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A Floristic Approach on the Biodiversity of Gangotri Hillocks of Nemmara, Kerala, India

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ABSTRACT

Floristic inventory and diversity assessments are necessary to understand the present diversity status of an area. The present study was conducted on the hillocks of Gangotri to find out its floristic diversity. The study area is composed of 58 plant species belonging to 20 families, of which 50 plants belongs to dicotyledons and 8 belonging to monocots. The biological spectrum of study area comprises 37% therophytes, 23% phanerophytes, 11% hemicryptophytes, and 27% chamaephytes. The therophytes reflexes a semi arid climate. The phytoclimate in study area is thero-phanerophytic as they form the dominant life forms .

Key words: *Floristic studies, Gangotri hillocks,*

Introduction

Vegetation is one of the most precious gifts, nature has provided to us, meeting all our needs and requirements like food fodder, fuel, medicine, timber, resin, oil etc. According to FES (2010) Biodiversity reflects the totality of genus, species and ecosystems in a region. It is essential for human survival and economic well being and for the ecosystem function and stability (Singh, 2002). To understand and assess the biodiversity of an area, taxonomic study is very much essential. Taxonomy is an integrative and intuitive science of identifying, naming and classifying plants. This may be considered as the oldest of sciences, as primitive man used to distinguish plants based on food yielding, fibre yielding, timber yielding etc. The realisation of the economic potential of the biodiversity and the necessity for its preservation for the future welfare of mankind has suddenly boosted the importance of the subject of Taxonomy (Manilal, 1997).

Floristic studies are considered as the backbone of studying plant diversity, conservation, management and utilization. Plant communities play a pivotal role in sustainable management by maintaining biodiversity and conserving the environment. Floristic study and diversity assessments are necessary to understand the present diversity status and conservation of biodiversity. To satisfy the needs and greed of the people, many important plants are threatened and becoming rare, even some are on the verge of extinction.A sound understanding of the richness of species is necessary for appropriate conservation and restoration of the biological diversity. Biodiversity is important for human survival, economic well being and ecosystem functioning and its stability. To satisfy the need and greed of humans, many important plants are threatened, and becoming rare, or are on the verge of extinction. To evaluate the complexity of forest resources an understanding of species diversity is important. Many floristic studies have been conducted worldwide, of this much of them were for inventory making (Whittaker and Niering, 1965; Linder *et al*., 1997;

(Assistant Professor)

chittibabu and Parthsarathy, 2000). Apart from inventory making, floristic studies can be used for comparison of tree species diversity (Pitman *et al*., 2002), phonological assessment (Frankie *et al*., 1974), species area and species individual relationship (Condit *et al*., 1996). Based on the objectives many researchers use various sampling techniques to analyse the floristic data.

Preparation of Flora of smaller areas like a hillock or an under explored areas is not only a prerequisite for the revision of Flora of a vast country like India, but also for understanding eecosystem function and conservation. These hillocks act as a rich and diverse ecological communities performing various functions. So the present study was conducted to identify the various plant species occupying the gangotri hillocks in different sesons.

Review of Literature

India is one of the mega biodiversity country with varied physical and cultural features. India contains about world's 8% biodiversity (Ahmedullah and Nayar, 1986). Systematic floristic exploration in India started with the arrival of Europeans to the Malabar Coast for spice trade. Coloquis dos Simples (Garcia de Orta, 1565), a checklist of the medicinal plants of India, was the first published work on the plants of Western Ghats. Nearly a century later Van Rheede, the Dutch Governor of Malabar surpassed all others by compiling his monumental and historic work in 12 volumes, the *Hortus Indicus malabaricus* (1678-1703). His work representing the first important scientific account of Indian plants with excellent illustrations are faithful representations of the plants described. Britishers made major contributions to floristic studies in India. Beddome, Bourdillon, Jacob, Lawson and Wight were the pioneers

The first part of Gamble's Flora of the Presidency of Madras appeared in 1915, and the other six parts were published by 1925. After Gamble's death, Fischer completed the remaining parts of the flora by 1936. This flora is acclaimed as the best among the regional floras of India, (1928, 1931, and 1935) notes on new and little known plants of south India are of considerable importance in the study of plants of the state. For this epic work, Gamble also made a botanical tour of the erstwhile Travancore state. The Flora of British India (Hooker, 1872-1897) brought out the complete floristic account of the British India. The Flowering Plants of Travancore (Rama Rao, 1914) and the Flora of the Presidency of Madras (Gamble and Fischer, 1915-1936) published during the early years of 20th century aresome of the pioneer floristic accounts.

