

AGAPETES D. DON EX G. DON – JEWELS OF THE EAST AT THE ROYAL BOTANIC GARDEN EDINBURGH

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ABSTRACT

The Royal Botanic Garden Edinburgh (RBGE) holds a number of collections of the family Ericaceae (Conlon, 2010; 2012). One of these is the genus *Agapetes* D. Don ex G. Don. An overview of the literature on this genus is given with the distribution and a history of the collection at RBGE. Horticultural information for the cultivation and propagation of the genus is included.

INTRODUCTION

Agapetes is in family Ericaceae and was originally named in 1834 by George Don (1798–1856), a botanist who worked at the Chelsea Physic Garden and collected for the Royal Horticultural Society in Brazil, Sierra Leone and the West Indies; he had a brother, David Don (1799/1800–1841) who was also a botanist. Their father, George Don (1764–1814), was a Scottish botanist appointed to the post of Superintendent at Royal Botanic Garden Edinburgh (RBGE) in 1792 (Muir, 1994). George Don initially described 16 species of *Agapetes* (Don, 1834).

The name *Agapetes* comes from the Greek *agapetos* meaning beloved or desirable; *agape* – love; *agapeo* – to be well contented with. This is a reference to the plants being showy or beautiful (Quattrocchi, 2000) which is quite obvious when one looks closely at the flowers (Fig. 1).

There are roughly 100 accepted species of the 220 names ever recorded for the genus *Agapetes* (Missouri Botanical Garden, 2015) and they are closely related to the genera *Paphia*, *Dimorphanthera* and the Southeast Asian *Vaccinium*.

HISTORY OF AGAPETES

After George Don named the genus in 1834 along with 16 species, the next person to do any major work on the genus was C.B. Clarke in 1881–1882. Clarke was superintendent of the Calcutta Botanical Garden and later a botanist at the Royal Botanic Gardens, Kew (RBG, Kew) who published in Hooker's *Flora of British India* (Clarke, 1882). By this time, around 40 species had been recognised. Clarke's work was followed by several others who named additional small numbers of species until a considerable amount of work was carried out by H.K. Airy Shaw, a tropical botanist also working at RBG, Kew

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Fig. 1 Painting of four species of *Agapetes* by Mary Bates. Clockwise from top left: *A. buxifolia*, *A. smithiana* var. *major*, *A. meiniana* (syn. *Paphia meiniana*), *A. macrantha* var. *macrantha*. Reproduced with kind permission of John Mendum.

who published on *Agapetes* from 1935 to 1960 (Airy Shaw, 1935; 1948; 1958–1959; 1960a; 1960b); much of the material he worked on came from collections made by Frank Kingdon-Ward, the English botanist and plant hunter who made more than 20 plant-collecting expeditions to Tibet, north-west China, Myanmar and Assam in the first half of the 20th century. After Airy Shaw's work there were 80–90 accepted species. This was followed by the work of P.F. Stevens (a researcher at Missouri Botanical Garden who trained at RBGE) in the 1970s and later. He uses molecular characteristics and DNA analysis as the basis for his work. This includes transfer of the species occurring to the east of Wallace's Line to the genus *Paphia*, which was initially named by Seemann in 1864 (Seemann, 1864) (Fig. 2) (Stevens, 2004). Some of the most recent work has been carried out by scientists from the Botanical Survey of India following extensive field surveys in eastern Himalaya and north-east India and the study of specimens from several Indian herbaria (Banik & Sanjappa, 2007; 2008). This work has added six new records for India along with three new species. In 2012 Watthana published a revision of the Thai species (Watthana, 2012) (Fig. 3). The most recent publication on *Agapetes* describes a new species, *Agapetes putaoensis* Y.H. Tong & N.H. Xia, and a new variety, *Agapetes wardii* W.W. Sm. var. *heterotricha* Y.H. Tong & N.H. Xia, from Myanmar, by researchers at the Chinese Academy of Sciences (Tong & Xia, 2014).

