THE DISTRIBUTION OF FISHES IN THE GLOBAL MANGROVES

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ABSTRACT

The study deals with the global distribution pattern of mangrove ichthyofauna. A total of 740 species of fishes have so far been reported from the mangroves of the world belonging to 17 geographic regions. There are 197 species (present record) of fishes occurring in the Pichavaram mangroves. Most of these fishes have a "marine nativity" and they immigrate to the mangroves. The mangroves act as sanctuaries and as nursery grounds to protect and feed them. About 30% of the known fish species of the mangroves occur at Pichavaram and 50% within India. The Godavari deltaic mangroves have the maximum number of species. About 159 species of fishes seem to be restricted in their occurrence to the Indo-Pacific mangroves. About 80% of the families of fishes recorded from the global mangroves are also known from Indian mangroves.

INTRODUCTION

THE mangrove ecosystem comprises within it the biota, land, estuarine channels, gullies, neritic inlets, swamps, mudflats, bushy thickets and woody forests. Certain species of the mangrove flora show a high degree of adaptations. This sort of specialisation does not seem to be so much pronounced and widespread with regard to the fauna, at least externally. There are quite a number of species belonging to the genera *Rhizophora*, *Avicennia*, *Bruguiera*, *Sonneratia*, *Xylocarpus*, *Ceriops*, *Aegiceros*, *Kandelia*, etc contributing to form a distinct mangrove vegetation. Amongst the fauna, their preference to the mangroves is not as diversified as the flora; their number is limited to a handful of species belonging to a few families or orders. For example, the molluscs (Class: Gastropoda) such as *Cerithidea obtusa*, *Dostia crepidularia*, *Melampus singaporensis*, *Cassidula* sp., *Pythia plicata*; oysters (Class: Bivalvia) like *Crassostrea madrasensis* and *Ostrea folium*; the crabs like *Scylla serrata*; the salt-water crocodile, *Crocodilus porosus*; the birds such as egrets (*Bubulcus ibis*, *Egretta garzetta*, *Egretta intermedia*, *Ardea alba*), the herons (*Ardeaola grayii*, *Nycticorax nycticorax*), the sandpiper (*Tringa* sp.); the Bengal tiger, *Panthera tigris*, etc indicate their preference to mangrove ecosystems, where they may occur predominantly. Again it is not in all mangrove ecosystems that they occur—although a majority of the species may be common—largely due to human interference—which often leads to overall deterioration in the quality of the environment.

The preference to the mangroves remains rather obscure regarding the ichthyofauna. Earlier ichthyofaunal studies have revealed that the same species could occur in many other mangrove sites of identical clime—say within the tropics. These tropical mangroves, thus, come to harbour and promote as it were characteristic fauna. The fauna show identical trends in adaptations to cope up with the salt problem of the environment. They overcome physiological deficiencies and withstand the ecological stresses imposed upon by the tidal flushing, summer drought and monsoon flood. This ecosystem is usually connected to the main river and estuary and receives the drainage flow from hinterland. Our knowledge of the predominant fauna of the mangroves still remains very much scanty and inadequate.

THE IMPORTANCE OF THE FAUNAL STUDY

The global mangrove fauna are interesting inasmuch as they consist of same or phyletically related species of certain genera or families. Thus, they are spread over the different zoogeographic regions wherein the mangroves are located. The trend could provide a clue to the evolutionary aspects of a species and zoogeographical similarities existing among mangrove fauna. In this study, an attempt has been made to understand the importance of the prevailing zoogeographic distribution of the ichthyofauna.

The juveniles and adult fishes from the local Pichavaram mangroves (11°29′N; 79°49′E) were sampled by means of velon net, plankton net and cast net and from commercial landings around Parangipettai

coastal waters. The available information on zoogeographic occurrence of fishes from 17 different geographic regions (figure 1; *vide* table 1) is taken into consideration to know the salient features of their distribution. We will use broadly the term 'mangal' after Macnae[1], to refer to the natural communities of the organisms living within the mangroves.

