THE FLORA OF THE INDUS DELTA.

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(*Continued from p.* 132 *Vol. VI, Nos. 3 and 4.*)

PART IV.—B. PLANT-GEOGRAPHICAL CONSIDERATIONS.

I. Statistical Notes.

The following table gives a conspectus of the indigenous and introduced species and genera of the Indus Delta, and the same data for the Sundribuns. We add the latter in this place in order to save space, though we shall discuss the floristic relations between the two deltas later on.

Families.	Indus Delta.						Sundribuns.					
	Genera		Species		Total		Genera		Species		Total	
	Indigenous	Introduced	Indigenous	Introduced	Genera	Species	Indigenous	Introduced	Indigenous	Introduced	Genera	Species
Ranunculaceae	...	...	...	...	...	...	1	...	1	...	1	1
Menispermaceae	...	1	...	1	...	1	1	...	1	...	1	1
Nymphæaceae	...	2	...	3	...	2	3	...	...	...	...	...	...
Cruciferae	...	1	2	1	3	3	4	1	...	1	...	1	1
Capparidaceae	...	5	...	6	...	5	6	3	1	3	1	4	4

Resedaceae	...	1	...	1	...	1	1	...	...	...	...	...	...					
Bixaceae	...	...	...	...	...	...	...	1	...	1	...	1		1				
Polygalaceae	...	1	...	1	...	1	1	...	...	...	...	...	...					
Caryophyllaceae	...	1	...	1	...	1	1	...	...	...	...	...	...					
Portulacaceae	...	1	...	2	...	1	2	1	...	1	...	1		1				
Tamaricaceae	...	1	...	3	...	1	3	1	...	1	..	1		1				
Elatinaceae	...	1	...	2	...	1	2	...	...	...	...	...	...					
Malvaceae	...	5	1	10	1	6	11	4	...	6	...	4		6				
Tiliaceae	...	3	...	8	...	3	8	2	...	2	...	2		2				
Sterculiaceae	...	1	...	1	...	1	1	2	...	2	...	2		2				
Zygophyllaceae	...	3	...	4	...	3	4	...	...	...	...	...	...					
Geraniaceae	...	1	...	1	...	1	1	1	...	1	...	1		1				
Rutaceae	...	...	1	...	1	1	1	4	...	4	...	4		4				
Burseraceae	...	1	...	1	...	1	1	...	...	...	...	...	...					
Meliaceae	...	...	1	...	1	1	1	2	...	3	...	2		3				

FAMILIES.	INDUS DELTA.						SUNDRIBUNS					
	Genera		Species		Total		Genera		Species		Total	
	Indigenous	Introduced	Indigenous	Introduced	Genera	Species	Indigenous	Introduced	Indigenous	Introduced	Genera	Species
Olacaceæ ...	...	...	...	...	...	...	1	...	1	...	1	1
Celastraceæ ...	1	...	1	...	1	1	1	...	1	...	1	1
Rhamnaceæ ...	1	...	1	1	1	2	1	...	1	1	1	2
Ampelidaceæ ...	...	...	...	...	...	...	2	...	4	...	2	4
Sapindaceæ ...	...	...	...	...	...	...	3	...	3	...	3	3
Anacardiaceae ...	...	1	...	1	1	1	2	...	2	...	2	2
Moringaceae ...	...	1	...	1	1	1	...	...	...	...	...	...
Leguminosae ...	13	9	23	12	22	35	21	4	32	6	25	38
Droseraceae ...	...	...	...	...	...	...	1	...	1	...	1	1
Rhizophoraceae ...	3	...	5	...	3	5	4	...	6	...	4	6
Combretaceae ...	...	2	...	2	2	2	1	...	1	...	1	1

Myrtaceae	...	...	1	...	1	1	1	2	1	3	1	3	4			
Lythraceae	...	2	2	2	2	4	4	2	...	3	...	2	3			
Papayaceae	...	...	1	...	1	1	1	...	...	...	...	...	...			
Turneraceae	...	...	...	...	...	...	...	1	...	1	...	1	1			
Passifloraceae	...	...	...	...	...	...	...	1	...	1	...	1	1			
Cucurbitaceae	...	7	...	7	...	7	7	6	...	7	...	6	7			
Ficoidaceae	...	3	...	4	...	3	4	2	...	2	...	2	2			
Rubiaceae	...	...	...	...	...	...	...	5	...	6	...	5	6			
Compositae	...	14	...	18	...	14	18	11	...	12	...	11	12			
Goodeniaceae	...	1	...	2	...	1	2	...	...	...	...	...	...			
Plumbaginaceae	...	1	...	1	...	1	1	1	...	1	...	1	1			
Myrsinaceae	...	1	...	1	...	1	1	1	...	1	...	1	1			
Ebenaceae	...	...	...	...	...	...	...	1	...	2	...	1	2			
Oleaceae	...	...	1	...	1	1	1	...	...	...	...	...	...			
Salvadoraceae	...	1	...	2	...	1	2	1	...	1	...	1	1			

Families.	Indus Delta.						Sundribuns.					
	Genera		Species		Total		Genera		Species		Total	
	Indigenous	Introduced	Indigenous	Introduced	Genera	Species	Indigenous	Introduced	Indigenous	Introduced	Genera	Species
Apocynaceae ...	1	1	1	1	2	2	2	...	2	...	2	2
Asclepiadaceae ...	7	1	8	1	8	9	11	...	12	...	11	12
Gentianaceae ...	1	...	1	...	1	1	2	...	2	...	2	2
Hydrophyllaceae ...	...	...	...	...	...	...	1	...	1	...	1	1
Boraginaceae ...	3	...	9	...	3	9	3	...	3	...	3	3
Convolvulaceae ...	5	...	13	1	5	14	4	...	9	...	4	9
Solanaceae ...	5	2	7	3	7	10	1	...	4	...	1	4
Scrophulariaceae ...	6	...	7	...	6	7	5	...	5	...	5	5
Orobanchaceae ...	1	...	1	...	1	1	...	...	...	...	...	...
Lentibulariaceae ...	...	...	...	...	...	...	1	...	2	...	1	2
Bignoniaceae ...	1	...	1	...	1	1	1	...	1	...	1	1

Pedaliaceae	...	...	1	...	1	1	1	...	...	...	...	...	...	
Acanthaceae	...	4	1	7	1	5	8	3	...	6	...	3	6	
Verbenaceae	...	3	...	3	...	3	3	6	...	12	...	6	12	
Labiatae	...	3	...	4	1	3	5	3	...	4	...	3	4	
Nyctaginaceae	...	1	...	2	...	1	2	...	...	...	...	...	...	
Amarantaceae	...	8	...	11	...	8	11	3	...	3	2	3	5	
Chenopodiaceae	...	6	...	8	...	6	8	4	...	4	...	4	4	
Polygonaceae	...	1	...	1	...	1	1	...	...	...	...	...	...	
Aristolochiaceae	...	1	...	1	...	1	1	1	...	1	...	1	1	
Lauraceae	...	...	...	...	...	...	...	1	...	1	...	1	1	
Loranthaceae	...	...	...	...	...	...	...	2	...	4	...	2	4	
Euphorbiaceae	...	3	1	11	4	4	15	14	...	16	...	14	16	
Moraceae	...	...	1	...	1	1	1	...	...	...	...	...	...	
Urticaceae	...	1	...	1	2	1	3	3	...	6	...	3	6	
Casuarinaceae	...	...	1	...	1	1	1	1	...	1	...	1	1	

Families.	Indus Delta.						Sundribuns.					
	Genera		Species		Total		Genera		Species		Total	
	Indigenous	Introduced	Indigenous	Introduced	Genera	Species	Indigenous	Introduced	Indigenous	Introduced	Genera	Species
Salicaceae ...	1	...	1	...	1	1	...	...	...	...	...	...
Ceratophyllaceae ...	...	...	...	...	...	...	1	...	1	...	1	1
Gnetaceae ...	1	...	1	...	1	1	...	...	...	...	...	...
Hydrocharitaceae ...	1	...	1	...	1	1	4	...	4	...	4	4
Orchidaceae ...	...	...	...	...	...	...	8	...	13	...	8	13
Scitaminaceae ...	...	1	...	1	1	1	2	...	2	...	2	2
Amaryllidaceae ...	1	...	1	...	1	1	1	...	1	...	1	1
Dioscoreaceae ...	...	...	...	...	...	...	1	...	1	...	1	1
Liliaceae ...	1	...	3	...	1	3	1	...	1	...	1	1
Commelinaceae ...	1	...	1	...	1	1	2	...	2	...	2	2
Flagellariaceae ...	...	...	...	...	...	...	1	...	1	...	1	1

Palmae	...	1	1	1	1	2	2	4	2	4	2	6	6
Pandanaceae	...	1	...	1	...	1	1	1	...	2	...	1	2
Typhaceae	...	1	...	2	...	1	2	1	...	2	...	1	2
Araceae	...	...	...	...	...	...	...	2	...	2	...	2	2
Lemnaceae	...	1	...	1	...	1	1	...	...	...	...	...	...
Alismaceae	...	1	...	1	...	1	1	...	...	..	...	...	...
Naiadaceae	...	3	...	4	...	3	4	2	...	2	...	2	2
Cyperaceae	...	4	...	11	...	4	11	9	...	19	...	9	19
Gramineae	...	28	2	40	6	30	46	22	...	29	...	22	29
TOTAL	...	184	36	279	53	220	332	229	8	304	13	237	317

The species observed in the Delta, including the introduced plants, number 332, belonging to 220 genera and 73 families. Of these are indigenous 61 families, 184 genera, and 279 species. From now we shall confine ourselves to the indigenous plants only.

