

DIVERSITY OF VASCULAR PLANT TAXA OF THE FLORA OF ETHIOPIA AND ERITREA

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ABSTRACT: The Ethiopian Flora Project was started in 1980 with the objectives of writing up a Flora of Ethiopia within the shortest time possible; build-up of the National Herbarium and a related library and promoting scientific activities in taxonomic botany, economic botany, forestry, plant ecology, plant physiology, etc. The writing up of the Flora of Ethiopia within the shortest time possible was the cardinal objective of the project. In the Flora of Ethiopia and Eritrea about 6,027 vascular plant species (including subspecies), with about 10% endemism have been documented in eight volumes in ten books. In addition to providing the total number of taxa (species and subspecies) in the Flora area (Ethiopia and Eritrea), information on how many of these vascular plant taxa are fern-allies (lycopodiophytes), ferns (pteridophytes), naked-seeded plants (gymnosperms) and flowering plants (angiosperms), and how many of the taxa in these groups are restricted in their distribution (endemic) to the Flora area, both Ethiopia and Eritrea, Ethiopia or Eritrea only. This paper presents a brief account of the diversity of the vascular plants in the Flora area to highlight the values of the resource that has been developed during the past 30 years.

INTRODUCTION

The Ethiopian Flora Project was started in April 1980 with the objectives of writing-up a Flora of Ethiopia within the shortest time possible; building a National Herbarium and a related library; and promoting scientific activities in taxonomic botany, economic botany, forestry, plant ecology, plant physiology, etc.

This paper deals with the accomplishment of the cardinal objective of the Ethiopian Flora Project – “writing-up a Flora of Ethiopia within the shortest time possible”. The writing of the Flora focused on the higher plants (the vascular plants). The publication of the Ethiopian Flora started in 1989 with the printing of Volume three of the Flora of Ethiopia (including Eritrea) (Hedberg and Edwards, 1989). With the separation of Eritrea from Ethiopia in 1991, the work continued as planned, but the publications were made to reflect the reality and the subsequently published volumes were named as the “Flora of Ethiopia and Eritrea”. It is from the published volumes of the

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Flora of Ethiopia (Volume 3), and Flora of Ethiopia and Eritrea (Volumes 1, 2 and 4-8) that the data for this paper have been obtained as shown in Table 1 and in Hedberg and Edwards (1989), Edwards *et al.* (1995), Phillips (1995), Edwards *et al.* (1997; 2000), Hedberg *et al.* (2003), Mesfin Tadesse (2004), and Hedberg *et al.* (2006; 2009a; 2009b).

Table 1. Volumes of Flora of Ethiopia and Eritrea (FEE) with contents and year of publication.

Volume	Content (Families)	No. of Genera	No. of Species (including subspecies)	Year of publication
3	Pittosporaceae – Araliaceae	274	1162	1989
7	Poaceae (Gramineae)	156	609	1995
2, Part 2	Canellaceae – Euphorbiaceae	130	724	1995
6	Hydrocharitaceae – Arecaceae	173	793	1997
2, Part 1	Magnoliaceae – Flacourtiaceae + Appendix	217	651	2000
4, Part 1	Apiaceae – Dipsacaceae	178	413	2003
4, Part 2	Asteraceae (Compositae)	133	472	2004
5	Gentianaceae – Cyclocheilaceae	244	991	2006
1	Lycopodiaceae – Pinaceae + Appendix	87	212	2009
8	General part and index to Volumes 1-7			2009

The documentation of the vascular plants diversity in the Flora of Ethiopia and Eritrea provided detailed information on the diversity of vascular plant groups, families, genera and species (including subspecies) in the Flora area and endemic taxa of the Flora area, and individual countries (Ethiopia and Eritrea). It should be noted that subspecies are counted together with a species if there are two or more than two subspecies within a species in the Flora area, with one of the subspecies considered equivalent to a species.

