

DISTRIBUTIONAL RESUME OF THE MARITIME STRAND FLORA OF INDIA

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ABSTRACT

A distributional resume of the maritime strand flora on a regional basis conforming to coastal physiographic sub-divisions of India is given. Points of interest on regional distribution, growth forms and other relevant observations of phytogeographical interest are given.

INTRODUCTION

The strand flora of the Indian coast has not been analysed even though infrequently references to the occurrence of strand plants have been mentioned in various published floras and papers since the time of the publications of the Flora of British India. Schimper's classical work (1891) deals with the littoral flora of Indo-malayan coasts. His conclusions are largely based on his own observations in the Malayan archipelago and also the findings of Kurz on the shores of Andamans and Burma. Since 1960, some work has been carried out by the Ecology Unit of the Botanical Survey of India on a regional basis conforming to coastal physiographic sub-divisions and it was often felt that a descriptive consolidated account of the strand flora would be an essential pre-requisite for a study of coastal ecology. To facilitate such studies an attempt is made in this survey to include the literature dealing with the internal distribution pattern of strand plants, their growth forms and other relevant observations of phytogeographical interest.

COASTAL PHYSIOGRAPHY

India has a long coastline of 5,689 km washed by the Bay of Bengal on the east coast, the Arabian sea on the west and the Indian ocean touching the southern end. The West coastline is long and straight starting from Cape Comorin in the deep south to the 20 parallel N and includes two peninsulas. In contrast the east coast runs in wide curves changing directions from north to north east from the 16° parallel and includes mobile sand dunes, saline flats and prograded rice fields of considerable width. The west coastline runs along the states of Gujarat including the coast lines of the two peninsulas: Saurashtra and Kutch, Maharashtra, Mysore and Kerala. The east coastline runs along the States of West Bengal, Orissa,

Andhra Pradesh and Tamil Nadu. Further the physiographic areas of both the coasts are subdivided into eight parts: Gujarat, Konkan, Karnataka, Malabar, Tamil Nadu, Andhra Pradesh, Utkal and West Bengal basin corresponding more or less to the respective states (Chatterjee, 1965). The maritime strand is the adjacent part of the sea shore and runs more or less parallel to the coastline. It is defined here as a strip of beach lying in between the prevailing high tide limit and the upper limits of the back shore sandy relief. Always under the influence of surf or salt spray, this area supports distinct strand flora represented by distinct plants of ecological interest. Along the Indian coast the strand area is discernible to three different substrata: Sand, Rock and Coral sand; and the vegetation varies in relation to the substratum. In India the development of strand vegetation into a strand forest is very much limited due to three causes: changes in the orographic and edaphic factors, coastal plantations and prograded rice fields. The natural strand forests in patches are observed at the Sunderbans, Utkal, Tamil Nadu, Malabar and Karnataka coasts. Sometimes strand forests develop at such places where the mangroves are not extensively developed or at the back of mangrove forests on raised sandy banks. In the rest of coastal areas the strand conditions decrease towards the landward fringe resulting in the formation of scrub forests. However, under favourable climatic conditions prevailing in the hinterland one could see the sequential development of strand vegetation from pioneer mat stage to that of forest stage. In a typical strand forest the following successional stages may be recognised: open mat forming pioneer zone followed by closed herbaceous pioneer zone, a bush zone and a woodland which merges with the climax community (Rao *et al.* 1972).

SALIENT FEATURES OF THE STRAND FLORA ALONG THE WEST COAST

Gujarat coast: This extends along the peninsulas of Kutch and Saurashtra and includes a portion of areas south of Cambay, up to the borders of Konkan coast. This coast is divisible under three sub types: Kutch, Saurashtra and southern-Gujarat.

Kutch coast: The coastal area of Kutch is surrounded on the south by the Gulf of Kutch and on the west by the Arabian sea. The coast gently rises and is fringed with mangrove swamps. In some areas it rises in rows of sandy hills or beaches or as in the north west, in broken rocky cliffs. The sandy strand is intercepted here and there by muddy coast and sometimes by rocky strand. The few publications on the flora of Kutch are from Blatter (1908-1909), Jain *et al.* (1960a, b; 1968) and no further adequate attempt has been made to work out the ecological features of the coast line.

The strand flora is similar to that of Sind (Pakistan). Further the reported occurrence of such plants like *Astragalus prolixus*, *Heliotropium renifolium*, *Spinifex littoreus*, *Scaevola taccada*, *Peganum harmala*, *Tamarix articulata*, is of distributional interest because these plants are not recorded to occur in the adjacent peninsular coast of Saurashtra.

Saurashtra coast: The coast line is bounded by the Arabian sea in the south and southwest by the Gulf of Kutch in the northwest and by the Gulf of Cambay and mainland in the east. The coastal area can be divided into three sub types: The coast line from the mouth of the Gulf of Kutch to Okhamandal, the coast line of Okhamandal to Diu and the coastline of Diu to Gopnath continued, up to Amli. These have been studied from an ecological point of view since 1960 (Rao *et al.*, 1963a, b; 1964, 1965, 1966, 1967, 1969, 1970). The coastline bordering the Gulf of Kutch and Cambay are muddy with limited strand conditions whereas the coast lines from Okhamandal to Diu and also from Diu to Gopnath are fringed with wind blown sand humps often intercepted by rocky cliffs. Rock strand and sand strand are frequently seen along this coast line. The recent ecological studies (Rao *et al.*, *l.c.*) along this area have revealed that the north-western half of Saurashtra coast, more or less corresponding to that of arid zone is botanically similar to that of Kutch Sindh strand flora and the south-eastern area bordering the Gulf of Cambay corresponding to the semi arid zone to the Konkan coast. The western

or Persio-arabian elements like *Asparagus dumosus*, *Capparis cartilaginea*, *Helichrysum cutchicum* (Rao and Deshpande, 1969), *Sericostema pauciflorum*, *Limonium stocksii*, *Lotus garcinii* and *Euphorbia nivulia* are well represented in the arid coastal area. However, their frequency diminishes towards the south-eastern areas of semi arid zone where the flora is represented by Indian, Malasian and Polynesian coastal elements like *Ipomoea pes-caprae*, *Sesuvium portulacastrum*, *Hydrophyllax maritima*, *Borreria articularis*, *Psilostachys sericea*, *Launaea sarmentosa*, *Canavalia maritima* and *Hyphaene indica*.

Gujarat coast (South of the river Narmada): The coast line south of Narmada up to Daman is marshy intercepted infrequently by sandy shores of limited stretches. The recorded sand strand flora mostly correspond to the Indo-malayan elements (Toor, 1958, Rao, 1965). The noteworthy features of strand plants are the northern limit of *Spinifex littoreus* at Domas, occurrence of *Zoysia matrella* at Daman, *Perotis indica* at Domas and the absence of *Calophyllum inophyllum* along the Gujarat coast lines. Recently Shaw (1965) has reported the occurrence of *Spinifex littoreus* into Dholkia creek. The frequent occurrence of *Hyphaene indica* in the Diu-Kodinar sector of Saurashtra coast is repeated along the Daman coast.

