

A CONTRIBUTION TO THE STUDY OF *Quercus* L. IN THE HIMALAYAS

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ABSTRACT

Fagaceae, commonly known as the beech family, has the virtues to show unique evolutionary specialization and great ecological variation. In view of this, the interesting genus *Quercus* L. was selected from this family to trace its existence in the Subtemperate-temperate realms of Himalaya. In all 22 species have been documented in this work through studies in the Herbaria, field and libraries during 2013-2014. An artificial key to the species was prepared to facilitate their identification. It was also evident 16 species are exclusive in the temperate region.

KEYWORDS : Himalayas, Fagaceae, Quercoideae

The dicotyledonous family Fagaceae, commonly of beeches or oaks, has a global representation in form of 670-900 species of 7 genera, the area extending from southern East Asia to northern Southeast Asia being the main distribution centre. This taxon has certain unique features as seen in their woody stem, spiral or alternate leaves, deciduous scaly stipules, nuts as fruits. A large number of Fagacean species grow in north-eastern parts of the country. So far economic and ecosystem perspective are concerned this taxon is very important

The present work, although preliminary in its kind, aims to contribute towards updating of Floras of concerned regions as well as of India as whole.

MATERIALS AND METHODS

The present taxonomic work carried out during 2013-2014 mainly documents the specimens preserved in the Central National Herbarium (CAL) and Botanical Survey of India Sikkim Himalayan Circle (BSHC) along with their respective field numbers and information about the place of collection and their flowering and fruiting periods. Pertinent literature were consulted (Balakrishnan, 1983; Chowdhery and Wadhwa., 1984; Cronquist, 1981; Deb, 1981; Forman, 1964; Grierson and Long, 1991; Gupta, 1968; Hajra, 1996; Kanjilal and Das, 1940; Mukherjee, 1988; Nair, 1977) for review and identification. Some of the floristically rich areas in the Darjeeling-Sikkim Himalaya were also visited for field studies. The concerned species were identified following standard taxonomic methods and literature as cited. Website of the International Plant Names Index (IPNI), The Plant List were consulted for updating species names.

RESULTS AND DISCUSSION

Systematic account Since Taxonomy is a descriptive and informative subject, an account of general characteristics of the Fagaceae has been prepared as given in the following.:

Trees or shrubs with trilacunar nodes. Bark smooth or deeply furrowed. Roots forming ectotrophic mycorrhizae. Leaves alternate, stipule deciduous. Flowers unisexual; Staminate flowers commonly in reduced dichasia that are organized into aments or sometime into small head, with 4-12 stamens, filament distinct, anthers bithecal, longitudinal in dehiscence; pistillate flowers 1-7 together at the base of the staminate inflorescences or from separate axils, pistil 1, the ovary inferior, 3-6 loculed, ovule anatropous. Fruit a nut surrounded by enlarged persistent hard bracteoles forming the so-called cupule or by numerous imbricate bracts, indehiscent or dehiscent. Seeds exalbuminous.

Quercus L.

The genus *Quercus* belongs to the Subfamily Quercoideae of Fagaceae which is characteristically with Stigma dilated and covering the more or less recurved upper face of the style; male flowers without rudimentary ovary; stamens usually 6; anthers large, more or less basifixed; cupule open, entire or lobed.

The genus *Quercus* needs to be clearly delimited from its nearest relative *Lithocarpus*.

- 1a. Male and female flowers in unisexual or androgynous inflorescence, erect; leaves with typically appressed 2-4 rayed trichome.....*Lithocarpus*
- 1b. Male and female flowers on separate shoots, male flowers in cluster, pendulous; absence of such trichomes on leaves.*Quercus*

