

## Diversity of the genus *Clerodendrum* Linnaeus (Lamiaceae) in Northeast India with special reference to Barnadi Wildlife Sanctuary, Assam

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### Abstract

The genus *Clerodendrum* Linnaeus (Lamiaceae) comprises of 23 species and 2 varieties in India of which Northeast India represents 18 species and 2 varieties. Barnadi Wildlife Sanctuary in Assam harbours 7 species of the genus viz., *Clerodendrum chinense* (Osbeck) Mabblerley, *C. colebrookianum* Walpers, *C. cordatum* D. Don, *C. indicum* (Linnaeus) O. Kuntze, *C. japonicum* (Thunberg) Sweet, *C. paniculatum* Linnaeus and *C. serratum* (Linnaeus) Moon. The paper provides the diversity and distribution of *Clerodendrum* species in Northeast India with special reference to Barnadi Wildlife Sanctuary, Assam along with their phytogeographical affinities in rest part of India and neighbouring countries. The correct nomenclature of each species, brief description, ethnobotanical uses of the available species, photo plates and other relevant notes are also highlighted.

**Key words:** *Clerodendrum*, Lamiaceae, diversity, distribution, Northeast India, Barnadi Wildlife Sanctuary, Assam

### INTRODUCTION

*Clerodendrum* Linnaeus was first described by Linnaeus in 1753 with the lone species *Clerodendrum infortunatum* Linnaeus and is derived from two Greek words *kleros* meaning “chance or fate” and *dendron* “a tree” (Quattrocchi 2000). The genus is very diverse and widely distributed in tropical and subtropical regions of the world representing ca. 580 species (Shrivastava & Patel 2007). According to Rajendran & Daniel (2002), 23 species and a variety occur in India and 17 species and a variety in Northeast India. With the new combination of *Clerodendrum japonicum* (Thunberg) Sweet var. *urticifolia* (Roxburgh) R.C. Srivastava & R.K. Choudhary (Srivastava & Choudhary 2008) and new distributional report of *Clerodendrum paniculatum* Linnaeus to Northeast India from Barnadi Wildlife Sanctuary, Assam (Deori *et al* 2012) the diversity of *Clerodendrum* species in India has increased to 23 species, 2 varieties and Northeast region to 18 species and 2 varieties.

Northeast India is one of the richest and most interesting floristic regions of the world due to diverse geographical area, varied topographical, ecological, climatic and soil conditions, immigration and colonization of plant species from widely different territories coupled with the fact that it is the transitional zone between the paleo-arctic, Indo-Malayan and Indo-

Chinese biogeographical zones as well as the confluence of the Himalayan region with Peninsular India (Rao 1994). Protected areas like Biosphere Reserves, National Parks, Wildlife Sanctuaries and various Reserve forests can play a vital role in the conservation of Biodiversity and maintaining natural ecosystems. The documentation and proper assessment of the diversity is needed in the respective areas and habitat. The study of plant genetic resources in the smaller area is more valuable in the biodiversity conservation strategies. The Northeast region is considered as one of the richest biodiversity centers of the Indian sub-continent. Assam being one of the northeastern states comprises of 13 wildlife sanctuaries (Bora & Kumar 2003).

Barnadi Wildlife Sanctuary (BWS) is situated in Udalguri district of Assam covering an area of 26.22 sq km (**Fig. 1**). It lays between 26° 48' N Latitude 91° 44' E Longitude in the foot hills of Eastern Himalaya bordering to Bhutan in the Northwestern part.

The name of the sanctuary is derived from river Barnadi. The sanctuary was earlier known as the Barnadi Reserve Forest and it has been upgraded as Wildlife Sanctuary in 1980 by the Government of Assam particularly for the safety of the hispid hare and world's rarest and smallest wild pig *Porcula salvania* Hodgson (Pigmy hog). The floristic diversity of Barnadi Wildlife Sanctuary is quite rich with tropical vegetation up to an elevation of 250 m. The paper deals with the diversity and distribution of *Clerodendrum* species in Northeastern states of India with special reference to BWS, along with their phytogeographical affinities with the rest of India and neighbouring countries. The correct nomenclature of each species, brief description, ethnobotanical uses of the available species, photo plates (**Plates 1 & 2**) and other relevant notes are also provided.

