycarpa* but differs by having rounded floral bracts and margins with long hairs, coriaceous and stiff leaves, transversely dehiscent stamens and secondary veins which have less than 5 pairs (Fig. 2B).

17. Piper lanatum Roxb., Fl. Ind. 1: 161. 1820; Ridl., Fl. Malay Penins. 3: 38. 1924.— *Cubeba lanata* (Roxb.) Miq., Syst. Piperac. 1: 298. 1843. Type: India, *Roxburgh s.n.* (lectotype **BR** [BR0000006597801!], designated here).

— *P. lowong* Blume, Verh. Batav. Gen. 11: 161. 1826.— *Cubeba lowong* (Blume) Miq., Comm. Phytogr. 3: 33. 1840. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [AMD82238!], designated by Suwanphakdee *et al.*, 2018; isolectotypes **G-DC** [G00206348!], **K** [K000820066!]).

— *P. caninum* Blume, Verh. Batav. Gen. 11: 214. 1826; Hook.f., Fl. Brit. India 5: 82. 1887; Ridl., Fl. Malay Penins. 3: 38. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 442. 1959; Backer & Bakh.f., Fl. Java 1: 171. 1963; Gardner, Blumea 51(3): 580. 2006; Suwanphakdee *et al.*, Thai Forest Bull., Bot. 34: 206. 2006; Suwanphakdee & Chantaranothai, Trop. Nat. Hist. 8(2): 208. 2008; Suwanphakdee *et al.*, Kew Bull. 73, 33: 5. 2018.— *Cubeba canina* (Blume) Miq., Comm. Phytogr. 3: 33. 1840. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1545499!], designated by Suwanphakdee *et al.*, 2018).

— *P. javanicum* C.DC., Prodr. 16(1): 343. 1869. Type: Singapore, *Wallich s.n.* [Numer. List 6645B] (lectotype **K-W** [K001124402!], designated by Suwanphakdee *et al.*, 2018).

— *P. thwaitesii* C.DC., Prodr. 16(1): 357. 1869.— *P. caninum* Blume var. *thwaitesii* (C.DC.) Hook.f., Fl. Brit. India 6: 82. 1886. Type: Sri Lanka, *Thwaites 2178* (lectotype **G-DC** [G00206602!], designated by Suwanphakdee *et al.*, 2018; isolectotype **K** [K000794377!]).

— *P. densibaccum* C.DC., Philipp. J. of Sci. 5(5): 454. 1910. Type: the Philippines, Lake Lanao, Camp Keithley, *Clemens s.n.* (holotype **G-DC** [G00329052!]).

— *P. pilobracteatum* A.Chaveer. & R.Sudmoon, Acta Phytotax. Sin. 44(4): 449. 2006. Type: Thailand, Phangnga, Sri Phangnga NP, *Chaveerach 63495* (holotype **BK**?).

Thailand.— PENINSULAR: Chumphon [Tha Sae, 12 Apr. 1959, *Bunchuai 1145* (**BKF**); 26 May 1969, *Sadakorn 81* (**BK**); 11 Apr. 1967, *Sutheesorn 2172* (**BK**); Thung Raya Nasak WS, 29 Aug. 2002, *Middleton et al. 1468* (**BKF**, **K**); Pa Toh, 28 July 2003, *Suwanphakdee 55* (**BK**)]; Ranong [Kraburi, 1 Feb. 1927, *Kerr 11747* (**BK**, **BM**, **K**, **L**); Ko Ka, 27 Jan. 1929, *Kerr 16854* (**BK**, **BM**, **K**, **L**); Khao Pawta Chongdong, 19 Jan. 1929, *Kerr 16732* (**BK**, **BM**, **K**); 21 Jan. 1929, *Kerr 16804* (**BK**, **BM**, **L**); Bok Krai, 30 Dec. 2008, *Suwanphakdee 263* (**BK**, **BKF**, **KKU**); Bang Son, 14 Mar. 1928, *Put 1570* (**BK**, **BM**, **K**, **L**)]; Surat Thani [Khao Pra Mi, 9 Jan. 1966, *Hansen & Smitinand 11855* (**BKF**, **L**); Klong Panom, 16 July 2000, *Chamchumroon 866* (**BKF**); Ko Samui, 9 Apr. 1927, *Kerr 12567* (**BK**, **BM**, **K**, **L**); Ko Tao, 21 Sept. 1928, *Kerr 16060* (**BK**, **BM**, **L**); Ban Kawp Kep, 12 Apr. 1927, *Kerr 13312* (**BK**, **BM**, **K**, **L**); Khao Sok NP, 29 Mar. 1993, *Chantaranothai et al. 1527*, (**TCD**); 21 Mar. 2004, *Suwanphakdee 114* (**DMSC**); 9 Nov. 2010, *Suwanphakdee* 283 (**BK**, **BKF**, **KKU**)]; Phangnga [Kuraburi, 27 Aug. 1929, *Kerr 16854* (**BK**); Bang Tor, 19 Feb. 1929, *Kerr 17155* (**BK**, **BM**, **K**, **L**); Tap Pud, 3 Mar. 1930, *Kerr 18347* (**BK**, **BM**); 5 Mar. 1930, *Kerr 18375* (**BK**); Sri Phangnga NP, 6 Apr. 2006, *Suwanphakdee 179* (**BK**, **BKF**); 28 Jan. 2007, *Suwanphakdee 217* (**BK**, **BKF**)]; Krabi [Ao Luk, 15 Mar. 1930, *Kerr 18561* (**BK**, **L**); 31 Mar. 1930, *Kerr 18792* (**BK**, **BM**, **L**); Khao Panom, 31 Mar. 1930, *Kerr 18742* (**BK**); 18 June 2006, Williams *et al. 1899* (**BKF**)]; Nakhon Si Thammarat [Khao Luang NP, 5 Mar. 1983, *Koyama et al. T-34049* (**BKF**, **L**); 24 Nov. 1984, *Maxwell 84-482* (**BKF**, **PSU**); 9 May 1985, Ramsri 63 (**L**); 24 Oct. 1951, *Smitinand 1001* (**BKF**); 7 May 2004, *Suwanphakdee 137* (**BK**); same locality and date, *Suwanphakdee 139* (**BKF**); 26 Oct. 2006, *Triboun 3688* (**BK**); 18 Mar. 2008, *Suwanphakdee 222* (**BK**, **BKF**); 19 Apr. 2010, *Suwanphakdee 308* (**BK**, **BKF**, **KKU**); Si Chon, 25 Feb. 1987, *Maxwell 87-216* (**BKF**, **L**, **PSU**); 21 June 1951, *Suvanakoses 148* (**BKF**); 21 Dec. 2006, *Pooma et al. 6519* (**BKF**); 26 Jan. 1956, *Thavorn 531* (**BKF**); 4 Dec. 1957, *Thavorn 973* (**BKF**); Yong Waterfall, 31 Aug. 1982, *Shimizu et al. T-28978* (**BKF**)]; Phatthalung [Na Wong, 19 Apr. 1928, *Kerr 15321* (**BK**, **BM**, **L**)]; Trang [Khao Chong, 7 Mar. 1920, *Chermsirivattana & Larsen 1649* (**BK**, **BKF**); 1 Apr. 1969, *Sangkhachand 1827* (**BK**); 9 Oct. 1970, *Charoenphol et al. 3506* (**BKF**); 12 Aug. 1975, *Maxwell 75-771* (**BK**); *Maxwell 75-801* (**BK**); 17 Dec. 1979, *Shimizu et al. T-27467* (**BKF**); 8 July 2000, *Middleton et al. 322* (**BKF**); 16 Mar. 2004, *Suwanphakdee 104* (**BKF**)]; Satun [Khao Keo Kaenge, 13 Mar. 1928, *Kerr 14544* (**BK**, **BM**)]; Songkhla [Ton Nga Chang WS, 24 Dec. 1927, *Kerr 13663* (**BK**, **BM**, **K**, **L**); 8 Dec. 1985, *Maxwell 85-1085* (**BKF**, **L**, **PSU**); 19 Jan. 1986, *Maxwell 86-31* (**BKF**, **L**, **PSU**); *Pooma et al.1941* (**BKF**); 19 Mar. 2004, *Suwanphakdee 111* (**KKU**); Rattapoom, 9 Nov. 1984, *Maxwell 84-410* (**BKF**, **PSU**); 13 Nov. 1984, *Maxwell 84-424* (**BKF**, **PSU**); 4 Jan. 1985, *Maxwell 85-20* (**BKF**, **PSU**); Ko Hong Hill, Hat Yai, 9 Jan. 1986, *Maxwell 86-32* (**L**)]; Pattani [Khao Kala Khiri, 3 Apr. 1928, *Kerr 15000* (**BK**, **BM**, **K**, **L**)]; Yala [Betong, 23 Aug. 1923, *Kerr 7640* (**BK**, **BM**, **L**)].

Distribution.— India, Sri Lanka, Malaysia, Singapore, Indonesia, the Philippines.

Vernacular.— Phrik nok (พริกนก)(Trang).

Ecology.— Common in the wild or in plantations, occurring from the lowlands to mountain summits, growing in open or shaded areas by streams or waterfalls in lowland or hill evergreen forest; flowering and fruiting all year round.

Notes.— *Suwanphakdee et al.* (2018) incorrectly applied the *Piper caninum* to this species. However, *P. lanatum* is an earliest available name and therefore, the one that should be used by priority. *Piper lanatum* is a slender woody climber. The leaves are highly variable in size, shape and indumentum. The inflorescences are slender and the infructescences are

erect. The fruits have a short stalk and the ripe fruits are succulent and attractive with shiny, dark orange or red coloration (Fig. 2C).

18. Piper leptostachyum Wall. ex Miq., Syst. Piperac. 1: 315. 1843; Hook.f., Fl. Brit. India 5: 95. 1887. Suwanphakdee *et al.*, Nordic J. Bot. 2016. 34: 610; Mukherjee, Phytotaxa 338(1): 23. 2018; Mukherjee, Phytotaxa 441(3): 267. 2020. Type: Myanmar, Nidaun/Ataran river, *Wallich s.n.* [Numer. List 6649] (holotype **K-W** [K001124408!]).

— *P. indicum* C.DC., Prodr. 16(1): 362. 1869. Type: MyanmaSr, Nidaun/Ataran river, *Wallich s.n.* [Numer. List 6649](holotype **G-DC** [G00206817!]).

— *P. rhytidocarpum* Hook.f., Fl. Brit. India 5: 92. 1886; Long in Grierson & Long, Fl. Bhutan 1(2): 347. 1984; Gilbert & Xia, Novon 9(2): 194. 1999; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 7. 1999; Mukherjee, Phytotaxa 338(1): 27. 2018.

— *Piper nigrum* var. *macrostachyum* C.DC., Prodr. 16(1): 363. 1869. Type: India, Meghalaya, Khasia mountains, *Hooker & Thomson s.n.* (holotype **G-DC** [G00207056!]; isotypes **CAL**, **K** [K000794409!]).

— *P. chaudocanum* C.DC., Ann. Conserv. Jard. Bot. Gen. 2: 274. 1898, as '*chandocanum*'; C.DC. in Lecomte, Fl. Indo-Chine 1: 91. 1910; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 8. 1999. Type: Vietnam, Monte Chandoe, *Harmand 536* (holotype **G-DC** [G00329209!]).

Thailand.— NORTHERN: Chiang Rai [Chiang Kham, 25 Jan. 1954, *Sangkhachand 113* (**BKF**)]; Nakhon Sawan [Khlong Khlung, 2 June 1922, *Kerr 6047* (**BK**, **BM**, **L**)]; NORTH-EASTERN: Loei [Phuluang WS, 10 Oct. 1998, *Chaveevach 7* (**BK**)]; EASTERN: Nakhon Ratchasima [Khao Yai NP, 18 Aug. 1964, *Sutheesorn 9* (**BK**); 20 Oct. 2004, *Suwanphakdee 160* (**BK**, **DMSC**)]; SOUTH-WESTERN: Kanchanaburi [Khao Tawng, 5 Nov. 1930, *Kerr 19744* (**BK**)]; Phetchaburi [Kaeng Krachan NP, 12 Dec. 2002, *Middleton et al.1593* (**BKF**); 16 May 2003, *Suwanphakdee 37* (**DMSC**, **KKU**); 17 May 2003, *Suwanphakdee 40* (**BK**, **BKF**); 5 Apr. 2004, *Suwanphakdee 124* (**BK**, **BKF**, **DMSC**)]; Prachuap Khiri Khan [Pa La U, 16 May 2003, *Suwanphakdee 37* (**BK**); Huai Yang Waterfall NP, 7 Oct. 1980, *Put 3236* (**BK**, **BM**); 19 Feb. 1921, Winit 618 (**BKF**); 4 Aug. 1995, *Larsen et al. 45395* (**BKF**); 26 Aug. 2002, *Middleton et al.1344* (**BKF**, **K**); 18 Feb. 2006, *Middleton et al. 3774* (**BKF**); 11 Apr. 2010, *Suwanphakdee 299* (**BK**, **KKU**)]; CENTRAL: Saraburi [Muak Lek, 30 Aug. 1924, *Kerr 9062* (**BK**, **BM**); *Kerr 9069* (**BK**, **BM**); Sam Lahn, 18 May 1974, *Geesink et al. 6805* (**BKF**, **K**, **L**); 19 May 1974, *Maxwell 74-527* (**BK**, **BKF**); 16 June 1974, *Maxwell 74-615* (**BK**, **BKF**, **L**); 4 Aug. 1992, *Larsen et al. 43766* (**BKF**); 17 Feb. 2003, *Suwanphakdee 22* (**BK**); 20 Oct. 2004, *Suwanphakdee 161* (**DMSC**)]; Nakhon Nayok [Nang Rong Waterfall, 13 May 1954, *Suvattabhandu s.n.* (**BK**); 4 Aug. 1992, *Puudjaa 68* (**BKF**)]; SOUTH-EASTERN: Prachin Buri [Krabin, 8 Nov. 1930, *Kerr 19794* (**BK**, **L**)]; Chon Buri [Sriracha, 5 Apr. 1920, *Kerr 4158* (**BK**, **BM**); Khao Khiao WS, 9 Sept. 2000, *Phengklai 12961* (**BKF**); *Phengklai 12790* (**BKF**); Chan Tathen, 17 Dec. 1974, *Chermsirivatana & Sangkhachand 1933* (**BK**); 5 Apr. 1976, *Vacharee 3* (**BK**); 10 July 1976, *Maxwell 76-425* (**BK**); 16 Nov. 2003, *Suwanphakdee 73* (**DMSC**); Ban Bung, 18 July 1966, *Phengklai 1272* (**BKF**, **C**, **K**, **L**, **P**)]; Chanthaburi [Ma Kham, 2 July 1930, *Kerr 19466* (**BK**, **BM**); 26 Nov. 1930, *Lakhanakara*, 26 Nov. 1930 (**BK**); Pong Nam Ron, 9 Feb. 1958, *Bunpheng 1072* (**BKF**, **SING**); 20 June 1973, *Phengklai 3236* (**BKF**, **L**); Khao Soi Dao WS, 28 Nov. 1979, *Shimizu et al. T-23872* (**BKF**); 10 Nov. 1969, *van Beusekom & Smitinand 2084* (**BKF**, **L**)]; Trat [Ko Chang, 24 Mar. 2001, *Chayamarit et al. 2912* (**BKF**); PENINSULAR: Chumphon [Lang Suan, 19 June 1828, *Put 1741* (**BK**, **BM**, **L**)].

Distribution.— India, Bangladesh, China, Myanmar, Laos, Vietnam.

Ecology.— In open or slightly shaded areas, by streams or waterfalls in lowland or hill evergreen forest; flowering February, fruiting March–May.

Vernacular.— Sa khan nu (สะค้านหนู)(Saraburi).

Uses.— Stems are used as medicine.

