

Taxonomy and ethnobotany of *Acmella* (Asteraceae) in Thailand

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Abstract. Panyadee P, Inta A. 2022. Taxonomy and ethnobotany of *Acmella* (Asteraceae) in Thailand. *Biodiversitas* 23: 2177-2186. Thai toothache plant is an ethno-species, referred to as any species in the genus *Acmella* of the aster family (Asteraceae). The plants are used commonly in Thailand as vegetables and medicine. However, in earlier phytochemistry and ethnobotanical studies, missed scientific names: *Acmella olearcea* and *Spilanthes acmella*, were applied to these species. In this study, we have clarified the identity of these ethno-species and related species in the genus *Acmella*. There were six species of *Acmella* in Thailand, including two native species and four introduced species. The keys and brief description of these species are provided. In ethnobotanical studies, *A. olearcea* and *S. acmella* were mentioned as nearly 80% of total use records. These names could be referred to *A. paniculata* which is one of the native species and most widely distributed. Although there were a reasonable amount of studies on the Thai toothache plant, more comparative studies for their bioactivities are still needed according to the taxonomical confusion of their names.

Keywords: Compositae, ethnomedicine, local vegetable, revision, seasoning, toothache

INTRODUCTION

Phak Phed or Thai toothache plant is one of the most common vegetables and medicinal plants in Thailand. This ethno-species is referred to as the herbaceous plant in the Asteraceae family with yellow-flowering heads the size of a little fingertip (Royal Institute of Thailand 2009). This referred to plants in the genus *Acmella* Rich. ex Pers. In Thai phytochemistry and ethnobotanical studies, two scientific names are widely applied to *Acmella olearcea* (L.) R.K.Jansen, and *Spilanthes acmella* (L.) Murray.

Acmella olearcea, commonly known as the 'toothache plant', is a cultivated species, grown primarily for medicinal and ornamental purposes (Jansen 1985). Its flowering head and root are used for curing pain and stimulating salivary in Latin America (Jansen 1985). This species is characterized by its large yellow discoid head, the diameter is >1 cm. It is believed to be derived through the cultivation of *A. alba*, a native species of Peru (Jansen 1985). In Asia, it is known only from cultivation in China and Taiwan and escape in weedy habitat (Chen and Hind 2011). According to this restriction of distribution and floristic studies in Thailand (Koyama et al. 2016), we observe that the flowering heads of Thai *Acmella* spp. are smaller. Then we examine the description and photos of *A. olearcea* published in Thai ethnobotanical research along with the voucher deposited in the herbarium of Queen Sirikit Botanic Garden (QBG), we suppose that this name is misapplied to *Phak Phed* or Thai *Acmella*.

In another scientific name, *Spilanthes acmella* (L.) Murray is now treated as a synonym of *Blanicvillea acmella* (L.) Philipson (Hassler 2018). This species has white flowers which are not in line with the definition of the Thai

toothache plant. The species is native to India and Sri Lanka and has been recorded in northern Africa (Orchard 2012) but not in Thailand. It should be noted that the name *S. acmella* once was applied to *Acmella paniculata* (Wall. ex DC.) R.K.Jansen for long time (Jansen, 1985) based on its basionym *Verbesina acmella* L. However, the type of *V. acmella* was lately identified as *Blanicvillea acmella* (Koster and Philipson 1950). Therefore, *S. acmella* could not be served as the basionym of *A. paniculata* anymore.

The name *S. acmella* (L.) Murray could be referred to *Acmella paniculata* (Wall. ex DC.) R.K.Jansen in ethnobotany and phytochemistry studies in Thailand. *Acmella paniculata* could be distinguished by its discoid yellow heads. This is one of two native *Acmella* species in Thailand, and we strongly believe that it is a typical *Phak Phed*. However, this name is applied to *Acmella* species with noticeable radiate capitula in many research documents. Currently, we have observed that the white discoid head *Acmella* species is now used and sold in the local markets in northern Thailand. Moreover, it is called *Phak Phed* as same as the typical species, *A. paniculata*.

The misapplication of the names and confusion of various *Acmella* spp. is common among ethnobotanical and phytochemistry reports, local books of traditional vegetable and medicinal plants, and anonymous information sources on the Internet. This erroneous would lead to the chaotic in future ethnopharmacological studies and other related studies. Moreover, the recent publication of Flora of Thailand for Asteraceae (Koyama et al. 2016) provides only a key description of two native species, namely *A. paniculata* and *A. uliginosa*.