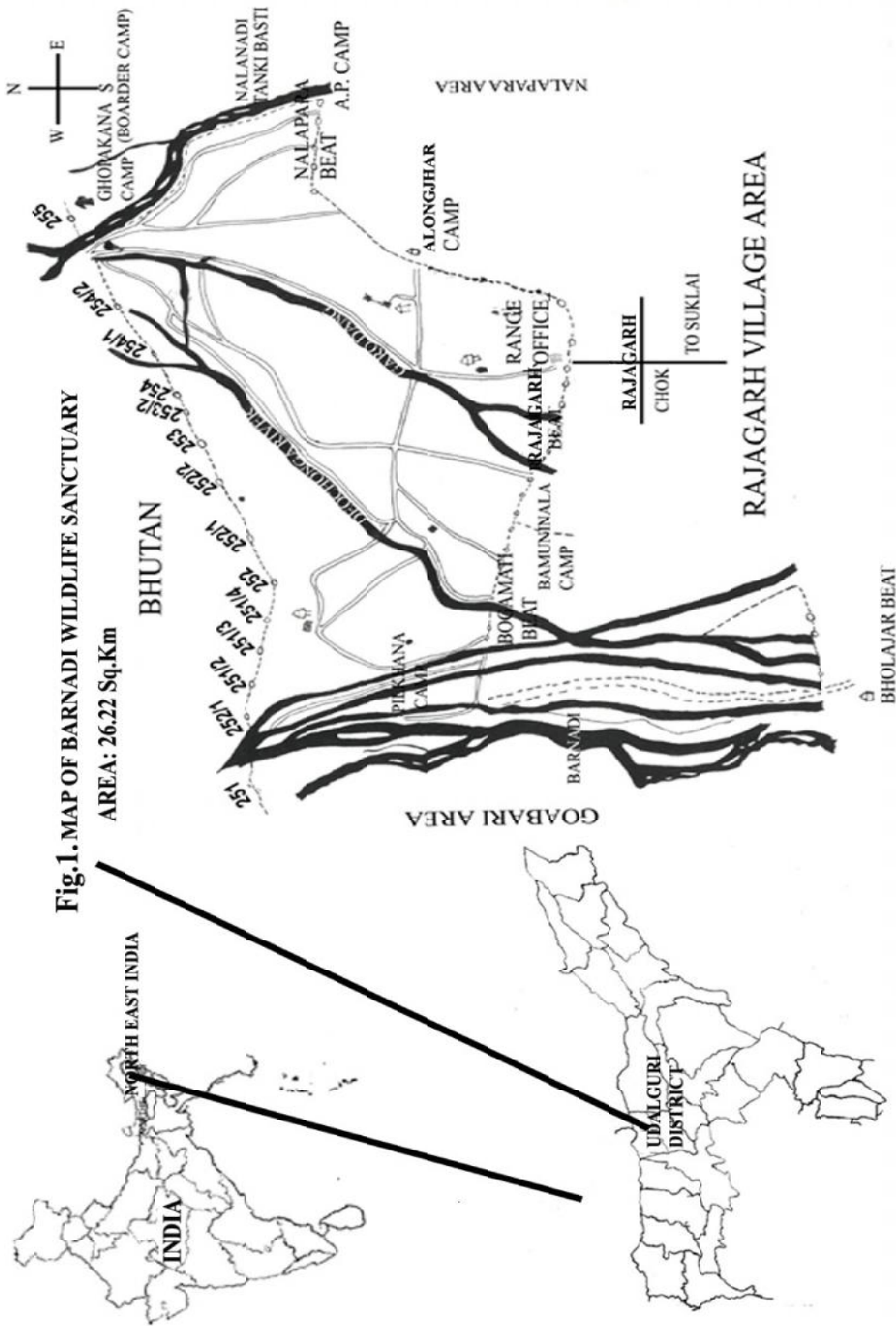
### METHODOLOGY

The present account on the diversity of the genus *Clerodendrum* Linnaeus in Northeastern states of India with special reference to Barnadi Wildlife Sanctuary, Assam is based on extensive studies of herbarium specimens (cited in the text) collected from the region and housed in ASSAM, consultation of all available literatures (Hooker 1885; Kanjilal *et al* 1939; Deb 1983; Haridasan & Rao 1987; Rajendran & Daniel 2002; Srivastava & Choudhary 2008) and collections made regularly from all parts of the Barnadi Wildlife Sanctuary during 2010 – 2012 under Annual Action Plan of Botanical Survey of India, Eastern Regional Centre, Shillong. The whole process of collection, pressing and preparation of herbarium specimens were in accordance to the conventional herbarium techniques (Jain & Rao 1977). The specimens were identified with the help of different floras and taxonomic revisions (Hooker 1885; Brandis 1907; Kanjilal *et al* 1939; Balakrishnan 1983; Haridasan & Rao 1987; Rajendran & Daniel 2002) and confirmed the identity at ASSAM. The 7(seven) *Clerodendrum* specimens collected from BWS have been deposited at ASSAM herbarium. The distribution of the species in other parts of India and neighbouring countries has been taken from available literatures (Kress *et al* 2003; Leeratiwong *et al* 2011; Press *et al* 2000; Rajendran & Daniel 2002; Wu & Raven 1994). The recorded species are enumerated below alphabetically along with protologue references, specimen studied, distribution, utility etc.

### ENUMERATION

*Clerodendrum bracteatum* Wallich *ex* Walpers, Repert. Bot. Syst. 4: 106. 1845; C.B. Clarke in Hooker *f.* Fl. Brit. India 4: 593. 1885. Rajendran & Daniel, Indian Verbenaceae, 85. 2002. [**Plate- I, Fig. A**]

Shrubs, 2 – 8 m high; branches and branchlets downy-villous, obtusely 4-angular. Lamina ovate, acuminate. Flowers in capitate cyme, white, scented. Drupes greenish-purple.



**Flowering & Fruiting:** September – March

**Specimens examined:** **Arunachal Pradesh**, Bhalukpong, *J. Joseph* 39785. **Assam**, Mikir hills, *D. B. Deb* 35169. **Meghalaya**, Jowai-Jarain, *N. P. Balakrishnan* 42996. **Mizoram**, Lushai Hills, North Vaulaiphai *D. B. Deb* 31092. **Nagaland**, Kohima, *C. L. Malhotra* 74949. **Sikkim**, Gangtok, *R. S. Rao* 645.