Notes.— *Piper rhytidocarpum* is treated here as a synonym of *P. leptostachyum*, following *Suwanphakdee et al.* (2016). Gilbert & Xia (1999) lectotypified *P. rhytidocarpum* with *Hooker & Thomson s.n.* (lectotype **K** [K000794414!]). However, Mukherjee (2018) pointed out that *P. rhytidiocarpum* is a replacement name for *P. nigrum* var. *macrostachyum* (C.Presl) DC. This was described from a single collection made by Hooker & Thomson. Under Article 7.4 of the

International Code for Algae, Fungi and Plants (Turland *et al.* 2018) 'a replacement name is typified by the type of the replaced synonym'. In this case, it is the holotype indicated above.

Piper leptostachyum is similar to *P. nigrum* but differs in its leaf shape and texture, the catkin-type inflorescence, transversely dehiscent stamens and larger fruit. The ripe fruits are dark purple or black (Fig. 2D).

19. Piper lonchites Roem. & Schult., Mant. 1: 241. 1822; Miq., Syst. Piperac. 2: 331. 1844. Hook.f., Fl. Brit. India 5: 90. 1887; Ridl., Fl. Malay Penins. 3: 49. 1924. Type: Malaysia, Penang, *Wallich s.n.* [Numer. List 6644B] (lectotype **K-W** [K001124400!]; designated here; isolectotype **BR** (2 sheets) [BR0000006598273! & BR0000006598280!], **G-DC** (3 sheets)[G00206582!, G00320150! & G00206592!], **K** (3 sheets)[K000820949!, K000794896! & K000842460!], **L** [L0929297!], **U** [U1476319!]).

— *P. lonchites* Wall. ex C.DC., J. Asiat. Soc. Beng. 75: 306. 1914, **nom. illeg**.

Thailand.— NORTHERN: Tak [Umphang, Thung Yai WS, 14 Jan. 2011, *Suwanphakdee* 365 (**BK**)]; Phitsanulok [Thung Salaeng Luang NP, 18 Nov. 2010, *Suwanphakdee 356* (**BK**)]; NORTH-EASTERN: Phetchabun [Muang, 27 Mar. 1922, *Kerr 5684* (**BK**, **BM**, **L**); Khao Keo Ngoi, 13 Apr. 1922, *Kerr 5759* (**BK**, **BM**, **K**, **L**); Nam Nao NP, 27 Dec. 1982, *Koyama et al. T-31828* (**BKF**, **L**), 30 May 2003, *Suwanphakdee 131* (**BK**, **BKF**, **KKU**)]; Loei [Phu Luang WS, 5 Dec. 1965, *Tagawa et al. T-1536* (**BKF**); Phu Ruea NP, 21 May 2004, *Bunwong 199* (**KKU**); Phu Suansai NP, 10 Feb. 2004, *Suwanphakdee 91* (**BK**, **BKF**, **KKU**)]; Nakhon Phanom [Tha Utain, 15 Feb. 1924, *Kerr 8451* (**BK**, **BM**, **L**)]; EASTERN: Chaiyaphum [Phu Khiao WS, 23 May 1974, *Geesink et al. 6878* (**BKF**, **L**); 12 Feb. 2010, *Suwanphakdee 290* (**BK**, **BKF**, **KKU**)]; SOUTH-WESTERN: Kanchanaburi [Sri Sawat, 29 June 1974, *Larsen & Larsen 33927* (**BKF**, **K**, **L**); Thong Pha Phum NP, 1 Apr. 2005, *Suwanphakdee 164* (**BK**, **BKF**, **DMSC**, **KKU**)]; Phetchaburi [Kaeng Krachan NP, 26 Jan. 2005, *Williams et al. 1108* (**BKF**); 27 Dec. 2008, *Suwanphakdee 260* (**BK**, **BKF**, **KKU**)]; SOUTH-EASTERN: Chanthaburi [Khao Soi Dao WS, 26 Nov. 1979, *Shimizu et al., T-23682* (**BKF**); 12 Jan. 1969, *van Beusekom & Smitinand 2151* (**BKF**, **L**); Khao Khitchakut NP, 9 Apr. 2008, *Phonsena 5920* (**BK**); Pong Nam Ron, 4 Feb. 1959, *Smitinand 5471* (**BKF**)]; PENINSULAR: Nakhon Si Thammarat [Khao Luang NP, 20 Apr. 2010, *Suwanphakdee 311* (**BK**, **BKF**, **KKU**)].

Distribution.— India, Malaysia.

Ecology.— In open areas on mountain summits or shaded areas along streams or near waterfalls in lowland evergreen, hill evergreen or freshwater swamp forest; flowering May–April, fruiting June–August.

Vernacular.— Phrik thai pa (พริกไทยป่า)(General).

Notes.— Roemer & Schultes published *Piper lonchites* without indicating a type specimen. Later, Miquel (1844) cited *Wallich s.n.* [Numer. List 6644B] as the type specimen with an explanation that it refered to "the material on the left hand and lower right-hand specimens" (Fig. 3). We found *Wallich s.n.* [Numer. List 6644B] [K001124400] in **K-W** and have chosen this specimen as the lectotype. The other specimens deposited in **BR**, **G-DC**, **K** and **L** are isolectotypes. *Piper lonchites* is similar to *P. nigrum* but differs in its chartaceous leaves, catkin-type inflorescence, rounded floral bracts which are spirally arranged in rows and the alternating rows of stamens.The ripe fruits are dark green or black (Fig. 2E).

20. Piper longum L., Sp. Pl. 1: 29. 1753; Hook.f., Fl. Brit. India 5: 83. 1887; C.DC. in Lecomte, Fl. Indo-Chine 1: 74. 1910; Long in Grierson & Long, Fl. Bhutan 1(2): 348. 1984; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 119. 1999; Suwanphakdee *et al.*, Kew Bull. 73 art. 33: 7. 2018. Type: *Herb. Hermann 4: 48* (lectotype **BM** [BM000621029!], designated by Huber 1987).

— *Chavica roxburghii* Miq., Syst. Piperac. 1: 239. 1843. Type: India, Guapara, *Wallich s.n.* [Numer. List 6640D] (lectotype **K-W** [K000794337!], designated by Suwanphakdee *et al.*, 2018).

Thailand.— NORTHERN: Mae Hong Son [Mae Lanoi, 29 Feb. 2004, *Pongamornkul 1815* (**QBG**); Mae Sariang, 1 May 2003, *Pongamornkul 1817* (**QBG**)]; Chiang Mai [Doi Saket, 21 July 2007, *Warintorn 07-049* (**QBG**)]; Lampang [Chae Son NP, 22 Aug. 1995, *Maxwell 95-527* (**BKF**)]; Tak [Sam Ngao, 10 Nov. 1920, *Kerr 4588* (**BK**, **BM**, **K**, **L**); Mae Sot, 19 Aug. 1994, *Maxwell 94-899* (**BKF**]; SOUTH-EASTERN: Phetchabun [Lom Sak, 8 Aug.

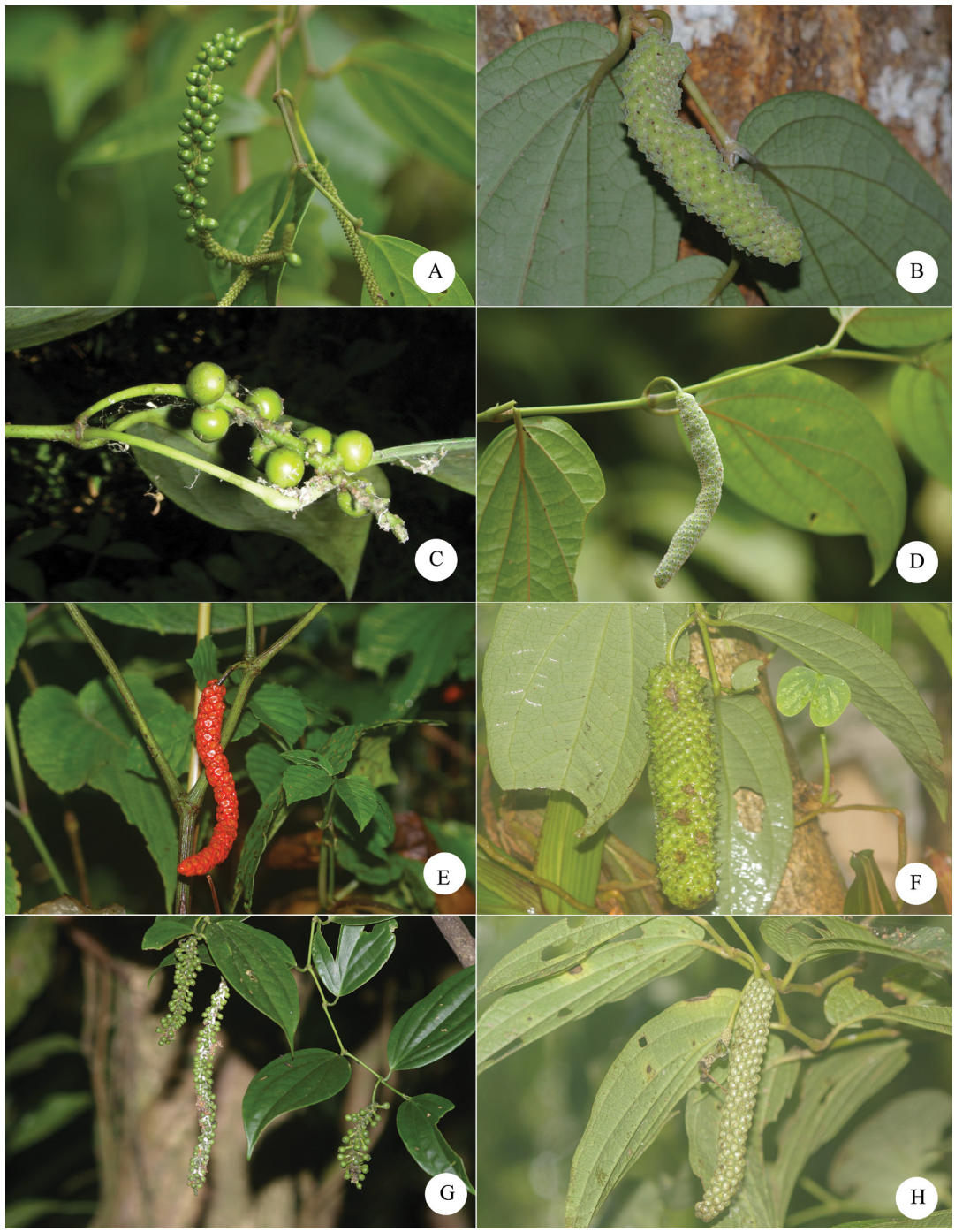

Figure 1. A. *Piper arcuatum* Blume; B. *P. argyrites* Ridl. ex C.DC.; C. *P. baccatum* Blume; D. *P. betle* L.; E. *P. boehmeriifolium* (Miq.) C.DC. var. *boehmeriifolium*; F. *P. durionoides* Suwanph. & Chantar.; G. *P. griffithii* C.DC.; H. *P. kongkandanum* Suwanph. & Chantar. (photos by Suwanphakdee).

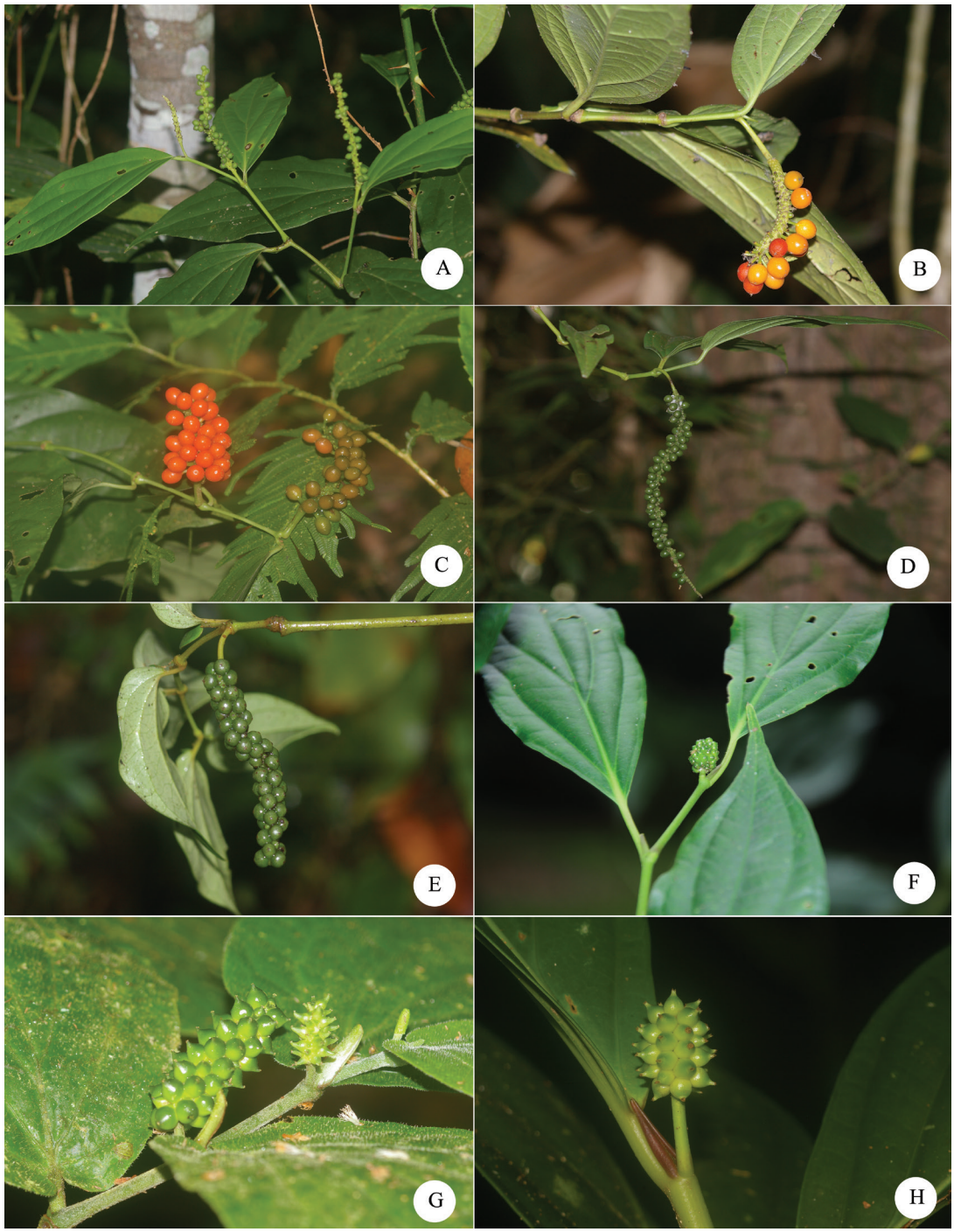

Figure 2. A. *Piper kurzii* Ridl.; B. *P. laetispicum* C.DC.; C. *P. lanatum* Roxb.; D. *P. leptostachyum* Wall. ex Miq.; E. *P. lonchites* Roem. & Schult.; F. *P. peepuloides* Roxb.; G. *P. rostratum* Roxb.; H. *P. smitinandianum* Suwanph. & Chantar. (photos by Suwanphakdee).

Figure 3. Type of *Piper lonchites* Roem. & Schult.

2002, *Suwanphakdee 10* (**BKF**)]; Loei [Phu Kradueng NP, 29 Oct. 1984, *Murata et al. T-51750* (**BKF**)]; SOUTH-WESTERN: Phetchaburi [Ban Huai Sok, 22 Aug. 2002, *Suwanphakdee 11* (**BK**,**BKF**, **KKU**, **DMSC**)]; PENINSULAR: Trang [Khao Chong, 15 July 2003, *Suwanphakdee 48* (**BK**, **BKF**, **DMSC**, **KKU**)].

Distribution.— India, Sri Lanka, Bhutan, China, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Ecology.— In open or disturbed areas, or margins of all forest types; flowering July–August, fruiting August–September.

Vernacular.— Phrik hang (พริกหาง)(Central).

Uses.— All parts, especially the fruit, are used for a medicine.

