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Angiosperm diversity of riparian zone of Kuppam river, Kannur, Kerala, India: 1- Checklist of trees and herbs

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ABSTRACT

This study was undertaken to analyse the riparian flora of the Kuppam River in Kannur District, Kerala, India. A total of 337 plant species were recorded, comprising 197 herbs and 140 trees. Among the herbs, Poaceae was the dominant family with 21 species, while Moraceae represented the highest number of tree species with 16. The recorded tree species belonged to 41 angiosperm families, and the herbs were distributed across 45 families. The overall vegetation pattern reflects characteristics of a tropical rainforest ecosystem, as evidenced by the presence of representative families such as Dipterocarpaceae, Lauraceae, and Clusiaceae. Additionally, families including Balsaminaceae, Orchidaceae, and Podostemaceae, known for their requirement of specific tropical climatic conditions, were also documented. The riparian vegetation of the Kuppam River further comprises several endemic and rare, endangered and threatened species, highlighting its ecological significance and the need for conservation attention.

KEY WORDS

Diversity; Riparian flora; Kuppam river; RET species

ARTICLE HISTORY

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Introduction

Wetlands are considered as 'hotspots of community civilizations' as they are the repositories capable of sustaining various microclimates, which exhibit natural interactions. Riparian systems are one of the major components of wetlands, which are inter-zones that sandwich the terrestrial and aquatic ecosystems. This interface plays a very important role in deciding the mineral exchange between these two ecosystems and the type of flora and fauna that thrive in such conditions. It encompasses the zone of the underlying water table to the topmost vegetational cover of the river shores, which is under the influence of surface water wholly or partially in an aquatic environment. Riparian systems are ecosystems comprised of streams, rivers, lakes, wetlands and floodplains that form a complex and interrelated hydrologic system [1]. They are also known as gallery forests or streamside forests [2]. The combination of water-soil-vegetation characteristics of these areas reflects the influence of the higher available moisture quantities compared to their adjacent terrestrial upland ecosystem. Riparian vegetations also enable wildlife habitat, enhanced biodiversity, and provide wildlife corridors, enabling aquatic and riparian organisms to move along riverine systems [3]. The biotic communities inhabiting the riparian areas, their association with the immediate environment, role in alteration of functioning of the river basin as a whole etc., have gained more impetus of the researchers of the past two decades [4]. Riparian ecosystems are habitats occupying approximately one-thousandth of the surface of earth and are considered inherently rare ecosystems [5]. The threat to these aquifers and terrains is high due to various types of anthropogenic pressures.

Riparian studies are comparatively meagre in tropical regions, and the tropics and neotropics are poorly explored for their floristic structure and is limited to a few works in Amazonian regions, though temperate regions are represented fairly well [6]. One of the earliest works is done on the riparian flora of flood plain wetlands of river Murray in Australia [7]. The variation of riparian vegetation with respect to width at high altitudinal region and their conservation and management strategies in Australia has been worked out [8]. Riparian studies in USA have been well documented with major adequate contributions [9,10]. Effect of woody debris on riparian habitats of water bodies of Canada has been evaluated [11]. There are studies pertaining to preliminary analysis and classification of riparian system of Mexico. The sustainable use of riparian system in rural areas of Peru, the South American country, has been elaborated [12]. There are studies based on phenology and biodiversity of riparian vegetation of the Ganga River bank at Bharwari (Kaushambi) in Uttarpradesh, India [13]. Riparian flora of Mahi river of Vadodara, Gujarat has been carried out [14]. One of the pioneer studies was the investigation of the gallery forest of the River Tambiraparani, Mundanthurai Wildlife Sanctuary, South India, and proposals for conservation measures due to its species richness and anthropogenic disturbances [15]. A comparative study on the forest zone and agro-ecosystem zone in the riparian forests of the Cauvery River basin showed a significant difference between these two in terms of species richness [16]. An investigative correlation study between the impact of riparian land use and stream insects of Kudremukh National Park, Karnataka state, India, has been done which opined that there exists differential distribution in diversity and community composition of stream insects with different riparian land use types [17]. Two monumental works on riparian flora of Kerala Rivers are by Bachan and Joby [18,6]. The former elaborated on diversity and ecological significance of riparian flora of Chalakkudy river of Kerala, India, and latter explored the taxonomy and ecology of riparian flora of Pampa River, Kerala, India. There is documentation of the ecology and socio-cultural aspects of riparian vegetation of Valapattanam River of Kerala [19].

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Methods

Study area

Kannur district spreads (geographical area of 2966 sq.km.) between latitudes 11° 40' to 12° 48' North and longitudes 74° 52' to 76° 07' East. The district is limited by the Western Ghats in the east (Coorg district of Karnataka State), Kozhikode and Wayanad districts in the south, Kasaragod district in the north and the Arabian Sea in the west. The topography of the terrain is rugged in the highlands and associated midlands and further slopes towards the west to coastal tracts. The annual average rainfall of Kannur district is 3,438 mm of which more than 80 percent is received during south west monsoon. There are seven major rivers in Kannur district, which show a dendritic drainage pattern in general. They are Valapattanam river (113 km), Kuppam River (71 km), Ancharakandy river (64 km), Mahe river (55 km), Peruvamba river (51 km), Ponniyam river (29 km) and the Ramapuram River (19 km) (CED, 2017).

