PLANT SCIENCE TODAY
Vol 12(4): 1-7
https://doi.org/10.14719/pst.10847

eISSN 2348-1900

RESEARCH ARTICLE

A phytosociological study on *Gnetum gnemon* L. patches in different forests of Northeast India

Saurav Kumar Boruah*, Gitartha Saikia, Partha Pratim Baruah & Nilakshee Devi

Department of Botany, Gauhati University, Guwahati 781 014, Assam, India

*Correspondence email - skboruah19@gmail.com

Received: 23 July 2025; Accepted: 17 September 2025; Available online: Version 1.0: 27 October 2025; Version 2.0: 05 November 2025

Cite this article: Saurav KB, Gitartha S, Partha PB, Nilakshee D. A phytosociological study on *Gnetum gnemon* L. patches in different forests of Northeast India. Plant Science Today. 2025; 12(4): 1-7. https://doi.org/10.14719/pst.10847

Abstract

Phytosociological study across 12 *Gnetum gnemon* strands in Northeast (NE) India were undertaken to understand the ecological behaviour of the species where a total of 103 plant species belonging to 70 genera under 30 families were documented grown in association with *Gnetum gnemon.* Rubiaceae was the most dominant family followed by Lamiaceae and *Ardisia*, *Calamus*, *Clerodendrum* and *Psychotria* were the dominant genera in those strands. Diversity indices revealed Behali (H' = 3.39, 1-D = 0.96) having highest diversity and Noxatilla (H' = 2.59, 1-D = 0.92) having the lowest. Simpson's Evenness index (E) was highest in Barail (0.90) and lowest in Dhansiri (0.70) whereas the Sorensen-Dice similarity indices varied from 16.33 % to 87.72 % showing overall low similarity among the study-sites. Though *Gnetum gnemon* was dominant with highest IVI values at Chala; in other strands, it occupied lower position in the list which could be attributed to high extraction by the local people, habitat fragmentation and invasion by some native and non-native invasive plants which were outnumbered in and around 6 *Gnetum gnemon* strands out of 12 studied strands.

Keywords: diversity indices; *Gnetum gnemon*; Important Value Index; invasive species; phytosociology; similarity analysis

Introduction

Gnetum gnemon L. is a species of evergreen gymnosperm found in Southeast Asia and Pacific Islands (1). It belongs to the family Gnetaceae and order Gnetales. Markgraf classified *Gnetum gnemon* into five varieties, with *Gnetum gnemon* var. *gnemon* as type variety (2, 3) which is a tree cultivated in South Asia for its multipurpose utility (4). The remaining varieties of *Gnetum gnemon* are shrubby in growth form (3). NE India, being the western edge of the plant's distribution harbours two varieties - *Gnetum gnemon* var. *brunonianum* (Griff.) Markgraf and *Gnetum gnemon* var. *griffithii* (Parl.) Markgraf which primarily inhabit evergreen and deciduous forests (5, 6) as an understory shrub in smaller patches in association with a varied group of other shrubs and herbs. On a few occasions, *Gnetum gnemon* patches were reported on the bank of a few forest streams (7) and inside some home gardens (8).

Gnetum gnemon contributes not only provides foods and shelter to some birds and smaller mammals, but also the extensive root system helps in reducing soil erosion in the hillslopes (9). Economically, *Gnetum gnemon* is valued for its edible leaves and seeds, which are widely consumed by the traditional societies (1). Fibres yield from its bark are used to prepare fishing nets and in making handicrafts (3). In few South Asian countries, the wood is used for making paper and construction of house besides using it as firewood (4).

In NE India too, *Gnetum gnemon* is popular as vegetable among different tribes (10). Leaves of *Gnetum gnemon* are edible and eaten throughout the year whereas male cones and fruits are the seasonally available most sought-after food supplement for the wild gatherers (11, 12) leading to put immense pressure on germination and growth of natural patches in wilderness. Further, mass destruction in understory forest due to commercial logging, expansion of agriculture, roads and human habitation (13, 14); *Gnetum gnemon* strands get dwindling in entire NE region of India, which needs conservation support and ecological investigation. The present endeavour is therefore made to understand the phytosociological behaviour of *Gnetum gnemon* in different forest areas of NE India.

Materials and Methods

A total of 12 forests (Table 1) across NE India was selected and surveyed for *Gnetum gnemon* populations based on previous reports of available literatures (5, 15) and herbaria (ASSAM, GUBH) including a few sources of social media which are depicted on map (Fig. 1).