Konkan coast (Maharashtra State): The coast extends from north of Goa to Daman, a distance of 500 km, and is more or less clifty, occasionally intercepted by sandy beaches of limited length over littoral concrete. The northern part under riverine and tidal influence becomes muddy otherwise the coast is of jutting headlands and often covered with a thick mantle of sand.

The ecological information on the strand flora is inadequate and scanty. But a few publications pertaining to this area are from Bharucha (1950), Satyanarayan (1958), Shah (1962), Navalkar (1951), Burns (1910), Cooke (1908), Blatter (1905) and Nairne (1894).

The development of rich strand flora in the form of a strand forest is not seen anywhere along the coast due to the paucity of extensive strand conditions. Along the sea shores of the areas south of Daman including Bombay and Salsette island there are innumerable marshy areas fringed with mangroves and only in raised grounds with less salinity there are saline pastures chiefly represented by *Aeluropus lagopoides*, *Paspalum vaginatum*, *Digitaria* sp., *Sporobolus virginicus* and *Fimbristylis* sp. The

newly recorded occurrence *Psilostachys sericea* on Juhu sands near Bombay is of interest (Shah, l.c.). *Cyperus pedunculatus* a strand creeper has been reported at Marmagao (Vartak, 1968) and its spread north of Goa is very much limited and not so extensive as in the coastal Karnataka and Kerala.

Karnataka coast (Mysore State): The Karnataka coast extends about 225 km and is comparatively wider in the south than in the North; their range being 8 km to 24 km. The coast line is sandy and rocky. The few publications which are helpful in building up the strand flora are of (Arora *et al.* 1965), Cooke (1908) and Santapau (1961).

The noteworthy strand plants of this area are *Scaevola taccada*, *S. plumieri*, *Cyperus pedunculatus*, *Crotalaria nana* and *Anotis carnososa*, *Euphorbia atoto*, *Indigofera aspalathoides* and *I. uniflora*. Their frequency of occurrence is more in this coast than in the Konkan coast. *Ipomoea tuba*, is of extensive occurrence along the coast (Rao, 1964). The other plants of interest reported with precise locality are of *Acrostichum aureum*, a salt tolerant fern and *Flagellaria indica* on rock strand.

Malabar coast (Kerala State): The Malabar or Kerala coast extend from the north of Kasargod to Travancore district in the South. The coast extends about 500 km with an average width of only 25 km and ranging from 10 to 30 m in elevation. This area bounds in lakes and back water systems most of them are connected to the sea. Some of the recorded floristic accounts on this coastal area are from Hooker *et al.* (1875-1897), Gamble (1915), Erlanson (1936), Mudaliar *et al.* (1952) and Thomas (1962).

The interesting feature of the strand flora is the occurrence of *Parsonsia helicandra*, *Wedelia biflora*, *Canavalia maritima*, and *Barringtonia racemosa* under the coastal influence. Another noteworthy plant is *Scaevola taccada*, a coral sand indicator widely represented in near by coral islands. The rare plants which are common to this coast and that of Karnataka are *Cyperus pedunculatus*, *Flagellaria indica*, *Calophyllum decipens* and *Acrostichum aureum* (Rao *et al.* 1973). A fairly wide spread plant *Euphorbia rosea* of this coast has not been recorded from Karnataka coast. Similarly the strand climber *Mucuna gigantea* is not reported to occur in the Karnataka coastal area.

EAST COAST

The physiographic area of east coast is divisible into four distinct parts from north to south: Bengal

Basin coast, Utkal, Andhra and Tamil Nadu coasts corresponding to respective states.

Bengal basin coast (West Bengal State): The West Bengal coast is divisible into two parts: Midnapur coast and the Gangetic Sundarbans and the river Hooghly forming a dividing river between them. The Sundarbans is a swampy tidal delta of 3000 sq. miles of 24-Parganas where the sandy areas are limited and a few are along the sea face.

The contribution towards this coastal flora is that of Prain (1903) and Rao *et al.* (1970). Along the limited sea face consistent vegetation is seen. The coastal elements are mostly drawn from the Malayan strand flora, and some of the characteristic strand flora of Utkal are completely absent in this area. The new addition to the strand flora is the occurrence of *Aeluropus lagopoides* on saline strand bordering the eastern bank of the river Hooghly, shore of Sagar island and Junput (Rao *et al.* 1965).

The sandy coastal strip from Higili towards south to the mouth of Suvarnarekha river, forms a part of the Midnapur coast, in West Bengal. The sand strand is composed of *Spinifex littoreus*, *Launaea sarmentosa*, *Cyperus arenarius*, *Borreria articularis*, *Polycarpaea corymbosa*, *Polygala erioptera*, *Ipomoea pes-caprae*, *Sida cordifolia* and *Jatropha gossypifolia* and many local plants are found growing towards the landward fringe of the backshore. This floristic composition is similar to that of the adjacent Utkal coast except for the absence of three widely spread Utkal strand plants: *Euphorbia rosea*, *Geniosporum tenuiflorum* and *Hydrophyllax maritima*. In this area the other newly recorded plants of strand dune habitat of Utkal coast are *Cyperus arenarius*, *Portulacca tuberosa*, *Syzygium ruscifolium* (Mukherjee and Banerjee, 1968), *Gisekia pharnaceoides*, *Rothia indica*, *Trianthema triquetra* and *Spinifex littoreus* (Rao *et al.* 1966, 1967).

Utkal coast (Orissa State): The coast covers in between an area situated from a little north of the Suvarnarekha river to a little south of the Rushikulya river including the Mahanadi delta and the coastal lagoon chilka. The coast line is straightly curved; conforms more or less to Orissa State boundary, about 400 km in length and lined with innumerable sand dunes caused due to strong waves and wind. The strand flora is very conspicuous and sometimes strand forests are also observed at certain places. The sand flora requires further study (Haines, 1921). This account is compiled taking into account our extensive and intensive ecological

survey of strand flora (Rao *et al.*, 1968, 1970, 1971, 1972) and also published accounts recorded pertaining to Orissa (Haines, 1921; Mooney, 1961; Raizada, 1949; Sanyal, 1957).

The interesting components of strand flora are *Spinifex littoreus*, *Euphorbia rosea*, *Phyllanthus rotundifolius*, *Fimbristylis junciformis*, *Gemnosporum tenuiflorum* and *Hydrophylax maritima*. The newly reported *Aeluropus lagopoides* from several stations of Bengal coast is yet to be located in Utkal coast, *Enicostema hyssopifolia* is a very common plant all along the Indian coast except in Orissa and W. Bengal. The other plants recorded from this coast are *Atlantia angulata*, *Myriostachya wightiana* and *Ipomoea tuba*.