Kuppam River (12° 6' and 20° 25' Northern Latitude & 75° 24' and 57° 31' Eastern Longitude) has its genesis from the Padinalkadu Ghats of Koorg district of Karnataka state, at an elevation of approximately 650 m., which is the part of Southern Western Ghats. Its steep initial course covers a distance of 15 km. before entering Kerala, where its bed level falls to nearly 120 m., due to the slope of Western Ghats. Total length of the river is approximately 82 km. and it, along with its five tributaries, drains an area of 539 sq. km; of which 70 sq.km lies in State of Karnataka. This river, also known as Mattol River, has its major course in Kannur district through the undulating hillocks of high land and is close to Valapattanam River and both flows more or less parallel before converging at Azhikkal in Kannur and finally pours out to Arabian Sea. The coast of the river shows thick vegetation of various kinds. Since a thorough reconnaissance is lacking about the riparian components of the river, this research work stands very much relevant.

Methodology

Collection and identification of riparian plant species was performed through field visits during the period 2015 -20. The collections were done in monsoon, post-monsoon and pre-monsoon seasons. Fortnightly explorations were conducted in study area and voucher specimens were collected in triplicates or more based on the necessity. Trails and trail-less zones of the riparian systems was pedestrianized for elaborate coverage of the flora on both sides of the river. Later they were pressed, dehydrated and affixed on standard herbarium sheets (43x23 cm) in portrait form by standard herbarium techniques [20]. The herbarium sheets and the pickled specimens were deposited in the research department of botany, Sir Syed College, Taliparamba, Kannur.

The riparian angiosperm species identification was done with the assist of relevant literatures like Flora of Presidency of Madras, Flora of British India; Vol. 1–7, The flora of Palni Hills, South India, Flora of the Tamilnadu and Carnatic, Flowering plants of Thrissur Forest, CD of Flowering plants -KFRI, Trees of Thrissur district, Flora of Kerala-Grasses, Flora of Cannanore, Identification manual of forest trees and different regional checklists and taxonomic publications. The Google group 'efloraofindia' and Facebook groups 'Indian Flora', 'Flora of Western Ghats', etc., also helped in species identity. The naming and the citations were performed with the help of databases like Tropicos 2022, The Plant List 2021, International Plant Name Index, World Checklist of Selected Plant families (WCSP, 2019), etc [21-27].

Results

The following trees and Herbs have been collected from the riparian zone of Kuppam river as given in Table 1.

Table 1. List of trees and herbs collected from the riparian zone of the Kuppam River.

SN.	Scientific Name	Family	Habit	Reproductive Phenology
1	Dillenia pentagyna Roxb	Dilleniaceae	Tree	Feb-June
2	Annona reticulata L	Annonaceae	Tree	May-Aug
3	Polyalthia fragrans (Dalz) Bedd	Annonaceae	Tree	Sept-Jan
4	Nymphaea pubescensWilld	Nymphaeaceae	Herb	Nov-Dec
5	Cleome rutidosperma DC	Capparaceae	Herb	May-Nov
6	Cleome viscosa L	Capparaceae	Herb	Mar-July
7	Crataeva magna (Lour) DC	Capparaceae	Small Tree	Mar-Apr
8	Hydnocarpus pentandra (Buch - Ham) Oken	Flacourtiaceae	Small Tree	Dec-May
9	Calophyllum calaba L	Clusiaceae	Small Tree	Sep-May
10	Garcinia gummi-gutta (L) Robs	Clusiaceae	Small Tree	Jan-Sep
11	Dipterocarpus indicus Bedd	Dipterocarpaceae	Tree	Feb-July
12	Hopea parviflora Bedd	Dipterocarpaceae	Tree	Jan-June
13	Hopea ponga (Dennst) Mabb	Dipterocarpaceae	Tree	Mar-June
14	Vateria indica L	Dipterocarpaceae	Tree	Mar-Aug
15	Sida acuta Burmf	Malvaceae	Herb	Aug-Oct
16	Sida beddomei Jacob	Malvaceae	Herb	Jan-Mar
17	Sida mysorensis Wight & Arn	Malvaceae	Herb	Oct-Feb