The phytosociological study was done using quadrat method. A total of 120 sampling plots (10 quadrates in each site) were established across the study sites. All the plants within each quadrat were counted and recorded. Unidentified plants were collected and subsequently processed for identification following the standard herbarium method (16) and deposited at GUBH (Gauhati University Botanical Herbarium). Identification was carried out using various relevant floras and other existing literatures (5, 8, 15, 17, 18) and by consulting ASSAM and GUBH

Table 1. Study sites with codes and GPS Location

Sl. No.	Study site	Study code	Latitude	Longitude
1	Barail	GG 01	N 24° 58' 36.0"	E 92° 47' 04.5"
2	Behali	GG 02	N 26° 53' 05.8"	E 93° 20' 15.2"
3	Chala	GG 03	N 27° 00' 09.5"	E 94° 54' 19.1"
4	Chapanala	GG 04	N 26° 19' 07.8"	E 92° 53' 38.9"
5	Dhansiri	GG 05	N 25° 49' 58.0"	E 93° 25' 22.0"
6	Garampani	GG 06	N 26° 23' 28.5"	E 93° 52' 49.3"
7	Koilamati	GG 07	N 26° 21' 20.6"	E 93° 46' 44.8"
8	Meleng	GG 08	N 26° 40' 17.3"	E 94° 21' 26.1"
9	Nambor Doigrung	GG 09	N 26° 26' 20.0"	E 93° 54' 48.2"
10	North Karbi Anglong	GG 10	N 26° 34' 10.3"	E 93° 25' 45.3"
11	Noxatilla	GG 11	N 24° 36' 09.1"	E 92° 43' 29.0"
12	Silanijaan	GG 12	N 26° 20' 16.1"	E 93° 52' 01.2"

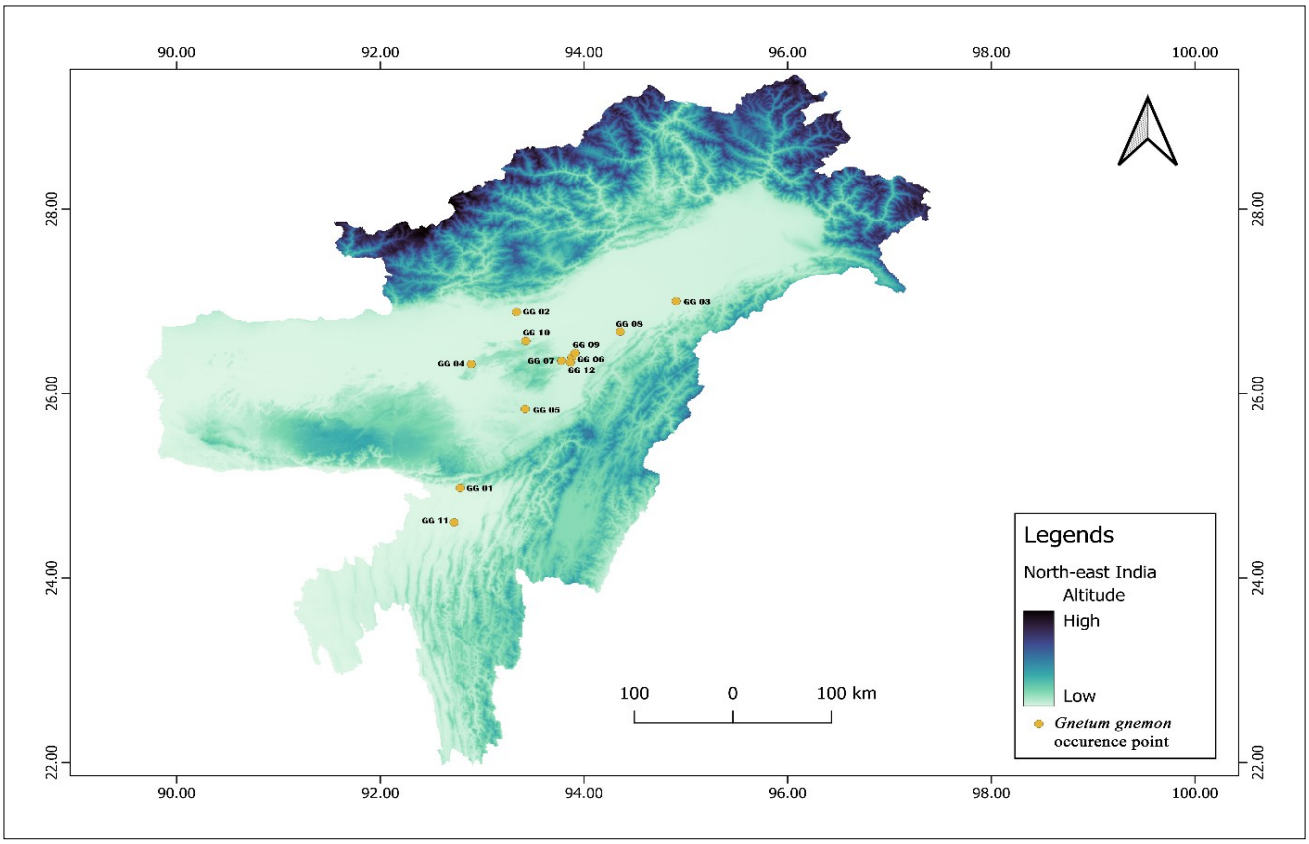

Fig. 1. Map of Northeast India showing study sites.

herbarium and online herbarium specimens. Plant species were assigned updated nomenclature based on the "Plants of the World Online" database (19) from the Royal Botanic Gardens, Kew (https://powo.science.kew.org/).

