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DIVERSITY OF POLYGONACEAE MEMBERS IN IDUKKI DISTRICT, KERALA

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Abstract **- The explosive growth of human population, uncontrolled exploitation of natural resources, habitat loss and pollution are rapidly degrading the quality of environment and cause the loss of species diversity at an alarming rate. Idukki is a biodiversity rich area and includes so many rare, endangered and endemic species. Western Ghats, the boundary of Idukki district is considered as one of the 18 centres in the world were megadiversity exists.In this context we have undertook a study of diversity and distribution of the family polygonaceae in idukki district and documents the members of the family.**

Key words **– Diversity, Idukki, Kerala, Polygonaceae**

I. INTRODUCTION

Plant and plant products have been the primary producers based upon which the modern civilization has been built. The study of plants appears to have originated from purely utilitarian point of view. The primitive man must have had an economic interest in the plants around him particularly in those that were of direct use to him [1]. The development of modern technology gave a new phase to pharmaceutical industry. As a consequence most of the mystic remedies of the ancient 'herbalist' have given way to more efficacious modern drugs. In addition, plant yield a wide variety of raw materials for the modern man, it is impressive that the correct identity and nomenclature of the plants concerning are determined. Therefore a reliable floristic inventory is a prerequisite of a given area. Such inventory may also help the conservationist to take adequate protection measures against rare and threatened plant communities or species that get wiped out from the face of earth.

The Indian region is very rich for its flora and fauna. This is due to its variety of climatic and altitudinal zones coupled with varied ecological habitats [2]. It is estimated that about 45, 000 species of flowering plants occurs in India, with the angiosperm flora alone consists of about 17, 000 species. Among these 40 - 45% are endemic to the region, largely concentrated in three major biogeographical zones, viz. the Western Himalayas, Eastern Himalayas, and the peninsular India [3]. The Indian aquatic flora comprises little less than half of the world's aquatic flowering plant species. Insectivorous plants, saprophytes, parasites and others with peculiar biological adaptations also occur in this region [4].

II. MATERIALS AND METHODS

Idukki, located in the middle part of the Kerala, the district is bound on the East by Madurai district of Tamil Nadu state while on the West by Ernakulam and Kottayam districts of Kerala In the South it is the Pathanamthitta district while on

the North it is bound by Trichur and Coimbatore districts of Kerala and Tamil Nadu states respectively. It lies between 9°15' and 10°21' of north latitude and 67°37' and 77°25' of east longitude with an area of 4479km². It extends by 115km from South to North and 67 km from East to West. The district is accessible only by road.

The plants for the present study were collected from different parts of Idukki. The plants were collected along with flowers and fruits. All the important details of each plant including habit and habitat of the plants, distribution, flowering and fruiting times and height of the plants and vegetative and floral morphology were studied and the specimens were processed and later preserved in herbarium cabinets. For initial identification standard floras like Flora of British India [5]. (Hooker ., 1875), Flora of presidency of Madras [6], the Flora of Tamil Nadu Carnatic [7], Flora of Coimbatore [8], Flowering plants of Travancore [9], Flora of Thiruvananthapuram [10], Floristic Studies in Parambikulam [11], Flowering Plants, Kerala [12], etc. were consulted. The identified plants were later confirmed at the Regional Herbaria of Kerala, S B College, Changanacherry. The nomenclature of plants was updated articles and recommendations given by the International Code of Botanical Nomenclature. The processed specimens of all taxa collected were incorporated into Regional Herbarium of Kerala, S B College, Changanacherry. Descriptions of plant specimens were prepared. Bentham and Hooker system of classification is followed in this work. Dichotomous intended keys are used for families, genera and species wherever necessary. The treatment of each species includes the original citation of the correct name followed by basinonym and other synonyms if any, there by facilitating reference to various Indian floras and publications.

