Taiwania, **52**(3): 210-215, 2007

Two New Species of *Piper* (Piperaceae) from Malay Peninsula

Arunrat Chaveerach[1,4], Piya Mokkamul[1], Runglawan Sudmoon[2] and Tawatchai Tanee[3]

(Manuscript received 24 January, 2007; accepted 10 June, 2007)

ABSTRACT: Two new taxa of the genus *Piper* (Piperaceae) collected in Malaysia, *Piper berembunse* A. Chaveerach & R. Sudmoon and *P. serrulatium* A. Chaveerach & T. Tanee, are described and illustrated. Morphological differences between the new species and related taxa are also discussed.

KEY WORDS: new species, *Piper*, Piperaceae, Malay Peninsula.

INTRODUCTION

The genus *Piper* L. consists of over 1000 species distributed mainly in tropical regions of the world (Cheng et al., 1999). It has high ethnobotanical potential worldwide and is of interest to a variety of fields and industries, such as pharmaceutical botany, traditional medicine, aromatic industries, foods, and landscape decoration (Chaveerach et al., 2006a). *Piper nigrum* L., for example, is cultivated by the local people in South East Asia region and exported worldwide (Tawan et al., 2002). The essential oils and leaf extracts of *P. nigrum* are active against several bacterium strains and some fungi. Leaves of *P. hispidinervium* C. DC. contain high levels (83-93%) of safrole, and this can be derived into two chemicals, heliotropin and piperonal butoxide (PBO) which are used for fragrance and flavoring, and pyretroid insecticides (Rocha and Ming, 1999). There are many other *Piper* species which may be potential sources for safrole and other chemicals. As a highly useful resource, more studies should be conducted on *Piper* species. It is likely that there are other important economical uses of unknown species, while the application of known species can also be improved. Therefore, it is hopeful that new species discovered may provide active ingredients.

The genus *Piper* was first described by Linnaeus in 1753 with the type specimens of *P. nigum* L. (Huber, 1988). Hooker (1885) followed this by describing 45 species in The Flora of British India. Later, Quisumbing (1930) enumerated 89 species for the Philippine Flora, and this high diversity suggests that the Philippine is the center of biodiversity of the genus. Twenty-three species were reported by Backer and Bakhuizen Van Den Brink (1963) in Flora of Java. Ridley (1967) listed 73 species from Malay Peninsula (15 species of erect plants). New Guinea was explored by Chew, who reported four species from New Guinea in 1972 and 13 species in 2003. Also from New Guinea, Gardner (2003) reported six non-climbing species and two, *P. bolanicum* and *P. recessum*, were new species,. Long (1984) listed 12 species for Bhutan. Four years later, Huber (1988) reported 10 species from Ceylon. Forty one species in Vietnam were reported by Ho (1991). Sixty species include 34 endemic species were enumerated in the Flora of China (Cheng et al., 1999). Our group reported three new species of *Piper* (Chaveerach et al., 2006a) and listed 37 species in Thailand (Chaveerach et al., n.d.). Recently we reported a new species and two new varieties (Chaveerach et al., 2007), two unknown species are in the process of being reported; these should be counted for 40 species and 2 varieties in Thailand.

Our work is focusing on the species diversity of the genus *Piper* exactly in Thailand starting from 1999. Additionally, *Piper* species from neighboring countries are of our interest. The associated specimens have been deposited at the Bangkok Herbarium (BK!), Bangkok, Thailand. Collector numbers A. Chaveerach 1-492 and some type specimens have just registered including BK! 63495-6, BK! 63498-500, BK! 63501-503, BK! 63514, BK! 63515, BK! 63516, BK! 63719, BK! 63720 and BK! 63721. So on, many species are processed for registration including these two new species from Malaysia. The further study of diversity of *Piper* in Thailand is taking survey on some still left, unintentional missing species, the new species and varieties especially at the border. They will be reported in supplemented publications.

1. Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand.
2. Department of Biochemistry, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand.
3. Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham 44000, Thailand.
4. Corresponding author. Tel: 66-4334-2908; Fax: 66-4336-4169; Email: raccha@kku.ac.th

In this paper, two new taxa from Malay Peninsula are described and illustrated. We were the first to discover them in 2003. Two years later, 2004 and 2005, we repeated survey at those localities for making complete specimens, but we could not. However, since for *Piper* flowers are unisexual, dioecious or monoecious, so naming of some species is often based on this characteristic, for examples, *P. diospyrifolium* Kunth (Kunth, 1939) was first validly published with female type specimens. We had seen male specimens with 4 stamens at the New York Botanical Garden (ID 556260-556266) later; *P. ornatum* N.E.Br. was first validly published with only description of vegetative part (Brown, 1884); *P. dominantinervium* A. Chaveerach & P. Mokkamul and *P. phuwuaense* A. Chaveerach & T. Tanee, were validly published with male spikes (Chaveerach et al., 2006a). Although, presenting of complete specimens is more valid, lacking of male spikes of these two new species is essential to provide the names.

Taxonomic identifications of the two new species described in this research were investigated based on references available from Roxburgh (1820), Candolle (1910a), Candolle (1910b), Hayata (1911), Merrill (1912), Quisumbing (1930), Henderson (1959), Backer & Bakhuizen Van Den Brink (1963), Ridley (1967), Chew (1972, 2003), Yuncker (1972), Wang and Liu (1976), Tseng (1979), Smith (1981), Van Royen (1982), Tebbs (1982), Long (1984), Hooker (1885), Heyne (1987), Huber (1988), Keng (1990), Ho (1991), Lin and Lu (1996), Cheng et al. (1999), Chaveerach et al. (2002, 2006a, 2006b, 2007), Chaveerach (2003), and Gardner (2003). Type specimens were checked from many herbaria i.e. Bangkok Herbarium (BK); Bangkok Forest Herbarium (BKF); Botanic Gardens, Singapore (SING); Queen Sirikit Botanic Garden (QBG); Department of Botany, Faculty of Science, Kasetsart University (BSKU); Khon Kaen University (KKU); Department of Medical Sciences Herbarium (DMSC); Royal Botanic Garden, Kew (K). Specimens studied are *Piper berembunse* A. Chaveerach & R. Sudmoon: A. Chaveerach 300 (BK!, BKF!); *P. kurzii* Ridl.: J.A.R. Anderson 30733 (SING); BGO Staff 5287 (QBG), 6622 (QBG), C. Niyomdham 2928 (BKF); T. Santisuk (BKF); C. Suwanphakdee 12 (BK), 20 (BKF), 36 (KKU), 51 (BSKU), 58 (DMSC), 121 (DMSC), 155 (BSKU); *P. serrulatium* A. Chaveerach & T. Tanee: A. Chaveerach 302 (BK!, BKF!); *P. oreophilum* C.DC.: 682491-1 (KEW). Botanical illustrations of these two new specimens are shown. Based on classification of the genus *Piper* in Malaysia by Ridley (1967), *Piper serrulatium* is added to Section 4 *Pseudochavica* and *P. berembunse* is added to Section 5 *Eu-piper*. Key to a new species of *Piper* from Malay Peninsula is included.

Key to a new species of *Piper* from Malay Peninsula

Shrubby, branched; leaf blade ovate, coriaceous; bract circular Nerves 2 from base and 2 from midrib; stigmas 3 ……..... *P. kurzii*
Nerves numerous; stigmas 2 ..... *P. berembunse*

Piper berembunse A. Chaveerach & R. Sudmoon, sp. nov. Fig. 1

Diagnosis: This new species is few similar to *P. kurzii* Ridl., but most different in the following characters; leaves peltate, adaxially callous, abaxially pellucid dotted, veins penninerved, regular interval from midrib, peduncles 2-3 cm long, rachis glabrous, stigmas 4, fruits globose.

Latin Diagnose: Due to the new species is few similar to *P. kurzii* Ridl., but most different in all characters, therefore, all morphological characters were translated into Latin as below.