The district floras of Kerala State like the Flora of Calicut (Manilal and Sivarajan, 1982), Flora of Cannannore (Ramachandran and Nair, 1988) Flora of Silent Valley (Manilal, 1997), Flora of Palghat District (Vajravelu, 1990), Flora of Thiruvananthapuram (Mohanan and Henry, 1994), Flowering Plants of Thrissur Forests (Sasidharan and Sivarajan, 2003) Flora of Nilambur (Sivarajan and Phillip Mathew, 1997) also adds data to the floristic studies.

Materials and Methods

Study Area

The present study was conducted in Gangotri hillocks, a small undisturbed and uncultivated rocky hillocks beneath the hills of Nelliampathy south western Ghats. Gangotri hillocks are geographically located at $10^0.59'$N latitude and $76^0.59'$E. The climate is tropic. The summer is from February to May, followed by southwest monsoon. Average rainfall is 2135mm and the temperature ranges from 22 ^{o}C-37 ^{o}C. The soil was laterite and the rocks granite type.

Floristic analysis

The study was carried out from June 2016 to March 2017, covering all seasons. Plant specimens were collected. At least 3 specimens were collected either in flowering or fruiting condition. Each specimen was numbered as it is collected and detailed notes were entered in the field book, when a taxon identification becomes uncertain more specimens were collected for validation. Life forms were categorised according to Raunkier's classification (1934). Provisional identification were made with the help of Flora of Presidency of Madras (Gamble and Fisher, 1915-1935) and flora. Plants were collected and photographed. The voucher specimen was deposited at the herbarium of Department of Botany, NSS College, Nemmara.

The list of plant species categorized in to following life form classes. 1. Phanerophytes-Includes tress with perennating bud located upright 2. Chamaephytes- Plants with buds located little above the ground. 3. Hemicryptophytes- Plants with perennial shoots and buds close to surface. 4. Cryptophytes -

Plants with perennating buds buried in soil substratum. 5. Therophytes- All annual species. Field studies were carried out in all seasons to cover the overall vegetation and species diversity. Information of habit, habitat, flowering and fruiting period, vegetation type, the nature of perennating bodies was collected to draw a biological spectrum, following the concept of Raunkiaer (1934).

Results and Discussion

On the basis of field survey conducted during various seasons 58 plant species belonging to 20 families were collected, identified and listed (Table 1) excluding lichens, mycoflora, bryophyte and pteridophytes. Out of the identified plant species, 58 plants belonging to angiosperms belongs to 50 Dicotyledons and 8 plants belong to monocotyledons. In the study area, the ratio of Family: Genera, Family: Species and Genera: Species recorded were recorded in Table 2. It was determined that Fabaceae and Poaceae family contains the most species (8 species), followed by the family Rubiaceae with 6 plants species. Lamiaceae were represented with 5 species, followed by Asteraceae, Convolvulaceae, Combretaceae and Euphorbiaceae. (Fig. 1)

The genera represented by the highest number of taxa in the study area are as follows *Ipomoea* is represented by 3 taxa, *Commelina* by 2 taxa, *Alysicarpus* by 2 taxa, *Ziziphus* by 2 taxa. Of the total plant species observed based on the habit herbs were predominant (64%), Shrubs 8% trees 3% and climbers 18% (Fig. 1).

A comparison of the top 10 families in the order of species richness and dominance with that of Flora of Madras Presidency shows that many of the families represented are in Gangothri Hillocks. Fabaceae, Poaceae and Rubiaceaea are the first three families