THE GLOBAL STATUS OF THE MANGROVE ICHTHYOFAUNA

A total of 740 species of fishes belonging to about 100 families have been reported so far from the mangroves of the world, of which 10 species belong to elasmobranchs and the rest to teleosts. Some 60 species of freshwater fishes occur within the mangroves of the tropics. Among the fish families, Achiridae, Brotulidae, Carcharhinidae, Characidae, Grammistidae, Holocentriadae, Labridae, Pimelodidae, Poecilidae, Pomacanthidae and Rivulidae occurring in the mangroves of the Atlantic coastline, do not seem to have been reported so far from the mangroves of the Pacific and Indian Ocean region. Among fish families reported from the global mangroves, the family Gobiidae (a principal group in brackish water areas) enjoys having the maximum number (some 110) of species. The adaptive radiation among gobiids helps them to colonise estuary, mudflats, backwater, marshy and swampy areas including the mangroves.

Table 1 *Geographic locations of mangroves from where ichthyofaunal studies were conducted*

Sl. No.	Mangroves Estuaries	Geographic locations
I.	*INDO-PACIFIC MANGROVES*	
	a. *Mangroves of Southeast Africa*	
1	Durban Bay mangrove lagoons	South Africa
2	Morrumbene estuary	Mozambique
	b. *The Indian mangroves*	
3	Mandovi & Zuari estuarine system	Goa – West coast of India (Arabian Sea)
4	Pichavaram – Vellar-Coleroon estuarine system	East coast of India (Bay of Bengal)
5	The Godavari estuary	East coast of India (Bay of Bengal)
6	The Sunderbans (Deltaic mangroves)	India, Bangladesh (Northern part of Bay of Bengal)
	c. *Mangroves of the Malacca Straits*	
7	Ponggol estuary	Singapore
8	Angsa Bank – Kuala Selangor (coastal mangroves)	The Malaysian coasts
	d. *The Australian mangroves*	
9	Northern Territory	Australia
10	Far-North Queensland	Australia
11	Southern Queensland	Australia
12	Sydney District (New-South Wales Seaboard)	Australia
II.	*THE ATLANTIC SEABOARD MANGROVES*:	
	a. *American – Atlantic coastline*	
13	Jew Fish Chain mangroves	Bahama Island
14	Puerto Rico mangroves	Puerto Rico
15	Caribbean mangroves	Guadeloupe
16	Cumana mangrove lagoons	Venezuela
	b. *African – Atlantic coastline*	
17	Niger deltaic mangroves	Nigeria

There are 197 species (present record) of fishes observed from Pichavaram mangroves alone. About 80 families occur in the mangroves of India. Some 68 families occur all along the east coast of India, including the mangroves of Pichavaram, the Godavari and the Sunderbans. Although some 17 families have not been so far reported from the Sunderban mangroves, their occurrence in the Godavari and Pichavaram mangroves is known. Most of the species (of these families) are also typical marine forms, including the coral reef fishes. The paucity of coral reefs is noteworthy in the northern part of the Bay of Bengal when compared to the Andaman Sea and the Gulf of Mannar "marine provinces". The heavy freshwater discharge into the Bay of Bengal by the mighty rivers reduces the salinity to 18‰ even in the Central Bay during the rainy season[2]. A comparison has been attempted between some of the fishes at family level among the various mangroves (*vide* table 2—families are arranged *à la* Nelson[3]).

THE INDO-PACIFIC MANGROVES

Some 356 species have been recorded so far from the mangroves of India. The area-wise break up of fish species found in some of the Indian mangroves is as follows:

(a) 197 species from the Pichavaram mangroves
(b) 223 species from the Godavari estuary
(c) 168 species from the Sunderbans

The principally carnivorous fish families such as Ariidae, Centropomidae, Polynemidae, Pomadasyidae and Sciaenidae are represented by 84 species in the world mangroves. Among them 59 species occur in the Indo-Pacific mangals. The Indo-Malayan mangroves contain 56 species of these families and only 3