**Uses:** Juice of root is used in fever and as brain tonic (Basumatary *et al* 2004).

*Clerodendrum cecil-fischeri* Rajendran & P. Daniel in *Taxon* 40: 611. 1991; & *Indian Verbenaceae*, 91. 2002. *Clerodendrum fischeri* H.B. Naithani & Bennet in *Indian Forester* 109: 280. f.1. 1983. **[Plate- I, Fig. I]**

Shrubs, 1 – 3 m high; branches and branchlets obtusely 4-angular. Lamina ovate or ovate-cordate, irregularly serrate, often ciliate. acute – acuminate. Flowers numerous in terminal compact corymbs, white. Ripe fruits red.

**Flowering & Fruiting:** April – October

**Specimens examined:** **Meghalaya**, Raliang forest, *A. S. Rao* 4253.

*Clerodendrum chinense* (Osbeck) Mabberley, *Plant-Book*, Repr.: 707. 1989; Chen & M.G. Gilbert in *Wu & Raven*, *Fl. China* 17: 39. 1994; Phuong in *N.T. Ban et al*, *Fl. Vietnam* 3: 288. 2005. *Cryptanthus chinensis* Osbeck, *Dagb. Ostind. Resa.* 215. 1757. *Clerodendrum philippinum* Schauer in *A. DC.*, *Prodr.* 11: 667. 1847; Rajendran & Daniel, *Indian Verbenaceae*, 133. 2002; Srivastava & Choudhary in *Bull. Arun. For. Res.* 9. 2008. **[Plate- II, Fig. B]**

Shrubs, 3 – 5 m high; branches subterete or 4-anguled, hirsute, medullose, nodes annulate, swollen. Lamina ovate, serrate, acute. Flowers numerous, in terminal corymbs. pinkish. Mature fruits greenish blue.

**Flowering & Fruiting:** February – December

**Specimens examined:** **Assam**, Goalpara, *G. K. Deka* 18219; Udalguri dist., Barnadi Wildlife Sanctuary, Barnadi River bank, *C. Deori & D. K. Roy* 119209. **Arunachal Pradesh**, Kameng, *M. Ramaswamy* 16627. **Mizoram**, Lushai Hills, Aizwal, *D. B. Deb* 30673.

**Uses:** Juice of the root administered in case of headache and body pain (Krishnan & Singh 1987).

*Clerodendrum colebrookianum* Walpers, *Repert. Bot. Syst.* 4: 114. 1845; C.B. Clarke in *Hooker f.*, *Fl. Brit. India* 4: 594. 1885; Rajendran & Daniel, *Indian Verbenaceae*, 93. 2002. *Kar et al.* in *Pleione* 6(1): 103. 2012. *Clerodendrum glandulosum* Wallich *ex Voigt*, *Hort. Suburb. Calcutt.* 466. 1845; Biswas in *Indian For. Rec., Bot.* 3(1): 41. 1940. **[Plate- II, Fig. D]**

var. *colebrookianum*

A large shrub, up to 5 m high; branches and branchlets stout, 4-anguled, sparsely pubescent. Leaves opposite-decussate; lamina ovate-cordate, entire, acute. Flowers numerous in axillary and terminal corymbs, white, turning pink or rose. Fruits subglobose, bluish green.

**Specimens examined:** **Arunachal Pradesh**, Kameng F.D., Sessa, *J. Joseph* 39779. **Assam**, Udalguri Dist., Barnadi Wildlife Sanctuary, Borengajuli, *C. Deori & D. K. Roy* 119254. **Meghalaya**, Tura Peak, *D. B. Deb* 28917. **Mizoram**, Lushai hills, *D. B. Deb* 30577.

**Nagaland**, Tneusang, *T. M. Hynniewta* 80432. Sikkim, without precise locality, *N. L. Bor* 21312.

**Flowering & Fruiting:** June – December

**Uses:** Leaves are warmed over fire, mashed into a paste and massaged in rheumatism (Kharkongor & Joseph 1981). Leaves are taken as vegetable in blood pressure (Kalita & Barthakur 2010). Leaf decoction is also taken ease the hypertension (Begum & Hynniewta 2007).

*Clerodendrum colebrookianum* var. *denticulata* C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 594. 1885; Moldenke in Phytologia Mem. 2: 535. 1980 & Phytologia 58: 461. 1985; Rajendran & Daniel, Indian Verbenaceae, 96. 2002.

Lamina cordate, denticulate, acute, dark green above and shiny beneath; petioles terete, often furrowed.

**Flowering & Fruiting:** August – January

**Note:** According to Rajendran & Daniel (*l.c.*) the variety is distributed in Assam, Meghalaya and Mizoram.

*Clerodendrum cordatum* D. Don, Prodr. Fl. Nepal. 103. 1825; Rajendran & Daniel, Indian Verbenaceae, 96. 2002; Srivastava & Choudhary in Bull. Arun. For. Res. 7. 2008. *Clerodendrum viscosum* Ventenat, Jard. Malm. 1: 25, t.25.1804, *nom. illeg.* *C. infortunatum* Linnaeus, Sp. Pl. 653. 1753; C. B. Clarke in Hooker *f.*, Fl. Brit. India 4: 594.1884. [Plate II, Fig. G]

A gregarious under-shrub, 0.5 – 5 m high; branches subterete or obtusely 4-angular. Lamina ovate to ovate-lanceolate, serrate–dentate, acute – acuminate, pubescent. Flowers in terminal panicles, white with pink tinge or red, madly fragrant. Drupes subglobose, dark purple-black.

**Flowering & Fruiting:** December – June

**Specimens examined:** Assam, Udalguri district, Barnadi Wildlife Sanctuary, Nalapara, *K. Pagag & N. Sarma* 124679. Meghalaya, Umling, *J. Joseph* 43774.