The genus has a complicated taxonomic history with questions regarding the closeness of *Paphia*, *Dimorphanthera* and *Vaccinium* and their complex distribution (Sleumer, 1967; Stevens, 1972; 1985; 2004).



Fig. 2 Scan of *Paphia vitensis* Seem. from Seemann, B. (1865–1873) *Flora Vitiensis*, p. 147, Plate XXVIII b. Scan: Tony Conlon.



Fig. 3 Fruits of *Agapetes thailandica* Watthana. Photo: Tony Conlon.

DESCRIPTION AND DISTRIBUTION OF *AGAPETES*

Agapetes can be described as woody, sometimes arching or climbing evergreen shrubs which are often epiphytic, rarely terrestrial and have a swollen basal stem, thickened roots or a woody tuber (Fig. 4). They are found predominantly in upper rain forest or moss forest above 1,000 m and up to over 3,000 m. Their flowers can be almost jewel-like, often with thick or waxy petals (Figs 1 & 5).

Prior to 2004 distribution was believed to be somewhat disjunct over southern and eastern Asia with species occurring over a relatively wide area from the Himalayas to Australia and Papua New Guinea. Collections at RBGE come from India, Nepal, Bhutan, China, Myanmar (Burma), Thailand, Peninsular Malaysia then with a fairly large gap over to Papua New Guinea, Australia and the islands of New Caledonia and Fiji. In 2004 Stevens separated, or reinstated, the ‘Oceanic *Agapetes*’ which occur in Papua New Guinea, Fiji and New Caledonia to the genus *Paphia*, which has led to more cohesive distributions of all these genera. This means that there are about 20 species in *Paphia* and 80–90 species remaining in *Agapetes*. This leaves the current distribution of *Agapetes* to be from the eastern Himalayas through to south-west China and Indochina to Southeast Asia as far as Peninsular Malaysia (Ruizheng & Stevens, 2005) (Fig. 6).



Fig. 4 Swollen stem and roots of *Agapetes hosseana* Diels. Photo: Tony Conlon.



Fig. 5 *Agapetes variegata* (Roxb.) D. Don ex G. Don var. *macrantha* (Hook. f.) Airy Shaw showing waxy flowers. Photo: Tony Conlon.