The ratio of families to genera and species is 1 : 3.01 : 4.57, or approximately 1 : 3 : 4.5.

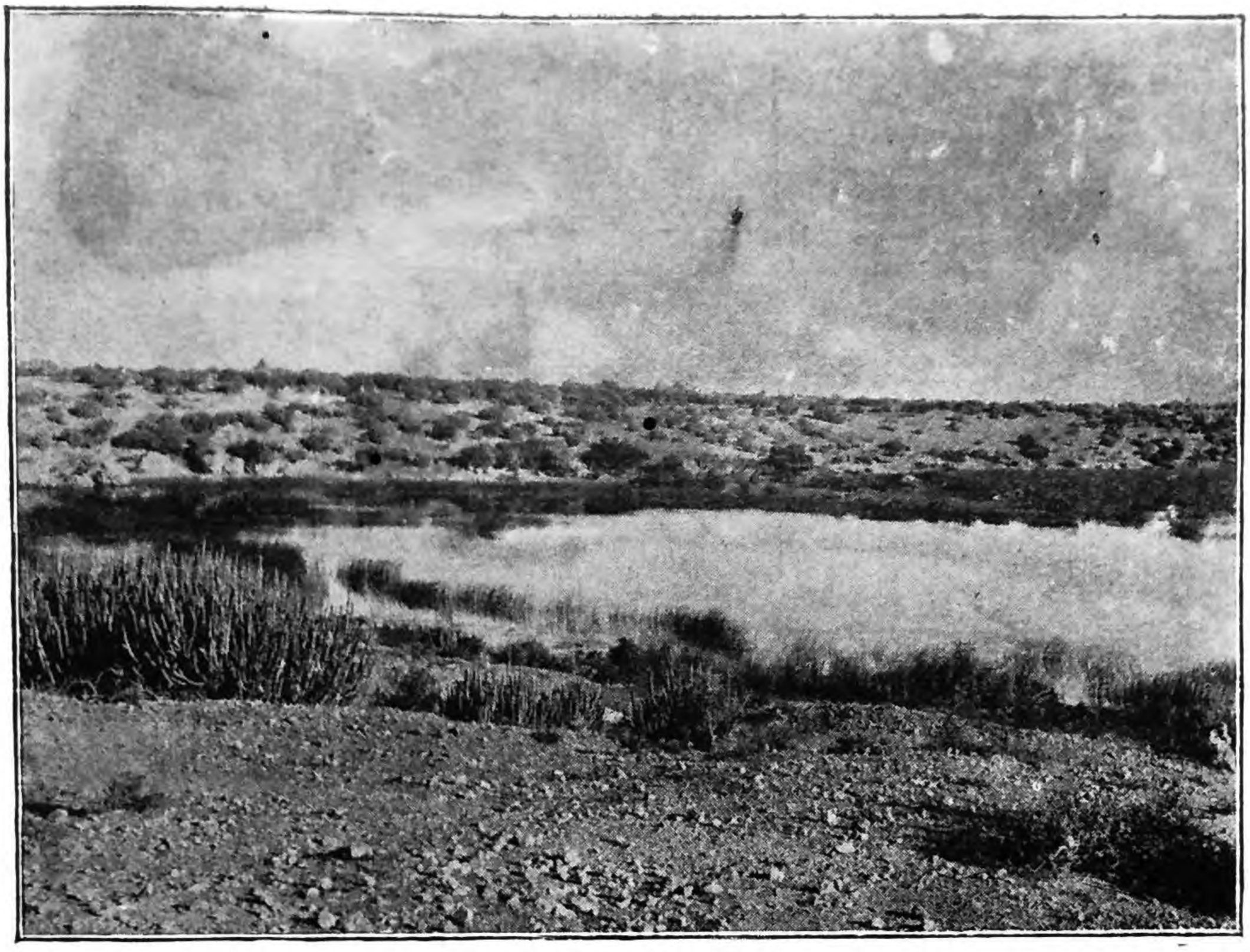
A comparison of the Dicotyledons with the Monocotyledons shows the great poverty of the latter :

Dicotyledons :	Genera	139,	species 211
Monocotyledons :	,,	44,	,, 67

The ratio, therefore, of the Monocotyledons to the Dicotyledons is 1 : 3.14.

The following list shows the families arranged according to the number of species belonging to each :

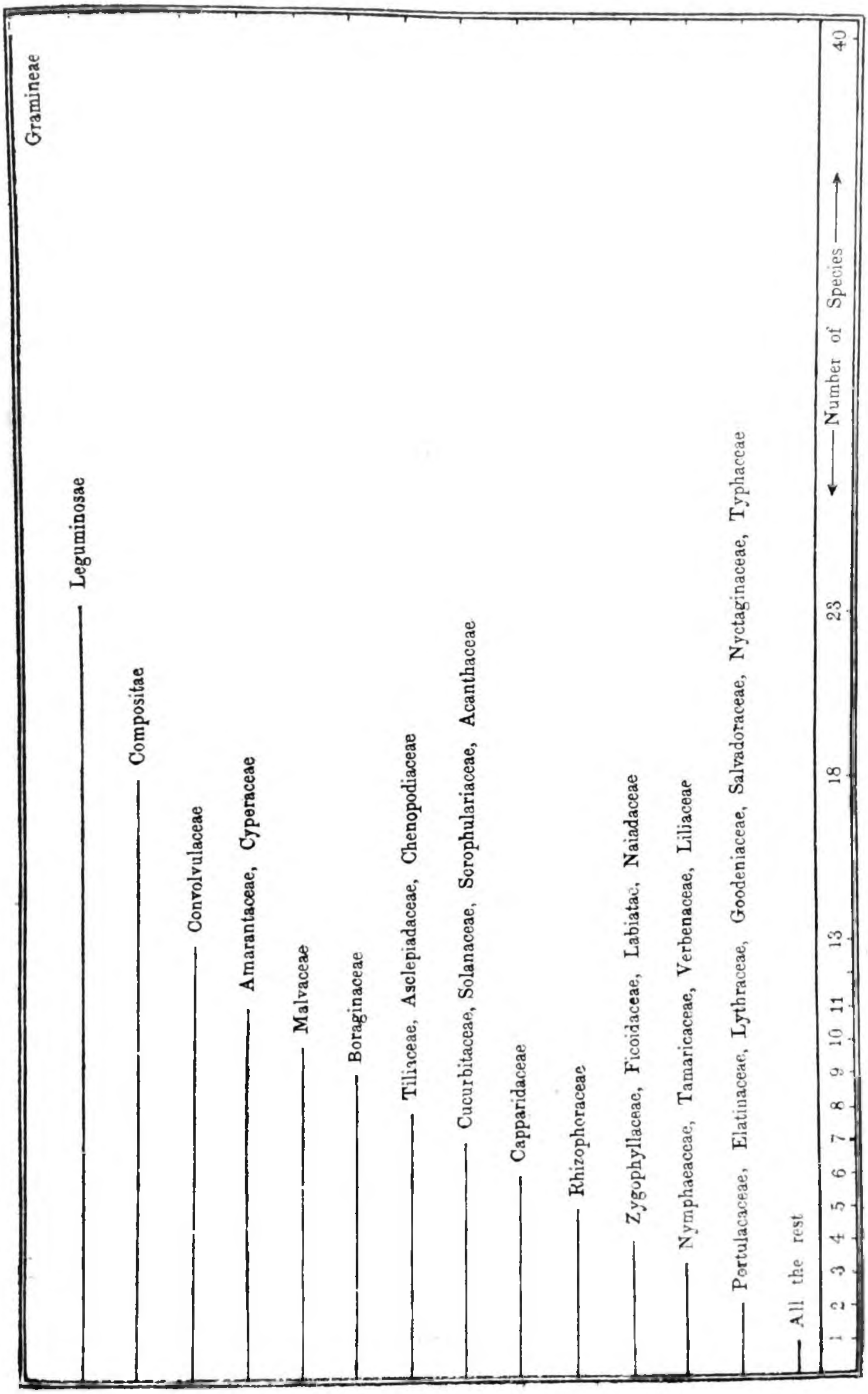
FAMILIES.	Indigenous species	Indigenous genera	FAMILIES.	Indigenous species	Indigenous genera
Gramineae ...	40	28	Nyctaginaceae ...	2	1
Leguminosae ...	23	13	Typhaceae ...	2	1
Compositae ...	18	14	Menispermaceae ...	1	1
Convolvulaceae ...	13	5	Cruciferae ...	1	1
Euphorbiaceae ...	11	3	Resedaceae ...	1	1
Amarantaceae ...	11	8	Polygalaceae ...	1	1
Cyperaceae ...	11	4	Caryophyllaceae ...	1	1
Malvaceae ...	10	5	Sterculiaceae ...	1	1
Boraginaceae ...	9	3	Geraniaceae ...	1	1
Tiliaceae ...	8	3	Burseraceae ...	1	1
Asclepiadaceae ...	8	7	Celastraceae ...	1	1
Chenopodiaceae ...	8	6	Rhamnaceae ...	1	1
Cucurbitaceae ...	7	7	Plumbaginaceae ...	1	1
Solanaceae ...	7	5	Myrsinaceae ...	1	1
Scrophulariaceae...	7	6	Apocynaceae ...	1	1
Acanthaceae ...	7	4	Gentianaceae ...	1	1
Capparidaceae ...	6	5	Orobanchaceae ...	1	1
Rhizophoraceae ...	5	3	Bignoniaceae ...	1	1
Zygophyllaceae ...	4	3	Polygonaceae ...	1	1
Ficoidaceae ...	4	3	Aristolochiaceae ..	1	1
Labiatae ...	4	3	Urticaceae	1	1
Naiadaceae ...	4	3	Salicaceae ...	1	1
Nymphaeaceae ...	3	2	Gnetaceae ...	1	1
Tamaricaceae ...	3	1	Hydrocharitaceae ...	1	1
Verbenaceae ...	3	3	Amaryllidaceae ...	1	1
Liliaceae ...	3	1	Commelinaceae ...	1	1
Portulacaceae ...	2	1	Palmae ...	1	1
Elatinaceae ...	2	1	Pandanaceae ...	1	1
Lythraceae ...	2	2	Lemnaceae ...	1	1
Goodeniaceae ...	2	1	Alismaceae ...	1	1
Salvadoraceae ...	2	1			