Frutices circa 50-60 cm alti ramosi glabri dioeci. Caules graciles 0.3-0.4 cm crassi nodis tumidis. Petioli 1.5-2.5 cm longi; laminae foliorum ovatae vel lanceolatae peltatae 4.5-5.7 x 11-14 cm, crasse chartaceae, in pagina adaxiali callosae, abaxiali punctis pellucidis notatae, basi rotunda ab apice petioli, apice acuminato; venae penninerves, uno pari ex apice petioli assurgente et cum aliis e nervo medio ortis juncto per spatia aequalia, alternatae, aliis ex apice petioli deorsum curvatis in basi extensa, in pagina abaxiali prominentes. Spicae masculae non visae. Spicae femineae pendulae 0.5-0.7 x 4-5 cm bracteis circularibus sessilibus; stigmata 4 ciliata. Spicae fructiferae 1.4-1.6 x 6.0-8.5 cm; drupae globosae in rhachidi inclusae, maturae luteo-aurantiacae. Florent et fructum maturant a mense Septembri ad Decembrem.

Typus: Central Malaysia. Camerons Highland: Berembun Mountain, alt. 1000-1600 m, evergreen forest, 2003-10-18, A. Chaveerach 300 (holotype: BK; isotype: BKF).

Shrubs, 50-60 cm tall, much branched, glabrous, dioecious. Stems slender 0.3-0.4 cm thick, node swollen. Petioles 1.5-2.5 cm long, glabrous; leaf blades ovate to lanceolate, peltate, 4.5-5.7 x 11-14 cm^2, thick coriaceous, adaxially callous, abaxially pellucid dotted, base round, protruding from the end

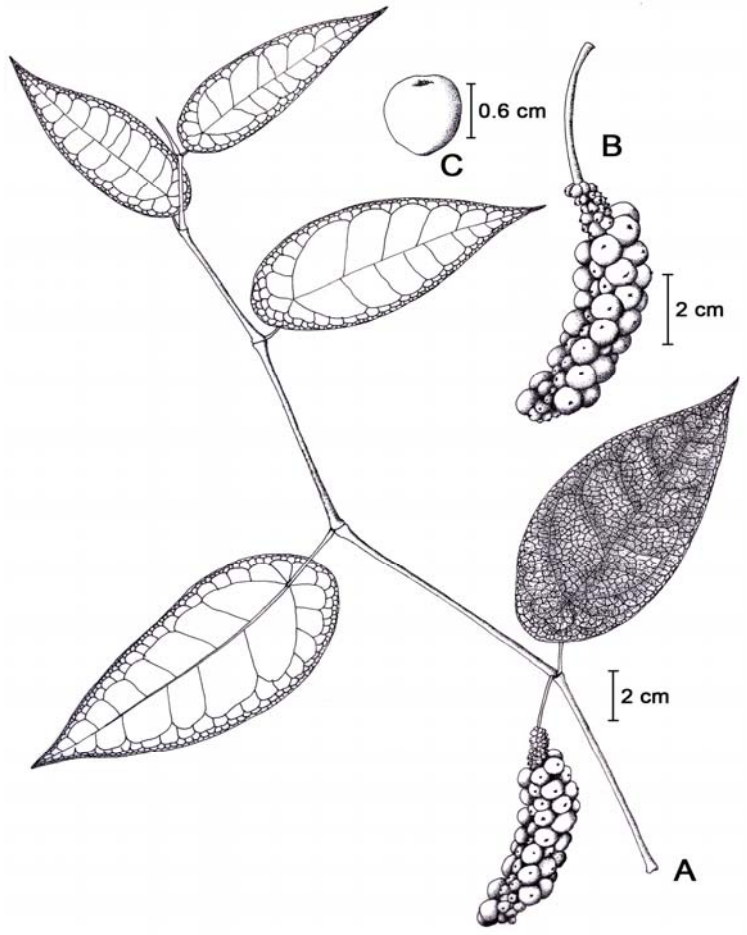

Fig. 1. *Piper berembunse* A. Chaveerach & R. Sudmoon. A: A branch with fruiting spike. B: Fruiting spike. C: Fruit. Illustration by Piya Mokkamul based on specimen no. A. Chaveerach 300 (BK).