III. RESULTS AND DISCUSSION

The present study documents total of 11 members of polygonaceae from the study area. They are ***Antigonon leptopus*** Hook. & Arn., ***Persicaria barbata*** (L.) H. Hara, ***Persicaria chinensis*** (L.) Gross, ***Persicaria glabra*** (Willd.) Gomez, ***Persicaria hydropiper*** (L.) Spach., ***Persicaria minor*** (Huds.) Opiz, ***Persicaria nepalensis*** (Meisner) Gross, ***Persicaria pubescens*** (Blume) Hara, ***Persicaria pulchra*** (Blume) Sojak**,** ***Polygonum plebeium*** R.Br., ***Rumex nepalensis*** Spreng., The detailed descriptions along with accepted name as well as synonyms of each taxa are given below. The taxa were authenticated with the help of available floras and literature. The names of each taxa is validated as per the rules and regulations of ICN.

ANTIGONON Endlich.

Vines**,** perennial annual; roots tuberous. Stems scandent, tendril-bearing, pubescent or glabrous; tendrils terminal and axillary, branched. **Leaves** deciduous or persistent, cauline, alternate, petiolate; ocrea usually deciduous, chartaceous; blade broadly ovate to deltate or truncate, margins entire, sometimes undulate. Inflorescences terminal and axillary, often clustered near tips of stems, racemelike, pedunculate. Pedicels present. Flowers bisexual, (1-)2-5 per ocreate fascicle, base stipelike; perianth accrescent in fruit, pink to purple or, rarely, white or yellowish, campanulate, glabrous; tepals 5, connate proximally, petaloid, dimorphic, outer 3 broader than inner 2; stamens (7-)8(-9); filaments connate ca. 1/ 2 their length, forming staminal tube, adnate to perianth tube, glandular-pubescent; anthers yellow to reddish, ovate to elliptic; styles 3, recurved, distinct; stigmas reniform-capitate. Achenes included in membranous perianth, brown, unwinged, subglobose to bluntly 3-gonous proximally, 3-gonous distally, glabrous or pubescent.

1. *Antigonon leptopus* Hook. & Arn., Bot. Beech. Voy. 308. t. 69. 1841; FCC 247; FKL 333; FKD 314; FKT 339; FCN 380; FMP 678; FPL 391; FAP 766.

Climber 25 ft long, Leaves 2.5 to 7.5 cm, simple opposite, cordate or triangular at base, Flowers in panicles, clustered along the rachis, pink or white coloured, underground tubers and large root stocks.Prolific seed producer.

Indegenous to South America.Widely grown in gardens (Fig 1).

RHK, 7107, 30/4/2014, Locality- Nedukandam; Collected by- Mahesh Mohanan. P.

PERSICARIA (Linnaeus) P. Miller

Erect, ascending or straggling herbs or subshrubs. Leaves entire, petiolate or subsessile; stipules conspicuous, sheathing around internode (ocreae), tubular or cleft, margin glabrus or variously ciliate persistent, getting torn with age. Flowers actinomorphic, bisexual, aggregated in capitate clusters or racemes; bracts ochreate, margin ciliate or glabrous; bracteoles 2-5, hyaline, usually connate ; pedicel jointed. Perianth pink or white, companulate, lobes 4 or 5, often unequal, deciduous. Stamens 4-8, alternating with glandular disc-lobes; anthers usually disjunct. Ovary globose or ovoid ; style-arms 2 or 3; stigmas capitellate, deciduous. Disc-lobes adnate with perianth –base. Nutlet biconvex, 3-gonous, rarely compressed and biconcave ; testa shiny, smooth, pitted.

2. *Persicaria barbata* (L.) H. Hara, Fl. E. Himal. 1: 70. 1966; FAA 198; FPT 547 ; FPB 258.