Notes.— The leaves of *Piper longum* are dimorphic, being cordate or auriculate on sterile shoots and sagittate or ovate on fertile shoots. Fertile (flowering and fruiting) shoots are erect and sterile shoots are creeping. This species is often confused with *P. sarmentosum* but it differs in size, auriculate base leaf, inflorescence size, and fruits which are fully connate.

21. Piper macropiper Pennant, Outl. Globe. 4: 242. 1800; Gardner, Blumea 51(3): 582. 2006.— *P. arborescens* Roxb., [Hort. Beng.: 80. 1814, **nom. nud.** ex] Fl. Ind. 1: 161. 1820. Type: Rumphius, Herb. Amb. 5: 46, t. 28, f. 1. 1747.

— *P. moluccanum* Spreng., Syst. Veg. 1: 112. 1817. Type: not located.

— *P. lanceolatum* Roxb., Fl. Ind. 1: 159. 1820. Type: India, *Roxburgh s.n.* (holotype **G** [G00386489!]).

— *P. miniatum* Blume, Verh. Batav. Gen. 11: 166. 1826; Hook.f., Fl. Brit. India 5: 85. 1887; Ridl., Fl. Malay Penins. 3: 39. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 440. 1959; Backer & Bakh.f., Fl. Java 1: 171. 1963.— *Chavica miniata* (Blume) Miq., Syst. Piperac. 1: 234. 1843. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1546296!]; designated here; isolectotypes **BO!**, **G-DC** [G00206627!], **K** [K000794888!]).

— *P. auriculatum* Blume, Verh. Batav. Gen. 11: 171. 1826. Type: not located.

— *P. glandulosum* Opiz in Presl, Rel. Haenk. 158. 1828. Type: not located.

— *Chavica macrostachya* Miq., Syst. Piperac. 1: 236. 1843. Type: Indonesia, Java, *Blume s.n.* (holotype **BO!**; isotypes: **G-DC** [G00320869!], **L** [L1546169!]).

Thailand.— PENINSULAR: Trang [Thung Khai Botanical Garden, 17 Mar. 2004, *Suwanphakdee 109* (**BK**, **BKF**, **KKU**), *Suwanphakdee 315* (**BK**, **BKF**, **KKU**)]; Narathiwat [Tak Bai, Phu Kok Ku, 17 Apr. 1986, *Niyomdham 1198* (**BKF**, **K**, **L**)].

Distribution.— India, Malaysia, Indonesia, the Philippines.

Vernacular.— Phlu pa (พลูป่า)(Narathiwat).

Ecology.— In peat swamp forest; flowering and fruiting April–September.

Notes.— Blume (1826) described *Piper miniatum* without indicating type specimens. Later, Miquel (1843) transferred it to the genus *Chavica* and refered to *Blume s.n.* in **BO**, **G-DC** [G00206627], **K** [K000794888] **L** [L1546296] and *Cuming 841* (**G-DC** [G00206626!], **TCD** [TCD18340]) as types. We designate the Blume collection in **L** (L1546296) as the lectotype and the others as isolectotypes. In Thailand, *P. macropiper* is distributed mainly in swamp forest of the southern region. The fruits are the smallest in the genus. The palmately patterned leaf venation is showy.

22. Piper majusculum Blume, Verh. Batav. Gen. 11: 210. 1826; Backer & Bakh.f., Fl. Java 1: 171. 1963; Gardner, Blumea 51(3): 582. 2006; Suwanphakdee *et al.*, Nordic J. Bot. 2016. 34: 611.— *Chavica majuscula* (Blume) Miq., Syst. Piperac. 271. 1843. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1546892!], designated by Suwanphakdee *et al.*, 2016; isolectotype **G-DC** [G00206465!]).

— *P. rotundistigmum* C.DC., Philip. J. Sci. 5: 425. 1910. Type: the Philippines, Mindanao, Lake Lanao, Camp Keithley, *Clemens 58341-2* (holotype **G-DC** [G00322943!], drawing).

— *P. febrifugum* C.DC., Rec. Bot. Surv. Ind. 6: 10. 1912; Ridl., Fl. Malay Penins. 3: 39. 1924. Type: Malaysia, Sunjei Ujong, Atrar Sang Trap, *Alvin 1867* (lectotype **SING!**, designated by Suwanphakdee *et al.*, 2016; isolectotypes **BM** [BM000949838!], **K** [K000794923!]).

— *P. kraense* Ridl., J. Fed. Mal. States Mus. 10: 112. 1919, as '*kraensis*'. Type: Thailand, Ranong, Kra

Isthmus, *Kloss 7045* (lectotype **K** [K000794895!], designated by Suwanphakdee *et al.*, 2016; isolectotype **SING!**).

— *P. subgrande* Ridl., Fl. Malay Penins. 5: 329. 1925. Type: Malaysia, Batu caves, *Ridley 14013* (holotype **K** [K000794913!]).

— *P. amboinense* (Miq.) C.DC., Prodr. 16(1): 347. 1869.— *Chavica amboinensis* Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 134. 1863. Type: Indonesia, Amboina, *Forsten s.n.* (lectotype **U** [U1476512!], designated by Suwanphakdee *et al.*, 2016; isolectotypes **L** (2 sheets)[L15360006!, L1536005!], **U** [U1476511!]).

Thailand.— SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 13 May 2005, *Middleton et al. 3428* (**BKF**)]; PENINSULAR: Chumphon [Ngao NP, Klong Prao Waterfall, 27 Sept. 2003, *Suwanphakdee 54* (**BK**, **BKF**, **DMSC**, **KKU**); 20 Feb. 2007, *Suwanphakdee 196* (**BKF**); 19 June 2010, *Suwanphakdee 318* (**BK**, **BKF**, **DMSC**, **KKU**); 31 Dec. 2008, *Suwanphakdee 262* (**BK**, **BKF**, **KKU**); 14 Nov. 2010, *Suwanphakdee 287* (**BK**, **BKF**, **KKU**)].

Distribution.— India, Myanmar, Malaysia, Indonesia, the Philippines.

Ecology.— In shaded or open areas along streams or near waterfalls in evergreen forest; flowering August to September.

Vernacular.— Tue (ตือ)(Phangnga).

Notes.— The leaves of *P. majusculum* are the largest, and the inflorescences the longest, in the woody climbing species of Thai *Piper*.

23. Piper minutistigmum C.DC., Rec. Bot. Surv. Ind. 6: 9. 1912; Ridl., Fl. Malay Penins. 3: 43. 1924. Type: Malaysia, Perak, Larut, *Kunstler 2388* (lectotype **G-DC** [G00320785!], designated here).

Thailand.— PENINSULAR: Narathiwat [Tak Bai, 15 Sept. 1985, *Niyomdham 995* (**BKF**, **K**, **L**)].

Distribution.— India, Malaysia, Indonesia, the Philippines.

Ecology.— In peat swamp forest; flowering and fruiting April–September.

Vernacular.— Ta khan nok (ตะค้านนก) (Narathiwat).

Notes.— Candolle (1912) described *Kunstler 2388* and *Scortechini s.n.* as a syntypes of *Piper minutistigmum*. We located *Kunstler 2388* in **G-DC** [G00320785] and, as this specimen was well preserved, we have selected it as the lectotype. *Piper minutistigmum* is similar to *P. betle* but differs in its thick leaves that are coriaceous when dry, and its larger infructescences. In Thailand, this species is found only in swamp forest in the southern region.

24. Piper muricatum Blume, Verh. Batav. Gen. 11: 219. 1826; Hook.f., Fl. Brit. India 5: 82. 1887; Ridl., Fl. Malay Penins. 3: 32. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 441. 1959; Backer & Bakh.f., Fl. Java 1: 169. 1963; Suwanphakdee *et al.*, Thai Forest Bull., Bot. 34: 209. 2006; Suwanphakdee *et al.*, Kew Bull. 73, 33: 7, 2018. Type: Indonesia, *Blume s.n.*, (lectotype **L** [L1547468!], designated by Suwanphakdee *et al.*, 2018).

— *P. birmanicum* var. *macrostachyon* C.DC. in A.DC., Prodr. 16(1): 338. 1869. Type: Malaysia, Maluccas, *Griffith 4408* (holotype **K** [K000794931!]).

— *P. muricatum* f. *peninsulare* C.DC., Rec. Bot. Surv. Ind. 6: 18. 1912. Type: Malaysia, Selangor, *Ridley 8531* (lectotype **SING**!, designated by Suwanphakdee *et al.*, 2018; isolectotype **CAL** [CAL0000025054!]).

Thailand.— PENINSULAR: Yala [Betong, 1 Aug. 1923, *Kerr 7443* (**BK**); Khao Cha Bor , 27 Apr. 1931, *Lakshnakara 820* (**BK**)]; Narathiwat [Hala Bala, 16 Aug. 1995, *Larsen et al. 5678* (**AAU**, **BKF**); 18 Nov. 1971, *Sathaphon 210* (**BKF**, **L**); 22 Nov. 1971, *C.S.S. 276* (**BKF**); 14 Oct. 2005, *Chongko & Boonkongchart 389* (**CMUB**); Waeng, 3 Mar. 1974, *Larsen & Larsen 32890* (**AAU**, **BKF**, **K**, **L**)].

Distribution.— India, Malaysia, Indonesia, the Philippines.

Ecology.— In evergreen forest by streams; flowering and fruiting May.

Vernacular.— Phum nara (พุ่มนรา)(General).

Notes.— *Piper muricatum* is similar to *P. ridleyi* but differs by having stipes which are longer than the fruit. In Thailand, this species is mainly distributed in the area around the Thai-Malaysian border.

25. Piper nigrum L., Sp.Pl. 1: 308. 1753; Hook.f., Fl. Brit. India 5: 90. 1887; C.DC. in Lecomte, Fl. Indo-Chine 1: 88. 1910; Backer & Bakh.f., Fl. Java

1: 169. 1963; Yonqian *et al.* in Wu & Raven, Fl. China 4: 115. 1999. Type: *Herb. Hermann 3: 21, No 26* (lectotype **BM**! [BM000621872], first step designated by Huber in Dassanayake & Fosberg (ed.), Revised Handb. Fl. Ceylon 6: 283. 1987, second step designated here).

— *P. laxum* Vahl, Enum. 1: 326. 1804. Type: not located.

— *P. nigrum* var. *trioicum* C.DC., Prodr. 16(1): 363. 1869. Type: Bangladesh, *Griffith 4423* (**K** (3 sheets) [K000794415!, K000794412! & K000794407!]).

— *Muldera wightiana* Miq., London J. Bot. 5: 557. 1846. Type: India, Courtellum, *Wight 2624* (lectotype **E** [E00313757!], designated here).

— *M. multinervis* Miq., London J. Bot. 5: 558. 1846.— Type: India, Malabar, *Wight 3017* (holotype **K** [K000794416!]).

Thailand.— Cultivated; Chonburi [Sriracha, 18 Aug. 1924, *Collins 1010* (**BK**, **L**)]; Chanthaburi [Khao Ploi Wen, 9 Dec. 1927, *Kerr 18052* (**BK**, **BM**); 19 Jan. 1958, *Larsen & Hansen 561* (**BKF**), Makham, 29 Nov. 2010, *Suwanphakdee 353* (**BK**)]; Chumphon [Thung Tako, 20 Sept. 2002, *Suwanphakdee 14* (**DMSC**)]; Ranong [Kraburi, 25 Dec. 1928, *Kerr 16348* (**BK**)].

Distribution.— Native to India. Introduced into Thailand, other Asian countries and parts of tropical South America, West Africa and Caribbean Islands.

Ecology.— Cultivated; flowering and fruiting all year round.

Vernacular.— Phrik thai (พริกไทย)(General).

Uses.— Cultivated for the production of peppercorns, the well known and widely used spice. Also used as a medicinal plant.

Notes.— Huber (1987) refered to the nomenclatural type of *Piper nigrum* as *Herb. Hermann 3: 21* and *4: 11* in **BM**. Although there are specimens in two volumes of the Hermann Herbarium, they are part of a single gathering (Jarvis, 2007) and are accepted as a valid first-step lectotypification. In our second-step lectotypification we have chosen **BM** [BM000621872] in 3: 21 because it well preserved. *Piper nigrum* is well known and of high economic value as a spice. The inflorescence of *P. nigrum* consists of unisexual, bisexual or polygamous flowers. The floral bract is oblong when flowering and spathulate when fruiting. The four stamens are transversely dehiscent. The fruits are globose and ripe fruits are dark orange or red.

26. Piper ornatum N.E.Br., Gard. Chron. 2: 424. 1884. Type: Sulawesi [Celebes], 8 Sept. 1884, *Curtis s.n.* (holotype **K** [K000820056!]).

Thailand.— Cultivated [Bangkok, Suan Luang Rama IX, 15 Aug. 2004, *Suwanphakdee 159* (**BK**, **DMSC**, **KKU**); Nonthaburi [Bang Yai, 8 Dec. 2010, *Suwanphakdee 355* (**BK**)].

Distribution.— Native to Sulawesi. Introduced into Thailand and elsewhere.

Vernacular.— Phlu long ya (พลูลงยา)(General).

Ecology.— Cultivated in shaded areas with high humidity; flowering and fruiting all year round.

Uses.— Used as an ornamental plant.

Notes.— In Thailand, *Piper ornatum* was orginally recorded as *P. crocatum*, a small shrub with hairs on stems and leaves, and erect and cylindrical inflorescences, native to tropical western South America. *Piper ornatum* is very popular as an ornamental plant as its leaves have many spots or bands and colors such as white, pink, red and purple when young.The globose inflorescence is useful for identification.

27. Piper pedicellatum C.DC., J. Bot. 4: 164. 1866; C.DC. in Lecomte, Fl. Indo-Chine 1: 73. 1910; Long in Grierson & Long, Fl. Bhutan 1(2): 349. 1984; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 124. 1999; Mukherjee, Phytotaxa 338(1): 25. 2018; Suwanphakdee *et al.*, Kew Bull. 73, 33: 7, 2018. Type: "Bengalria orient" *Griffith 4404* (lectotype **K** [K000794428!]; designated by Gilbert & Xia, 1999; isolectotype **P** [P01656299!]).

— *P. curtipedunculum* C.DC., Notizbl, Konigl. Bot. Gart. Berlin-Dehlem.6: 481. 1917. Type: China, Yunnan, Mengzi, *Henry 10438* (lectotype **B** [B100294777!]; designated here; isolectotypes **A** [A00005900!], **E** [E00318488!], **G-DC** [G00314149!], **K** [K000794373!], **MO** [MO150824!], **US** [US00105456!]).

— *P. clarkei* C.DC., Candollea 1: 186. 1923. Type: India, Darjeeling, *Clarke 9164* (lectotype **K**

[K000794426!], designated by Suwanphakdee *et al.*, 2018; isolectotype **BM** [**BM**000950691!]).

— *P. pedicellatum* C.DC. var. *eglandulatum* Chaveer. & Mokkamul, Acta Phytotax. Geobot. 58(1): 35. 2007. Type: Thailand. Chiang Mai, Doi Inthanon NP, *Chaveerach 48* (holotype **BK!**).

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon NP, 9 Mar. 1931, *Garrett 660* (**BKF**, **L**), San Kamphaeng, 5 Mar. 1996, *Maxwell 97-207* (**BKF**)]; Nan [Doi Phu Kha NP, 21 Nov. 1993, *Larsen et al. 44694* (**AAU**, **K**, **PSU**), 9 Aug. 1991, *Pooma 439* (**BKF**), 24 Sept. 1989, *Paisooksantivatana Y-2499-89* (**BK**), 2 July 2004, *Suwanphakdee 151* (**BK**, **BKF**, **KKU**), 11 Feb. 2006, *Suwanphakdee 175* (**BK**, **BKF**, **KKU**)]; Phitsanulok [Phu Hin Rongkla NP, 17 July 2004, *Suwanphakdee 156* (**BK**, **BKF**, **KKU**)]; SOUTH-WESTERN: Kanchanaburi [Kwae Noi River Basin, 13 June 1946, *Kostermans 863* (**BK**, **L**); Sangkhlaburi, 1 Apr. 1968, *van Beusekom & Phengklai 260* (**BKF**, **L**)].