According to these facts, the clarification of the ethno-species 'Thai toothache plant' (*Acmella* spp.) in Thailand is

needed. Here, the keys based on Thai specimens, brief description, and diagnostic notes are provided along with their color photographs. Additionally, we investigate their ethnobotanical uses.

MATERIALS AND METHOD

Taxonomical investigation

We surveyed herbarium collections, visited local markets, and consulted the local people. The field surveys were conducted from 2016 to 2022. Despite the field collection, the main source of information was based on the voucher deposited in the herbarium of Queen Sirikit Botanic Garden (QBG). Each species included a brief description of some easy characters and character states. We followed Jansen (1985) for details of the description.

Ethnobotanical investigation

The ethnobotanical data of *Phak Phed* (*Acmella* spp. and *Spilanthes acmella*) were extracted from 107 bibliographical sources (theses and bachelor studies, published journals, proceeding articles, and unpublished reports) from 1993 to 2018. The criteria for selecting these documents were followed Phumthum et al. (2018). The documents must be original research and have scientific names. Among these, the uses of *Phak Phed* were reported in 44 documents. The details of these documents are provided in supplementary files. The ethnobotanical use was noted as 'use-record.'

Definition of *Phak Phed* and use-records

The term *Phak Phed* referred to an ethno-species, including *Acmella* spp., which was published and occurred in Thailand. Moreover, it also included the scientific name *Spilanthes acmella* (L.) Murray. The term 'use-record' referred to the different uses reported from different ethnic groups from each bibliographical source. For example, Songsangchun (2015) reported that Thai Yuan and Lawa people used *Acmella paniculata* as vegetables. This would count two use records for *A. paniculata* reported in this study.

RESULTS AND DISCUSSION

Acmella in Thailand

The genus *Acmella* is a small herb, consisting of 30 species which is distributed mainly in the tropical and subtropical regions around the world (Jansen 1985). Some of them are now considered weeds in the pantropic (Mabberley 2017). Five species were previously reported in Thailand (Jansen 1985), including two native species, i.e., *A. paniculata* and *A. uliginosa*, and the other three introduced species, i.e., *A. brachyglossa*, *A. calva*, and *A. ciliata*. In this study, another introduced species, *A. radicans* was firstly reported for its naturalization and uses. There is no specimen nor photo to confirm the occurrence of *A. olearaceae* in Thailand yet. The keys, brief

description, diagnostic notes, and ethnobotanical uses of these species are provided below.

Key to species of *Acmella* in Thailand

1. Head discoid (without ray florets)
 2. Pappus absent; achenes glabrous 2. *A. calva*
 2. Pappus of 2 or 3 setae; achenes glabrous to densely ciliate
 3. Floret white, 4 lobed; inflorescences cluster 2–3 heads; achenes lack a corky margin at maturity, surface lack or with few ciliates, often shouldered 5. *A. radicans*
 3. Floret yellow, all or mostly 5 lobed; inflorescences solitary; achenes with clear cork-like margin, surface with moderately to densely tuberculate ciliate, lacking shouldered 4. *A. paniculata*
1. Head radiate (with ray florets)
 4. Disc florets 4-merous; phyllaries uniseriate, 5-6; achenes 1.2–1.8 mm long. 6. *A. uliginosa*
 4. Disc florets 4- or 5-merous; phyllaries biseriate, 7–11; achenes 1.4–2.3 mm long
 5. Floret yellow-orange; head ovoid or cone-shaped; mature achenes with clear cork-like margin, pappus absent or with 2 short sub-equal bristle, less than 1 mm long 3. *A. ciliata*
 5. Floret pale yellow; head cone-shaped; mature achenes without clear cork-like margin, pappus well developed with two sub-equal bristle, 0.5–1.1 mm long, shorter 0.3–1 mm 1. *A. brachyglossa*

Taxonomic notes

Acmella brachyglossa

Acmella brachyglossa Cass., Dict. Sci. Nat. (ed. 2) 50: 258. 187; Jansen, Syst. Bot. Monogr. 8: 73. 1985; Chung et al. Bot. Stu. 49: 74. 2008.

Erect, decumbent herb ca 10–30 cm high. Stem glabrous to slightly pilose. Leaves ovate, 2–9 × 1–5 cm, acute to acuminate. Head radiate, terminal or axillary solitary or cluster of 2–3 heads, cone-like, 5–9 mm diam. Phyllaries 2-seriate. Ray florets 5–8, tube ca 1 mm long, limbs 0.5–1.6 mm long, corollas pale yellow. Disc florets ca 2 mm long, 4-5 lobed, pale yellow. Achene black, ca 2 mm long, strigose, margin densely ciliate without clear cork-like margin; pappus of two subequal bristles.