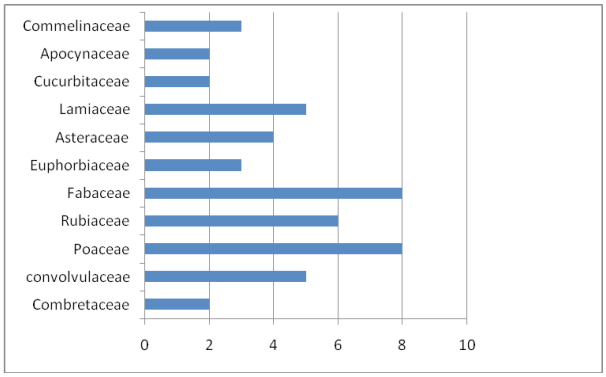

Fig. 1. Plant Families with higher number of species

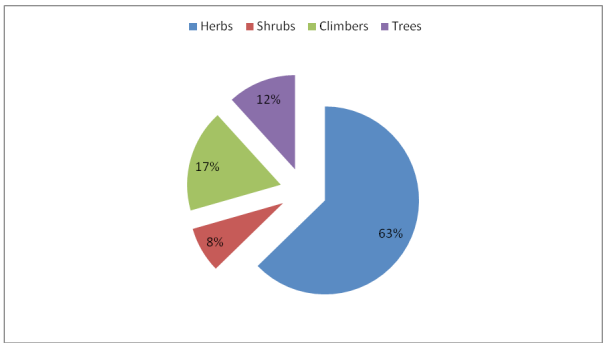

Fig. 2. Analysis of habit wise distribution of species

dominant in the study area similar to that of Flora of Madras Presidency.

Life form Diversity

India being a tropical country is very rich in floristic diversity Out of the 34 Biodiversity hotspots two are located in India. There are 4,465 taxa of flowering plants in Kerala belonging to 1,315 genera in 192 families. Angiosperm in India are usually dominated by herbaceous families. About 74% of the genera are herbaceous. In the present study also about 63% of the plant species are herbs. According to the Convention of Biodiversity (CBD), invasive species are the main cause of biodiversity loss. Species which cross over theirof natural distribution and get introduced to new habitats are known as alien species (Saxena, 1991). Those alien species which have thus increased its spread in the new location displacing the local biota are called as alien invasive species (Keane and Crawley, 2002). Our ecosystem are susceptible to invasive species. In the present study also invasive species are found like *Commelina africana*, *Mikaniamicarantha*, *Hyptissauveolans etc.*

Raunkiaer's (1934) classification of life forms is used by ecologists throughout the world. The ratio of the life forms of different species in terms of numbers or percentages in any floristic community called the biological spectrum. The biological spectrum is regarded as indicative of the prevailing environment. In the study area higher percentage of therophytes indicate long dry seasons, occurrence of similar biological spectrum indicates similar climatic conditions. The biological spectrum is prepared in order to know the trends of vegetation development. The biological spectrum of study area (Fig. 3 and 4) comprises 37% therophytes, 23% phanerophytes, 11% hemicryptophytes, and 27% chamaephytes. The therophytes reflexes a semi-arid climate.