**Uses:** The root extract is used against jaundice (Das & Choudhury 2010). Leaf decoction taken in malaria and its juice taken in dysentery (Begum & Hynniewta 2007). Root is used in abdominal pain, malaria and skin diseases (Nath *et al* 2006).

*Clerodendrum farinosum* (Roxburgh) Wallich [Numer. List 49, No. 1810. 1829, *nom. nud.*] *ex* Steudel, Nomencl. Bot. ed. 2, 1: 382. 1840; Rajendran & Daniel, Indian Verbenaceae, 102. 2002. *Volkameria farinosa* Roxburg, (Hort. Bengal. 46. 1814, *nom. nud.*), Fl. Ind. 3: 64. 1832. *Clerodendrum venosum* Wallich *ex* C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 592. 1885, *nom. illeg.* incl. type of *Volkameria farinosa* Roxburgh (as ‘*Clerodendron*’); Kanjilal *et al*, Fl. Assam 3: 490. 1939. [Plate I, Fig. F]

A small tree, up to 8 m high; branches obtusely 4-angular. Leaves opposite-decussate; lamina elliptic or elliptic–oblong, entire or faintly serrate, acuminate, membranous, glabrous above. Flowers in terminal and axillary thyrses, numerous, whitish purple. Drupes sub-globose, purplish black.

**Flowering & Fruiting:** June – December

**Specimens examined:** Arunachal Pradesh, Tirap, *D. B. Deb* 25816. Meghalaya, Cherrapunjee, Mawmloo forest, *S. R. Sharma* 9558. Mizoram, Mizo Hills, *R. Dutta* 33316.

*Clerodendrum griffithianum* C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 590. 1885; Kanjilal *et al.*, Fl. Assam 3: 487. 1939; Rajendran & Daniel, Indian Verbenaceae, 103. 2002. [Plate I, Fig. C]

Shrubs, 5 – 6.5 m high. Stem and branchlets subterete or obtusely 4-angled. Leaves opposite-decussate; lamina elliptic-lanceolate, subentire or obscurely serrate, caudate-acuminate, cuneate to acute at base. Panicles terminal or subterminal. Flowers white or yellow. Drupes ovoid enclosed by accrescent calyx.

**Flowering & Fruiting:** December – May

**Specimens examined:** Arunachal Pradesh, Passighat, *G. K. Deka* 23103. Assam, Dulong Reserve Forest, *G. Panigrahi* 27601.

*Clerodendrum hastatum* (Roxburgh) Lindley in Edward's Bot. Reg. 16:t. 1307. 1844; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 595. 1885; Rajendran & Daniel, Indian Verbenaceae, 105. 2002; Srivastava & Choudhary in Bull. Arun. For. Res. 8.2008. *Siphonanthus hastata* Roxburgh, Fl. Ind. 3: 67. 1832. [Plate I, Fig. B]

Shrubs, 1 – 5 m high; branchlets slender, obtusely 4-angled, densely hirsute, lenticellate. Leaves opposite or ternate; lamina ovate-cordate, acute or acuminate, base hastate. Panicles terminal corymbose. Flowers fragrant, white or cream-coloured. Drupes obovoid or subglobose, purplish black.

**Flowering & Fruiting:** May – December

**Specimens examined:** Assam, Goalpara, *U. Kanjilal* 5742. Arunachal Pradesh, Tirap, *D. B. Deb* 26737. Meghalaya, Shillong, Lake Garden, *P. C. Kanjilal* 9237.

**Uses:** Paste of 3 – 4 leaves is applied on infected skin area for 8 – 10 hours (Baishya & Bora 2007).

*Clerodendrum indicum* (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 506. 1891 (as '*Clerodendron*'); Rajendran & Daniel, Indian Verbenaceae, 109. 2002. *Siphonanthus indica* Linnaeus, Sp. Pl. 109. 1753. *Siphonanthus angustifolia* Willdenow, Sp. Pl. 1:609. 1798. *Clerodendrum siphonanthus* R. Brown in W.T. Aiton, Hort. Kew. ed. 2, 4: 65. 1812; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 595. 1885. [Plate II, Fig. C]

Shrubs or undershrubs, stoloniferous, gregarious, 1.5 – 3 m high. Stem obtusely 4-angular. Leaves in whorls of 3-6 or opposite; lamina elliptic or linear to oblong-lanceolate or oblanceolate, entire recurved, acute or acuminate, cuneate to attenuate at base. Inflorescence axillary, solitary or whorled cymes. Flowers greenish white or cream-coloured. Drupes globose, bluish, green or black.

**Flowering & Fruiting:** July – January

**Specimens examined:** Assam, Nalbari, *G. K. Deka* 10509; Udalguri dist., Barnadi Wildlife Sanctuary, Barnadi River Bank, *C. Deori* & *D. K. Roy* 119275. Manipur, Imphal Valley, *G. Panigrahi* 13452. Tripura, Kutnapara, *B. K. Huidrom* 100486.

**Uses:** Leaves are eaten as vegetable by the Mikirs; smoke of dried leaves is said to cure cough; the juice from herbaceous portion is used with ghee for various skin diseases (Kanjilal *et al* 1939). Leaf juice is used as tonic, root juice is used in cough and scrofulons, resin is syphilitic rheumatism (Kalita & Barthakur 2010).