Polygonum barbatum L. Sp. Pl. 362. 1753; FBI 5:37 . 1886; FPM 1189(833). 1925; Subram., Indian For. 96: 527. 1970; FCC 247; FKL 332; FKD 315; FCN 381; FMP 680; FPL 390; FTV 379; FTM 298; FTC 371; FNB 564; FPR 332; FCH 263; FAP 768; FAM 542.

Herb to 1.5 m high. Leaves lanceolate, 7-12 x 1-2.5 cm, chartaceous, lateral nerves 16-20 pairs, glabrous, except for the appressed – strigose nerves and margin, base acute to cuneate, apex gradually acute ; petiole to 1 cm ; ocreae tubular, truncate, 1.5- 2 cm, strigose, coarsely ciliate, ciliae to 1.5 cm. Spikes terminl and axillary, to 7 cm ; bracts closely imbricate, oblong, 2.5 mm, narrowed below, thick, truncate, sparsely ciliate ; bracteoles to 2 mm,obtuse. Stamens 5; filament 1.5 mm; anthers 0.25 mm. Ovary obovoid, 0.7 mm ; style 0.5 mm, arms 3, each 0.5 mm ; stigmas capitellate. Nutlets trigonous, 2 x 1.5 mm (Fig 2).

RHK, 7102, Locality- Kanthallur; Collected by - Mahesh Mohanan. P.

3. *Persicaria chinensis* (L.) Gross. In Engl., Bot. Jahrb. Syst. 49: 269,277 , 315. 1913; FSV 226; FPT 548; FPB 258.

Polygonum chinense L. Sp. Pl. 363. 1753; FBI 5:44. 1886; FPM1190(833). 1925; FKL 333; FKD 315; FKT 337: FCN 381; FMP 680; FPL 390; FTV 379; FTM 298; MPC 25,38; FTC 371; FSH 254; SFK 64; FNB 564; FPR 332; FCH 263; FAM 543.

Staggling shrub to 2 m high. Leaves broadly elliptic-oblong, 6-11 x 3-7 cm, thick – chartaceous, lateral nerves 10-12 pairs, glabrous above, scabrous along nerves below, base rounded to acute, margin entire to minutely crenulated, apex rounded, abruptly acute; petiole to 2 cm long ; ocreae 2-4 cm,membranous, obliquely cleft, abruptly acuminate, extending to the base of the higher node. Inflorescence of stalked, capitate clusters aggregated in lax, terminal, corymbose panicles, to 7 cm across; bract oblong, concave, 2.5 x 1.5 mm, scarious, rounded, (sub) acute; bracteoles to 2.5 mm long. Perianth white, 4 mm across, lobes 5, subequal, to 4 mm long, united from near the middle ; lobes ovate, concave, acute. Stamens 8, (sub)exserted ; filaments to 2.5 mm long; anthers to 0.6 mm long. Ovary globose,to 0.7 mm across; style-arms 3, stout, 1 mm long; stigmas capitellate. Nutlets trigonous, smooth (Fig 3).

RHK,7105,30/4/2014, locality- Muniyarkudi; Collected by - Mahesh Mohanan.P

4. *Persicaria glabra* (Willd.) Gomez, Ann. Inst. Segunda Ensef. Habana 2:278. 1896; FSV 227;

FPT 548; FPB 258.

Polygonum glabrum Willd., Sp. Pl. 2: 447.1799; FBI 5:34. 1886; FPM 1189(832). 1925; FKT 338; FCC 247; FKL 333; FKD 316;FCN 381; FMP 681; FPL 391; FTV 379; FTM 299; FSH 255; FNB 565;FPR 332; FCH 264; FAP 768.

