

SYSTEMATIC SURVEY OF ZINGIBERACEAE OF DIBRUGARH DISTRICT, ASSAM, INDIA

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ABSTRACT

The present survey enumerates 22 species under 9 genera of Monocotyledonous Family Zingiberaceae of Dibrugarh District, Assam. In the survey only the naturally growing species are taken into account. The genera are *Alpinia*, *Amomum*, *Boesenbergia*, *Curcuma*, *Globba*, *Hedychium*, *Kaempferia*, *Larsenianthus* and *Zingiber*. The survey was done following general taxonomic procedure involving specimen collection in reproductive stages, herbarium preparation, identification, enumeration and also obtaining information of local economic uses by inhabitants.

Key Words: *Zingiberaceae, Dibrugarh District, Systematic Survey, Herbarium*

INTRODUCTION

Zingiberaceae, is a Monocotyledonous Angiosperm family of perennial, attractive aromatic plants yielding spices, condiments, dyes, perfumes and medicines besides many ornamental species cultivated for their showy flowers. It is chiefly present in tropical regions confined mainly to Asia, Africa, tropical America and Australia, Indomalaya region being the main centre of its occurrence (Burt and Smith, 1972, Jain and Prakash, 1995). The first attempt on detailed study of Zingiberaceae in 20th century was made by Schumann (1904) who discussed almost all the available species of that time with detailed description, correct nomenclature including all available synonyms and key to the species and genera. Later Holttum (1950) published a detailed account of the Zingiberaceae of Malay Peninsula. The other notable contributions on Zingiberaceae are those of Burt (1972), Burt and Smith (1972a and b, 1983). In India, the earliest notable contribution was that of Roxburgh (1812) who reported 8 genera and 47 species from India and added 19 species in his *Flora Indica* in 1832. Baker (1890-92) presented an account of Zingiberaceae in Hooker's *Flora of British India*. However, there are different estimates of number of genera and species by different workers. Karthikeyan and Mudgal (1995) in their article in "Bharat ki Vanaspathik Vividhata" listed 22 genera and 167 species of Zingiberaceae. Again, Jain and Prakash (1995) in an article on phytogeography and endemism of Zingiberaceae reported 22 genera and 178 species from India distributed in Eastern Himalaya, North-east India, Western ghats and Andaman and Nicobar islands and only a few showing representation in Central India and Western Himalaya.

Plants under Zingiberaceae are rhizomatous perennial herbs. Leaf shoots with few to many distichously arranged blades, the sheaths generally open on the side opposite the lamina, ligulate. Inflorescence terminal on the leaf shoot or borne on a separate leafless shoot. Flowers solitary in the axils of bracts or in cincinni, bracteolate or ebracteolate. Calyx tubular. Corolla tube slender, divided into 3 subequal petals. Labellum adnate at the base to the corolla tube, showy. Lateral staminodes petaloid, either free from the labellum or connate to it. Fertile stamens one only, anther sometimes developing into an anther-crest. Style linear, held between the anther-thecae. Ovary inferior, trilocular with axile placenta. Epigynous glands called stylodes form 2 erect outgrowths on top of the ovary. Fruit a dehiscent capsule. Seeds arillate.

The present survey was done in the Dibrugarh District of Assam, India during 2007-2011. The district extends from 27°5'38" N to 27°42'30" N latitude and 94°33'46" E to 95°29'8" E longitude; occupying an area of 3,381 square kilometers. It has five reserve forests namely, Dihingmukh, Jeypore, Jokai, Namdang and Telpani. A meager portion of the Dibru-Saikhowa National Park is also under its administrative area.

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In additions to the forests, there are several small and large wetlands which are significant habitats for the plants under Zingiberaceae.

MATERIAL AND METHODS

Established taxonomic procedures for specimen collection, herbarium preparation (Jain and Rao, 1977) and identification of taxa are followed with literatures of Rao and Verma (1972), Kumar (2001), Sabu (2006) and studying the specimens collected by earlier workers from Assam and housed at herbaria viz. Gauhati University and BSI. Collected specimens are deposited at the Herbarium of Gauhati University, Guwahati.

RESULTS

The keys to the genera and species were made mainly on the basis of macro—morphological characters. The recent nomenclature for naming taxa on the basis of current Index Kewensis has been followed. As the number of genera is not large, key to the genera is made directly and not by delimiting them to various tribes and subfamilies of Zingiberaceae as suggested by Burtt and Smith (1972) and followed by Bhat (1993). With nomenclature and enumeration, brief descriptions of each species, flowering and fruiting period, local names and short information on economic uses wherever available are mentioned. Simple dichotomous keys to species under each genus are provided for identification. Descriptions of the genera are not given separately, since the species under the genera depicts the characters of the genera.

