

BIBLIOGRAPHICAL REVIEW ON THE BOTANICAL STUDIES IN TRIPURA

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ABSTRACT

This paper "Bibliographical Review on the Botanical studies in Tripura" presents most probably all the literature that refers to the plant life in Tripura. No work of any appreciable size was ever published on any aspect of plants in this territory. In absence of such a work the author had to go through the chronological narratives on the rulers of the land, historical accounts, administrative reports, and literary publications on Tripura for materials on botanical aspects. Such a search resulted in finding out several interesting records of Tripura plants. All these isolated references, however trivial may be, have been referred to in this paper. The views expressed by the author in course of the review of references, are based on his constant field and herbarium study on the vegetation and flora of Tripura for five years. For this reason he could not agree with the views expressed by the casual observers on the vegetation of Tripura.

INTRODUCTION

A thorough study and review of the earlier publications is a prerequisite to the scientific study on any problem. Unfortunately no work of any appreciable size was ever published on any aspect of plant life in Tripura territory.

On taking up the study of flora of Tripura in January, 1956, the author had to make a frantic effort to piece together the scattered information on the subject in non-botanical literature. He had to go through the chronological narratives on the rulers of the land, historical accounts, administrative reports, and literary publications on Tripura for materials on botanical aspects. Such a search resulted in finding out several interesting records of Tripura plants. All those isolated information, however trivial may be, have been referred to in this paper.

The views expressed by the author in course of the review of the references are based on his constant field and herbarium study of the vegetation and the flora of Tripura for five years. In certain cases the author could not agree with the views expressed by the casual observers on the subject. In most of the literature, only the local names are mentioned, and in some cases botanical names along with the local names are also indicated. In this paper, the names used in the papers under reference have been retained indicating the correct name in the parenthesis.

THE TERRITORY OF TRIPURA

Situation : Tripura a centrally administered territory lies between $22^{\circ}56'$ and $24^{\circ}32'N$ and $91^{\circ}10'$ and $92^{\circ}22'E$ covering an area of 10660. 40 sq. km. The territory is bounded on the north by the District of Sylhet, on the west by Tippera and Noakhali Districts, on the south by Noakhali, Chittagong and Chittagong Hill Tracts and on the east by the

Chittagong Hill Tracts and the Mizo District (Lushai Hills). Excepting a portion of the eastern boundary with the Mizo District, all other portions of the boundary form the international border with the Pakistan.

Climate : The Climate of this territory is characterised by moderate temperature and highly humid atmosphere. December to February is the cold season that is followed by the summer from March to May. June to September is the south west monsoon season i.e. the so-called rainy season. October and November constitute the post monsoon season.

The average annual rainfall in the territory is 210.07 mm. (82.70"). The rainfall generally increases from the south-west to the north-east. About 63% of the annual rainfall is received in the south-west monsoon season. The rainfall in the summer months March to May amounts to about a quarter of the annual total. The highest rainfall which amounted to 135% of the normal occurred in 1915, while in 1903 the year with the lowest rainfall it was 64% of the normal.

On an average the territory has 99 rainy days in a year. It varies from 85 at Sonamura to 121 at Dharmanagar.

January is the coldest month when the mean daily maximum temperature is $25.5^{\circ}C$ ($77.9^{\circ}F$) and the mean daily minimum is $10.4^{\circ}C$ ($50.7^{\circ}F$) while the night temperatures continue to rise till July and August. Day temperature is the highest in April.

The highest maximum temperature recorded at Agartala was $40.0^{\circ}C$ ($104.0^{\circ}F$) on 17-4-1956, and the lowest minimum was $3.9^{\circ}C$ ($39.1^{\circ}F$) on 2-1-1955.

Humidity is generally high throughout the year. In the summer season the relative humidity is between 50 and 75% while in the south west monsoon season it is over 85%.

Geology : The hills of Tripura are of tertiary age (Deb, 1960). The oldest rock upto now determined is of lower miocene. The laterites observed here and there are of pleistocene. The soil is recent alluvium.

Topography : Six principal ranges of hills increasing in elevation towards the east, north and south

* This piece of investigation was undertaken by the author while working as the Senior Lecturer-in-Charge, Department of Botany, M. B. B. College, Agartala, Tripura.

with an average distance of about 20 km. are spread over the territory. The principal hill ranges, beginning from the east are the Jampai (highest points at Betling shib, 975.36 m. and Jampai, 566.92 m.), Sakbantlang (highest point at Sakhan, 816.25 m.), Langtarai (highest point at Phengpur, 481.889 m.) and Atharamura (436.92 m.).

These hills form a watershed from which the drainage pours down north by the *Khawai*, *Dolai*, *Manu*, *Juri* and *Longai*, west into the *Meghna* by the *Gomati* and south-west into the *Bay of Bengal* by the *Fenny* and *Muhari* rivers.

BOTANICAL EXPLORATION

The State of Tripura persistently resisted against all sorts of aggression for long five hundred years during the Mahammadans and British Rule in India and maintained her glorious independence from time immemorial upto the date of her integration with the Indian Union, on 17-9-1949. It is apparently surprising that such a land did not draw the attention of any botanical explorer. The reason of her remaining botanically unexplored until the recent past, may probably be attributed partly to her independent status as a state and partly to the geographical position of the territory. Surrounded by more denser forests, namely Chittagong Hills, Mizo Hills and Sylhet Hills which were explored from time to time, it is not unnatural that Tripura did not attract any explorer. On the other hand, the Rulers of the State were inclined more to mining the forest rather than cropping, not to speak of nurturing her. While they took so much interest from time to time in assessing the geological potentiality, they could not fore-see the long pervading effect of surveying her vegetable resources.