https://doi.org/10.61577/jpri.2025.100005

18	Sida rhombifolia L	Malvaceae	Herb	Sep-Dec
19	Thespesia populnea (L) Soland ex Correa	Malvaceae	Tree	Mar-June
20	Ceiba pentandra (L) Gaertn	Bombacaceae	Tree	Feb-June
21	Melochia corchorifolia L	Sterculiaceae	Herb	July-Apr
22	Pterospermum acerifolium (L) Willd	Sterculiaceae	Small Tree	May-June
23	Pterospermum reticulatum Wight &Arn	Sterculiaceae	Small Tree	Jan-Nov
24	Pterygota alata (Roxb) RBr in Bennet & Br	Sterculiaceae	Tree	Apr-May
25	Theobroma cacao L	Sterculiaceae	Small Tree	Nov-May
26	Corchorus capsularis L	Tiliaceae	Herb	July-Nov
27	Grewia tiliifolia Vahl	Tiliaceae	Tree	Feb-June
28	Elaeocarpus serratus L	Elaeocarpaceae	Tree	Apr-Sep
29	Biophytum sensitivum (L) DC	Oxalidaceae	Herb	Oct-Jan
30	Oxalis corniculata L	Oxalidaceae	Herb	Mar-Dec
31	Impatiens balsamina L	Balsaminaceae	Herb	Mar-Oct
32	Impatiens minor (DC) Bennet	Balsaminaceae	Herb	Aug-Dec
33	Impatiens scapiflora Heyne ex Roxb	Balsaminaceae	Herb	July-Dec
34	Melicope lunu-ankenda (Gaertn) Hartley	Rutaceae	Small Tree	May-July
35	Naringi crenulata (Roxb) Nicols in Sald & Nicols	Rutaceae	Small Tree	June-Dec
36	Zanthoxylum rhetsa (Roxb) DC	Rutaceae	Tree	Mar-N0v
37	Azadirachta indica AJuss	Meliaceae	Tree	Feb-Sep
38	Naregamia alata Wight &Arn	Meliaceae	Herb	Aug-Dec
39	Swietenia macrophylla King in Hook	Meliaceae	Tree	Mar-May
40	Lophopetalum wightianum Arn	Celastraceae	Tree	Dec-July
41	Dimocarpus longan Lour	Sapindaceae	Tree	Mar-Aug
42	Sapindus trifoliata L	Sapindaceae	Small Tree	Dec-Apr
43	Schleichera oleosa L	Sapindaceae	Tree	Mar-June
44	Anacardium occidentale L	Anacardiaceae	Tree	Nov-Apr
45	Holigarna arnottiana Hook f	Anacardiaceae	Tree	Jan-July
46	Lannea coromandelica (Houtt) Merr	Anacardiaceae	Tree	Jan-May
47	Mangifera indica L	Anacardiaceae	Tree	Jan-May
48	Nothopegia heyneana (Hookf) Gamble	Anacardiaceae	Small Tree	May-June
49	Nothopegia racemosa (Dalz) Ramam In Sald &Nicols	Anacardiaceae	Small Tree	May-June
50	Spondias pinnata (Lf) Kurz	Anacardiaceae	Tree	Mar-Dec
51	Moringa pterygosperma Gaertn	Moringaceae	Tree	Nov-Mar
52	Erythrina variegate L in Stickman	Fabaceae	Small Tree	Mar-Apr
53	Gliricidia sepium (Jacq) Kunth ex Walp	Fabaceae	Small Tree	Mar-May
54	Pongamia pinnata (L) Pierre	Fabaceae	Small Tree	Apr-Dec
55	Bauhinia racemosa Lam	Caesalpiniaceae	Small Tree	Mar-Dec
56	Cassia fistula L	Caesalpiniaceae	Small Tree	Feb-Sep
57	Chamaecrista mimosoides (L) Greene	Caesalpiniaceae	Herb	July-Dec
58	Delonix regia (Boj ex Hook) Rafin	Caesalpiniaceae	Tree	Feb-July
59	Humboldtia brunosis Wall	Caesalpiniaceae	Tree	July-Nov

https://doi.org/10.61577/jpri.2025.100005

60	Peltophorum pterocarpum (DC) Backer ex heyne	Caesalpiniaceae	Tree	Jan-Dec
61	Saraca asoca (Roxb) de Wilde	Caesalpiniaceae	Small Tree	Feb-Aug
62	Senna tora (L) Roxb	Caesalpiniaceae	Herb	Aug-Dec
63	Tamarindus indica L	Caesalpiniaceae	Tree	Sep-Apr
64	Acacia auriculiformis ACunn ex Benth in Hook	Mimosaceae	Small Tree	Jan-Dec
65	Acacia mangium Willd	Mimosaceae	Tree	July-Feb
66	Adenanthera pavonina L	Mimosaceae	Tree	Jan-Sep
67	Albizia lebbeck (L) Benth in Hook's	Mimosaceae	Tree	Mar-Dec
68	Mimosa pudica L	Mimosaceae	Herb	July-Jan
69	Samanea saman (Jacq) Merr	Mimosaceae	Tree	Mar-May
70	Xylia xylocarpa (Roxb) Taub	Mimosaceae	Tree	Feb-Dec
71	Bruguiera gymnorrhiza (L)Savi in Lam	Rhizophoraceae	Small Tree	June-Oct
72	Carallia brachiata (Lour) Merr	Rhizophoraceae	Tree	Oct-Apr
73	Rhizophora mucronata Poir in Lam	Rhizophoraceae	Small Tree	Apr-Oct
74	Terminalia cuneata Roth	Combretaceae	Tree	Nov-June
75	Psidium guajava L	Myrtaceae	Small Tree	Mar-May
76	Syzygium caryophyllatum (L) Aston in Trimen	Myrtaceae	Small Tree	Jan-Feb
77	Syzygium cumini (L) Skeels	Myrtaceae	Tree	Dec-Apr
78	Syzygium laetum (Buch-Ham) Gandhi in Sald & Nicols	Myrtaceae	Small Tree	Dec-July
79	Syzygium occidentalis (Bourd) Gandhi in Sald &Nicols	Myrtaceae	Small Tree	Mar-Apr
80	Syzygium salicifolium (Wight) Graham	Myrtaceae	Small Tree	Apr-May
81	Syzygium travancoricum (L) Gamble	Myrtaceae	Tree	Apr-June
82	Syzygium zeylanicum (L) DC	Myrtaceae	Small Tree	Jan-Apr
83	Careya arborea Roxb	Lecythidaceae	Small Tree	Feb-July
84	Sonerila rheedei Wight &Arn	Melastomataceae	Herb	July-Aug
85	Ammania baccifera L	Lythraceae	Herb	Sep-Dec
86	Lagerstroemia speciosa (L) Pers	Lythraceae	Small Tree	Mar-Nov
87	Sonneratia caseolaris (L) Engl in Engl & Prantl	Sonneratiaceae	Tree	Jan-Dec
88	Turnera angustifolia Mill	Turneraceae	Herb	May-Dec
89	Turnera subulata Smith in Rees	Turneraceae	Herb	Jan-Dec
90	Begonia integrifolia Dalz in Hook	Begoniaceae	Herb	July-Aug
91	Trianthema portulacastrum L	Aizoaceae	Herb	Apr-June
92	Mollugo pentaphylla L	Molluginaceae	Herb	July-Sep
93	Centella asiatica (L) Urban in Mart	Apiaceae	Herb	Jan-Dec
94	Catunaregam spinosa (Thunb) Tirveng	Rubiaceae	Small Tree	Apr-Dec
95	Haldina cordifolia (Roxb) Ridsd	Rubiaceae	Tree	Oct-Mar
96	Hedyotis diffusa (DC) Willd	Rubiaceae	Herb	Aug-Nov
97	Hedyotis hermanniana Dutta	Rubiaceae	Herb	Jan-Dec
98	Hedyotis neesiana Arn	Rubiaceae	Herb	Sep-Dec
99	Hedyotis puberula (G Don) RBr exArn	Rubiaceae	Herb	Nov-Mar
100	Ixora brachiata Roxbex DC	Rubiaceae	Small Tree	Jan-May
101	Mitragyna tubulosa (Arn) Hav	Rubiaceae	Tree	Apr-May