of petioles; apex acuminate; veins penninerved, a pair forming at the end of petiole, ascending and combining the others from midrib at regular intervals, alternate, some others forming at the end of petiole curved down on protruded base, abaxial veins prominent. Male spike not seen. Female spikes pendulous, 0.5-0.7 x 4-5 cm^2, peduncle 2-3 cm long, terete, glabrous, bracts circular, c. 3 x 2-3 mm^2, not stalked; stigmas 4, ciliated. Fruit spikes 1.4-1.6 x 6.0-8.5 cm^2; drupes pulpy, partly embedded c. 1/3 on rachis, ovoid-conic, globose, 0.6-0.8 cm in diameter, with style-beak persistent, yellowish-orange when ripen. Flowering and fruiting from September to December.

Vernacular name: Plu Berembun.

Distribution: *Piper berembunse* A. Chaveerach & R. Sudmoon was found near the summit of Berembun Mountain, Cameron Highland, central Malaysia, alt. 1000-1600 m. on shady ground in foggy humid hill evergreen forest.

Notes: The specific epithet of this new species is named following the natural area location. It is an endemic plant that has only been found at Berembun Mountain, Cameron Highland, Pahang, in central Malay Peninsula. This mountain is the highest peak in Cameron Highland with the altitude of 1,864 m. It is a well known agricultural area, especially for its decorative flower plantations, and very rich in biodiversity. From taxonomic identifications based on references cited above, *P. berembunse* is not much similar to any species, but few similar to *P. kurzii* in shrubby, branched, leaf blade lanceolate, coriaceous, bract circular, and to *P. crocatum* Ruiz & Pav. and *P. ornatum* N. E. Br. in leaf peltate.

Key to a new species of *Piper* from Malay Peninsula

Shrubby; leaf blade lanceolate, coriaceous; veins 5 from base, a pair from midrib; bract suborbicular-orbicular, not stalked; fruit spike 2-3 cm long; drupe pulpy, ovoid-conic with style-beak persistent.

Style short; stigmas 2 recurved ..... *P. oreophilum*
Style long; stigmas 3 hairy ..... *P. serrulatium*