Subshrub to 2.5 m high. Leaves narrowly lanceolate,10-25 x 1.5-4 cm, thick-chartaceous, lateral nerves 25-40pairs, closely pinnate, base acute to decurrent, apex gradually acuminate ; petiole to 2 cm long; ochreae tubular, 2.5- 4 cm, margin truncate, glabrous. Racemes terminal or from the upper axils, 7-10 cm long ; bracts oblong,to 3 mm long, broadly triangular,

margin scarious, obtuse ;bracteoles to 2 mm long. Perianth rose coloured, 3.5 mm across ; lobes 5,oblong, 3 x 1.5 mm, obtuse. Stamens 5; filaments to 2 mm long ; anthers oblong,to 0.7 mm. Ovary globose,to 0.7 mm across ;style to 0.8 mm long, arms 3, each to 1 mm long ; stigma capitellate. Nutlets compressed, 3 x 2.8 mm, faces flattened. (Fig 4).

RHK,7104,30/4/2014,locality- Nedumkandam; Collected by - Mahesh Mohanan.P

5. ***Persicaria hydropiper*** (L.) Spach., Hist. Veg. 10: 536. 1841.

Polygonum hydropiper L. Sp. Pl. 361. 1753; FBI : 5:39. 1886; FPM 1190(833). 192; FKT 338; FNB 566; FPR 332; FCH 264; FTC 371; FAP 769.

Annual herb with an erect stem, 20-70 cm high, leaves alternate and stalkless, narrowly ovate with entire margins finged by very short hairs,stipules are fused in to stem enclosing sheath that is loose and fringed at the upper end. Inflorescence, a nodding spike. Perianth 4- 5 segments, united near the base, green at base and white or pink at the edges. Stamens 6.Carpels 3 fused, styles 3. Fruit ovoid,dark brown,flattened (Fig 5).

RHK, 7106, Locality- Nedumkandam; Collected by - Mahesh Mohanan. P.

6. ***Persicaria minor*** (Huds.) Opiz, Seenam Rostlin Kveteny Ceske 72. 1852

Polygonum minus Huds., Fl. Angl. (ed. 1) 148. 1762; FBI 5:36. 1886; FPM 1189(833). 1925; FPR 333.

Polygonum strictum All., Fl. Pedem. 2:297. 1785.

Annuals, Leaves, ocreae brownish, cylindric, 3-10 mm long chartaceous, margin truncate , ciliate with bristles, surface glabrous, petiole 0.1-0.2 cm long, glabrous, leaves sometimes sessile; Inflorescence terminal and axillary, 10-50 x 2-4 mm; peduncle 2-25 mm long. Flowers enclosed in ocreae, ocreolae not overlapping proximally, usually overlapping distally, flowers 1-3 (4) per ocreate fascicle, homostylous; perianth roseate to red, rarely white, glabrous not glandular- punctuate, scarcely accrescent; tepals , connate, obovate to elliptic, 2.5-3 mm long. Veins not prominent, not anchor shaped, margins entire, apex obtuse to rounded; stamens 5, included; anthers yellow to pink, elliptic; styles 2, connate at base. Achenes included, brownish black to black, bi convex or rarely trigonous (Fig 6).

RHK, 7103, 30/4/2014, locality- Kovilpadi, Collected by - Mahesh Mohanan.P

7. ***Persicaria nepalensis*** (Meisner) Gross in Engl., Bot. Jahrb. Syst. 49:277. 1913; FKT 338; FTV 380; MPC 38; FPR 333.

Polygonum nepalense Meisner, Monogr. Polygon. 84. t. 7. 1826.

Polygonum alatum Buch. Ham. ex Spreng., Syst. Cur. Post. 4:154. 1827; FBI 5:41. 1886.

Polygonum punctatum Buch.-Ham. ex D.Don, Prodr. Fl. Nepal 72. 1825; FPM 1190(833). 1925.