https://doi.org/10.61577/jpri.2025.100005

102	Morinda citrifolia L	Rubiaceae	Small Tree	July-Nov
103	Neolamarckia cadamba (Roxb) Bosser	Rubiaceae	Tree	Apr-Aug
104	Neurocalyx calycinus (R Br ex Bennett) Robins	Rubiaceae	Herb	May-Aug
105	Ochreinauclea missionis(Wall ex G Don) Ridsd	Rubiaceae	Small Tree	June-Nov
106	Ophiorrhiza mungos L	Rubiaceae	Herb	Aug-Oct
107	Ophiorrhiza rugosa Wall var decumbens	Rubiaceae	Herb	June-Oct
108	Oldenlandia auricularia (L) K Schum in Engl &Prntl	Rubiaceae	Herb	Oct-Dec-
109	Pavetta indica L	Rubiaceae	Small Tree	Apr-July
110	Spermacoce articularis L	Rubiaceae	Herb	Oct-Dec
111	Spermacoce hispida L	Rubiaceae	Herb	May-Aug
112	Spermacoce latifolia Aubl	Rubiaceae	Herb	Aug-Oct
113	Spermacoce ocymoides Burmf	Rubiaceae	Herb	Nov-Dec
114	Spermacoce remota Lam	Rubiaceae	Herb	Mar- Sept
115	Ageratum conyzoides L	Asteraceae	Herb	Aug-Dec
116	Ageratum houstonianum Mill	Asteraceae	Herb	Feb-May
117	Blumea lacera (Burmf) DC in Wight	Asteraceae	Herb	Jan-Dec
118	Blumea laevis (Lour) Merr	Asteraceae	Herb	Dec-June
119	Blumea mollis(DDon) Merr	Asteraceae	Herb	Jan-Nov
120	Blumea oxydonta DC in Wight	Asteraceae	Herb	Nov-Dec
121	Conyza canadensis (L) Cronq	Asteraceae	Herb	June-Aug
122	Cyathocline purpurea (D Don) O Ktze	Asteraceae	Herb	Mar-Nov
123	Eclipta prostrata (L) L	Asteraceae	Herb	Jan-Dec
124	Elephantopus scaber L	Asteraceae	Herb	Oct-Jan
125	Emilia sonchifolia (L) Cass	Asteraceae	Herb	July-Dec
126	Eleutheranthera ruderalis (Sw) Sch-Bip	Asteraceae	Herb	May-Nov
127	Grangea maderaspatana (L) Poir in Lam	Asteraceae	Herb	Apr-Aug
128	Sphaeranthus indicus L	Asteraceae	Herb	Jan-Apr
129	Spilanthes calva DC	Asteraceae	Herb	Mar-Oct
130	Spilanthes ciliata HBK	Asteraceae	Herb	Aug-Dec
131	Spilanthes radicans Jacq	Asteraceae	Herb	Oct-Mar
132	Struchium sparganophorum (l) O Ktze	Asteraceae	Herb	Aug-Feb
133	Synedrella nodiflora (L) Gaertn	Asteraceae	Herb	Jan-Dec
134	Tridax procumbens L	Asteraceae	Herb	Jan-Dec
135	Vernonia anthelmintica (L) Willd	Asteraceae	Herb	Oct-Mar
136	Vernonia cinereal (L) Less	Asteraceae	Herb	Aug-Feb
137	Wedelia trilobata (L) AS Hitchc	Asteraceae	Herb	June- Sept
138	Sphenoclea zeylanica Gaertn	Campanulaceae	Herb	Nov-Jan
139	Lobelia alsinoides Lam	Lobeliaceae	Herb	Aug-Oct
140	Chrysophyllum cainito L	Sapotaceae	Tree	July-Sep
141	Madhuca nerifolia (Moon) HJLam	Sapotaceae	Tree	Nov-Mar
142	Mimusops elengi L	Sapotaceae	Tree	Dec-Aug
143	Diospyros assimilis Bedd	Ebenaceae	Tree	Feb-Aug