No. 21. Tatta Lake, fringed with sedges; shore rocky and gravelly, covered with *Capparis decidua* Pax and *Euphorbia caducifolia*.

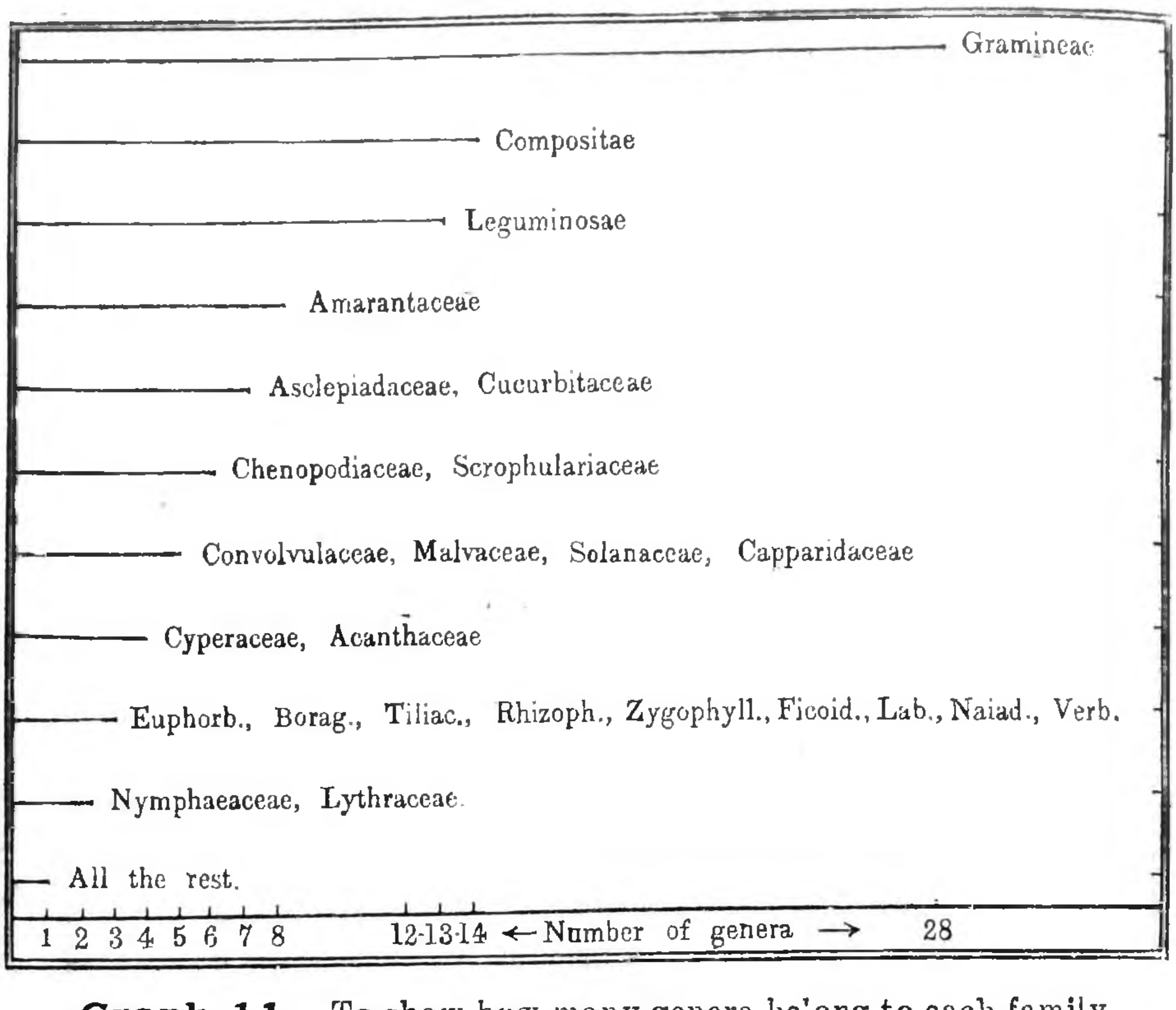
No. 22. An almost pure formation of *Euphorbia caducifolia* on a rocky slope near Tatta.

We show the same graphically (Graph 10):



Graph 10.—To show the number of species belonging to each family.

It is a striking fact that out of 61 families 36 are represented by 1 genus only, and 28 by 1 species. Diagram 11 shows how many genera belong to each family.