Distribution.— Bangladesh, China.

Ecology.— In shaded areas on mountain summits or by streams in evergreen forest; flowering February to March, fruiting July.

Vernacular.— Plu na haeo (พลูนาแห้ว)(General).

Notes.— Candolle (1919) indicated *Henry 10438* as being the type. We found collections in several herbaria (**A**, **B**, **E**, **G-DC**, **MO**, **K**, **US**) and we designated a specimen in **B** [B100294777] as the lectotype because it is informative for species identification. Plants of *Piper pedicellatum* are generally glabrous and the fruits are the smallest of the Thai species.

28. Piper peepuloides Roxb., [Hort. Bengal.: 4. 1814, **nom. nud.** ex] Fl. Ind. 1: 159. 1820; Hook.f., Fl. Brit. India 5: 83. 1887. Suwanphakdee *et al.*, Nordic J. Bot. 34: 613. 2016; Mukherjee, Phytotaxa 338(1): 25. 2018; Mukherjee, Phytotaxa 441(3): 268. 2020.— *Chavica peepuloides* (Roxb.) Miq., Syst. Piperac. 1: 237. 1843. Type: Bangladesh, Sylhet, *Roxburgh. Icon. Pl. 2169* (lectotype **K!**, designated by Mukherjee, 2020; isolectotype **CAL**).

— *P. mullesua* Buch-Ham. ex D.Don, Prodr. Fl. Nepal: 20. 1825; Long in Grierson & Long, Fl. Bhutan 1(2): 347. 1984; Yonqian *et al.* in Wu & Raven, Fl. China 4: 115. 1999; Mukherjee, Phytotaxa 338(1): 23. 2018.— *Chavica mullesua* (Buch-Ham. ex D.Don) Miq., Syst. Piperac. 1: 280. 1843. Type: Nepal, Naranhetty, 17 Jan. 1803, *Hamilton s.n.* (lectotype **BM** [BM000950696!], designated by Mukherjee, 2018; isolectotypes **BM** [BM000895997!], **CAL**).

— *P. guigual* Buch-Ham. ex D.Don, Prodr. Fl. Nepal: 20. 1825; Mukherjee, Phytotaxa 338(1): 23. 2018.— *Chavica mullesua guigual* (Buch-Ham. ex D.Don) Miq., Syst. Piperac. 1: 280. 1843. Type.— Nepal, Narainhetty, 6 Feb. 1803, *Buchanan-Hamilton s.n.* (lectotype **BM**[BM000950728!], designated by Mukherjee, 2018; isolectotype **CAL**).

— *Chavica neesiana* Miq., Syst. Piperac. 249. 1843; Mukherjee, Phytotaxa 441(3): 268. 2020.— Types: Nepal, *Wallich s.n.* [Numer. List 6656] (lectotype **U** [U1476536!], left-hand specimen on sheet, first step designated (as holotype) by Suwanphakdee *et al.*, 2016, second step designated by Mukherjee, 2020).

— *C. sphaerostachya* Miq., Syst. Piperac. 1: 278. 1843. Type: Nepal, *Wallich s.n.* [Numer. List 6656] (lectotype **U** [U1476536!], right-hand specimen on sheet, designated by Suwanphakdee *et al.*, 2016; isolectotype **K** [K000794464!]).

— *Piper brachystachyum* Hook.f., Fl. Brit. India 5: 87. 1886. Type: Nepal, *Wallich s.n.* [Numer. List 6656] (lectotype **K-W** [K001124432!]; isolectotype **K-W** [K001124429!], **BM** [BM000950695!], **G-DC** [G00207123!], designated by Suwanphakdee *et al.*, 2016).— *P. vasculosum* Wall., **nom. nud.**

Thailand.—NORTHERN: Chiang Mai [Doi Inthanon NP, 4 Nov. 1994, *Pooma 898* (**BKF**)]; Chiang Rai [Doi Tung, 23 Oct. 1995, *Pooma 1211* (**BKF**)]; Nan [Doi Phu Kha NP, 10 Nov. 1991, *Pooma 551* (**BKF**); 14 Nov. 2001, *Srisanga 2249* (**QBG**); 12 Aug. 2001, *Srisanga & Maknoi 2006* (**QBG**)].

Distribution.— India, Sri Lanka, Nepal, China.

Ecology.— In evergreen, lower montane, forest and hill evergreen forests by streams or on granite of cliffs near waterfalls; flowering and fruiting February.

Vernacular.— Phrik pha (พริกผา)(General).

Uses.— Fresh or dried roots are soaked in spirit alcohol and drunk as a tonic, young leaves are locally used as a vegetable.

Notes.— There has been confusion over the typification of *Piper peepuloides*. Suwanphakdee *et al.* (2016) designated *Wallich s.n.* [Numer. list 6650A] (**U** [U1476553]) as the lectotype while Mukherjee (2018), apparently unaware of the earlier lectotypification, designated *Wallich s.n.* [Numer. List 6650A] (**K** [K000794359]) as the lectotype. Mukherjee (2020) provided evidence to demonstrate that both lectotypifications were erroneous and proposed a new lectotypification based on a Roxburgh drawing in K. We accept this here.

Miquel (1843) described *Chavica neesiana* and indicated that it formed the major part of *Wallich s.n.* [Numer. List 6656]. Suwanphakdee *et al.* (2016) selected the specimen on the left-hand side of a sheet in **U** [U1476536] as the holotype of *C. neesiana* However, Mukherjee (2018) lectotypified *C. neesiana* with *Wallich s.n.* [Numer. List 6656] **K-W** [K001124432], a specimen earlier selected as the lectotype of *Piper brachystachyum* by Suwanphakdee *et al.* (2016). Mukherjee (2020) subsequently cited the left-hand specimen on U14765636 as the lectotype of *C. neesiana*, which we accept. As indicated above, Mukherjee (2020) is designated as a second-step lectotypification.

Some authors (e.g. Mukherjee, 2020) treat *Piper mullesua* as as distinct species from *P. peepuloides* on the basis of differences in the characters of the female spikes. However, we treat them here as conspecific. They are minor differences between the male and female plant, such as leaf shape, larger and thicker leaves in female plants. The male inflorescences are longer than female.

Suwanphakdee *et al.* (2016) lectotypified *Chavica sphaerostachya* it with the right-hand specimen on *Wallich s.n.* [Numer. List 6656](**U** [U1476536]). Mukherjee (2018), placed it in the synonymy of *Piper mullesua* and lectotypified it with U1476536, without distinguishing the left or right-hand specimens and citing an earlier barcode (U0016199) attached to the sheet. However, the earlier lectotypification of Suwanphakdee *et al.* (2016) has prority and is followed here. Suwanphakdee *et al.* (2016) also lectotypified *P. brachystachyum* with Nepal, *Wallich s.n.* [Numer. List 6656](**K-W** [K001124432!]). Mukherjee (2018) placed *P. brachystachyum* in the synonymy of *P. mullesua* and lectotypified with a different specimen, namely *Wallich s.n.* [Numer. List 6656] (**BM** [BM1088832]). Again, the earlier lectotypification of Suwanphakdee *et al.* (2016) has prority and is followed here.

Wallich s.n. [Numer. List 6656] is notoriously mixed. The collections consist of male and/or female plants and there only minor differences between the sexes. Often, there are more than two specimens on a single herbarium sheet and more than ten sheets in in a wide range of herbaria herbaria such as **BM**, **G**, **K**, **K-W**, **L**, **U** and **MO**. Many determinations have been placed on the sheets, adding to the confusion. We were able to examine nearly all the collections and have concluded that they are conspecific and the typifications indicated above are sound.

Piper peepuloides is distinguished by having globose or subglobose erect infructescences, fruits that are very small, dense and connate at the base in some collections, with a spike-like inflorescences in some collections, and young leaves that have a sugary odour when bruised. This species often grows on rocks or cliffs (Fig. 2F).

29. Piper penangense (Miq.) C.DC., Prodr. 16(1): 353. 1869; Hook.f., Fl. Brit. India 5: 88. 1887; Ridl., Fl. Malay Penins. 3: 42. 1924; Suwanphakdee & Chantaranothai, Nat. Hist. of Chula. Univ. 8(2): 206. 2009.— *Chavica penangensis* Miq., Syst. Piperac. 1: 279. 1843. Types: Malaysia, Penang, *Wallich s.n.* [Numer. List 6642B] (lectotype **L** [L0940196!], designated here; isolectotype **G-DC** (2 sheets) [G00321984!, G00321985!], **K** (2 sheets) [K000794905!, K000842407!], **L** [L0940195!]).

Thailand.— PENINSULAR: Yala [Bannang Star, 10 Oct. 1991, *Larsen et al. 42293* (**BKF**); Betong, 23 Feb. 2003, *Niyomdham et al. 6053* (**BKF**); 23 May 2005, *Middleton et al. 3622* (**BKF**); Tan To Waterfall, Ban Chulaphon Phatthana 7 area, 9 Feb. 2004, *Middleton et al. 2857* (**BKF**)].

Distribution.— India, Malaysia.

Vernacular.— Cha phlu pinang (ชะพลูปีนัง) (General).

Ecology.— In shaded areas, along streams, near waterfalls or in open areas on mountain summit and in lowland and hill evergreen forest; flowering and fruiting in May.

Notes.— Miquel (1843) published *Chavica penangensis* based on *Wallich s.n.* [Numer. List 6642B].Later, *C. penangense* was transferred to

Piper penangense by Candolle (1896). We found two collections of *Wallich s.n.* [Numer. List 6642B] in **L** and others in **G** and **K**. We designate the collection in **L** [L0940196] as the lectotype because it is the best preserved and most informative for species identification. The distinctive character of *P. penangense* is its style-like fruit spine. This species is similar to *P. sarmentosum* in gross morphology but differs in the style-like fruit spine and the free fruit.

30. Piper polycarpa Ridl., J. Fed. Malay States Mus. 9: 112. 1919; Suwanphakdee & Chantaranothai, Nat. Hist. J. Chula. Univ. 8(2): 208. 2008. Type: Thailand, Tasan, Kra Isth, *Kloss 6888* (holotype **K** [K000794894!]).

— *Chavica venosa* Miq. Pl. Jungh. 1: 295. 1854. Type: not located.

— *Piper venosum* (Miq.) C.DC., Prodr. 16(1): 340. 1869. Type: not located.

— *P. dominantinervium* A.Chaveer. & P.Mokkamul, Acta Phytotax. Sin. 44(4): 447. 2006. Type: Thailand, Phangnga, Sri Phangnga NP, *Chaveerach 63498-500* (**BK**?, **KKU**?).

Thailand.—PENINSULAR: Ranong [Kraburi, 1 Feb. 1927, *Kerr 11742* (**BK**, **BM**, **K**, **L**); *Kerr 11742A* (**BK**, **BM**, **L**); Bok Krai Waterfall, 30 Dec. 2008, *Suwanphakdee 261* (**BK**, **BKF**, **KKU**); Khao Pra Mi, 8 Jan. 1966, *Hansen & Smitinand 11844* (**BKF**, **L**); 27 Feb. 1968, *Vacharapong 152* (**BK**); 8 Jan. 1966, *Sutheesorn 766* (**BK**); Khlong Na Kha WS, 26 Jan. 2007, *Suwanphakdee 207* (**BKF**); 209 (**BKF**); 19 June 2010, *Suwanphakdee 316* (**BK**, **KKU**); 29 Sept. 2003, *Suwanphakdee 56* (**BK**)]; Phangnga [Kuraburi, 29 April 1973, *Geesink & Santisuk 5040* (**BKF**, **L**); Thap Put, 5 Mar. 1930, *Kerr 18375* (**BK**, **BM**, **L**); Ta Kua Pa, 3 Feb. 1929, *Kerr 17061* (**BK**, **BM**, **K**, **L**); Sri Phangnga NP, 22 Mar. 2004, *Suwanphakdee 115* (**DMSC**); 6 Apr. 2006, *Suwanphakdee 180* (**BKF**); 8 Nov. 2009, *Suwanphakdee 279* (**BK**, **BKF**, **KKU**)]; Trang [Khao Chong, 9 July 2000, *Middleton et al. 333* (**BKF**); 17 Mar. 2004, *Suwanphakdee 106* (**BKF**); *Suwanphakdee 107* (**KKU**)]; Narathiwat [Ba Cho, 17 Dec. 1968, *Sangkhachand 1580* (**BK**)].

Distribution.— Malaysia, Indonesia.

Ecology.— In open or shaded areas, along streams or near waterfalls to mountain summits in evergreen forest; flowering February–March, fruiting March–September.

Vernacular.— Phlu kae (พลูแก)(Ranong); phlu nang khao (พลูหนังเขา)(Phangnga).

Notes.— *Piper polycarpa* has zigzag stems and its leaf venation is pinnate with 5–12 pairs of veins. Based on vegetative characters, this species differs from *P. laetispicum* in the higher number of secondary veins and the subcoriaceous leaf. The floral bracts are rounded and have sparsely ciliate margins.

31. Piper porphyrophyllum N.E.Br., Gard. Chron. 22: 438. 1884; Ridl., Fl. Malay Penins. 3: 45. 1924; Suwanphakdee *et al.*, Kew Bull.73: art. 33: p. 7, 2018. Type: Malaysia, Penang, *Wallich s.n.* [Numer. List 6643E] (lectotype **K-W** [K000794902!], designated by Suwanphakdee *et al.*, 2018; isolectotype **K** [K000794900!]).

— *P. leptonema* Hook.f., Fl. Brit. India 5: 91. 1886. Type: Malaysia, *Maingay 1335* (holotype **K** [K000794898!]).

Thailand.— PENINSULAR: Surat Thani [Khao Sok NP, 9 Nov. 2009, *Suwanphakdee 282* (**BKF**, **KKU**)]; Yala [Hala Bala WS, 4 Oct. 1999, *Niyomdham et al. 5917* (**BKF**)].

Distribution.— Malaysia, Singapore.

Ecology.— In shaded areas near streams in evergreen forest.

Vernacular.— Phlu tuk kae (พลูตุ๊กแก)(Yala).

Uses.— Potentially an ornamental plant.

Notes.— Young leaves of *Piper porphyrophyllum* have red, pink, purple, white and shiny black spots or bands which are similar to those of *P. ornatum*. However, it differs in its mature leaves which turn to plain green and are coriaceous or subcoriaceous when dry. Its floral bracts and fruit are similar to those of *P. nigrum* but it differs in the inflorescence which is a catkin, and the fruit is smaller and loose on the rachis.

32. Piper quinqueangulatum Miq. in Zoll., Syst. Verz. 2: 85. 1854; Backer & Bakh.f., Fl. Java 1: 170. 1963; Gardner, Blumea 51(3): 583. 2006; Suwanphakdee *et al.*, Nordic J. Bot. 34: 615. 2016. Type: Indonesia, Java, *Zollinger 1233* (holotype **P** [P01952129!]).

— *P. korthalsii* Miq., Ann. Mus. Bot. Lugd. Bat. 1: 139. 1863. Type: Indonesia, Sumatra, *Korthals s.n.* (lectotype **L** [L1547158!], designated by Suwanphakdee *et al.*, 2016; isolectotype **K** [K000820065!]).

— *P. cristatum* C.DC. in Elmer, Leaflets Philipp. Bot 3: 770. 1910. Type: The Philippines, Mindanao, *Elmer 10703* (lectotype **G-DC** [G00329641!], designated by Suwanphakdee *et al.*, 2016; isolectotype **BISH** [BISH1004059!], **E** [E00504353!], **GH** [GH00005949!], **K** [K000587330!], **MO** [MO-022706!], **NY** [NY00283898!], **US** [US00105445!]).

