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STUDIES ON THE LIMESTONE VEGETATION OF SAHASRADHARA NEAR DEHRA DUN (UTTAR PRADESH)—AN ACCOUNT OF THE VEGETATION

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ABSTRACT

The paper gives a brief account of the vegetation of Sahasradhara near Dehra Dun (U. P.). Environmental factors have also been discussed.

INTRODUCTION

Sahasradhara lies in the outer Himalayan range in the Dehra Dun district of Uttar Pradesh. It is known for limestone quarries in India. But in earlier days, a detailed vegetational study of the limestone localities was not undertaken in this area. A passing reference to about eleven plants from Sahasradhara is made by Kanjilal (1928) and about five by Duthie (1903-29). The author recorded more than 600 plants from the area.

PHYSIOGRAPHY

Location and Geology : Sahasradhara is situated between 30°23′ N and 78°8′ E in Dehra Dun district at a height of 700-1400 m above mean sea level. The place is known for the sulphur spring (height 810 m) and is considered to be a health resort. Ravi Prakash and Gupta (1957) have mentioned the following about the geology of Sahasradhara.

"The upper krol limestone dips 51°S in a direction 70° near Sahasradhara. This massive limestone-dolomite band is overlain just near the spring by a series of limestone shales and dolomites. This series of limestone and shale is probably equivalent of Krol D. stage".

DRAINAGE

Two main streams, one originating from Rudwara in the north-east of Kaligad and the other from Dhobi ghat in the north-west, confluence at Sera to form the Baldi river (main river passing through the area). There are many fast flowing streams and rivulets traversing the hillocks on either side of the river at many places and converge into it.

ENVIRONMENTAL FACTORS

Climate : Sahasradhara area experiences two drought periods in a year. A major drought period from about the middle of April to the middle of June and another comparatively a shorter one from the last week of October upto the 3rd week of December.

Similarly, alternating with these two drought periods are the two favourable growth seasons.

The maximum temperature fluctuates between 19.4°C to 35.5°C, the lowest maximum being recorded during the month of January and the highest during May and June.

The relative humidity varies from 74-91% except for the months of March, April, May and June when it touches the minimum of 40% and does not exceed 64%.

The maximum rainfall is recorded during the months of July, August and September. For these months, it varies from 287.8 to 660.7 mm, the maximum being in July-August. The winter rains are comparatively much less *i.e.* varying from 41.02 to 68.4 mm for January, February and March. During the remaining months of the year namely, April, May, June, October, November and December, the rainfall is negligible, usually not exceeding 33.8 mm.

Edaphic : Soil samples were collected from the different sites from surface to 100 cm depth and analysis for physical and chemical properties was done by the customary methods.

Physical analysis of the soil: The different samples tested in this area have a gritty texture. The coarse fractions of the soil are much higher than the silt and clay fractions. Thus, the gravel constituents of the soil vary from 22.0% to 39.0%, the fine gravel ranges from 13.0% to 35.0%. The coarse sand varies from 12.8% to 21.7% and fine sand ranges from 5.2% to 27.5% and the silt and clay range from 3.2% to 9.04%.

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Chemical analysis of the soil: The moisture content varies from 0.123% to 3.163% from the depth of 25 cm to 100 cm in the case of Bagdwara side rocks and in the case of Bauta side rocks from 0.998% to 2.239% from the depth of 25 cm to 100 cm. The organic matter is low *i.e.* 5.676% in the Bagdwara rocks at 25 cm depth but slightly higher *i.e.* 7.404% at 100 cm depth. In Bauta rocks it is higher at 25 cm depth *i.e.* 6.722% and low at 100 cm depth *i.e.* 4.921%.

The percentage of the mixed oxides is less in the Bagdwara rocks but is higher in the Bauta rocks. It ranges from 2.959% to 13.981% in the Bagdwara rocks. Along the Bauta rocks, the mixed oxides ranges from 14.334% to 20.691%. The percentage of silica is also less in the rocks along Bagdwara. It varies from 0.822% to 7.998%. It is highest at 50 cm depth *i.e.* 7.99% while in the rocks along the Bauta it is much higher and ranges from 10.14% to 19.14%. It is highest at 75 cm, depth *i.e.* 19.14%. Again along the Bagdwara rocks, the magnesium carbonate ranges from 8.82% to 24.27% at the various layers of the soil. It is lowest at 100 cm depth *i.e.* 8.82% and highest at 25 cm depth *i.e.* 24.27%. Along the Bauta rocks, magnesium carbonate varies from 7.31% to 11.53% in the different layers of soil samples. It is highest at 25 cm depth *i.e.* 11.53% and lowest at 75 cm depth *i.e.* 7.31%.

The presence of calcium carbonate is comparatively much higher in the rocks studied at the two sites. It ranges from 55.75% to 60.03% in the rocks along Bagdwara. Similarly along the Bauta rocks calcium carbonate varies from 38.05% to 54.73% the highest *i.e.* 54.73% being at 25 cm depth and the lowest *i.e.* 38.05% being at 75 cm depth.