Distribution. A weedy species commonly found in Central America, northern South America, and the West Indies (Jansen 1985). Also widely cultivated and naturalized in Taiwan (Chung et al. 2008)

Ecology. This species is a weedy found in the wasteland and roadside. It also grows in moist places along the ditches and stream.

Ethnobotanical uses. Tender shoot and inflorescence are eaten as a vegetable by ethnic people like Karen or Hmong [QBG-44900, 45195, 102375, 102495]. Leaves are used to treat toothache, snake, and scorpion bites by Hmong people [QBG-102495].

Note. *Acmella brachyglossa* is a weedy species, it is found in many areas, especially on the roadside and in abandoned areas. Although the occurrence is indicated in Jansen (1985), without citing any voucher specimen. It

could be said that this is the first time that this species has been officially reported from Thailand. Despite its widespread, there is no report about its invasive status. Comparing the distribution, *A. brachyglossa* should be considered as the same rank as *A. ciliata* which was recently approved as invasive species in Thailand (FPCRO, 2019).

This species could be easily distinguished from other *Acmella* species in Thailand by its pale yellow or greenish head with inconspicuous ray florets (other species with radiate head, i.e., *A. ciliata* and *A. uliginosa* have a yellow or orange-yellow head). In dried specimens, these characteristics of achenes are especially useful for identification, i.e., densely ciliate without cork-like margin, a well-developed pappus of 3 or 2 subequal bristles.

Acmella calva

Acmella calva (DC.) R.K.Jansen, Syst. Bot. Monogr. 8: 41. 1985

Decumbent, perennial herb 20–30 cm high, sparsely to moderately pilose. Leaves narrowly ovate to ovate, 2.5–6 × 1–3 cm, acute, sparsely to moderately strigose; petioles up to 2 cm. Head discoid, axillary, or terminal solitary, cone-like, 6–8 diam. Phyllaries 2-seriate. Corolla ca 2 mm long, 5 lobed, yellow to orange-yellow. Achenes 1.7–2.2 mm long, glabrous, lacking a cork-like margin; pappus absent.

Distribution. China (Yunnan), India, Indonesia, Myanmar, Nepal, Philippines, Sri Lanka

Ecology. It grows in weedy habitats, streamsides, marshes, forest margins; 1000–1900 m asl. (Chen and Hind 2011).

Ethnobotanical uses. – (not recorded)

Note. Beside a specimen collected by H.B.G. Garrett in 1931 (H.B.G. Garrett-678, L.2999556, L) from Doi Pa Kao (ดอยผ้าขาร), Chiang Mai, no other specimen is found. This species could be distinguished by the following combinations, i.e., yellow discoid head; achenes glabrous, without pappus; stem decumbent or repent with rooting at nodes.

Acmella ciliata

Acmella ciliata (Kunth) Cass., Dict. Sci. N at. (ed. 2) 24: 331. 1822; Jansen, Syst. Bot. Monogr. 8: 36. 1985; Chung et al., Bot. Stu. 49: 76. 2008.

Decumbent, perennial herbs, 20–60 cm high. Stem unbranched to branched, glabrous to sparsely pilose. Leaves ovate to broadly ovate, 2.0–7 × 1–5 cm, apex acute, glabrous to sparsely pilose; petioles up to 0.7–4 cm, narrowly winged. Head radiate, terminal or axillary solitary or cluster of 2–3 heads, broadly ovate or cone-like, 5–10 diam. Phyllaries 2-seriate. Ray florets 5–10, tube 0.9–2 mm, limb 1–4 mm, yellow-orange. Disc florets ca 2 mm long, 5 lobed, yellow-orange. Achene black, ca 1.8 mm long, margins sparsely to moderately ciliate, with clear cork-like margins; pappus usually absent or of 2 short subequal bristles less than 1 mm long.

Distribution. Native to South America; widely naturalized in the south and southeast Asia

Ecology. Found mostly in a moist area, marshy; elevation up to 2000 m

Ethnobotanical uses. Leaves are eaten raw as a vegetable by people in southern Thailand (Upho 2005, as *Spilanthes paniculata*).

Note. Another naturalized and widespread species. One of the invasive species in protected areas of Thailand (FPCRO, 2019). *Acmella ciliata* is characterized by its radiate, yellow-orange, ovoid head. It is commonly used and sold in the local markets. The plant is commonly mistakenly described under the name *A. paniculata*, which could be found in many textbooks and on the Internet. This species has radiated flower head which clearly differed from *A. paniculata*.