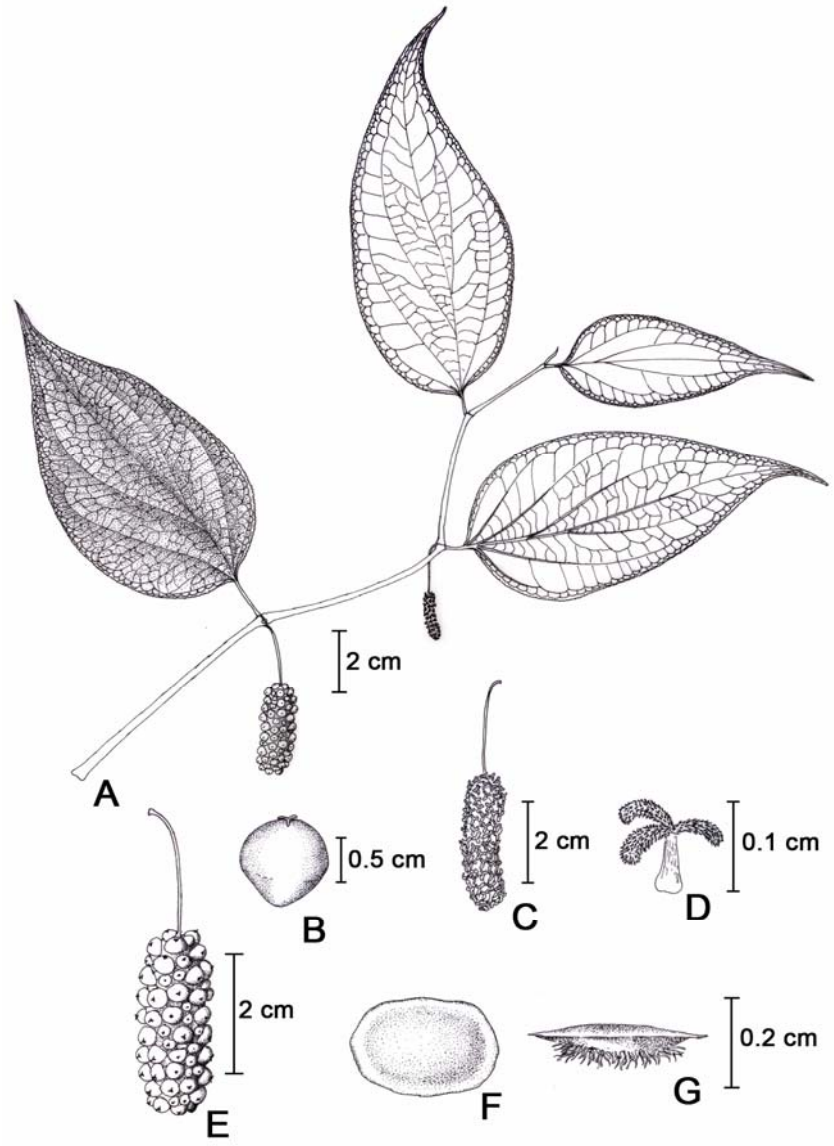

Fig. 2. *Piper serrulatium* A. Chaveerach & T. Tanee. A: A branch with female spike and fruiting spike. B: Fruit. C: Female spike. D: Pistil. E: Fruiting spike. F: Top view of bract. G: Side view of bract. Illustration by Piya Mokkamul based on specimen no. A. Chaveerach 302 (BK).

Piper serrulatium A. Chaveerach & T. Tanee, sp. nov. Fig. 2

Diagnosis: This new species is similar to *P. oreophilum* C.DC., but different in the following characters; stem glabrous, petioles glabrous, 0.7-1 cm long, slender, leaf blades ovate to broadly ovate, apex long curved acuminate, both sides glabrous, veins glabrous, margin serrulate, stigma 3, hairy.

Latin Diagnose: Caules glabra, petioli 0.7-1 cm longi, glabri graciles, laminae foliorum ovatae vel late ovatae, apice longe curvatimque acuminato, margine serrulato, folia glabri utrinque, venae glabra, margine serrulato, stigmatibus 3 pubescentibus.

Typus: Central Malaysia. Pahang, Cameron Highland: Berembun Mountain, alt. 1200-1600 m, evergreen forest, 2003-10-18, A. Chaveerach 302 (holotype: BK; isotype: BKF).

Shrubs about 50-70 cm tall, much branching, glabrous, dioecious. Stems slender 0.4-0.5 cm thick, node enlaged. Petioles 0.7-1 cm long, slender; leaf blades ovate to broadly ovate, 5.2-5.8 x 12-14 cm^2, membranous, unequal-sided by midrib, base equally or unequally round, apex long curved acuminate, margin serrulate; veins 7-8, 4-5 basal, a pair from midrib, arising up to 2-3.5 cm above base, alternate, abaxial veins prominent. Male spikes not seen. Female spikes pendulous, 0.2-0.3 x 1 cm^2, peduncles about 2 cm long; bracts suborbicular to orbicular, not

stalked, lower surface pubescent, ovary sunk in rachis with a long style; stigmas 3, hairy. Fruit spikes 0.5-1 x 2-3 cm^2; drupe pulpy, 0.7-0.8 cm in diameters, not crowded, embedded on rachis c. 1/3 of the length, ovoid-conic with style-beak persistent. Flowering and fruiting from September to December.

Vernacular name: Plu Malay

Distribution: This species was found near the summit of Berembun Mountain, Cameron Highland, Pahang in the central of Malaysia, alt. 1200-1600 m. on shady ground in foggy humid hill evergreen forest.

Notes: The specific epithet of this new species is named according the dominant serrulate character. *P. serrulatium* is similar to *P. oreophilum* Ridl. in shrubby, leaves lower ovate, base round on leaves upper, veins 5 from base, a pair from midrib, bract suborbicular-orbicular, not stalked, fruit spike 2-3 cm long, drupe pulpy, ovoid-conic with style-beak persistent.

