PHYTOGEOGRAPHIC CONSIDERATIONS

The area surveyed is primarily a deciduous forest with the plains or even the low hills supporting various degraded stages of it. Vast areas on the plains have been brought under the plough. (For a full account of the different vegetation types, please refer pages 16 - 46).

In the present chapter, a phytogeographical analysis of the flora has been attempted with a view to studying the composition of the flora from the view point of its origin. Realising the effect of biotic factors on the development of various vegetational types and consequently on the floristic elements present in them, the present analysis is compared with those of Pavagadh and Ratanmahal, which have comparatively less biotic interference.

The affinities of the flora of the area with those of adjoining areas have been briefly discussed.

It is also suggested that the Kawant Range forests as also the other forests all along the eastern boundary of Gujarat state provide a meeting ground for the various Indian elements.

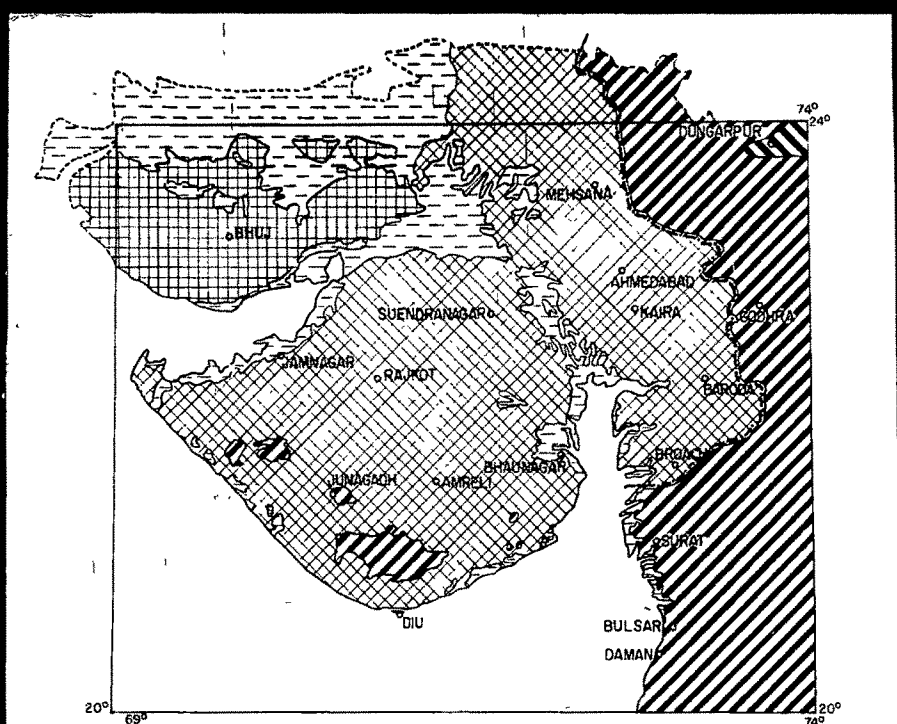
The Drude's (1890, 1913) line demarcating the "Indo-Malayan" flora (eastern element) and the "Perso-Arabian" flora (western element) passes through the gulf of Cambay

northwards along the Aravalli ranges in north Gujarat and Rajasthan. There are serious differences of opinion regarding the placing of the line in the Rajasthan, and some workers (Nair & Kanodia, 1959; Vyas, 1964, 1967) have suggested that the line be shifted eastwards even beyond the limits of Rajasthan. Meher-Homji (1970) on the basis of his analysis of floristic elements of the principal vegetation types of north Gujarat and Rajasthan concludes that the forests of Teak or of miscellaneous species located on the hills show a preponderance of Indo-Malayan elements; while in the thickets or scattered scruby vegetation composed of xerophytic species met with in the sandy alluvial plains of north Gujarat and Rajasthan, the western element is conspicuous. This demarcation in general, corresponds with that of Drude (Map 2). It is, therefore, natural to expect a predominance of eastern element in the forests (including the area surveyed here) located all along the hilly, eastern border of Gujarat state.

The eastern element includes the E. Indian, Indo-Malayan and Australian elements. Following are a few important examples .

Eastern element

E. Indian : *Tamarix ericoides*, *Abelmoschus*



Map ✱ Potential vegetation types of north Gujarat and Southern Rajasthan (after GAUSSEN, LEGRIS, MEHER-HOMJI, 1968, slightly modified).

Map - 2.