— *P. magnibaccum* C.DC., Rec. Bot. Surv. Ind. 6: 5. 1912; Ridl., Fl. Malay Penins. 3: 46. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 439. 1959; Suwanphakdee *et al.*, Thai Forest Bull., Bot. 34: 207. 2006. Type: Malaysia, Perak, Maxwell Hill, *Ridley 5480* (lectotype **SING!**, designated by Suwanphakdee *et al.*, 2006; isolectotype **G-DC** [G00320017!]).

— *P. amphibracteatum* C.DC., J. Linn. Soc. Bot. 42: 128. 1914. Type: Malaysia, *Gibbs s.n.* Feb. 1910 (holotype **BM** [BM000624277!]).

— *P. salticola* Ridl., J. Asiat. Soc. Mal. 1: 88. 1923. Type: Indonesia, Sumatra, *Ridley s.n.*, Feb. 1921 (lectotype **K** [K000820064!], designated by Suwanphakdee *et al.*, 2016; isolectotype **K** (2 sheets) [K000575307! & K000820063!]).

Thailand.— SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 9 May 2005, *Middleton et al. 3332* (**BKF**)]; PENINSULAR: Chumphon [Khao Nom Sao, Patoh, 8 Dec. 2011, *Suwanphakdee 374* (**BKF**, **BK**, **KKU**)]; Nakhon Si Thammarat [Khao Luang NP, 25 Jan. 1966, *Hansen & Smitinand 12055* (**BKF**); 17 May 1968, *van Beusekom & Phengklai 831* (**BKF**,**L**); 7 May 2004, *Suwanphakdee 140* (**DMSC**); 20 Mar. 2008, *Suwanphakdee 225* (**BK**, **BKF**, **KKU**, **QBG**); *Suwanphakdee 226* (**BK**, **BKF**, **KKU**, **QBG**); 2 Apr. 2010, *Suwanphakdee 271* (**BK**, **BKF**, **KKU**, **QBG**)]; Yala [Khao Han Kut, 25 Mar. 1998, *Niyomdham 5332* (**BKF**, **K**)].

Distribution.— India, Malaysia, Indonesia and the Philippines.

Ecology.— In freshwater swamps by streams or near waterfalls; flowering and fruiting March–April.

Vernacular.— Phlu chet pik (พลูเจ็ดปีก)(General).

Notes.— The 7-winged stem and petiole are diagnostic and have a superficial resemblance to *Dioscorea* (Dioscoreaceae). The fruit apex is style-like and both pointed and curved.

33. Piper ramipilum C.DC., Rec. Bot. Surv. Ind. 6(1): 3. 1912; Ridl., Fl. Malay Penins. 3: 39. 1924; Suwanphakdee *et al.*, Thai Forest Bull., Bot. 34: 209. 2006. Type: Malaysia, Penang, Balik Palau, *Curtis 792* (lectotype **SING!**, designated by Suwanphakdee *et al.*, 2006; isolectotype **K** [K000794922!]).

— *Chavica frustrata* Miq., Pl. Jungh. 1: 16. 1852. Type: not located.

Thailand.— PENINSULAR: Chumphon [Tha Sae, Ka Poh Waterfall, 12 Apr. 1967, *Sutheesorn 2201* (**BK**), 9 Feb. 1979, *Koyama et al.15337* (**BKF**)]; Nakhon Si Thammarat [Khao Luang NP, 29 July 1994, *Smitinand 781* (**BKF**); 7 May 2004, *Suwanphakdee 136* (**BK**, **BKF**, **DMSC**, **KKU**); 2 Apr. 2010, *Suwanphakdee 270* (**BK**, **BKF**, **KKU**); 19 Apr. 2010, *Suwanphakdee 309* (**BK**, **BKF**, **KKU**); 20 Apr. 2010, *Suwanphakdee 312* (**BK**, **BKF**, **KKU**)]; Phatthalung [Khao Pu Khao Ya NP, 22 Mar. 1986, *Maxwell 86-192* (**BKF**)]; Trang [Khao Chong, 16 Aug. 1964, *Suvarnakoses 2180* (**BKF**); 13 Mar. 1966, *Bunnab 469* (**BKF**); 23 Mar. 1966, *Bunnab 470* (**BKF**); 19 July 1969, *Sangkhachand1997* (**BK**); 16 Mar. 2004, *Suwanphakdee 105* (**BK**, **BKF**, **KKU**)]; Songkhla [Ton Nga Chang WS, 19 Mar. 2004, *Suwanphakdee 110* (**DMSC**, **KKU**); 11 Nov. 2009, *Suwanphakdee 284* (**BK**, **BKF**, **KKU**)]; Yala [Bannang Star, 10 Oct. 1991, *Larsen et al. 42295* (**BKF**); Betong, 20 July 2004, *Pooma et al. 4459* (**BKF**)]; Narathiwat [Bacho Waterfall, 18 June 1992, *Larsen et al. 42983* (**BKF**)].

Distribution.— India, Malaysia.

Ecology.— Open areas or disturbed areas in evergreen forest; flowering March, fruiting May.

Vernacular.— Phrik khao (พริกเขา)(Nakhon Si Thammarat).

Notes.— *Piper ramipilum* has uniquely ramulose hairs on all parts except the fruit. The rows of floral bracts are alternately arranged with the rows of stamens.

34. Piper retrofractum Vahl, Enum. Pl. 1: 314. 1804; C.DC. in Lecomte, Fl. Indo-Chine 1: 83. 1910;

Backer & Bakh.f., Fl. Java 1: 172. 1963; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 128; 1999; Gardner, Blumea 51(3): 583. 2006.— *Chavica retrofracta* (Vahl) Miq., Syst. Piperac. 1: 275. 1843. Type: 'Habitat in India orientali', *unknown collector s.n.* (lectotype **C** [C10016619!], first step designated by Gardner, 2006, second step designated here).

— *P. longum* Blume, Verh. Batav. Gen. 11: 197. 1826. Type: not located.

— *P. chaba* Hunter, As. Res. 9: 391. 1809. Type: not located.

— *P. parvifolium* Blanco, Fl. Filip. 1: 23. 1837. Type: not located.— *Chavica parviflora* Hassk., in Fl. 47: 59. 1864. Type: not located.

— *P. officinarum* (Miq.) C.DC., Prodr. 16(1): 356. 1869.— *Chavica officinarum* Miq., Syst. Piperac. 1: 256. 1843. Type: Indonesia, Java, *Blume s.n.* (**K** [K000820050!]).

Thailand.— Cultivated: NORTHERN: Chiang Mai [Mae Sa, 4 Jan. 1989, *Pooma 137* (**BKF**, **CMUB**)]; CENTRAL: Saraburi [Phu Kae, 10 Jan. 1989, *Santisuk 6880* (**BKF**)]; Bangkok [Bangkhen, 4 May 1924, *Kerr 8960* (**BK**, **L**); 8 Aug. 1974, *Maxwell 74-748* (**BK**)]; Nonthaburi [Medicinal Plant Research Institute, 1 Apr. 2002, *Suwanphakdee 3* (**KKU**, **DMSC**)]; SOUTH-EASTERN: Chanthaburi [Muang, 14 July 2003, *Maxwell 03-194* (**BKF**, **CMUB**)]; Trat [Ban Kadan, 21 Nov. 1971, *Vidal 5796* (**BKF**)]; Rayong [Ban Pa, 2 Sept. 1979, *Sirisuk 343* (**CMUB**)]; Chon Buri [Sattahip, 5 Nov. 1969, *Maxwell* s.n. 5 Nov. 1969 (**BK**)]; SOUTH-WESTERN: Ratchaburi [Ban Ping, 15 Oct. 1916, *Winit 424* (**BKF**)]; PENINSULAR: Chumphon [Sawee, 23 Aug. 1988, *Vacharee 684* (**BK**)]; Suratthani [Wiangsa, 8 Aug. 2005, *Pooma et al. 5551* (**BKF**); Tha Chana, 13 June 2006, *Williams et al., 1708* (**BKF**)]; Phattalung [Khuan Khanun, 24 Dec. 2006, *Pooma et al. 6617* (**BKF**)]; Nakhon Si Thammarat [Thung Song, 27 July 1929, *Bunnak 222* (**BK**, **BM**, **L**)]; Satun [Muang, 10 Mar. 2006, *Middleton et al. 4195* (**BKF**)].

Distribution.— Bangladesh to the Philippines.

Vernacular.— Di pli (ดีปลี)(General); di pli chueak (ดีปลีเชือก)(Peninsular).

Ecology.— Cultivated, flowering and fruiting all year around.

Uses.— Economic plant used for spice and seasoning throughout Asia; also used for medicine.

Notes.— The plants all have fully connate fruits and erect infructescences. Male inflorescence collections are only known from the Philippines. The cultivated plant in Thailand is female only but can form fruits as this species can be parthenocarpic.

35. Piper ribesioides Wall., Pl. As. Rar. 1(4): 79. 1830; C.DC., Prodr. 16(1): 342. 1869; Hook.f., Fl. Brit. India 5: 81. 1887; Ridl., Fl. Malay Penins. 3: 34. 1924; Henderson, Malay.Wild Flow.Dicot. 4(3): 442. 1959; *Suwanphakdee et al.*, Kew Bull.73, 33: 14. 2018. Type: Myanmar, Chappedong, *Wallich s.n.* [Numer. List 6637] (lectotype **K-W** [K001124357!], designated by Suwanphakdee *et al.*, 2018; isolectotypes **BM** [BM000949830!], **G** [G00438866!], **G-DC** [G00206359!], **K** (4 sheets)[K000061828!, K000794384!, K000794385!, K000794386!]).

— *P. sumatranum (Miq.)* C.DC., Prodr. 16(1): 343. 1869; Hook.f., Fl. Brit. India 5: 81. 1887.— *Chavica sumatrana* Miq., Comm. Phyt.: 3: 33. 1840. Type: Malaysia Penang, *Wallich s.n.* [Numer. List 6646B] (lectotype **K-W** [K001124405!], designated by Suwanphakdee *et al.*, 2018; isolectotype **BM** [BM000949828!]).

Thailand.— EASTERN: Nakhon Ratchasima [Ka Tok, 30 Dec. 1943, *Kerr 8183* (**BK**, **BM**, **K**, **L**); Ban Rai, 23 Nov. 1924, *Kerr 9455* (**BK**, **BM**, **K**); Khao Yai NP, 19 Mar. 1965, *Kasem 447* (**BK**); 14 Mar. 1968, *van Beusekom & Phengklai 42* (**BKF**, **L**)]; Ubon Ratchathani [Phu Chong Na Yoi NP, 5 Dec. 2003, *Suwanphakdee 74* (**DMSC**)]; SOUTH-EASTERN: Prachinburi [Khao Yai NP, 27 Mar. 1998, *Wongprasert s.n.* (**BKF**)]; Chon Buri [Khao Khieo WS, 5 Jan. 1975, *Maxwell 75-4* (**BK**, **L**); 28 Mar. 1976, *Maxwell 76-166* (**BK**, **L**)]; SOUTH-WESTERN: Kanchanaburi [Thong Pha Phum NP, 31 Jan. 2004, *Suwanphakdee 86* (**BK**); same locality, 13 Apr. 2004, *Suwanphakdee 125* (**KKU**); *Suwanphakdee 127* (**DMSC**)]; CENTRAL: Nakhon Nayok [Khao Yai NP, 17 Mar. 2000, *Charoenchai 896* (**BKF**); 25 Apr. 2001,. *Maxwell 01-271* (**BKF**); 8 May 2006, *Maxwell 06-308* (**QBG**)]; PENINSULAR: Chumphon [Pa Toh, 27 Feb. 1927, *Kerr 12140* (**BK**, **BM**, **K**)]; Ranong [Khlong Na Kha WS, 4 Nov. 1974, *Geesink et al. 7570* (**BKF**, **K**, **L**); Muang Len, 11 Jan. 1966, *Hansen & Smitinand 11902* (**BKF**, **L**); 29 Sept.

2003, *Suwanphakdee 56* (**KKU**); *Suwanphakdee 57* (**DMSC**); 26 Jan. 2007, *Suwanphakdee 210* (**BK**)]; Phangnga [Sri Phangnga NP, 22 Mar. 2004, *Suwanphakdee 116* (**KKU**); 10 Dec. 2003, *Pooma et al.3764* (**BKF**)]; Krabi [Muang, 20 Oct. 2006, *Suwanphakdee 185* (**BK**)]; Nakhon Si Thammarat [Khao Luang NP, 23 Jan. 1966, *Sutheesorn 871* (**BK**); 25 Mar. 1993, Chantaranothai *et al.* 1371, (**TCD**); 7 May 2004, *Suwanphakdee 133* (**KKU**); *Suwanphakdee 134* (**DMSC**); 19 Apr. 2010, *Suwanphakdee 310* (**BK**, **BKF**, **KKU**); 2 Apr. 2010, *Suwanphakdee 267* (**BK**, **BKF**, **KKU**)]; Phatthalung [Khao Pu Khao Ya NP, Riang Tong Waterfall, 23 Mar. 1986, *Maxwell 86-213* (**BKF**, **L**)]; Trang [Yan Ta Khao, Khao Chong, 9 Mar. 1976, *Chermsirivattana & Sangkhachand 2210* (**BK**); 24 Nov. 1985, *Bunnab 185* (**BKF**); 17 May 2004, *Suwanphakdee 106* (**BKF**); 9 Nov. 1988, *Paisooksantivatana Y-2293-88* (**BK**)]; Yala [Betong, 26 July 1928, *Kerr 7330* (**BK**, **BM**, **K**, **L**)].

Distribution.— India, Myanmar, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Ecology.— Common in lowland and hill evergreen forest; flowering March, fruiting May.

Vernacular.— Ta khan lek (ตะค้านเล็ก)(Trat); ta khan yuak (ตะค้านหยวก)(Nakhon Si Thammarat).

Uses.— The stems are used for medicine.

Notes.— The fresh leaves of *Piper ribesioides* are the thickest of any Thai *Piper* spp. and are strongly coriaceous when dry. Leaf size and shape are variable and differ between those on the ground and those on the climbing part of the plant. The inflorescences can be single or in clusters of 2–3 inflorescences, and there are 3-ovate floral bracts surrounding the stamens or ovary. The fruits are globose, free with a long stalk (3–7 mm long) and shiny. The ripe fruits are dark orange to red and rugose when dry.

36. Piper ridleyi C.DC., Rec. Bot. Surv. Ind. 6: 19. 1912; Ridl., Fl. Malay Penins. 3: 33. 1924; Suwanphakdee *et al.*, Thai Forest Bull., Bot. 34: 210. 2006; Suwanphakdee *et al.*, Kew Bull. 73, 33: 14. 2018. Type: Malaysia, Selangor, Suiting Peras, *Ridley 7609* (lectotype **SING!**, designated by Suwanphakdee *et al.*, 2018; isolectotype **CAL** [CAL0000020946!]).

— *P. velutibracteatum* C.DC., Ann. Cons. Jard. Bot. Gen. 21: 289. 1920. Type: North Borneo, Labuk Bay, *Ridley s.n.* (holotype **SING**!).

— *P. malaccense* C.DC., Rec. Bot. Surv. Ind. 6: 12. 1912; Ridl., Fl. Malay Penins. 3: 33. 1924. Type: Malaysia, Moluccas, *Merliman 1617* (lectotype **K** [K000794929!], designated by Suwanphakdee *et al.*, 2018).

Thailand.— PENINSULAR: Yala [Betong, 6 Aug. 1923, *Kerr 7443* (**BK**, **BM**, **K**, **L**); 9 Aug. 1923, *Kerr 7903* (**K**); Kao Cha Bor, 27 Apr. 1931, *Lakshnakara 820* (**BK**, **BM**, **K**); 19 July 2004, *Pooma et al. 4427* (**BKF**)]; Narathiwat [Sungai Kolok, 3 Mar. 1974, *Larsen & Larsen 32890* (**BKF**); 7 Apr. 1997, *Niyomdham & Puudjaa 4978* (**BKF**); Waeng, 18 Nov. 1971, *C.S.S. 210* (**BKF**); Hala Bala WS, 5 May 2004, *Suwanphakdee 144* (**BKF**, **DMSC**)].