ACKNOWLEDGEMENTS

The authors are thankful to Datuk Seri Lim Chong Keat for his very kind collaboration.

LITERATURE CITED

Backer, C. A. and R. C. Bakhuizen Van Den Brink. 1963. Flora of Java (Spermatophytes only) Vol. I Gymnospermae, Families 1-7; Angiospermae, Families 8-110. N.V.P. Noordhof, Groningen, The Netherlands. pp. 167-174.

Brown, N. E. 1884. *Piper ornatum* N.E.Br. The Gard. Chron. **22**: 424.

Candolle, C. De. 1910a. Philippine Piperaceae. In: Elmer, A. D. E. (ed.), Leaflets of Philippine Botany. Philippine Island, Manila, Philippine. pp. 759-789.

Candolle, C. De. 1910b. Piperaceae. In: Lecomte, H. (ed.), Flore Generale de L' Indo-Chine. Masson et Cie, Paris, France. pp. 62-69.

Chaveerach, A. (R), H. Kunitake, S. Nuchadomrong, N. Sattayasai and H. Komatsu. 2002. RAPD patterns as a useful tool to differentiate Thai *Piper* from morphologically alike Japanese *Piper*. Science Asia **28**: 221-226.

Chaveerach, A. 2003. Application of Molecular Techniques in Systematic Study of the Genus *Piper* in the Northeast of Thailand. Ph.D. Dissertation, Khon Kaen University, Khon Kaen, Thailand. 178 pp.

Chaveerach, A., R. Sudmoon, T. Tanee and P. Mokkamul. 2006a. Three new species of Piperaceae from Thailand. Acta Phytotax. Sinica **44**: 447-453.

Chaveerach A., P. Mokkamul, R. Sudmoon and T. Tanee. 2006b. Ethnobotany of the genus *Piper* (Piperaceae) in Thailand. Ethnobot. Res. Appl. **4**: 223-231.

Chaveerach, A., A. Tanomtong, R. Sudmoon, T. Tanee and P. Mokkamul. 2007. A new species and two new varieties of *Piper* (Piperaceae) from Thailand. Acta Phytotax. Geob. **58**: 33-38.

Cheng, Y., N. Xia and M. G. Gilbert. 1999. Piperaceae. In: Wu, Z.-Y. and P. H. Raven (eds.), Flora of China. Vol.4. Science Press, Beijing, China. pp. 110-129.

Chew, W.-L. 1972. The genus *Piper* (Piperaceae) in New Guinea, Solomon Islands, and Australia. J. Arnold Arbor. **53**: 1-25.

Chew, W.-L. 2003. Studies in Malaysian Piperaceae. Garden's Bulletin Singapore **55**: 13-15.

Gardner, R. O. 2003. *Piper* (Piperaceae) in New Guinea: the non-climbing species. Blumea **48**: 47-68.

Hayata, K. 1911. *Piper kawakamii* Hayata. J. Coll. Sci. Imp. Univ. Tokyo **30**: 234.

Henderson, M. R. 1959. Pepper Family (Piperaceae). Malayan Wild Flowers Dicotyledons. Caxton Press, Kuala Lumpur, Malaysia. pp. 25-51.

Heyne, K. 1987. Tumbuhan Berguna Indonesia. Jalan Gatot Subroto, Jakarta. pp. 619-642.

Ho, P.-H. 1991. Piperaceae. An Illustrated Flora of Vietnam. Nha Xuat Ban Tre, Saigon, Vietnam. pp. 288-301.

Hooker, J. D. 1885. Piperaceae: the Flora of British India. Vol. 5. L. Reeve & Co., Ltd., Ashford, Kent, England. pp. 78-99.

Huber, H. 1988. Piperaceae. In: Dassanayake, M. D. (ed.), A Revised Handbook to the Flora of Ceylon. Vol. 6. A. A. Balkema, Rotterdam, the Netherlands. pp. 272-289.

Keng, H. 1990. The Concise Flora of Singapore. Gymnosperms and Dicotyledons. Singapore University Press, Singapore. pp. 62-63.