https://doi.org/10.61577/jpri.2025.100005

144	Diospyros ferrea (Willd) Bakh	Ebenaceae	Small Tree	Feb-May
145	Diospyros malabarica (Desr) Kostel	Ebenaceae	Tree	Mar-May
146	Chionanthus mala-elengi (Dennst) PS Green	Oleaceae	Small Tree	Dec-Apr
147	Olea dioica Roxb	Oleaceae	Small Tree	Small Tree
148	Alstonia scholaris (L) R Br	Apocyanaceae	Tree	Oct-Feb
149	Catharanthus pusillus (Murr) GDon	Apocyanaceae	Herb	Apr-Oct
150	Catharanthus roseus (L) GDon	Apocyanaceae	Herb	Aug-Jan
151	Holarrhena pubescens (Buch-Ham) Wall ex GDon	Apocynaceae	Small Tree	Apr-Oct
152	Spigelia anthelmia L	Loganiaceae	Herb	July- Aug
153	Strychnos nux-vomica L	Loganiaceae	Tree	Mar-Dec
154	Canscora diffusa (Vahl) RBr ex Roem & schult	Gentianaceae	Herb	Oct-Jan
155	Nymphoides indica (L) OKtze	Menyanthaceae	Herb	Jan-Dec
156	Ehretia canarensis (Clarke) Gamble	Boraginaceae	Small Tree	Sep-Jan
157	Heliotropium indicum L	Boraginaceae	Herb	Sep-Mar
158	Physalis angulata L	Solanaceae	Herb	July-Dec
159	Bacopa monnieri (L) Pennell	Scrophulariaceae	Herb	Jan-Dec
160	Limnophila aromatica (Lam) Merr	Scrophulariaceae	Herb	Aug-Dec
161	Limnophila heterophylla (Roxb) Benth	Scrophulariaceae	Herb	Aug-Dec
162	Lindernia anagallis (Burmf) Punnell	Scrophulariaceae	Herb	July-Dec
163	Lindernia antipoda (L) Aston in Trimen	Scrophulariaceae	Herb	Aug-Oct
164	Lindernia crustacea (L) Fv Muell	Scrophulariaceae	Herb	Aug-Nov
165	Mecardonia procumbens (Mill) Small	Scrophulariaceae	Herb	Oct-Dec
166	Scoparia dulcis L	Scrophulariaceae	Herb	Jan-Dec
167	Stemodia verticillata (Mill) Sprague	Scrophulariaceae	Herb	Mar-Apr
168	Torenia bicolor Dalz in Hook	Scrophulariaceae	Herb	Jan-Dec
169	Torenia violacea (Azaolo ex Blanco) Pennell	Scrophulariaceae	Herb	Jan-Dec
170	Utricularia aurea Lour	Lentibulariaceae	Herb	Sep-Dec
171	Oroxylum indicum (L) Benth ex Curz	Bignoniaceae	Tree	July-Dec
172	Pajanelia longifolia (Willd) KSchum in Engl&Prantl	Bignoniaceae	Tree	Jan-June
173	Stereospermum colais (Buch-Ham ex Dillw) D L Mabberley	Bignoniaceae	Tree	Feb-Oct
174	Andrographis atropurpurea (Dennst) Alston	Acanthaceae	Herb	July-Sep
175	Andrographis paniculata (Burmf) Wall ex Nees in Wall	Acanthaceae	Herb	Mar-Dec
176	Asystasia chelonoides Nees in Wall	Acanthaceae	Herb	Jan-Mar
177	Asystasia dalzelliana Sant	Acanthaceae	Herb	Sep-Jan
178	Asystasia gangetica (L) Anders in Thw	Acanthaceae	Herb	Sep-Dec
179	Dipteracanthus prostrates (Poir) Nees in Wall	Acanthaceae	Herb	Oct-Apr
180	Gymnostachyum febrifugum Benth	Acanthaceae	Herb	Sep-Dec
181	Justicia japonica Thunb	Acanthaceae	Herb	Aug-Feb
182	Nelsonia canescens (Lam) Spreng	Acanthaceae	Herb	Jan-Mar
183	Phaulopsis imbricata (Forssk) Sweet	Acanthaceae	Herb	Nov-Mar
184	Rhinacanthus nasutus (L) Kurz	Acanthaceae	Herb	Nov-Feb
185	Ruellia tuberosa L	Acanthaceae	Herb	Mar-Nov

