

Comparative study of Flora of three Plateaus in Western Maharashtra

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Abstract: The current study aimed at comparing the flora of Bhavale, Kaas and Velneshwar plateaus. Data was collected by check list method. The comparative study revealed similarities between all the three study stations in the monsoon. While floral diversity of Bhavale was distinctly varying in the summer season, as Bhavale was otherwise a barren land taken up for plantation and reforestation by an NGO Hariyali. The study also highlights that conservation education and measures are required to preserve the flora to maintain the ecological balance of Velneshwar which is currently undergoing rapid development.

Key words : Velneshwar, Kaas, Bhavale, floral diversity.

The Western Ghats is one of the major biodiversity hot spots in India. It shows vast diversity in flora and fauna with high degree of endemism. The floral diversity in various parts of the Western Ghats of Maharashtra is well documented owing to ecologically sensitive flora. Geographically the Western Ghats is distributed as coastal region and plateau region which shows variations in the flora. Geographical and climatic conditions govern the native flora. There are various reports which document the native flora of Maharashtra but up till now very few attempts have been made to study the comparative floral diversity in various regions of Maharashtra. In present study, comparative documentation of the native flora present at plateaus of Bhavale, Velneshwar and Kaas was carried out.

The three plateaus are geographically very distinct and are expected to have diverse plant populations. There is urgent need to document such diverse floral population to conserve and maintain the ecosystem. Therefore this study was undertaken to study scientifically and document the plants growing in the plateau regions of Maharashtra and to propose strategies for conservation of ecosystem.

Study area

Bhavale (18°42'N, 75°45'E) is the small village in Thane district of Maharashtra and adopted by NGO, Hariyali for restoration of the depleting forest cover.

Velneshwar (17°08'N, 73°16'E,) is situated on the western coast of Maharashtra is mainly known for the Velneshwar temple and picturesque Velneshwar beach. The habitat is now claimed by various industries and infra-

structural projects as a promising area. Anthropological activities are still not well spread in Velneshwar region but they are slowly progressing to threaten the existing floral diversity.

Kaas (17°43'N, 73°49'E) is situated in the central portion of Deccan plateau of Maharashtra. It is well known tourist destination and serious damage to the ecosystem has been observed due to increased tourist activity, major collection by the botanists and many other reasons like climate change. The flora on the plateaus comprises mainly of ephemeral and seasonal herbaceous elements and hence gets neglected by the botanists (Watve, 2013). The constant threat to the floral diversity of Kas is seen due to the lack of conservational activities in the earlier years. Presently many NGOs have taken up the initiative to conserve the severely damaged Kas ecosystem.

Materials And Methods

The study area of Bhavale covers 10 hectares of land given to Hariyali for restoration of forest cover, while in Velneshwar the study area is of 35 acres involving the area in and around Vidya Prasarak Mandal's Maharshi Parshuram College of Engineering. The data was collected by taking the photographs of the habit and floral morphology of the plant species. The data of Kaas plateau was collected chiefly during the monsoon when it becomes the valley of flowers comprising mainly of ephemerals.

The data of the three plateaus was compared for similarities and IUCN Red data book for determining the ecological importance.