Key to the genera:

- 1a. Lateral staminodes forming small teeth at base of labellum, or adnate to labellum (forming a 3-lobed structure), or absent.
- 2a. Lateral staminodes adnate to labellum forming a 3-lobed structure; style extended well beyond fertile part of anther; anther connective crest elongate, wrapped around style..... *Zingiber*
- 2b. Lateral staminodes forming small teeth at base of labellum or absent; style extended just beyond fertile part of anther; anther connective crest (if present) not wrapped around style.
- 3a. Inflorescences terminal or lateral on pseudostems.....*Alpinia*
- 3b. Inflorescences on separate shoots arising from rhizomes.....*Amomum*
- 1b. Lateral staminodes petaloid.
- 4a. Ovary 1-loculed, placentation parietal; anther long; labellum adnate to filament to form a slender tube above lateral staminodes and corolla lobes..... *Globba*
- 4b. Ovary 3-loculed, placentation axile; anther short; labellum free from filament.
- 5a. Anther with 2 basal spurs *Curcuma*
- 5b. Anther without basal spurs.
- 6a. Multiple adventitious plantlets form in the axis of basal sterile bracts.....*Larsenianthus*
- 6b. No such structures seen
- 7a. Leaves all basal or on very short pseudostems; inflorescences terminal on pseudostems or on separate shoots arising from rhizomes.
- 8a. Labellum strongly concave..... *Boesenbergia*
- 8b. Labellum not concave.....*Kaempferia*
- 7b. Leaves on conspicuous pseudostems; inflorescences terminal on pseudostems.....*Hedychium*

Alpinia Roxburgh, Asiat. Res. 11: 350. 1810. [nom. cons.];

Key to the species:

- 1a. Buds enclosed in large bracteoles.....*A. roxburghii*

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1b. Buds not enclosed in bracteoles

2a. Lip ovate, white with lilac veins, capsule orange red.....*A. galanga*

2b. Lip cuneate, emarginated, pink, capsule black.....*A. nigra*

Alpinia galanga (Linnaeus) Willdenow, : Sp. Pl. 1: 12. 1797; Baker in Hook f. FBI.VI: 253. 1893; Deb Fl. Tripura. II:369.1983; *Maranta galanga* L. Sp. Pl.ed. II:3.1753

Rhizomes tuberous. Pseudostems ca. 2 m. Ligule suborbicular, ca. 5 mm; petiole ca. 6 mm; leaf blade oblong or lanceolate, 25--35 × 6--10 cm, glabrous or abaxially pubescent, base attenuate, apex acute or acuminate. Panicles ca. 20 × 30 cm; rachis glabrous or pubescent; branches many, 2-4 cm, 3-6-flowered; bracts and bracteoles persistent; bracteoles lanceolate, 5-8 mm. Flowers green-white, fragrant. Calyx tubular, 6-10 mm, persistent. Corolla tube 6-10 mm; lobes oblong, 1.6-1.8 cm. Lateral staminodes purple, subulate or linear, 2-10 mm. Labellum white with red lines, obovate-spatulate, ca. 2 cm, apex deeply 2-cleft. Filament ca. 1 cm; anther ca. 7 mm. Capsule brown or red when dry, oblong, slightly contracted at middle, 1-1.5 cm × ca. 7 mm, thin, glabrous. Seeds 3-6. Fl. May, fr. Sept. Vern: Tora, Goon-tora, Torabaghini (Assamese) Use: Medicinal and young seedlings are used as vegetable. Coll. no: RB 513. Date: 25-9-2008.

Alpinia nigra (Gaertner) B. L. Burtt, Notes Roy. Bot. Gard. Edinburgh. 35: 213. 1977; *Zingiber nigrum* Gaertner, Fruct. Sem. Pl. 1: 35. 1788; *Alpinia allughas* (Retzius) Roscoe Trans. Linn. Soc. London 8: 346. 1807; Baker in Hook f. FBI. VI: 253.1892; Deb. Fl.Tripura.II: 368.1983.

Pseudostems 1.5--3 m. Leaves sessile or subsessile; ligule orbicular, 4--6 mm, glabrous; leaf elliptic-lanceolate, 25--40 × 6--8 cm, glabrous, base and apex acute. Panicles erect, to 30 cm; branches expanded, 2--8 cm; rachis and branches tomentose, usually lax with remote cincinni; bracts ovate; bracteoles funnellform, tomentose, persistent. Pedicel 3--5 mm. Calyx tubular, 1.2--1.5 cm, split down 1 side for ca. 2/3 its length, pubescent abaxially. Corolla tube ca. 1 cm; lobes oblong, ca. 1.2 cm, pubescent abaxially, central one wider, apex cucullate. Lateral staminodes subulate. Labellum obovate, ca. 1.5 cm, base clawed, apex 2-cleft. Stamen ca. 1.5 cm; filament linear, ca. 1 cm; anther curved. Ovary densely pubescent. Capsule black when dry, globose, 1.2--1.5 cm in diam., sparsely pubescent, irregularly dehiscent; pedicel 5--10 mm. Seeds 5-6 mm in diam. Fl. and fr. Jul-Aug. Vern: Tora (Assamese). Use: Fishes are cooked by covering with the leaves. Coll no: RB 600. Date: 23-8-2009