Table 1. List of plants

Sl.No.	Botanical Name	Family	Habit	Lifeform
1	*Abutilon crispa*	Malvaceae	Herb	Phanerophytes
2	*Alloteropsiscimicina*	Poaceae	Herb	Therophyte
3	*Alysicarpusmonilifer*	Fabaceae	Herb	Therophyte
4	*Alysicarpusovalifolius*	Fabaceae	Herb	Therophyte
5	*Andropogonpumilus*	Poaceae	Herb	Therophyte
6	*Anisochiluscarnosus*	Lamiaceae	Herb	Therophyte
7	*Anisomelesindica*	Lamiaceae	Herb	Chaemaephyte
8	*Anogeissuslatifolia*	Combretaceae.	Small tree	Phanerophytes
9	*Apludamutica*	Poaceae	Herb	Hemicryptophyte
10	*Aristidaadscensionis*	Poaceae	Herb	Therophyte
11	*Bidenspilosa*	Asteraceae	Herb	Geophyte
12	*Brachiariaramosa*	Poaceae	Herb	Therophyte
13	*Brideliaretusa*	Euphorbiaceae	Spiny tree	Phanerophyte
14	*Buteamonosperma*	Fabaceae	Tree	Phanerophyte
15	*Cajanuslineatus*	Fabaceae	Shrub	Phanerophyte
16	*Canthiumangustifolium*	Rubiaceae	Shrub	Phanerophyte
17	*Centrosemamolle*	Fabaceae	Herb	Therophyte
18	*Chamaecristamimosoides*	Caesalpiniaceae	herb	Chaemaephyte
19	*Chrysopogonfallax*	Poaceae	Herb	Therophyte
20	*Cleome rutidosperma*	Capparaceae	Herb	Therophyte
21	*Commelinaafricana*	Commelinaceae	Herb	Chaemaephyte
22	*Commelinabenghalensis*	Commelinaceae	Herb	Chaemaephyte
23	*Croton hirtus*	Euphorbiaceae	Herb	Phanerophyte
24	*Cynodondactylon*	Poaceae	Herb	Hemicryptophyte
25	*Eragrostistenella*	Poaceae	Herb	Therophyte
26	*Hedyotisdiffusa*	Rubiaceae	Herb	Chaemaephyte
27	*Holarrhenaantidysenterica.*	Apocynaceae	Tree	Phanerophyte
28	*Hybanthusenneaspermus*	Violaceae	Herb	Hemicryptophyte
29	*Hyptissuaveolens*	Lamiaceae	Shrub	Phanerophyte
30	*Ichnocarpusfrutescens*	Apocynaceae	Climber	Hemicryptophyte
31	*Indigoferalinnaei*	Fabaceae	Herb	Hemicryptophyte
32	*Ipomoea campanulata*	Convolvulaceae	Climber	Phanerophyte
33	*Ipomoea hederifolia*	Convolvulaceae	Climber	Therophyte
34	*Ipomoea marginata*	Convolvulaceae	Climber	Therophyte
35	*Ipomoeastaphylina*	Convolvulaceae	Climber	Therophyte
36	*Linderniaciliata*	Linderniaceae	Herb	Chaemaephyte
37	*Leucasaspera*	Lamiaceae	Herb	Chaemaephytes
38	*Luffacylindrica*	Cucurbitaceae	Climber	Chaemaephytes
39	*Merremiatridentata*	Convolvulaceae	Climber	Therophyte
40	*Microstachyschamaelea*	Euphorbiaceae	Herb	Therophyte
41	*Mikaniamicrantha*	Asteraceae	Climber	Therophyte
42	*Mitracarpushirtus*	Rubiaceae	Herb	Hemicryptophyte
43	*Murdanniasemiteres*	Commelinaceae	Annual herb	Chaemaephyte
44	*Passiflorafoetida*	Passifloraceae	climber	Phanerophyte
45	*Pentanemaindicum*	Asteraceae	Herb	Therophyte
46	*Polycarpeacorymbosa*	Caryophyllaceae	Herb	Hemicryptophyte
47	*Sesamumprostratum*	Pedaliaceae	Herb	Hemicryptophyte
48	*Sidaelongata*	Fabaceae,	Herb	Hemicryptophyte
49	*Spermacoce* hispida	Rubiaceae	Herb	Chaemaephyte
50	*Spilanthesacmella*	Asteraceae	Herb	Therophyte
51	*Sophubiadelphinifolia*	Scrophulariaceae	Herb	Chaemaephyte
52	*Strigaangustifolia*	Scrophulariaceae	Herb	Chaemaephyte
53	*Strychnosnuxvomica.*	Loganiaceae,	Tree	Phanerophyte

Table 1. *Continued ...*

Sl.No.	Botanical Name	Family	Habit	Lifeform
54	*Tephrosiapurpurea*	Fabaceae,	Herb	Chaemaephyte
55	*Terminaliapaniculata*	Combretaceae.	Tree	Phanerophyte
56	*Toddaliaasiatica.*	Rutaceae	Climber	Therophyte
57	*Ziziphus mauritiana.*	Rhamnaceae	Small tree	Phanerophyte
58	*Ziziphusoenoplia*	Rhamnaceae	Evergreen shrub	Therophyte