The first botanical exploration of Tripura was undertaken by late P. M. Deb Burman the then Curator of the Herbarium, Royal Botanic Garden, Calcutta. He made an intensive collection of specimens from certain localities. A search in the herbarium, Indian Botanic Garden, gives an idea of his valuable collection. His collection dates probably from 24-9-14, (no. 1) to 15-7-1921 (no. 1233) though several isolated specimens are dated the years 1910 and 1924, as well. His total collection may not exceed 1300 Field Numbers. His collection centres round Agartala and Unokoti, some specimens from Udaipur and Sonamura were also collected by him. That such a valuable collection was not followed by publication, is probably due to his sudden and premature death. Some of his specimens however, have been cited in recent revisions of different genera and families.

The second explorer was Dr. K. Biswas the then Superintendent of Indian Botanic Garden, Calcutta. He visited Tripura for about a fortnight in 1941. Specimens in the Herbarium, Indian Botanic garden, indicate that he collected about 300 Field Numbers from Agartala, Fatikroy, Dopada, Lethrai and

Hmunpui, these are dated from 28-3-1941 to 5-4-1942.

The author of the present paper has been collecting specimens from different regions of the territory since his joining the M. B. B. College on 21-1-1956. Upto 1961, he collected from this territory about 2700 Field Numbers. Very recently as an officer of the Botanical Survey of India, he explored with the party, the Jampai and Sakhan ranges etc. from 19-1-62 to 11-2-62, collecting thereby 759 Field Numbers.

Shri R. S. Rao of Botanical Survey of India collected about 150 Field Numbers for about a week in August, 1957, from Charilam, Garjee, Chandrapur reserve forests and Radhakishorpur. The author of the present paper had the opportunity of accompanying Shri Rao in his tour in Tripura and to collect and record the same specimens with him.

DEVELOPMENT OF FORESTRY

For long the forest had no value in Tripura. With the development of the neighbouring Districts of Sylhet, Tippera and Noakhali by the British Government, forest produce of this territory created a market in those districts and thus the importance of the forest produce was increasingly felt. At that time the forest used to be mined for maximum revenue, without any regulation or control.

In the year, 1887, rules were framed for preservation and improvement of trees in reserved forests but no area was declared as reserved. Probably the rules framed were not given effect to. In those rules, 7 species were named as reserved for protection.

In fact all of those species were used to be treated as reserved even before the issue of the notification, although there was no written order to that effect (Datta, 1952). Reservation of a tree indicated that royalty was payable for it.

In 1903 certain other rules were framed with a view to regulating the collection of forest produce and payment of royalty thereof.

Administrative report for 1906-07, (Das, 1907) indicated the abundance of sal (*Shorea robusta* Gaertn.) in the Sonamura, Sadar, Udaipur, Belonia and Dharmanagar sub-divisions and occurrence of Nageswar (*Mesua ferrea* Linn.), Garjan (*Dipterocarpus* sp.), Agar (*Aquilaria agallocha* Roxb.) and other valuable trees in several parts of the State. Timber, bamboos, grasses and canes were exported. In 1908-1909 reserved and unclassified forests were estimated as about 5.178 sq. km. (20 sq. miles) and 10000 sq. km. (3861 sq. miles) respectively. The provision of the forest regulations in regard to the export of the minor forest produce by the land route was extended to the Sonamura sub-division. This measure created opposition and led to rioting by people on the border. The export duty on forest produce yielded about Rs. 200000.00 annually to the State.

In 1909-10, His Highness was inclined for adoption of a definite policy in the administration of the

forest and for placing it on a sound footing as early as possible. He further stressed on guarding against the possibility of deforestation in reclamation of jungle tracts (Gupta, 1910). Accordingly a trained forester was engaged in 1910-11 to make thorough inspection and submit schemes for organisation of the Department (Deva Varma, 1911).

A comprehensive set of rules was drawn up in 1913. Certain procedure for collecting revenue was laid down. Commission Agents were appointed for the sale of forest permits for shoulder borne export of minor forest produce and forest stations were set for collection of duty and prevention of forest offences. The territory was divided into several forest mahals or sub-divisions.

A regulation was issued (Deb Burman, B. K., 1914) classifying the timber and declaring 32 trees (species?) as reserved. Trees were classified into seven classes according to their relative importance. A limit was put to the size below which no tree might be felled. There was no limit to the quantity that might be felled and removed per annum. There was no restriction to the felling and export of bamboos and canes. The rules introduced for the preservation and improvement of the forests were expected to make the State forests a perennial and increasing source of revenue.

In 1920-21, the unclassed forests were worked under the State rules. The reserved sal forests of the 'Sonamura Division' were worked under the system of coppice with standards and those of 'Udaipur Division', under the selection method. For the Feni River Mahal the rules of Forest Department of Bengal were followed. (Das Gupta, 1921).

1090 hectares (269.244 acres) of the forest were declared as reserved in 1935-36 (Sen, 1936).

In 1938, an Officer-in-charge was appointed for the forest reserves and afforestations, who was designated in the next year, as the 'Conservator of Forests', though the incumbent had no technical qualification (Bodhjunga, 1941).

Forest area reserved upto 1939 was 1372.3 sq. km. (530.05 sq. miles) and it rose to 292.65 sq. km. (113.0 sq. miles) in 1943.

Upto 1945, approximately 78.10 hectares (93 acres) were planted with 'Gamair' (*Gmelina arborea* Linn.), 'Sal' (*Shorea robusta* Gaertn.), Jarul [*Lagerstroemia speciosa* (Linn.) Pers.], 'Sonal' (*Cassia fistula* Linn.), etc.

Datta (1952) described in detail the past system of management, methods of extraction, market and marketable products etc. from an utilitarian point of view. He pointed out that the forests had been wantonly destroyed by jhumming and over exploitation, leading to destruction of the vegetation. He further pointed out a number of defects in the forest policy of the territory, inviting immediate attention.