Alpinia roxburghii Sweet Hort. Brit. [Sweet] 390. 1826; *A. bracteata* Roxb. Hort. Beng. 2. 1814, nom. nud.; Roxb. Fl. Ind.1 i 63. 1820; Baker in Hook. f. FBI. VI: 255. 1892; Fischer in Rec. Bot. Surv. India.12 (2): 143. 1938.; Deb. Fl.Tripura.II: 368.1983.

Herbs with inclined stem and erect racemes. Leaves 30-45×5-10cm, oblong-lanceolate, pubescent beneath. Flowers in simple racemes; rhachis densely pubescent; pedicels very short. Pale brownish purple bracts cover each flower in bud. Corolla white. Lip ovate, half as long as the corolla segments, emarginate, variegated red and yellow at the centre, white at the edges, with two horn like processes at the base. Capsule globose. Seeds many. Fl and frt: May –Aug. Coll. no: RB 888. Date: 8-5-2010

Amomum Roxburgh, Pl. Coromandel. 3: 75. 1820. [nom. cons.]:

Amomum subulatum Roxburgh, Pl. Coromandel. 3: 75. 1820; Hook f. FBI.VI: 240. 1892; Kumar. Zingiberaceae. Sikkim:17.2001.

Plants 1--2 m tall. Ligule 3--4 mm, membranous, apex rounded, emarginate; petiole absent or nearly so on proximal leaves, 1--3 cm on distal ones; leaf blade oblong-lanceolate, 25--60 × 3.5--11 cm, glabrous, base rounded or cuneate, apex long cuspidate. Spikes subterbinate, ca. 5 cm in diam.; peduncle 0.5--4.5 cm, scalelike sheaths brown; bracts pale red, ovate, ca. 3 cm, apex obtuse with horny cusp; bracteoles tubular, ca. 3 cm, apex acute, emarginate. Calyx glabrous, 3-cleft to middle; lobes subulate. Corolla tube equaling calyx; lobes yellow, central one subulate at apex. Lateral staminodes red, subulate, ca. 2 mm. Labellum with yellow midvein, oblong, ca. 3 cm, white pubescent, veins conspicuous, apex involute. Filament ca. 5 mm; anther ca. 1 cm; connective appendage elliptic, entire, ca. 4 mm. Capsule purple or red-brown, globose, 2--2.5 cm in diam., with 10 undulate wings, apex with persistent calyx. Fl. May, fr. June-July. Coll. no: RB 1101. Date: 20-7-2011

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Boesenbergia Kuntze, Revis. Gen. Pl. 2: 685. 1891; *Gastrochilus* Wallich, Pl. Asiat. Rar. 1: 22. 1829, not Don (1825):

Boesenbergia rotunda (Linnaeus) Mansfield, Kulturpflanze. 6: 239. 1958.; Kartikeyan et al. Fl. Ind.

Enum. Monocot. 290.1989; *Curcuma rotunda* Linnaeus, Sp. Pl. 1: 2. 1753; Hook f. FBI. VI: 220.1893

Plants to 50 cm. Rhizomes bright yellow, ovoid-globose, strongly aromatic; roots robust. Leaves 3 or 4; leaf sheath red; ligule 2-cleft, ca. 5 mm; petiole 7--16 cm, channeled; leaf blade green on both surfaces, ovate-oblong or elliptic-lanceolate, 25--50 × 7--12 cm, glabrous except for sparsely hairy midvein abaxially, base rounded to cuneate, apex apiculate. Inflorescences terminal on pseudostems, appearing from within apical leaf sheaths, subsessile, 3--7 cm; bracts lanceolate, 4--5 cm. Flowers aromatic. Calyx 1.5--2 cm, apex 2-cleft. Corolla pink; corolla tube 4.5--5.5 cm; lobes oblong, 1.5--2 cm. Lateral staminodes light pink, obovate, ca. 1.5 cm. Labellum white or pink with purple stripe, fiddle-shaped, 2.5--3.5 cm, concave, margin slightly crisped, apex entire. Filament short; connective appendage reflexed, 2-cleft, 1--3 mm. Fl and frt: Jul-Aug. Coll. no: RB 340. Date: 10-7-2008

Curcuma Linnaeus, Sp. Pl. 1: 2. 1753; Gen. Pl. ed. 5; 3, 1754:

Key to the species:

1a. Leaves completely green

2a. Rhizome pale yellow

3a. Mango like odour of the rhizome when broken or cut.....*C.amada*

3a. No any particular odour when rhizome broken or cut.....*C.angustifolia*

2b. Rhizome yellow or orange yellow.....*C.longa*

1b. Leaves having deep purple or blackish purple color besides green

4a. Deep purple color is at the middle of the leaf along the mid rib...*C.zedoaria*

4b. Deep purple or blackish purple color starts from the middle of the lamina and extends to the petiole.....*C.caesia*

Curcuma angustifolia Roxb. in Asiat. Res. 11:338. t. 3. 1810; Royle, Ill. Himal. 357, 359. 1839; Baker in Hook. f., FBI. VI:210.1890; Kumar. Zingiberaceae. Sikkim: 29,30.2001.

