BIOLOGICAL SPECTRUM OF THE FLORA OF GUJARAT STATE

G. L. SHAH, S. S. YADAV AND A. H. MENON
Sardar Patel University, Vallabh Vidyanagar

INTRODUCTION

The description of the vegetation of an area, based on visual observations, is found in research papers dealing with the florISTICS. However, a simpler but meaningful system of vegetation description on a physiognomic basis is the life form system first proposed by Humboldt (1805) and subsequently by a number of workers (Grisebach, 1884; Kraus, 1901; Deude, 1897; Pound and Clements, 1908; Warming, 1909 etc.). Raunkiaer's (1934) system is based on the principle of protection of buds during unfavourable seasons. It is most compact, consistent and widely used as such or with a few modifications (Braun-Blanquet, 1932; Cain, 1950; Danseran, 1951, 1957; Phillips, 1956; Kershaw, 1973; Muller-Dombois & Ellenberg, 1974). Raunkiaer (1934) worked out the life form spectrum or biological spectrum of the entire phanerogamic flora of the world which is known as the normal spectrum. According to him, the plant climate of a region is characterised by the life form(s) which in the biological spectrum of the region exceed the percentage of the same life form(s) in the normal spectrum.

Biological spectra have been worked out for the flora of restricted localities in India by Ferreira (1940), Bharucha & Ferreira (1941a, 1941b), Bharucha & Dave (1944) Das & Sarup (1951), Sarup (1952), Lakshmanan (1962), Meher-Homji (1962, 1964), Trivodi & Sharma (1953), Rao (1968) and Agarwal (1975). For Gujarat, Borgesen (1929) studied the vegetation of Dwarka in Saurashtra with reference to Raunkiaer's life forms. This work is followed by an account of the biological spectrum of the vegetation of Bhavnagar also in Saurashtra (Murthy, 1957) and Dangs (Shah & Yadav, 1979). But this information is meagre because no data of this type are available for many forest divisions of Gujarat and the State of Gujarat as a whole. An attempt is now made to present a comparative account on the biological spectra of different forest divisions as well as the whole State of Gujarat as an adjunct to the FLORA OF GUJARAT (Shah, 1978). The biological spectrum of Gujarat is also compared with the biological spectra of Madhya Pradesh, Rajasthan, Mount Abu, Bombay and Mahabaleshwar.

The biological spectra, where data are not available, are carefully worked out from the published literature on floristics for Madhya Pradesh (Miwat, 1956; Maheshwari, 1960; Rao & Sastry, 1964; Panigrahi et al., 1965, 1966a, 1966b, 1967; Ramal & Panigrahi, 1967; Sankaran, 1967a, 1967b; Shukla & Panigrahi, 1967; Agarkar, 1969; Kandik, 1969; Saxena, 1970; Saxena & Shukla, 1970), for Rajasthan (Jain & Kotwal, 1960; Puri et al., 1964; Verma et al., 1935; Dhillon & Bajwa, 1969) and Sal-
sette Island (Malad-Madhi area), Bombay (Shah, 1901). A detailed account of the edaphic and climatic conditions of Gujarat is given by Shah (1978) and hence omitted here.

**OBSERVATIONS**

A comparison of the biological spectra of different forest divisions of Gujarat reveals that of all the life forms, therophytes constitute the highest percentage which in turn is relatively much higher than their percentage in the normal spectrum. Among the forest divisions, Northern Gujarat has the highest percentage followed by that in Pavagadh. In other forest divisions their percentage are 30.2-39.2.

The phanerophytes (meso-, micro-, and nano-) become next abundant life form in Panchmahals, Chhotaudepur, Pavagadh, Rajpipla, Dangs, Bulsar and Dharapur (23.1-29.77%), the highest and the lowest percentage in Dangs and Pavagadh making up 29.77% and 17% respectively against 43% in the normal spectrum.

The mesophanerophytes are relatively more than the microphanerophytes except in Saurashtra, North Gujarat and Panchmahals where the converse is true. The nanophanerophytes are almost equal or slightly more than the mesophanerophytes in Rajpipla, Dangs, Bulsar and Dharapur.