Abundance, relative abundance, density, relative density, frequency, relative frequency and Important Value Index for each species were calculated in each study sites using standard formula (20-22). Diversity indices such as Shannon Wiener's index, Simpson's diversity index, Simpson's dominance index and Simpson's evenness index were calculated for each study sites (23 -25). To check the similarity among the study sites, similarity index is also calculated following Dice and Sorensen (26, 27). All calculations were performed using Microsoft Excel.

Results and Discussion

Diversity

A total of 103 plant species (Table 2) belonging to 70 genera under 30 families were recorded in 12 different selected *Gnetum gnemon* patches from the NE India. Except *Gnetum gnemon*, all the other 102 plants were angiosperms; of which 97 species were dicots and 5 species were monocots. Rubiaceae was the spacious family with 12 species followed by Lamiaceae (11 species), Phyllanthaceae (8 species), Euphorbiaceae and Primulaceae (6 species) respectively. Arecaceae and Fabaceae were represented by 5 species each and Acanthaceae, Annonaceae, Apocynaceae, Malvaceae and Rutaceae were represented by 4 species each. Among the 70 genera, *Ardisia* was the dominant genera with 5 species followed by *Calamus*, *Clerodendrum* and *Psychotria* with 4 species each and *Mallotus* and *Solanum* (with 3 species each) respectively. *Antidesma*, *Bridelia*, *Calicarpa*, *Clausena*, *Combretum*, *Croton*, *Ficus*, *Gomphostemma*, *Ixora*, *Leea*, *Lepisanthes*, *Litsea*, *Phlogacanthus*, *Rauvolfia*, *Rubus* and *Senna* having 2 species each and all the other 48 genera having 1 species each.

Out of the 103 species found in the study sites, around 7 species namely *Chromolaena odorata*, *Lantana camara*, *Ricinus communis*, *Senna alata*, *Senna tora*, *Solanum torvum* and *Xanthium strumarium* were the non-native and invasive but acclimatised with the regional climate.

Table 2. Important Value Index (IVI) of the plant species in different study sites