Nitrogen percentage varies from 0.011% to 0.047% along the Bagdwara rocks and along the Bauta rocks it ranges from 0.036% to 0.054% at the different layers of the soil samples. At 100 cm depth, it is 0.036% and 75 cm depth, it is 0.054%.

The pH value is markedly higher in the limestone rocks. It ranges from 8.0 to 8.4 at various sites of study along the Bagdwara and Bauta rocks.

BIOTIC

Rocks are subjected to many human activities like breaking and dynamiting the rocks for limestone extractions. At certain places crop fields are situated below the quarries and thus the natural vegetation and cultivated fields are disturbed very much.

VEGETATION

The vegetation of the area studied is of mixed deciduous type and can be distinguished into three strata of trees, shrubs and herbs.

The common trees of the area are *Acacia catechu* Willd., *Bauhinia retusa* Roxb., *Bombax ceiba* Linn., *Sapium insigne* Trimen and *Toona ciliata* Roem. The common shrubs are *Cocculus laurifolius* DC., *Colebrookea oppositifolia* Sm., *Mallotus philippensis* (Lamk.) Muell.-Arg. and *Murraya koenigii* (Linn.) Spreng. The common herbs are *Ageratum conyzoides* Linn., *Borreria articularis* (Linn. f.) F. N. Will., *Nepeta hindostana* (Roth) Haines, *Sida cordata* (Burm. f.) Boiss., *Triumfetta rhomboidea* Jacq. and *Xanthium strumarium* Linn. The common climbers in the area are *Cissampelos pareira* Linn., *Cryptolepis buchananii* Roem. & Sch., *Dioscorea bulbifera* Linn., *Holmskioldia sanguinea* Retz., *Ipomoea hederifolia* Linn., *Phanera vahlii* (Wight & Arn.) Benth. and *Pueraria tuberosa* (Roxb.) DC.

VEGETATION IN DIFFERENT HABITATS

Limestone quarries: The limestone quarries within the area were under constant vigil during the coarse of the present field study. It has been noticed that the quarried rocks when freshly cut, remained barren for a longer period till at certain places crevices were formed. *Eriophorum comosum* Wall. ex Nees and *Pogonatherum paniceum* (Lamk.) Hack. thrived in these crevices. At certain other places, where the environment was favourable, the following herbs were recorded.

Arthraxon lancifolius (Trin.) Hochst., *Aerva sanguinolenta* (Linn.) Blume, *Apluda mutica* Linn., *Campanula colorata* Wall. ex Roxb., *Celosia argentea* Linn., *Chrysopogon fulvus* (Spreng.) Chiov., *Eriophorum comosum* Wall. ex Nees, *Eragrostiella nardoides* (Trin.) Bor, *Galium vestitum* D. Don, *Gentiana aprica* Decne, *Leucas lanata* Benth., *Lindenbergia macrostachya* Benth., *Origanum vulgare* Linn., *Pogonatherum paniceum* (Lamk.) Hack. and *Sporobolus diander* (Retz.) P. Beauv, etc.

Besides, the following plants were also recorded from the stabalized soil in the surroundings of the quarries:

Trees: *Acacia catechu* Willd., and *Bauhinia retusa* Roxb. etc.

Shrubs: Boehmeria platyphylla D. Don, *Caryopteris wallichiana* Schau., *Cocculus laurifolius* DC., *Colebrookea oppositifolia* Sm., *Euphorbia royleana* Boiss., *Leptodermis lanceolata* Wall., *Mimosa rubicaulis* Lamk., *Murraya koenigii* (Linn.) Spreng.,

Nyctanthes arbor-tristis Linn., *Sophora mollis* (Royle) Baker, *Spermadictyon suaveolens* Roxb. and *Woodfordia fruticosa* (Linn.) Kurz etc.

Herbs : Ageratum conyzoides Linn., *Arundinella nepalensis* Trin., *Borreria stricta* (Linn. f.) K. Schum., *Canscora diffusa* R. Br., *Erianthus filifolius* Nees ex Steud., *Malvastrum coromandelianum* (Linn.) Garcke, *Nepeta hindostana* (Roth) Haines, *Oxalis corniculata* Linn., *Rumex hastatus* D. Don, *Sida cordata* (Burm. f.) Bross., *Torenia cordifolia* Roxb. and *Xanthium strumarium* Linn. etc.

The plants recorded from the base to the top of the hillocks are as under:—

(a) Plants recorded generally from the base of the hillocks:

Trees : Melia azedarach Linn., *Pterospermum acerifolium* Willd., etc.

Shrubs : Calotropis procera (Ait.) Ait. f., *Itea nutans* Royle, *Lantana camara* Linn. var. *aculeata* (Linn.) Moldenke, *Salix acmophylla* Boiss., *Tamarix dioica* Roxb. and *Zizyphus mauritiana* Lamk. etc.