Results And Discussion

Table 1: List of Trees at Bhavale, Kaas and Velneshwar

Genus	Species	Family	Bhavale	Kaas	Velneshwar
<i>Acacia</i>	<i>arabica</i>	Mimosae	+	-	-
<i>Adenanthera</i>	<i>pavonia</i>	Mimosae	+	-	-
<i>Aglaiia</i>	<i>lawii</i>	Meliaceae	-	+	-
<i>Anacardium</i>	<i>occidentale</i>	Anacardiaceae	+	+	+
<i>Annona</i>	<i>squamosa</i>	Annonaceae	+	-	-
<i>Azadirachta</i>	<i>Indica</i>	Meliaceae	+	-	-
<i>Bauhinia</i>	<i>tomentosa</i>	Caesalpiniae	+	-	-
<i>Bombax</i>	<i>salmalia</i>	Bombacaceae	+	-	-
<i>Butea</i>	<i>monosperma</i>	Fabaceae	+	-	-
<i>Cassia</i>	<i>fistula</i>	Caesalpiniae	+	-	+
<i>Dalbergia</i>	<i>latifolia</i>	Fabaceae	+	-	-
<i>Delonix</i>	<i>regia</i>	Caesalpiniae	+	-	-
<i>Dolichondron</i>	<i>Falcate</i>	Bignoniaceae	-	-	+
<i>Ferniana</i>	<i>colorata</i>	Sterculiaceae	-	-	+
<i>Ficus</i>	<i>bengalensis</i>	Moraceae	+	+	+
<i>Ficus</i>	<i>rumphii</i>	Moraceae	+	-	+
<i>Ficus</i>	<i>ernotiana</i>	Moraceae	-	-	+
<i>Ficus</i>	<i>pallid</i>	Moraceae	-	-	+
<i>Flacourtia</i>	<i>montana</i>	Flacourtiaceae	+	-	+
<i>Gmelina</i>	<i>arborea</i>	Verbenaceae	+	-	-
<i>Gymnosporia</i>	<i>montana</i>	Celastraceae	-	-	+
<i>Hardwickia</i>	<i>binata</i>	Caesalpiniae	-	-	+
<i>Heterophragma</i>	<i>quadriloculare</i>	Bignoniaceae	-	-	+
<i>Khaya</i>	<i>senegalensis</i>	Euphorbiaceae	+	-	-
<i>Kigelia</i>	<i>pinnata</i>	Bignoniaceae	+	-	-
<i>Macaranga</i>	<i>peltata</i>	Euphorbiaceae	+	-	-
<i>Mangifera</i>	<i>indica</i>	Anacardiaceae	+	+	+
<i>Melia</i>	<i>azadirach</i>	Meliaceae	+	-	-
<i>Memecylon</i>	<i>umbellatum</i>	Melastomataceae	-	-	+
<i>Peltoforum</i>	<i>ferruginum</i>	Caesalpiniae	+	-	-
<i>Phoenix</i>	<i>sylvestris</i>	Palmae	+	-	-
<i>Phyllanthus</i>	<i>emblica</i>	Euphorbiaceae	+	-	+
<i>Pithecolobium</i>	<i>dulce</i>	Mimosae	+	-	-
<i>Pongamia</i>	<i>pinnata</i>	Leguminosae	+	-	+
<i>Sapium</i>	<i>insigne</i>	Euphorbiaceae	-	-	+
<i>Syzigium</i>	<i>rubicunda</i>	Myrtaceae	-	-	+
<i>Syzigium</i>	<i>jambolana</i>	Myrtaceae	+	-	-
<i>Tabebuia</i>	<i>pentaphylla</i>	Bignoniaceae	-	-	+
<i>Tabernaemontana</i>	<i>alternifolia</i>	Apocyanaceae	-	+	-
<i>Tamarindus</i>	<i>indicus</i>	Leguminosae	+	-	+
<i>Tectona</i>	<i>grandis</i>	Verbenaceae	+	-	-
<i>Terminalia</i>	<i>elliptica</i>	Combretaceae	-	-	+
<i>Terminalia</i>	<i>paniculata</i>	Combretaceae	-	-	+
<i>Terminalia</i>	<i>arjuna</i>	Combretaceae	-	-	+
<i>Thevetia</i>	<i>peruviana</i>	Apocyanaceae	+	-	-
<i>Trewia</i>	<i>nudiflora</i>	Euphorbiaceae	+	-	+
<i>Vitex</i>	<i>negundo</i>	Verbenaceae	+	-	-
<i>Xanthoxylum</i>	<i>rhetsa</i>	Rutaceae	-	-	+

Table 2: Shrubs of Bhavale, Kaas and Velneshwar.