S.N.	Plant Name	Important Value Index in different study-sites											
		GG 01	GG 02	GG 03	GG 04	GG 05	GG 06	GG 07	GG 08	GG 09	GG 10	GG 11	GG 12
1	*Abelmoschus moschatus* Medik.	-	-	-	-	6.74	-	-	-	-	-	-	-
2	*Abroma augustum* (L.) L.f.	7.50	-	-	-	-	-	-	-	-	8.24	-	-
3	*Actephila excelsa* (Dalzell) Müll.Arg.	13.26	-	-	-	-	-	-	-	-	-	-	-
4	*Alangium chinense* (Lour.) Harms	-	-	-	-	-	4.21	7.10	-	11.99	-	-	-
5	*Allophylus chartaceus* (Kurz) Radlk.	-	5.00	-	-	-	-	-	-	-	-	-	-
6	*Antidesma montanum* Blume	-	3.43	-	-	-	-	-	-	-	-	-	-
7	*Antidesma roxburghii* Wall. ex Tul.	14.45	15.53	17.82	-	-	-	-	11.58	-	-	-	-
8	*Ardisia colorata* G.Lodd.	-	-	11.10	-	-	-	-	-	-	-	-	-
9	*Ardisia macrocarpa* Wall.	-	3.43	-	-	-	-	-	-	-	-	-	-
10	*Ardisia paniculata* Roxb.	-	-	-	-	-	-	-	-	-	-	20.55	-
11	*Ardisia solanacea* Roxb.	-	6.58	8.33	-	-	8.62	-	-	8.04	13.61	7.65	5.33
12	*Ardisia* sp.	-	-	-	-	15.23		-	-	3.91	-	-	-
13	*Boehmeria nivea* (L.) Gaudich.	13.26	-	-	11.40	-	6.05	-	-	7.85	-	-	-
14	*Boeica filiformis* C.B.Clarke	-	9.07	-	-	-	-	-	-	-	-	-	-
15	*Breynia retusa* (Dennst.) Alston	10.83	-	-	-	-	-	-	-	-	-	-	-
16	*Bridelia assamica* Hook.f.	-	6.93	-	-	-	-	-	-	-	-	-	-
17	*Bridelia stipularis* (L.) Blume	8.54	-	-	-	-	-	-	-	-	-	-	-
18	*Calamus flagellum* Griff. ex Walp.	-	-	-	-	-	-	11.35	-	-	-	-	-
19	*Calamus floribundus* Griff.	-	-	-	-	-	-	14.39	-	-	-	-	-
20	*Calamus* sp.	-	6.58	10.38	-	-	-	-	-	-	12.18	-	-
21	*Calamus tenuis* Roxb.	-	-	-	-	-	-	-	11.56	-	-	18.01	14.03
22	*Callicarpa longifolia* Lam.	-	-	-	-	-	8.62	-	-	3.91	-	-	-
23	*Callicarpa nudiflora* Hook. & Arn.	-	-	-	6.45	-	-	-	-	-	-	-	-
24	*Calotropis gigantea* (L.) W.T.Aiton	-	-	-	-	-	-	-	-	-	10.30	-	-
25	*Chassalia curviflora* (Wall.) Thwaites	13.61	6.58	-	-	-	-	-	-	-	-	-	-
26	*Chromolaena odorata* (L.) R.M.King &	15.84	-	12.45	31.02	42.70	16.35	41.03	28.75	22.86	19.70	34.62	26.78
27	*Clausena excavata* Burm.f.	-	-	-	-	6.74	8.62	4.94	-	12.17	-	-	14.03
28	*Clausena heptaphylla* (Roxb. ex DC.)	16.67	-	-	-	-	-	-	-	-	-	-	-
29	*Clerodendrum glandulosum* Lindl.	-	-	4.16	-	-	7.88	-	11.56	8.04	-	-	-
30	*Clerodendrum indicum* (L.) Kuntze	-	-	-	-	8.86	-	-	-	-	-	-	-
31	*Clerodendrum infortunatum* L.	-	18.74	19.42	31.68	30.04	20.21	20.08	27.73	18.25	24.63	23.69	14.55
32	*Clerodendrum laevifolium* Blume	-	5.00	-	-	-	4.21	-	-	-	-	-	-
33	*Coffea benghalensis* B.Heyne ex Roth	-	13.37	-	15.01	10.98	11.55	-	-	-	14.06	-	12.24
34	*Combretum acuminatum* Roxb.	-	-	-	8.59	-	-	11.35	-	-	-	-	-
35	*Combretum wallichii* DC.		-	-	-	-	-	-	-	-	-	29.07	-
36	*Croton caudatus* Geiseler	12.50	-	-	11.19	-	-	-	-	-	-	-	-
37	*Croton* sp.	-	-	-	-	-	-	-	-	-	10.93	-	-
38	*Dalhousiea bracteata* (Roxb.) Graham ex	-	3.43	-	-	-	-	-	-	-	-	-	-
39	*Dasymaschalon longiflorum* (Roxb.) Finet	4.17	-	-	-	-	-	-	-	-	-	-	-
40	*Deeringia amaranthoides* (Lam.) Merr.	-	-	-	-	4.62	-	-	-	-	-	-	-
41	*Dendrocnide sinuata* (Blume) Chew	-	15.52	8.33	-	-	12.49	-	9.80	14.23	13.61	-	9.94
42	*Derris taiwaniana* (Hayata) Z.Q.Song	-	-	-	-	-	-	-	9.80	5.98	-	-	-
43	*Ficus* sp.	-	-	-	-	-	-	-	-	-	10.93	-	-
44	*Ficus subincisa* Buch.-Ham. ex Sm.	-	5.85	-	-	-	-	-	-	-	-	-	-
45	*Fissistigma bicolor* (Roxb.) Merr.	-	3.43	-	-	-	-	-	-	-	-	-	-
46	*Glochidion thomsonii* (Müll.Arg.) Hook.f.	14.45	-	-	-	-	-	-	-	-	-	-	-
47	*Glycosmis pentaphylla* (Retz.) DC.	-	8.00	-	-	-	7.88	-	-	7.85	8.42	-	14.03
48	***Gnetum gnemon* L.**	***15.65***	***8.00***	***26.06***	***8.59***	***16.28***	***16.35***	***22.85***	***8.04***	***10.61***	***6.54***	***7.65***	***15.63***
49	*Gomphostemma niveum* Hook.f.	-	11.22	-	-	-	-	-	-	-	-	-	-
50	*Gomphostemma parviflorum* Wall. ex	-	-	6.94	-	-	9.91	-	-	9.23	-	-	-