On the other hand the chamaephytes become the next abundant life form in Saurashtra and North Gujarat. The phanerophytes are relatively less in these divisions because of unfavourable climatic conditions like longer periods of dry months, relatively less annual rainfall and therefore, less humidity and also, in general, absence of dense forests over most of these divisions.

As compared to the normal spectrum, the hydrophytes are better represented in all forest divisions. Their occurrence in variable proportion depends on the abundance of puddles, ditches, ponds and river beds. Their lowest percentage (0.41%) in Pavagadh seems to be due to lack of puddles and ditches and only 3 to 4 ponds.

The geophytes are fairly represented in the areas studied except Saurashtra, North Gujarat, Pavagadh and Chhotaudepur. The higher percentage of geophytes at Bulsar (6.43%) as against the normal spectrum (4%) may be due to slightly more humid and warm conditions as compared to other regions and also due to loose, fertile upper soil horizon which favours the development of the rhizome geophytes, while considerable shading of leaves hinders the growth of therophytes as in hilly regions (Braun-Blanquet, 1932).

The epiphytes, succulents and parasites are poorly represented in all divisions and even their aggregate percentage is lower than that in the normal spectrum. However, the lianas are more than ten percent in all regions except North Gujarat, the highest percentage being at Rajpipla.

The hemicyrтопhytes are much less in all forest divisions than those in normal spectrum but among the forest divisions of Gujarat the highest percentage is in Panchmahals followed by Rajpipla.

Thus the phytoclimatic is chamae-thermophitic in Saurashtra and North Gujarat, mesophanero-chamae-thermophytic in Panchmahals, Pavagadh, Rajpipla and Bulsar and mesophanero-

nerotherophyitic in Chhotaudepur, Dangs and Dharampur.

Gujarat State has on the whole a chamato-
therophytic plant climate. A comparison of
this biological spectrum with those of the ad-
jacent States, shows that Rajasthan and
Madhya Pradesh also have similar plant cli-
mates, but it is variable for some parts in
Maharashtra State, chamaetherophytes in Sal-
sette Island (Mahad-Madh area)—Bombay and
phanerophytic-therophytic in Vihar lake—Bom-
bay but only phanerophytic in Mahabaleshwar.

DISCUSSION

From the above data it is evident that the
dominant life form is therophytes indicating a
warm dry climate (Daoseram, 1951, 1957).
According to Pandey (1961, 1964) and Pan-
deya et al. (1968) their higher percentage indi-
cates a pronounced biotic or anthropogenic in-
fluence which maintains the vegetation open
for further invasion of annuals with a result
that a good phanerophytic flora may be very
much reduced in course of time. Bcadle (1951)
and Agarwal (1975) concluded that in such
affected areas the phytoclimates is not likely to
give a correct indication of the vegetation. A
similar conclusion is also drawn by Meher-
Homji & Misra (1973) while discussing the bi-
ological spectra of Mount Abu, Bombay (Vihar
lake), Allahabad and Karamna (Varanasi Dis-
trict). One of us (Shah, 1961) who has studied
the flora and vegetation of Salsette Island—
Bombay has also made similar observations.

In the eastern and south-eastern forest
divisions of Gujarat, though the indiscriminate
cutting of trees, overgrazing of herbaceous
vegetation and seedlings of tree and shrub
species, fair season or permanent road cons-
tructions and shifting cultivation have affected
the vegetation, the phanerophytes are next
abundant life forms. This may suggest that
the biotic interference is not too intense and
the favourable climate especially the rainfall
accompanied by relatively more humidity and
less temperatures during summer months pre-
vails as yet (see also Meher-Homji & Misra,
1973).

Meher-Homji & Misra (1973), have traced
the gradual evolution of the biological spectrum
from therophytic of the desert with extreme
aridity to the phanerophytic of the humid trop-
cies. Our data also indicate a change in
phytoclimates from chamae-therophytes in
semi-arid regions of Saurashtra and North
Gujarat to the mesophaner-therophytic of
humid regions of Dharampur and Dangs with
mesophanero-chamae therophytic as an inter-
mediate phytoclimates in Panchmahals, Pava-
gadh and Rajpipla forest divisions.