Andhra coast (Andhra Pradesh): The Andhra coast extends from the southern limit of the Utkal plains to the Pulicat lake and conforms more or less to Andhra Pradesh State boundary. It includes the Krishna and Godavari delta. The coast line conforms to rock and sand types. The few publications from this region are from Gamble (1915-36), Venkateshwaralu (1944), Venkateshwaralu *et al.* (1972), Rao (1957) and Rao *et al.* (1970, 1971, 1972).

The interesting report is the occurrence of *Psilostachys sericea* at Nellore sea sands (Gamble, l.c.). This handsome herb is reported in Saurashtra coast (Rao *et al.* l.c.) and Bombay coast near Juhu (Shah l.c.). It appears to be very much restricted in distribution and does not seem to have spread widely along similar situations. The other plants of interest are *Aeluropus lagopoides*, *Indigofera aspalathoides*, *Ipomoea tuba*, *Trianthema triquetra*, *Trachys muricata*, *Dimorphocalys glabellus* and *Myriostachya wightiana*.

Tamil Nadu coast: The Tamil Nadu coast extends from the southern limit of Pulicat Lake to point Calimere and conforms to Tamil Nadu state boundary, stretching about 675 km with an average width of 100 km and includes the Cauvery delta with marshy spots in the southern parts. The published papers on this are a few and mostly give a general picture of the vegetation (Gamble, 1915-1932; Fyson, 1920; Mrlange and Meherhomaji, 1965; Nayar, 1969, Lawrence, 1961; Rao *et al.* 1973; Daniel, 1967). The noteworthy strand plants of this area are *Scaevola plumieri*, *Breweria evolvuloides*, *Heterostemma tanjorensis*, *Sesamum prostratum* and *Nesaea lanceolata*, *Pemphis acidula*, a coral stone indicator is reported in the southern rocky areas of the coast. *Halopyrum mucronatum* a

widely spread coastal grass reported in Karnataka coast, Saurashtra coast and Krusadi group of islands, has been reported at the southern tips of the coast. *Sesamum prostratum* occurs on sand shore at Adyar near Madras. Recently *Myriostachya wightiana* has been reported at Vedharanyam along this coast (Sebastine *et al.*, 1967).

The coast line bordering the southern strip from point Calimere to Cape Comorin including that of a few leading islands of the Gulf of Manaar like Rameswaram, Krusadi, Shingle (Rao *et al.* 1963a, 1964), Hare and Church (Srinivasan, 1960; Sunderaj *et al.*, 1964, 1966) exhibits strand flora which is akin to that of Ceylon coast. Pure strand scrub forests of *Pemphis acidula* is characteristic of all islands except Rameswaram. The chief components of strand flora are *Pemphis acidula*, *Suriana maritima*, *Thespesia populnea*, *Halopyrum mucronatum*, *Scaevola taccada*, *S. plumieri*, *Ipomoea pes-caprae* and *Spinifex littoreus*.

The reported occurrence of *Messerschmidia argentea* on the shores of Krusadi island (Sunderraj *et al.*, 1962) is obviously a newly invaded strand pioneer from Ceylon. This invader is a potential forest builder and if left undisturbed this may regenerate to a great extent as to become a strand forest. Among the plants of interest are the occurrence of *Polycarpaea spicata*, reported to occur only in West coast along Saurashtra coast, Laccadive group of islands and also in small islands off the coast of Jaffna (Ceylon), *Suriana maritima* and *Cordia subcordata* of Ceylon strand flora.

COMMONLY OCCURRING STRAND FLORA CATEGORISED UNDER DIFFERENT GROWTH FORMS

(1) MAT FORMING STRAND CREEPERS: *Aeluropus lagopoides* (On saline sand), *Canavalia maritima*, *C. cathartica*, *Cyperus arenarius*, *C. pedunculatus*, *C. stoloniferus*, *Dolichos ciliatus*, *Indigofera aspalathoides*, *I. uniflora*, *Ipomoea pes-caprae*, *I. repens*, *I. tuba*, *Ischaemum muticum*, *Launaea sarmentosa*, *Paspalum vaginatum*, *Perotis indica*, *Sesuvium portulacastrum*, *Sporobolus virginicus*, *Trianthema hydaspicum*, *Trachys muricata*, *Vigna luteola*, *Zoysia matrella* (On saline sand).

(2) DIFFUSELY BRANCHING PROSTRATE/ERECT STRAND HERBS & SEDGES: *Allamania nodiflora*, *A. nodiflora* var. *roxburghii*, *Anotis carnosa*, *Artiplex repens*, *A. stocksii*, *Astragalus prolixus*, *Borreria articularis*, *B. stricta*, *Corchorus depressus*, *Crotalaria burhia*, *C. laburnifolia*, *C. medicagenea*, *C. nana*,

C. rigida, *C. striata*, *C. verrucosa*, *C. trifoliastrium*, *Desmodium biarticulatum*, *Enicostema hyssopifolium*, *Euphorbia atoto*, *E. rosea*, *Fimbristylis spathacea*, *F. junciformis*, *Geniosporum tenuiflorum*, *Gisekia pharmaceoides*, *Glinus oppositifolius*, *Heliotropium currasavicum*, *Helichrysum cutchicum*, *Heylandia latebrosa*, *Hydrophylax maritima*, *Indigofera cordifolia*, *Lotus garcini*, *Mollugo cerviana*, *M. disticha*, *Nesaea lanceolata*, *Osbeckia zeylanica* var. *non-rostrata*, *Peplidium mariimum*, *Phaseolus trilobus*, *Phyllanthus rotundifolius*, *Polycarpaea corymbosa*, *P. spicata*, *Psilostachys sericea*, *Pulicaria angustifolia*, *Rothia indica*, *Scaevola plumieri*, *Synostemon bacciforme*, *Taverniera cuneifolia*, *Tephrosia spinosa*, *T. strigosa*, *Trianthema triquetra*, *Xyris indica*, *Zornia gibbosa*.

(3) STRAND CLIMBERS: *Aristolochia indica*, *Bauhinia anguina*, *Breweria evolvuloides*, *Caesalpinia crista*, *Capparis sepiaria*, *Cassytha filiformis*, *Cissus quadrangularis*, *Dalbergia spinosa*, *Derris uliginosa*, *Flagellaria indica*, *Heterostemma tanjorensis*, *Hibiscus tilaceus*, *Ipomoea tuba*, *Leptadenia reticulata*, *Mucuna gigantea*, *Parsonsia helicandra*, *Pisonia aculeata*, *Pachygone zeylanica*, *Sarcolobus carinatus*, *Sarcostemma acidum*, *Sapindus emarginatus*, *Solanum trilobatum*.