Kunth, O. 1939. *Piper diospyrifolium*. Linnaea **13**: 627.

Lin, T.-T. and S.-U. Lu. 1996. Angiospermae. In: Editorial Committee of the Flora of Taiwan. Flora of Taiwan. 2nd ed. ROC, Taipei, Taiwan. pp. 624-631, 823-824.

Linnaues, C. 1753. Species Plantarum. L. Salvius, Stockholm, Sweden. pp. 28-30.

Long, D. G. 1984. Bhutan: Including a Record of Plants From Sikkim. Vol. 1. Part 2. Royal Botanic Garden, Edinburgh, Scotland. pp. 345-351.
Merrill, E. D. 1912. A Flora of Manila. Bureau of Printing, Manila, Philippine. pp. 169-171.
Quisumbing, E. 1930. Philippine Piperaceae. The Philip. J. Sci. **43**: 1-187.
Ridley, H. N. 1920. *Piper oreophilum*. Asiatic Society Straits L. **32**: 188.
Ridley, H. N. 1967. Piperaceae: The Flora of the Malaysia Peninsula. Vol. 3: Apetalae. L. Reeve & Co., Ltd., Ashford, Kent, England. pp. 25-51.
Rocha, S. F. R. and L. Ming. 1999. *Piper hispidinervium*: a sustainable source of safrole. In: Janick, J. (ed.), Perspectives on New Crops and New Uses, Proceedings of the Fourth National Symposium New Crops and New Uses: Biodiversity and Agricultural Sustainability. ASHS Press, Alexandria, Virginia, USA. pp. 479-481.
Roxburgh, W. 1820. Flora of India **1**: 158-162.
Ruiz, H. and J. Pavon. 1798. *Piper crocatum*. Flora Peruviana, et Chilensis **1**: 35.
Smith, A. C. 1981. Piperaceae. Flora Vitiensis Nova. Vol. 2. Pacific Tropical Botanical Garden, Lawai, Kauai, Hawaii, USA. pp. 56-63.
Tawan, C. S., I. B. Ipor, B. A. Fashinuddin and H. Sani. 2002. A Brief Account on the Wild *Piper* (Piperaceae) of the Crocker Range, Sabah. ASEAN Review of Biodiversity and Environmental Conservation. http://www.arbec.com.my/pdf/art6julysep02.pdf
Tebbs, M. C. 1982. Piperaceae. In: Hara, H., A. O. Chater and L. H. G. Williams (eds.), An Enumeration of the Flowering Plants of Nepal **3**: 36.
Tseng, Y.-C. 1979. Piperaceae. Acta Phytotax. Sinica **17**: 33-35.
Van Royen, P. 1982. The Alpine Flora of New Guinea. Vol. 3. Taxonomic part Winteraceae to Polygonaceae. J. Cramer, Vaduz, the Netherlands. pp. 1267-1288.
Wang, F. and T. Liu. 1976. Flora of Taiwan: Angiospermae. Vol. 3. Epoch Publishing, Co. Ltd., Taipei, Taiwan. pp. 556-565.
Yuncker, T. G. 1972. The Piperaceae of Brazil. Hoehnea **2**: 19-366.

馬來西亞胡椒屬二新種

Arunrat Chaveerach[1,3], Piya Mokkamul[1], Runglawan Sudmoon[2] and Tawatchai Tanee[2]

(收稿日期：2007 年 1 月 24 日；接受日期：2007 年 6 月 10 日)

摘　　要

本文報導產自馬來西亞胡椒屬二新種：*Piper berembunse* A. Chaveerach & R. Sudmonn 及 *P. serrulatium* A. Chaveerach & T. Tanee。文中除了分類描述及繪圖外，尚討論此二新種與相近種的關係。

關鍵詞：新種、胡椒屬、胡椒科、馬來半島。

1. Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand.
2. Department of Biochemistry, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand.
3. Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham 44000, Thailand.
4. Corresponding author. Tel: 66-4334-2908; Fax: 66-4336-4169; Email: raccha@kku.ac.th