Erect herbs; leafy stems very short, Leaves gradually acuminate to a fine point, blade 50-60 × 4-12 cm; petioles 15-20 cm long. Scape 5-10 cm long; spikes 4-9 cm long; bracts green, ovate, 2.5 cm long; coma of 5-9 bracts; flowers pale yellow, exserted, about 4 cm long, 3-4 in axil of each bract, opening in succession; calyx 3-lobed, hairy, 1.5 cm long; lobes ovate-triangular; corolla-tubes about 1.5 cm long; lobes pale yellow, oblong, dorsally scantily pubescent; lip yellow, rounded, deeply 2-fid or emarginate, 1.5-2 cm long; lateral staminodes petaloid, yellow, partly connate with short, broad filament, free portion 1.25 cm long, oblong; stamen 1, anther puberulous, reclinate, with basal spurs and short basal knobs; ovaries villous. Capsules ovoid, hairy, about 1 cm long, opening by 3 valves. Fl. and Fr.: June-Aug. Vern: Keturi (Ass.) Coll. no: RB 1097. Date: 5-6-2011

Curcuma amada Roxb. in Asiat. Res. 11: 341. 1810; Baker in Hook. f. FBI. VI:213. 1890; Deb. Fl.Tripura II:372.1983.

Herbs rhizomatous, bearing scape from the centre of the leafy tuft; rhizome pale yellow; fibrous roots ending in tubers. Leaves 40-60 × 12.5-17.5 cm, oblong, oblong-elliptic or oblanceolate, ending in a short twisted cusp and with a white or hyaline margin, puberulous on the upper surface, glabrous beneath. Spike 7.5-15 cm long, on a scape 15-30 cm long, from the centre of the leafy tuft; bracts pale green, those of the coma pink or white. Flowers ca 4.5 cm long, exserted. Calyx puberulous. Corolla tubular, ventricose, posterior lobe hooded. Lip exceeding the corolla, deep yellow at centre and throat, other parts cream coloured. One stamen perfect; filaments short, broad; anther reclinate with 2 long declinate spurs. Ovary villous. Fl and frt: June-Oct. Vern: Aam aada (Assamese) Coll. no: RB 886. Date: 8-8-2010

Curcuma caesia Roxb. in Asiat. Res. 11: 334. 1810; Baker in Hook. f. FBI. VI: 1890; Kumar in J. Econ. Tax. Bot. 15: 722. 1991; Kumar in Zingiberaceae, Sikkim: 29,30.1981.

Root stocks ovoid., large; tubers sessile, longer, pale grey inside. Pseudostem about 1 m. Leaves long, petiolate, green, blade 30-50 × 12-15 cm, large, oblong with a broad purple-brown band in the middle,

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glabrous beneath. Spikes 12-15 x 6-7.5 cm, densely flowered. Bracts of the coma longer, many, red. floweres bracts ca 4 cm long. ovate, obtuse, green. Floweres pale yellow shorter than bracts, lip 1.2 cm broad, obscurely 3-lobed with middle lobe emarginate. Capsules ovoid, trigonous. Seeds oblong, arillate, white. Fl. and frt.: May—June Vern: Kola Halodhi Use: Rhizome powder mixed with milk to drink in case of bone injury. Rhizome paste is also applied on injured portion. Coll. no: RB 708. Date: 7-6-2009
Curcuma longa Linn., Sp. Pl. 2. 1753; J. L. Stewart, Punj. Pl. 238.1869; Baker in Hook. f. FBI. VI: 214.1890; *Curcuma domestica* Val. Bull. Jard. Bot. Buitenzorg ser. II, XXVII: 31.1918

Up to 1.5 m. Leaves petiolate, lamina up to c. 50 cm long, lanceolate. Inflorescence borne centrally to the leaf tuft. All bracts greenish white, occasionally pink tinged. Flowers yellow-white. Fl and frt: Oct-Jan. Vern: Halodhi (Ass.) Use: Spice Coll. no: RB 887 Date: 8-8-2010

Curcuma zedoaria (Christmann) Roscoe, Transactions of the Linnean Society of London. 8: 354. 1807; Hook f. FBI. VI:210.1892; Kumar in Zingiberaceae. Sikkim. 34.2001; *Amomum zedoaria* Christmann in G. F. Christmann and G. W. F. Panzer, Vollst. Pflanzensyst. 5: 12. 1779.