An uniform type of phytoclimates in Rajas-
than, Gujarat and Madhya Pradesh indicates
the dominant semi-arid conditions in these
States. In Maharashtra a similar climate does
prevail in drier parts (e.g. Pune) but in hilly
regions which are more humid, it is phanero-
phytic. There seems to be a change from
mesophaner-therophytic phytoclimates in sou-
thern hilly parts of Gujarat to phaner-therophy-
tic and phanerophytic phytoclimates in hilly
parts of Maharashtra (e.g. Mahabaleshwar,
Vihar). But there exists a gap in the informa-
tion about the phytoclimates in the regions be-
tween the southern most limits of Gujarat and
Bombay in Maharashtra. This lacuna can be
bridged up by the floristic studies of the un-
exploried areas.
REFERENCES


— Ecological map of the Sagar Madhya Pradesh-II. Composition of the fenced grassland association. II B—Composition of the associations
open to grazing or occupying special habitat.

PANIGRAHI, G. AND R. PRADHAN. Contribution to the
botany of Madhya Pradesh-IV (The families
Euphorbiaceae and Urticaceae). Ibid. 38 : 555-564.
1969.

AND A. N. SINGH. Contribution to the botany
of Madhya Pradesh-V. The family Leguminosae.

AND D. M. VERMA. Contribution to the botany
of Madhya Pradesh-III. (The families Ebenaceae

C. M. ARORA, D. M. VERMA AND V. N. SINGH.
Contribution to the botany of Madhya Pradesh-I
(Dilleniaceae in Moringaceae). Bull. bot. Surv.
India 8 : 117-128. 1966.

PHUKET, R. AND F. E. CLEMENTS. The Phytogeography
of Nebraska. Lincoln. 1968.

PURN G. S. S. K. JAIN, S. K. MUKHERJEE, S. SARIY
AND N. N. KOTWAL. Flora of Rajasthan. Rec.

RAMAL AND G. PANIGRAHI. Contribution to the
botany of Madhya Pradesh VI (Compositae in
1967.

RAO, A. S. AND A. R. K. SASTRY. An account of the
flowering plants of Indore District in Madhya
Pradesh. Ibid. 8 : 267-286. 1964.

RAO, C. C. Biological spectrum of Karamasu wate-

RAJAGIRI, C. The Life-forms of Plants and Statisti-
cal Plant Geography. London. 1934.

SANKARAN, K. Studies on the vegetation of ponds,
swamps and river banks in Raipur. Madhya
102. 1967a.

— Composition of Raipur and its surroundings
338. 1967b.

SARAF, S. The biological spectrum of the flora of

SAXENA, H. O. The flora of Amarkantak (Madhya

AND S. G. SHUKLA. On a collection of plants

SHARMA, G. L. The Flora of Gujarat State. Vallabh
Vidyanagar. 1978.

AND S. S. YADAV. A contribution to the flora of
Dangs forest in Gujarat. Floristics, floristic
composition and biological spectrum Indian

SHUKLA, H. AND G. PANIGRAHI. Contribution to the
botany of Madhya Pradesh VII. (Graminse,
excluding Bambuseae). Bull. bot. Surv. India 9 :

SHIVASTAVA, G. D. The biological spectrum of the
Allahabad flora. Jour. Indian bot. Soc. 23(1) :
1-7. 1944.

TIWARI, S. D. N. AND J. K. MAHESHWARI. The Cy-pereaceae of Madhya Pradesh-I. Indian Forerster 90 :
147-158. 1964a.

AND ——. The Cyperaceae of Madhya Pradesh-II.
 Ibid. 90 : 616-629. 1964b.

TRIVEDI, B. S. AND P. G. SHARMA. Biological spectrum of
Lucknow flora. Proc. nat. Acad. Sci. India 35 :

VERMA, D. M.; R. M. WADHWA AND O. P. MISRA. Some
additions to the flora of Rajasthan. Ibid. 35 :

WARMING, E. Geology of Plants. An Introduction to
the Study of Plant Communities. London. 1906.