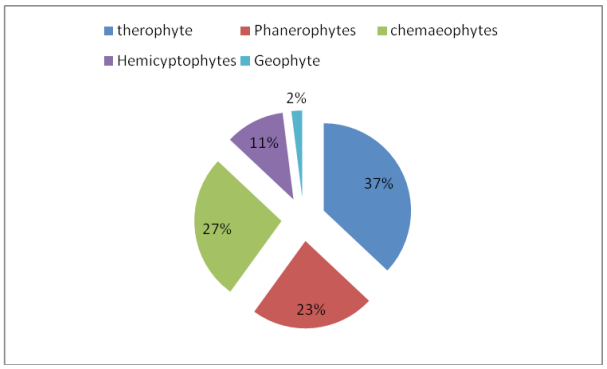

Fig. 3. Biological Spectrum of Life-Forms of present study area

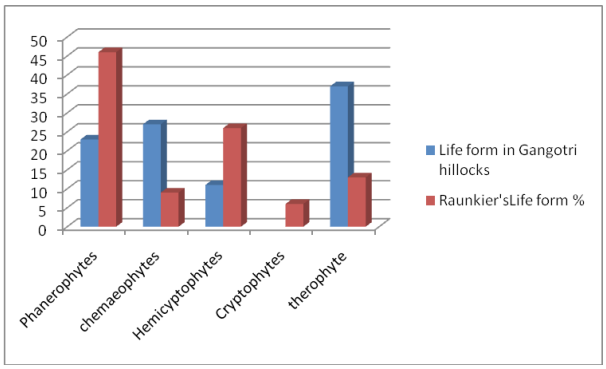

Fig. 4. Comparison of Raunkier's Life form with that of present Flora

The phytoclimate in study area is thero-phanerophytic as they form the dominant life forms. The dominance of therophytes is characteristics of the subtropics and often related to soil conditions and climate. Thus, it indicates that the soil and climatic conditions in the study area are favourable for the growth of therophytes and supports luxuriant undergrowth vegetation.

According to Raunkier (1934) the climate of a region is characterized by life form, while the biological spectrum of the region exceeds the percentage of the same life form. However, the proportion of life form is altered due to biological disturbance. Biological spectrum may be changed due to the anthropogenic pressure like grazing, trampling, invasive species etc. A biospectrum is established when all plant species of a community is classified into life forms and their ratio expressed in percentage or number (Saxena *et al*., 1987). Biological spectrums are beneficial in comparing plant communities which are separated geographically and are also regarded as an indicator of prevailing environmental conditions. Occurrence of similar biological spectra in different regions indicates similar climatic conditions. Several workers have studied the life forms and biological spectrum of different regions of India (Meher-Homji. (1981); Ghildiyal and Srivastava, 1990; Gupta and Kachroo, 1983). The life-form is the ultimate manifestation of the sum of all the adaptations undergone by a plant to the climate in which it resides. The "Biological Spectrum"proposed by Raunkier expresses both the life-form distribution in a flora and the phytoclimate under which the pre-

Table 2. Comparison of first 10 large families with other Flora

Sl. No.	Flora of Madras Presidency.	Gangothri hillocks
1	Fabaceae	Fabaceae
2	Poaceae	Poaceae
3	Rubiaceae	Rubiaceae
4	Acanthaceae	Lamiaceae
5	Euphorbiaceae	Convolvulaceae
6	Asteraceae	Asteraceae
7	Cyperaceae	Euphorbiaceae
8	Lamiaceae	Commelinaceae
9	Urticaceae	Cucurbitaceae
10	Asclepediaceae	Apocynaceae

Table 3. Ratio of Species, Genera and Families in the Study Sites.

	Family: Genera	Family: Species	Genera: Species
Total Number	24:52	24:58	52:58
Ratio	1:2.2	1:2.42	1:1

vailing life-forms evolved. Life-form is thus an important part of vegetation description, ranking next to floristic composition.

Conclusion

The present study revealed the presence of 58 plants species belonging to angiosperms of which 50 are Dicotyledons and 8 plants belong to monocotyledons. Fabaceae and Poaceae were the dominant families, followed by Rubiaceae, Lamiaceae and Convolvulaceae Based on habit herbs are dominant with 64% of the population. There was the occurrence of invasive species which might affect the natural flora and may cause threat to the biodiversity. The biological spectrum of study area comprises 37% therophytes, 23% phanerophytes, 11% hemicryptophytes, and 27% chamaephytes. The therophytes reflexes a semi arid climate. The phytoclimate in study area is thero-phanerophytic as they form the dominant life forms Diversity of the plants in the study area is affected mainly due to manmade fires, and also by devotees going to hanuman temple. The study is also significant because information related to lifeforms gives an account of prevailing phytoclimatic conditions which can further be used to infer microclimatic conditions in an area.

References

Ahmedullah, M. and Nayar, M.P. 1986. *Endemic Plants of Indian Region.* Vol. I Botanical Survey of India, Calcutta.