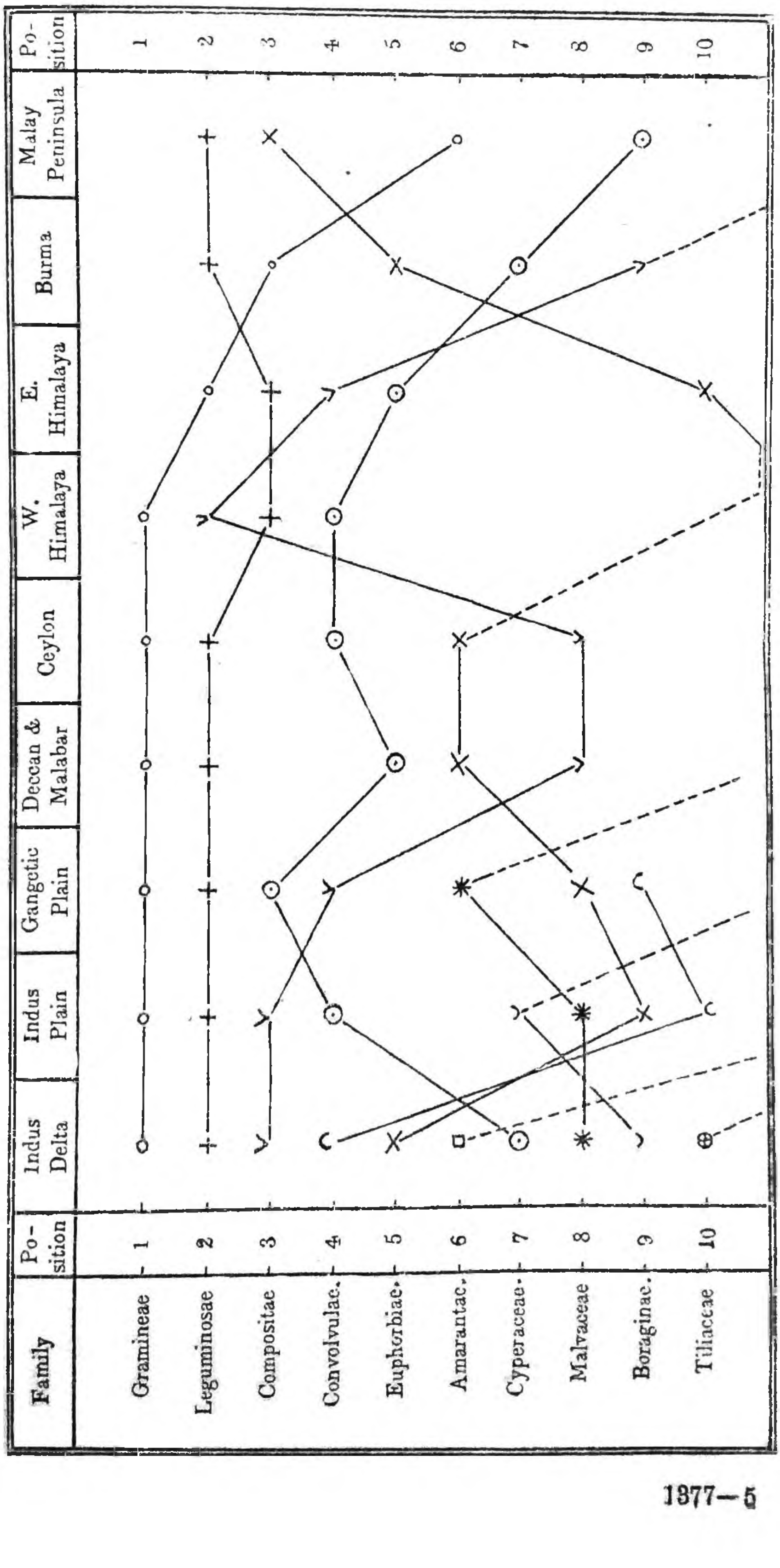


Graph 11.—To show how many genera be'ong to each family.

The following are the dominant families if we consider the number of species belonging to each.

FAMILIES.	Species	Percentage of total	FAMILIES.	Species	Percentage of total
Gramineæ ...	40	14·3	Malvaceæ ...	10	3·5
Leguminosæ ...	23	8·2	Boraginaceæ ...	9	3·2
Compositæ ...	18	6·4	Tiliaceæ ...	8	2·8
Convolvulaceæ ...	13	4·6	Asclepiadaceæ ...	8	2·8
Euphorbiaceæ ..	11	3·9	Chenopodiaceæ ...	8	2·8
Amarantaceæ ...	11	3·9	Cucurbitaceæ ...	7	2·5
Cyperaceæ ...	11	3·9	Solanaceæ ...	7	2·5

In order to obtain a clearer insight into the relations of the flora of the Indus Delta with other botanical regions of India, Burma and Ceylon, we add a graph showing the distribution of the 10 dominant orders of the Indus Delta in the Indus Plain, the Gangetic Plain, the Deccan and Malabar, Ceylon, the W. Himalaya, the E. Himalaya, Burma, and the Malay Peninsula. A glance at the graph will explain the salient features. (Graph 12).



Graph 12.—Distribution of the 10 dominant families in various botanical regions.

II. Geographical Distribution.

Out of the 279 indigenous species we have classified 265 according to their geographical distribution. 14 species have not been considered on account of their abnormal and erratic distribution. We distinguish 16 groups:

1. 6 endemic species, viz.

Gossypium Bakeri.
Periploca sp.
Convolvulus sp.
Andrachne sp.
Asparagus gharoensis.
Asparagus deltae.

So far we have to consider them as endemic, but it is more than likely that some day they will be found in the neighbouring countries.

2. The Indian element consisting of 29 species which are found in various parts of India and extend sometimes into Ceylon:

Nymphaea rubra
Maerua arenaria
Cadaba indica
Tamarix dioica
Triumfetta rotundifolia
Indigofera uniflora
I. viscosa
Tephrosia tenuis
Mimosa hamata
Kedrostis rostrata
Corallocarpus epigaeus
Pluchea tomentosa
Echinops echinatus
Volutarella divaricata
Daemia extensa
Trichodesma indicum, var. amplexicaule
Rivea hypocrateriformis
Linaria ramosissima
Lindenbergia urticaefolia
Clerodendron Phlomidis
Suaeda nudiflora
Polygonum plebejum
*Euphorbia caducifolia**
E. Clarkeana
Ficus glomerata
Crinum asiaticum
Pandanus tectorius
Urochloa setigera
Oryza coarctata

3. The Indo-Malayan Element, consisting of 16 species, some of them extending to Australia and Polynesia:

Crotalaria juncea
C. medicaginea
Indigofera cordifolia
Pongamia glabra
Ceriops Roxburgniana
Sonneratia acida
Scaevola frutescens
Oxystelma esculentum
Heliotropium paniculatum
Solanum xanthocarpum
Bonnaya veronicaefolia
Avicennia officinalis
Cyperus Haspan
Fimbristylis ferruginea
Coix Lachryma-Jobi
Eragrostis amabilis

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* *Euphorbia caducifolia* Haines should be substituted for *Euphorbia nivulia* Ham. throughout the series. Mr. C. E. C. Fischer of the Kew Herbarium informs us that our tree-*Euphorbia* is *E. caducifolia* (See Kew Bull. (1925), 341).

No. 23. An almost pure formation of *Cyperaccæ* in an inundated swamp near Tatta.

No. 24. A pool near Kullan Kote Lake. In the water *Panicum*, on the bank *Euphorbia, Acacia, Tamarix.*

4. Plants belonging to the N. African-Indian Desert. We include also those species which have been found only in the Indian Desert. This is the best-represented group numbering 60 species :

Farsetia Jacquemontii
Ochradenus baccatus
Polycarpaea spicata
Tamarix Troupii
Tamarix articulata
Gossypium Stocksii
Tribulus alatus
Commiphora mukul
Zizyphus rotundifolia
Crotalaria Burhia
Indigofera anabaptista
Tephrosia petrosa
Alhagi camelorum
Prosopis spicigera
Cucumis prophetarum
Citrullus Colocynthis
Orygia decumbens
Pluchea lanceolata
Gnaphalium pulvinatum
Inula grantioides
Pulicaria angustifolia
P. Stocksii
Launaea chondrilloides
L. nudicaulis
Statice Stocksii
Salvadora oleoides
Periploca aphylla
Sarcostemma Stocksii
Leptadenia spartium
Heliotropium calcareum
Heliotropium undulatum (also Mediterranean and trop. Asia)
Convolvulus scindicus
C. Rottlerianus
C. microphyllus
Lycium barbarum
Schweinfurthia sphaerocarpa
Cistanche tubulosa
Tecomella undulata
Blepharis sindica
Salvia aegyptiaca (also Mediterranean)
Aerua tomentosa
A. pseudo-tomentosa
Atriplex Stocksii
Suaeda monoica
Salsola foetida
Euphorbia granulata
E. jodhpurensis
Ephedra foliata
Asparagus dumosus
Cyperus arenarius
Saccharum Griffithii
Cymbopogon Jwarancusa
Digitaria pennata
Cenchrus biflorus
Sporobolus arabicus
Helcochloa dura
Eragrostis ciliaris
Chloris villosa (also Mediterranean)
Eleusine flagellifera
Aeluropus villosus (also Mediterranean)

5. The Tropical and N. African-Indian Desert Element. It is also known under the name of N. African Steppe, and comprises Kordofan, Darfur, Sennaar, Etbai, Abyssinia, Yemen, Hadramaut, and the island of Socotra, and sends a number of representatives into

India, especially the N.-W. part. In the Delta we have 37 species belonging to that group:

Cocculus pendulus
Cleome brachycarpa
Capparis decidua
Polygala irregularis
Bergia odorata
Sida grewioides
Abutilon muticum
A. fruticosum
Senra incana
Grewia populifolia
Corchorus antichorus
Melhania Denhamii
Zygophyllum simplex
Acacia arabica
A. Senegal
Vernonia cinerascens
Dicoma tomentosa
Salvadora persica
Calotropis procera
Pentatropis cynanchoides
Cordia myxa
Cordia Rothii
Heliotropium ophioglossum
H. ovalifolium (also Mediterranean)
Convolvulus rhyniospermus
Solanum albicaule
Lindenbergia abyssinica
Ruellia patula
Barleria acanthoides
B. Hochstetteri
Leucas urticaefolia
Aristolochia bracteata
Andrachne aspera
Commelina albescens
Cenchrus catharticus
Aristida funiculata
Eleusine aristata

6. This group comprises 13 species which are common to tropical Africa and India:

Nymphaea stellata
Grewia asiatica
G. villosa
Triumfetta pentandra
Trianchema pentandra
Ruellia prostrata var. dejecta
Justicia heterocarpa
Nothosaerua brachiata
Arthrocnemum indicum
Typha elephantina (also N. Africa)
Cyperus tegetum
Pennisetum cenchroides (also Mediterranean)
Desmostachya cynosuroides (also Syria)

7. Common to the Tropics of the Old World are 39 species:

Portulaca quadrifida
Bergia ammannioides
Abutilon polyandrum
Thespesia populnea
Corchorus tridens
Gymnosporia montana
Indigofera paucifolia
Sesbania aculeata
Aeschynomene indica
A. aspera
Alysicarpus vaginalis
Rhizophora mucronata
R. conjugata
Ceriops Candolleana

Bruguiera gymnorhiza
Momordica Charantia
Coccinia indica
Melothria maderaspatana
Vernonia cinerea
Enicostemma littorale (also W. Indies)
Merremia chrysoides
Ipomoea eriocarpa
I. aquatica
Physalis minima
Limnophila gratioloides
Barleria Prionitis
Ocimum canum
Boerhaavia verticillata
Pupalia lappacea
Alternanthera nodiflora
Phyllanthus reticulatus (also China)
Cyperus stoloniferus
C. alopecuroides
Saccharum spontaneum
Dichanthium annulatum
Paspalum scrobiculatum var. Commersonii
Phragmites karka (also Japan)
Eragrostis interrupta var. Koenigii
Diplachne fusca

8. Common to the Tropics generally are 19 species:

Cleome viscosa
Gynandropsis pentaphylla
Abutilon indicum
Corchorus acutangulus
Rhynchosia minima
Acacia Farnesiana
Trianthema monogyna
Blainvillea rhomboidea
Merremia aegyptia
Ipomoea biloba
Datura fastuosa
Amarantus viridis
Achyranthes aspera
Euphorbia hypericifolia
Phyllanthus Niruri
Cocos nucifera
Eleocharis atropurpurea
Paspalidium geminatum
Chloris barbata

9. Occurring in most warm countries are the following 22 species:

Portulaca oleracea
Sida spinosa
Tribulus terrestris
Fagonia cretica
Mollugo hirta
Eclipta erecta
Sonchus oleraceus
Scaevola Plumierii
Cressa cretica
Amarantus polygamus
Alternanthera triandra
Vallisneria spiralis
Cyperus rotundus
Hemarthria compressa
Digitaria sanguinalis
Eriochloa ramosa
Echinochloa colona
E. stagnina
Setaria verticillata
Aristida Adscenscionis
Tragus racemosus
Cynodon dactylon

10. 6 species are found in the tropical and subtropical regions of the Old World or of the whole world :

Grangea maderaspatana — *Boerhaavia diffusa*
Lippia nodiflora — *Euphorbia hirta*
Ocimum sanctum — *E. pilulifera*

11. In the warm parts of the Old World we find 3 species:

Ammannia baccifera — *Eleusine aegyptiaca*
Fimbristylis dichotoma

12. One species is common to the temperate and subtropical regions :

Zanichellia palustris

13. Mediterranean—Oriental 2 species :

Withania somnifera — *Saccharum Ravennae*

14. Oriental 5 species :

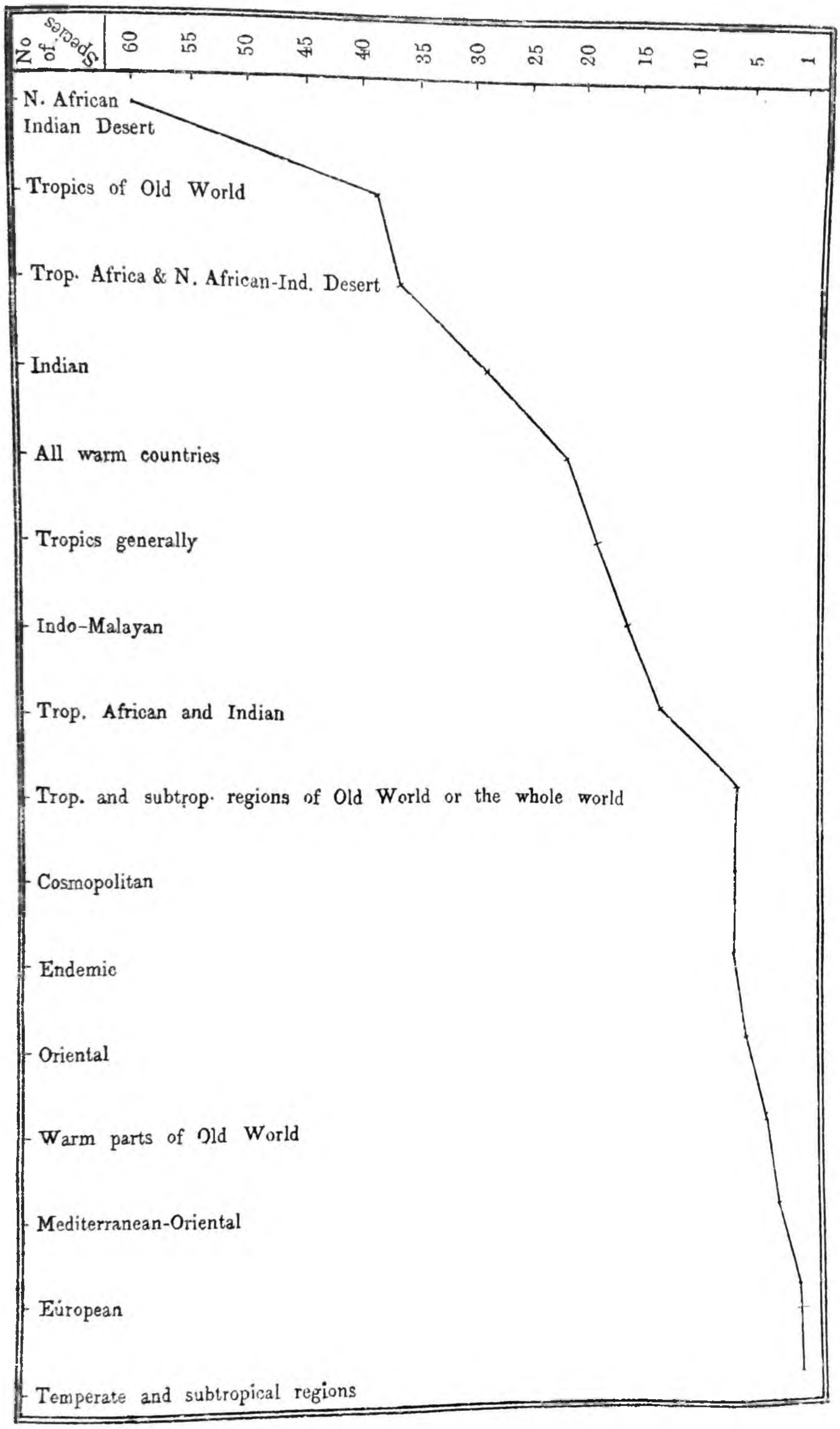
Taverniera cuneifolia — *Haloxylon recurvum*
Nerium odorum — *Populus euphratica*
Suaeda fruticosa (also Europe, N. Africa and America)

15. European 1 species : *Erodium cicutarium.*

16. Cosmopolitan 6 species :

Convolvulus arvensis — *Sagittaria sagittifolia*
Solanum nigrum — *Scirpus maritimus*
Chenopodium murale — *Echinochloa Crus-Galli*

The following graph 13 shows at a glance to what extent the various floristic areas of the globe are represented in the Indus Delta.



Graph 13.

We can readily distinguish 3 well-marked elements in the flora of the Delta: an eastern, a western, and a more general element including those species which are purely Indian.