Genus	Species	Family	Bhavale	Kaas	Velneshwar
<i>Abelmoschus</i>	<i>tetraphyllus</i>	Malvaceae	+	-	-
<i>Adhatoda</i>	<i>zeylanica</i>	Acanthaceae	+	-	-
<i>Alternanthera</i>	<i>sessilis</i>	Amaranthaceae	+	-	-
<i>Argyreia</i>	<i>boseana</i>	Convolvulaceae	-	+	-
<i>Argyreia</i>	<i>cuneata</i>	Convolvulaceae	-	+	-
<i>Argyreia</i>	<i>sericea</i>	Convolvulaceae	-	+	-
<i>Azanza</i>	<i>lampas</i>	Malvaceae	+	-	-
<i>Blumea</i>	<i>camphora</i>	Asteraceae	+	-	-
<i>Calotropis</i>	<i>gigantea</i>	Asclepiadaceae	+	-	-
<i>Calycopteris</i>	<i>floribunda</i>	Combretaceae	+	-	-
<i>Capparis</i>	<i>spinosis</i>	Capparaceae	-	-	+
<i>Carissa</i>	<i>carandus</i>	Apocyanaceae	+	-	-
<i>Crotalaria</i>	<i>leptostachya</i>	Fabaceae	-	+	-
<i>Dalbergia</i>	<i>trigona</i>	Fabaceae	-	-	+
<i>Dendrophoe</i>	<i>trigona</i>	Loranthaceae	-	-	+
<i>Dracaena</i>	<i>terniflora</i>	Dracaenaceae	-	+	-
<i>Eupatorium</i>	<i>adenophorum</i>	Asteraceae	-	-	+
<i>Hamelia</i>	<i>patens</i>	Rubiaceae	-	-	+
<i>Helecteris</i>	<i>isora</i>	Sterculiaceae	+	-	-
<i>Holarrhena</i>	<i>antidysentrica</i>	Apocyanaceae	+	-	-
<i>Hyptis</i>	<i>suaveoloens</i>		+	-	-
<i>Indigofera</i>	<i>tinctoria</i>	Fabaceae	+	-	-
<i>Ixora</i>	<i>coccinea</i>	Rubiaceae	-	-	+
<i>Lavandula</i>	<i>lawii</i>	Lamiaceae	-	+	-
<i>Leea</i>	<i>macrophylla</i>	Leeaceae	+	-	-
<i>Lepidagahis</i>	<i>bandraensis</i>		+	-	-
<i>Malachra</i>	<i>capitata</i>	Malvaceae	+	-	-
<i>Mimosa</i>	<i>pudica</i>	Mimosae	+	-	-
<i>Phyllanthaceae</i>	<i>reticulatus</i>	<i>Phyllanthaceae</i>	-	-	+
<i>Psychotria</i>	<i>truncata</i>	Rubiaceae	-	+	-
<i>Scurulina</i>	<i>feruginea</i>	Rhamnaceae	-	-	+
<i>Scutia</i>	<i>myrtina</i>	Rhamnaceae	-	-	+
<i>Strobilanthes</i>	<i>callosa</i>	Acanthaceae	-	+	-
<i>Tephrosia</i>	<i>purpurea</i>	Fabaceae	+	-	-
<i>Trimpfeta</i>	<i>rhomboidea</i>	Tiliaceae	+	-	-
<i>Urena</i>	<i>lobata</i>	Malvaceae	+	-	-
<i>Zizyphus</i>	<i>oenoplea</i>	Rhamnaceae	-	-	+
<i>Zizyphus</i>	<i>rugosa</i>	Rhamnaceae	-	-	+