(4) STRAND PLANTS WITH PERENNATING ORGANS: *Asparagus dumosus*, *Chlorophyton tuberosum*, *Crinum asiaticum*, *C. defnum*, *Portulaca tuberosa*, *Scilla hyacinthina*, *Urgenia indica*.

(5) STRAND SHRUBS AND TREES: (A) Tussock & Thickets: *Acrostichum aureum* (as a Strand fern), *Alhagi pseudalhagi*, *Asparagus dumosus*, *Clerodendrum inerme*, *Dimorphocalyx glabellus*, *Halopyrum mucronatum*, *Jatropha glandulifera*, *Limonium stocksii* (Rock strand), *Lotus garcini*, *Myriostachya wightiana*, *Saccharum officinarum*, *Solanum arundo*, *Spinifex littoreus*, *Syzygium rusifolium*, *Tamarix articulata*, *T. troupii*.

(6) STRAND (STUNTED) TREES: *Acacia planifrons*, *Ardisia littoralis*, *Anacardium occidentale*, *Atalantia angulata*, *Borassus flabellifera*, *Capparis cartilaginea*, *Calophyllum inophyllum*, *Calotropis gigantea*, *C. procera*, *Casuarina equisetifolia*, *Cerbera manghas*, *Cocos nucifera*, *Colubrina asiatica*, *Commiphora wightii* (Rock sand), *Cordia subcordata*, *Erythrina indica*, *Euphorbia caudifolia*, *E. nivulia*, *Grewia tenax*, *Guettarda speciosa*, *Gymnosporia emarginata*, *Hernandia ovigera*, *Heritiera fomes*, *H. littoralis*, *Hibiscus tiliaceus*, *Hyphaene indica*, *Ixora coccinea*, *Maba buxifolia*, *Morinda citrifolia*, *Messerschmidia*

argentea (Coral sand), *Pandanus tectorius*, *Pemphis acidula* (Coral rock), *Premna corymbosa*, *P. latifolia*, *P. serratifolia*, *Pongamia pinnata*, *Samadera indica*, *Salvadora persica*, *Scaevola taccada*, *Scutia myrtina*, *Streblus asper*, *Suriana maritima*, *Thespesia populnea*.

CONCLUSIONS

The internal distribution pattern of the Indian maritime strand flora can be sorted out under three types: plants showing complete fidelity to inner strand, plants of mid/outer strand under the maritime influence and plants from strand to inland extensions.

Under the first category there are two sub types: Sand strand and Rock strand. Characteristic plants of sand strand are *Aeluropus lagopoides*, *Allmania longepedunculata*, *A. nodiflora* var. *roxburghii*, *Anotis carnosa*, *Asparagus dumosus*, *Borreria articularis*, *Canavalia maritima*, *Crotalaria nana*, *Cyperus arenarius*, *C. pedunculatus*, *Euphorbia atoto*, *E. rosea*, *Fimbristylis junciformis*, *F. spathacea*, *Geniosporum tenuiflorum*, *Halopyrum mucronatum*, *Hydrophylax maritima*, *Ipomoea pes-caprae*, *I. tuba*, *Juncus maritimus*, *Launaea sarmentosa*, *Lotus garcini*, *Messerschmidia argentea*, *Mollugo cerviana*, *M. disticha*, *Oldenlandia* sp., *Perotis indica*, *Phyllanthus rotundifolius*, *Psilostachys sericea*, *Rothia indica*, *Scaevola plumieri*, *S. taccada*, *Spinifex littoreus*, *Sesamum prostratum*, *Sporobolus virginicus*, *Thuarea involuta*, *Wedelia biflora* and *Zoysia matrella*.

Characteristic plants of rock strand are: *Anotis foetida*, *Atriplex stocksii*, *Capparis cartilaginea*, *Commiphora wightii*, *Flagellaria indica*, *Jatropha gossypifolia*, *Limonium stocksii*, *Pemphis acidula*, *Polycarpaea spicata*, *Polygala irregularis*, *P. erioptera*, *Senra incana*.

Under the second category is incorporated plants of mid/outer strand growing under the maritime influence:

Ardisia littoralis, *Atalantia angulata*, *Barringtonia racemosa*, *B. asiatica*, *Calophyllum inophyllum*, *Caesalpinia crista*, *C. nuga*, *Cerbera manghas*, *Clerodendrum inerme*, *Colubrina asiatica*, *Dalbergia spinosa*, *Derris uliginosa*, *Dolichos ciliatus*, *Guettarda speciosa*, *Hernandia ovigera*, *Heritiera littoralis*, *H. fomes*, *Hibiscus tiliaceus*, *Intsia bijuga*, *Leptadenia reticulata*, *Mucuna gigantea*, *Myriostachya wightiana*, *Paramignya longispina*, *Pisonia aculeata*, *Premna corymbosa*, *Samadera indica*, *Scyphiphora hydrophyllacea*, *Synostemon bacci-*

forme, *Tamarix troupii*, *Thespesia populnea* and *Urochondra setulosa*.

Under the third category are those plants which extend from the sea towards the interior and sometimes a few of them attain an altitude up to 2000 m. A few of them have their niche breadth more frequently under the maritime influence than in inland areas. Certain interesting plants are: *Acacia planifrons*, *Aerva monsonia*, *Andrographis echeoides*, *Azima tetracantha*, *Calotropis gigantea*, *C. procera*, *Capparis decidua*, *Cassytha filiformis*, *Cosmostigma racemosum*, *Drosera burmanii*, *D. indica*, *Dodonea viscosa*, *Euphorbia caudicifolia*, *E. nivulia*, *Enicostema hyssopifolium*, *Hyphaene indica*, *Gisekia pharnaceoides*, *Ischaemum santapau*, *Jatropha gossypifolia*, *Kickxia ramossima*, *Leptadenia reticulata*, *L. pyrotechnica*, *Lepidagathis trinervis*, *Lindenbergia urticaefolia*, *Maba buxifolia*, *Pachygone zeylanica*, *Parsonsia helicandra*, *Phaseolus trilobus*, *Pongamia pinnata*, *Premna latifolia*, *Salvadora persica*, *Sericostoma pauciflora*, *S. aecidum*, *Scilla hyacinthina*, *Syzygium ruscifolium*, *Randia dumetorum*, *Urgenia indica*, *Stenotaphrum dimidiatum* and *Vitex trifoliata*.