Demarcation line between western elements and Indo-Malayan-Indian elements as given by vegetation types.(after Meher-Homji, 1970).

manihot, Eriolaena hookeriana, Ailanthes excelsa, Boswellia serrata, Ventilago denticulata, Leea macrophylla, L. edgeworthii, Lannea coromendelica, Indigofera glandulosa, Eleiotis monophylla, Schrebera swietenioides and Murdannia fasciculata.

Indo-Malayan : Miliusa tomentosa, Tinospora cordifolia, Cadaba fruticosa, Capparis grandis, Bombax ceiba, Sterculia urens, Helicteres isora, Celastrus paniculata, Cassine glauca, Butea monosperma, Dichrostachys cinerea, Bauhinia racemosa, Cassia fistula, Hymenodictyon excelsum, Wrightia tinctorea, Holarrhena antidysenterica, Tectona grandis, Bridelia squamosa, Mallotus philippensis, Holoptelea integrifolia, Arthraxon lancifolius and Coix larcyma-jobi.

Australian : Polygala chinensis, Polycarpaea corymbosa, Hibiscus panduraeformis, H. vitifolius, Crotalaria juncea,

Physalis minima and *Apluda mutica*.

The western element includes the Indus plain element, the Saharo-Sindian, the Sudano-Rajasthanian, Tropical and North African and the Mediterranean elements. Following are a few important examples.

Western element

Indus plain : *Maerua oblongifolia*, *Hibiscus hirtus* var. *talbotii*, *Buchanania lanzan*, *Crotalaria pusilla*, *Prosopis cineraria*, *Pulicaria angustifolia* and *Cenchrus biflorus*.

Saharo-Sindian : *Grewia daemine*, *Zizyphus nummularia*, *Indigofera tinctorea*, *Colocynthis citrullus*, *Cenchrus pennisetiformis* and *Sporobolus marginatus*.

Sudano-Rajasthanian : *Capparis decidua*, *Acacia nilotica* ssp. *indica*, *Salvadora persica*, *Convolvulus microphyllus*, *Desmostachya bipinnata* and *Cymbopogon jwarancusa*.

Tropical and North African : *Ranunculus sceleratus*,

Argemone mexicana, Cleome monophylla, Bergia odorata, Hibiscus ovalifolius, H. lobatus, Crotalaria calycina, Vahlia digyna, Blastania fimbristipula, Aristolochia bracteolata, Cymbopogon martinii and Themeda quadrivalvis.

Mediterranean : Cocculus hirsutus, Polygala erioptera, Corchorus trilocularis, Indigofera cordifolia, Alhagi pseudalhagi, Leucas urticaefolia and Cenchrus ciliaris.

The General element : Cleome gynandra, C. viscosa, Sida alba, Waltheria indica, Corchorus fascicularis, Triumfetta rhomboidea, Tephrosia hirta, Crotalaria retusa, Cassia tora, Gnaphalium indicum, Enicostema hyssopifolium, Heliotropium ovalifolium, Justicia diffusa, Polygonum plebeium, Urginea indica, Commelina diffusa, Cyperus difformis, Cynodon dactylon, Eragrostis ciliaris and Hackelochloa granularis.