**PLATE - I.** Species of *Clerodendrum* recorded from Northeast India. **A.** *C. bracteatum*; **B.** *C. hastatum*; **C.** *C. griffithianum*; **D.** *C. lasiocephalum*; **E.** *C. nicolsonii*; **F.** *C. farinosum*; **G.** *C. panigrahanium*; **H.** *C. wallichii*; **I.** *C. cecil-fischeri*

***Clerodendrum inerme*** (Linnaeus) Gaertner, Fruct. Sem. Pl. 1: t. 57, f.1. 1788; R. Brown, Prodr. 511. 1810; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 589. 1885; Rajendran & Daniel, Indian Verbenaceae, 112. 2002; Srivastava & Choudhary in Bull. Arun. For. Res. 8. 2008; Kar *et al.*, Pleione 6 (1): 101-109. *Volkameria inermis* Linnaeus, Sp. Pl. 637. 1753.

Scandent or scrambling shrub, much branched, to 3 m; branches and branchlets slender, young parts flattened, obtusely 4-angular when mature, minutely pubescent, lenticellate. Leaves opposite-decussate; lamina elliptic or obovate, entire, obtuse or acute. Flowers solitary, axillary or sometimes in 3 – 9 flowered cymes. white with pinkish tip. Drupes pyriform, black or brown when mature.

**Flowering & Fruiting:** June – August

**Note:** According to Srivastava & Choudhary (*l.c.*), Kar *et al.* (*l.c.*) *Clerodendrum inerme* is distributed in Arunachal and Assam.

**Uses:** It is an ornamental plant that is also used in traditional medicine to treat hypertension, an incurable disease (Guessan *et al.* 2010).

***Clerodendrum japonicum*** (Thunberg) Sweet, Hort. Brit. 322. 1826; Srivastava & Choudhary in Bull. Arun. For. Res. 24(1&2): 9. 2008. *Volkameria japonicua* Thunberg in J.A. Murray, Syst. Nat. ed.14: 578.1784. *Clerodendrum squamatum* Valh, Symb. Bot. 2: 74. 1791; Kanjilal *et al.*, Fl. Assam 3: 491. 1939. *Clerodendrum kaempferi* (Jacquin) Siebold in Verh. Batav. Genootsch. Kunsten 31. 1830; Rajendran & Daniel, Indian Verbenaceae, 121. 2002. **[Plate II, Fig. F]**

var. *japonicum*

Shrubs, 2 – 3 m high; branches stout, obtusely 4-angular. Lamina ovate to ovate-cordate. Panicles terminal; flowers red, numerous. Drupes globose, bluish black.

**Flowering & Fruiting.:** March – December

**Specimen examined:** Assam, Udalguri dist., Barnadi Wildlife Sanctuary, Borengajuli, C. Deori & D. K. Roy 119291. Meghalaya, Govt. Garden, Shillong, S. R. Sharma 10317.

**Uses:** Cultivated as an ornamental plant. Leaves are used as vegetable (Pal 1984).

***Clerodendrum japonicum*** var. *urticifolia* (Roxburgh) R.C. Srivastava & R.K. Choudhary in Bull. Arun. For. Res. 9. 2008. *Volkameria urticifolia* Roxburgh, Fl. Ind.3: 61. 1832. *Clerodendrum squamatum* var. *urticifolia* (Roxburgh) C.B. Clarke in Hooker *f.*, Fl. Brit.India 4: 594. 1885.

Shrubs, ca. 3 m high, glabrous. Lamina ovate, denticulate, shortly acuminate, hairy throughout. Flowers in panicle, scarlet or bright red. Drupes blue black with enlarged calyx.

**Flowering & Fruiting:** May – September

***Clerodendrum lasiocephalum*** C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 594. 1885; Kanjilal *et al.*, Fl. Assam 3: 489. 1939. **[Plate I, Fig. D]**

Shrub, 1 – 3 m high, branches and brachlets obtusely 4-angled. Lamina elliptic or oblong-elliptic, dentate, acuminate, cuneate at base. Flowers numerous in terminal corymbs, scarlet-red. Drupes globose, red.

**Flowering & Fruiting:** March – November





**PLATE - I.** Photographs of species of *Clerodendrum* from NE India. **A.** *C. serratum*; **B.** *C. chinense*; **C.** *C. indicum*; **D.** *C. colebrookianum*; **E.** *C. paniculatum*; **F.** *C. japonicum*; **G.** *C. cordatum*

**Specimens examined:** Arunachal Pradesh, Tirap F.D., Chelglong to Khela, R.S. Rao 20268. Meghalaya, Nongpoh, S. R. Sharma 17155; Umroi, G. K. Deka 9950.

*Clerodendrum macrostachyum* Turczaninow in Bull. Soc. Imp. Naturalistes Moscou 36: 220. 1863 (as "*Clerodendron*"); C.B. Clarke in Hooker f., Fl. Brit. India 4: 591. 1885; Kanjilal *et al.*, Fl. Assam 3: 492. 1939; Rajendran & Daniel, Indian Verbenaceae, 125. 2002. *C. subscaposum* Hemsley in Hooker's Icon. Pl. 27: t. 2675. 1900.

Herb, 1–2 m high, branchlets slender, 4-angular or subterete. Leaves decussate-opposite; lamina ovate or cordate ovate, deeply cordate at base. Flowers in terminal panicles, pale blue or purple. Drupes obovoid, covered with red glands.