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Key to the Species

- 1a. Deciduous tree or shrub.....2
 1b. Evergreen large tree..... 5
 2a. Small tree or shrub up to 10 ft., leaves undulate or shallowly lobed, dark bluish-green above*Q. undulata*
 2b. Large tree up to 80 ft..... 3
 3a. Leaves lobbed, nearly sessile, acorn pedunculate..... *Q. robur*
 3b. Leaves serrated and petiolate..... 4
 4a. Leaf- margin coarsely serrate up to base, oblong-elliptic, acuminate, round or cuneate base *Q. acutissima*
 4b. Leaf-margin coarsely dentate, usually entire toward base, obovate, acute, base cuneate.....
 *Q. griffithii*
 5a. Leaf base caudate or round..... 6
 5b. Leaf base acute or cuneate.....12
 6a. Leaves usually entire, glabrous on both side.....*Q. floribunda*
 6b. Leaves serrate or spinuous toothed
7
 7a. Nerves 6-8 pairs..... 8
 7b. Nerves 10- 20 pairs..... 10
 8a. Nerves forked..... 9
 8b. Nerves not forked and strong..... *Q. ilex*
 9a. Leaves short petioled, rusty tomentose beneath*Q. semicarpifolia*
 9b. Leaves with densely stalked stellate tomentose beneath *Q. senescens*
 10a. Tree with dark-grey bark.....11
 10b. Tree with massively ridged grey-brown bark; leaves wedge shape, dark yellow-green, shining above, very pubescent below..... *Q. michauxii*
 11a. Leaves ovate-elliptic or obovate, glabrous above, pale tomentose beneath..... *Q. lanata*
 11b. Leaves more narrowly ovate-elliptic or lanceolate, more sharply serrate, densely white tomentose beneath..... *Q. oblongata*
 12a. Leaves glabrous beneath, nerves 15-25 pairs, straight, margin toothed almost base, dark green, shining above..... *Q. lamellosa*
 12b. Leaves pilose, pubescent or glaucous beneath.....13
 13a. Leaf apex sub-obtuse, densely tomentose beneath..... *Q. helferiana*
 13b. Leaf apex acuminate..... 14
 14a. Nerves 10-13 pairs, slender and arched Leaves coriaceous, elliptic to lanceolate, sharply toothed in upper half, susilvery beneath..... *Q. thomsoniana*
 14b. Nerves 13-30 pairs, not slender and arched 15
 15a. Bark grey or blackish grey.....16
 15b. Bark, dark reddish grey brown, with broad, thin, rounded ridges, scaly; nut oblong-ovoid brown; cup, saucer-shaped covered with thin imbricate reddish brown scales..... *Q. rubra*
 16a. Leaves elliptic..... 17
 16b. Leaves ovate or oblong-lanceolate.....18
 17a. Leaves glabrous above, grayish appressed pubescent beneath, acorn ellipsoid..... *Q. glauca*
 17b. Leaves glaucous beneath, acorn subglobose.....
 *Q. oxyodon*
 17c. Yong leaves densely fulvous tomentose, glabrate when young, cupule 2/3 covered with lamellate ring like fulvo-tomentose scale..... *Q. rex*
 17d. Leaves glaucous beneath, margin bluntly serrate, acorn oblong, cupule villous.....
 *Q. semiserrata*
 18a. Leaves glossy, finely pubescent beneath, flowers in fascicled spike..... *Q. lineata*
 18b. Leaves pilose beneath, cup sub-hemispheric, 9zonate *Q. patkoiensis*
 18c. Leaves shining above, reticulate beneath, cup deep hemispheric or obconic..... *Q. mespilifolia*

Species Enumeration

1. *Quercus* × *undulata* Torr. Ann. Lyceum Nat. Hist. New York 2: 248 1828.
2. *Quercus acutissima* Carruth. J. Linn. Soc., Bot. 6: 33 1862.
3. *Quercus floribunda* Lindl. ex A. Camus Chênes Atlas 2: 131 1935.

4. *Quercus glauca* Thunb. Syst. Veg. ed. 14 858 1784. Specimen examined : On the way to Bey, North Sikkim, R.C Srivastava, 10324.
5. *Quercus griffithii* Hook.f. & Thomson ex Miq. Ann. Mus. Bot. Lugduno-Batavi 1: 104 1864. Specimen examined: Anon, Khasi Hills, 439492.
6. *Quercus helferiana* A.DC., Prodr. 16(2): 101. 1864.
7. *Quercus ilex* L., Sp. Pl. 995. 1753.
8. *Quercus lamellosa* Sm. Cycl. 29: 23. 1819. Specimen examined: 10 th Mile, South Sikkim, S.K.Rai & S.Prodhan, 23989; Way to Tholung, North Sikkim, D.Maity, 23243.
9. *Quercus lanata* Sm. Cycl. 29: 27. 1819.
10. *Quercus lineata* Blume Bijdr. 523. 1826. Specimen examined: Sikkim, 440286.
11. *Quercus mespilifolia* Wall. ex A.DC. Prodr. 16(2): 101. 1864. Specimen examined: Tendong R.F, South Sikkim, B. K.Shukla, 206901.
12. *Quercus michauxii* Nutt. Gen. N. Amer. Pl. 2: 215. 1818.
13. *Quercus oblongata* D.Don Prodr. Fl. Nepal. 57 1825.
14. *Quercus oxyodon* Miq. Ann. Mus. Bot. Lugduno-Batavi 1: 114 1864.
15. *Quercus patkoiensis* A.Camus Bull. Soc. Bot. France 80: 353 1933.
16. *Quercus rex* Hemsl. Hooker's Icon. Pl. 27: t. 2663. 1899.
17. *Quercus robur* L. Sp. Pl. 996. 1753.
18. *Quercus rubra* L. Sp. Pl. 996. 1753.
19. *Quercus semecarpifolia* Sm. Cycl. 29: 20. 1819.
20. *Quercus thomsoniana* A.DC, Prodr. 16(2): 98. 1864.
21. *Quercus semiserrata* Roxb. Fl. Ind. ed. 1832 3: 641. 1832.