The detailed analysis of the Indian strand flora has revealed that it is a mixture of three elements: Polynasian and Malaysian, Persio-arabian/Western and a few Indian. The strand flora of Ceylon is well represented in the southern coastline of Madras

including the leading islands of the Gulf of Manaar. Further, they have spread north westward along the coast of Malabar (Kerala), Karnataka, Konkan and Kutch coast. But the same is not the situation in the east coast known as Coromandal coast, a term used in 18th and 19th centuries without precise boundaries. The interesting feature of the flora especially towards the north eastward along the coasts of Andhra and Orissa is the absence of plants like *Scaevola taceada*, *S. plumieri*, *Polycarpaea spicata* and *Cyperus pedunculatus* even though they are recorded along Tamil Nadu coast especially bordering the southern coastal areas. The other distinct aspect is the absence of dominant plants of Coromandal coast in the Sundarbans area. Finally certain plants like *Thuraea involuta*, *Lepturus repens*, *L. radicans*, *Guettarda speciosa*, *Hernandia ovigera* hitherto reported in Nicobar, Ceylon, Laccadive islands are yet to be located along the Indian shores. The recorded presence of certain plants like *Suriana maritima*, *Cordia subcordata*, *Messerchimidia argentea*, *Pemphis acidula* along the southern coastal strip and leading islands of the Gulf of Manaar are yet to make a headway northwards along the Indian coasts.

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INTERNAL DISTRIBUTION OF STRAND FLORA

	WEST COAST						EAST COAST				
	KUTCH	SAURASHTRA	GUJARAT SOUTH	MAHARASHTRA	MYSORE	KERALA	TAMIL NADU	ANDHRA PRADESH	ORISSA	W. BENGAL (Midnapur coast)	W. BENGAL (Sundarban)
	1	2	3	4	5	6	7	8	9	10	11
MENISPERMACEAE											
<i>Pachygyne zeylanica</i> (Gaertn.) Sant. & Wagh	-	-	-	-	+	+	+	+	-	-	-
CAPPARACEAE											
<i>Capparis cartilaginea</i> Decne	+	+	-	-	-	-	-	-	-	-	-
POLYGALACEAE											
<i>Polygala irregularis</i> Boiss.	+	+	-	-	-	-	-	-	-	-	-
CARYOPHYLLACEAE											
<i>Polycarpaea spicata</i> Wt. & Arn.	+	+	-	-	-	-	+	-	-	-	-

	WEST COAST						EAST COAST				
	1	2	3	4	5	6	7	8	9	10	11
GUTTIFERAE											
<i>Calophyllum inophyllum</i> Linn.	—	—	+	+	+	+	+	+	+	—	—
MALVACEAE											
<i>Hibiscus tiliaceus</i> Linn.	—	—	—	+	+	+	+	+	+	—	+
<i>Sida cordata</i> (Burm. f.) Bross.	+	+	+	+	+	+	+	+	+	+	+
<i>Malachra capitata</i> (L.) Linn.	—	+	+	+	—	—	—	—	+	+	+
<i>Thespesia populnea</i> (Linn.) Soland. ex Correg	—	+	+	+	+	+	+	+	+	—	+
STERCULIACEAE											
<i>Heritiera fomes</i> Buch.	—	—	—	—	—	—	—	—	+	—	+
<i>H. littoralis</i> Dryand.	—	—	—	+	+	+	+	+	+	—	—
SIMARUBEACEAE											
<i>Samadera indica</i> Gaertn.	—	—	—	—	—	+	—	—	—	—	—
RHAMNACEAE											
<i>Colubrina asiatica</i> Brongn.	—	—	—	+	+	+	+	+	—	—	—
SAPINDACEAE											
<i>Sapindus emarginatus</i> Vahl	—	—	—	—	+	+	+	+	+	—	—
PAPILIONACEAE											
<i>Crotalaria nana</i> Burm.	—	—	—	—	+	+	+	?	+	—	—
<i>C. trifoliatum</i> Willd.	—	—	—	—	+	+	+	+	—	—	—
<i>C. rigida</i> Heync	—	—	—	—	+	+	+	—	—	—	—
<i>C. laburnifolia</i> L.	—	—	—	—	+	+	+	—	—	—	—
<i>Indigofera aspalathoides</i> Vahl	—	—	—	—	+	+	+	—	—	—	—
<i>I. cordifolia</i> Heync ex Roth	—	+	+	+	+	+	+	—	+	—	—
<i>I. uniflora</i> Buch.-Ham.	—	—	—	—	+	+	+	—	—	—	—
<i>Tephrosia strigosa</i> (Dalz.) Sant. & Mahesh.	—	+	+	+	+	+	+	+	—	—	—
<i>T. maxima</i> Pers.	—	—	—	—	+	+	+	—	—	—	—
<i>T. lanceolata</i> Grah. ex Wt. & Arn.	—	—	—	—	—	+	—	+	—	—	—
<i>Mucuna gigantea</i> DC.	—	—	—	+	+	+	+	—	—	—	+
<i>Canavalia maritima</i> (Aubl.) Thou.	—	+	—	—	+	+	+	+	+	—	+
<i>C. cathartica</i> Thou.	—	—	—	+	—	—	—	—	—	—	+
<i>Heylandia latebrosa</i> DC.	—	+	+	+	+	+	+	+	+	—	—
<i>Lotus garcinii</i> DC.	+	+	—	—	—	—	—	—	—	—	—
<i>Taverniera cuneifolia</i> Arn.	—	+	+	+	+	+	+	+	+	—	—
<i>Zornia gibbosa</i> Span.	—	+	+	+	+	+	+	+	+	+	—
<i>Dolichos ciliatus</i> Klein	—	—	—	—	+	—	+	—	—	—	—
<i>Astragalus prolixus</i> Sieb.	+	—	—	—	—	—	—	—	—	—	—
CAESALPINIACEAE											
<i>Bauhinia anguina</i> Roxb.	—	—	—	—	—	+	—	—	+	—	—
MIMOSEAE											
<i>Acacia planifrons</i> Wt. & Arn.	—	+	—	—	—	+	+	—	—	—	—
MYRTACEAE											
<i>Syzygium ruscifolium</i> (Willd.) Sant. & Wagh	—	—	—	—	—	—	+	+	+	+	—
MELASTOMATACEAE											
<i>Osbeckia zeylanica</i> Willd.	—	—	—	+	+	+	+	—	+	—	—
LYTHRACEAE											
<i>Nesaea lanceolata</i> Kochne	—	—	—	+	+	—	+	+	—	—	—
<i>Pemphis acidula</i> Forst.	—	—	—	—	—	—	+	—	—	—	—
AIZOACEAE											
<i>Sesuvium portulacastrum</i> Linn.	+	+	+	+	+	+	+	+	+	+	+
<i>Mollugo cerviana</i> Ser.	—	—	+	+	+	—	—	—	—	—	—
<i>M. disticha</i> Ser.	—	—	—	—	—	+	—	+	—	—	—
<i>Trianthema triquetra</i> Rottl & Willd.	—	+	—	+	—	+	+	+	+	—	+
RUBIACEAE											
<i>Oldenlandia coerulea</i> Gamble	—	—	—	—	+	+	+	+	+	—	—
<i>O. pruinosa</i> O. Ktze.	—	—	—	—	—	+	—	—	—	—	—