THE EASTERN ELEMENT

Indo-Malayan	16 species

THE WESTERN ELEMENT

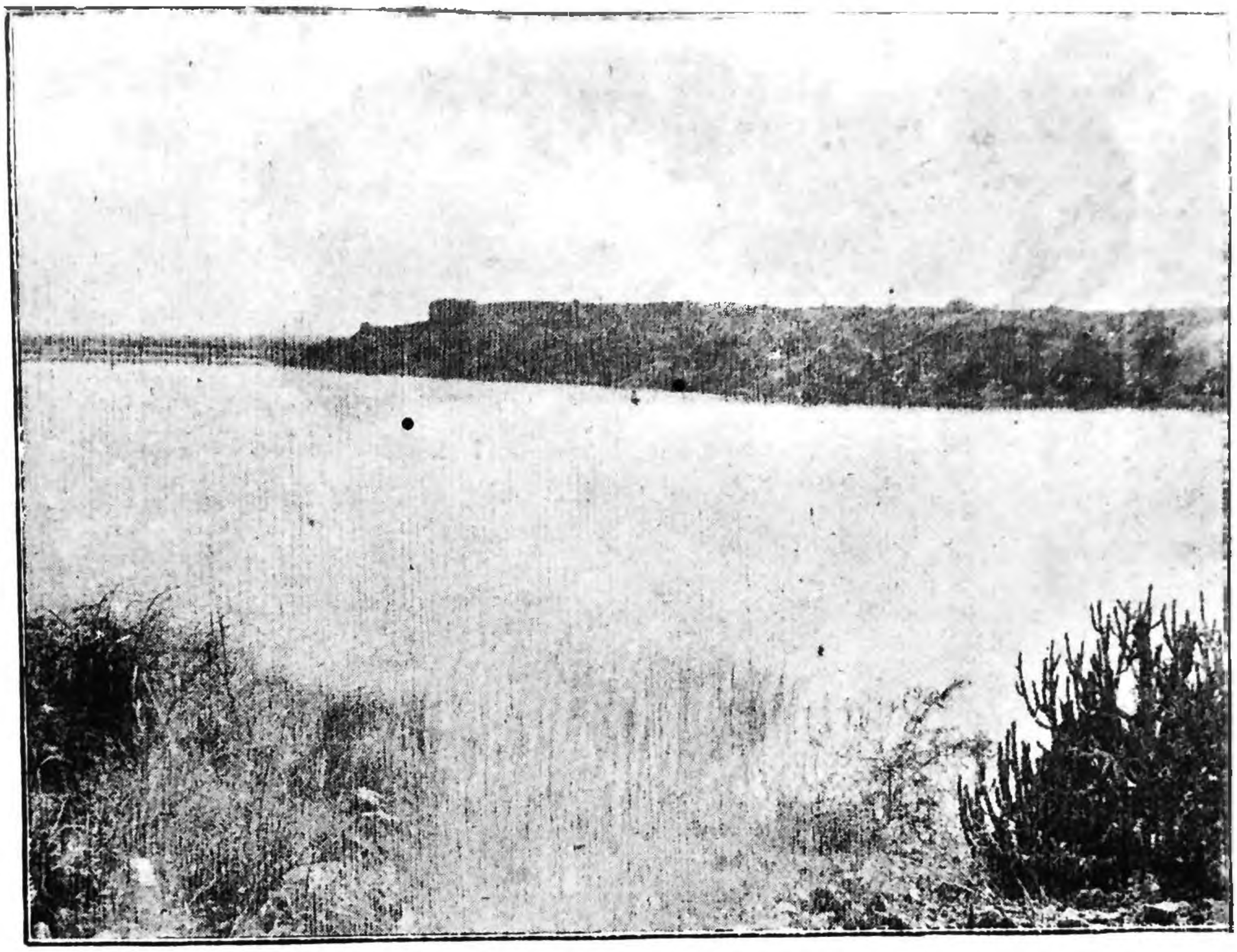
N. African-Indian Desert	60 species
Trop. Africa and N. African-Indian Desert	37 ,,
Trop. African and Indian	13 ,,
Oriental	5 ,,
Mediterranean-Oriental	2 ,,
European	1 ,,
Total ...	118 species

THE GENERAL ELEMENT:

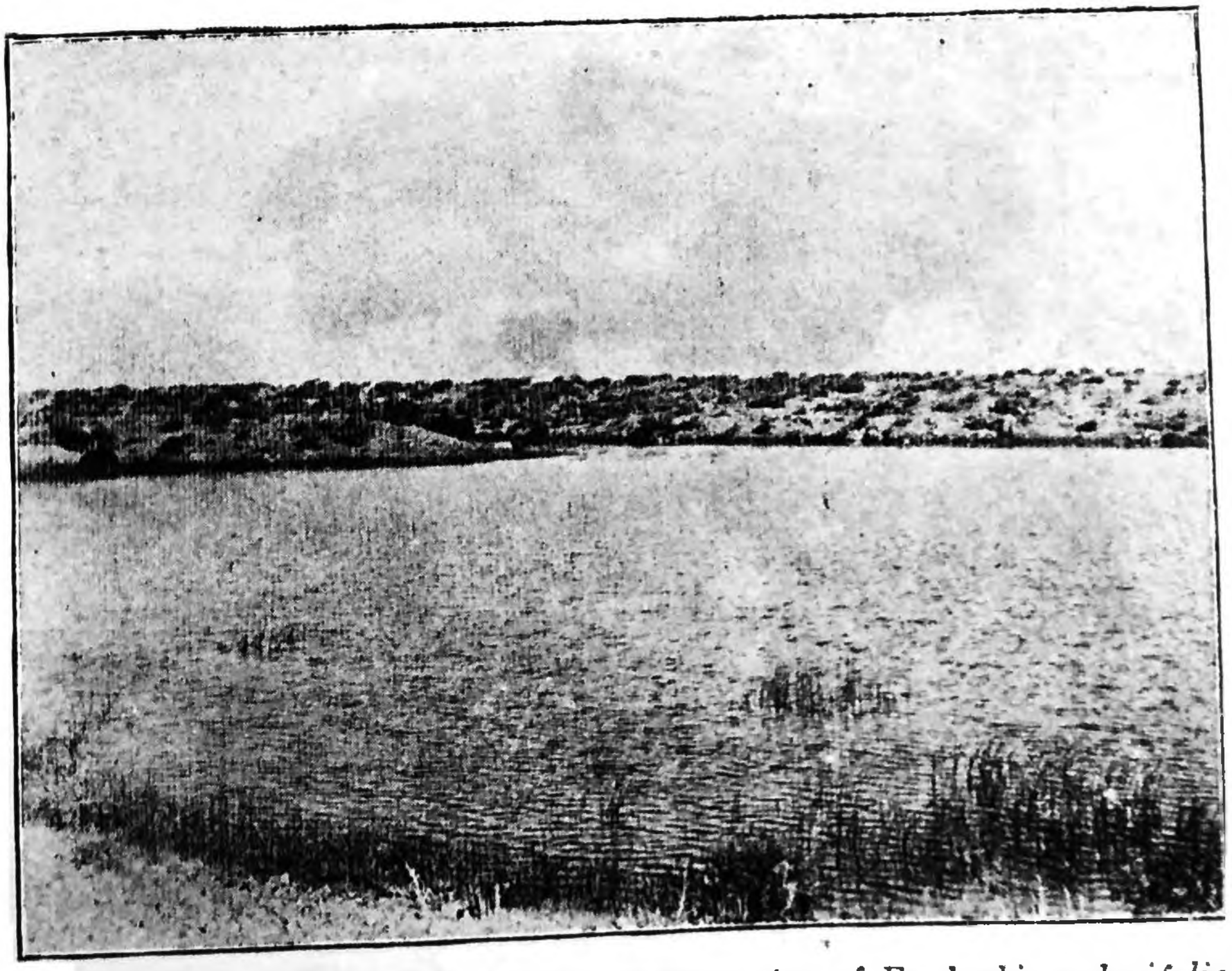
Endemic	...	6 species
Indian	...	29 ,,
Tropics of Old World	...	39 ,,
Tropics generally	...	19 ,,
Warm parts of Old World	.	3 ,,
All warm countries	...	22 ,,
Tropical and subtrop. regions of the Old World or of the whole world	...	6 ,,
Temperate and subtrop. regions	...	1 ,,
Cosmopolitan	...	6 ,,
Total	...	131 ,,

We are allowed to neglect the general element for our purposes, as it consists of species which are either only Indian or show a wider distribution over the eastern and western parts of the Old World, or comprise even certain regions of the whole globe.