Acmella paniculata

Acmella paniculata (Wall. ex DC.) R.K. Jansen, System Bot. Monogr. 8: 67; Chung et al., Bot. Stu. 49: 78. 2008.

Erect, annual herb up to 40 cm high. Stem branched, glabrous to sparsely pilose. Leaves narrowly ovate to ovate, 2–6 × 0.8–4.5 cm, acute to acuminate; sparsely ciliate; petioles 0.5–5 cm. Head discoid, axillary or terminal solitary, cone-like, 7–10 diam. Phyllaries 2-seriate. Corolla ca 1.5–2.2 mm long, 4–5 lobed, yellow. Achenes deep brown, 2–3 mm long, sparsely to densely tuberculate, margins moderately ciliate with clear cork-like margins; pappus of 2 subequal bristles.

Distribution. India (E India, type), China, Southeast Asia, Sri Lanka

Ecology. Wasteland, the agricultural field, roadsides; elevation 800–2000 m

Ethnobotanical uses. Leaves and inflorescence used as a vegetable, also used as ‘toothache’ plant. More information in Tables S1 and S2.

Note. We believed that *A. paniculata* is a typical species for the ethno-species Thai toothache plant. It is characterized by the following combined characteristics, i.e., yellow discoid head and achenes with clear cork-like margin, surface with tuberculate ciliate.

The cultivated variety is planted in the Karen rice field of Thailand as a vegetable. It could be eaten as fresh vegetables or pickled. The overall size of the variety is bigger than the common variety, i.e., ca 50 cm high and the head is ca 1–2 cm in diameter. However, the achenes are similar to the common variety.

Acmella paniculata is one of the common vegetables in northern Thailand and some areas of northeastern. It is eaten fresh or as part of curry vegetables. Moreover, it is used as spices for its pungent taste. Medicinally, the crush of the whole plant is used to treat rash (QBG-105882).

Acmella radicans

Acmella radicans (Jacq.) R.K.Jansen, Syst. Bot. Monogr. 8:69. 1985; Maity et al., Nelumbo 59: 54–57. 2017.

Erect herb ca 50 (–90) cm high. Stem little branched to many-branched, sparsely hairy. Leaves ovate or ovate-rhomboid, 3–8 × 1–4 cm, acute, sparsely hairy; petioles up to 2 cm. Head discoid, axillary or terminal cluster of 2–3 (5) heads, cone-like, 4–5 mm diam. Phyllaries 2-seriate. Corolla ca 2 mm long, 4 (5) lobed, white or greenish-white.

Achenes 2–2.7 mm long, moderately to densely ciliate with straight-tipped hairs, often with apical shoulders; pappus of 3 (for the outer series of achenes) or 2 subequal bristles.

Distribution. America, Bangladesh, Mexico, recently recorded as a weed in eastern India (Maity et al. 2017)

Ecology. Waste areas, cultivated fields or along the roadside, and the stream. Flowering all year round.

Ethnobotanical uses. Karen people, occasionally, eat the leaves as a vegetable. It is occasionally sold in the local market in northern Thailand along with other *Acmella* spp. Another variety, var. *debilis* (Humboldt, Bonpland & Kunth) R.K. Jansen, is distributed in South America (Jansen 1985) and India (Jagtap and Bachulkar 2015).

Note. This species grows as a weed in waste areas. It is easy to recognize by the white discoid heads, with exclusively 4-merous white or greenish-white florets. Its inflorescence is an axillary or terminal cluster of 2–3 heads.

Acmella uliginosa

Acmella uliginosa (Sw.) Cass., Dict. Sci. Nat. (ed.2) 24: 331. 1882; Jansen, Syst. Bot. Monogr. 8: 55. 1985; Chung et al., Bot. Stu. 49: 79. 2008.

Erect or decumbent, annual herbs, 10–20 (–40) cm high. Stem one to several from base, glabrous to moderately pilose. Leaves lanceolate, narrowly ovate or ovate, 1.5–3 × 0.4–2.3 cm, apex acute to acuminate; petioles 0.5–1.5 cm. Head radiate, terminal solitary or cluster of 2–3 heads, ovoid, 4–6 diam. Phyllaries are uniseriate. Ray florets 4–7, tube ca 1 mm long, limb 1–2 mm long, yellow to yellow-orange. Disc florets 1.5–3 mm long, 4 lobed, yellow-orange. Achene black, 1.2–1.5 mm long, margin ciliate; pappus of 2 sub- or unequal bristles.