Table 1: Distribution of Quercus L. in Different Zone of Himalayans Region

Sl No.	Name of the Species	Western Himalaya	Eastern Himalaya	North Eastern Himalaya
1.	<i>Q. x undulata</i>	+	-	-
2.	<i>Q. acutissima</i>	-	+	+
3.	<i>Q. floribunda</i>	+	-	-
4.	<i>Q. glauca</i>	+	+	+
5.	<i>Q. griffithii</i>	-	+	+
6.	<i>Q. helferiana</i>	-	-	+
7.	<i>Q. ilex</i>	+	-	-
8.	<i>Q. lamellosa</i>	-	+	+
9.	<i>Q. lanata</i>	-	+	+
10.	<i>Q. lineata</i>	-	-	+
11.	<i>Q. mespilifolia</i>	-	+	-
12.	<i>Q. michauxii</i>	+	-	-
13.	<i>Q. oblongata</i>	+	+	-
14.	<i>Q. oxyodon</i>	-	+	+
15.	<i>Q. patkoiensis</i>	-	-	+
16.	<i>Q. rex</i>	-	-	+
17.	<i>Q. robur</i>	+	-	-
18.	<i>Q. rubra</i>	+	-	-
19.	<i>Q. senescens</i>	-	+	-
20.	<i>Q. semecarpifolia</i>	+	+	+
21.	<i>Q. semiserrata</i>	-	+	+
22.	<i>Q. thomsoniana</i>	-	+	+
Total		9	12	13

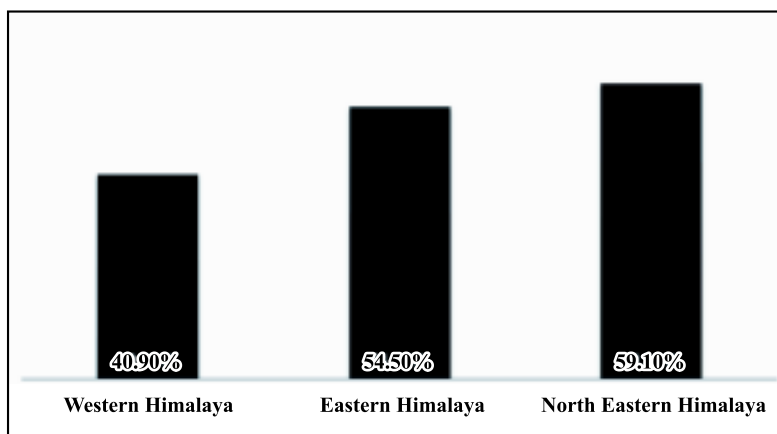


Figure 1: Relative Distribution of *Quercus* in Different Regions of Himalaya

Table 2 : Distribution of *Quercus* L. in Different Altitudinal Ranges of the Himalaya