Distribution.— India, Malaysia, Indonesia, the Philippines.

Ecology.— In evergreen forest; flowering and fruiting May.

Vernacular.— Phlu rit le (พลูริดเลย์)(General).

Notes.— *Piper ridleyi* is an undershrub or small shrub and all its parts are covered with dense woolly or pilose hairs. The stipe of *P. ridleyi* is shorter than the fruit.

37. Piper rostratum Roxb., Fl. Ind. 1: 162. 1820; Hook.f., Fl. Brit. India 5: 87. 1887; Suwanphakdee & Chantaranothai, Trop. Nat. Hist. 8(2): 206. 2008; Suwanphakdee *et al.*, Kew Bull. 73, 33: 14. 2018.— *Peperomia rostrata* (Roxb.) A.Dietr., Sp. Pl. 1: 153. 1831. Type: Malaysia, Malacca, *Roxburgh 2675* (holotype **BM** [BM000939635!]).

— *Rhyncholepis roxburghii* Miq., Syst. Piperac. 1: 284. 1843. Type: Malaysia, Maluccas, *Roxburgh 2675* (holotype **BM** [BM000939635!]).

— *Piper stylosum* Miq., Ann. Bot. Mus. Lugd. Bat. 1: 139. 1863; Ridl., Fl. Malay Penins. 3: 42. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 440. 1959. Type: Indonesia, Sumatra, *Korthals s.n.* (lectotype **L** [L1547514!], designated by Suwanphakdee *et al.*, 2018; isolectotype **K** [K000820049!], **L** [L1547518!]).

— *P. birmanicum* C.DC., J. Bot. 4: 163. 1866. Type: Malaysia, Moluccas, *Griffith 4414* (lectotype **K**

[K000794910!], designated by Suwanphakdee *et al.*, 2018; isolectotype **K** (2 sheets)[K000794908! & K000790909!]).

Thailand.— PENINSULAR: Trang [Yan Ta Khao, Phu Pha Mek, 6 Apr. 2003, *Middleton et al. 1953* (**BKF**)]; Yala [Betong, 15 July 1923, *Kerr 7202* (**BK**, **BM**, **K**); 11 Aug. 1923, *Kerr 7571* (**BK**, **BM**, **K**); 12 Aug. 1923, *Kerr 7903A* (**K**), 19 July 2004, *Pooma et al. 4424* (**BKF**); Hala Bala WS, 1 May 2004, *Suwanphakdee 141* (**BK**, **DMSC**)]; Narathiwat [Hala Bala WS, 9 Mar. 2004, *Chongko 255* (**CMUB**); Khao Pi Sat, 30 Apr. 1998, *Niyomdham & Puudjaa 5457* (**BKF**)].

Distribution.— Malaysia, Singapore, Indonesia.

Ecology.— In lowland or hill evergreen forest; flowering and fruiting May.

Vernacular.— Cha phlu khon (ชะพลูขน)(General).

Notes.— *Piper rostratum* resembles *P. sarmentosum* but differs in having woolly, velutinous or scabrous hairs. Generally, the inflorescence is a catkin and sometimes spike-like. The fruits are free with a style-like spine at the apex (Fig. 2G).

38. Piper sarmentosum Roxb. in Hunter, As. Res. 11: 565. 1810; Ridl., Fl. Malay Penins. 3: 40. 1924; Backer & Bakh.f., Fl. Java 1: 172. 1963; Yongqian *et al.* in Wu & Raven, Fl. China 4: 119. 1999. Type: India, Calcutta, *Roxburgh 1267* (lectotype **BM** [BM000950704!]; designated by Gilbert & Xia, 1999).— *Chavica sarmentosum* (Roxb.) Miq., Syst. Piperac. 1: 242. 1843.

— *P. brevicaule* C.DC., Ann. Conserv. Jard. Bot. Gen. 2: 272. 1898; C.DC. in Lecomte, Fl. Indo-Chine 1: 71. 1910. Type: Vietnam, Tonkin, village de Tchontiao, *Balansa 3631* (lectotype **P** [P02030064!]; isolectotype **P**[P02030063!], designated by Gilbert & Xia, 1999)

— *P. lolot* C.DC., Ann. Conserv. Jard. Bot. Gen. 2: 272. 1898; C.DC. in Lecomte, Fl. Indo-Chine 1: 86. 1910.— Type: Vietnam, Tonkin, Environs de Quang-Yen, *Balansa 539* (holotype **P!**).

— *P. albispicum* C.DC. in Lecomte, Fl. Indo-Chine 5: 85. 1910. Type: Vietnam, Tonkin, meridional, *Bon 983* (holotype **G-DC** [G00317821!]).

— *P. gymnostachyum* C.DC. in Lecomte, Fl. Indo-Chine 5: 72. 1910. Type: Cambodia, Phuocthan, *Thorel "T" s.n.* (holotype **P** [P02025575!]).

— *P. pierrei* C.DC. in Lecomte, Fl. Indo-Chine 5: 78. 1910. Type: Vietnam, In Sylvis at Baochiang in austro cochinchine, *Pierre 1042* (lectotype **P** [P01656234!]; designated here; isolectotypes **G-DC** [G00322055!], **P** [P01656235!]).

— *P. saigonense* C.DC. in Lecomte, Fl. Indo-Chine 5: 79. 1910. Type: Vietnam, Ad urbem Saigon in austro Cochinchine, *Pierre 1142* (lectotype **P** [P01980655!], designated here; isolectotypes **C** [C10016632!], **G-DC** [G00323001!], **MO** [MO204016!], **P** (2 sheets)[P01980654!, P01980647!]).

— *P. siassiense* C.DC., Philip. J. Sci. 5: 443. 1910. Type: the Philippines, Siassi Island, *Merrill 5311* (lectotype **G-DC** [G00322960!]; designated here; isolectotype **NY** [NY00283930!], **P** [P02029921], **US** [US00107083!]).

Thailand.— NORTHERN: Chiang Mai [Muang, 9 July 1991, *Pooma 504* (**BKF**); Doi Chiang Dao WS, 4 Feb. 1979, *Bjørland & Schumacher 563* (**BKF**)]; Phayao [Doi Luang NP, 11 Aug. 1997, *Detrmitr 72* (**BKF**)]; Lampang [Mae Salop, 25 Sept. 1925, *Winit 1464* (**BK**, **BKF**); Muang Bahn, 29 Oct. 1996, *Maxwell* 96-1423 (**BKF**); Muang, 15 Apr. 2004, *Kietinum et al. 16* (**BKF**)]; Phitsanulok [Thung Salaeng Luang NP, 20 July 1966, *Larsen et al. 556* (**BKF**, **L**)]; NORTH-EASTERN: Loei [Chiang Karn, 3 Sept. 1968, *Phengnaren 589* (**BKF**); Phu Luang WS, 29 Sept. 1990, *Chantaranothai et al. 90/435* (**KKU**, **TCD**)]; Nakhon Panom [Muang, 4 Nov. 1982, *Vacharee 407* (**BK**)]; EASTERN: Nakhon Ratchasima [Khao Yai NP, 23 May 2002, *Detrmitr 520* (**BKF**); 10 July 2004, *Suwanphakdee154* (**BKF**)]; SOUTH-WESTERN: Uthai Thani [Huai Kha Khaeng WS, 18 Nov. 1989, *Smitinand 89-35* (**BKF**)]; Kanchanaburi [Kwae Noi River Basin, 2 May 1946, *Wichian 321* (**BK**, **L**); Sai Yok, 6 Nov. 1979, *Shimizu et al. T-21792* (**BKF**); 3 July 1963, *Larsen 10481* (**BKF**); Sangklaburi, 13 Aug. 1993, *Maxwell 93-893* (**BKF**)]; CENTRAL: Lop Buri [Wang Kan Leung Waterfall, 19 Nov. 1984, *Murata et al. T-51033* (**BKF**)]; Ang Thong [Muang, 17 Sept. 1972, *Maxwell 72-392* (**BK**)]; Saraburi [Sam Lan Waterfall, 29 July 1974, *Maxwell 74-745* (**BK**, **L**); 2 Nov. 1974, *Maxwell 74-960* (**BK**, **L**)]; Nonthaburi [Medicinal Plant Research Institute, 1 Apr. 2002, *Suwanphakdee 2* (**BKF**,**DMSC**)]; Bangkok [Bang Khen, 9 Oct. 1921, *Lakhanakhara 213* (**BK**, **L**); 5 Sept. 1924, *Kerr 11041* (**BK**); 28 June 2004, *Suwanphakdee 147* (**BK**)]; SOUTH-EASTERN : Chon Buri [Sriracha, 26

Aug. 1924, *Collins 1009* (**BK**)]; Chanthaburi [Khao Soi Dao Wildlife Sacntuary, 24 Aug. 1972, *Larsen et al. 31934* (**BKF**); Priw Waterfall, 19 Jan. 1958, *Sørensen et al. 541* (**BKF**, **L**)]; PENINSULAR: Surat Thani [Ko Samui, 8 Apr. 1927, *Kerr 12535* (**BK**, **BM**); 3 Dec. 1974, *Geesink et al. 7741* (**BKF**, **K**); 14 July 2003, *Suwanphakdee 47* (**KKU**); Oct. 1915, *Vanpruk 777* (**BKF**, **K**)].

Distribution.— India, Sri Lanka, Myanmar, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Ecology.— Common or in disturbed areas or cultivated; flowering and fruiting all year round.

Vernacular.— Cha phlu (ชะพลู)(General).

Uses.— The leaves are used locally as a vegetable and the roots are used for medicine.

Notes.— This species is common in Southeast Asia and has a number of synonyms. *Piper saigonense* was named by Candolle (1910), with *Pierre 1142* as the type. We found several collections under this number and chose the collection from **P** [P01980655] as the lectotype because it is the best preserved. The Philippine species, *P. siassiense* was also published by Candolle (1910) and was based on *Merrill 5311*. We again found several collections and chose the specimen from **G-DC** [G00322960] as the lectotype, as it is the best available material.

Piper sarmentosum is markedly variable in leaf shape and size, and they also differ between male and female plants. In general, the inflorescence is a catkin but can sometimes be a spike. The male inflorescence is longer than the female and is fragrant. Both male and female inflorescences, as well as the infructescences, are erect. The fruits are free or sometimes connate at the base and are dark purple or black when ripe.

39. Piper smitinandianum Suwanp. & Chantar., Thai Forest Bull., Bot. 40: 34. 2012. Type: Narathiwat, Waeng, 12 June 1970, *Smitinand 10907* (holotype **BKF**!).

Thailand.— PENINSULAR: Narathiwat [Waeng, 20 Sept. 1965, *Phengklai & Smitinand 1188* (**BKF**), 12 June 1970, *Smitinand 10907* (**BKF**), 22 Nov. 1971, *C.S.S. 268* (**BKF**), same locality, 28 Oct. 2017, *Suwanphakdee 553* (**BK**, **BKF**, **QBG**), same date, *Suwanphakdee 554* (**BKF**)].

Distribution.— Endemic.

Ecology.— Along streams in evergreen forest; flowering September–November, fruiting November–June.

Vernacular.— Prik thai a chan tem (พริกไทยอาจารย์เต็ม)(General).

Notes.— Suwanphakdee *et al.* (2012) published *Piper smitinandianum* as a new species based on herbarium specimens deposited in **BKF**. Later, the first author revisited the type locality, collected living specimens and found a male plant, which allowed further morphological characters to be added to the species description. The plant has prop-roots from the nodes. The male inflorescence is cylindrical and 3–5 cm long. The male flower has a rounded floral bract 1.5–2 mm in diameter. The anthers are 1–1.5 mm long with 1 mm long filaments. The peduncle is 1–1.5 cm long. The inflorescence is 1.5–4 by 1–1.5 cm (Fig. 2H).

40. Piper suipigua Buch-Ham. ex D.Don, Prodr. Fl. Nepal. 20. 1825; Long in Grierson & Long, Fl. Bhutan 1(2): 350. 1984; Yongqian *et al.* in Wu & Raven, Fl. China 4: 128. 1999; Mukherjee, Phytotaxa 338(1): 28. 2018.— *Chavica suipigua* (Buch-Ham. ex D.Don) Miq., Syst. Piperac. 1: 275. 1843. Type: Nepal, Naranhetty, 21 Aug. 1802, *Buchanan s.n.* (holotype **BM** [BM000950698!]; isotype **G-DC** [G00206597]!).

— *P. nepalense* Miq., Syst. Piperac. 1: 318. 1843. Type: Nepal, *Wallich s.n.* [Numer. List 6650B] (lectotype **U** [U1476540!], designated by Mukherjee, 2018; isolectotypes **BR** [BR0000006599409!], **C** [C10016600!], **CAL**, **G-DC** (3 sheets)[G00206597!, G00206598! & G00206595!], **GZU** (2 sheets) [GZU000256215! & GZU000256228!], **K** [K000794463!], **K-W** [K001124409!]).

Thailand.— NORTHERN: Mae Hong Son [Mae Surin NP, 20 Oct. 2009, *Suwanphakdee 276* (**BK**, **BKF**, **KKU**)]; Chiang Mai [San Kamphaeng, 5 Oct. 1995, *Maxwell 95-841* (**BKF**); Doi Suthep NP, 26 July 1914, *Kerr 3306* (**BM**, **L**); 30 Oct. 1994, *Nanakorn et al. 2597* (**QBG**); 28 May 1988, *Maxwell 88-693* (**BKF**, **L**); 12 Aug. 1988, *Maxwell 88-987* (**BKF**, **L**); 14 July 1988, *Koyama T-61908* (**BKF**); 10 May 1999, *Nanakorn s.n.* (**QBG**); 19 Oct. 2003, *Suwanphakdee 66* (**BK**, **BKF**, **KKU**); Mae On, 5 Oct. 1995, *Maxwell 93-841* (**BKF**); 23 Oct 2005,