Spreading herb. Leaves ovate-rhomboid, 2-3.5 x 1-2.5 cm, chartaceous, lateral nerves 4-6 pairs, faint, glabrous to glaucescent, base truncate or acute, decurrent into a winged petiole, ending in amplexicaul base around the node, subpetiolate, apex acute ; upper leaves sessile with cordate base around node ; ocreae tubular, membranous,to 0.7 cm long, truncate, obliquely cleft, hairy at base. Inflorescence capitate clusters sessile or pedunculate, 0.4-0.8 cm across, subtended by a cordate, involucral leaf ; bracts ovate-oblong,to 3.5 mm long, scarious, acute ; bracteoles 2, widely separated above, folded to, 1.5 mm long, acute. Perianth pinkish to white, to 2 mm across; lobes 4, unequal ; outer 2 broadly ovate ; inner ones oblong, to 3 mm long, subacute. Stamens 4 ; filaments 1.5 mm long ; anthers 0.5 mm long. Ovary globose,to 0.6 mm across; style 1 mm long, arms 0.3 mm long; stigmas capitellate. Nutlets compressed, circular,to 2.5 mm across, faces convex to flat, minutely pitted in lines (Fig 7).

RHK, 7108, Locality- Kattappana; Collected by - Mahesh Mohanan. P.

8. ***Persicaria pubescens*** (Blume) Hara in Hara et al., Enum. Fl. Pl. Nepal 3: 177. 1982, var. acuminata (Franch. & Sav.) Hara, Fl. East Himalayas 74. 1966.

Polygonum hydropiper L. var. acuminata Franch. & Sav., Enum. Fl. Jap. 2: 474. 1877.

Polygonum hydropiper L. var. flaccidum Steward, Contrib. Gray Herb. 88: 59. 1930; FCN 382; FPR 332.

Polygonum donnii Wight, Ic. t. 1801. 1852.

Polygonum hydropiper L. ssp. microcarpum Danser var. triquetrum Danser, Bull.Jard. Bot. Buitenz. ser. 3. 8: 189. 1927; FPL 391.

Polygonum glandulosum Rao, BBSI 5: 257. 1963 non R. Br. 1810.

Polygonum sarbhanyanicum Rao, BBSI 6: 106. 1964.

Annual herb. Leaves upto 15 cm long, ocreae strigose, 10-15 mm long with much longer 8-10 mm long cilia. Spikes upto 15 cm long, filiform, which are rather drooping, extremely slender and much interrupte; ocreolae glabrous glandular with ciliate mouth. Perianth gland dotted. Stamens always 8. Nuts trigonous (Fig 8).

RHK, 7110, Locality- Muniyarkudi; Collected by - Mahesh Mohanan. P.

9. *Persicaria pulchra* (Blume) Sojak, Preslia 46(2) : 154. 1974; FKT 339; FPR 333; FAP 770.

Polygonum pulchrum Blume, Bijdr. 530. 1826.

Polygonum tomentosum Willd., Sp. Pl. 2: 447. 1799, non Schrank 1789; FBI : 30. 1886; FPM 1189(832). 1925.

Erect herb to 1.5 m high. Leaves lanceolate or linearly obovate, 10-15 x 2-4 cm, thick-chartaceous, lateral nerves 15-20 pairs, thin, closely pinnate, silky-tomentose, base cuneate to decurrent, apex gradually acuminate ; petiole to 2 cm long ; ocreae tubular, 2-3 cm long, margin truncate, chartaceous, softly ciliate. Panicles terminal, to 10 cm long ; peduncle tomentose ; bract oblong,to 4 x 2 mm long, thick, narrowed below, sericeous without, margin ciliate, to 1.5 mm ; bracteoles to 1 mm. Perianth pinkish, to 4 mm across ; lobes 5, equal, ovate,to 3.5 mm long, shortly connate at base, subacute. Stamens 5; filaments to 2 mm long; anthers 0.5 mm long. Ovary globose, to 1 mm across; style-arms 2, united from near the middle,to 1mm long ; stigmas capitellate. Nutlets biconvex,to 3 mm across (Fig 9).

RHK, 7112, Locality- Kovilpadi; Collected by - Mahesh Mohanan. P.