No remarkable change took place in the policy and administration of the Forest Department even

after the integration of the State with the Indian Union in November, 1949, till the implementation of the first and the second five year plans, when scientific forestry was given effect to.

During the 'first five year plan', work started on several aspects of forest development. Till then there was no working plan for the territory. In 1954, an Officer was appointed for the purpose. 595 miles of the boundary in 12 reserved forests were demarcated, 1445.2 acres afforested and 8 miles of forest roads constructed.

Under the 'Second plan' work was continued on the 'First plan' schemes. Afforestation followed by demarcation of forest boundaries, together claimed about half the plan outlay. Only a little more than 17% of the 1297 sq. miles of the forest area in record was demarcated and reserved. By 1958-59, 80 miles of forest roads had been constructed, work on improvement of high forests and their maintenance through climber cutting, thinning etc. was also taken up.

In both the plans, however, forest utilization hardly received any attention. Even the beginning of a forest resources survey as the basis of a scientific utilisation was not undertaken.

Forestry contributes at present not much to the income of the territory but its potentialities are large. The production from forests, which is low enough for the country as a whole, being only one tenth of what obtained in Europe, is even worse in Tripura. Excepting a small quantity of soft wood exported to Assam, the remaining forest produce is utilised locally. Bamboo that covers vast areas of the territory, contributes least in money value as a forest produce. Its per acre value may not be more than five naye paise. The production of various types of the forest produce, major and minor, during 1958-59, when compared with that for the period 1933-34 to 1945-46, suggests that at one time forests have been heavily worked.

The most remarkable feature of the economy of Tripura is the large forest area (22%) under forests. The territory as a whole contributed about 0.7% to the national income of the country in 1955-1956. In Tripura about 60% of it contributed only 0.5 percent to the total net product. The reason for such a difference is attributed to the long neglect of forest wealth and poor quality of the forest produce.

STUDY OF THE VEGETATION

Tavernier's Travels in India in 1676 (Phillip, 1905) did not record anything about the forests of Tripura.

According to the some (Sen, 1919) the capital of Tripura at Agartala was established by cutting off a vegetation of *Aquilaria agallocha* Roxb. locally 'Agaru' from which the name of the capital 'Agartala' has been derived. The environmental condition of Agartala in the past, as the history of the locality indicates, was not favourable for 'Agaru' vegetation. Hence such a derivation of the name 'Agartala

seems to be unfounded. It does not rule out, however, the existence of this plant in Tripura. Sen (l.c.) further recorded the occurrence of this plant in Dharmanagar sub-division. At present it is found commonly in Kailashahar sub-division whereas at Dharmanagar it is practically absent.

Sen (l.c.) recorded the occurrence of 'Bishlata' *Milletia pachycarpa* Benth., in Tripura hills. A very interesting case of successful resistance of the Tripura army against the attack by the Pathan on the state at the time of 'Dhanya Manikya', by poisoning the water of the Gomoti river is recorded in history of the state. In old times 'Kuki' and other tribes used to smear the arrow-head with the juice of this plant in fighting against enemies. This is used as a fish-poison. The range of distribution of this plant is recorded in 'Krishna mala' (not read in original) according to which, this plant does not grow in the country to the right side of the river Chatheng. In fact this is found all over the territory and is used now-a-days in fish poisoning.

Hunter (1876) in "Statistical Account of Hills Tipperah" reported that the whole of the hilly tracts are covered with heavy forest of timber value with under growth of canes and thorny plants. Bamboos, and reeds are also abundant.

In the "Imperial Gazetteer of India," Hunter (1908) described that the hills are clothed on the south with a forest very similar in appearance and composition to that of Chittagong and Lauraceae, Dipterocarpaceae, Ternstroemiaceae, Euphorbiaceae and Leguminosae are well represented. The north is drier and densely covered with bamboo jungle. The forest which covers the hills contains *Shorea robusta* Gaertn., *Toona ciliata* Roem., *Gmelina arborea* Linn., *Lagerstroemia speciosa* (Linn.) Pers., *Depterocarpus turbinatus* Gaertn. f. and a large quantity of bamboos and canes.

Hooker (1909) placed Tripura in his sub-zone Northern Burma, a botanical sub-region recognised by Major Prain who refers to it the Lushai Hills, Tripura, Chittagong, Arakan and the Andaman Island. The vegetation throughout this sub-region approximates to that of the Eastern Himalayas, differing conspicuously in the absence of an alpine zone and of any species of *Picea* Link, *Abies* Juss., *Tsuga* Carr., *Larix* Miller, or *Juniperus* Linn., and in the presence of Nepal and Sikkim palm *Trachycarpus martiana* H. Wdl. and of *Shorea robusta* Gaertn. In the valleys and lower elevations, the vegetation of the tropical zones of the Himalayas prevails.

Datta (1952) classified the forests broadly into 5 types, namely (1) Bamboo forests, (2) Sal forests—(a) paddy field type and (b) high land type, (3) Garjan forest, (4) Mixed evergreen—deciduous forest—(a) Hill type and (b) Valley type (5) Evergreen and Savannah. His fourth and fifth types are not properly named. In the valley type he described

in fact evergreen forest. 'Evergreen and Savannah' is not an appropriate name.

Under every type named, he listed a number of species some of which named below do not appear to occur here. Probably those were determined in field, leading to confusion with allied plants. These are: (1) *Stereospermum chinensis*, (?) (2) *Talcuma phelocarpa* King, (3) *Lophopetalum fimbriatum* Wight, (4) *Cinnamomum cecidophne* Meisn., (5) *Salix terasperma* Roxb., (6) *Livistona jenkinsiana* Griff., (7) *Sabia limoniacea* Wall.

Unless the vegetation is thoroughly studied nothing can be said with assertion about the occurrence of these plants here.