**Note:** According Rajendran & Daniel (*l. c.*) the species is distributed in Meghalaya.

*Clerodendrum nicolsonii* Rajendran & P. Daniel in Candollea 48: 347, f. 1. 1993; Rajendran & Daniel, Indian Verbenaceae, 128. 2002. [Plate I, Fig. E]

Shrubs, 3 – 3.5 m high; young parts pubescent, nearly glabrous when mature; branches and branchlets acutely 4-angular. Lamina obovate to oblanceolate-elliptic, faintly irregularly serrate, abruptly acuminate, obtuse or acute to cuneate at base. Flowers numerous in terminal panicles, white. Drupes globose, black.

**Flowering & Fruiting:** May – November

**Specimen examined:** Assam, Lakhimpur, D. M. Verma 46654 (Paratype-ASSAM!).

*Clerodendrum paniculatum* Linnaeus, Mant. Pl. 90. 1767; C.B. Clarke in Hooker f., Fl. Brit. India 4: 593. 1885; Rajendran & Daniel, Indian Verbenaceae, 128. 2002; C. Deori *et al.*, J. Econ. Taxon. Bot. 36(4): 835-836. 2012. [Plate II, Fig. E]

Shrubs, 2 – 3 m high; stem stout, obtusely 4-angular, minutely pubescent. Leaves gradually becoming smaller upwards; lamina ovate or ovate cordate, deeply 3 – 7 lobed, subrotund to cordate at base. Flowers numerous in terminal panicles, reddish. Drupes globose, bluish black enclosed by persistent calyx.

**Flowering & Fruiting:** February – October

**Specimens examined:** Assam, Uladguri dist., Barnadi Wildlife Sanctuary, Bogamati, C. Deori & D.K Roy 119085; Barnadi Wild Life Sanctuary, Nalapara, S.R. Talukdar 122978.

**Uses:** Used for the treatment for inflammation, ulcer and skin diseases. A decoction of root is used as tonic for aches and pains. It is also used for the treatment of sore eyes, urinary tract, gonorrhoea and kidney problems (Arun *et al* 2011).

*Clerodendrum panigrahianum* Rajendran & P. Daniel in J. Bombay Nat. Hist. Society 95 (1): 99-101. 1998; Rajendran & Daniel, Indian Verbenaceae, 131. 2002. [Plate I, Fig. G]

Shrubs, 3 – 8 m high; branches and branchlets subterete. Leaves decussate-opposite, sometimes subopposite; lamina ovate, irregularly and distantly serrate with acute serration, shortly acuminate, obtuse or sub cordate at base. Flowers terminal, numerous, compact with mature flowers in the periphery, white with rose or pink tinged.

**Flowering:** May

**Specimens examined:** Arunachal Pradesh, Kameng F.D., Rahung to Dirangdzong, R. S. Rao 7430 (Paratype-ASSAM!).

*Clerodendrum serratum* (Linnaeus) Moon, Cat. Pl. Ceylon 46. 382. 1824; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4:592. 1885; Rajendran & Daniel, Indian Verbenaceae, 139. 2002. *Volkameria serrata* Linnaeus, Mant. Pl. 90. 1767. *Clerodendrum divaricatum* Jack in Malayan Misc. 1: 148. 1820. [Plate II, Fig. A]

Shrub, 2 – 4 m high, root stock woody; branches stout, subterete or obtusely 4-angular. Leaves ternate; lamina oblanceolate, elliptic-lanceolate to oblong, serrate, acute or shortly acuminate, cuneate or decurrent at base. Flowers in terminal thyrses, blue or violet. Drupes subglobose, dark purple or black.

**Flowering & Fruiting:** July – September.

**Specimens examined:** Arunachal Pradesh, Tirap, on the way to Deomali, R. S. Rao 20393. Assam, Udalguri dist., Barnadi Wildlife Sanctuary, Garodong, C. Deori & D. K. Roy 119114. Meghalaya, Dawki, Khasi & Jaintia Hills, N.P. Balakrishnan 42730. Manipur, Senapati, Makhel village, R. Gogoi 116101. Mizoram, Lushai hills, Sairang, D. B. Deb 30570. Sikkim, without precise locality, N. L. Bor 21318. Tripura, Agartala, R. S. Rao 8891.

**Uses:** Young shoots, leaves and flowers are used as vegetables; root is used in febrile and catarrhal affections (Kanjilal *et al* 1939). The root has a pungent and bitter taste and used in fever and rheumatism. The root extract is taken in malaria and applied in catarrhal (Begum & Hynniewta 2007). The leaf juice is used in external applications in cephalalgia and ophthalmia (Baruah & Sarma 1987).

*Clerodendrum wallichii* Merrill in J. Arnold Arbor. 23: 220. 1952; Rajendran & Daniel, Indian Verbenaceae, 143. 2002. *C. nutans* Wallich *ex* D. Don, Prodr. Fl. Nepal. 103. 1825; C.B. Clarke in Hooker *f.*, Fl. Brit. India 4: 591. 1885. [Plate I, Fig. H]

Shrub, 1 – 3 m high, branches and branchlets acutely 4-angular. Leaves decussate-opposite, sometimes ternate; lamina oblanceolate, elliptic-lanceolate or oblong-lanceolate, entire or slightly repand, acuminate, acute to cuneate at base. Flowers in terminal cymose racemes, white. Drupes globose, dark purple.

**Flowering & Fruiting:** September – March

**Specimens examined:** Arunachal Pradesh, Siang, Tuting to Minguing, R. S. Rao 17611. Assam, Darrang Distr., Biswanath Reserve, C. S. Purkayastha 21757. Meghalaya, Nongpoh, Balaiba, Tilla, J. Joseph 43610. Manipur, Senapati dist., R. Gogoi 116101. Mizoram, Chhikhatiang, N. Odyuo 113532. Tripura, Daucherra, D. B. Deb 26861.