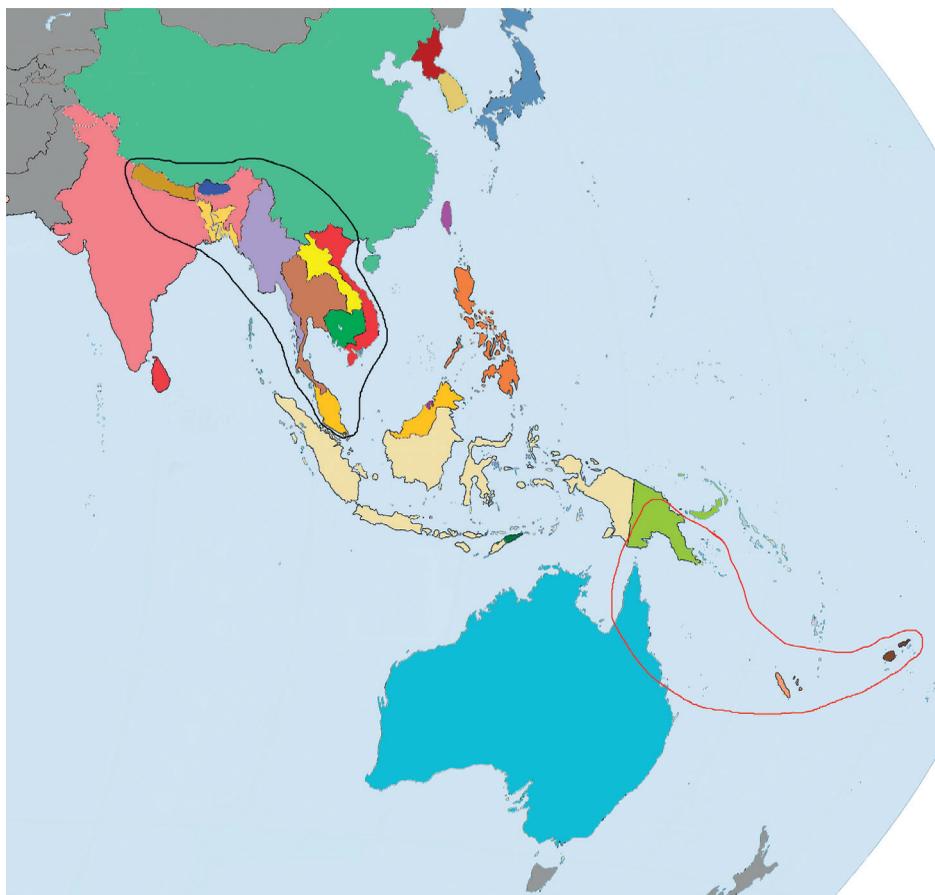


Fig. 6 Map of Southeast Asia showing the distribution of *Agapetes* (surrounded by the black line) and *Paphia* (shown by the red line). Map drawn by Tony Conlon.

THE COLLECTIONS AT THE ROYAL BOTANIC GARDEN EDINBURGH

The Living Collection

The Living Collection of *Agapetes* at RBGE includes about 25 taxa, 22 of which are currently living, the rest held as seed. This is a relatively small collection compared to some of the other Ericaceae holdings at RBGE and it has been added to in an unstructured way over the years with no field trips mounted to look specifically for *Agapetes* (see Appendix). However, the author believes it to be the only substantial collection of the genus in cultivation worldwide. Most accessions were introduced in the 1970s and 1980s. However, Bill Burt collected *A. hosseana* Diels (Fig. 7), with interesting, almost ‘painted’ fruits, from Thailand in 1967, and Paddy Woods collected two species

in 1968, one, *A. scortechinii* (King & Gamble) Sleumer (Fig. 8), from Peninsular Malaysia and the other, *A. stenantha* (Schltr.) Sleumer (= *Paphia stenantha* Schltr.) (Fig. 9) from Papua New Guinea. Other collectors from RBGE include David Chamberlain, who brought back *A. obovata* (Wight) Hook. f. (Fig. 10) and *A. odontocera* (Wight) Hook. f. (Fig. 11) from Meghalaya in north-east India. A large specimen of this plant can be seen in the Montane Tropics display house. It flowers well every year, showing its classic characteristic of cauliflory; the flowers emerge from the woody stem rather than a leaf stalk. Chamberlain also collected the popular red-striped *A. serpens* (Wight) Sleumer (Fig. 12) from north-west Bengal in India in 1975. Peter Cox and Sir Peter Hutchison visited Meghalaya in 1979, bringing back the yellow-flowered *A. smithiana* var. *major* Airy Shaw (Figs 1 & 13); J. Wrigley collected *A. meiniana* F. Muell. (syn. *P. meiniana* (F. Muell.) Schltr.) (Fig. 1) from Mount Bellenden Ker, Queensland, Australia in 1979. The Sino-British Cangshan Expedition to Yunnan in 1981 brought back *A. manni* Hemsl., which has smallish white flowers with green tips. Andrew Grierson and David Long brought back the yellow-flowered *A. flava* (Hook. f.) Sleumer (Fig. 14) and *A. smithiana* Sleumer (Fig. 15) from Bhutan in 1982. Stuart MacPherson went to Sikkim in 1983, bringing back *A. smithiana* Sleumer (Fig. 15). Ian Sinclair and David Long visited Bhutan in 1984 and collected the dark red-flowered *A. saligna* (Hook. f.) Hook. f. (Fig. 16) and *A. sikkimensis* Airy Shaw. John Sandham's visit to Papua New Guinea in 1986 introduced *A. vitis-idaea* Sleumer (= *P. vitis-idaea* (Sleumer) P.F. Stevens), and Anthony Schilling brought back *A. flava* (Hook. f.) Sleumer (Fig. 14) from Nepal in 1986. The collaborative Kew/Edinburgh Kanchenjunga Expedition to Nepal in 1989 brought back *A. incurvata* (Griff.) Sleumer var. *hookeri* (C.B. Clarke) Airy Shaw (Fig. 17) and *A. smithiana* Sleumer (Fig. 15). George Kirkpatrick collected *A. serpens* (Wight) Sleumer in Sikkim in 1990 (Fig. 18). This was followed by the Edinburgh Sikkim Expedition with David Long, Ron McBeath, Henry Noltie and Mark Watson in 1992 to Darjeeling, India, where they collected *A. incurvata* (Griff.) Sleumer var. *hookeri* (C.B. Clarke) Airy Shaw. Crinan Alexander, Mark Newman and Phil Thomas on the Gaoligong Shan Biotic Survey Expedition in Yunnan in 1996 returned with four *Agapetes* sp. including *A. manni* Hemsl. The most recent additions arrived in 1999 when George Argent collected in Thailand, adding to the collection with the colourful *A. moorei* Hemsl. (Fig. 19) and *A. thailandica* Watthana with its interesting fruits which are white at first, becoming greener with a glaucous bloom as they age (Fig. 3).