Distribution. Native to tropical regions in Africa, America, and Asia. The species has now become invasive in the wet area of Pacific islands (Chung et al. 2008).

Ecology. Moist areas, rice field, roadside, elevation 400–1200 m

Ethnobotanical uses. It is occasionally sold in the local market as a vegetable like other *Acmella* spp. It is less preferred than other species because of its small habit.

Note. *Acmella uliginosa* is easily recognized by its small head with short ray florets and 4-merous disc florets. It is another native species which is a pantropical weed.

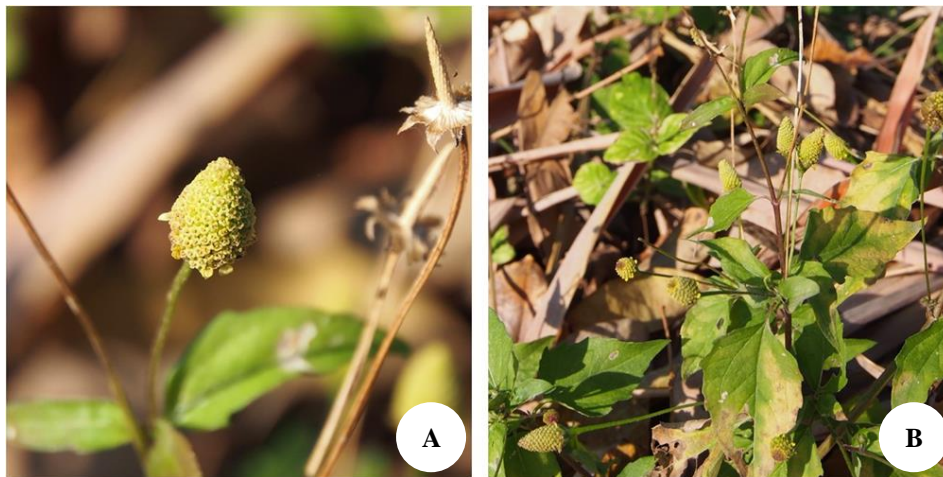


Figure 1. *Acmella brachyglossa* Cass.: A. Inflorescence, B. Habit

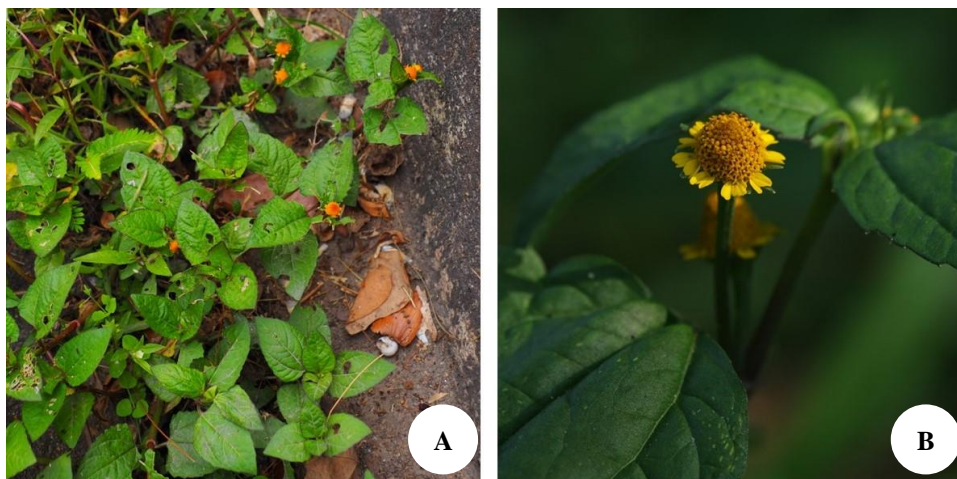


Figure 2. *Acmella ciliata* (Kunth) Cass.: A. Plant habit, B. Inflorescence



Figure 3. *Acmella paniculata* (Wall. ex DC.) R.K.Jansen. A-B. Cultivated plant; A. Habit, B. Inflorescence; C. Inflorescence of wild species