Table 3: Herbs of Bhavale, Kaas and Velneswar

Genus	Species	Family	Bhavale	Kaas	Veneswar
<i>Achyranthes</i>	<i>aspera</i>	Amaranthaceae	+	-	-
<i>Adelocaryum</i>	<i>coelestinum</i>	Begoniaceae	-	+	-
<i>Adelocaryum</i>	<i>malabaricum</i>	Boraginaceae	-	+	-
<i>Adenoon</i>	<i>indicum</i>	Asteraceae	-	+	-
<i>Adhathoda</i>	<i>zeylanica</i>	Acanthaceae	-	-	+
<i>Aerides</i>	<i>crispa</i>	Orchideaceae	-	+	-
<i>Aerides</i>	<i>maculosa</i> Lindl	Orchideaceae	-	+	-
<i>Amaranthus</i>	<i>viridis</i>	Amaranthaceae	+	-	-
<i>Ammania</i>	<i>baccifera</i>	Lythraceae	+	-	-
<i>Argyria</i>	<i>strigosa</i>	Convolvulaceae	-	-	+
<i>Arisaema</i>	<i>caudatum</i>	Araceae	-	+	-
<i>Arisaema</i>	<i>ghaticum</i>	Araceae	-	+	-
<i>Arisaema</i>	<i>murrayi</i>	Araceae	-	+	-
<i>Barleria</i>	<i>gibsoni</i>	Acanthaceae	-	+	-
<i>Begonia</i>	<i>crenata</i>	Begoniaceae	-	+	-
<i>Bulbophyllum</i>	<i>fimbriatum</i>	Orchideaceae	-	+	-
<i>Canscora</i>	<i>diffusa</i>	Gentianaceae	+	-	-
<i>Cassia</i>	<i>tora</i>	Caesalpiniae	+	-	-
<i>Celosia</i>	<i>argentea</i>	Amaranthaceae	+	-	-
<i>Ceropegia</i>	<i>lawii</i>	Asclepiadaceae	-	-	+
<i>Cleome</i>	<i>chelidonii</i>	Capparidaceae	+	-	-
<i>Cleome</i>	<i>viscose</i>	Capparidaceae	+	-	-
<i>Colebrookia</i>	<i>oppositefolia</i>	Lamiaceae	-	-	+
<i>Commelina</i>	<i>benghalensis</i>	Commelinaceae	+	-	-
<i>Corchoru</i>	<i>capsularis</i>	Tiliaceae	+	-	-
<i>Crinum</i>	<i>brachynona</i>	Amaryllidaceae	-	+	-
<i>Crotolaria</i>	<i>pumila</i>	Fabaceae	-	-	+
<i>Cyanotis</i>	<i>fasciculata</i>	Commelinaceae	-	-	+
<i>Delphinium</i>	<i>malabaricum</i>	Ranunculaceae	-	+	-
<i>Dendrobium</i>	<i>microbulbon</i>	Orchideaceae	-	-	+
<i>Drosera</i>	<i>indica</i>	Droseraceae	+	-	+
<i>Ensete</i>	<i>superbum</i>	Musaceae	-	+	-
<i>Eriocaulon</i>	<i>sedgewickii</i>	Ericaulaceae	-	-	+
<i>Eupatorium</i>	<i>spp.</i>	Asteraceae	+	-	-
<i>Euphorbia</i>	<i>hirta</i>	Euphorbiaceae	+	-	-
<i>Euphorbia</i>	<i>panchganiensis</i>	Euphorbiaceae	-	+	-
<i>Exacum</i>	<i>pumillum</i>	Gentianaceae	+	-	-
<i>Exacum</i>	<i>lawii</i>	Gentianaceae	-	+	-
<i>Exacum</i>	<i>pumilum</i>	Gentianaceae	-	+	-
<i>Flemingia</i>	<i>nilgheriensis</i>	Leguminosae	-	+	-
<i>Gloriosa</i>	<i>superba</i>	Liliaceae	+	+	+
<i>Haplanthodes</i>	<i>verticillatus</i>	Acanthaceae	-	+	-
<i>Heracleum</i>	<i>grande</i>	Apiaceae	-	+	-
<i>Impatiens</i>	<i>balsaminae</i>	Balsaminaceae	+	+	-
<i>Impatiens</i>	<i>dalzellii</i>	Balsaminaceae	-	+	-