Historically important original Frank Kingdon-Ward material has also previously been grown at RBGE, particularly *A. manni* Hemsl. from seed which was sent from the New York Botanical Garden in 1950. It appears that the oldest living accession presently growing in the collection was from 1964, *A.* × 'Ludgván' (known as Ludgván's cross) (Fig. 20) which was acquired as a cultivated, or garden-origin, plant from Bodnant Garden. There is evidence, however, of *Agapetes* (*A. buxifolia* Nutt.) (Figs 1 & 21) listed in a publication of seeds collected from plants growing at RBGE in 1897 (RBGE, 1898). Some of the other notable *Agapetes* species at the Garden include *A. variegata* (Roxb.)

D.Don ex G.Don var. *macrantha* (Hook.f.) Airy Shaw (Figs 1 & 5) with spectacular, relatively large, pink-and-white striped flowers.

Some of these plants are relatively easy to grow and a number of them are available commercially. Those most often seen are *A.* × ‘Ludgvan’ (Ludgvan’s cross = *A. incurvata* × *A. serpens*) (Fig. 20), *A. serpens*, *A. serpens* ‘Nepal Cream’ and occasionally *A. hosseana* and *A. smithiana*.

The Herbarium Collection

There are about 400 specimens, representing some 80 taxa, in the herbarium filed under *Agapetes*. Of these, 56 specimens are classified as ‘cultivated’ which means they have been taken from plants in the Living Collection at RBGE (see Appendix). Currently 133 herbarium specimens are available to access online along with high-quality scanned images of all the type specimens with additional images of other specimens (Royal Botanic Garden, Edinburgh, 2015). The oldest of these dates back to at least 1844 and is a specimen of *A. setigera* D.Don ex G.Don originally held in the herbarium at Royal Botanic Gardens, Kew which appears to have been collected in the Khasiya Hills in Assam in present day north-east India by Griffiths and Lemann and determined by C.B. Clarke for the *Flora of British India* (Clarke, 1882).



Fig. 7 *Agapetes hosseana* Diels fruit. Photo: Tony Conlon.



Fig. 8 *Agapetes scortechinii* (King & Gamble) Sleumer. Photo: Tony Conlon.



Fig. 9 *Agapetes stenantha* (Schltr.) Sleumer = *Paphia stenantha* Schltr. Photo: Tony Conlon.