Diversity of vascular plant taxa in the Flora area

There are about 243 families of vascular plants in the Flora area, of which 175 are found in both Ethiopia and Eritrea, 63 only in Ethiopia and five only in Eritrea. Thus, the Ethiopian flora encompasses about 238 vascular plant families while that of Eritrea has 180 families. The Flora area has about 1,592 genera, of which 842 are found in both countries while 697 and 53 genera are found only in Ethiopia and Eritrea, respectively. Hence, there are 1,539 genera in Ethiopia and 895 in Eritrea. Of the 6,027 species (including subspecies) found in the Flora area, 1,882 are common to both countries while 3,875 have been recorded from Ethiopia and 270 from Eritrea only. Thus, there are 5,757 species (including subspecies) in Ethiopia and about 2,152 species (including subspecies) in Eritrea.

Diversity of plant groups and families in the Flora area

The eight volumes of the Flora of Ethiopia and Eritrea produced in ten books and published between 1989 and 2009 covered four vascular plant groups in the Flora area, namely lycopodiophytes (fern-allies), pteridophytes (ferns), gymnosperms and angiosperms (Table 2).

Table 2. Names of vascular plant groups and number of families and categories below family in each group.

No.	Group Name	No. of Families	No. of Genera	No. of Species (including subspecies)
1	Lycopodiophytes (Fern-allies)	3	5	17
2	Pteridophytes (Ferns)	33	73	177
3	Gymnosperms	5	9	18
4	Angiosperms	202	1,505	5,815
4a	Dicotyledons	157	1,176	4,413
4b	Monocotyledons	45	329	1,402
	Total	243	1,592	6,027

Lycopodiophytes and pteridophytes

The two groups are considered the lower, least specialized, groups of vascular plants. In the Flora area, these two groups are represented by 36 families (Table 3). Of the 36 families, three (Lycopodiaceae – Isoetaceae) are considered more closely related and placed in the lycopodiophytes (fern-allies), which contain five genera and 17 species. The remaining 33 families (Equisetaceae – Azollaceae) belong to the pteridophytes, which are known as ‘true ferns’ and contain 73 genera and 177 species (including subspecies).

Table 3. List of families with the number of genera and species in the lycopodiophyte and pteridophyte groups.

No.	Name of Family	No. of Genera	No. of Species (including subspecies)
1	Lycopodiaceae	3	6
2	Selaginellaceae	1	8
3	Isoetaceae	1	3
4	Equisetaceae	1	1
5	Ophioglossaceae	2	9
6	Marratiaceae	1	1
7	Osmundaceae	1	1
8	Gleicheniaceae	1	1
9	Grammitidaceae	2	2
10	Polypodiaceae	9	10
11	Anemiaceae	1	1
12	Negripteridaceae	1	2
13	Sinopteridaceae	5	17
14	Cryptogrammeaceae	1	1
15	Actiniopteridaceae	1	3

No.	Name of Family	No. of Genera	No. of Species (including subspecies)
16	Pteridiaceae	1	9
17	Adiantaceae	1	7
18	Hemionitidaceae	2	2
19	Vittariaceae	2	3
20	Parkeriaceae	1	1
21	Marsileaceae	2	8
22	Hymenophyllaceae	4	6
23	Cyatheaceae	1	1
24	Dennstaedtiaceae	1	1
25	Hypolepidaceae	4	5
26	Thelypteridaceae	7	11
27	Aspleniaceae	1	37
28	Woodsiaceae	4	5
29	Dryopteridaceae	5	14
30	Tectariaceae	3	3
31	Lomariopsidaceae	2	6
32	Nephrolepidaceae	1	2
33	Oleandraceae	2	3
34	Davalliaceae	1	1
35	Blechnaceae	1	2
36	Azollaceae	1	1
Total		78	194

Gymnosperms

The gymnosperms, also commonly known as naked-seeded plants, are composed of five families and nine genera with 18 species (Table 4). Only three genera (*Ephedra*, *Juniperus* and *Podocarpus*) in three families (Ephedraceae, Cupressaceae and Podocarpaceae), represented by three and one species each, respectively, are indigenous to the Flora area. The remaining three families with six genera and a total of 13 species are introductions; the most widely planted being *Cupressus lusitanica* (Cupressaceae).

Table 4. List of families with the number of genera and species in the gymnosperms.