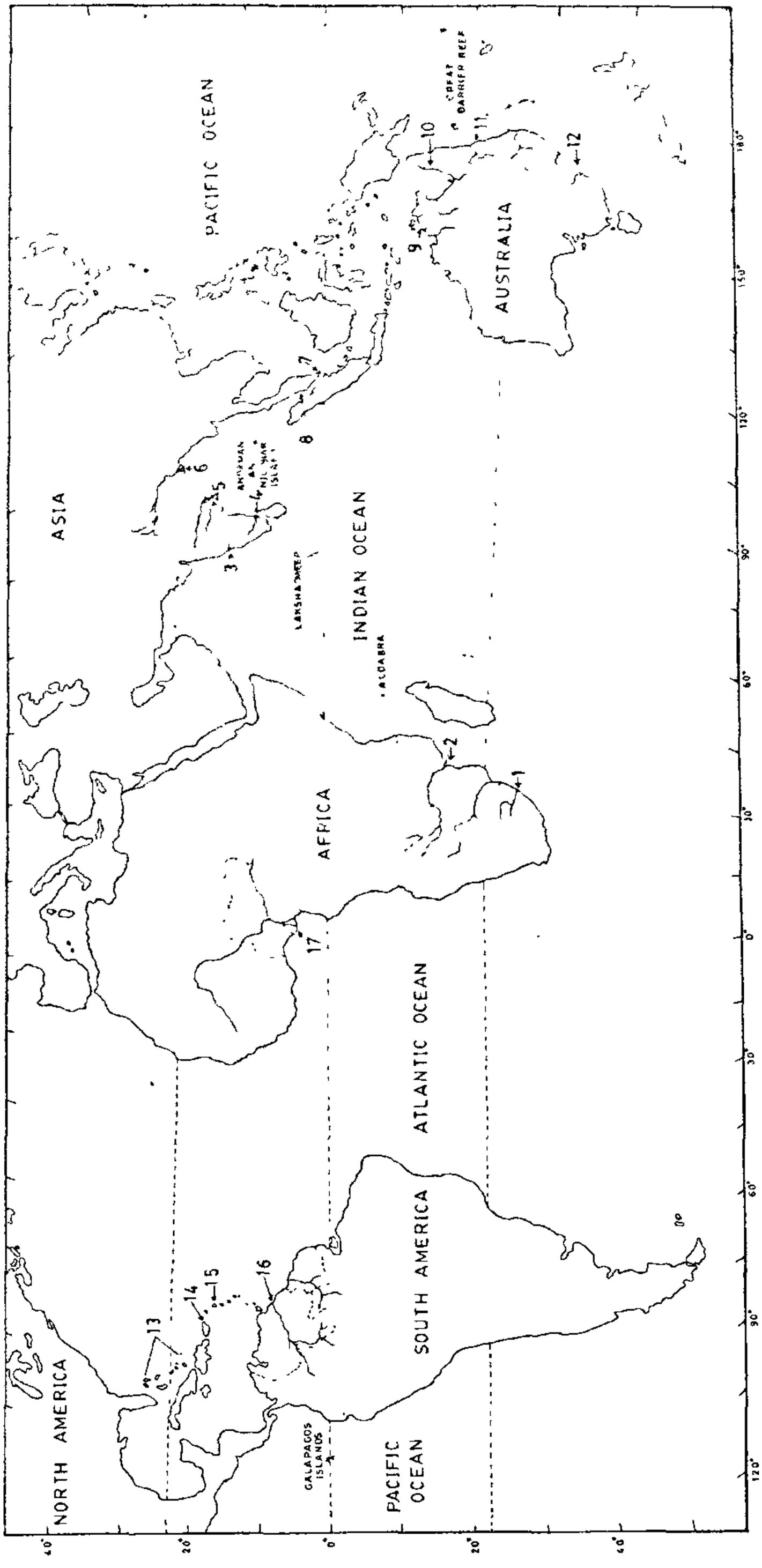

Figure 1. Areas of Indo-Pacific and Atlantic mangroves where studies have been conducted. (Numbers 1–17 denote the study areas – *vide* table 1)

Table 2 *Comparative tabular account of some families of fishes between mangroves of the world and Pichavaram mangroves at family level (according to the phyletic classification given by Nelson[3])*

Fish families	Number of fish spp reported from the mangroves of the world	Number of fish spp reported from the Pichavaram mangroves
Clupeidae*	35	6
Congridae	3	1
Ophichthidae	9	2
Plotosidae	5	2
Belonidae	8	2
Syngnathidae	11	1
Scorpaenidae	12	4
Platycephalidae	7	3
Serranidae	13	5
Sillaginidae	4	1
Carangidae	21	9
Lutjanidae	21	6
Gerridae	22	5
Pomadasyidae	17	2
Sparidae	10	2
Sciaenidae	28	10
Mullidae	6	2
Mugilidae	26	10
Polynemidae	10	3
Scaridae	11	1
Eleotridae	18	3
Gobiidae	110	16
Periophthalmidae	19	3
Soleidae	7	2
Cynoglossidae	10	3
Tetraodontidae	15	6

* Starting from the 'primitive' family

species occur within the Australian mangroves. The mangroves of the Indian Ocean possess greater number of species belonging to the above carnivorous fish families. In contrast, a sharp decline in species number is noteworthy in the mangroves of the Pacific Ocean region. Such a decline could be due to the relatively poor discharge of freshwater into the Pacific Ocean.