Fig. 10 *Agapetes obovata* (Wight) Hook. f. Photo: Tony Conlon.



Fig. 11 *Agapetes odontocera* (Wight) Hook. f. Photo: Tony Conlon.



Fig. 12 *Agapetes serpens* (Wight) Sleumer. Photo: Tony Conlon.



Fig. 13 *Agapetes smithiana* Sleumer var. *major* Airy Shaw. Photo: Tony Conlon.



Fig. 14 *Agapetes flava* (Hook. f.) Sleumer. Photo: Tony Conlon.



Fig. 15 *Agapetes smithiana* Sleumer. Photo: Tony Conlon.



Fig. 16 *Agapetes saligna* (Hook. f.) Hook. f. Photo: Tony Conlon.



Fig. 17 *Agapetes incurvata* (Griff.) Sleumer. Photo: Tony Conlon.



Fig. 18 *Agapetes serpens* (Wight) Sleumer. Photo: Tony Conlon.



Fig. 19 *Agapetes moorei* Hemsl. Photo: Tony Conlon.



Fig. 20 *Agapetes* × 'Ludgvan'. Photo: Tony Conlon.



Fig. 21 *Agapetes buxifolia* Nutt. (also illustrated in Fig. 1). Photo: Tony Conlon.

CULTIVATION

Agapetes are more tolerant of adverse conditions than many other Ericaceae with which they are grown under glass at RBGE (Conlon, 2010; 2012). They are kept in the same greenhouse as the montane tropical *Vireya* rhododendrons and other ericaceous genera such as *Vaccinium*, *Dimorphanthera* and *Diplycosia* with a night minimum temperature of 10°C. This reflects the cool, montane, mossy situations in which they are found in the wild. Some have been successfully grown outside in a sheltered patio on the north side of the main range of display glasshouses for a number of years. However, many of these plants succumbed to the particularly cold and snowy winter of 2010–2011. An individual of *A. incurvata* var. *hookeri* collected on the Kew/Edinburgh Kanchenjunga Expedition of 1989 from 2,600 m in Nepal survived the longest before finally succumbing to the Edinburgh elements.

Most of the *Agapetes* grown at RBGE are in plastic half pots, also called pans, or baskets but they also grow well as epiphytes on pieces of cork bark. Under glass they are grown in what is now a standard mix for montane tropical epiphytic ericaceous plants, consisting of a medium-sized potting bark (3–15 mm) with horticultural charcoal (5–15 mm) added at a ratio of 70 litres of bark to 3–4 litres of charcoal. A weak balanced feed (NPK 1:1:1) is applied at half-strength once or twice a month in spring and summer. Plants are generally potted on when required but do not suffer if they remain in the same pots for a number of years.

Agapetes are drought-tolerant and irrigation is weather- and season-dependent with a daily watering in the summer which is reduced to about once a week in winter. They can quite easily miss a watering without any damaging outcomes. The house is shaded during the spring and summer months to help prevent scorching of young growth.

Propagation is mainly carried out with semi-ripe cuttings which strike well in a mix of propagating bark (2–7 mm) with added medium-grade vermiculite or perlite, charcoal and chopped sphagnum moss depending on availability. Cuttings are then put in a closed case with bottom heat and daily misting as required. Seed can also be successful if sown on sterilised small-grade propagating bark (2–7 mm) or growbark (0–6 mm). Pots are then placed in a three-quarter-closed case suspended on a metal grille above a reservoir of heated water (21°C) to keep humidity high, and a fan at one end to encourage good air movement and ventilation.

A number of *Agapetes* can be seen on display in the Montane Tropics glasshouse at RBGE.