51	*Goniothalamus sesquipedalis* (Colebr.	5.83	-	-	-	-	-	-	-	-	-	-	-
52	*Holmskioldia sanguinea* Retz.	-	-	-	11.19	-	-	-	-	-	4.66	-	-
53	*Ixora acuminata* Roxb.	-	-	16.67	-	-	-	-	8.04	-	-	9.80	-
54	*Ixora polyantha* Wight	-	11.22	25.02	10.73	14.87	11.55	15.60	16.40	15.94	8.42	-	9.94
55	*Justicia adhatoda* L.	10.83	-	-	-	-	-	-	-	-	-	-	-
56	*Lantana camara* L.	-	-	6.23	10.73	24.74	18.88	20.08	16.82	11.99	-	25.10	20.41
57	*Leea asiatica* (L.) Ridsdale	-	11.22	4.16	-	-	11.20	14.39	11.56	11.32	12.27	-	15.63
58	*Leea indica* (Burm.f.) Merr.	14.45	-	16.67	-	-	8.62	-	11.58	13.63	12.27	-	-
59	*Lepionurus sylvestris* Blume	-	6.58	6.23	-	-	-	-	-	-	-	-	-
60	*Lepisanthes rubiginosa* (Roxb.) Leenh.	-	-	-	-	-	-	-	-	-	6.54	-	-
61	*Lepisanthes senegalensis* (Poir.) Leenh.	-	5.0	-	-	-	-	-	-	-	-	-	-
62	*Licuala peltata* Roxb. ex Buch.-Ham.	-	-	-	-	-	-	-	-	-	-	7.65	-
63	*Litsea salicifolia* (Roxb. ex Nees) Hook.f.	7.50	-	13.87	-	-	-	-	-	-	12.18	-	-
64	*Litsea* sp.	-	-	-	15.85	-	-	-	-	-	-	-	-
65	*Maesa indica* (Roxb.) Sweet	-	11.22	-	-	6.74	-	-	-	-	10.93	-	-
66	*Mallotus paniculatus* (Lam.) Müll.Arg.	12.50	-	-	-	-	-	-	-	-	-	-	-
67	*Mallotus roxburghianus* Müll.Arg.	-	15.52	8.30	27.39	13.37	-	-	-	-	-	-	-
68	*Mallotus* sp.	-	-	-	-	-	-	-	-	-	14.96	30.78	-
69	*Melastoma malabathricum* L.	19.17	17.66	-	19.28	-	17.63	28.74	20.01	19.40	23.46	38.13	21.46
70	*Miliusa dioeca* (Roxb.) Chaowasku &	5.83	-	-	-	-	-	-	-	-	-	-	-
71	*Mimosa rubicaulis* Lam.	-	-	-	11.19	-	-	-	-	-	-	-	-
72	*Morinda angustifolia* Roxb.	-	-	-	-	-	7.88	-	11.58	9.23	-	-	-
73	*Mussaenda roxburghii* Hook.f.	-	3.43	-	-	-	4.21	-	-	6.47	-	-	9.25
74	*Olax acuminata* Wall. ex Benth.	15.65	-	-	-	13.46	11.55	28.74	-	15.94	-	18.01	21.31
75	*Pavetta indica* L.	-	6.58	6.94	-	-	-	-	-	-	-	-	-
76	*Phlogacanthus curviflorus* (Nees) Nees	-	12.30	18.98	20.52	10.98	11.55	29.68	-	14.79	10.30	-	17.22
77	*Phlogacanthus thyrsiformis* (Roxb. ex	-	-	14.53	-	20.41	17.63	14.25	17.60	-	-	-	18.81
78	*Phyllanthus glaucus* Wall. ex Müll.Arg.	-	-	-	12.80	-	-	-	-	-	-	-	-
79	*Pseuderanthemum latifolium* (Vahl)	12.50	20.06	12.49	-	10.64	-	15.70	16.40	-	-	-	-
80	*Psychotria denticulata* Wall.	-	6.93	-	-	-	-	-	-	-	-	-	-
81	*Psychotria erratica* Hook.f.	7.50	-	-	-	-	11.20	-	19.47	3.91	-	-	14.55
82	*Psychotria monticola* Kurz	5.83	-	-	-	-	-	-	-	-	-	-	-
83	*Psychotria* sp.	-	-	4.16	-	-	-	-	-	-	-	14.11	-
84	*Rauvolfia serpentina* (L.) Benth. ex Kurz	-	-	-	-	-	-	-	4.53	-	-	-	-
85	*Rauvolfia verticillata* (Lour.) Baill.	-	3.43	-	-	-	-	-	-	-	-	-	-
86	*Ricinus communis* L.	-	-	-	-	-	-	-	-	5.98	-	-	-
87	*Rotheca serrata* (L.) Steane & Mabb.	-	8.16	-	-	-	-	-	-	-	-	-	-
88	*Rubus alceifolius* Poir.	-	-	-	-	4.62	-	-	-	-	-	-	-
89	*Rubus* sp.	-	-	-	-	-	7.88	11.35	-	3.91	6.54	-	7.64
90	*Sarcochlamys pulcherrima* (Roxb.)	9.17	-	-	-	-	-	-	-	-	-	15.18	-
91	*Senna alata* (L.) Roxb.	12.50	-	-	-	-	-	-	-	-	-	-	-
92	*Senna tora* (L.) Roxb.	-	-	-	-	8.86	-	-	-	-	-	-	-
93	*Sida cordifolia* L.	-	-	-	8.58	-	-	-	-	-	10.30	-	-
94	*Solanum lasiocarpum* Dunal	-	-	-	-	9.23	6.05	-	-	5.98	-	-	-
95	*Solanum torvum* Sw.	-	-	6.23	4.31	7.82	-	-	-	-	-	-	-
96	*Solanum virginianum* L.	-	-	-	-	-	-	-	-	5.98	-	-	-
97	*Stixis suaveolens* (Roxb.) Baill.	-	-	-	-	-	-	-	10.37	-	-	-	-
98	*Tabernaemontana divaricata* (L.) R.Br.	-	-	-	9.99	-	11.20	-	-	10.61	-	-	17.22
99	*Tamilnadia uliginosa* (Retz.) Tirveng. &	-	-	8.30	-	-	-	-	-	-	-	-	-
100	*Urena lobata* L.	-	-	6.23	-	-	-	-	16.82	-	-	-	-
101	*Vitex negundo* L.	-	-	-	-	12.05	-	-	-	-	-	-	-
102	*Xanthium strumarium* L.	-	-	-	13.52	-	-	-	-	-	14.06	-	-
103	*Zanthoxylum oxyphyllum* Edgew.	-	5.00	-	-	-	-	-	-	-	-	-	-
	Total number of species	**26**	**34**	**26**	**21**	**22**	**28**	**17**	**21**	**29**	**25**	**15**	**20**