"The call of the Forest" (1957) was published by Tripura Administration to give an idea to the people about the plan and achievement of the Forest Department in course of the first and the second plan periods.

Datta and Chakraborty (1957) published an abstract of "A sketch of the vegetation of Tripura" in the Science Congress Abstract, that was not followed by the publication of the paper. It is a spurious paper which need not be taken into account.

In the first working plan of Tripura, Choudhury (1958) dealt at length with the forests, condition and system of management of the forests. He prescribed nine 'working circles' indicating reasons, delimitations and the species suitable for each. It is beyond the scope of this paper to discuss his prescription that deserves some modification. Certain points of botanical interests are taken up here for discussion.

It appears to have been written in much hurry. Types of the forest deserve more intensive study and identification of certain plants needs confirmation. According to him four different main types of forests are found i.e., Sal (*Shorea robusta* Gaertn.), Garjan (*Dipterocarpus turbinatus* Gaertn. f.) miscellaneous and bamboo. He finds it "very peculiar and interesting that species of all these types are found growing either separately or intimately mixed together in the same locality in certain blocks". On the other hand, anything to the contrary might have created interest. He further observed that Sal is totally absent from the southern part of the Territory. In fact Sal forest is situated in the southern part of the territory.

According to Choudhury (1958, pp. 6) Muli exists everywhere except "wherever ousted by other varieties of bamboos or Garjan" but he did not cite any evidence or any convincing argument in support of this observation. As far as the author has studied the forests of Tripura, he does not hold the view that muli (*Melocanna bambusoides* Trin.) can ever be ousted by any other bamboo or Garjan.

Anybody who has some idea about Sal and Garjan forests of India and Burma will find nothing peculiar and interesting in association of Sal and Garjan with some evergreen and deciduous trees and bamboos brakes.

Choudhury reports that Kanak (*Schima wallichii* Choisy), Harguza (*Dillenia pentagyna* Roxb.), Kum (*Careya arborea* Roxb.), Awal (*Vitex peduncularis* Wall.), Bahera (*Terminalia belerica* Roxb.), Simul (*Salmalia malabarica* Sch. & Endl.), *Lannea coromandelica* Merr., Kajikara (*Garuga pinnata* Roxb.), Sida Janul (*Lagerstroemia parviflora* Roxb.), Korai (*Albizia procera* Benth.), Gamair (*Gmelina arborea* Roxb.), Sonal (*Cassia fistula* Linn.) etc. are restricted to the south of Khowai river whereas Chandul (*Tetrameles nudiflora* R. Br.), Rata (*Amoora wallichii* King), Khemta (*Chukrasia tabularis* Juss.), Ramdala (*Duabanga grandiflora* (Roxb.) Walp., Champa (*Michelia champaca* Linn.), Sundi (*Michelia montana* Bl.), Nageswar (*Mesua ferrea* Linn.), Agar (*Aquilaria agallocha* Roxb.) etc. to the north of the said river. Recent study of the vegetation by the author indicates that such an observation on the restricted distribution of these species to the north and south of the Khowai river, is unsound and, in fact, no such restriction exists in distribution of these species.

Deb (1961) published a number of abstracts of papers indicating the broad characteristics of the flora.

Rao (1959) on the basis of about a week's exploration, published in the Indian Science Congress Abstract a "Vegetational note on the southern forests of Tripura State," and described the vegetation as of a typically moist deciduous type. According to him, mixed forests along Charilam and Radhakishorepur consist mostly of tree species of *Dillenia pentagyna* Roxb., *Careya arborea* Roxb., *Garuga pinnata* Roxb., *Terminalia belerica* Roxb., *Lannea coromandelica* Merr., and others while the reserved forest of Chandrapur and Garjee are dominated by *Shorea robusta* Gaertn. with species of *Dillenia* Linn., *Ficus* Linn., *Lagerstroemia* Linn., and others.

He (Rao, 1960) published on the basis of the same exploration, another abstract on "Studies of some moist deciduous forests of Tripura State". The general pattern of the vegetation he ascribed to two distinct types namely moist deciduous mixed forest and moist deciduous Sal forest, distributed in four different areas each presenting a characteristic community. Mixed forests of Charilam area comprise of *Elaeocarpus-Terminalia-Sapium-Callicarpa* community whereas Radhakishorepur with similar type of forest is dominated by *Ficus-Albizia-Lagerstroemia-Vitex* communities. In Sal forest zone two distinct communities were recognized, i.e., (1) *Eugenia-Sterculia-Vitex* in Garjee area and (2) *Grewia-Bridelia-Antidesma* in Chandrapur region.

Biswas (1958) published an article in the "Amrita Bazar Puja Annual" on the "Vegetable resources of the Tripura State". He observed that it is a peculiar mixture of rain forest and deciduous types and in general Malayan character. According to

him about 60% of the species found in Tripura are of medicinal importance.

Deb (1961 g), however, estimated the total number of medicinal plants growing in Tripura to be 263. In the list he included only those plants which are recognized as medicinal plants in the Indian Pharmaceutical Codex. This is about 20% of the higher plants found in Tripura. The percentage of medicinal plants will on intensive exploration increase but it is not likely to go upto 60%.

"The list of medicinal plants deposited in various herbaria of the Botanical Survey of India" (Bull. Bot. Surv. India: 2:226-227, 1960) included (1) *Hydnocarpus kurzii* (King) Warb. and (2) *Vitex peduncularis* Wall., as occurring in Chirang (wrongly for Charilam) forest, Tripura. The former does not occur in the locality cited. However, this plant is found in abundance in the Jampai ranges and is rare in Debtamura hill, as collected by the author of this paper.