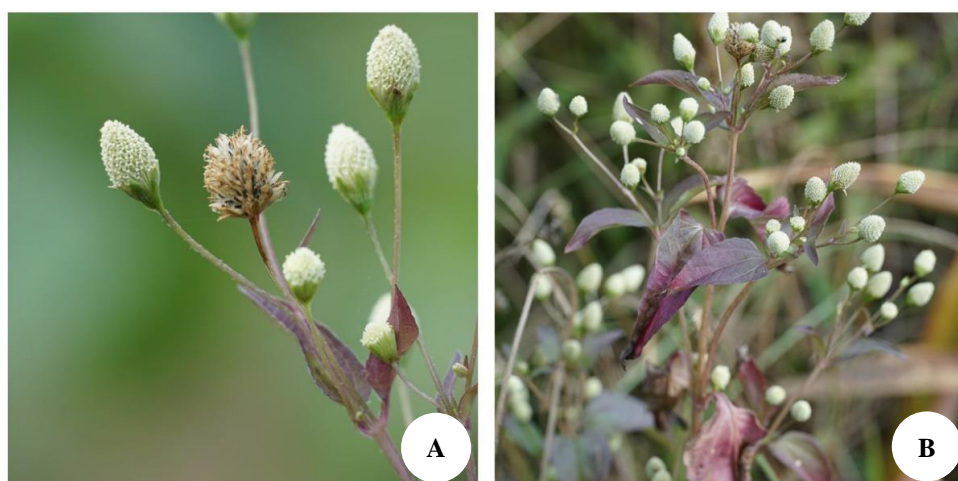


Figure 4. *Acmella radicans* (Jacq.) R.K.Jansen: A. Inflorescence, B. Plant habit



Figure 5. *Acmella uliginosa* (Sw.) Cass.: A. Inflorescence, B. Plant habit

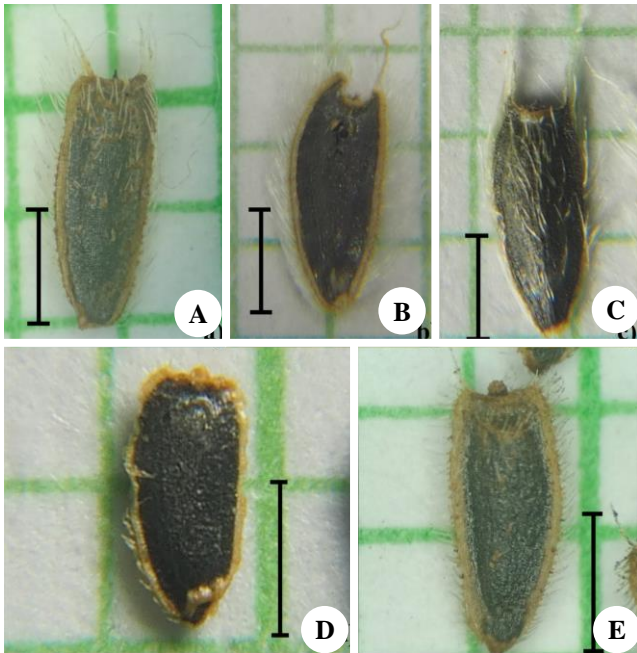


Figure 6. Comparing seeds of *Acmella* in Thailand. A. *A. paniculata*, B. *A. radicans*, C. *A. brachyglossa*, D. *A. uliginosa*, E. *A. ciliata* (scale = 1 mm)

Ethnobotany of Thai toothache plant

A total of 88 use records from 44 ethnobotanical studies were recorded for the uses of the Thai toothache plant (Tables S1 and S2). Six scientific names were reported, i.e., *Acmella brachyglossa*, *A. ciliata*, *A. oleracea*, *A. paniculata*, *A. uliginosa*, and *Spilanthes acmella*. The use-records of *A. oleracea* contributed to more than 50% of total use-records (49 out of 88). *Spilanthes acmella* was second highest use-records, ca 27%. As previously mentioned, these two species are not found in Thailand yet. Although *S. acmella* could be referred to *A. paniculata*, there is no rigid proof. The name could also refer to *A. oleracea* (Barbosa et al. 2016). Moreover, most of the studies lack the voucher for further confirmation of corrected species. Therefore, it is worth considering these species as one ethno-species.

Thai toothache plant is commonly used as vegetable or medicines with 56% and 42% of total use-records, respectively. Besides these, it was used to feed the pigs, combined with other vegetables (Srisanga 1993; Panyadee 2012). Young shoot and inflorescence were the most preferred plant parts. It could be eaten raw or added to a vegetable curry. More information is provided in Table S1.

A total of 37 use records for the medicinal purpose were documented from 44 ethnobotanical studies (Table S2). The Thai toothache plant was used to treat various ailments but mostly to treat toothache (54%). *Acmella oleracea* has been widely cited for its use as a folk remedy for treating toothache. By chewing its capitula, the mouth will numb and temporarily relieve dental and oral pain (Jansen 1985; Hind and Biggs 2003). This has resulted from the analgesic effect of spilanthol (Barbosa et al.