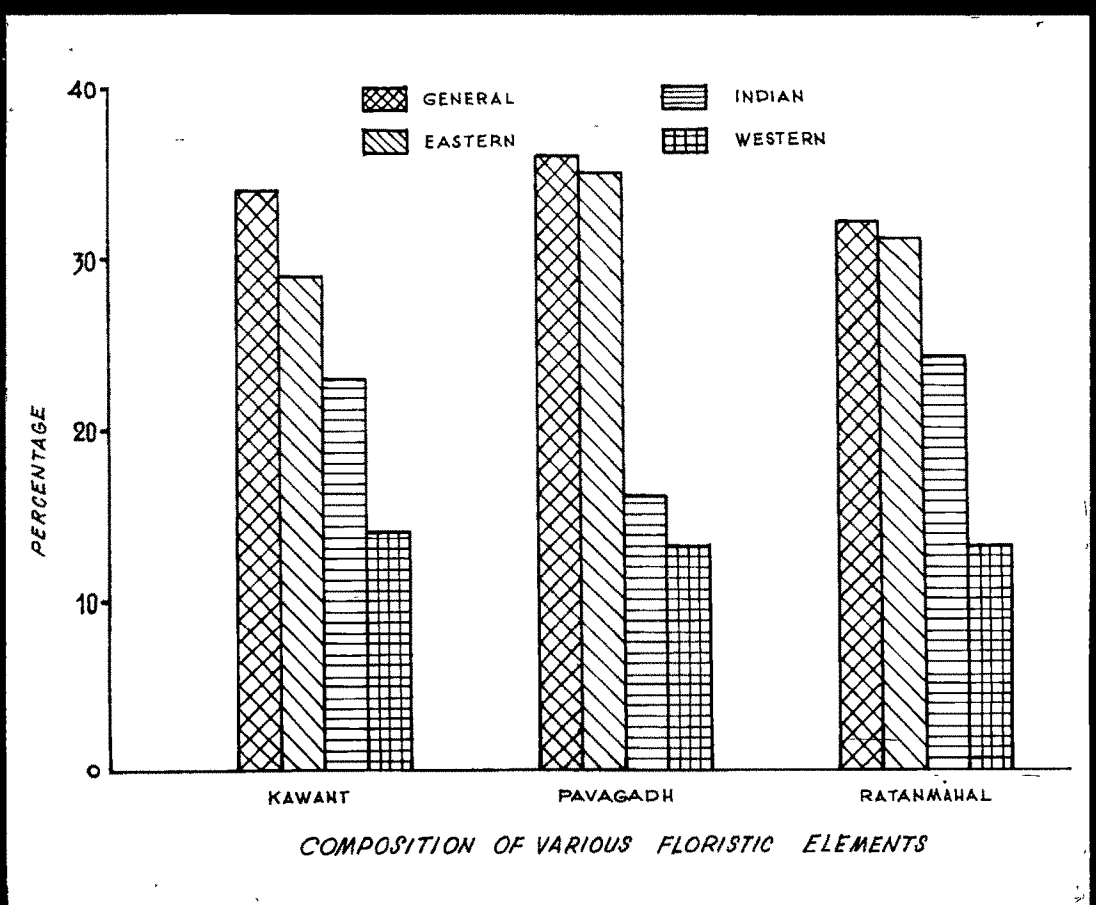
Table - 5.

Comparison of the various floristic elements in the hilly forests and the surrounding plains

Name of the Forest	Eastern element		Western element		General element		Indian element		Total	
	Plains	Forests	Plains	Forests	Plains	Forests	Plains	Forests	Plains	Forests
Kawant	76 + 107 (29%)		63 + 29 (14%)		135 + 76 (34%)		66 + 76 (23%)		340	288
Pavagadh	53 + 116 (35%)		47 + 24 (13%)		101 + 85 (36%)		36 + 46 (16%)		237	271
Ratanmahal	63 + 118 (31%)		54 + 25 (13%)		143 + 50 (32%)		62 + 80 (24%)		322	273

Indian element :Triumfetta rotundifolia, Soymida febrifuga, Zizyphus xylopyra, Ampelocissus latifolia, Crotalaria mysorensis, Dalbergia sissoo, Goniogyna hirta, Rhynchosia capitata, Caesalpinia crista, Trachyspermum stictocarpum var. stictocarpum, Adina cordifolia, Hemidesmus indicus, Tylophora fasciculata, Sopubia delphinifolia, Lepidagathis cuspidata and Spodiopogon rhizophorus.

It has been observed (Meher-Homji 1970; Sabnis & Bhatt 1973) that the chief factor in most places interfering with natural development of vegetation is the biotic influence and this biotic influence facilitates the entry and spread of western elements comprising the various xerophytic species. The composition of the floristic elements shown in table - 5, clearly reveals the dominance of eastern element over the western element. However, the ratio of eastern to western element for the flora of Kawant Range forest is nearly 2 : 1, while it 2.7 : 1 and 2.4 : 1 for Pavagadh and Ratanmahal. The percentage of general element is more or less same in all the areas. These facts go to prove the extent of biotic interference, which is evidently more in the Kawant Range forests. (Graph 2).


GENERAL
EASTERN
INDIAN
WESTERN
40
30
20
10
0
PERCENTAGE
KAWANT
PAVAGADH
RATANMAHAL
COMPOSITION OF VARIOUS FLORISTIC ELEMENTS

Graph - 2.

Table - 6.