Sl No.	Name of The Species	Western Himalaya			Eastern Himalaya			North Eastern Himalaya		
		Tropical	Temperate	Alpine	Trop.	Temp.	Alp.	Trop.	Temp.	Alp.
1.	<i>Q. undulata</i>	+	-	-	-	-	-	-	-	-
2.	<i>Q. acutissima</i>	-	-	-	-	+	-	-	+	-
3.	<i>Q. floribunda</i>	+	+	-	-	-	-	-	-	-
4.	<i>Q. glauca</i>	+	+	-	+	+	-	+	-	-
5.	<i>Q. griffithii</i>	-	-	-	+	+	-	+	-	-
6.	<i>Q. helferiana</i>	-	-	-	-	-	-	+	-	-
7.	<i>Q. ilex</i>	+	-	-	-	-	-	-	-	-
8.	<i>Q. lamellosa</i>	-	-	-	+	+	-	+	+	-
9.	<i>Q. lanata</i>	-	-	-	+	+	-	-	+	-
10.	<i>Q. lineata</i>	-	-	-	-	-	-	-	+	-
11.	<i>Q. mespilifolia</i>	-	-	-	-	+	-	-	-	-
12.	<i>Q. michauxii</i>	-	+	-	-	-	-	-	-	-
13.	<i>Q. oblongata</i>	-	+	-	+	+	-	-	-	-
14.	<i>Q. oxyodon</i>	-	-	-	+	+	-	-	+	-
15.	<i>Q. patkoiensis</i>	-	-	-	-	-	-	-	+	-
16.	<i>Q. rex</i>	-	-	-	-	-	-	+	+	-
17.	<i>Q. robur</i>	+	-	-	-	-	-	-	-	-
18.	<i>Q. rubra</i>	-	+	-	-	-	-	-	-	-
19.	<i>Q. semecarpifolia</i>	-	+	-	-	+	-	-	+	-
20.	<i>Q. semiserrata</i>	-	-	-	-	+	-	+	-	-
21.	<i>Q. senescens</i>	-	-	-	-	+	-	-	-	-
22.	<i>Q. thomsoniana</i>	-	-	-	-	+	-	+	-	-
<i>Total</i>		5	6	0	6	12	0	7	8	0

22. *Quercus senescens* Hand.-Mazz. Symb. Sin. 7: 37 .1929.

An Overall Contemplation

Present study records twenty-two of species of *Quercus* L. in the different zones of the Himalaya (Table 1), The geographical distribution of which shows that 40.90%

of the species occur in the Western Himalaya, 54.50% in the Eastern Himalaya and 59.10% in the North-eastern Himalaya (Figure1).

It was also evident that as many as 14 species (*Q. glauca*, *Q. undulata*, *Q. robur*, *Q. oblongata*, *Q. ilex*, *Q. floribunda.*, *Q. thomsoniana*, *Q. lamellosa*, *Q. lanata*, *Q. oxyodon*, *Q. griffithii*, *Q. helferiana*, *Q. rex*) occur in

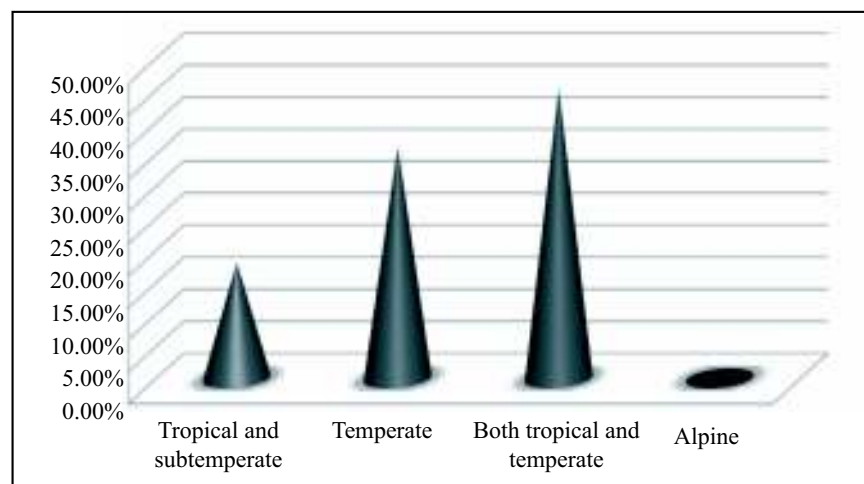


Figure 2 : Altitudinal Gradient of Prevalence of *Quercus* in Himalayas Region

tropical and sub-temperate region and 18 species (*Q. glauca*, *Q. semecarpifolia*, *Q. michauxii*, *Q. oblongata*, *Q. patkoiensis*, *Q. thomsoniana*, *Q. acutissima*, *Q. lamellosa*, *Q. oxyodon*, *Q. mespilifolia*, *Q. senescens*, *Q. griffithii*, *Q. lineata*, *Q. semiserrata*, *Q. rex*, *Q. rubra*) are found in the temperate regions of the Himalaya (Table 2, Figure 2).

CONCLUSION

The Magnoliopsid taxon, thus studied, appears to be fascinating and may be presumed to have evolved as a consequence of high degree of specialization. The evolutionary specialization shows a kind of concomitance of variability with its wide ecological amplitude. In view of all these, the taxon would in all the days to come remain as attractive to taxonomists as it was in the past. However a survey of literature is ample enough to reveal significant lacunae in eco-taxonomic researches in the Himalayan region, especially in the context of the Amentifers which need to be filled up in future.

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