(Abbreviations used: GG 01 - Barail, GG 02 - Behali, GG 03 - Chala, GG 04 - Chapanala, GG 05 - Dhansiri, GG 06 - Garampani, GG 07 - Koilamati, GG 08 - Meleng, GG 09 - Nambor Doigrung, GG 10 - North Karbi Anglong, GG 11 - Noxatilla, GG 12 - Silanijaan)

Species richness and IVI

The species richness in the studied *Gnetum gnemon* strands showed distinct variations. Behali harbours 34 plant species followed by Nambor Doigrung (29 species), Garampani (28 species), Barail (26 species), Chala (26 species), North Karbi Anglong (25 species), Dhansiri (22 species), Chapanala (21 species), Meleng (21 species), Silanijaan (20 species) and Koilamati (17 species) respectively. The species richness is lowest (15 species) in Noxatilla forest.

The IVI study revealed that *Gnetum gnemon* was dominant only in Chala (26.6) whereas it occupies 4th dominant onwards (Fig. 2) in other study sites. In Barail, *Gnetum gnemon* having IVI 15.65 against the highest IVI 19.17 of *Melastoma malabathricum* positioned itself in 4th. Likewise, in Behali it is in 15th position with IVI 8.00 against highest IVI 20.06 of *Pseuderanthemum latifolium*; in Chapanala it is in 17th position with IVI 8.59 against highest IVI 31.68 of *Clerodendrum infortunatum*; in Dhansiri it is in 5th position with IVI 16.28 against highest IVI 42.70 of *Chromolaena odorata*; in Garmpani it is in 5th position with IVI 16.35 against highest IVI 20.21 of *Clerodendrum infortunatum*; in Koilamati it is in 5th position with IVI 22.85 against highest IVI 41.03 of *Chromolaena odorata*; in Meleng it is in 19th position with IVI 8.04 against highest IVI 28.75 of *Chromolaena odorata*; in Nambor Doigrung it is in 13th position with IVI 10.61 against highest IVI 22.86 of *Chromolaena odorata*; in North Karbi Anglong it is in 22nd position with IVI 6.54 against highest IVI 29.70 of *Chromolaena odorata*; in Noxatilla it is in 13th position with IVI 7.65 against highest IVI 38.13 of *Melastoma malabathricum*; and in Silanijaan it is in 7th position with IVI 15.63 against highest IVI 26.78 of *Chromolaena odorata*.

Diversity, dominance, evenness and similarity indices

Both Shannon's Diversity Index (H') and Simpson's Diversity Index (1-D) measure species diversity but they vary in their sensitivity to species richness and evenness. In the present study, Behali showed highest H' (3.39) followed by Nambor Doigrung (3.26), Garampani (3.25), Barail (3.20), North Karbi Anglong (3.15) and Chala (3.12). 1-D was lowest in Noxatilla (2.59). In case of 1-D; a total of four study-sites Barail, Behali, Garampani and Nambor Doigrung showed the highest value (1-D = 0.96) and Noxatilla showed the lowest value (1-D = 0.92).

Simpson's Dominance Index (D) was highest in Noxatilla (0.08) followed by Koilamati (0.07) and lowest in Barail, Behali, Garampani and Nambor Doigrung (0.04). The lower ranges from 0.04 to 0.08 of the D indicating balanced ecosystems with no single species dominated these sites.

Simpson's Evenness Index (E) measures how evenly species are distributed across the sites and it ranged from 0 (low evenness) to 1 (perfect evenness). It was highest (0.90) in Barail and Silanijaan followed by Garampani and North Karbi Anglong (0.86 each), Meleng (0.85), Noxatilla (0.81) and Koilamati (0.80). E is lowest in Dhansiri (0.70). Most of the sites showed balanced species distribution (Table 3).

The similarity among the different study sites were calculated using Sorensen-Dice index and scaled these to a percentage (0-100 %) output. Garampani and Nambor Doigrung showed highest similarity (87.72 %) followed by Garampani and Silanijaan (79.17 %), Nambor Doigrung and Silanijaan (69.39 %) and Koilamati and Silanijaan (64.86 %). Sites Barail and Dhansiri; and sites Behali and Noxatilla showed the lowest similarity (16.33 %) followed by Barail and Behali (16.39 %). Around 60 % of the site pairs showed similarity in the range of 30-50 %. Barail was consistently dissimilar as all values are below 30 % while sites Garampani, Koilamati, Nambor Doigrung and Silanijaan showed higher similarity between them (all above 50 %) (Fig. 3).