According to Biswas (1) *Areca cathecu* Linn., (2) *Borassus flabellifer* Linn., (3) *Cocos nucifera* Linn., (4) *Phoenix sylvestris* Roxb., are abundant in Tripura. The author of this paper does not agree with Dr. Biswas on this point. In fact these palms are extremely rare in Tripura. The local demand for the fruits of these plants is met with almost exclusively by import.

In a paper on the timber yielding plants of Tripura territory, Deb (1961 e) estimated the total number of tree species as 273. This is about 21% of the higher plants growing in the territory. Out of 273 species 64 trees are of recognized commercial importance. The remaining 209 species are of minor importance. In order to assess the forest resources of the territory, those trees were classified by him into ten categories from the point of view of commercial importance, according to Jacob (1940).

Deb (1959 b) in a small paper drew an outline of the vegetation of Tripura and classified the forests as follows:

- A. Climatic types
 - (1) Wet evergreen forest, (2) Semi evergreen forest, (3) Moist deciduous forest—(a) Sal forest, (b) Moist deciduous mixed forest
- B. Seral types
 - (4) Fresh water swamp and creeper forest, (5) Riverain forest
- C. Subsidiary edaphic types
 - (6) Bamboo forest, (7) Cane brakes, (8) Garjan forest, (9) Savannah, (10) Grass land.

In that paper he described the characteristics of the different types of the forest and named the dominant and other species in each type. In another paper (1961 g) contributed for the Gazetteer of Tripura, he elaborated the outline mentioned above and dealt with the forest types in details. He is, however, still not sure about the status of the Sal and Garjan forests. Particularly the Sal forest, he

is constrained to consider as a true climatic type at all (Champion, 1936). This point will be discussed at length elsewhere. Deb (1959 a) contributed another paper, on the effect of Jhum cultivation in Tripura.

Rao and Panigrahi, (1961) in a paper on the "Distribution of vegetational types and their Dominant species in Eastern India" placed the vegetation of western(?) region of Tripura in moist and dry deciduous forest on the basis of the exploration by the senior author who in his earlier publication (Rao l.c.) located the same area studied by him in the southern part of Tripura. According to this paper the reserved forests of Tripura adjoining Charilam and Radhakishorepur comprise of *Garuga pinnata* Roxb., *Lannea coromandelica* Merr., *Schima wallichii* Choisy, *Albizzia procera* Benth., *Microcos paniculata* Linn., etc. (l.c., 278) which are not met with in corresponding forest types in Assam and NEFA whereas *Dillenia pentagyna* Roxb., *Terminalia* sp., *Careya arborea* Roxb., *Lagerstroemia parviflora* Roxb. etc. are common to all.

In the earlier publications the senior author (Rao, l.c.) placed those forests under "moist deciduous type." "Moist and dry deciduous" type is not the characteristic representative type of the forests of Tripura. Species of *Elaeocarpus*, *Sapium*, *Callicarpa*, *Ficus*, *Vitex*, *Grewia*, *Brideia*, *Antidesma* and *Eugenia*, considered by Rao as dominant in the area, are not mentioned in this paper, *Shorea robusta* Gaertn. the most dominant species in the area is not cited along with other dominants. *Garuga pinnata* Roxb. is not more dominant than *Schima wallichii* Choisy. *Dipterocarpus turbinatus* Gaertn. f. one of the dominant species of the first rank has not been named at all. Thus all the three papers under the common authorship of Shri Rao, based on the same field study by him for about a week, when scrutinized together, appear to be self contradictory and create confusion as to the actually dominant species in the area. The observation that certain species are not met with in corresponding forest types in Assam and NEFA is not acceptable.

TAXONOMY AND RECORD OF INTERESTING PLANTS FROM TRIPURA

The earliest reference in the scientific literature on the plants of Tripura as far as searched out, was made by F. Hamilton (1837) in connection with *Duabanga* sp. He noted that this plant in Tripura is called 'Duabanga' or 'Banurhola.' To commemorate the occurrence of the plant in Tripura he named it *Duabanga sonneratioides* now called *Duabanga grandiflora* (Roxb.) Walp, after the local name. It could not be ascertained, however, whether the plant concerned was actually collected from Tripura District of undivided Bengal or Tripura territory. It may also be plausible that the plant concerned was collected from some place other than

Tripura and, its local name in different places were collected through different agencies.

Hunter (1876) recorded the probable occurrence of 102 indigenous medicinal plants. Botanical names of those plants were supplied to him by Dr. King the then Superintendent, Indian Botanic Garden, Calcutta. Those are listed below.