No.	Name of Family	No. of Genera	No. of Species
1	Ephedraceae	1	3
2	Podocarpaceae	1	1
3	Araucariaceae	1	1
4	Cupressaceae	5	7
5	Pinaceae	1	6
Total Taxa		9	18

Angiosperms

The angiosperms, which are also widely known as flowering plants, are the largest group of vascular plants worldwide as well as in the Flora area. They are represented by 202 families composed of 1,505 genera and 5,815 species (including subspecies) in the Flora area (Table 2). The two sub-groups of angiosperms, dicots and monocots, possess 157 and 45 families, 1,176 and 329 genera and 4,413 and 1,402 species (including subspecies), respectively. The top 25 families and genera include 58.98% of the genera, 70.35% of the species (including subspecies) and 77.90% of the endemic taxa (Tables 5 and 6).

Endemism in the Flora area

There is no endemic family in the Flora area. However, there are four genera that are endemic to the Flora area, namely, *Chiliocephalum* Benth. (Asteraceae), with two species (*C. schimperi* Benth. and *C. tegetum* Mesfin, both restricted to Ethiopia), *Pseudobleparispermum* J.-P. Lebrun & Stork (Asteraceae), a monotypic genus with *P. bremeri* J.-P. Lebrun & Stork restricted to Ethiopia, and the monotypic genus *Hypagophytum* Berger (Crassulaceae), with *H. abyssinicum* (A. Rich.) Berger, and *Nephrophyllum* A. Rich., with *N. abyssinicum* Hochst. ex A. Rich. which are endemic to the Ethiopian Highlands (Ethiopia and Eritrea). Altogether, there are about 647 species (including subspecies), which are endemic to the Flora area. Of these, 544 taxa are confined to Ethiopia, 14 to Eritrea and 89 taxa are common to both Ethiopia and Eritrea. In addition, there are over 60 taxa (species and subspecies) that have been included in the Flora volumes as undescribed (species/subspecies.), which are confined to the Flora area. With additional information and publication of the remaining taxa, the number of endemic taxa is likely to increase.

Nevertheless, as some taxa that have currently been considered restricted to the Flora area may be discovered in neighboring countries, while other taxa that are considered to occur in the Flora area and beyond may be found restricted to the Flora area as endemic taxa, in addition to the taxa mentioned as spp. in the Flora, the current percentage endemism (about 10%) may not go up or down drastically.

The 647 endemic taxa are distributed in 76 families of pteridophytes and angiosperms, and the top 25 genera and 25 families with their number of endemic taxa and percentage endemism are listed in tables 5 and 6. The 25 vascular plant families which account for about 10% of the total number of

families (243) contain 70.35% of the total number of species (including subspecies) in the Flora area. As can be seen from the tables, Asteraceae/Compositae has the largest number and percentage of endemic taxa, while Cucurbitaceae and Amaranthaceae have the lowest (but Myrtaceae, with only two indigenous genera and two species, is without any endemic taxon).

Table 5. Top 25 families of vascular plants of FEE with total number of genera and species (including subspecies), endemism and author/s.