Conclusion

This study documents the plant species found in the habitats of *Gnetum gnemon* in NE India and highlights the status of *Gnetum gnemon* and other plants in these forest strands using the Important Value Index (IVI). The findings picturized the species' richness across the different study sites and reveal both dominant and infrequent species. As the study showed the aggressiveness of certain invasive plants, conservation strategies are required to protect these high-diversity forest patches and the *Gnetum gnemon*. Additionally, sustainable harvesting practices for *Gnetum gnemon* are crucial to balance ecosystem integrity with economic needs. Also, long-term monitoring will help in designing effective conservation plans.

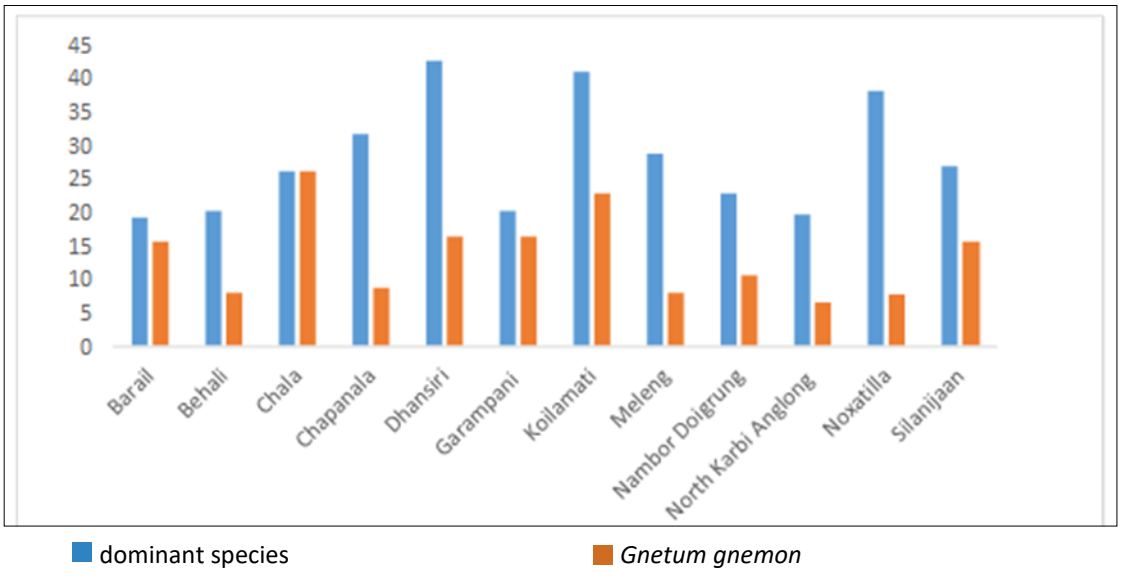

Fig. 2. Comparison of IVIs of *Gnetum gnemon* and the species with highest IVI in the study sites.

Table 3. Study sites with diversity, dominance and evenness indices

Sl. No.	Study site	Shannon's Diversity Index (H')	Simpson's Dominance Index (D)	Simpson's Diversity Index (1-D)	Simpson's Evenness Index (E)
1	Barail	3.20	0.04	0.96	0.90
2	Behali	3.39	0.04	0.96	0.77
3	Chala	3.12	0.05	0.95	0.78
4	Chapanala	2.92	0.06	0.94	0.79
5	Dhansiri	2.92	0.06	0.94	0.70
6	Garampani	3.25	0.04	0.96	0.86
7	Koilamati	2.72	0.07	0.93	0.80
8	Meleng	2.96	0.06	0.94	0.85
9	Nambor Doigrung	3.26	0.04	0.96	0.82
10	North Karbi Anglong	3.15	0.05	0.95	0.86
11	Noxatilla	2.59	0.08	0.92	0.81
12	Silanijaan	2.94	0.06	0.94	0.90

	GG 01	GG 02	GG 03	GG 04	GG 05	GG 06	GG 07	GG 08	GG 09	GG 10	GG 11	GG 12
GG 01	100.00											
GG 02	16.39	100.00										
GG 03	22.64	43.33	100.00									
GG 04	20.83	25.45	34.04	100.00								
GG 05	16.33	28.57	41.67	37.21	100.00							
GG 06	25.45	38.71	48.15	40.82	44.00	100.00						
GG 07	22.73	27.45	41.86	42.11	51.28	57.78	100.00					
GG 08	29.17	29.09	55.32	28.57	32.56	53.06	47.37	100.00				
GG 09	25.00	31.75	43.64	32.00	39.22	87.72	52.17	52.00	100.00			
GG 10	23.08	40.68	43.14	43.48	29.79	49.06	38.10	34.78	44.44	100.00		
GG 11	23.81	16.33	34.15	27.78	27.03	32.56	37.50	38.89	31.82	30.00	100.00	
GG 12	21.28	37.04	43.48	43.90	47.62	79.17	64.86	53.66	69.39	53.33	45.71	100.00

Fig. 3. Similarity Index among different study sites.