Leaf blades narrowly ovate or elliptical, 45--67 ´ 15--22 cm. Inflorescences erect, 11--23 ´ 5--10 cm; bracts of main axis whitish proximally, proximal bracts green and distal bracts pink; proximal bracts ovate to rectangular, deeply saccate, 4--4.5 ´ 4 cm, apex obtuse or truncate-apiculate; distal bracts narrowly ovate, 8--9 ´ 4--4.5 cm, apex rounded. Flowers: perianth white or spotted with purple; staminodes pale yellow with yellow streak down center of lip. Fl and Frt: May- June. Coll. no: RB 1098. Date: 12-5-2011

Globba Linnaeus, Mant. Pl. 2: 143, 170. 1771:

Globba clarkei Baker in Hook f. FBI, VI: 201. 1890; Rao and Verma in Bull. Bot. Surv. India 11: 246. 1969; Kumar, Zingiberaceae. Sikkim: 40.2001

Herbs, 0.5-1.5 m high. Leaves 15-30 x 3-6 cm, lanceolate, caudate, hairy at base beneath; lanceolate, early caducous: Flowers yellowish brown or orange-yellow, 1-3 together, deeper yellow at mouth, usually replaced by tiny white or brownish bulbils. Calyx 0.6-1 cm long; corolla-tube 1.8-3 cm long, lobes 8-9 x 5 mm; staminodes 10-12 x 2-3.5 cm: lip 1.5-2 cm long, obovate, bilobed at apex, auricled at base, anthers lanceolate, crested. Capsule 1.5-2 cm long, oblong, 3-lobed, wrinkled. Fl. and frt: June-Oct.. Coll. no: RB 707. Date: 7-5-2009

Hedychium J. König in Retzius, Observ. Bot. 3: 73--74. 1783:

Key to the species:

1a. Flower white

2a. Inflorescence more than 30cm long. Bracts long.....*H. stenopetalum*

2b. Inflorescence less than 30cm. long. Bracts short and congested...*H. coronarium*

2a. Flowers orange-red.....*H. coccineum*

Hedychium coccineum Buch.-Ham. ex Sm. in Rees, Cyclop. xvii. n. 5; Lodd. Bot. Cab. t. 705.; Kumar. Zingiberaceae. Sikkim:86.2001; *H. aurantiacum* Roscoe Monandr. Pl. Scitam. t. 61 1825.

Pseudostems 1.5-2 m. Leaves sessile; ligule 1.2-2.5 cm; leaf blade narrowly linear, 25-50 × 3-5 cm, glabrous, base subrounded or attenuate, apex caudate-acuminate. Spikes cylindric, usually dense, glabrous or sparsely villous; bracts oblong, 3-3.5 cm, leathery, sparsely pubescent, rarely glabrous, 3-flowered, margin involute or rather flat, apex obtuse or acute. Flowers red. Calyx ca. 2.5 cm, sparsely pubescent especially at 3-toothed apex. Corolla tube slightly longer than calyx; lobes reflexed, linear, ca. 3 cm. Lateral staminodes lanceolate, ca. 2.3 cm. Labellum orbicular, ca. 2 cm wide or rather small, apex deeply 2-cleft. Filament ca. 5 cm; anther 7-8 mm. Ovary sericeous, 2.5-3 mm. Capsule globose, ca. 2 cm in diam. Seeds red. Fl. Aug, fr. Oct. Coll. no: RB 709. Date: 8-6-2009

Hedychium coronarium J. König in Retzius, Observ. Bot. 3: 73-74. 1783; Hook f. FBI. VI: 225.1892; Kumar. Zingiberaceae. Sikkim.:47.2001.

Pseudostems 1-3 m. Leaves sessile; ligule 2-3 cm, membranous; leaf blade oblong-lanceolate or lanceolate, 20-40 × 4.5--8 cm, adaxially glabrous, abaxially finely pubescent or thinly hairy, base acute, apex long acuminate. Spikes ellipsoid, 10-20 × 4--8 cm; bracts imbricate, ovate, 4.5-5 × 2.5-4 cm, 2- or 3-

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flowered. Flowers white, fragrant. Calyx ca. 4 cm, split on 1 side. Corolla tube ca. 8 cm, slender; lobes lanceolate, ca. 5 cm, central one spatulate, apex mucronate. Lateral staminodes oblong-lanceolate, ca. 5 cm. Labellum white, pale yellow at base, obcordate, 4-6 × 4-6 cm, apex 2-cleft. Filament ca. 3 cm; anther ca. 1.5 cm. Ovary sericeous. Fl and frt: Aug-Dec. Coll. no: RB 296. Date: 1-8-2008

Hedychium stenopetalum Lodd. Bot. Cab. t. 1902.; Hook f. FBI.VI:231.1893; *Hedychium elatum* Horan. Prod. Scitam. 25, partim. 1862.