	WEST COAST						EAST COAST				
	1	2	3	4	5	6	7	8	9	10	11
<i>Oldenlandia diffusa</i> Roxb.	—	—	—	+	+	+	+	+	+	—	+
<i>O. umbellata</i> Linn.	—	+	—	+	—	+	+	—	+	—	—
<i>O. stricta</i> Linn.	—	—	—	—	—	+	+	—	—	—	—
<i>O. shuteri</i> Hook. f.	—	—	—	—	—	—	+	—	—	—	—
<i>Anotis carnosa</i> Benth. & Hook. f.	—	—	—	+	+	—	—	—	—	—	—
<i>A. foetida</i> Benth. & Hook. f.	—	—	—	+	+	—	—	—	—	—	—
<i>Guettarda speciosa</i> L.	—	—	—	—	—	?	?	—	—	—	—
<i>Scyphiphora hydrophyllacea</i> Gaertn.	—	—	—	—	—	+	+	—	+	—	—
<i>Ixora coccinea</i> Linn.	—	+	+	+	+	—	+	—	+	+	+
<i>Morinda citrifolia</i> Linn.	—	—	+	+	+	+	+	+	+	—	+
<i>Hydrophylax maritima</i> Linn. f.	—	+	+	+	+	+	+	+	+	—	—
<i>Borreria articularis</i> (Linn. f.) F. N. Will.	+	+	—	—	+	+	+	+	+	—	—
COMPOSITAE											
<i>Blumea obliqua</i> (L.) Druce	—	+	+	+	+	+	+	+	+	+	+
<i>Sphaeranthus amaranthoides</i> Burm. f.	—	—	—	+	+	+	+	—	—	—	+
<i>Wedelia biflora</i> DC.	—	—	—	+	+	+	+	+	—	—	+
<i>Voluterella divaricata</i> Benth.	—	+	+	+	+	—	—	+	—	—	—
<i>Launaea sarmentosa</i> (Willd.) Alston	+	+	+	+	+	+	+	+	+	+	+
<i>Helichrysum cutchicum</i> (C. B. Cl.) Rao et Deshpande	+	+	—	—	—	—	—	—	—	—	—
GOODENIACEAE											
<i>Scaevola taccada</i> (Gaertn.) Roxb.	+	—	—	+	+	+	+	—	—	—	—
<i>S. plumieri</i> (L.) Vahl	—	—	—	—	+	—	+	—	—	—	—
PLUMBAGINEAE											
<i>Limonium stocksii</i> (Boiss) O. Ktze.	+	+	—	—	—	—	—	—	—	—	—
MYRSINACEAE											
<i>Ardisia littoralis</i> Andr.	—	—	—	+	+	+	+	—	+	—	—
EBENACEAE											
<i>Maba buxifolia</i> Pers.	—	—	—	—	+	+	+	—	+	—	—
SALVADORACEAE											
<i>Salvadora persica</i> Linn.	+	+	+	+	+	+	+	+	+	—	—
APOCYNACEAE											
<i>Cerbera manghas</i> Linn.	—	—	—	+	+	+	+	+	+	—	—
<i>Parsonsia helicandra</i> Hook. & Arn.	—	—	—	+	+	+	+	+	+	—	+
ASCLEPIADACEAE											
<i>Leptadenia reticulata</i> Wt. & Arn.	—	+	+	+	+	+	+	—	+	—	—
<i>Oxystelma esculentum</i> R. Br.	—	—	—	+	+	+	+	—	+	—	+
<i>Tylophora tenuis</i> Bl.	—	—	—	?	+	+	+	—	—	—	+
<i>Calotropis gigantea</i> Br.	+	+	+	+	+	+	+	+	+	+	+
<i>C. procera</i> Br.	+	+	+	—	—	—	—	—	—	—	—
<i>Cosmostigma racemosum</i> (Roxb.) Wt.	—	—	—	+	+	+	+	—	—	—	—
<i>Heterostemma tanjorensis</i> Wt. & Arn.	—	—	—	+	+	+	+	—	—	—	—
<i>Sarcostemma acidum</i> (Roxb.) Voigt.	+	+	+	+	+	+	+	+	+	+	—
<i>Ceropegia bulbosa</i> Roxb.	—	+	+	+	+	+	+	—	—	—	—
<i>Sarcolobus globosus</i> Wall.	—	—	—	—	—	—	—	—	—	—	+
GENTIANACEAE											
<i>Enicostema hyssopifolium</i> (Willd.) Vend.	—	+	+	+	+	+	+	+	—	—	—
BORAGINACEAE											
<i>Heliotropium variflorum</i> Stocks	+	—	—	—	—	—	—	—	—	—	—
<i>H. curassavicum</i> Linn.	—	—	—	—	—	+	+	+	+	+	+
<i>Messerschmidia argentea</i> (L.f.) Johnst.	—	—	—	—	—	—	+	—	—	—	—
<i>Cordia subcordata</i> Lamk.	—	—	—	—	—	—	+	—	—	—	—
CONVOLVULACEAE											
<i>Ipomoea pes-caprae</i> (L.) R. Br.	+	+	+	+	+	+	+	+	+	+	+
<i>I. tuba</i> (Schlecht.) G. Don	—	—	—	—	+	+	+	+	+	—	+
<i>Cressa cretica</i> L.	+	+	+	+	+	+	+	+	+	—	—

	WEST COAST						EAST COAST				
	1	2	3	4	5	6	7	8	9	10	11
<i>Fimbristylis spathacea</i> Roth	+	+	+	+	+	+	+	+	+	+	+
<i>F. sericea</i> R. Br.	—	—	—	—	—	—	—	+	+	—	—
<i>F. junciformis</i> Kunth	—	—	—	—	—	+	+	+	+	—	+
<i>Bulbostylis barbata</i> (Rottb.) Cl.	—	—	+	+	+	+	+	+	+	+	+
GRAMINEAE											
<i>Spinifex littoreus</i> (Burm. f.) Merr.	+	+	+	+	+	+	+	+	+	+	—
<i>Paspalum vaginatum</i> Sweet.	—	—	—	—	+	+	+	+	—	—	—
<i>Trachys muricata</i> (Linn.) Pers. ex Trin.	—	—	—	+	+	+	+	+	+	—	—
<i>Lopholepis orinotocephala</i> (Hook.) Steud.	—	—	—	—	—	+	+	—	—	—	—
<i>Perotis indica</i> (L.) O. Ktze.	—	—	+	+	+	+	+	+	+	+	—
<i>Sporobolus virginicus</i> (Linn.) Kunth.	—	+	+	+	+	+	+	+	+	—	+
<i>Halopyrum mucronatum</i> Stapf	+	+	—	+	+	+	+	—	—	—	—
<i>Coelachyrum lagopoides</i> (Burm. f.) Senratna	—	—	—	—	+	+	+	—	—	—	—
<i>Aeluropus lagopoides</i> (Linn.) Trin. ex Thw.	+	+	+	+	+	+	+	+	—	+	+
<i>Triplopogon ramosissimus</i> (Hack.) Bor	—	—	—	+	+	—	+	—	—	—	—
<i>Urochondra setulosa</i> (Trin.) Hubb.	+	+	—	—	—	—	—	—	—	—	—
<i>Myriostachya wightiana</i> (Nees ex Steud.) Hook. f.	—	—	—	—	—	—	+	+	+	—	+
<i>Stenotaphrum dimidatum</i> (L.) Brongn.	—	—	—	—	—	+	+	—	—	—	—
<i>Ischaemum muticum</i> L.	—	—	—	+	+	+	+	—	—	—	—
<i>I. santapauli</i> Bor	—	—	—	+	—	—	—	—	—	—	—
<i>Zoysia matrella</i> (L.) Merr.	—	+	+	+	+	+	+	+	+	+	+
FERN											
<i>Acrostichum aureum</i> L.	—	—	—	+	+	+	+	—	+	—	+