<i>Impatiens</i>	<i>dalzellii</i>	Balsaminaceae	-	+	-
<i>Impatiens</i>	<i>lawii</i>	Balsaminaceae	-	+	-
<i>Impatiens</i>	<i>minor</i>	Balsaminaceae	-	+	-
<i>Impatiens</i>	<i>oppositifolia</i>	Balsaminaceae	-	+	-
<i>Impatiens</i>	<i>pulcherrima</i>	Balsaminaceae	-	+	-
<i>Impatiens</i>	<i>tomentosa</i>	Balsaminaceae	-	+	-
<i>Justicia</i>	<i>trinervia</i>	Acanthaceae	-	+	-
<i>Kalanchoe</i>	<i>olivacea</i>	Crassulaceae	-	+	-
<i>Lepidagathis</i>	<i>lutea</i>	Acanthaceae	-	-	+
<i>Leucas</i>	<i>ciliate</i>	Lamiaceae	-	-	+
<i>Martynia</i>	<i>annua</i>	Pedaliaceae	+	-	-
<i>Murdania</i>	<i>simplex</i>	Commelinaceae	-	-	+
<i>Murdannia</i>	<i>wightii</i>	Commelinaceae	+	-	-
<i>Murdannia</i>	<i>lanuginosa</i>	Commelinaceae	-	+	-
<i>Murdannia</i>	<i>vaginata</i>	Commelinaceae	-	+	-
<i>Murdannia</i>	<i>versicolor</i>	Commelinaceae	-	+	-
<i>Neanotis</i>	<i>lancifolia</i>	Rubiaceae	+	+	-
<i>Neanotis</i>	<i>subtilis</i>	Rubiaceae	-	+	-
<i>Neuracanthus</i>	<i>sphaerostachyus</i>	Acanthaceae	-	+	-
<i>Pimpinella</i>	<i>wallichiana</i>	Apiaceae	-	+	-
<i>Pinda</i>	<i>concanensis</i>	Apiaceae	-	+	-
<i>Plectranthus</i>	<i>mollis</i>	Lamiaceae	-	+	+
<i>Pogostemon</i>	<i>spp.</i>	Acanthaceae	-	-	+
<i>Polygonum</i>	<i>glabrum</i>	Polygonaceae	-	-	+
<i>Pseuderanthemum</i>	<i>malabaricum</i>	Acanthaceae	-	+	-
<i>Ramphicarpa</i>	<i>longifolia</i>	Scrophulariaceae	+	-	-
<i>Rotala</i>	<i>fimbriata</i>	Lythraceae	-	+	-
<i>Rungia</i>	<i>pectinata</i>	Acanthaceae	-	-	+
<i>Senecio</i>	<i>edgeworthi</i>	Asteraceae	-	-	+
<i>Senecio</i>	<i>arachnoidea</i>	Asteraceae	-	+	-
<i>Sesamum</i>	<i>orientale</i>	Pedaliaceae	+	-	-
<i>Smithia</i>	<i>sensitiva</i>	Fabaceae	+	+	+
<i>Smithia</i>	<i>bigemina</i>	Fabaceae	-	+	+
<i>Smithia</i>	<i>agharkarii</i>	Fabaceae	-	+	-
<i>Smithia</i>	<i>hirsute</i>	Fabaceae	-	+	-
<i>Smithia</i>	<i>salsuginea</i>	Fabaceae	-	+	-
<i>Smithia</i>	<i>setulosa</i>	Fabaceae	-	+	-
<i>Sonchus</i>	<i>oleraceus</i>	Asteraceae	-	-	+
<i>Spermacoce</i>	<i>pusilla</i>	Rubiaceae	+	-	-
<i>Striga</i>	<i>gesnerioides</i>	Scrophulariaceae	-	-	+
<i>Swertia</i>	<i>densifolia</i>	Gentianaceae	-	+	-
<i>Trichodesma</i>	<i>indica</i>	Boraginaceae	+	-	-
<i>Tricholepis</i>	<i>glaberrima</i>	Asteraceae	-	-	+
<i>Utricularia</i>	<i>reticulate</i>	Lentibulariaceae	-	-	+
<i>Utricularia</i>	<i>praeterita</i>	Lentibulariaceae	-	+	-
<i>Utricularia</i>	<i>purpurascens</i>	Lentibulariaceae	-	+	-
<i>Utricularia</i>	<i>albo-caerulea</i>	Lentibulariaceae	-	+	-