2016). Spilanthol is a bioactive compound that can be found in many *Acmella* species (Paulraj et al. 2013; Barbosa et al. 2016). Therefore, it is not surprising if the plant is also commonly used to treat toothache in Thailand.

In conclusion, *Phak Phed* or Thai toothache plant is a common vegetable and medicinal plant in Thailand. This ethno-species referred to plants in the genus *Acmella*. Previously, two scientific names were widely applied to this ethno-species, i.e., *Acmella oleracea* and *Spilanthes acmella*. Both of them are proved as invalid names of *Phak Phed*. The confusion of the names applied for *Phak Phed* would also lead to chaos in further phytochemistry and ethnopharmacological study because it did not confirm which species were tested. This problem could be easily solved if the voucher specimens are made. Unfortunately, this is not common in past studies. Therefore, further comparative studies of *Acmella* spp. for their bioactivities are still needed.

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Table S1. The use of the ethno-species “*Phak Phed*” as food reported in Thai ethnobotanical studies

Use	Ethnicity	Part of uses	Reference	Scientific name in Reference		
Cooked for pungent flavoring	Hmong	Entire leaf	Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.		
	Lawa	Entire leaf	Songsangchun (2015)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen		
Part of vegetable curry	Thai Yuan	Entire leaf	Songsangchun (2015)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen		
	H'tin	Leaf sheath	Tangtragoon (1998)	<i>Spilanthes acmella</i> (L.) L.		
	Karen	Karen	Inflorescence, leaf sheath	Tovaranonte (2003)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Trisonthi et al. (2007)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
			Inflorescence, young shoot	Kamwong (2010)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Johnsom & Grivetti (2002)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	
			Leaf sheath	Young shoot	Kantasrila (2016)	<i>Acmella oleracea</i> (L.) R.K.Jansen
					Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
			Entire leaf	Leaf sheath, young shoot	Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
					Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
			Young shoot	Young shoot	Tangtragoon (1998)	<i>Spilanthes acmella</i> (L.) L.
					Chanklom (2006)	<i>Acmella oleracea</i> (L.) R.K.Jansen
	Lahu	Lahu	Inflorescence, young shoot	Tangtragoon (1998)	<i>Spilanthes acmella</i> (L.) L.	
				Yaso (2000)	<i>Spilanthes acmella</i> (L.) L.	
	Lawa	Lahu	Leaf sheath	Boonkorn (1997)	<i>Spilanthes acmella</i> (L.) L.	
				Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.	
	Lisu	Lisu	Flower, young shoot	Tovaranonte (1998)	<i>Spilanthes acmella</i> (L.) L.	
				Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Lua	Lisu	Young shoot	Sriboonpoun (2011)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Mien	Mien	Young shoot	Panyadee (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Tangtragoon et al. (2004)	<i>Spilanthes acmella</i> (L.) L.	
	Shan	Shan	Inflorescence	Udompanid (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Tovaranonte (1998)	<i>Spilanthes acmella</i> (L.) L.	
	Tai Lue	Tai Lue	Aerial parts	Muangyen (2013)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Turreira-Garcia et al. (2017b)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	
	Thai Yuan	Thai Yuan	Entire leaf, young shoot	Trisonthi et al. (2007)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
Krueasan (1998)				<i>Spilanthes acmella</i> (L.) L.		
Side dish vegetables of chili paste	Yunnan Chinese	Aerial parts	Muangyen (2013)	<i>Acmella oleracea</i> (L.) R.K.Jansen		
			Tovaranonte (2001)	<i>Acmella oleracea</i> (L.) R.K.Jansen		
	Akha	Akha	Inflorescence, young shoot	Songsangchun (2015)	<i>Spilanthes acmella</i> (L.) L.	
				Ponpim (1996)	<i>Spilanthes acmella</i> (L.) L.	
	Karen	Karen	Young shoot	Inta (2008)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Thatsaneeyakorn (1997)	<i>Spilanthes acmella</i> (L.) L.	
	Karen	Karen	Aerial parts	Khamfachuea (2008)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Sonsupub (2010)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Karen	Karen	Inflorescence, young shoot	Winiychaiyanan (1995)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	
				Pongamornkul and Muangyen (2013)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Kayah	Kayah	Leaf sheath	Pongamornkul (2003)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Trisonthi et al. (2007)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Khamu	Khamu	Young shoot	Supawimolpan (2011)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Pongamornkul (2006a)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Lawa	Lawa	Aerial parts	Srithi et al. (2017)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Inta et al. (2011)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	not mention specifically	Shan	Inflorescence, young shoot	Inta (2008)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Inta (2008)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
	Tai Lue	Tai Lue	Inflorescence, young shoot	Penpanassak and Inta (2018)	<i>Acmella oleracea</i> (L.) R.K.Jansen	
				Penpanassak and Inta (2018)	<i>Acmella oleracea</i> (L.) R.K.Jansen	