Acknowledgements

The authors are greatly thankful to the officials of the Assam Forest Department and Chala Village Sanctuary Conservation Society for their support in carry out the research work. The authors are also grateful to the Head, Department of Botany, Gauhati University for providing facilities created under UGC-SAP & DST-FIST schemes. They also like to thank Mr. Chiranjib Bora for preparing the map.

Authors' contributions

SKB and GS carried out the field studies and performed the statistical analysis. PPB and ND drafted the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

References

1. Kim JH, Won H. Identification of Cambodian *Gnetum* (Gnetaceae, Gnetales) species by DNA barcoding. Korean J Plant Taxon. 2016;46 (2):163–74. https://doi.org/10.11110/kjpt.2016.46.2.163
2. Markgraf F. Monographie der Gattung *Gnetum*. Bull Jard Bot Buitenzorg, Serie III. 1930;10:407–511.
3. Markgraf F. Gnetaceae. Flora Malesiana. 1951;1(4):336–47.
4. Manner HI, Elevitch CR. *Gnetum gnemon* (*Gnetum*). Agroforestry.net; 2006.
5. Kanjilal UN, Kanjilal PC, De RN, Das A. Flora of Assam. Vol. 4. Government of Assam; 1940.
6. Khuraijam JS, Singh R. Gymnosperms of Northeast India: Distribution and conservation status. Pleione. 2015;9(2):283–8.
7. Borthakur SK. Ethnobotany of the Khasi and Garo Tribes of Meghalaya, India. Bishen Singh Mahendra Pal Singh; 2001.
8. Haridasan K, Rao RR. Forest flora of Meghalaya. Bishen Singh Mahendra Pal Singh; 1985.
9. Burkill IH. A dictionary of the economic products of the Malay Peninsula. Ministry of Agriculture and Cooperatives; 1966.
10. Borah D, Tangjang S, Das AP, Upadhaya A, Mipun P. Assessment of non-timber forest products in Behali Reserve Forest, Assam,

Northeast India. Ethnobot Res Appl. 2020;19:1-15. https://doi.org/10.32859/era.19.43.1-15

11. Yadav A, Verma PK, Bora HR. Socio-economic impact of medicinal plants on the forest fringe communities of Nambor Reserve Forest, Assam. J Med Plants Stud. 2019;7(6):14–7.
12. Borah D, Das N, Mihu I, Hajong B, Tangjang S. Diversity and composition of shrubs in Behali Reserve Forest of Biswanath district, Assam, with special emphasis on *Gnetum gnemon* L. Ecol Quest. 2022;33(2):1–19. https://doi.org/10.12775/EQ.2022.015
13. Baloch E. *Gnetum gnemon*. The IUCN Red List of Threatened Species. 2011. e.T194943A8924190.
14. Terangpi R, Engtipi U, Teron R. Utilization of lesser-known plants, *Gnetum gnemon* L. and *Rhynchotechum ellipticum* (Dietr.) A. DC. among the Karbis, Northeast India. J Sci Innov Res. 2013;2(5):943–9. https://www.jsirjournal.com/Vol2Issue5015.pdf
15. Hooker JD. The Flora of British India. Vol. 5, Part 4. L. Reeve & Co.; 1888. p. 641–3.
16. Paul P, Dhar S, Das D, Chowdhury M. Herbarium techniques: Evolution from conventional to digitization. Orange Book Publication; 2020. p. 128.
17. Deb DB. The Flora of Tripura State. Vol. 2. Today and Tomorrow's Printers and Publishers; 1983.
18. Dash SS, Singh P. Flora of Kurung Kumey District, Arunachal Pradesh. Botanical Survey of India, Ministry of Environment, Forest and Climate Change; 2017.
19. POWO. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. [Cited 2024]. https://powo.science.kew.org/
20. Cottam G, Curtis JT. The use of distance measures in phytosociological sampling. Ecology. 1956;37(3):451–60. https://doi.org/10.2307/1930167
21. Curtis JT. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press; 1959.
22. Magurran AE. Measuring biological diversity. Blackwell Publishing; 2004.
23. Shannon CE. A mathematical theory of communication. Bell Syst Tech J. 1948;27(3):379–423. https://doi.org/10.1002/j.1538-7305.1948.tb01338.x
24. Shannon CE, Weaver W. The mathematical theory of communication. University of Illinois Press; 1949.
25. Simpson EH. Measurement of diversity. Nature. 1949;163(4148):688. https://doi.org/10.1038/163688a0
26. Dice LR. Measures of the amount of ecologic association between species. Ecology. 1945;26(3):297–302. https://doi.org/10.2307/1932409
27. Sørensen T. A method of establishing groups of equal amplitude in plant sociology. Kongelige Danske Videnskabernes Selskab. 1948;5 (4):1–34.

Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

Publisher information: Plant Science Today is published by HORIZON e-Publishing Group with support from Empirion Publishers Private Limited, Thiruvananthapuram, India.