Herbs : Ammannia baccifera Linn., *Asclepias curassavica* Linn., *Caesulia axillaris* Roxb., *Cardiospermum halicacabum* Linn., *Commelina haskarlii* Clarke, *Eriocaulon sieboldianum* Sieb. & Zucc. ex Steud., *Fagopyrum esculentum* Moench, *Filago germanica* Linn., *Indigofera linifolia* Retz., *Martynia annua* Linn., *Polygonum barbatum* Linn. subsp. *gracile* Danser, *Ranunculus laetus* Wall. ex Royle, *Saccharum spontaneum* Linn., *Zeuxine strateumatica* (Linn.) Schlect. and *Zornia gibbosa* Span. etc.

(b) Plants recorded generally from the slopes of the hillocks:

Trees : Bridelia squamosa (Lamk.) Gehrm., *Diospyros kanjilalii* Duthie, *Elaeodendron roxburghii* Wight & Arn. and *Shorea robusta* Gaertn. etc.

Shrubs : Casearia graveolens Dalz., *Helicteres isora* Linn., *Holarrhena antidysenterica* (Linn.) Wall. ex DC. and *Sophora mollis* (Royle) Baker etc.

Herbs : Buchnera hispida Buch.-Ham. ex D. Don, *Desmodium velutinum* (Willd.) DC., *Delphinium denudatum* Wall. ex Hook. f. & Thoms. and *Rumex nepalensis* Spreng. etc.

Plants usually recorded from near-about the top of the hillocks:

Shrubs : Berberis asiatica Roxb. ex DC., *Indigofera heterantha* Wall. ex Brandis etc.

Herbs : Inula nervosa Wall. ex DC., *Lespedeza stenocarpa* Maxim. and *Stellaria webbiana* Wall. ex Benth. etc.

Plants recorded from the limestone rocks:

(a) CRYPTOGAMS: (1) *Lichens : Umbilicaria polyrrhiza* (Linn.) Ach. (2) *Liverworts & Mosses : Marchantia palmata* Nees, *Plagiochasma articulatum* Kashyap, *Cratoneuron filicinum* (Hedw.) Spruce and *Rhynchostegium vagans* (Harv.) Jacq. etc. (3) *Ferns : Adiantum capillus-veneris* Linn., *A. philippense* Linn., *Asplenum alternans* Wall., *Cheilanthes farinosa* (Forsk.) Kaulf., *C. rufa* Desv., *Polystichium aculeatum* (Linn.) Copeland and *Pteris cretica* Linn. etc.

(b) PHANEROGAMS: *Flowering plants : Agrostis pilosula* Trin. var. *pilosula, Argostemma verticillatum* Wall., *Arthraxon lancifolius* (Trin.) Hochst., *Arundinella nepalensis* Trin., *Begonia picta* Sm., *Bergenia ligulata* (Wall.) Engl. var. *ciliata* (Royle) Engl., *Campanula colorata* Wall. ex Roxb., *Celosia argentea* Linn., *Chirita bifolia* D. Don, *C. pumila* D. Don, *Corallodiscus lanuginosus* (Wall. ex DC.) B. L. Burtt, *Chrysopogon fulvus* (Spreng.) Chiov., *Didymocarpus pedicellata* R. Br., *Eragrostiella nardoides* (Trin.) Bor, *Eriophorum comosum* Wall. ex Nees, *Galium vestitum* D. Don, *Linderbergia macrostachya* Benth., *Origanum vulgare* Linn., *Platystemma violoides* Wall., *Pogonatherum paniceum* (Lamk.) Hack., and *Viola serpens* Wall. ex Roxb. etc.

Plants recorded along the limestone gullies and ravines:

Trees : Dalbergia sericea G. Don, *Wendlandia heynei* (R. & S.) Sant. & Merch. etc.

Shrubs : Boehmeria platyphylla D. Don, *Murraya paniculata* (Linn.) Jack. and *Rhamnus triquetra* (Wall.) Brand. etc.

Herbs : Argostemma sarmentosum Wall., *Barleria cristata* Linn., *Boenninghausenia albiflora* Reichb., *Canscora diffusa* R. Br., *Galium rotundifolium* Linn. and *Impatiens cristata* Wall. etc.

Plants recorded from the river bed area:

Trees : Acacia catechu Willd. and *Moringa oleifera* Lamk. etc.

Shrubs : Solanum hispidum Pers. and *Tamarix dioica* Roxb. etc.

Herbs : Alysicarpus glumaceus (Vahl) DC., *Crotalaria prostrata* Rottl. ex Willd., *Desmodium heterophyllum* (Linn.) DC. and *Eupatorium glandulosum* H. B. & K. etc.

The total number of species collected from the area excluding cultigens is 541. Those belong to 387 genera and 98 families. Family Asteraceae dominates with 50 species and is followed by Poaceae

with 49 species, Fabaceae with 45 species and Lamiaceae with 26 species.

All the specimens collected by the author from Sahasradhara are deposited in the Herbarium of the Botanical Survey of India, Dehra Dun, U.P. (BSD).

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