THE MANGROVES AND THE CORAL REEFS

Quite a reasonable number of coral reef fishes are distributed in the Old and New World mangroves. Most of these fishes seem to use the mangroves as nursery grounds[4]. Generally, coral reefs flourish in the typical marine environment, whereas the mangroves flourish in the brackish water environment. In certain instances, like in the Great Barrier Reef near Australia[5,6] and in the Andaman Sea environs, the mangroves grow even within or nearby coral reefs. The coral growth in offshore region provides protection against strong waves and tidal action, thereby promoting mangrove establishment. This kind of juxtaposed situation of coral reefs and mangrove ecosystems is the cause behind the presence of a good number of coral fishes within the mangroves. This was also brought out from the earlier reports from the Bahama mangroves[7] and from the Australian mangroves[8].

The total number of species of the coral fishes inhabiting the Indian mangroves gradually decline from the southern coast of India (Pichavaram) towards the head of the Bay of Bengal (the Sunderbans). The available record reveals 39 species occurring in Pichavaram, 16 in the Godavari mangroves and only 3 in the Sunderbans. Krishnamurthy and Jeyaseelan[9] linked it to the gradual disappearance or decline of the coral reefs from the Gulf of Mannar to the head of the Bay of Bengal. The lack of a visible coral reef formation could be due to drainage of immense quantity of silt laden freshwater from the great rivers such as the Ganga, Brahmaputra, Irrawaddy, Mahanadi, Godavari and Krishna to the Bay[10–12].

A species-wise check up of the global mangrove ichthyofauna reveals the occurrence within of a great number of marine fishes belonging to the adjacent seaboard's continental shelf waters (table 3). Some 10 species of the mangrove ichthyofauna are cosmopolitan in distribution, being widespread throughout the tropical oceans also. Some 159 species seem to be restricted to the Indo-Pacific region. Their zoogeographic distribution is grouped in four categories as given below:

Regions	*Total number of species*
(a) South-east Africa + India + Australia	70
(b) South-east Africa + India	57
(c) India + Australia	24
(d) South-east Africa + Australia	8

Day[13] compared the mangrove fauna of the Morrumbene estuary (Mozambique) with the fauna of the Malaysian and Queensland (Australia) mangroves and observed that the majority of the genera were the same. Sasekumar[14] from his studies at Port Swettenham (Malaysia) reported also faunal similarities among Indo-Pacific mangroves. The adaptations to overcome the physiological deficiencies imposed upon by the mangrove environment (due to

Table 3 *Marine fish species no. of the continental shelf and their distribution in the adjoining mangroves.*

	Regions			
	South-east Africa	India	Australia	America (Atlantic Board
Continental shelf	142	159	117	16
Mangroves	75	128	28	9

excess salt, mobile mud, lack of sufficient flow of freshwater, low dissolved oxygen concentration, putrefaction, etc), the mangrove flora have developed as specialisations both morphological and physiological in their shoot and root systems including pneumatophore formation, stilt roots, vivipary, excretory salt glands etc, in their various families. Although such a high degree of visible "external specialisations" may not be perfect in fauna, the characteristics of the biota seem to indicate a converging trend in evolutionary adaptations inclusive of their physiological mechanisms to cope with this unique environmental situation.