POLYGONUM Linnaeus

Herbs, rarely subshrubs, or small shrubs, rarely dioecious. Stems erect, prostrate, or ascending, usually with conspicuously swollen nodes, glabrous or pubescent, rarely prickly. Leaves simple, alternate, subsessile; leaf blade variously shaped, margin entire; ocrea tubular, membranous, margin entire or lacerate, apex truncate or oblique. Inflorescence terminal or axillary, racemose, spicate, capitate, or paniculate, sometimes flowers fascicled or solitary in axils of leaves. Pedicel often articulate. Flowers bisexual, rarely unisexual; bracts and bracteoles membranous. Perianth persistent, 5(or 4)-parted. Stamens 7 or 8, rarely 4. Styles 2 or 3, deciduous, mostly elongate. Achenes trigonous or biconvex, rarely biconcave.

10. *Polygonum plebeium* R. Br., Prodr. 420. 1810. “plebejum; FBI 5: 27. 1886; FPM 1188(832). 1925; FCN 382; FPL 391; FPT 549; FTC 371; FPR 333; FPB 258.

Prostrate herb. Leaves oblong, 0.6-0.8 x 0.15 – 0.3 cm, thick, midnerve impressed above, prominent below, lateral nerves obscure, base attenuate to shortly decurrent, apex obtuse or acute, subsessile ;stipules (ocreae) hyaline, scarious, obliquely tubular,to 3 mm long, lacerate. Flowers actinomorphic, bisexual, in axillary fascicles ; pedicel to 2 mm, jointed; bracts hyaline,to 1.5 mm long; bracteoles to 1 mm long. Perianth rose coloured,to 2 mm across ; lobes 5, unequal ; outer 3 vertically folded, somewhat spotted without, muriculate along the rib ; inner 2 oblong, smooth, to 2 mm long, acute. Stamens 6, included, alternating with basal, glandular, disc-lobes ; filaments basally decurrent,to 0.8 mm long ;anthers to 0.2 mm long. Ovary 3-gonous, to 0.4 mm long; style to 0.3 mm long, broadly 3-fid above; stigmas simple. Nutlets strongly 3-gonous to, 2 x 1 mm, with persistent style (Fig 10).

RHK, 7111, Locality- Nedumkandam; Collected by - Mahesh Mohanan. P.

RUMEX Linnaeus

Annual or perennial herbs, rarely shrubs. Leaves various, mostly radical or cauline, alternate;

Stipules hyaline, ocreate, often disappearing with age. Flowers hermaphrodite monoecious or dioecious, in axillary clusters or in whorls arranged in simple or panicled racemes; pedicels jointed; bracts ocreate ; bracteoles 0. Perianth simple, calycine; segments 6, rarely 4, the inner accrescent, entire or toothed, the midrib often enlarged or tubercled. Stamens 6; filaments short; anthers oblong. Ovary trigonous; ovule solitary; styles 3 ; stigmas fimbricate. Fruit a small nut, enclosed in the usually enlarged inner perianth segments, the angles acute. Seed erect; embryo lateral, nearly straight; cotyledons linear or oblong.

11. *Rumex nepalensis* Spreng., Syst. Veg. 2: 159. 182; FBI 5:60. 1886; FPM 1192(835). 1925; SFK 65; FPR 333.

A tall stout annual or perennial herb to 1 m high, sometimes with tuberous roots, the stems grooved, the leaves long petioled. Flowers with a peak during February- May. Fruits March onwards (Fig 11).

RHK,7101,30/4/2014, locality- Kanthalloor; Collected by - Mahesh Mohanan.P

Similar results were obtained by Sasidharan N (2004) and Antony V T(2011) shows that its natural diversity is decreasing as increasing human encroachment and subsequent biodiversity destruction. The decrease in numbers of *Polygonum hudropiper* is an example for this.

Fig. 1 *Antigonon leptopus* Hook.