Comparison of Kawant flora with some adjoining floras

Floras	Total no. of species	No. of sp. common with Kawant flora	* Affinity percentage
Khandala	1124	356	46.2
Dangs	698	348	45.4
Rajpipla	474	330	42.9
Pavagadh	563	369	47.8
Ratanmahal	645	447	58.2
Mt. Abu	485	264	34.4
Saurashtra	1074	412	53.7

$$* \text{ Affinity percentage} = \frac{\text{No. of Kawant plants, common with other flora}}{\text{Total no. of Kawant plants}} \times 100$$

Relationship with adjoining floras (Table - 6)

Comparison with Khandala Ghats

The chain of hill ranges of the Western Ghats is an

important topographical unit in western India. The flora of Khandala on Western Ghats has been intensively studied by Santapau (1960). Although the altitude and rainfall of Khandala are much higher than those of Kawant range, there is a fair resemblance in their floras, the affinity percentage being 46.2.

Some of the plants which occur in the Western Ghats and have their northern limit in Mt. Abu, are also located here. Such plants are Atylosia sericea, Centratherum phyllolaenum, Eranthemum roseum, Carvia callosa, Nepeta bombaiensis, Aerides crispum etc. Other plants common to Kawant and Khandala are Impatiens balsamina, Cassine glauca, Ventilago denticulata, Leea edgeworthii, Schleichera oleosa, Butea parviflora, Pueraria tuberosa, Acacia pennata, Rotala serpyllifolia, Trachyspermum stictocarpum var. stictocarpum, Pimpinella heyneana, Wahlenbergia marginata, Tylophora fasciculata, Cynoctonum mitreola, Rotula aquatica, Barleria prattensis, Radermachera xylocarpa and many others.

Comparison with Dangs

The Dangs forests are situated in the southern parts of Gujarat, the flora of which has been worked out by Santapau (1955), Jain (1963), Santapau and Shah (1965) and Shah and Suryanarayana (1967, 1969). Although the rainfall

in Dangs is almost double that of Kawant range, the affinity percentage of their floras comes to 45.4. The noteworthy plants which are common to these areas are Miliusa tomentosa, Polygala chinensis, Hibiscus hirtus, Triumfetta pentandra, Alysicarpus bupleurifolius, Rhynchosia rothii, Spermadictyon suaveolens, Blumea malcolmii, Pulicaria wightiana, Argyreia sericea, Lavendula bipinnata, Lindernia multiflora, Rhynchospora wightiana etc.

Comparison with Rajpipla

The flora of Rajpipla has been cursorily surveyed by Shah (1967) and Bhatt, et al (1971). The Kawant range has 330 plants common with this area, the affinity percentage being 42.9. The total number of plants recorded from Rajpipla is 474. It is quite likely that the affinity percentage will certainly increase, if an extensive and intensive survey of this area is undertaken. The important plants common to these areas are Cleome simplicifolia, Tamarix ericoides, Hibiscus vitifolius, Azanza lampas, Ventilago denticulata, Zizyphus xylopyra, Leea macrophylla, Buchanania lanzan, Atylosia scarabaeoides, Crotalaria hirsuta, Desmodium neo-mexicanum, Dichrostachys cinerea, Wrightia tomentosa, Ipomoea sindica, Oroxylum indicum, Leucas martinicensis, Homonia riparia, Cyanotis fasciculata, Spodiopogon rhizophorus etc.

Comparison with Pavagadh

The comparison of the Kawant Range flora with that of Pavagadh is more valid because the flora is intensively studied by Chavan & Oza (1966), and subsequently by Shah & Inamdar (1965); Chavan, et al. (1967); Bedi, et al. (1968); Bedi & Sabnis (1970) and Bedi, et al. (1972). Out of the total number of 563 plants, 369 are common with the Kawant forests. The affinity percentage, therefore, comes to 47.8. Pavagadh is probably the highest hill between Khandala on the Western Ghats and Mt. Abu in the Aravallis. It, therefore, harbours a number of Western Indian plants and helps in their migration to northern areas. Some of the plants common with Kawant forests are Celastrus paniculata, Indigofera colutea, Rhynchosia rothii, Blumea fistulosa, Dyerophytum indicum, Cryptolepis buchanani, Kickxia ramosissima, Didymocarpus pygmaeus, Haplanthus verticillatus, Barleria prattensis, Carvia callosa, Anisomeles heyneana, Aerva sanguinolenta, Curcuma inodora, Arisaema neglectum, Aristida redacta, Arthraxon lancifolius etc.