The tallest species among all surveyed, ca 3.5 metres. Leaves sometimes 60cm × 10-15cm., very hairy all over beneath. Leaves oblong; Spike 30cm. or more long, lax or moderately dense-flowered, flowers pure white, rachis very stout; bracts large oblong often 2-flowered. rigid, often 5cm×2.5cm. Calyx shorter than and corolla-tube scarcely longer than the bract. Corolla segments linear, 4cm.; staminodes oblanceolate, shorter than the corolla-segments; lip pure white, oblong-cuneate bifid, 2.5cm., narrowed gradually into a short claw; stamen twice as long as the lip, filament pale, 4cm-5cm.; anther linear, yellow, 1cm. Ovary hairy, Fruit ovoid to oblong, hairy green. Fl and frt: June-Aug. Coll. no: RB 515 Date: 29-9-2008

Kaempferia Linnaeus, Sp. Pl. 1: 2. 1753:

Key to the species:

1a. Inflorescences on separate shoots arising from rhizomes,

appearing before pseudostems.....*K. rotunda*

1b. Inflorescences terminal on pseudostems.....*K. galanga*

Kaempferia galanga Linnaeus, Sp. Pl. 1: 2. 1753; Baker in Hook f. FBI.VI:219.1890; Deb. Fl. Tripura. II:378.1983.

Rhizomes pale green or greenish white inside, tuberous, fragrant. Leaves usually 2, spreading flat on ground, subsessile; leaf sheath 2--3 cm; leaf blade green, orbicular, 7--20 × 3--17 cm, glabrous on both surfaces or villous abaxially, margin usually white, apex mucronate or acute. Inflorescences terminal on pseudostems, enclosed by imbricate leaf sheaths, sessile, few to many flowered; bracts lanceolate, ca. 2.5 cm. Calyx equaling bracts. Corolla tube 2--2.5 cm; lobes white, linear, ca. 1.2 cm. Lateral staminodes obovate-cuneate, ca. 1.2 cm. Labellum ca. 2.5 × 2 cm, apex slightly 2-lobed or deeply 2-cleft; lobes white with purple markings at base. Anther sessile; connective appendage strongly reflexed, rectangular, 2-lobed. Fl. Aug-Sep. Vern: Gathion (Assamese) Use: Rhizome paste and powder used in rituals of marriages. Coll. no: RB 1099. Date: 5-8-2011

Kaempferia rotunda Linnaeus, Sp. Pl. 1: 3. 1753.; Baker in Hook f. FBI. VI:222.1892; Deb. Fl. Tripura. II:378.1983.

Rhizomes with tuberous roots. Leaves 2-4, erect; ligule broadly triangular, 3--4 mm; petiole 1--2 cm, channeled; leaf blade adaxially usually variegated dark and pale green on both sides of midvein, abaxially tinged purple, lanceolate-oblong, 17-27×7.5-9.5 cm, base cuneate. Inflorescences on separate shoots arising from rhizomes, appearing before pseudostems, sessile or shortly pedunculate, 4-6-flowered; bracts purple-brown; bracteoles ca. 2.3 cm, apex 2-toothed. Calyx 4.5-7 cm, split on 1 side, apex 3-toothed. Corolla tube equaling calyx; lobes spreading, white, linear, ca. 5 cm. Lateral staminodes erect, white, lanceolate, ca. 5 × 1.7 cm, apex acute. Labellum lilac, suborbicular, apically 2-cleft to base; lobes downcurved, ca. 3.5 × 2 cm, apex acute. Anther connective appendage erect, 2-cleft, fishtail-like. Ovary 4--6 mm, hairy. Fl and frt: Apr-May. Vern: Bhumi-champa (Assamese) Use: Used as ornamental plant for the flowers coming out of the leafless rhizome in blooming season. Coll. no: RB 101 Date: 7-4-2007

Larsenianthus Kress and Mood, gen. nov.; PhytoKeys 1: 15--32 (2010):

Larsenianthus careyanus (Benth.) Kress and Mood. PhytoKeys 1: 24. 2010; *Hitchenia careyana* Benth. and Hook Gen. Pl. [Bentham and Hooker] 3(2): 643. 1883; Hook FBI. VI:225.1892; Chowdhury *et al.*, Ass. Fl.288.2005; *Curcuma careyana* Wall. Numer. List [Wallich] n. 6595. 1832

Evergreen herb, medium-sized to 215 cm tall. Stems 3--4 cm diam. at base; leaves 7--9 per stem., to 40 cm; basal leaf sheaths 3, glossy, dark green sparsely hairy, turning brown; petiole 0--2 mm in length; ligule 7--8 cm × 4 cm, semi-transparent, green turning brown, densely pubescent, apex truncate.