https://doi.org/10.61577/jpri.2025.100005

186	Rungia parviflora (Retz) Nees in Wall	Acanthaceae	Herb	Mar-Apr
187	Rungia pectinata (L) Neses in DC	Acanthaceae	Herb	Nov-Feb
188	Staurogyne zeylanica (Nees) OKtze	Acanthaceae	Herb	Jan-Mar
189	Callicarpa tomentosa (L) Murr	Verbenaceae	Small Tree	Nov-Apr
190	Citharexylum spinosum L	Verbenaceae	Small Tree	Apr-Sep
191	Gmelina arborea Roxb	Verbenaceae	Tree	Jan-June
192	Phyla nodiflora (L) Greene	Verbenaceae	Herb	Nov-Dec
193	Tectona grandis L	Verbenaceae	Tree	May-Jan
194	Vitex altissima L	Verbenaceae	Tree	Mar-July
195	Avicennia officinalis L	Avicenniaceae	Small Tree	Apr-Nov
196	Anisochilus carnosus (Lf) Wall ex Benth in Wall	Lamiaceae	Herb	Sep-Dec
197	Anisomeles indica (L) OKtze	Lamiaceae	Herb	Jan-Apr
198	Leucas biflora (Vahl) RBr	Lamiaceae	Herb	Oct-Feb
199	Leucas indica (L) RBr ex Vatke in Oesterr	Lamiaceae	Herb	July-Oct
200	Leucas zeylanica (L) RBr	Lamiaceae	Herb	May-July
201	Pogostemon purpurascens Dalz in Hook's	Lamiaceae	Herb	Jan-Apr
202	Boerhavia diffusa l	Nyctaginaceae	Herb	Aug-Dec
203	Mirabilis jalapa L	Nyctaginaceae	Herb	Apr-Aug
204	Achyranthes aspera L	Amaranthaceae	Herb	Oct-Mar
205	Aerva lanata (L) Juss ex Schult	Amaranthaceae	Herb	Sep-Apr
206	Alternanthera bettzickiana (Regel) Voss in Vilmorin	Amaranthaceae	Herb	Oct-Feb
207	Alternanthera braziliana (L) Kuntze	Amaranthaceae	Herb	Jan-Dec
208	Alternanthera sessilis (L) RBr ex DC	Amaranthaceae	Herb	Jan-Dec
209	Amaranthus spinosus L	Amaranthaceae	Herb	June-Dec
210	Amaranthus viridis L	Amaranthaceae	Herb	July-Dec
211	Celosia argentea L	Amaranthaceae	Herb	Nov-Dec
212	Cyathula prostrata (L) Blume	Amaranthaceae	Herb	Sep-Apr
213	Rivina humilis L	Phytolaccaceae	Herb	Nov-Jan
214	Persicaria glabra (Willd) Gomez	Polygonaceae	Herb	Aug-Dec
215	Indotristicha ramosissima (Wight) Van Royen	Podostemaceae	Herb	Jan-Mar
216	Polypleurum stylosum (Wight) Hall	Podostemaceae	Herb	Oct-Feb
217	Peperomia pellucida (L) Kunth	Piperaceae	Herb	Sep-Dec
218	Alseodaphne semecarpifolia Nees in Wall	Lauraceae	Small Tree	Feb-Apr
219	Cinnamomum malabatrum (Burm f) Blume	Lauraceae	Tree	Mar-Apr
220	Cinnamomum riparium Gamble	Lauraceae	Small Tree	Feb-Mar
221	Cinnamomum verum Presl	Lauraceae	Small Tree	Mar-Apr
222	Litsea ghatica Sald	Lauraceae	Small Tree	Sep-Feb
223	Persea macrantha (Nees) Kosterm	Lauraceae	Tree	Dec-May
224	Antidesma ghaesembilla Gaertn	Euphorbiaceae	Small Tree	Dec-Jan
225	Antidesma montanum Blume	Euphorbiaceae	Small Tree	Jan-Dec
226	Aporosa lindleyana (Wight) Baill	Euphorbiaceae	Small Tree	Dec-June
227	Bischofia javanica Blume	Euphorbiaceae	Tree	Mar-Oct

https://doi.org/10.61577/jpri.2025.100005

228	Blachia umbellate (Willd) Baill	Euphorbiaceae	Small Tree	Feb-Apr
229	Bridelia retusa (L) Spreng	Euphorbiaceae	Tree	Aug- Dec
230	Euphorbia heterophylla L	Euphorbiaceae	Herb	June-Aug
231	Euphorbia hirta L	Euphorbiaceae	Herb	Jan-Dec
232	Euphorbia thymifolia L	Euphorbiaceae	Herb	Nov-May
233	Excoecaria agallocha L	Euphorbiaceae	Small Tree	Nov-Feb
234	Glochidion zeylanicum (Gaertn) A Juss	Euphorbiaceae	Small Tree	Mar-May
235	Hevea braziliensis (Willd ex A Juss) Muell - Arg	Euphorbiaceae	Tree	Feb-June
236	Macaranga peltata (Roxb) Muell-Arg in DC	Euphorbiaceae	Tree	Jan-Feb
237	Mallotus philippensis (Lam) Muell-Arg	Euphorbiaceae	Tree	Oct-Mar
238	Mallotus tetracoccus (Roxb) Kurz	Euphorbiaceae	Tree	Apr-July
239	Margaritaria indica (Dalz) Airy Shaw	Euphorbiaceae	Tree	Mar-Apr
240	Microstachys chamaelea (L) Muell-Arg	Euphorbiaceae	Herb	July-Dec
241	Phyllanthus amarus Schum&Thonn	Euphorbiaceae	Herb	July-Oct
242	Phyllanthus maderaspatensis L	Euphorbiaceae	Herb	Jan-Dec
243	Phyllanthus reticulatus Poir, in Lam	Euphorbiaceae	Herb	Aug-Dec
244	Phyllanthus urinaria L	Euphorbiaceae	Herb	July-Oct
245	Phyllanthus virgatus G Forst var virgatus	Euphorbiaceae	Herb	Jan-Dec
246	Trewia nudiflora L	Euphorbiaceae	Tree	May-Nov
247	Debregeasia longifolia (Burmf) Weddin DC	Urticaceae	Small Tree	Dec-Apr
248	Laportea interrupta (L) Chew	Urticaceae	Herb	Aug-Sep
249	Pellionia heyneana Wedd	Urticaceae	Herb	June-Sep
250	Pilea microphylla (L) Liebm	Urticaceae	Herb	Aug-Nov
251	Pouzolzia wightii Bennett	Urticaceae	Herb	Dec-Mar
252	Pouzolzia zeylanica (L) Bennett	Urticaceae	Herb	Aug-Dec
253	Trema orientalis (L) Blume	Ulmaceae	Tree	Sep-Dec
254	Artocarpus heterophyllus Lam	Moraceae	Tree	Nov-Apr
255	Artocarpus hirsutus Lam	Moraceae	Tree	Dec-Mar
256	Ficus amplissima JE Smith in Rees	Moraceae	Tree	Sep-Dec
257	Ficus benghalensis L	Moraceae	Tree	May-Aug
258	Ficus callosa Willd	Moraceae	Tree	Mar- Apr
259	Ficus exasperate Vahl	Moraceae	Small Tree	Feb-Apr
260	Ficus hispida L	Moraceae	Small Tree	Sept-May
261	Ficus microcarpa L	Moraceae	Small Tree	Mar-May
262	Ficus racemosa L	Moraceae	Tree	Feb-May
263	Ficus religiosa L	Moraceae	Tree	Nov-Feb
264	Ficus talbotii King	Moraceae	Tree	Jan-Apr
265	Ficus tinctoria GForst ssp gibbosa (Blume) Corner	Moraceae	Small Tree	Oct-Dec
266	Ficus tinctoria GForst ssp parasitica (Koen ex Willd) Corner	Moraceae	Small Tree	Mar-Apr
267	Ficus tsjahela Burmf	Moraceae	Tree	Mar-Apr
268	Ficus virens Ait	Moraceae	Tree	Jan-Mar
269	Casuarina litorea L	Casuarinaceae	Tree	June-July