(1) *Cassia fistula* Linn., (2) *Hemidesmus indicus* R. Br., (3) *Achyranthes aspera* Linn., (4) *Clitoria ternatea* Linn., (5) *Emblica officinalis* Gaertn., (6) *Aconitum napellus* Linn., (7) *Anethum sowa* Roxb., (8) *Punica granatum* Linn., (9) *Oxalis corniculata* Linn., (10) *Zingiber officinale* Rosc., (11) *Aegle marmelos* Corr., (12) *Curcuma zedoaria* Rosc., (13) *Adhatoda vasica* Nees, (14) *Terminalia bellerica* Roxb., (15) *Trichosanthes cordata* Roxb. (*Trichosanthes tuberosa* Roxb.), (16) *Pavonia odorata* Willd., (17) *Centella asiatica* (Linn.) Urban, (*Hydrocotyle asiatica* Linn.), (18) *Ricinus communis* Linn., (19) *Cydonia vulgaris* Pers., (20) *Ocimum basilicum* Linn., (21) *Embelia ribes* Burm. f., (22) *Nerium indicum* Mill., (23) *Alstonia scholaris* (Linn.) R. Br., (24) *Gynocardia odorata* R. Br., (25) *Centanthrum anthelminticum* (Willd.) Kuntze (*Vernonia anthelmintica* Willd.), (26) *Croton tiglium* Linn., (27) *Plumbago indica* Linn., (*Plumbago rosea* Linn.), (28) *Michelia champaca* Linn., (29) *Datura metel* Linn., (*Datura alba* Nees), (30) *Coriandrum sativum* Linn., (31) *Cedrus libani* Barrel var. *deodara* Hook. f. (*Pinus deodara* Roxb.), (32) *Elettaria cardamomum* Maton, (33) *Diospyros peregrina* (Gaertn.) Gurke (*Diospyros embryopteris* Pers.), (34) *Cannabis sativa* Linn., (35) *Aloe barbadensis* Mill. (*Aloe perfoliata* Willd.), (36) *Paederia foetida* Linn., (37) *Enhydra fluctuans* Lour., (*Enhydra heloncha* DC.), (38) *Terminalia chebula* Retz, (39) *Cochlearia flava* Ham., (*Cochlearia alyssoides* DC.), (40) *Lepidium sativum* Linn., (41) *Curcuma domestica* Valetton (*Curcuma longa* Linn.), (42) *Plantago ovata* Forsk (*Plantago ispaghul* Roxb.), (43) *Sesbania sesban* (Linn.) Merr. (*Aeschynomene sesban* Linn.), (44) *Glycyrrhiza glabra* Linn., (45) *Abutilon indicum* (Linn.) Sweet, (46) *Carum copticum* Benth., (*Ptychotis ajowan* DC.), (47) *Andrographis paniculata* Nees, (48) *Caesalpinia crista* Linn. (*Caesalpinia bunducella* Fleming), (49) *Datura metel* Linn., (*Datura fastuosa* Linn.), (50) *Strychnos nux-vomica* Linn., (51) *Syzygium cumini* Skeels (*Eugenia jambolana* Lam.), (52) *Feronia limonia* (Linn.) Swingle (*Feronia elephantum* Correa), (53) *Cassia sophera* Linn., (54) *Anthocephalus indicus* A. Reichb., (*Nauclea cadamba* Roxb.), (55) *Oldenlandia corymbosa* Linn. (*Oldenlandia biflora* Lamk.), (56) *Nigella sativa* Linn., (57) *Holarrhena antidysenterica* Wall. (*Wrightia antidysenterica* Grah.), (58) *Capsicum annuum* Linn., (59) *Calotropis gigantea* (Linn.) R. Br. ex Ait., (60) *Cyperus rotundus* Linn., (61) *Zingiber zerumbet* Smith, (62) *Lawsonia inermis* Linn. (*Lawsonia alba* Lamk.), (*Trigonella foenumgraecum* Linn.), (63) *Azadirachta indica* Juss., (64) *Mesua ferrea* Linn., (65) *Vitex negundo* Linn., (66) *Opuntia*

elator Mill. (*Opuntia dillenii* Grah), (69) *Cyperus scariosus* R. Br. (*Cyperus pertenuis* Roxb.), (70) *Butea monosperma* (Lamk) Taub. (*Butea frondosa* Koen. ex Roxb.), (71) *Citrus limon* (Linn.) Burm. f. (*Citrus limonum* Wall.), (72) *Jatropha curcas* Linn., (73) *Boerhaavia diffusa* Linn. (*Boerhaavia procumbens* Roxb.), (74) *Piper betle* Linn., (75) *Piper longum* Linn., (76) *Mentha arvensis* Linn., (*Mentha sativa* Roxb.), (77) *Trapa bispinosa* Roxb., (78) *Trichosanthes dioeca* Roxb., (79) *Adenanthera pavonina* Linn., (80) *Nymphaea pubescens* Willd. (*Nymphaea rubra* Roxb.), (81) *Argemone mexicana* Linn., (82) *Euphorbia nerifolia* Linn., (83) *Moringa oleifera* Lamp. (*Moringa pterigosperma* Gaertn.), (84) *Urginea indica* (Roxb.) Kunth., (85) *Ichnocarpus frutescens* R. Br., (86) *Sarmalia malabarica* (DC.) Schott. & Endl. (*Bombax malabaricum* DC.), (87) *Nyctanthes arbor-tristis* Linn., (88) *Nymphaea stellata* Willd. (89) *Areca cathecu* Linn., (90) *Centanthrum anthelminticum* (Willd.) Kuntze (*Vernonia anthelmintica* Willd.), (91) *Nerium indicum* Mill. (*Nerium odorum* Ait.), (92) *Brassica hirta* Moench (*Sinapsis alba* Linn.), (93) *Brassica nigra* Koch (*Sinapsis nigra* Linn.), (94) *Cucumis sativus* Linn., (95) *Centella asiatica* (Linn.) Urban, (*Hydrocotyle asiatica* (Linn.)), (96) *Tamarindus indica* Linn., (97) *Ocimum sanctum* Linn., (98) *Cinnamomum* sp., (99) *Nicotiana tabacum* Linn., (100) *Operculina turpethum* Manso., (*Ipomoea turpethum* Br.), (101) *Sesamum indicum* Linn. (*Sesamum orientale* Linn.), (102) *Linum usitatissimum* Linn., (103) *Valerina wallichii* DC. (104) *Erythrina variegata* Linn. var. *orientalis* (Linn.) Merr. (*Erythrina indica* Lamk.).

On scrutiny it appears that in two cases the same plant has been recorded twice (nos. 17 & 95; 25 & 90) under different local names. The numbers 19, 31, 42, have not yet been collected from the territory. Since the botanical names were listed on the basis of the local name such a discrepancy is very natural as the same local name may indicate more than one species. For instance, the local name 'Chalmugra' refers to two species namely (1) *Gynocardia odorata* R. Br. and (2) *Hydnocarpus kurzii* Warb., both of which occur in Tripura in plenty but the list contains only *Gynocardia odorata* R. Br. which, in fact, is not the real 'Chalmugra' plant.