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Inflorescence terminal, erect to 35 cm, clasped by two leaf sheaths, light yellow-green, glabrous; spike cylindric, bracts up to 60 per inflorescence, 3–4 lower bracts sterile, 3.5 cm in length \times 3 cm in width, green with a broad white edge, glabrous. Bracteoles lanceolate, cymbiform, not tubular, keeled with uneven sides, Flowers conspicuous, 4–6 per bract; calyx tubular, 10–18 mm in length, trilobed, white, transparent, glabrous; floral tube 45–52 in length \times 1–2 mm in diameter; lateral staminodes 2 mm \times 2 mm, suborbicular, white, iridescent, reflexed, apex truncate, pink, glabrous; labellum 24 mm \times 6 mm at widest, elongate, oblanceolate, white to light purplepink; anther 5 mm \times 3 mm width, oblong; stigma, ca. 1 mm long, apical opening with hairs, white; ovary trilocular. Fruits 2.0 cm \times 1.0 cm. Fl. and frt: April-Aug. Coll. no: RB 607. Date: 25-8-2009

Zingiber Miller, Gard. Dict. Abr., ed. 4, [1545]. 1754, nom. cons.:

Key to the species:

1a. Flowering peduncles not more than 10cm long

2a. Bracts green, lip yellow, un-spotted.....*Z.chrysanthum*

2b. Bracts red, lip yellowish white, conspicuously spotted.....*Z.rubens*

1b. Flowering peduncles 15-55cm long

3a. Leaves linear lanceolate, not more than 2.5cm broad; spikes sub-cylindric; lip purple or black.....*Z.officinale*

3b. Leaves oblong or lanceolate, 3-8cm broad, spikes ovoid; lip white or yellow

4a. Leaves oblong, glabrous beneath, ligule 10-25mm long;

bracts orbicular, green.....*Z.zerumbet*

4b. Leaves lanceolate, pubescent beneath; ligule 1-2mm long;

Bracts ovate, red.....*Z.montanum*

Zingiber chrysanthum Rose. Monandr. Pl. t. 86. 1827; Baker in Hook f. FBI. VI: 243. 1892; Kumar. Zingiberaceae. Sikkim:70.2001.

Plants Of Indian Subcontinent 2: 252. 1991. Stem upto 3 m high. Leaves 25-30 \times 5-7 cm, oblong-lanceolate, pubescent beneath. Spikes very dense, globose-ovoid ca 5 cm in diam., with very short peduncle. Outer bracts ovate, inner 4-5 cm broad, lanceolate; peduncle acuminate, tip hairy, green. Flowers bright red; calyx pubescent; corolla tube 4-5 cm long, lobes ca 2.5 cm long, lanceolate, bright red; lip ca 2-3 cm long, unspotted, A bright yellow, deeply 3-lobed, midlobe orbicular, lateral ovate; stamens shorter than lip, orange; ovary pubescent. Capsules ellipsoid-oblong. Seeds brown, subglobose, aril membranous. Fls. and frt: July-Sept. Coll. no: RB 514 Date: 25-9-2008

Zingiber officinale Roscoe in Trans. Linn. Soc. 8:348. 1807; Baker in Hook. f. FBI. VI: 246. 1892; Deb. Fl. Tripura. II: 379.1983; *Amomum zingiber* Linnaeus, Sp. Pl. 1: 1. 1753.

Rhizomes branched, yellowish inside, thickened, fleshy, strongly aromatic. Pseudostems 50--100 cm. Leaves sessile; ligule slightly 2-lobed, 2--4 mm, membranous; leaf blade linear-lanceolate, 15--30 \times 2--2.5 cm, glabrescent. Inflorescences arising from rhizomes, ovoid, 4--5 \times ca. 1.5 cm; peduncle to 25 cm; bracts pale green, sometimes yellowish at margin, ovate, ca. 2.5 cm, apex mucronate; bracteoles equaling bracts. Calyx ca. 1 cm. Corolla yellowish green; tube 2--2.5 cm; lobes lanceolate, ca. 1.8 cm. Central lobe of labellum with purple stripe and cream blotches, oblong-obovate, shorter than corolla lobes; lateral lobes ovate, ca. 6 mm, free. Stamen dark purple; anther ca. 9 mm; connective appendage curved, ca. 7mm. Fl. Oct. Vern: Aada (Assamese) Use: spice. Coll. no: RB 601. Date: 24-8-2009

Zingiber montanum Link ex A.Dietr.Sp. Pl., ed. 6. i. 52.1831; *Zingiber purpureum* Rose. in Trans Linn. Soc. 8: 348. 1807; Kumar. Zingiberaceae.Sikkim;72.2001; *Z. cassumunar* Roxb. in Asiat. Res. 11: 347. t. 5. 1810; Baker in Hook, FBI. VI:248. 1892;