FACTORS OF EVOLUTION

The study of zoogeography would bring to focus the latent imprints left during the course of evolutionary adaptations to changing geological, climatic and biological features between various geographic regions from ages past. The continental drift in the distant past brought about changes over different regions of the world. The geographic isolation of islands (Galapagos, Aldabra, Andaman and Nicobar islands) brought into existence their unique biota. The similarities of biota of North America and Eurasia can be justified since both regions were reported to be in one biogeographical realm 'the Holarctic' up to the late Tertiary Period[15]. It has been further emphasized that the rivers are generally much older than the lakes. The geological history indicates a continuity of the river bottoms and river deltas and swamps and marshes thus paving the way for the evolution of older and permanent fauna[16]. Thus, it is quite likely that there is also some degree of similarity in evolution between the biogeographic realms among the mangrove biota. They would belong to a much older age. But the mangrove ichthyofauna through the ages would appear to use it, like other faunal assemblages, more as a transitional route for migration to inland waters rather than for permanent colonisation. However, their larvae, including those of their coastal marine counterparts seem to find a greater use for the ecosystem using it as a sheltered nursery area.

The oceans act as geographical barriers for the dispersal of freshwater fishes. There is also good evidence to show that the geographical barriers are not always effective. Any permanent or temporary change in the physical or hydrobiological features of the habitat would influence the organisms to cross such barriers[17]. In estuarine and mangrove environment, the degree of tolerance of prawns, fishes, etc to environmental stresses usually determines their limits of distribution. Many factors govern their distribution such as temperature, salinity, depth, the coastline configuration, the topography of ocean floor, etc. Their interplay would decide on the limits of their distribution. The inherent tolerance ability, habitat preferences, recruitment and longevity of marine organisms like prawns, fishes, etc would shape their geographic area of activity and degree of penetration through mangroves to interior regions to use them as nursery areas for their young progeny. Thus, the mangrove ecosystem also serves as it were, the custodian to take care of the young ones of the species as and when required.

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ANNOUNCEMENT

LADY TATA MEMORIAL TRUST AWARDS

The Lady Tata Memorial Trust Awards announced on the 18th June 1984, the death anniversary of Lady Meherabai Dorabji Tata for the year 1984–85. The list of recipients of awards are as follows:

1. Dr R. J. Baer, New York, £10,000/-, for the third year, 2. Miss A. G. Fisher, Maryland, USA, £5,000/-, for the second year, 3. Dr U. Testa, Italy, £8,000/-, for the second year, 4. Dr J. Adamski, Bombay, £8,000/-, for the first year, 5. Dr S. A. Clark, Southampton, U.K. £8,500/- for the first year, 6. Mr. V. Dixon, Paris, £5,000/- for the first year, 7. Mr. H. G. S. Gabra, Los Angeles, USA, £1,200/- for the first year, 8. Dr A. P. Iyer, Stockholm, £9,500/- for the first year, 9. Dr P. K. Orberg, Boston, USA, £11,000/- for the first year, 10. Dr N. Rebai, Marseille, France, £7,000/- for the first year, 11. Dr D. Saggiore, Italy, £6,300/- for the first year.

Senior Scholarships of Rs. 1,050/- p.m.: 1. Dr G. Bhattacharjee, Calcutta, for the second year, 2. Dr B. Bhattacharya, Calcutta, for the first year, 3. Dr D. Raghunadha Rao, Chandigarh, for the first year.

Senior Scholarships of Rs. 850/- p.m.: 1. Mr. M. P. Gupta, Chandigarh, for the second year, Mrs. L. S. Nadkarni, Bombay, for the second year, 3. Miss V. L. Reylon, New Delhi, for the first year, 4. Miss A. Sharma, Aligarh, for the first year.

Junior Scholarships of Rs. 750/- p.m.: 1. Dr D. Datta, Calcutta, for the second year, 2. Dr S. Mahapatra, Cuttack, for the first year.

Junior Scholarship of Rs. 600/- p.m.: 1. Mr. J. M. Shallom, Bombay, for the second year, Miss K. Chatterjee, Calcutta, for the first year (candidate relinquished the award), 3. Mr. P. P. Khanna, Agra, for the first year.

Junior Scholarships of Rs. 300/- p.m.: 1. Mr. A. K. Chaubal, Bombay, for the second year, 2. Miss V. R. Babulkar, Bombay, for the first year, 3. Mr. S. Chandrasekhar, Bombay, for the first year, 4. Miss Z. N. Khety, Bombay, for the first year, 5. Miss B. M. Kothari, Bombay, for the first year, 6. Miss M. M. Mahatme, Bombay, for the first year, 7. Miss C. J. Saraiya, Bombay, for the first year, 8. Miss A. M. Shenoy, Bombay, for the first year.