Bhattacharjee (1906, 1930) studied the soil sample of Tripura at the Prussian Government Agricultural Institute of Halle a. s., and recommended the soil as suitable for tea cultivation, that led to the foundation of tea gardens in the state and during the short period of eleven years as many as 40 gardens were started (Sanyal, 1930).

Collections of Deb Burman (l.c.) preserved in the Herbarium, Indian Botanic Garden, have been subjected, in recent times, to examination and recorded by different monographers in revision of genera and families of Indian plants.

Mukerjee (1940) in 'A revision of the Labiatae of the Indian Empire' described (1) *Coleus blumei*

Benth., (2) *Microtaena insuavis* (Hance) Prain ex. Dunn., (3) *Ocimum basilicum* Linn., (4) *Ocimum americanum* Jacq. (*Ocimum canum* Sims).

Chakravarty (1949) in a revision of the Indian Passifloraceae described only *Passiflora edulis* Sims (Deb Burman 797).

Datta (1930) recorded the occurrence of several Kuchila trees (*Strychnos nux-vomica* Linn.) in North Chandrapur and Sonamura and Rudraksha trees (*Elaeocarpus ganitrus* Roxb.) on the bank of Brahmachara. The author of the present paper also heard of the existence of those plants in those localities but himself could not effort to collect the specimens to confirm the identification.

Datta (l.c.) ascribed the dwindling of 'Agar' (*Aquilaria agallocha* Roxb.), Nageswar (*Mesua ferrea* Linn.) and Garjan (*Dipterocarpus turbinatus* Gaertn. f.) to the lease system and other reasons. Chakravarty (1951 a) recorded *Ophioglossum reticulatum* Linn. (Deb Burman 768) in another paper. Chakravarty (1951 b) recorded three species of *Corchorus* Linn., from Tripura in his revision of the genus. These are: (1) *Corchorus aestuans* Linn. (*Corchorus acutangulus* Lam.) (Deb Burman 999), (2) *Corchorus capsularis* Linn. (Deb Burman 959) and (3) *Corchorus olitorius* Linn. (Deb Burman 959). Mukerjee (1952) included 2 species from Tripura in his revision of the genus *Moghania* St. Hill in India and Burma. These are: (1) *Moghania stricta* (Roxb.) O. Ktze. (Deb Burman 385) and (2) *Moghania prostrata* (Roxb.) Mukerjee (Deb Burman 238, 262). Mukherjee, Sunil Kumar (1954) in the revision of the genus *Saccharum* Linn. described *Saccharum spontaneum* Linn. from Deb Burman's collection.

Deb (1956) in an article on "Sarpagandha" indicated the probability of the occurrence of *Rauvolfia serpentina* Linn. in Tripura that was subsequently followed by his discovery of the plant (Deb, 1958) from the territory.

Rao (1957) in 'A revision of the Indo-Malayan species of *Viscum* Linn., described *Viscum monorum* Roxb. ex DC. (Deb Burman 271, 511, 570 and K. Biswas 5021).

Mukerjee (1958) in 'A synopsis of Indian and Burmese *Polygala* described a new variety of *Polygala chinensis* Linn., in addition to the typical species i.e., *Polygala chinensis* Linn. (Deb Burman 855) and *Polygala chinensis* Linn. var. *hirsuta* Mukerjee (Deb Burman 866).

Chatterjee et al (1958) in a paper on the 'Identity of the Plant Piyaman or Madar—Jamua' described Deb Burman 766 and 1228 as *Syzgium cerasoides* (Roxb.) Chatterjee et Kanjilal f.

Chakravarty (1959) in his 'Monograph on Indian Cucurbitaceae', described 14 species as occurring in Tripura of which 13 species are based on Deb Burman's collection and one, his own. These are named below: (1) *Benincasa hispida* (Thunb.) Cogn. (Deb Burman 94), (2) *Bryonopsis laciniosa*

(Linn.) Naud. (Deb Burman 133, 799), (3) *Coccinia cordifolia* (Linn.) Cogn. (Deb Burman 432), (4) *Cucumis melo* Linn. var. *cultus* (cult) Kurz (Deb Burman 79, 679), (5) *Cucumis sativa* Linn. (Deb Burman 767), (6) *Luffa acutangula* (Linn.) Roxb. (Deb Burman 767), (7) *Luffa cylindrica* (Linn.) Roem. (Deb Burman 48, 598), (8) *Lagenaria leucantha* (Duch.) Rusby (Deb Burman 1072), (9) *Melothria heterophylla* (Lour.) Cogn. (Chakravarty, not numbered), (10) *Melothria madaraspatana* (Linn.) Cogn. (Deb Burman 786), (11) *Momordica charantia* Linn. (Deb Burman 173, 569), (12) *Momordica dioica* Roxb. ex Willd. (Deb Burman 673), (13) *Trichosanthes bracteata* (Lamk.) Voigt (Deb Burman 1177), (14) *Trichosanthes dioica* Roxb. (Deb Burman 1106).

Hedyotis coronata Wall. a Burmese-Malayan species and *Pterospermum semi-sagittatum* Ham. a Chittagong plant were recorded for India by Rao (l.c.) (Deb 1961 f.) recorded the occurrence of a guinean plant *Psidium guineense* Sw. for India from the same territory.

Deb on the basis of the study of the flora for about five years published abstracts of a number of papers in the proceedings of the Science Congress, 1961. These give us a conspectus of the flora. In the preliminary study on the Pteridophyta he (Deb, 1961 a) enumerated 36 species representing 25 genera and 21 families. Of these 26 species are terrestrial, 5 epiphytic and 5 aquatic of which 3 are, free floating.

In "Gymnosperms in Tripura Territory", he (Deb, 1961 b) described only 11 species representing 8 genera distributed over 6 families. Of these, 8 species occur only under cultivation and the remaining 3 species occur in natural habitat.