Fig 2 *Persicaria barbata* (L.) H.Hara

Fig 3 *Persicaria chinensis* (L.) Gross.

Fig 4 *Persicaria glabra Willd.*

Fig 5 *Persicaria hydropiper* L.

Fig 6 *Persicaria minor* Huds.

Fig 7 *Persicaria nepalensis* Meisner.

Fig 8 *Persicaria pubescens* Blume.

Fig 9 *Persicaria pulchra* Blume.

Fig 10 *Polygonum plebeium R.*

Fig 11 *Rumex nepalense* Spreng.

Fig 12 Map of the study Area

IV. CONCLUSIONS

According to the present data the Polygonaceae is represented by 5 genera in which 14 species were found in Kerala. Out of which only 4 genera and 11 species were documented from Idukki district, Kerala. All these names taken from published floras and the possible specimen also collected and herbaria were prepared. The study projects the requirements to adopt important measures to protect the plants. We should conserve the plants, since they are very important to retain life on the earth. Plants are the primary producers. A large number of other animals depend on plants for their food as well as for shelter, breeding ground etc. The destruction of single plants will result in the destruction of number of allied species. So the plants are essential to conserve biodiversity on the earth. To keep the biodiversity as it is now is a primary requirement of human himself to continue on earth. In Polygonaceae family the name of plants are changed recently. The genus *Polygonum* is changed to genus *Persicaria*, and *Polygonum plebeium* is the only plant found in kerala as under the *Polygonum* genus. *Polygonum* and *Persicaria* are generas used synononimously. Under family Polygonaceae there are no endemic species in Kerala as well as in Idukki district. These are weeds and growing flourishly in the climatic conditions of Idukki. The other major findings of the present study are that

the occurrence of various plant species under the Polygonaceae family is reduced to some extent due to various threatening factors. In this context, the conservation of such valuable icon is very essential for their successful existence.

V. REFERENCES

1. Lawrence H M George, 1958; An Introduction to Plant Taxonomy, The Macmillan Company, Newyork. Page no: 1-5.
2. Anikumar N, Sivadasan M, Ravi N, 2005; Flora of Pathanamthitta, Daya Publishing House, New Delhi. Page no: 422-426.
3. Sharma J K, Nair K K, Mathew George, Ramachandran K K, Jayson E A, Das Mohan K, Nandakumar U N, 2002; Studies on the Biodiversity of New Amarambalam Reserved Forest of Niligiri Biosphere Reserve, Kerala Forest Research Institute, Peechi. Page no: 116-120.
4. Sasidharan N, Suganapal P, 2001; Floristic Studies in Parambikulam Wildlife Sanctuary, Kerala Forest Research Institute, Peechi. Page no: 272-285.
5. Hooker J D,1875; Flora of British India, State for India Publication, Page no:256-259.
6. Gamble J S, 1915-1936; Flora of Presidency of Madras, Bishan Singh Mahendrapal Singh Publications, Dehradun.
7. Matthew K M, 1983; Flora of Tamil Nadu Carnatic Volume-3, Diocesan Press, Madras. Page no: 1355-1365.
8. Chandrabose N, Nair N C,1988; Flora of Coimbatore, Bishan Singh Mahendrapal Singh Publications, Dehradun. Page no: 258-260.
9. Sahib Rao M, Rama Rao, 1914; Flowering Plants of Travancore, The Government Press, Trivandrum. Page no: 334-335.
10. Mohanan M, Henry A N, 1994; Flora of Thiruvananthapuram, Botanical Survey of India,Calcutta. Page no: 388-397.
11. Sasidharan N, Suganapal P, 2001; Floristic Studies in Parambikulam Wildlife Sanctuary, Kerala Forest Research Institute, Peechi. Page no: 272-285.
12. Sasidharan N, 2004; Biodiversity Documentation for Kerala Part 6: Flowering Plants, Kerala Forest Research Institute, Peechi. Page no: 1-10, 394-401.