Taxonomic Studies on the Asian Species of the Genus Kalanchoe (Crassulaceae) 1. Kalanchoe spathulata and Its Allied Species

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Differences among Kalanchoe spathulata DC., K. crenata (Andrews) Haw., K. integra (Medik.) Kuntze, K. deficiens (Forssk.) Asch. & Scheweinf., K. rosea C.B.Clarke, K. laciniata (L.) DC., and K. ceratophylla Haw. are discussed and evaluated. Variations of Kalanchoe spathulata DC. and allied species are taxonomically examined. Seven varieties are recognized in K. spathulata. Three, var. baguioensis, simlensis, staintonii, are newly described; four new combinations, var. annamica, dixoniana, garambiensis, schumacheri, are proposed. A variety of K. ceratophylla Haw., var. indochinensis, is described.

Key words: Asia, Kalanchoe, new names, taxonomy.

During the preparation of a revision of the Asian species of Kalanchoe (Crassulaceae) for the flora of Nepal and Thailand, it becomes necessary to publish three new varieties and four new combinations under Kalanchoe spathulata DC.

About 70 species and infraspecific taxa of Kalanchoe have been described and reported from the Asian region eastward from the Arabian Peninsula. Haworth (1829) published a remarkable account of the genus after de Candolle’s synoptical work (1828), which now has only historical significance.

Hamet (1907, 1908) revised the entire genus, however his recognition of Kalanchoe laciniata (L.) DC. as a species encompassing a large number of heterogeneous taxa such as K. spathulata, K. integra and K. crenata caused considerable confusion and difficulty for the taxonomy of Kalanchoe.

Kalanchoe presents a number of fundamental problems in its classification. Foremost among them is the limited number of characters that can be usefully employed in the recognition of taxa. Moreover, most previously employed characters show a rather wide range of variation. Due to their preference for habitats such as rock outcrops and gravelly exposed slopes, the species essentially become sporadic in occurrence, and are often further isolated. This leads to difficulties in species delimitation as isolated populations drift towards fixation of different characters. A good example is the case of Kalanchoe spathulata DC. and numerous allied taxa. Thus I deal with the taxonomy of this allies.

Kalanchoe spathulata DC. is the most widespread species in the Asian region and has also been known under the name K. integra (Medik.) Kuntze (Fig. 1). Kalanchoe integra was first described by Medikus as Cotyledon in Historia Commentationes Academiae Electoralis Scientiarum et Elegantiorum Literarum Theodoro-Palatinae [3: 200] in 1775, based on a living plant cultivated at the garden of the Elector of Mannheim (Hortus Electorali Mannhemi-
Kalanchoe crenata (Andrews) Haw., widespread in tropical Africa from South Africa to Arabia and naturalized in tropical America, India and Malesia, is closely related to K. spathulata, but differs from it in the glandular-hairy inflorescence-axes, pedicels (and often sepals) and the sepals distinctly connate at the base. The margins of the leaves of K. spathulata are entire to slightly dentate or irregularly crenate, and rarely more or less regularly crenulate, and those of K. crenata are finely crenate. The leaves below the uppermost ones are deeply trilobed or tripartite in K. spathulata, but not lobed nor parted in K. crenata.

Kalanchoe spathulata somewhat resembles K. ceratophylla Haw. and their ranges partly overlap. Cufodontis (1957, 1965, 1969) and Fernandes (1980) made critical studies of Hamet’s K. laciniata. Wickens (1982) distinguished the Asian glabrous ‘K. laciniata’ from the true K. laciniata and applied the name K. ceratophylla to it. At least for the eastern and southeastern Asian species, however, it is apparent that none of these treatments have proved entirely satisfactory and more investigations are needed.

Kalanchoe spathulata clearly differs from K. laciniata and K. ceratophylla by having undivided uppermost leaves, and also by the narrowly ovate to lanceolate leaves with crenate to nearly entire margins. Kalanchoe laciniata and K. ceratophylla have trilobed uppermost leaves and deeply 3-to 7-lobed or divided cauline leaves. All of these species have similar flowers except the colour and hairiness of the corollas.

Thus, the Asian taxa of Kalanchoe spathulata-allies are classified into three species. Seven varieties are recognized in K. spathulata, and one variety is described in K. ceratophylla. They are distinguished by the following key.
Key to *Kalanchoe spathulata* and allied species and the varieties:

1. Leaves except for uppermost ones entire to irregularly crenate or narrowly crenulate; those of uppermost ones sometimes trilobed with ovate or narrowly oblong-ovate lobes

2. Plants rather densely papillate

3. Inflorescences obconical, lateral branchlets not conspicuously elongate

4. Leaves spathulate or narrowly oblong-ovate, margins regularly crenulate; Thailand

5. Plants up to 50 cm tall

6. Flowers yellow or cream yellow

7. Leaves in lower part oblong-ovate, margins rather finely serrate; Java

1a) *K. spathulata* var. *spathulata*

1b) *K. spathulata* var. *similensis* (described here)

1c) *K. spathulata* var. *baguioensis* (described here)

1d) *K. spathulata* var. *dixoniana*

1e) *K. spathulata* var. *garambiensis*

1f) *K. spathulata* var. *shumacheri*


*Cotyledon spathulata* Poir. in Lam.
Encycl. Suppl. 2: 373 (1811).