What is left to form an estimate of the plant-geographical position of the flora is the western element with 118 species, and the eastern (Indo-Malayan) with 16 species. The eastern forms just a little more than $\frac{1}{7}$ of the western. The ecological conditions of the Delta are not such as to exclude Indo-Malayan types entirely, but the western (chiefly African) element is vastly preponderant.

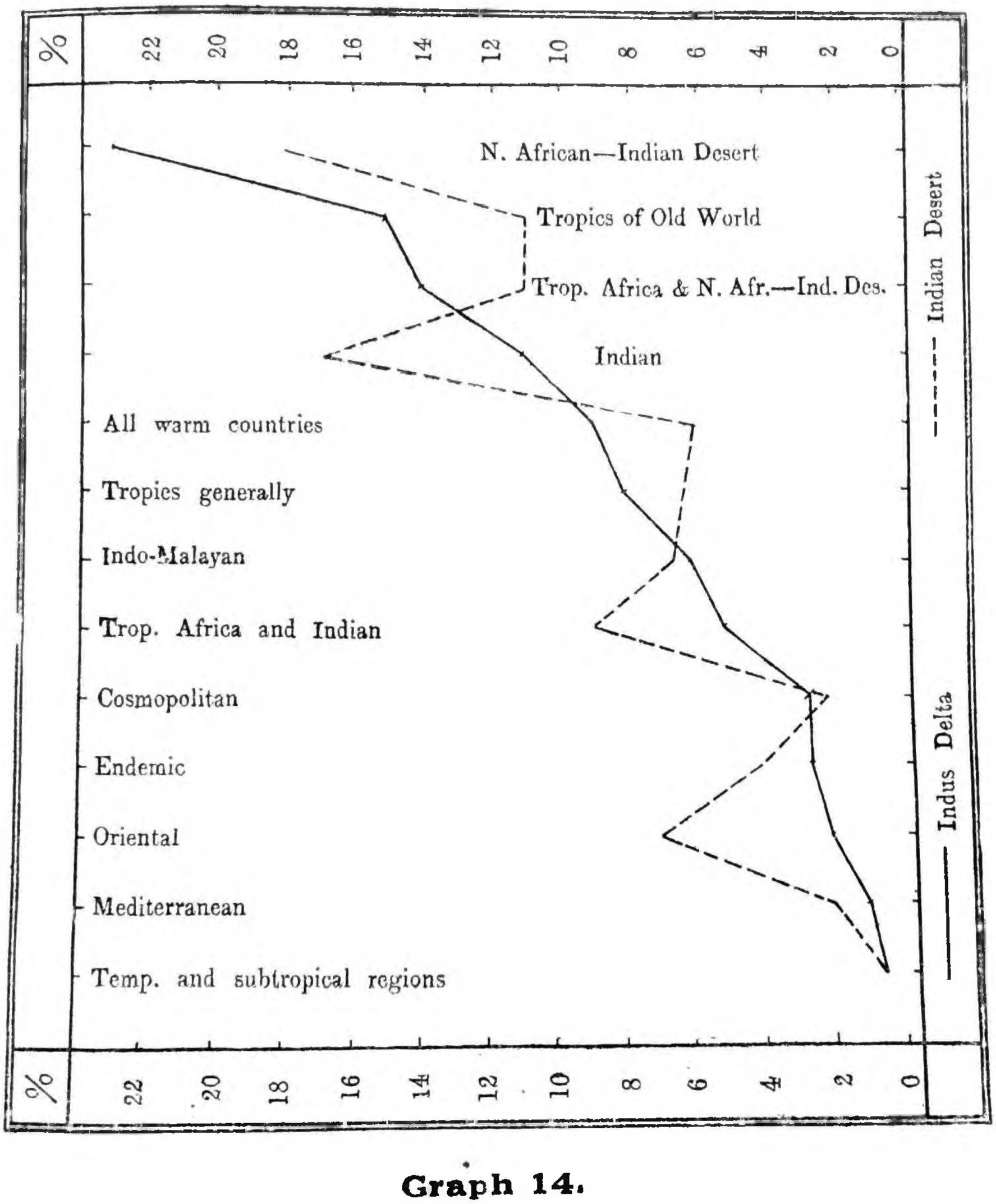


No. 25. Kullan Kote Lake. In foreground: Sedges, *Euphorbia*, *Capparis*. In background: A rocky hill with *Acacia*, *Grewia*, *Zizyphus*.



No. 26. Kullan Kote Lake. Mixed formation of *Euphorbia caducifolia* *Commiphora mukul*, *Acacia Senegal*, *Zizyphus*; shrubby *Acanthaceæ*.

A comparison of the vegetation of the Indus Delta with that of the Indian Desert (Jodhpur and Jaisalmer of which states alone we possess detailed information) is not without interest. Graph 14 speaks for itself.



Graph 14.

III. Origin of the flora.

The flora of the Indus Delta, except a narrow strip along the northern border and a small rocky area in the Tatta district and south of Tatta is, judging from its geographical position and geological condition, of very recent origin, taking recent in its geological sense.

Of the 279 species that make up its flora 226 are found in other parts of Sind. This latter number will very likely grow with the increased knowledge of the vegetation of Sind.

These are the 54 species, which, according to the data at present at our disposal,[1] have not been observed in extra-deltaic Sind :

Nymphaea stellata
Nelumbium speciosum
Maerua arenaria
Abutilon polyandrum
Gossypium Bakeri
Triumfetta rotundifolia
T. pentandra
Indigofera uniflora
Aeschynomene indica
A. aspera
Rhizophora mucronata
R. conjugata
Ceriops Roxburghiana
Bruguiera gymnorhiza
Sonneratia acida
Kedrostis rostrata
Vicoa cernua
Periploca sp.
Trichodesma indicum
Convolvulus sp.
Merremia aegyptia
Limnophila gratioloides
Bonnaya veronicaefolia
Lindenbergia urticaefolia
Ruellia prostrata
Avicennia officinalis
Ocimum sanctum
Chenopodium murale
Euphorbia pilulifera
E. jodhpurensis
Andrachne sp.
Ficus glomerata
Populus euphratica
Crinum asiaticum
Asparagus gharoensis
A. deltae
Commelina albescens
Pandanus tectorius
Typha elephantina
Lemna sp.
Sagittaria sagittifolia
Aponogeton monostachyon
Naias, 2 species
Cyperus stoloniferus
C. Haspan
Eleocharis atropurpurea
Saccharum Griffithii
Urochloa setigera
Echinochloa Crus-Galli
E. stagnina
Cenchrus catharticus
Eragrostis amabilis
Diplachne fusca

In the above list there are 6 endemic species which we have already mentioned. Cutch could contribute at least 8 species :

Nymphaea stellata
Triumfetta rotundifolia
Rhizophora mucronata
R. conjugata
Bruguiera gymnorhiza
Avicennia officinalis
Euphorbia pilulifera
Pandanus tectorius

Cutch is only partly known [2] and it is more than likely that other species may have reached the Delta via Cutch.