https://doi.org/10.61577/jpri.2025.100005

270	Bulbophyllum sterile (Lam) Suresh in Nicols	Orchidaceae	Herb	Dec-Jan
271	Dendrobium ovatum (L) Kranz in Engl	Orchidaceae	Tree	Dec-Jan
272	Pholidota imbricata Hook	Orchidaceae	Tree	Sep-Mar
273	Vanda testacea (Lindl) Reichbf	Orchidaceae	Herb	Apr-May
274	Zeuxine longilabris (Lindl) Benth ex Hookf	Orchidaceae	Herb	Feb-Mar
275	Amomum pterocarpum Thw	Zingiberaceae	Herb	May-Oct
276	Costus pictus DDonex Lindl	Zingiberaceae	Herb	Mar-Aug
277	Costus speciosus (Koenig) JESmith	Zingiberaceae	Herb	July-Oct
278	Curcuma oliganthaTrimen var lutea	Zingiberaceae	Herb	Apr-July
279	Curcuma oliganthaTrimen var oligantha	Zingiberaceae	Herb	Apr-July
280	Curcuma zedoaria (Christm) Rosc	Zingiberaceae	Herb	Apr-July
281	Globa ophioglossa Wight	Zingiberaceae	Herb	July-Sep
282	Zingiber cernuum Dalz	Zingiberaceae	Herb	Sep- Oct
283	Maranta arundinacea L	Marantaceae	Herb	Mar-Apr
284	Musa paradisiaca L	Musaceae	Herb	Jan-Dec
285	Curculigo orchioides Gaertn	Hypoxidaceae	Herb	June-Dec
286	Crinum defixum Ker-Gawl	Amaryllidaceae	Herb	Jan-Dec
287	Eichhornia crassipes (Mart) Solms	Pontederiaceae	Herb	Nov-Feb
288	Monochoria vaginalis (Burmf) Presl	Pontederiaceae	Herb	July-Nov
289	Aneilema ovalifolia (Wight) Hookf ex Clarke in A & C DC	Commelinaceae	Herb	Oct-Dec
290	Commelina bengalensis L	Commelinaceae	Herb	July-Nov
291	Cyanotis axillaris (L) DDon	Commelinaceae	Herb	Aug-Dec
292	Murdannia dimorpha (Dalz) Brueck in Engl&Prantl	Commelinaceae	Herb	July-Sep
293	Areca catechu L	Arecaceae	Tree	Jan-Dec
294	Arenga wightii Griff	Arecaceae	Tree	July-Sept
295	Borassus flabellifer L	Arecaceae	Tree	Mar-Sep
296	Calamus hookerianus Becc	Arecaceae	Tree	Oct-Apr
297	Caryota urens L	Arecaceae	Tree	Jan-Apr
298	Pandanus canaranus Warb in Engl	Pandanaceae	Small Tree	July-Aug
299	Typha angustifolia L	Typhaceae	Herb	Dec-Feb
300	Amorphophallus paeniifolius (Dennst) Nicolsvar Campanulatus (Decne) Sivad	Araceae	Herb	May-June
301	Caladium bicolor (Ait ex Dryand) Vent	Araceae	Herb	Dec-Jan
302	Colocasia esculenta (L) Schott in Schott &Endl	Araceae	Herb	May-Oct
303	Cryptocoryne retrospiralis (Roxb) Kunth	Araceae	Herb	Nov-Mar
304	Cryptocoryne spiralis (Retz) Fisch exWydler	Araceae	Herb	Oct-Apr
305	Lagenandra toxicaria Dalz in Hook	Araceae	Herb	Jan-Dec
306	Pistia stratiotes L	Araceae	Herb	Aug-Sep
307	Eriocaulon robustobrownianum Ruhland in Engl	Eriocaulaceae	Herb	Feb-Mar
308	Cyperus digitatus Roxb	Cyperaceae	Herb	Dec-Aug
309	Cyperus haspan L	Cyperaceae	Herb	Jan-Dec
310	Cyperus iria L var iria	Cyperaceae	Herb	Nov-Dec
311	Hypolytrum nemorum (Vahl) Spreng	Cyperaceae	Herb	Jan-Dec