Chittibabu, C.V. and Parthasarathy, N. 2000.Attenuated tree species diversity in human-impacted tropical evergreen forest site at Kolli hills, Eastern Ghats, India. *Biodiversity and Conservation.* 9: 1493-1519.

Condit, R., Hubbell, S.P. and Lafrankie, J.V. 1996. Species area and species - individual relationship for tropical trees. Acomparison of three 50ha plots. *Ecology.* 84 : 549-562.

FES 2010. Assessment of Biodiversity in Sitamata Wildlife Sanctuary. A Conservation Perspective. Report of Foundation for Ecological Sercurity, Gujarat, India.

Frankie, G.W., Baker, H.G. and Opler, P.A. 1974. Comparative phenological studies if trees in tropical wet and dry forests in the lowlands of Costa Rica. *The Journal of Ecology*. 62 : 881-919.

Gamble, J.S. and Fischer, C.E.C. 1915. 1936. *The Flora of the Presidency of Madras.* Part I- II, Adlard and Son Ltd., London.

Garcia, O.D. 1565. Coloquois dos Simples e Drogas he Cousas Medicinais da India. Goa

Ghildiyal, J.C. and Srivastava, M.M. 1990. Life-forms and biological spectrum of a tropical fresh-water swamp forest at Rishikesh (Dehra Dun). *Indian Journal of Forestry.* 13(2) : 132-148.

Gupta, V.C. and Kachroo, P. 1983. Life-form classification and biological spectrum of the flora of Yusmarg, Kashmir. *Tropical Ecology.* 24(1): 22-28

Keane, R.M. and Crawley, M.J. 2002. Exotic plant invasions and the enemy release hypothesis. *Trends Ecol. Evol*. 17: 164-170.

Kumar, A., Marcot, B. G. and Saxena, A. 2006. Tree species diversity and distribution patterns in tropical forests of Garo Hills. *Current Science*. 91(10): 1370–1381. http://www.jstor.org/stable/24094061

Linder, P. Elfving , B. and Zackrisson, O. 1997. Stand structure and successional trends in virgin boreal forest reserves in Sweden. *Forest ecology and Management.* 98 : 17-33.

Manilal, K.S. 1997. Taxonomy teaching in universities and colleges in India. *Rheedea.* 7(1) : 51-55.

Manilal, K.S. and Sivarajan, V.V. 1982. Flora of Calicut.

Meher – Homji, V. M. 1981. Environmental implications of life-form spectra from *India. J. Econ. Taxon. Botany.* (2): 23-30.

Pitman N.C.A., Terborgh, J.W. and Silman, M.R. 2002. A comparison of tree species in two upper Amazonian forests. *Ecology.* 83 : 3210-3224.

Ramachandran, V.S. and Nair, V.J. 1988. Flora of Cannanore.

Raunkiaer, C. 1934. *The Life Forms of Plants and Statistical Plant Geography*. The Clarendon Press, Oxford,

Sasidharan, N. 2003. Red listed threatened tree species in Kerala: a review. pp. 1-12.

Sasidharan, N. and Sivarajan, V.V. 1996. Flowering plants of Thrissur forests.

Saxena, 1991. Biological invasions in the Indian subcontinent: Review of invasion by plants. In: Ramakrishnan, P.S. (ed.). *Ecology of Biological Invasion in the Tropics*. International Scientific Publication New Delhi. 21-34.

Saxena, A.K., Pandey, T.P. and Singh, J.S. 1987. Altitudinal variation in the vegetation of Kumaun Himalaya. *Perspective Env. Bot*. pp: 44-66.

Singh, J.S. 2002. The biodiversity crisis: a multifaceted review. *Current Science.* 82 : 638–647.

Sivarajan, V.V. and Mathew, P., 1997. Flora of Nilambur (Western Ghats, Kerala). Bishen Singh Mahendra Pal Singh

Vajravelu, E., 1990. Flora of Palghat District, including Silent Valley national park, Kerala.

Van Rheede, H.A. 1678-1703. *A Commentary on the Hortus Malabaricus,* Part 1- 6. Amsterdam, Netherlands.

Whittaker, R. and Niering, W.A. 1965. Vegetation of the Santa Carolina Mountains, Arizona: A gradient analysis of the south slope. *Ecology*. 46 : 429-452.