**Uses:** Leaves are pounded with slaked lime and applied on skin infections (Kharkongor & Joseph 1981). Leaves are used as vegetable (Mao 1993). The paste of roots with those of *Ardisia paniculata* Roxburgh, *Claoxylon khasianum* Hooker *f.* and *Phlogacanthus thyrsiflorus* Nees is applied externally on abdominal tumor once every day for seven days, fresh paste is used each day (Lalramghinglova 2003).

**Note:** *Clerodendrum thomsoniae* Balfour and *Clerodendrum umbratile* King & Gamble are cultivated species and used as ornamentals in India. The former has been reported from Assam (Kar *et al* 2012) and Tripura (Deb 1983) and the latter from Arunachal Pradesh (Srivastava & Choudhary 2008). The occurrence of *Clerodendrum villosum* Blume in Arunachal Pradesh is doubtful (Srivastava & Choudhary 2008).

## RESULTS AND DISCUSSION

Based on the present study it has been found that Northeast India harbours the maximum diversity of *Clerodendrum* species in India. Of 23 species and 2 varieties found in India, 18 species and 2 varieties are reported from this region including a new addition, *Clerodendrum paniculatum* Linnaeus from Barnadi Wildlife Sanctuary, Assam (Deori *et al* 2012). Within

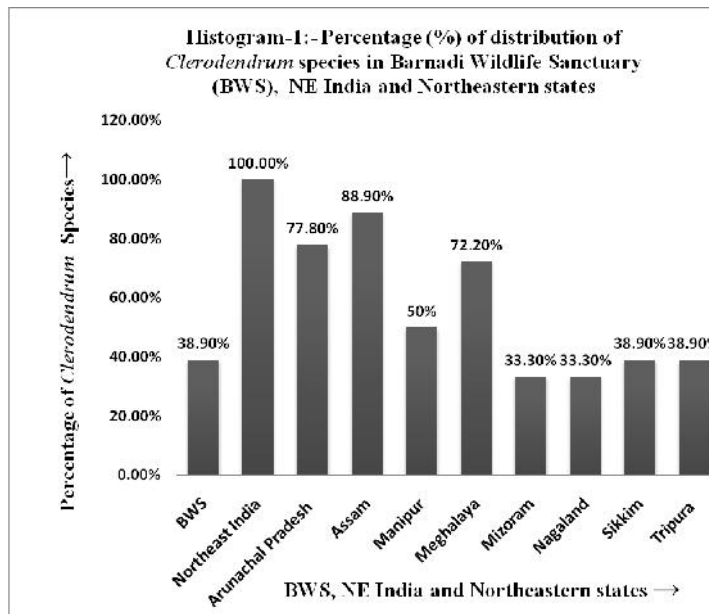
**Table-1.** Distribution of *Clerodendrum* in North East India, Barnadi Wildlife Sanctuary (ASSAM), Rest of India and Neighbouring countries (Abbreviation used: '+' indicates presence)

Species of <i>Clerodendrum</i>	Northeastern states										Neighbouring countries					
	Arunachal Pradesh	Assam	Barnadi wildlife sanctuary	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura	Rest of India	Bangladesh	Bhutan	Myanmar	Thailand	Nepal	China
<i>C. bracteatum</i>	+	+		+	+	+	+	+	+		+	+	+		+	+
<i>C. cecil-fischeri</i>		+		+	+		+						+			
<i>C. chinense</i>	+	+	+	+	+	+			+	+			+	+	+	+
<i>C. colebrookianum</i>	+	+	+	+	+			+	+	+	+	+	+	+	+	+
<i>C. colebrookianum</i> var. <i>denticulata</i>		+			+	+										
<i>C. cordatum</i>	+	+	+		+		+	+	+	+	+	+	+	+	+	+
<i>C. farinosum</i>	+	+			+	+	+						+	+		
<i>C. griffithianum</i>	+	+			+					+	+		+			+
<i>C. hastatum</i>	+	+			+					+	+	+				
<i>C. indicum</i>	+	+	+	+				+	+	+			+	+	+	+
<i>C. inerme</i>	+	+								+	+		+	+		+
<i>C. japonicum</i>	+	+	+	+	+			+		+	+	+	+	+		+
<i>C. japonicum</i> var. <i>urticifolia</i>	+															
<i>C. lasiocephalum</i>	+	+		+	+	+	+						+			
<i>C. macrostachyum</i>					+								+	+		+
<i>C. nicolsonii</i>		+														
<i>C. paniculatum</i>		+	+							+	+		+	+		+
<i>C. panigrahanum</i>	+															
<i>C. serratum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>C. wallichii</i>	+	+		+	+	+		+	+	+	+	+	+	+	+	+