https://doi.org/10.61577/jpri.2025.100005

312	Mariscus cyperinus (Retz) Vahl	Cyperaceae	Herb	June-Aug
313	Mariscus javanicus (Houtt) Merr & Metcalfe	Cyperaceae	Herb	Jan-Dec
314	Schoenoplectus littoralis (Schrad) Palla	Cyperaceae	Herb	Apr-May
315	Scleria laevis Retz	Cyperaceae	Herb	Mar-Oct
316	Scleria lithosperma (L) Sw	Cyperaceae	Herb	Jan-Dec
317	Arundo donax L	Poaceae	Herb	Aug-Dec
318	Axonopus compressus (Sw) PBeauv	Poaceae	Herb	Jan-Dec
319	Centotheca lappacea (L) Desv	Poaceae	Herb	Oct-Feb
320	Chloris barbata Sw	Poaceae	Herb	Mar-Dec
321	Chrysopogon aciculatus (Retz) Trin	Poaceae	Herb	June-Oct
322	Cynodon dactylon (L) Pers	Poaceae	Herb	Mar-Oct
323	Cyrtococcum longipes (Wight&Arn Ex Hook f) A Camus	Poaceae	Herb	Nov-Mar
324	Cyrtococcum oxyphyllum (Steud) Stapf in Hook	Poaceae	Herb	Aug-Mar
325	Dactyloctenium aegypticum (L) P Beauv	Poaceae	Herb	Jan- Dec
326	Digitaria ciliaris (Retz) Koeler	Poaceae	Herb	July-Nov
327	Eleusine indica (L) Gaertn	Poaceae	Herb	Jan- Dec
328	Eragrostis uniloides (Retz) NeesexSteud	Poaceae	Herb	Jan- Dec
329	Ischaemum timorense Kunth	Poaceae	Herb	Sep-Dec
330	Oplismenus burmannii (Retz) P Beauv	Poaceae	Herb	Sept-Nov
331	Panicum auritum Presl ex Nees	Poaceae	Herb	July-Mar
332	Panicum laxum Sw	Poaceae	Herb	June-Feb
333	Panicum maximum Jacq	Poaceae	Herb	Aug-Dec
334	Pennisetum polystachyon (L) Schult	Poaceae	Herb	Apr-Dec
335	Setaria palmifolia (Koenig) Stapf	Poaceae	Herb	Aug-Nov
336	Sporobolus indicus (L) RBr var diander	Poaceae	Herb	Mar-Sep
337	Themeda triandra Forssk	Poaceae	Herb	Oct-Jan

Discussion

The survey of the riparian zone of the Kuppam River recorded a total of 197 herbs and 140 trees. The maximum number of herbs was from the family Poaceae, with 21 representations. Among trees, the highest representation was 16 species from the family Moraceae. The trees belonged to 41 angiosperm families, and the herbs were included under 45 families. The vegetation, in general, was indicative of a tropical rain forest regime because of representative families like Dipterocarpaceae, Lauraceae, Clusiaceae, etc. It also included species from families such as Balsaminaceae, Orchidaceae, Podostemaceae, etc., which needed specific climatic conditions of the tropics to survive. The species richness and diversity of such vegetations can be attributed to altitudinal and latitudinal gradients of the location, along with temperature and rainfall patterns [28]. The riparian vegetation of the Kuppam River also included a few endemic and RET species.The general pattern of flowering indicated that the trees bloomed during the summer season and the herbs during autumn, immediately after the rainy season. The survey also yielded a grass species, Panicum laxum, which was discovered for the first time from Peninsular India region [29]. This was earlier reported from the Barak Valley of Assam as an addition to the flora of India [30]. The dominance of herbs over trees in Kuppam riverine flora agreed with the findings on the river Chalakkudy of Kerala, which encompassed 218 herbs and 170 trees. The flowering phenology indicated that flowering of most of the trees was towards the summer season (March to June), and the herbs showed flowering during the monsoon season (July to November).

Conclusion

The present study offers the first comprehensive checklist of angiosperm diversity in the riparian zone of the Kuppam River, Kannur, Kerala, documenting 337 species comprising 197 herbs and 140 trees across 86 families. The dominance of Poaceae among herbs and Moraceae among trees, along with the presence of key tropical families such as Dipterocarpaceae, Lauraceae and Clusiaceae, indicates that the riparian vegetation reflects a typical tropical evergreen to semi-evergreen system of the Western Ghats. The occurrence of endemic and RET species and the first record of Panicum laxum in Peninsular India highlight the floristic importance and conservation value of this riverine ecosystem. Flowering phenology showed a clear seasonal trend, with most trees flowering during summer and herbs during the monsoon to post-monsoon period, demonstrating the influence of rainfall and hydrological regimes

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on riparian vegetation. The predominance of herbaceous taxa over woody species corresponds with patterns observed in other Kerala rivers, suggesting similar ecological gradients and disturbance regimes. Overall, the Kuppam River riparian corridor supports high plant diversity shaped by altitudinal variation, high rainfall and continuous moisture. However, increasing anthropogenic pressures necessitate urgent conservation and sustainable riparian management in the Western Ghats region.

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Author Contributions

The first author conducted the exploration as per the directions of the second author. The manuscript was prepared by the first author, and its interpretation and further analysis were performed by the second author.

Conflict of Interest

The first and the second authors wish to declare that there is no potential conflict of interest during this research work, except that the first author was engaged in a major part of the work, which was related to the pursuit of his PhD, and the second author was the guide for the same. There was no financial support from any of the agencies towards this.

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