REFERENCES

- ARORA, R. K. AND K. R. AGGARWAL. Observations on the vegetation of Malpe coast and neighbouring islands. *J. Indian bot. Soc.* 44 : 314-324. 1950.
- BHARUCHA, F. R. The vegetation of Bombay and its environs. *J. Gujrat Res. Soc.* 11 : 233-43. 1950.
- BLATTER, E. Revision of the Flora of the Bombay Presidency. *J. Bombay nat. Hist. Soc.* 31 : 547-57. 1926.
- The Mangroves of the Bombay Presidency and its biology. *Ibid.* 16 : 644-654. 1905.
- On the Flora of Cutch. Part I & II. *Ibid.* 18 : 756-77, 19 : 157-176. 1908-1909.
- BORGENSEN, F. Notes on the vegetation at Dwarka with reference to Raunkiaer's life forms and statistical methods. *J. Indian bot. Soc.* 8 : 1-18. 1929.
- BURNS, W. A study of the Sea-shore vegetation. *J. Bombay nat. Hist. Soc.* 20 : 1024. 1910.
- CHATTERJEE, D. Indian species of *Canavalia* DC. *J. Indian bot. Soc.* 28 : 83-95. 1949.
- CHATTERJEE, S. P. *The Gazetteer of India*. 1 : 1-66. 1965.
- CLEGHORN, H. On the sand-binding plants of the Madras beach, Madras. *J. Litt. Sci.* NS. 1 : 85-90. 1856.
- COOKE, T. *The Flora of the Presidency of Bombay*. London. 1903-1908.
- DANIEL, J. C. The Point Calimere Sanctuary Madras State —May, 1967. *J. Bombay nat. Hist. Soc.* 64 : 512-523. 1967.
- ERLANSO, E. W. Plant colonization on two tropical islands. *J. Indian bot. Soc.* 5 : 193-213. 1936.
- FYSON, P. F. An ecologically regressive vegetation on the Trinnavally coast. *Proc. Indian Sci. Cong.* 1919 (Abstract).
- GAMBLE, J. S. *The Flora of the Presidency of Madras*. Reptd. Ed. 1957.
- GOOD, R. *The Geography of the Flowering plants*. 1953.
- HAINES, H. H. *The Botany of Bihar and Orissa*. Reptd. Ed. Calcutta. 1961.
- HOOKE, J. D. ET AL. *The Flora of British India*. Vols. 1-7, London. 1875.
- JAIN, S. K. The vegetation and succession of plant communities in Kutch, Gujarat. *Proc. Symp. Recent Adv. Tropical ecology*. 426-437. 1968.
- AND K. C. KANODIA. Additions to the Flora of Kutch. *Curr. Sci.* 29 : 361-382. 1960b.
- AND U. R. DESHPANDE. Further contribution to the flora of Kutch in Gujarat State. *Bull. bot. Surv. India*. 2 : 187-292. 1960.
- KAPADIA, G. A. Statistical synopsis of the flora of Barda mountain in Porbandar State, based on 'Vanapati Shastra' by Jaikrishna Indraj. *J. Indian bot. Soc.* 28 : 245-251. 1949.
- LAWRENCE, C. A. The vegetation of Kanyakumari district (Cape Comorin). *J. Bombay nat. Hist. Soc.* 57 : 184-195. 1960.
- MARLANGE, M. AND V. M. MEHER-HOMJI. Phytosociological studies in the Pondicherry region. *J. Indian bot. Soc.* 44 : 167-182. 1965.
- MOONEY, H. F. *Supplement to the Botany of Bihar and Orissa*. 1950.
- MUDALIAR, C. R. AND H. S. KAMATH. Back water flora of the West coast of South India. *J. Bombay nat. Hist. Soc.* 54 : 69-89. 1952.
- MUKHERJEE, A. K. AND L. K. BANERJEE. Three new plant records for West Bengal. *J. Bombay nat. Hist. Soc.* 65 : 268-269. 1968.
- NAIRNE, A. K. *The flowering plants of the Western India*. Bombay & London. 1894.
- NAVALKAR, B. S. Succession of the Mangrove vegetation of Bombay & Salsette islands. *J. Bombay nat. Hist. Soc.* 50 : 157-160. 1951.