CONCLUSION

As holders of what is believed to be the largest collection of *Agapetes*, horticulturists at RBGE have acquired a lot of experience of their growing habits and requirements. They have found that if provided with the conditions described the plants are fairly easy to cultivate and propagate. They make an excellent complement to similar plants that occur in their natural habitat, such as ferns and orchids, in a free-draining substrate or as

epiphytic plantings which show off their exquisite hanging flowers. A cool glasshouse, heated to a minimum of 10°C in winter, is ideal for most of the species; however, they will still grow well in a warmer glasshouse. In temperate climates, such as the warmer parts of Europe, some species will survive winter temperatures outside or could be put outside in pots in summer.

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APPENDIX

Agapetes accessions at Royal Botanic Garden Edinburgh on *BG-Base* (Walter & O’Neal, 1985–2010) database showing herbarium specimens or living material and country of origin on 12 February 2015. The Accessions column includes plants which were previously in the Living Collection but which have died.

<i>Agapetes</i> species	Accessions	Herbarium specimens	Origin of accessions and specimens	Alive?
<i>Agapetes</i> sp.	Y	Y	Yunnan, China, India, Thailand, Burma	Y
<i>Agapetes acuminata</i>	N	Y	Unknown	N
<i>Agapetes affinis</i>	N	Y	India	N
<i>Agapetes angulata</i>	N	Y	Burma	N
<i>Agapetes angustifolia</i>	N	Y	Burma	N
<i>Agapetes auriculata</i>	N	Y	Bhutan	N
<i>Agapetes bhutanica</i>	N	Y	Burma	N
<i>Agapetes brachypoda</i> var. <i>gracilis</i>	N	Y	Burma, Myanmar	N
<i>Agapetes bracteata</i>	N	Y	Thailand	N
<i>Agapetes brandisiana</i>	N	Y	Burma	N
<i>Agapetes burmanica</i>	Y	Y	Assam, India	Y
<i>Agapetes buxifolia</i>	N	Y	India	N
<i>Agapetes corallina</i>	N	Y	Burma	N
<i>Agapetes coriacea</i>	N	Y	Malay Islands	N
<i>Agapetes discolor</i>	N	Y	India, China	N
<i>Agapetes flava</i>	Y	Y	Assam, Bhutan, Nepal	Y
<i>Agapetes forrestii</i>	N	Y	China, West Yunnan	N
<i>Agapetes griffithii</i>	N	Y	India	N
<i>Agapetes hookeri</i>	N	Y	Nepal	N
<i>Agapetes hosseana</i>	N	Y	Burma	N
<i>Agapetes hyalocheilos</i>	Y	Y	Thailand	Y
<i>Agapetes</i> cf. <i>incurvata</i>	N	Y	Burma	N
<i>Agapetes incurvata</i>	Y	Y	Assam, Nepal, India, Bhutan	Y
<i>Agapetes incurvata</i> var. <i>hookeri</i>	Y	Y	Nepal, India	Y
<i>Agapetes interdicta</i>	N	Y	China, Yunnan, Burma	N
<i>Agapetes interdicta</i> var. <i>stenoloba</i>	N	Y	China, Burma, Yunnan	N