Table 4: List of Climbers of Bhavale, Kaas and Velneshwar

Genus	Species	Family	Bhavale	Kaas	Velneshwar
Amicratea	grahamii	Celastraceae	-	+	-
Canavalia	lineate	Leguminosae	+	-	-
Ceropegia	jainii	Apocynaceae	-	+	-
Ceropegia	vincaefolia	Apocynaceae	-	+	-
Cissampelos	pareiera	Menispermaceae	-	-	-
Ipomoea	pes tigris	Convolvulaceae	+	-	-
Mucuna	pruriens	Leguminosae	+	-	-
Piper	trichostachyon	Piperaceae	-	+	-
Trichosanthes	cucumerina	Cucurbitaceae	+	-	-
Vigna	capensis	Fabaceae	+	-	-

The trees and shrubs of Velneshwar and Bhavale were the prominent flora during the pre-monsoon period with very scanty under growth vegetation. The monsoon season showed an immense change in the floral landscape which was dominated by season herbs and grasses.

The tree species of Velneshwar mainly belonged to the Moraceae family. The plant species of this family are adaptable to the conditions of heavy rainfall during the monsoons and a dry season for the remaining part of the year. Bhavale flora mainly consisted of tree species belonging to the families Fabaceae, Verbenaceae and Bignoniaceae.

The shrubs in Velneshwar were dominated by species of the family Rhamnaceae while Bhavale was dominated by the species of the family Malvaceae.

The monsoon flora mainly consisted of herbs and grasses. Maximum species of herbs in Velneshwar belong to family Acanthaceae while that in Bhavale belong to the family Amaranthaceae. The difference in flora is mainly seen due to the difference in altitude of both the plateaus and their respective proximities from the sea.

Also during monsoon insectivorous plants like *Drosera indica* and *Utricularia reticulate* were seen in Velneshwar and Kaas while no insectivorous plants were seen at Bhavale. The flora of Bhavale and Velneshwar when compared to that of Kaas it was seen that plant population at Velneshwar is parallel to Kaas floral population.

Very few plants species at Bhavale are observed to be similar to Kaas flora. The flora of Kaas is dominated by seasonal herbs of family Acanthaceae, Balsaminaceae and

Fabaceae. The plant species commonly observed in Velneshwar and Kaas were *Impatiens* spp., *Smithia* spp. and *Utricularia* spp. whereas those common to Kaas and Bhavale were *Smithia* spp. and *Murdannia* spp.

The similarities in flora of Velneshwar and Kaas were mainly due to the presence of a rocky substratum whereas Bhavale exhibits a hilly terrain. Kaas landscape is more supportive to herbs because of lesser density of shrubs and trees. Hariyali has carried out dense afforestation in Bhavale facilitating tree growth. Also the rainfall in Kaas and Velneshwar is much higher than that in Bhavale which impacts the growth of monsoon herbs.

38 endangered species are listed from Kaas, 4 from Velneshwar but none are found in Bhavale as Bhavale is basically a barren hillock undertaken for plantation.

Flora of Kaas is becoming endangered mainly due to the anthropogenic activities like tourism and other human interferences. Velneshwar on the other hand is being slowly developed for industrial and infrastructural facilities which will eventually have a direct impact on the ecosystem of the place. Bhavale is already under reforestation. Maximum numbers of endemics (41) were reported from Kaas (Satara). The family Poaceae has largest number of endemic species (22 species), followed by Fabaceae with 5 species and Apiaceae, Apocynaceae and Asteraceae with 4 species each. (Lekhak and Yadav, 2012). 4 from Velneshwar and none from Bhavale are endemic. The endemic ecosystem of Kaas has already been declared as under threat and needs utmost protection but the same threat should be averted in Velneshwar. Endemic species exhibit very less diversity so the natural rate of conservation is very slow thereby

stressing the need of conservation *in-situ*.

Plant communities at plateau regions are edaphically controlled and show an adaptation for water accumulation, such as succulence and poikilohydry, carnivory in response to the lack of nutrients (N, P and S) in the soil and the presence of subterranean organs (bulbs, corms, tubers and rhizomes) to overcome extreme temperature during summer.