- NAYAR, M. P. The vegetation of Kanyakumari District. *Bull. bot. Surv. India* 1 : 122-126. 1959.
- PAYENS, J. P. D. A monograph of the genus *Barringtonia* (Lecythidaceae). *Blumea* 15 : 157-263. 1967.
- PRAIN, D. Flora of the Sundribans. *Rec. bot. Surv. India* 2 : 232-370. 1903.
- RAIZADA, M. B. Some interesting plants from Orissa. *Indian For.* 49 : 667-680. 1949.
- AND K. M. VAID. Glimpses of the vegetation of Okhamandal. *Ibid.* 83 : 641-646. 1957.
- RANGA ACHARYA, K. Note on the Tinnevely district. *Madras Agric. Dept. Year Book.* 95-109. Madras.
- RAO, R. S. Observations on the mangrove vegetation of the Godavari estuary. *Proc. Mangrove Symp.* 36-39. 1957.
- Materials for the flora of Goa. *Proc. Indian Sci. Cong. Comb. Botany* 51 & 52nd Session : 402. 1965.
- Studies on the vegetation of Daman, Dadra and Nagar Haveli of Western India. *Ibid.* 402-403. 1965.
- Helichrysum cutchicum* (C. B. Cl.) R. S. RAO et Desh.—an interesting species from Western India. *Bull. bot. Surv. India* 10 : 225-227. 1968 (1969).
- RAO, T. A. *Ipomoea tuba* (Schlecht.) G. Don from Rameswaram Island—a new distributional record for South India. *Ibid.* 6 : 307. 1964.
- A new locality record of *Cordia crenata* Del. *J. Bombay nat. Hist. Soc.* 61 : 128. 1970.
- AND A. K. MUKHERJEE. Distribution of some plants along Midnapur coast in West Bengal State. *Curr. Sci.* 34 : 589. 1965.
- AND—Ecological aspect along the shores of the Buralabanga Tidal estuary, Balasore District, Orissa State. *Proc. Indian Acad. Sci.* 76(B) : 201-206. 1972.
- AND—Ecological studies of Saurashtra coast and neighbouring islands. V. Jafarabad to Bhavanagar coastal area. *Bull. bot. Surv. India* 9 : 79-87. 1967.
- AND L. K. BANERJEE. A few unrecorded taxa for the Kanya Kumari shore. *J. Bombay nat. Hist. Soc.* (in press), 1973.
- AND—Is *Acrostichum aureum* L. truly a mangrove fern? *Curr. Sci.* 42 : 546-547. 1973.
- AND—Vascular plants of the Coastal Midnapore District, West Bengal. *Indian For.* 96 : 668-677. 1970.
- AND A. R. K. SASTRY. New distributional records for coastal plants from Andhra Pradesh. *J. Bombay nat. Hist. Soc.* 67 : 614-615. 1972.
- AND—An ecological approach towards classification of coastal vegetation of India. I. Strand vegetation. *Indian For.* 98 : 594-607. 1972.
- AND P. G. SHANWARE. Analysis of the Basic patterns of an estuarine shore in the vicinity of the Coringa Bay, Andhra Pradesh. *Proc. Indian Acad. Sci.* 75(B) : 40-50. 1972.
- AND B. C. KORLAHALI. A note on the inflorescence of *Hyphaene indica* Becc. *J. Bombay nat. Hist. Soc.* 66 : 235-237. 1969.
- AND—On interesting plants from Saurashtra coast. *Ibid.* 64 : 585-586. 1968.
- AND B. SAFUI. Some rare plants along Saurashtra coast and neighbouring Islands. *Proc. Indian Acad. Sci.* 58(B) : 362-366. 1963.
- AND K. R. AGGARWAL. Ecological studies of Saurashtra coast and neighbouring islands. II. Bcyt Island. *Bull. bot. Surv. India.* 8 : 16-24. 1966.
- AND—Ecological studies of Saurashtra coast and neighbouring islands III. Okhamandal point to Diu coastal area. *Arid Zone Problems Symposium, Jodhpur.* 31-42. 1964 (1971).
- AND A. K. MUKHERJEE. Ecological studies on the soil and vegetation of Krusadigroup of Islands in the Gulf of Manaar. *Bull. bot. Surv. India* 5 : 141-148. 1963.
- AND—An ecological account of the vegetation of Rameswaram islands. *Ibid.* 5 : 301-323. 1964.
- AND—Ecological studies of Saurashtra coast and neighbouring islands IV. Piram Island. *Ibid.* 8 : 60-67. 1966.
- AND L. K. BANERJEE. Some plant records for Orissa State. *J. Bombay nat. Hist. Soc.* 64 : 583-584. 1964.
- AND A. K. MUKHERJEE. Some plant records for West Bengal State. *Sci. & Cult.* 33 : 125. 1967.
- AND—Some interesting plant records from the Orissa coast. *J. Bombay nat. Hist. Soc.* 66 : 659-660. 1970.
- AND P. G. SHANWARE. Distribution of *Spinifex littoreus* (Burm. f.) Merr. along Indian coasts. *Ibid.* 63 : 463. 1967.
- AND—Ecological studies of Saurashtra coast and neighbouring islands. VI. An approach to a classification of Saurashtra coastland. *Bull. bot. Surv. India* 9 : 240-248. 1967.
- SANTAPAU, H. Critical notes on some Convolvulaceae of Bombay. Prof. S. P. Agharkar Comm. Vol. 12 : 22. 1961.
- SANYAL, A. Additional notes on the Botany of Bihar & Orissa. by H. H. Haines & its supplement by Dr. Herbert Mooney. *Indian For.* 83 : 230-234. 1957.
- SATYANARAYANA, Y. Ecological studies of Bombay coast line. Strand vegetation. *J. Biol. Sci.* 1 : 53-55. 1958.
- SAUER, J. Review of *Canavalia*. *Brittonia* 16 : 106-181.
- SCHIMPER, A. F. W. *Die Indo-Malaysische-strand flora*, 1891.
- SEBASTINE, K. M. AND J. L. ELLIS. A contribution to the Vascular flora of Vedharanyam and Talaignayar R. F., Tanjore Dt., Madras State. *Bull. bot. Surv. India* 9 : 190-200. 1967.
- SHAH, C. K. Grasses of Ahmedabad District. *Proc. Indian Sci. Cong. (Botany)* 54 session : 320-321. 1967.
- SHAH, G. L. The vegetation along the seashores in Salsette island, Bombay. *Bull. bot. Surv. India* 4 : 239-240. 1962.
- Notes on some Bombay plants. *J. Bombay nat. Hist. Soc.* 60 : 481-484. 1963.
- SIDHU, S. S. Studies on the mangroves of India I. East Godavari region. *Indian For.* 89 : 337-351. 1963.
- SRINIVASAN, K. S. Aspects of vegetation of Church island off Tuticorin part in S. India. *J. Bombay nat. Hist. Soc.* 57 : 348-353. 1960.
- SUBRAMANIA, V. IYER. Sand-binding plants. *Indian For.* 35 : 82-97. 1909.
- SUNDARRAJ, D. D. AND M. NAGRAJAN. The flora of Hare and Church islands off Tuticorin. *J. Bombay nat. Hist. Soc.* 61 : 587-602. 1964.
- AND—New plant records from South India. *Ibid.* 63 : 227-228. 1966.
- THOMAS, K. J. A survey of the vegetation of Veli (Trivandrum) with special reference to ecological factors. *J. Indian bot. Soc.* 41 : 104-130. 1962.
- TOOR, P. S. Studies in the vegetation of Gujarat coast, Western India. *Proc. Ind. Sci. Cong. Part. III Abstracts—Section VI—Botany* : 333-334. 1958.
- VARTAK, V. D. *Enumeration of plants from Gomantak, India.* Maharashtra Assoc. for the cultivation of Science, Poona-4. 1968.
- VENKATESHWARLU, J., P. V. BHIRAVAMURTY AND P. N. RAO. *The flora of Visakhapatnam.* Andhra Pradesh Academy of Sciences, Hyderabad, 1972.
- VENKATESHWARLU, W. The estuarial flora of the Godavary. *J. Bombay nat. Hist. Soc.* 44 : 432-435. 1944.