Maxwell 05-596 (**BKF**); Khun Awn, 31 June 1921, *Kerr 4741* (**BK**, **BM**, **L**); Doi Inthanon NP, 7 Nov. 1980, *Put 3394* (**BK**, **BM**, **L**), 11 Dec. 2007, *Tanaka 8146* (**QBG**); 3 Aug. 1988, *Phengklai 7477* (**BKF**), 26 July 1988, *Koyama T-61136* (**BKF**), 26 July 1988, *Takahashi T-62546* (**BKF**); 10 Dec. 1969, *van Beusekom & Phengklai 2444* (**BKF**, **L**); 26 June 1978, *Phengklai et al. 4107* (**BKF**); 8 Dec. 1981, *Koyama & Phengklai T-49903* (**BKF**); 5 Dec. 1984, *Mitsuta et al. T-43155* (**BKF**); 8 Dec. 1984, *Nagamasu T-50068* (**BKF**); 29 Nov. 1991, *Pooma 621* (**BKF**); 10 Sept. 1994, *Palee 253* (**BKF**); 16 Sept. 1995, *Larsen et al. 46521* (**BKF**); 16 Oct. 2001, *Srisanga & Maknoi 2188* (**QBG**); 9 Apr. 2004, *Suwanphakdee 59* (**BK**, **BKF**, **KKU**); 30 May 1979, *Vidal et al.6181* (**BKF**); Doi Chiang Dao WS, 14 Sept. 1967, *Shimizu T-10048* (**BKF**); 10 Nov. 1972, *Smitinand 7806* (**BKF**); 26 Jan 1996, *Maxwell 96-85* (**BKF**); 21 Dec. 2003, *Suwanphakdee 79* (**BK**, **BKF**, **KKU**); 4 Aug. 2007, *Watthana 2428* (**QBG**); 12 Dec. 2008, *Suwanphakdee 254* (**BK**, **BKF**, **KKU**); Mae Chaem, 18 Dec. 1998, *Konta et al. 4751* (**BKF**); 28 July 1988, *Phengklai 7075* (**BKF**); Huai Namdang NP, 27 May 1977, *Santisuk 1065* (**BKF**); Mae Rim, 3 Jan. 1972, *Smitinand 11544* (**BKF**); 17 Dec. 2006, *Pongamornkul 1910* (**QBG**); 14 Oct. 2010, *Suwanphakdee 343* (**BK**, **BKF**, **KKU**)]; Chiang Rai [Kun Chae NP, 18 July 1997, *Chayamarit 824* (**BKF**); Khunkorn Waterfall, 26 Mar. 2010, *Suwanphakdee 292* (**BK**, **BKF**, **KKU**)]; Nan [Doi Phu Kha NP, 14 Feb. 2004, *Suwanphakdee 97* (**BK**, **BKF**, **KKU**); 11 Feb. 2006, *Suwanphakdee 173* (**BK**, **BKF**, **KKU**); 4 Oct. 2010, *Suwanphakdee 321* (**BK**, **BKF**, **KKU**); *Suwanphakdee 322* (**BK**, **BKF**, **KKU**); 8 Oct. 2010, *Suwanphakdee 338* (**BK**, **BKF**, **KKU**)]; Lamphun [Doi Khun Tan NP, 4 Sept. 1967, *Tagawa et al. T-9158* (**BKF**, **L**); Mae Tha, 25 Sept. 1993, *Maxwell 93-1115* (**BKF**)]; Lampang [Chae Son NP, 22 June 1996, *Maxwell 96-849* (**BKF**); Muang Pan, 1 Dec. 1995, *Maxwell 95-1215* (**BKF**)]; Uttaradit [Phu Soi Dao NP, 14 Nov. 2010, *Suwanphakdee 348* (**BK**, **BKF**, **KKU**)]; Tak [Mae Tun, 3 July 1922, *Kerr 6221* (**BK**, **BM**, **L**); Thung Yai Naresuan WS, 14 Jan. 2011, *Suwanphakdee 365* (**BK**, **BKF**, **KKU**)]; Sukhothai [Ramkamhaeng NP, 8 Dec. 1987, *Paisooksantivatana & Sangkhachand Y-2201-87* (**BK**); 18 Jan. 2004, *Suwanphakdee 84* (**BK**, **BKF**, **KKU**); 29 Jan. 1995, *Maxwell 95-53* (**BKF**)]; Phitsanulok [Thung Salaeng Luang NP, 10 May 2004, *Kudjabnak & Watanachaiyingcharoen BRT 0077* (**BKF**); 18 Nov. 2010, *Suwanphakdee 356* (**BKF**, **KKU**); Phu Hin Rongkla NP, 17 July 2004, *Suwanphakdee 157* (**BK**, **BKF**, **KKU**); *Suwanphakdee 158* (**BK**)]; NORTH-EASTERN: Loei [Phu Kradeung NP, 6 May 1948, *Nakkan 2* (**BKF**); 24 Dec. 1971, *van Beusekom et al. 4516* (**BKF**, **L**), 2 Sept. 1988, *Takahashi T-63531* (**BKF**); 16 June 2004, *Suwanphakdee 145* (**BK**, **BKF**, **KKU**); 8 Nov. 2010, *Suwanphakdee 347* (**BK**, **BKF**, **KKU**)].

Distribution.— Nepal, China, Myanmar.

Ecology.— In high altitudes and mountain summits in pine and oak forest; flowering June–August, fruiting October–December.

Vernacular.— Chak khan hua wok (จักค้านหัววอก) (General).

Uses.— Used as a medicinal plant.

Notes.— This species is similar to the introduced *Piper nigrum* but is native and differs in its leaf indumentum, catkins, rounded floral bract and stamen number. The fruit is smaller than *P. nigrum* and ovoid, trigonoid or ellipsoid. The dry fruit has a granuloid surface.

41. Piper sulcatum Blume, Verh. Batav. Gen. 11: 158. 1826; Backer & Bakh.f., Fl. Java 1: 172. 1963. Suwanphakdee *et al.*, Nordic J. Bot. 34: 617. 2016. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1542853!], designated by Suwanphakdee *et al*., 2016; isolectotype **G-DC** [G00206472!]).

— *P. nigrescens* Blume, Verh. Batav. Gen. 11: 161. 1826.— *Cubeba nigrescens* (Blume) Miq., Comm. Phytogr.: 33. 1840. Type: Indonesia, Java, *Blume s.n.* (lectotype **L** [L1542854!], designated by Suwanphakdee *et al*., 2016; isolectotype **BO!**).

Thailand.— SOUTH-WESTERN: Phetchaburi [Kaeng Krachan NP, 28 Mar. 2003, *Middleton et al.1759* (**BKF**, **K**)]; SOUTH-EASTERN: Chanthaburi [Khao Soi Dao WS, 26 Nov. 1979, *Shimizu et al. T-23715* (**BKF**, **L**)]; PENINSULAR: Chumphon [Muang, 26 Feb. 1983, *Koyama et al. T-33751* (**BKF**, **L**); Thung Tako, 27 Sept. 2003, *Suwanphakdee 53* (**BK**, **BKF**, **DMSC**, **KKU**); Lang Suan, 19 June 1928, *Put 1741* (**BK**)]; Ranong [Khlong Nakha WS, 2 May 1974, *Larsen & Larsen 33570* (**AAU**, **BKF**, **L**)]; Phangnga [Sri Phangnga NP, 8 Nov. 2009, *Suwanphakdee 280* (**BK**, **BKF**, **KKU**)]; Narathiwat [Hala Bala WS, 20 Mar. 2008, *Pertmitr 777* (**CMUB**)].

Distribution.— India, Malaysia, Indonesia, the Philippines.

Ecology.— In evergreen forest by streams or near waterfalls; flowering September, fruiting October to December.

Vernacular.— Prik thai khon (พริกไทยขน) (General).

Notes.— Generally, the fruits of *Piper sulcatum* look like those of *P. nigrum*. However, *P. sulcatum* native to Thailand and differs in being a slender woody climber possessing chartaceous leaves with velutinous or pilose indumentum and hairy leaf margins. The inflorescence is a catkin and the floral bract is rounded. The male inflorescence is longer than the female one, and the fruit apex is retuse when dry.

42. Piper sylvaticum Roxb., [Hort. Bengal.: 4. 1814, **nom. nud.** ex] Fl. Ind. 1: 158. 1820; Hook.f., Fl. Brit. India 5: 83. 1887; Long in Grierson & Long, Fl. Bhutan 1(2): 348. 1984; Yongqian, Xia & Gilbert in Wu & Raven, Fl. China 4: 121. 1999; Mukherjee, Phytotaxa 338(1): 29. 2018; Suwanphakdee *et al*., Kew Bull. 73, 33: 17. 2018.— *Chavica sylvatica* (Roxb.) Miq., Syst. Piperac.1: 248. 1843. Type: India, 'mountains on the northwest border of Bengal' *Roxburgh s.n*. (lectotype Icones Roxburghianae Ineditae, Plate 2168, **K!**, designated by Mukherjee, 2018; isolectotype Plate 2168A **CAL**).

— *P. petiolatum* C.DC., J. Bot. 4: 161. 1866.— *Chavica petiolata* (C.DC.) C.DC., Prodr. 16(1): 389. 1869. Type: India, Bangladesh, "East Bengal" *Griffith 4405* (lectotype **K** [K000794631!], designated by Suwanphakdee *et al.*, 2018; isolectotype **K** [K000794632!]).

— *P. bavinum* C.DC., Ann. Conserv. Jar. Bot. Gen. 2: 270. 1898; C.DC. in Lecomte, Fl. Indo-Chine 1: 80. 1910. Type: Vietnam, Lambok, *Balansa 3630* (lectotype **P** [P02030119!], designated by Gilbert & Xia, 1999).

— *P. punctulinevum* C.DC. in Lecomte, Fl. Indo-Chine 5: 77. 1910. Type: Lao PDR, Luang Prabang. *Thorel s.n*. (lectotype **P** [P01655983!], designated by Gilbert & Xia, 1999).

— *P. punctulinevum* var. *panifolium* C.DC. in Lecomte, Fl. Indo-Chine 5: 77. 1910. Type: Laos PDR, Paklai, *Thorel s.n*. (holotype **P** [P01655982!]).

— *P. thomsonii* (C.DC.) Hook.f. var. *trichostigma* Chaveerach & Sudmoon, Act. Phytotax.et Geobot. 58(1): 35–38. 2007. Type: Thailand, Mae Hong Son, Mae Sariang, *A. Chaveerach 49* (holotype **BK!**).

— *P. trichostigma* (Chaveerach & Sudmoon) Suwanph. & Chantar., Blumea 43 (3): 235. 2011. Type: Thailand, Phetchaburi, Kaeng Krachan NP, *Suwanphakdee 259* (epitype **BK!** designated by Suwanphakdee *et al.*, 2011; isoepitypes **BKF!**, **KKU!**, **QBG!**).

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao WS, 19 Apr. 1956, *Suvarnakoses 1155* (**BKF**, **L**); 16 July 1968, *Larsen et al. 2554* (**BKF**), 5 June 1973, *Geesink et al. 5703* (**BKF**, **L**); 8 Apr. 1989, *Maxwell 89-428* (**BKF**, **L**); 14 Aug. 1995, *Maxwell 95-498* (**BKF**); Mae Taeng, 30 July 1997, *Maxwell 97-796* (**BKF**)]; Chiang Rai [Doi Luang NP, 18 June 2002, *Chamchamroon et al.1484* (**BKF**); Mae Sai, 2 June 2007, *Maxwell 07-372* (**QBG**)]; Nan [Doi Pha Chang WS, 4 Aug. 1998, *Maxwell 98-803* (**BKF**); Doi Phu Kha NP, 21 Nov. 1993, *Larsen et al. 44671* (**AAU**, **BKF**, **K**, **PSU**); 25 Sept. 2000, *Srisanga 1699* (**QBG**); 14 Feb. 2004, *Suwanphakdee 94* (**BK**, **BKF**, **KKU**); 2 July 2004, *Suwanphakdee 152* (**BK**, **BKF**, **KKU**); Khun Nan NP, 5 Apr. 2010, *Suwanphakdee 324* (**BK**)]; Payao [Doi Luang NP, 28 Mar. 2010, *Suwanphakdee 293* (**BK**, **BKF**, **KKU**)]; Phrae [Huai Hom, 20 Mar. 1961, *Adisai 48* (**BKF**)]; Tak [Doi Muser,12 Apr. 1985, *Paisooksantivatana 1565-85* (**BK**); Mae Sot, 12 May 1960, *Smitinand6007* (**BKF**); Thi Lo Su Waterfall, Umphang WS, 20 Mar. 2003, *Suwanphakdee130* (**BK**, **BKF**)]; NORTH-EASTERN: Loei [Phu Luang WS, 12 Apr. 1968, *Chemsirivathana 824* (**BK**); May 1998, *Chayamarit 1326* (**BKF**)]; CENTRAL: Nakhon Nayok [Nang Rong Waterfall, 13 Aug. 1968, *Larsen et al. 3053* (**AAU**, **BKF**, **L**)]; SOUTH-WESTERN: Kanchanaburi [Thong Pha Phum NP, 26 Jan. 2003, *van de Bult 621* (**BKF**); 15 Apr. 2004, *Suwanphakdee 129* (**BK**, **BKF**, **KKU**); Khao Lam NP, 1 May 2009, *Suwanphakdee 274* (**BK**, **BKF**, **KKU**); Sangkhlaburi, 8 May 1946, *Kostermans 351* (**BK**, **SING**); *Kostermans 351a* (**BK**, **SING**); 21 May 1946, *Bloombergen 619* (**BK**); 27 Mar. 1968, *van Beusekom & Phengklai 136* (**BKF**, **L**); 1 Apr. 1968, *van Beusekom & Phengklai 250* (**BKF**, **L**); 1 Aug. 1968, *Sangkhachand 1450* (**BK**); 14 Aug. 1971, *Phengklai et al. 2940* (**BKF**); 29 Apr. 2002, *Suwanphakdee 4* (**BK**, **BKF**, **KKU**, **QBG**); 11 Mar. 2003, *Suwanphakdee 31* (**BK**,

BKF, **KKU**); 31 Mar. 2005, *Suwanphakdee163* (**BK**, **BKF**, **KKU**); 1 Apr. 2005, *Suwanphakdee165* (**BK**,**BKF**, **KKU**)]; Phetchaburi [Kaeng Krachan NP, 4 Dec. 1993, *Larsen et al. 45041* (**AAU**, **K**, **PSU**); 30 Jan. 1995, *Williams et al. 1221*(**BKF**), 14 Dec. 2002, *Middleton et al. 1644* (**BKF**, **K**); 7 Apr. 2004, *Suwanphakdee 123* (**BK**, **BKF**, **KKU**, **QBG**); 26 Dec. 2008, *Suwanphakdee 259* (**BK**, **BKF**, **KKU**, **QBG**)]; PENINSULAR: Chumphon [Pha To, 6 July 1992, *Larsen et al. 43153* (**BKF**, **PSU**)]; Ranong [Khao Pawta Chongdong, 21 Jan. 1929, *Kerr 16804* (**BK**)]; Phangnga [Khao Lak, Takua Pa, 5 May 1973, *Geesink & Santisuk 5195* (**BKF**, **L**)]; Krabi [Khao Phanom, 31 Mar. 1930, *Kerr 15792* (**BK**)].

Distribution.— India, Sri Lanka, Bangladesh, China, Myanmar, Laos.

Ecology.— In shaded or partially open areas by streams or waterfalls in evergreen forest; flowering March–April, fruiting March–May.

Vernacular.—Sakhandong(สะค้านดง)(Kanchanaburi).

Uses.— Eaten locally as a vegetable.

Notes.— The lower surface of the leaf in *Piper sylvaticum* is pale yellow and the netted venation is very showy.Inflorescence length is variable but the male inflorescence is slender and much longer than the female. The infructescences are erect or slightly erect. The fruit is free, densely arranged and sessile, and the ripe fruits are dark orange or slightly pale red.

43. Piper thomsonii Hook.f., Fl. Brit. India 5: 87. 1885; Yongqian *et al.* in Wu & Raven, Fl. China 4: 120. 1999.— *Chavica thomsonii* C.DC., Prodr. 16(1): 389. 1869. Type: Sikkim, Khasia mountain, *Hooker & Thomson 18* (holotype **K** [K000794638!]).

Thailand.— NORTH-EASTERN: Loei [Phu Luang WS, 12 Apr. 1928, *Chermsirivatana 824* (**BK**); 16 Mar. 2002, *Chamchamroon & Puff 1413* (**BKF**)]; Nong Khai [Phon Phisai, 7 June 1963, *Adisai 480* (**BK**)]; Sakon Nakhon [Phu Phan NP, not record, *Chantaranothai 537* (**KKU**); 10 May 1997, *Pooma 1635* (**BKF**)]; Kalasin [Kuchinarai, 7 Aug. 1963, *Prachit 362* (**BK**)]; Nakhon Phanom [Dong Bang-I, 15 May 1932, *Kerr 21473* (**BK**, **BM**)]; EASTERN: Chaiyaphum [Phu Khiao WS, 23 June 1970, *Sangkhachand & Bunchuai 1670* (**BKF**); 12 Dec. 1971, *van Beusekom et al. 4193* (**BKF**, **L**); 3 Aug. 1972, *Larsen et al. 31316* (**BKF**); 25 June 1974, *Geesink et al. 6957* (**BKF**, **K**, **L**); 14 Jan. 1983, *Nanakorn 158* (**BKF**)]; Nakhon Ratchasima [Khao Yai NP, 10 Aug. 1968, *Larsen et al. 3258* (**AAU**, **BKF**, **L**)]; SOUTH-EASTERN: Sa Kaeo [Khao Ta Kiap, 22 May 2003, *Suwanphakdee 46/1* (**KKU**)]; Chon Buri [Sriraha, Ban Don, 30 Mar. 1920, *Kerr 4125* (**BM**, **L**); Khao Khieo WS, 24 June 1975, *Maxwell 75-663* (**BK**)].

Distribution.— India, China.