*Kalanchoe varians* Haw. in Phil. Mag. N. S. 9: 302 (1829), versim.

*Kalanchoe subamplectus* Wall., Pl. As. Rar. 2: t. 167 (1831), versim.

*Bryophyllum serratum* Blanco, Fl. Filip. ed. 2, 220 (1845).


In *Kalanchoe spathulata*, owing to the wide geographical distribution, the variations in shape, size, and dissection of leaves are extremely wide and show local tendencies. At present seven varieties are recognized in this species which are mostly restricted to narrow geographical areas.

a) var. *spathulata*.


Distr. India to Malesia and S Japan (Ryukyu Islands) through Thailand, Indo-China, China, and Taiwan.

Kalanchoe tashiroi approaches K. crenata in having ovate to widely ovate leaves with rather regularly crenate margins. I have a suspicion that this is the ‘K. crenata’ introduced or naturalized in Orchid Island off Taiwan. No other specimens of K. spathulata were collected from the island.

b) var. annamica (Gagnep.) H. Ohba, stat. nov.


Kalanchoe yunnanensis Gagnep. in Lecomte, Notul. Syst. 3: 220 (1918), syn. nov. Type: [China, Yunnan] Mongtze. Tanaut s.n. (P).


Distr. Indo-China (Laos, Vietnam [Annam]) and China (Yunnan).


This variety is characterized by the petiolate, narrowly ovate to lanceolate or lanceolate-oblong, serrat lower leaves and the linear or narrowly oblong or lanceolate entire or nearly entire upper leaves.

Kalanchoe chevalieri is considered to be conspecific with K. annamica, and both represent a geographic variety of K. spathulata. The type of K. yunnanensis is at fruiting stage, and has petiolate, narrowly ovate to lanceolate leaves 5–10 cm long and 1.5–3.5 cm wide with acute or obtuse-acute apices and rounded bases. The margins of the leaves vary from nearly entire to roughly and irregularly crenulate. The stems, inflorescence-axes and pedicels are glabrous and smooth. Though Fu et al. (2001) considered K. yunnanensis to be a synonym of var. spathulata (as K. integra), this shares significant features with var. annamica.

Pételot 4586 and Evrard 2206 are remarkable in that they have tripartite upper leaves, so it might be supposed that they have had a genetic influence from K. ceratophylla.

c) var. bagioensis H. Ohba, var. nov.

Differt a typo axisibus inflorescentiaeae pedicellis dense vel modice pubescentibus.

Stems up to 40 cm tall, upper part short hirsute. Leaves in lower part spatulate or narrowly oblong-ovate, 4–6 cm long, 1.7–2.5 cm wide, rather regularly crenulate or minutely serrate, apex rounded or obtuse, base widely cuneate, sessile; in upper part narrowly spatulate, narrowly obovate-lanceolate to widely linear, 2–3 cm long, 0.6–1.4 cm wide, entire to remotely and shallowly crenate, apex rounded or obtuse, base cuneate. Inflorescence-axes densely hairy with short-hirsute hairs. Flowers pedicellate, pedicels densely short-hirsute; bracts and bracteoles linear. Flowers 2–2.5 cm long, calyx densely short-hirsute; corolla yellow, short-hirsute on outer surface. Carpels sparse translucent and sometimes with glandular-hairs.


Distr. Philippines (Luzon Island), endemic to Baguio and the vicinity.

Kalanchoe garambiensis has an extremely dwarf habit reaching only 5 to 8 cm tall. This is known only from limestone crevices on the seashore in the southernmost area of Taiwan. Some specimens of var. spathulata which were collected from limestone mountains, e.g., Kerr 15355 (BM), approach to this variety in having a depauperate form with small, lanceolate leaves and short, slender flowering stems.

d) var. dixoniana (Raym.-Hamet) H.Ohba, stat. nov.
Distr. Thailand.
This, known from only the type collection, is characterized by the rather densely glandular hairy inflorescence-axes (upper part only), pedicels, sepals and corolla tubes and the oblong-obovate, sessile leaves with rather finely crenulate margins and flat narrow bases. These characters of var. dixoniana approach those of var. baguioensis.

e) var. garambiensis (Kudo) H.Ohba, stat. nov.
Distr. Taiwan (Kaohsiung).

f) var. schumacheri (Koord.) H.Ohba, stat. nov.
Kalanchoe integra auct. non (Medik.) Kuntze: C. A. Baker in Steenis, Fl. Mal., ser. 1, 4: 202 (1951), pro parte.
Distr. Java.
Specimens examined. Java. Sine loc. especialit. Unknown collector s. n. (L); sine loc. Horsfield s. n. (K); sine loc. Horsfield in 1802–1818 (K); Besocki, 1–1450 m. Koorder 47704β, 43957β, 44166β & 44324β (L).
This seems to reproduce vegetatively, new plants arising from lateral shoots. The leaves on lateral shoots are rather uniform throughout the stem with trullately ovate lamina of which the distal half is irregularly crenate or serrate and also with long petioles, as illustrated in the Table 14 (especially G) by Koorders (1918).