<i>Agapetes</i> species	Accessions	Herbarium specimens	Origin of accessions and specimens	Alive?
<i>Agapetes kudukii</i>	N	Y	Papua New Guinea	N
<i>Agapetes lacei</i>	N	Y	Burma, China, Yunnan, Tibet	N
<i>Agapetes laurifolia</i>	N	Y	Java	N
<i>Agapetes leptantha</i>	N	Y	Burma	N
<i>Agapetes listeri</i>	N	Y	NE India	N
<i>Agapetes lobbii</i>	N	Y	India, Burma, Thailand	N
<i>Agapetes loranthiflora</i>	N	Y	Thailand	N
<i>Agapetes loranthiflora</i> var. <i>glabrata</i>	N	Y	Thailand, India	N
<i>Agapetes macrantha</i>	N	Y	Unknown	N
<i>Agapetes manipurensis</i>	N	Y	India	N
<i>Agapetes mannii</i>	Y	Y	Burma, China, Yunnan	Y
<i>Agapetes megacarpa</i>	N	Y	W. China, Yunnan, Burma	N
<i>Agapetes meiniana</i>	Y	N	Australia	Y
<i>Agapetes miranda</i>	N	Y	China, Tibet	N
<i>Agapetes moorei</i>	Y	Y	Thailand, Burma	Y
<i>Agapetes moorei</i> var. <i>glabrescens</i>	N	Y	Burma	N
<i>Agapetes muscorum</i>	N	Y	Assam, India	N
<i>Agapetes neriifolia</i>	N	Y	Burma	N
<i>Agapetes nuttallii</i>	N	Y	Bhutan	N
<i>Agapetes oblonga</i>	N	Y	China, Burma, Yunnan	N
<i>Agapetes obovata</i>	Y	Y	India	Y
<i>Agapetes odontocera</i>	Y	Y	India	Y
<i>Agapetes odontocera</i> var. <i>stenosepala</i>	N	Y	Burma	N
<i>Agapetes parishii</i>	N	Y	Burma, Thailand	N
<i>Agapetes pensilis</i>	N	Y	Yunnan, China	N
<i>Agapetes praeclara</i>	N	Y	China, Tibet	N
<i>Agapetes pseudo-griffithii</i> var. <i>abbayana</i>	N	Y	Burma	N
<i>Agapetes pubiflora</i>	N	Y	China	N
<i>Agapetes pulcherrima</i>	N	Y	Unknown	N
<i>Agapetes pyrolifolia</i>	N	Y	Myanmar	N
<i>Agapetes refracta</i>	N	Y	Assam	N

<i>Agapetes species</i>	Accessions	Herbarium specimens	Origin of accessions and specimens	Alive?
<i>Agapetes rubropedicellata</i>	N	Y	Burma	N
<i>Agapetes saligna</i>	Y	Y	Bhutan, India, Sikkim, Bengal	Y
<i>Agapetes saxicola</i>	N	Y	Thailand	N
<i>Agapetes sclerophylla</i>	N	Y	Unknown	N
<i>Agapetes scortechinii</i>	Y	Y	Peninsular Malaysia	Y
<i>Agapetes serpens</i>	Y	Y	India, Nepal, Bhutan, Sikkim, W Bengal	Y
<i>Agapetes serpens</i> 'Nepal Cream'	Y	Y		Y
<i>Agapetes serpens</i> 'Scarlet Elf'	Y	N		Y
<i>Agapetes setigera</i>	N	Y	Assam	N
<i>Agapetes setigera</i> var. <i>verticillata</i>	N	Y	Assam	N
<i>Agapetes sikkimensis</i>	Y	Y	Bhutan	Y
<i>Agapetes similis</i>	N	Y	NE India	N
<i>Agapetes smithiana</i>	Y	Y	Bhutan, India, Nepal, Sikkim	Y
<i>Agapetes smithiana</i> var. <i>major</i>	Y	Y	Assam India	Y
<i>Agapetes stanantha</i>	Y	Y	Papua New Guinea	Y
<i>Agapetes thailandica</i>	Y	Y	Thailand	Y
<i>Agapetes toppinii</i>	N	Y	Burma	N
<i>Agapetes variegata</i>	N	Y	Thailand, India, Bhutan	N
<i>Agapetes variegata</i> var. <i>elegans</i>	N	Y	Burma	N
<i>Agapetes variegata</i> var. <i>macrantha</i>	Y	Y	Unknown	Y
<i>Agapetes vernayana</i>	N	Y	Burma	N
<i>Agapetes vitis-idaea</i>	Y	N	Papua New Guinea	N
<i>Agapetes wardii</i>	N	Y	Burma	N
<i>Agapetes</i> × 'Ludgvan'	Y	Y		Y
<i>Agapetes yunnanensis</i>	N	Y	W. China, Yunnan, Burma	N