Rhizomes aromatic, deep yellow inside. Stem leafy; 1-2 m high. Leaves sessile, 30-40 \times 5-7.5 cm, lanceolate or linear, acuminate, pubescent along mid rib beneath. Spikes 7-15 \times 2-4 cm, ellipsoid, on 10-30 cm long peduncles. Bracts 3-5 \times 2-3 cm, broadly ovate, acuminate or subacute, greenish red turning to bright red at maturity. Flowers yellow; corolla lobes 2-2.5 cm long, lanceolate, lip 2-3 \times 1.8-2.5 cm,

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mid—lobe orbicular, bifid, lateral lobes ovate; stamen shorter than lip. Capsules small, globose. Fl. and frt: July-Aug. Coll. no: RB 432. Date: 10-8-2008

Zingiber rubens Roxb. in Asiat. Res. 11: 348. 1810; Baker in Hook, FBI. VI: 243. 1892; Rao and Verma in Bull. BSI. XIV: 137. 1972; Kumar, Zingiberaceae. Sikkim: 72. 2001.

Stem stout, leafy, upto 2.5 m high. Leaves sessile 20cm × 5 cm, oblong-lanceolate, acuminate, puberulous beneath along mid-rib. Spikes 3-5 × 2-3 cm, subglobose; peduncle 3-10 cm long. Bracts 3-5 cm long, ovate-oblong, red, bracteoles lanceolate, 4- 5.5 cm long. Flowers red, calyx 3-4 cm long, pubescent, reddish; leorolla tube 3-4.5 cm long, slightly inflated, lobes 2-3 cm long, lanceolate, the lateral two fused at the base, red; lip 2-3.5 x 0.7- 1.5 cm, linear-oblong, deeply 3-lobed, yellowish white with red spots and streaks; anther with small filament, beak of the anther bright red. Capsules ellipsoid, 4 x 1.5-2 cm, reddish. Fl. and frt: Aug-Sept. Vern: Kau-phul (Assamese) Use: Rhizome used in religious rituals and also as spices. Sometimes rhizome is eaten raw. Coll. no: RB 433 Date: 15-8-2008

Zingiber zerumbet (Linnaeus) Roscoe ex Smith, Exot. Bot. 2: 105. 1806; Kumar, Zingiberaceae. Sikkim:75.2001; *Amomum zerumbet* Linnaeus, Sp. Pl. 1: 1. 1753; Baker in Hook f. FBI. VI: 247.1892.

Rhizomes yellowish inside, tuberous. Pseudostems 0.6-2 m. Leaves sessile or shortly petiolate; ligule entire, 1.5-2 cm; leaf blade lanceolate or oblong-lanceolate, 15--40 × 3-8 cm, glabrescent or abaxially somewhat pilose, base narrowed, apex acuminate. Inflorescences arising from rhizomes, conical or ovoid-oblong, 6-15 × 3.5-5 cm, apex obtuse; peduncle 10--30 cm, scale like sheaths 5-7; bracts closely imbricate, green when young, red when old, slightly hairy, slimy adaxially, margin membranous; bracteoles ca. 1.5 cm. Calyx 1.2-2 cm, membranous, split on 1 side, apex 3-toothed. Corolla tube 2-3 cm, slender; lobes pale yellow, lanceolate, central one 1.5-2.5 cm. Labellum pale yellow, ca. 1.5 × 2.5 cm; central lobe suborbicular or subobovate, 1.5-2 × ca. 1.5 cm, apex emarginate; lateral lobes obovate, ca. 1 cm, free nearly to base. Stamen ca. 1 cm; connective appendage beaklike, ca. 8 mm. Ovary ca. 4 mm, glabrous. Capsule ellipsoid, 0.8-1.2 cm. Seeds black. Fl. and frt: July- Oct. Coll. no: RB 1100 Date: 20-7-2011

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DISCUSSION

In the presented survey, out of the 22 species, the most common one is the *Alpinia nigra* found in all forests and wetlands. The species *Larsenianthus careyanus*, *Boesenbergia rotunda* and *Amomum subulatum* are found only in the Jeypore reserve forest in the areas near the Border of Arunachal Pradesh. The species *Alpinia roxburghii* and *Zingiber chrysanthum* are encountered only in the Jokai reserve forest. The species *Curcuma angustifolia* and *Curcuma zedoaria* are interestingly found mostly in roadsides, though they are not abundant in the forests. All the other species surveyed are unevenly distributed irrespective of any particular habitat. Species *Alpinia galanga*, *Curcuma longa*, *C.caesia*, *Hedychium coccinium*, *H. coronarium*, *Kaempferia galanga*, *K. rotunda*, *Zingiber officinale* and *Z. rubens* are also found as domesticated.

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