Harsh environmental conditions on the plateaus have given rise to plants with certain traits that allow them to overcome environmental adversities. These traits help the plants to overcome major environmental stresses such as drought, high temperature and light intensities and nutrient deficiency. A detailed account on the adaptation/ecophysiology of vascular plants of rock outcrops is provided by Kluge and Brulfert (2000). Some well-known adaptive traits that have been observed in the vascular plants on plateaus are mentioned below (modified after Biedinger *et al.*, 2000).

Carnivory: It is a means to overcome the scarcity of soil nutrients. Carnivorous plants are extremely calcifuge and need acidic and wet soils (Kluge and Brulfert, 2000). This kind of microhabitat is provided by plateaus. *Drosera burmannii*, *D. indica*, *Utricularia* species are the common carnivores on the plateaus. These species comprise ephemeral vegetation where soil deposition is negligible.

Soil varied from sandy to sandy loam type with good water holding capacity and normal EC. It was highly acidic (4.5–6), rich in organic carbon, available nitrogen and available potassium. Lekhak and Yadav (2012) relate the presence of carnivorous plants on the plateau to the poor nitrogen, phosphorous and potassium (N,P,K) values. However, the soil is poor only in available phosphorus. In addition to the carnivorous plants, many other plant species are able to survive in the habitat. Hence, the abundance of carnivorous species on rocky plateaus might be mainly because of reduced competition from other generalist species as a result of harsh physical environment, acidic soils and low levels of available phosphates. Presence and dominance of other plant adaptive strategies such as poikilohydry, geophytic, therophytic, hydrophytic species seen on rocky plateaus (Watve 2007, 2010; Lekhak & Yadav 2012) is also a result of extreme seasonality in climate. (Watve, 2013)

Conclusion

The study shows that there is similarity in the flora of Kaas and Velneshwar while Bhavale shows totally different floral pattern. The plateau of Kaas is already declared a UNESCO World Heritage Site and major conservation projects are already underway there. Bhavale has been adopted by the NGO Hariyali for afforestation however through this study an attempt is made to document the flora

of Velneshwar and state its ecological significance. The study also aims to emphasize the ecological importance of the three plateaus and the need for their flora to conserve so as to study the environmental relationships between the various strata of life and the inter dependence of abiotic and biotic factors of nature.

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References

- Awati, A. (2011) A Geographical Study of Wild Flowers on Kas Plateau (Satara District), International Referred Research Journal, July, ISSN- 0974-2832 RNI-RAJBIL 2009/29954. Vol. III *ISSUE-30
- Bhattarai, U, Tetali, P and Kelso, S. (2012), Contributions of vulnerable hydrogeomorphic habitats to endemic plant diversity on the Kas Plateau, Western Ghats, SpringerPlus 2012, 1:25.
- Bagawan, S.A and Kore, B. A. (2012); Liverworts and Hornworts of Kaas Plateau, The Bioscan 7(2) : 289-290, 2012.
- Chaoji, A. Kaas Flowering Plateau A case for conservation, <http://www.ecologics.in/articles/Kaas%20flowering%20plateau.pdf>.
- Watve, A. (2013) Status review of rocky plateaus in the Northwestern ghats and Kokan region of Maharashtra, India with recommendations for conservation and management.
- Lekhak MM and Yadav SR (2012). Herbaceous vegetation of threatened high altitude lateritic plateau ecosystems of Western Ghats, southwestern Maharashtra, India. *Rheedea*, 22 (1): 39-61.
- Douglas Stone R. (1998). Inventory of sensitive species and ecosystem in Utah: endemic and rare plants in Utah: an overview of their distribution and status. <http://dwrccdc.nr.utah.gov/ucdc/viewreports/plantrpt.htm>
- Rawat, G.S. (Ed.). (2008). Special Habitats and Threatened Plants of India. ENVIS Bulletin: Wildlife and Protected Areas, Vol. 11(1). Wildlife Institute of India, Dehradun, India. pp. 239.
- Kumar P. and G.S. Rawat. (2008) Chota nagpur Plateau: Relict Habitats and Endemic Plants. pp. 167-173.