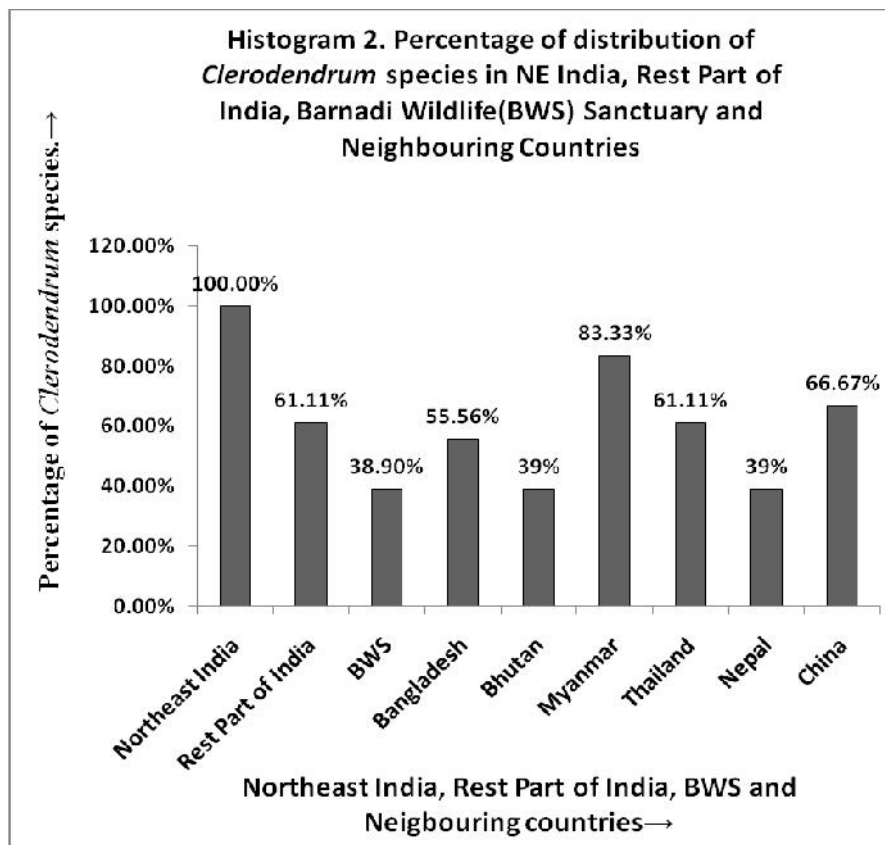
the region the maximum diversity is from the state of Assam with 16 species (88.9 %) and 1 variety (50 %) followed by Arunachal Pradesh with 14 species (77.8 %) and 1 variety (50 %), Meghalaya 13 species (72.2 %) and 1 variety (50 %); Manipur 9 species (50 %); Sikkim and Tripura with 7 species (38.9 %) each; Mizoram 6 species (33.3 %) and 1 variety and Nagaland 6 species (33.3 %). A total of 7 species (38.9 %) of *Clerodendrum* is recorded

**Table-2.** Percentage (%) of distribution of *Clerodendrum* species in North East India, Barnadi Wildlife Sanctuary (Assam) and Neighbouring countries

Locality	Percentage of species
Arunachal Pradesh	14sp. (77.8%), 1 var. (50%)
Assam	16 sp. (88.9%), 1 var. (50%)
Manipur	9 sp. (50%)
Meghalaya	13 sp. (77.8%), 1 var. (50%)
Mizoram	6 sp. (33.3%), 1 var. (50%)
Nagaland	6 sp. (33.3%)
Sikkim	7 sp. (38.9%)
Tripura	7 sp. (38.9%)
Barnadi Wildlife Sanctuary (Assam)	7 sp. (38.9%)
Rest Part of India	11 sp. (61.11%)
Bangladesh	10 sp. (55.56%)
Bhutan	7 sp. (39%)
Myanmar	15 sp. (83.33%)
Thailand	11 sp. (61.11%)
Nepal	7 sp. (39%)
China	12 sp. (66.67%)



from BWS, viz. *C. chinense* (Osbeck) Mabberley, *C. colebrookianum* Walpers, *C. cordatum* D. Don, *C. indicum* (Linnaeus) O. Kuntze, *C. japonicum* (Thunberg) Sweet, *C. paniculatum* Linnaeus and *C. serratum* (Linnaeus) Moon (Table-1, 2 & Histogram-1). This shows the species diversity of *Clerodendrum* in BWS with an area of 26.22 sq km is quite high in comparison to the other states of the Northeast region. The genus *Clerodendrum* Linnaeus in the sanctuary in particular and Northeast India in general shows great phytogeographical affinities with rest parts of India and the neighbouring countries viz. Bangladesh, Bhutan, Myanmar, Thailand, Nepal and China. Out of 18 species (100 %) and 2 varieties of northeast region, 11 species (61.11 %) are common to rest of India viz. *C. chinense*, *C. colebrookianum*, *C. cordatum*, *C. griffithianum*, *C. hastatum*, *C. indicum*,



*C. inerme*, *C. japonicum*, *C. paniculatum*, *C. serratum* and *C. wallichii*. Almost all the species occurring in Northeast India are common to the above neighbouring countries except *C. colebrookianum* var. *denticulata*, *C. japonicum* var. *urticifolia*, *C. nicolsonii* and *C. panigrahianum* which are not reported from the respective countries so far. Myanmar shows the highest affinity with 15 species (83.33 %) of the total 18 (100 %) species occurring in Northeast India followed by China with 12 species (66.67 %), Thailand with 11 species (61.11 %), Bangladesh 10 species (55.56 %) and Nepal and Bhutan with 7 species (39 %) each (Table-1, 2; Histogram- 2). This close affinity is because of the northeast region serves as the meeting place of Himalayan mountain with that of peninsular India and also acts as the transitional zone between India and the biogeographical regions of the neighbouring countries, which aids in frequent transmigration and intermixing of the floral elements with the help of various biotic and abiotic agencies. Hence, the distribution of the genus *Clerodendrum* Linnaeus in northeast region and BWS is quite significant from phytogeographical point of view.

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