g) var. simlensis H.Ohba, var. nov.
Differt a typo foliis oblanceolatis majoribus haud petiolatis.
Stems up to 80 cm tall, glabrous, base up 1.3 cm wide. Leaves sessile; those in lower part lanceolate or widely lanceolate, up to 22 cm long, 6.5 cm wide, apex rounded or obtuse, base long attenuate, margins nearly entire to remotely and shallowly crenate; in
upper part oblanceolate to widely oblanceolate, with long attenuate base. Inflorescence and flowers glabrous and smooth.


Distr. India (Himachal Pradesh).


Kalanchoe varians Howarth described from India Orientali might not be distinguishable from this variety. This variety is characterized by the large, oblanceolate sessile leaves.

h) var. staintonii H.Ohba, var. nov.


A typo foliis cuneato-vel trianguli-ovatis basi cuneatis, longe petiolatis bene differt.

Stems up to 1.2 m tall, glabrous and smooth, up to 1.5 cm diameter at the base. Leaves glabrous and smooth, conspicuously petiolate; those in lower part with petioles 4–6 cm long up to 25 cm long, 8 cm wide, narrowly oblong-ovate to narrowly triangular-ovate or widely lanceolate, apex rounded, base rounded or widely cuneate, margins rather regularly crenate to crenulate on distal two thirds; leaves in the upper part narrowly ovate to widely lanceolate, conspicuously petiolate, margins crenate to crenulate.

Fig. 1. Distribution of Kalanchoe spathulata and its allied taxa. Kalanchoe spathulata (solid line), var. garambiensis (A), var. baguioensis (B), var. shumacheri (C), var. dixoniana (D), var. annamica (E), var. staintonii (F), var. simlensis (G); K. crenata (broken line); K. deficiens (solid line with vertical stripes); and K. rosea (solid line with horizontal stripes).
Inflorescence and flowers glabrous, smooth. Corolla bright yellow to pale yellow; filaments green; pistils green.


Distr. Himalaya (Kumaon, Nepal, Sikkim & Bhutan) and Assam.


This variety is characterized by the long-petiolate, large leaves with rather regularly crenulate margins and rounded or widely cuneate base. In my observations in Nepal the shape and size, and also the length of petiole and the serration of leaves are constant. It usually grows gregariously on stony, sunny side slopes or river beds.


Distr. Endemic to India (Assam).


The flowers are fragrant with scarlet, pale pink and pale orange corollas. Except for the colour and fragrance of the flowers Kalanchoe rosea shares significant features with K. spathulata. Further comparative studies, with ample materials, are required.


Kalanchoe macrosepala Hance in J. Bot. 8: 5 (1870). Type: Hong Kong. Hance 1723 (BM holo).

Kalanchoe gracilis Hance in J. Bot. 8: 6 (1870). Type: Taiwan. Svinhoe. Unknown collector 7578 in 1861 (BM holo).


Distr. Himalaya, Thailand, Malesia (Malaya, Sumatra to the Philippines), Indo-China, China, Taiwan, and Mascarenes.

b) var. indochinensis H. Ohba, var. nov. Inflorescentiae ramulis lateralibus multis elongatis ex typo differt.

Stems up to 80 cm tall. Leaves up to 12 cm long, usually with 5 lobes; uppermost leaves linear not divided, 3–5 cm long, 4–5 mm wide. Inflorescences large, with elongate lateral branchlets, conspicuously bracteate; bracts and bracteoles linear, 1–3 cm long. Flowers ca. 2 cm long, corolla yellow, with pedicels up to 1.2 cm long.

Type: Laos. Dok Mien to Luang Prabang. Dr. Spire 878 (P holo, iso).
Distr. Indo-China (Laos and Vietnam).


*Kalanchoe ceratophylla* is variable especially in the shape of leaves. This variety is characterized by the inflorescences with many elongate lateral branchlets is restricted to Indo China (Laos and Vietnam).

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References (others see the taxonomic treatments)


別し、南西諸島の個体は台湾南部の鶯谷鼻から
記載された var. garambiensis に似てくるが、この
変種に含められるかどうかはさらなる研究が必要
である。なお、リュウキュウベンケイソウには、
私自身これまでリュウキュウベンケイの和名を採
用してきたが、植物名であることがよりっきり
するリュウキュウベンケイソウという呼び方を今
後は用いたい。
本論文ではリュウキュウベンケイソウに合計 3
つの新変種と 4 つの新組合せ、Kalanchoe cerato-
phylla には var. indochiensis という 1 変種を新たに
発表した。各分類群毎に異名とその分布域を示し、
多くの分類群では検討した標本を挙げた。
（東京大学総合研究博物館植物部門）