Ecology.— In open or disturbed areas in mixed deciduous or dry evergreen forest; flowering March–May, fruiting June–August.

Vernacular.— Phlu thomson (พลูทอมสัน) (General).

Notes.— *Piper thomsonii* is a slender woody climber. The inflorescence and infructescence are subglobose or globose and erect. Each infructescence contains 5–8 fruits which are densely crowded along the rachis and connate at the base in some specimens.

44. Piper umbellatum L., Sp. Pl.: 43. 1753; C.DC. in Lecomte, Fl. Indo-Chine 1: 67. 1910; Ridl., Fl. Malay Penins. 3: 51. 1924; Henderson, Malay. Wild Flowers Dicot. 4(3): 438. 1959; Yongqian *et al.* in Wu & Raven, Fl. China 4: 128. 1999.— *Pothomorphe umbellata* (L.) Miq., Comm. Phytogr.: 36. 1840.— *Lepianthes umbellatum* (L.) Raf., Sylva Tellur.: 85. 1838.— *Heckaria umbellata* (L.) Kunth, Linnaea 13: 569. 1839. Type: "Saururus arborescens, foliis amplis, cordatis non umbilicatis" in Plumier, Descr. Pl. Amér.: 55, t. 73. 1693 (lectotype, designated by Huber, 1987).

— *P. peltatum* L., Sp. Pl.: 42. 1753.— *Pothomorphe peltata* (L.) Miq., Comm. Phytogr.: 37. 1840; Backer & Bakh.f., Fl. Java 1: 168. 1963. Type: "*Saururus arborescens* foliis amplis rotundis et umbilicatis" in Plumier, Descr. Pl. Amér., 56, t. 74. 1693 (lectotype, designated by Howard, 1973).

— *P. subpeltatum* Willd., Sp. Pl., ed. 4 [Willdenow] 1(1): 166. 1797.— *Heckeria subpeltata* (Willd.) Kunth, Linnaea 13: 571. 1839.— *Piper subpeltata* (Willd.) Miq., Comm. Phyt.: 36. 1840; Backer & Bakh.f., Fl. Java 1: 168. 1963.— *P. umbellatum* L. var. *subpeltatum* (Willd.) C.DC., Candollea 1: 170. 1923. Type: not located.

— *P. reniforme* Poir., Encycl. (Lam.) 5: 465. 1804. Type: not located.

— *P. dombeyanum* C.DC., Prodr. 16(1): 332. 1869. Type: Peru, *Poeping 1389* (holotype **G-DC** [G00206096!]).

Thailand.—NORTHERN: Chiang Mai [Doi Chiang Dao WS, 21 Dec. 1940, *Garrett 1213*, (**TCD**); 2 Nov. 1961, *Bunchuai 1167* (**BKF**); 27 Nov. 1962, *Bunchuai 1232* (**BKF**); 3 June 1973, *Geesink et al. 5648* (**BKF**, **L**); 12 Feb. 1989, *Maxwell 89-200* (**BKF**, **CMUB**); 8 Oct. 1995, *Maxwell 95-849* (**BKF**, **CMUB**)]; Chiang Rai [Mae Chaem, 27 Jan. 1970, *Sutheesorn 1547* (**BK**); Mae Fa Luang, 8 Sept. 2006, *Maxwell 06-657* (**CMUB**)]; Phayao [Doi Luang NP, 7 May 1997, *Maxwell 97-471* (**CMUB**)]; Nan [Pua, Hue Sala, 10 Mar. 1921, *Kerr 5073* (**BK**, **BKF**, **BM**, **K**); Na Noi, 26 July 1992, *Larsen et al. 43595* (**BKF**); 16 Aug. 1995, *Pooma1078* (**BKF**); Doi Phachang, 4 Aug. 1998, *Maxwell 98-804* (**BKF**, **CMUB**)]; Payao [Doi Luang NP, 7 May 1997, *Maxwell 97-471* (**BKF**)]; Lampang [Mae Ngao, 4 Sept. 1922, *Winit 763* (**BK**, **BKF**, **K**); Chae Son NP, 26 July 1996, *Maxwell 56-1021* (**BKF**); Chae Hom, 7 Jan. 1992, *Maxwell 92-12* (**CMUB**); Muang Bahn, 23 May 1996, *Panatkool 61* (**CMUB**); Wang Nua, 26 July 1996, *Maxwell 96-1021* (**CMUB**)]; Tak [Muang, 3 Nov. 1984, *Paisooksantivatana 1464-84* (**BK**); Mae Sot, 22 July 1959, *Smitinand & Flonto 5999* (**BKF**); Doi Mu Sor, 7 Dec. 1960, *Umpai 3* (**BK**)]; SOUTH-WESTERN: Uthai Thani [Ban Rai, 3 May 1963, *Kasem 371* (**BK**)]; Kanchanaburi [Sisawat, 25 May 1962, *Kasem 176* (**BK**); Thong Pha Phum NP, 5 Feb. 1972, *Larsen & Smitinand 9571* (**BKF**); 24 Aug. 1999, *Wongprasert s.n.*, 24 Aug 1999 (**BKF**); 18 Dec. 2003, *Suwanphakdee 76* (**KKU**, **DMSC**); Sangkhlaburi, 6 Aug. 1968, *Sangkhachand 1478* (**BK**); 14 Aug. 1971, *Phengklai et al. 2946* (**BKF**); 11 Oct. 1993, *Maxwell 93-1216* (**CMUB**)]; Phetchaburi [Kaeng Krachan NP, 12 Aug. 2002, *Middleton et al. 1017* (**BKF**, **CMUB**); *Middleton et al. 3320* (**BKF**)]; Prachuap Khiri Khan [Phraek Ta Khraw Waterfall, 19 Jan. 2004, *Middleton et al. 2259* (**BKF**); Khao Luang, Huai Yang Waterfall NP, 12 Apr. 2010, *Suwanphakdee 301* (**BK**, **KKU**)]; SOUTH-WESTERN: Prachin Buri [Krabin Buri, 27 Mar, 1975, *Sutheesorn 3203* (**BK**)]; Chanthaburi [Khao Soi Dao WS, 13 May 1974, *Geesink et al. 6714* (**BKF**, **K**, **L**)]; PENINSULAR: Surat Thani [Khlong Phanom, 21 Feb. 2001, *Chayamarit et al.2615* (**BKF**); Ko Samui, 11 Mar. 1930, *Kerr 12542* (**BK**)]; Phangnga [Bang Toi, 11 Mar. 1930, *Kerr 18542* (**BK**, **BM**, **K**)]; Nakhon Si Thammarat [Khao Luang NP, 8 Mar. 1922, *Smith 688* (**BK**, **BM**, **K**); 17 Jan. 1966, *Tagawa et al. T-4536* (**BKF**, **L**); 25 Jan. 1966, *Hansen & Smitinand 12051* (**BKF**); 30 Jan. 1966, *Sutheesorn 844* (**BK**); 15 Dec. 1989, *Maxwell 85-1135* (**BKF**); 25 Mar. 1993, *Chantaranothai et al. 1381* (**TCD**); 17 Dec. 1994, *Ploenchit 222* (**BKF**); 7 May 2004, *Suwanphakdee 138* (**DMSC**); 20 Mar. 2008, *Suwanphakdee 227* (**BK**, **BKF**); 1 Apr. 2009, *Suwanphakdee 265* (**BK**)]; Trang [Khao Chong, 13 Mar. 1974, *Larsen & Larsen 33274* (**BKF**, **L**); 10 Oct. 1970, *Charoenpol et al. 3600* (**BKF**, **K**, **L**); 13 July 1985, *Maxwell 85-706* (**BKF**)]; Songkhla [Ton Nga Chang WS, 27 May 1985, *Maxwell 85-544* (**BKF**)]; Yala [Betong, 8 July 1928, *Kerr 7428* (**BK**, **BM**, **K**),14 Feb. 2004, *Middleton et al. 3079* (**BKF**, **KEP**)].

Distribution.— India, Sri Lanka, China, Laos, Vietnam, Cambodia, Malaysia, Indonesia, the Philippines.

Ecology.— In disturbed areas; flowering March–April, fruiting April.

Vernacular.— Han mu (หานหมู)(Northern); rok chang (รกช้าง)(Nakhon Si Thammarat).

Uses.— Young leaves are used locally as a vegetable (Nakhon Si Thammarat).

Notes.— The inflorescence of *Piper umbellatum* is characteristically a spike-like umbel originating from leaf-axils. The fruits appear similar to *Peperomia* in dry specimens but are obviously drupes in fresh material. Some botanists place this species in the genus *Potomorphe*.

45. Piper viridescens Suwanph. & Chantar. Nordic J. Bot. 32(4): 459. 2014. Type: Thailand, Nan, Khun Nan NP, 5 August 2010, *Suwanphakdee 325* (holotype **BKF!**; isotypes: **BK!**, **KKU!**, **QBG!**).

Thailand.—NORTHERN: Nan [Khun Nan NP, 5 Aug. 2010, *Suwanphakdee 325* (**BK**, **BKF**); same locality, 8 Oct. 2010, *Suwanphakdee 337* (**BK**, **BKF**); same locality, 7 Jan. 2013, *Suwanphakdee 382* (**BK**, **BKF**); *Suwanphakdee 383* (**BK**, **BKF**); *Suwanphakdee 384* (**BK**, **BKF**)].

Distribution.— Endemic.

Vernacular.— Di pli din (ดีปลีดิน)(General).

Ecology.—In evergreen forest by streams or waterfalls; flowering January–February, fruiting March–May.

Notes.—This plant is similar to *Piper boehmeriifolium* var. *boehmeriifolium* but is smaller and also differs in its woolly velutinous orpilose and glabrescent stem. The inflorescence and infructescence are shorter than *P. boehmeriifolium* var. *boehmeriifolium*. The floral bract is rounded. The infructescence is fully concrescent and the ripe fruit is dark green.

46. Piper wallichii (Miq.) Hand.-Mazz., Symb. Sin. Pt. 7: 155. 1929; Gilbert & Xia, Novon 9(2): 191. 1999; Yongqian *et al.* in Wu & Raven, Fl. China 4: 126. 1999; Mukherjee, Phytotaxa 338(1): 30. 2018.— *Chavica wallichii* Miq., Syst. Piperac. 1: 254. 1843.— *Piper aurantiacum* Wall. ex C.DC., Prodr. 16(1): 357. 1869; Hook.f., Fl. Brit. India 5: 86. 1887. **nom. illegit.** Type: Nepal, *Wallich s.n.* [Numer. List 6658A] (lectotype **K-W** [K000639619!], designated by Gilbert & Xia, 1999; isolectotypes **BM** [BM000950694!], **E** [E00313749!], **K** [K001124433!], **P** [P00624877!]).

— *P. chawya* (Miq.) C.DC., Prodr. 16(1): 351. 1869, as '*chuvya*'.— *Chavica chuvya* Miq., Syst. Piperac. 1: 267. 1843. Type: India, Gongachora, *Wallich s.n.* [Numer. List 6650C] (holotype **K-W** [K001124412!]).

— *P. henryei* C.DC., Ann. Conserv. Jard. Bot. Gen.: 271. 1898. Type: China, Hupei, *Henry 3311* (holotype **G-DC** [G00438864!]; isotypes **GH**, **MEL**).

— *P. aurantiacum* Wall. ex C.DC. var. *hupeense* C.DC., Notizbl, Konigl. Bot. Gart. Berlin-Dehlem 6: 478. 1917.— *P. wallichii* var. *hupeense* (C.DC.) Handel-Mazetti, Symb.Sin.7: 155. 1929. Type: China, Hupei, *Henry 3893* (lectotype **B**, designated by Gilbert & Xia, 1999; isolectotype **G-DC** [G00328146!], **GH**, **K** [K000794339!]).

— *P. ichangense* C.DC., Notizbl, Konigl. Bot. Gart. Berlin-Dehlem 6: 480. 1917. Type: China, Hubei, Hupeh occidentalis, *Wilson 499* "*489*" (holotype **B** (photo)[B100294754!]; isotypes **A**, **K** [K000794340!], **P** [P01980615!]).

— *P. flaviflorum* C.DC., Notizbl, Konigl. Bot. Gart. Berlin-Dehlem 6: 477. 1917. Type: China, Yunnan, *Henry 12931* (holotype **K** [K000794372!]).

— *P. martinii* C.DC., Notul. Syst. (Paris) 3: 41. 1914. 1923. Type: China, Guizhou (Kouy Teheou), *L Martin & E. Bodinier 2298* (lectotype **P**?; isolectotype **E** [E00318482!], **G-DC** [G00320393!], designated by Gilbert & Nian He, 1999).

— *P. emeiense* Y.C.Tseng, Acta phytotax. Sin. 24: 385. 1986. Type: China, Sichuan, *Hsiung 32838* (**IBSC**).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep NP, 2 June 1914, *Kerr 3260* (**BM**, **K**, **L**); 7 July 1988, *Maxwell 88-848* (**BKF**, **L**); Mae Tang, 3 June 1989, *Paisooksantivatana & Chuaycharoen Y-615-81* (**BK**); Mae Rim, 25 May 1994, *Nanakorn 707* (**QBG**); 20 Jan. 2008, *Jatupol 08-188* (**QBG**); same locality, 4 Aug. 2005, *Suwanphakdee 166* (**BK**, **BKF**, **DMSC**); 18 Oct. 2009, *Suwanphakdee 275* (**BK**, **BKF**, **KKU**); 24 Mar. 2010, *Suwanphakdee 291* (**BK**, **BKF**, **KKU**); Mae Taeng, 26 Nov. 1994, *Pooma 902/1* (**BKF**, **CMUB**); Huai Namdang NP, 18 Oct. 2009, *Suwanphakdee 277* (**BK**, **BKF**, **KKU**); Doi Chiang Dao, Ban Tham, 12 Dec. 2008, *Suwanphakdee 253* (**BK**)]; Chiang Rai [Doi Tung Palace, 16 Feb. 2004, *Suwanphakdee 101* (**BK**, **KKU**, **DMSC**); same locality and date, *Suwanphakdee 102* (**BK**, **BKF**, **DMSC**, **KKU**)]; Nan [Doi Phu Kha NP, 24 Sept. 2000, *Srisanga 1689* (**QBG**)]; Lampang [Wang Nua, 10 July 1997, *Maxwell 97-715* (**BKF**)]; Uttaradit [Phu Soi Dao NP, 22 Dec. 2007, *Suwanphakdee 205* (**BK**, **BKF**, **KKU**)]; Tak [Pa Charoen Waterfall, 25 Apr. 2004, *Pooma et al. 3949* (**BKF**); Thi Lo Su Waterfall, 16 Feb. 2008, *Suwanphakdee 220* (**BK**, **BKF**, **KKU**)]; Phitsanulok [Ban Rom Klao,16 Dec. 2010, *Suwanphakdee 350* (**BK**)]; NORTH-EASTERN: Loei [Wang Sapung, 16 Apr. 2491, *Din 164* (**BKF**)]; EASTERN: Chaiyaphum [Nong Bau Daeng, 14 May 2008, *Norsaengsri 3816* (**QBG**)]; SOUTH-WESTERN: Kanchanaburi [South-West of Kanchanaburi, without data, *Phengklai 296* (**BKF**); Thong Pha Phum NP, 15 May 2003, *Suwanphakdee72* (**BK**, **BKF**, **KKU**)].

Distribution.— India, Nepal, China, Myanmar, Laos.

Ecology.— In open or shaded areas, by streams or waterfalls or mountain summits in evergreen forest, or cultivated; flowering December–January, fruiting January–March.

Vernacular.— Cha khan (จะค้าน)(Northern); cha khan khao (จะค้านขาว)(Chiang Rai); phlu ling (พลูลิง)(Chiang Mai).

Uses.— Stems are used for spicy curry and it has anti-tumour and carminative properties.

Notes.— The infructescence of *P. wallichii* resembles *P. nigrum* but it is native and differs by its larger leaves, catkins and rounded floral bracts. The lower surface of leaf is glaucous and puberulous, and its infructescence length is variable.

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