Comparison with Ratanmahal

The flora of Ratanmahal has been thoroughly worked out by Bedi (1968). The Kawant forests have 447 plants common

with Ratanmahal, the affinity percentage being 58.2. Some of the noteworthy plants which are common to these forests are Soymida febrifuga, Crotalaria calycina, Eleotis monophylla, Indigofera glabra, Milletia auriculata, Holostemma annulare, Aristolochia bracteolata, Peristylus goodyerioides, Tacca leontopetaloides, Dioscorea belophylla, Urginea indica, Cyperus pseudokyllingioides and Themeda quadrivalvis.

Comparison with Mt. Abu

The flora of Mt. Abu has been surveyed by Macadam (1890); Sutaria (1941); Raizada (1954); Chavan and Sabnis (1960); Jain (1962) and Chohan, et al. (1967). Mt. Abu, because of its altitude and high rainfall, has the richest vegetation in whole of Rajasthan, and is a meeting ground for both the sub-tropical and temperate elements in its flora. The Kawant forests have nearly 264 plants common with Mt. Abu, the affinity percentage being 34.4. Some of the plants worth-mentioning are Ranunculus sceleratus, Melhania futteyporensis, Atylosia sericea, Potentilla supina, Trachyspermum stictocarpum var. stictocarpum, Campanula dimorphantha, Nepeta bombaiensis, Aerides crispum and Arthraxon lancifolius.

Comparison with Saurashtra

The flora of Saurashtra has been described by Santapau and Raizada (1954); Santapau (1962) and Santapau and Janardhanan (1967). Saurashtra has 412 plants common with Kawant forests. The affinity percentage, therefore, comes to 53.2. Some of important plants common to these areas are Melhania futteyporensis, Soymida febrifuga, Crotalaria prostrata, Indigofera colutea, Pueraria tuberosa, Uraria picta, Hardwickia binata, Blumea fistulosa, Goniocaulon glabrum, Argyreia sericea, Lindernia multiflora, Lavandula bipinnata, Baliospermum montanum, Mallotus philippensis, Curcuma inodora, Curculigo orchioides, Sauromatum guttatum, Eriophorum comosum and Spodiopogon rhizophorus.

Discussion

It is evident that the flora of Kawant Range forests comprises predominantly the general element and the eastern element, which constitute 34% and 29% of the total number of plants respectively. The large percentage of these pluri-regional 'wides' and 'aliens' can be explained on the basis of more and more incidence of biotic factors. As the area is mainly a Teak forest, the dominance of the eastern element over the western can easily be expected (Meher-Homji, 1970). The western element constitutes 14% of the total

flora and is likely to increase as more and more forest area will be cleared for agriculture or mining. The Indian element accounts for 23% of the total flora. It has been observed that although the area boasts of no endemic element, it along with the other hill ranges of Gujarat provide opportunities for the northward migration of certain Peninsular mountain element. This peninsular element has its northernmost limit in Mt. Abu (Jain, 1967). It also serves as a bridge for the north-western and the northern Indian mountain element in their attempt to spread southwards.

Out of nearly 75 plants, which are endemic to or which have a restricted distribution in the Western Ghats or South Indian hills and known to occur in the hilly forests of Gujarat, 47 are met with at Pavagadh, 32 in Ratanmahal and 38 in the Kawant Range forests. Some of them, if not all, have their northern limits in Mt. Abu. Such plants, to name only a few, are Polygala elongata, Atylosia sericea, Crotalaria pusilla, Trachyspermum stictocarpum var. stictocarpum, Centratherum phyllolaenum, Blumea malcolmii, B. fistulosa, Pulicaria wightiana, Leucas biflora, Nepeta bombaiensis, Lavandula bipinnata, Aerides crispum, Curcuma inodora, spodiopogon rhizophorus etc.

There are also a number of plants belonging to north-

western element or the north-Indian element such as Ranunculus sceleratus, Cochlearia cochlearioides, Potentilla supina, Anagallis arvensis var. caerulea, Campanula dimorphantha, Ipomoea sindica, Kickxia incana, Salvia plebeia, Arthraxon lancifolius and Cymbopogon jwarancusa, which use these areas as a bridge in their attempt to spread southwards.

In short, the flora of Kawant forests consists of general, eastern and western elements. Of the Indian element, it has the Peninsular mountain element having their northern limit in the hills of Gujarat or the Aravallis at Mt. Abu. It has also the north-western element and the north-Indian elements, which are migrating eastwards or southwards.