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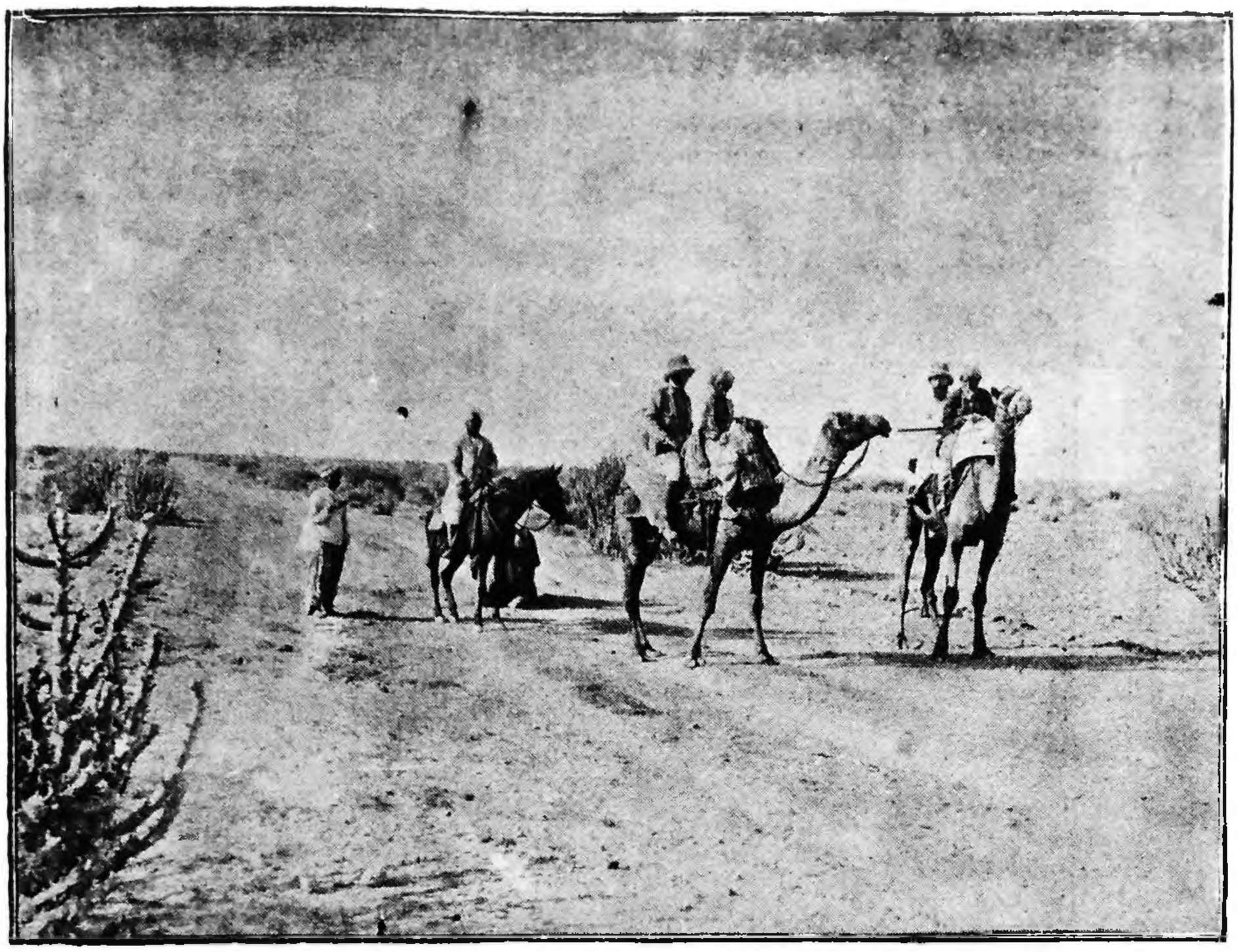
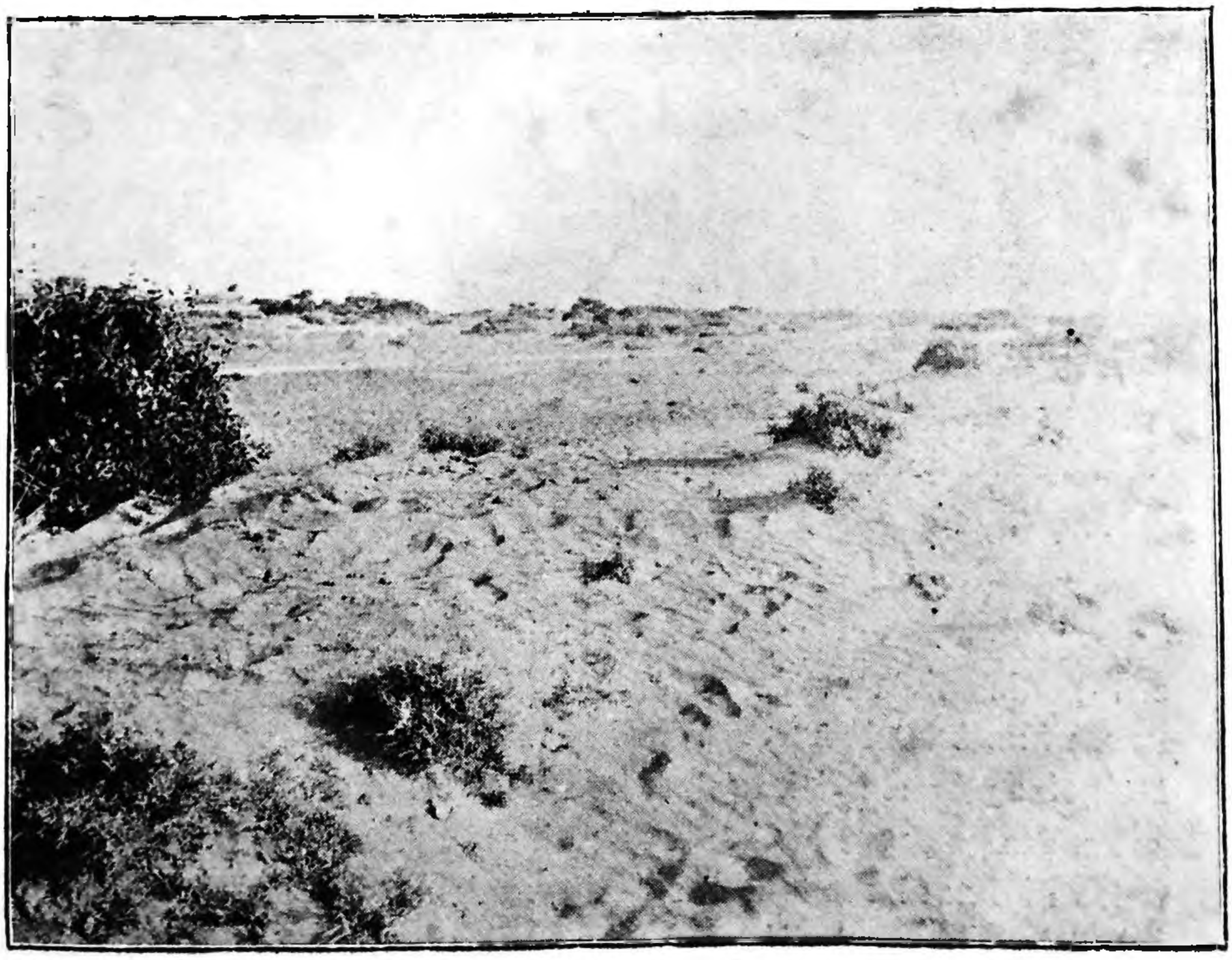
[1] T. S. Sabnis, The Flora of Sind. Journ. Ind. Bot. Soc., Vol. III, p. 151, etc.

[2] E. Blatter. On the Flora of Cutch. Journ. Bomb. Nat. Hist. Soc. XVIII (1908), 756-777 ; XIX (1909), 157-176.



No. 27. Barren rocky undulating plain between Gholam and Tatta with only *Capparis decidua* and *Euphorbia caducifolia*.



No. 28. Sand-dune near Gharo with *Calotropis procera*, *Leptadenia spartium*, *Asparagus gharoensis*.

The Rajputana Desert [3] can be held responsible for the presence of the following species in the Delta :

Merremia aegyptia
Lindenbergia urticaefolia
Ocimum sanctum
Euphorbia jodhpurensis
Eleocharis atropurpurea
Cenchrus catharticus

We seem to be justified in tracing

Maerua arenaria
Populus euphratica
Typha elephantina
Sagittaria sagittifolia

to the Punjab, and the following species to Baluchistan :

Trichodesma indicum
Limnophila gratioloides
Chenopodium murale
Saccharum Griffithii

always assuming that the plants in their migrations follow the principle of least resistance.

The W. coast of the Peninsula must have supplied the following members to the mangrove-vegetation of the Delta, in addition to those which we have mentioned as coming from Cutch :

Ceriops Roxburghiana
Someratia acida

We have now accounted for 31 out of the 54 species which do not occur in extra-deltaic Sind. As to the 23 remaining species they have a varied distribution in different parts of Gujarat, the Konkan and the Deccan. Before entering into useless speculations as to how they may have reached the Indus Delta, we prefer awaiting a more complete record of the vegetation of Kathiawar, Cutch and especially of the country lying south of the Marwar-Hyderabad railway line.

It is not difficult to trace the path which the Indo-Malayan and Indian plants east of Sind followed in their migration through West India, Rajputana and the Punjab.

For the immigration into Sind of all the western species we refer to Agharkar [4] who has studied the means of dissemination of the xerophytes, subxerophytes and halophytes of the flora of N. W. India and has discussed all the possible ways by which western plants, especially African, could enter the Indus plain.

(To be continued.)

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[3] E. B'atter and F. Hallberg. The Flora of the Indian Desert. Journ. Bomb. Nat. Hist. Soc. XXVI (1918), 218-246 ; XXVI (1919), 525-551, 811-818 ; XXVI (1920), 968-987 ; XXVII (1920), 40-47, 270-279 ; XXVII (1921), 506-519.

[4] S. Agharkar, Ueber die Verbreitungsmittel der Xerophyten, Subxerophyten und Halophyten des Nordwestlichen Indiens und ihre Herkunft. In Botanische Jahrbuecher (1920) Beiblatt 124.