Table S2. The use of the ethno-species “*Phak Phed*” as medicines reported in Thai ethnobotanical studies

Use as/to treat	Part of uses	Preparation/application	Ethnicity	Reference	Scientific name in Reference
Anthelmintics	Entire plant	#NA	Karen	Kantasrila (2016)	<i>Acmella oleracea</i> (L.) R.K.Jansen
	Flower, young shoot	Eaten raw	Karen	Kaewsangsai (2016)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen
Apthous ulcer	Leaf sheath	Chewing	Lisu	Panta (2015)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Blood tonic	Entire plant	Decoction/Drink	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Enhance appetite	Entire plant	Eaten raw	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Fever	Entire plant	Decoction/Bath	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Flatulence	Inflorescence	Decoction (part of formular)	Thai	Neamsuvan et al. (2013a)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Hemorrhoids	Entire plant	Decoction/Drink	Lawa	Pongamornkul (2006a)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Laxative	Entire plant	Decoction/Drink	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Muscular pain	Aerial parts	#NA	Thai	Turreira-Garcia et al. (2017b)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen
	Entire plant	Steam (part of formular)	Lawa	Pongamornkul (2006a)	<i>Acmella oleracea</i> (L.) R.K.Jansen
	Root	#NA	Karen	Kamwong (2010)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Postpartum blues	Leaf sheath	Decoction/Bath	Khamu	Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
Skin disease	Leaf sheath	Pounded/Poultice	Khamu	Tangtragoon (1998)	<i>Spilanthes acmella</i> (L.) L.
Stomachache	Leaf sheath	Eaten raw	Karen	Kantasrila (2016)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Toothache	Entire plant	Keep in mouth	Karen	Trisonthi and Trisonthi (2009)	<i>Spilanthes acmella</i> (L.) L.
	Inflorescence	Pounded with salt/Poultice	Thai Yuan	Tovaranonte (2001)	<i>Acmella oleracea</i> (L.) R.K.Jansen
		Pounded/Poultice	Hmong	Nuammee (2012)	<i>Acmella ciliata</i> (Kunth) Cass.
		#NA	Thai	Maneenoon et al. (2015)	<i>Acmella oleracea</i> (L.) R.K.Jansen
	Leaf sheath	Pounded/Poultice	Hmong	Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
			Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
		Put in steamed egg	Hmong	Nuammee (2012)	<i>Acmella ciliata</i> (Kunth) Cass.
	Root	Decoction/Drink	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
		Keep in mouth	Karen	Kaewsangsai (2016)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen
				Kantasrila (2016)	<i>Acmella oleracea</i> (L.) R.K.Jansen
			Thai Yuan	Songsangchun (2015)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen
		Pounded/Poultice	Shan	Pongamornkul and Muangyen (2012)	<i>Acmella oleracea</i> (L.) R.K.Jansen
		Pulped/Pistil	Karen	Pongamornkul and Muangyen (2013)	<i>Acmella oleracea</i> (L.) R.K.Jansen
			Khamu	Srithi (2012)	<i>Spilanthes acmella</i> (L.) L.
		Put in chicken soup	Hmong	Nuammee (2012)	<i>Acmella brachyglossa</i> Cass.
					<i>Acmella ciliata</i> (Kunth) Cass.
		#NA	Karen	Kamwong (2010)	<i>Acmella oleracea</i> (L.) R.K.Jansen
				Pongamornkul et al. (2002)	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen
	Stem	Keep in mouth	Thai Yuan	Songsangchun (2015)	<i>Spilanthes acmella</i> (L.) L.
	Unspecified	Chewing	Thai	Neamsuvan et al. (2012a)	<i>Acmella oleracea</i> (L.) R.K.Jansen
Wounds	Entire plant	Pounded/Poultice	Thai	Neamsuvan and Bunmee (2016)	<i>Acmella oleracea</i> (L.) R.K.Jansen
	Leaf sheath	Pounded/Poultice	Kayah	Trisonthi et al. (2007)	<i>Acmella oleracea</i> (L.) R.K.Jansen