No.	Family	Genera	Species & subspecies	Endemic Taxa	Author/s (Flora Volume)
1	Fabaceae	111	678	71	M. Thulin <i>et al.</i> (3)
2	Poaceae	156	609	39	S. Phillips (7)
3	Asteraceae	133	472	103	Mesfin Tadesse (4:2)
4	Euphorbiaceae	34	242	45	M. G. Gilbert (2:2)
5	Cyperaceae	19	231	14	K. A. Lye (6)
6	Acanthaceae	41	215	25	Ensermu Kelbessa (5)
7	Lamiaceae	44	202	28	O. Ryding <i>et al.</i> (5)
8	Orchidaceae	37	167	28	P. Cribb & S. Thomas (6)
9	Asclepiadaceae	45	165	29	D.J. Goyder <i>et al.</i> (4:1)
10	Malvaceae	17	141	5	K. Vollesen (2:2)
11	Convolvulaceae	21	139	17	Sebsebe Demissew (5)
12	Rubiaceae	55	117	7	Ch. Puff (4:1)
13	Scrophulariaceae	38	116	15	E. Fischer <i>et al.</i> (5)
14	Cucurbitaceae	24	74	1	C. Jeffrey (2:2)
15	Solanaceae	16	71	3	I. Friis & J. Edmonds (5)
16	Capparidaceae	8	68	2	L. Kers (2:1)
17	Myrtaceae	9	68	0	I. Friis (2:2)
18	Boraginaceae	19	66	6	H. Riedl & S. Edwards (5)
19	Burseraceae	2	62	4	K. Vollesen (3)
20	Brassicaceae	23	62	6	B. Jonsell (2:1)
21	Amaranthaceae	21	59	1	C. Townsend (2:1)
22	Apiaceae	34	59	12	I. Hedberg & O. Hedberg (4:1)
23	Commelinaceae	9	57	2	Ensermu Kelbessa & R. B. Faden (6)
24	Caryophyllaceae	22	51	8	M. G. Gilbert (2:1)
25	Aloaceae	1	48	33	Sebsebe Demissew & M.G. Gilbert (6)
25 Families		939	4,239	504	
Percent contribution to FEE		58.98%	70.35% of	77.90%	

Table 6. Top 25 indigenous genera of vascular plants of FEE with total number of species and endemics (including subspecies) and percent endemism.

No.	Name of Genus	No. of Species (including subspecies)	No. of Endemic Species (including subspecies)	% Endemism
1	<i>Cyperus</i>	121	9	7.44
2	<i>Euphorbia</i>	113	29	25.66
3	<i>Crotalaria</i>	92	14	15.22
4	<i>Indigofera</i>	86	8	9.30
5	<i>Acacia</i>	66	8	12.12
6	<i>Ipomoea</i>	63	4	6.35
7	<i>Commiphora</i>	56	2	3.57
8	<i>Hibiscus</i>	50	2	4.00
9	<i>Aloe</i>	48	33	68.75
10	<i>Vernonia</i>	48	14	29.17
11	<i>Eragrostis</i>	45	3	6.67
12	<i>Habenaria</i>	45	11	24.44
13	<i>Solanum</i>	44	3	6.82
14	<i>Barleria</i>	40	4	10.00
15	<i>Asplenium</i>	37	3	8.11
16	<i>Justicia</i>	37	7	18.92
17	<i>Plectranthus</i>	37	1	2.70
18	<i>Pennisetum</i>	35	7	20.59
19	<i>Trifolium</i>	33	9	27.27
20	<i>Hyparrhenia</i>	32	4	12.50
21	<i>Sporobolus</i>	31	0	00.00
22	<i>Panicum</i>	30	3	10.00
23	<i>Rhynchosia</i>	30	6	20.00
24	<i>Ceropegia</i>	29	10	34.48
25	<i>Pavonia</i>	29	2	6.90
		1277	196	
Percent of total taxa and endemics		21.19%	30.29%	

CONCLUSION AND RECOMMENDATIONS

The Ethiopian Flora has been concluded very satisfactorily fulfilling its objectives, including the documentation of the flora which was the main objective of the project. The total number of taxa documented in FEE is about 6,027 with 647 (10.74%) endemism. This was done with global participation whereby 90 botanists from 17 countries have been involved in the write-up. In this connection, it is important to note the contribution of local botanists to the writing up of family accounts for 1,390 (about 23%) taxa.

While the documentation of the FEE is one of the most important achievements of the Ethiopian Flora Project, it is believed that the printing of the Flora of Ethiopia and Eritrea in Ethiopia is considered the best decision taken by the proponents of the Flora Project at its early stage which

made the Flora volumes accessible locally, enhancing wider distribution and being sold at a reasonable price. Various specialized research and conservation initiatives have been made possible by the publication of a complete modern Flora for Ethiopia and Eritrea. The publications of the Flora of Ethiopia and Eritrea locally would also be a good example for other developing countries that intend to write their Floras in the future. This would also help build the human and material capacity of the countries owning the Floras in general and the institutions involved in Flora writing in particular.

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