He (Deb, 1961 c) further recorded for India from Tripura Territory a dozen of plants which are hitherto recorded to occur only in Burma and (or) Chittagong.

In "Little known plants from Tripura Territory" he (Deb, 1961 d) enumerated seventeen species of plants. The abstracts cited here have not yet been followed by the publication of the papers in details.

INTRODUCTION OF PLANTS TO TRIPURA FOSSILS

Cultivation of cotton (*Gossypium arboreum* Linn.) is supposed to have been introduced into Tripura at the time of Subrai (nick name of Maharaja Trilochan) who was a patron of art and culture (Sen, 1919). This indicates that the so-called local cotton plant which has been naturalised in Tripura is not indigenous to this country.

About 3 acres of land near Agartala, were under Poppy (*Papaver somniferum* Linn.) cultivation in 1773-74 (Hunter, 1876). Cultivation of Poppy plant in Tripura has long been abandoned.

Cultivation of Rhea (*Boehmeria nivea* Hook. & Arn.), Aloe (*Aloe barbadensis* Mill.), Mulberry (*Morus indica* Linn.), Sugarcane (*Saccharum offici-*

narum Linn.), Castor (*Ricinus communis* Linn.), Arhar (*Cajanus indicus* Spreng.) and Potato (*Solanum tuberosum* Linn.) was taken up at Kashipur by the State Agricultural Department in 1904-1905.

In 1905-1906 (Chatterjee, 1906) cultivation of mulberry was increased from 4 to 7 acres. Measures were taken for the preservation of valuable trees (not named) in the old farm at Birendranagar.

Cultivation of Jute (*Corchorus capsularis* Linn.) was introduced into the state near about 1906 (Das, 1907). In 1912-1913, sugarcane of different varieties, ginger (*Zingiber officinale* Rosc.), paddy, Arhar, mustard (*Brassica* sp.), sweet potatoes (*Ipomoea batatas* Lamk.) and different horticultural plants were grown in the Agricultural farm at Kashipur. During the year were tried, varieties of cotton namely the 'Sea inland' (*Gossypium barbadense* Linn.), and the indigenous (?) varieties (*Gossypium arboreum* Linn. race *cernuum* Silow). The former did not succeed while the growth of the latter was satisfactory.

Some rubber trees *Ficus elastica* Linn. were also grown in the farm. Those thrived well.

Cultivation of tea plants *Camellia sinensis* (Linn.) Kuntze in the State was first permitted in 1916-17 and extensive waste land of the State was thrown open for the purpose.

In the same year, cultivation of some crops, Mushari (*Lens culinaris* Medic.) and Khesari (*Lathyrus sativus* Linn.) and Bora paddy (*Oryza sativa* Linn. race ?) new to the locality, was taken up as an experiment. The results were satisfactory.

Potato—The Nainital, the Darzeeling and the Deshi varieties grew fairly well. Dharwar variety of cotton grows well during the rainy season. Experiment to grow it in the dry season did not prove a success. Other varieties of cotton such as Buri, American Dharwar (*Gossypium hirsutum* Linn.—race *latifolium* J. M. Hutchins.) and the Commillas (*Gossypium arboreum* Linn.—race *bengalense* Silow or *cernuum* Silow) proved successful under plough cultivation.

Cultivators were induced to grow high land improved paddy, 'Katak' and the low land paddy 'Indrusail' in 1925-26.

Nainital potato, American potato and Matihar tobacco (*Nicotiana rustica* Linn.) were tried in that year.

In 1935-36, improved variety of sugarcane, nearly 44000 cuttings of Coimbatore No. 213 were distributed in Sadar Sub-Division along with 5 maunds of ground nut (*Arachis hypogaea* Linn.).

Cultivation of pine-apple (*Ananas comosus* Merr.) increased year to year since that time. Cultivation of Napier grasses was encouraged by the administration in 1936-37. Seeds of English vegetables were distributed to the people for cultivation.

Some Khasias came to the area with a view to cultivating Pan in Panjhum.

FOSSILS

In the first paper published on the geology of Tripura, Das Gupta (1908) recorded the collection of some silicified fossil wood from the *tipams*. Bose (1910) discovered an interesting group of fossils mainly mollusca at Pecharthai (*Deb Burman* 1911). Those fossils have been assigned to the age of miocene period.

Two specimens of plant impressions of the carbonaceous shales which proved to be *Vertebraria indica* (Jacob & Banerjee, 1954) were collected by S. N. Sen (1952, 1954) of Geological Survey of India in 1952.

Recently Ghosh and Kazmi (1961) have described a new species of fossil *Pahudioxylon sahnii* Ghosh and Kazmi, collected from the Miocene(?) bed of Khowai river at Telimura, Tripura. It represents the characteristics of living leguminous wood. Another fossil collected from the same locality has been identified by Ghosh and Taneja (1961) as *Glutoxylon burmense* (Holden) Chowdhury. This is allied to anacardiaceous wood, and is considered to be associated with the oil bearing strata. It appears that Glutas were common trees growing in the Miocene period in a wide area extending to Raniganj, coal fields on the west. At present it is mainly confined to Burma, Thailand, Malay Peninsula, Viet Nam and Hainan Island with the exception of two species.

Silicified fossil wood of angiosperms are found in abundance all over the territory, particularly along the Assam Agartala road. Putrefied plants also are found embedded in peats-in bogs and marshes. These deserve thorough study that may throw interesting light on the origin of the present flora of the territory.

ACKNOWLEDGEMENTS

The author records with deep gratitude his heartfelt thanks to Rev. Father H. Santapau, the Director and Dr. K. Subramanyam, Deputy Director of the Botanical Survey of India, for kindly going through the manuscript and suggestions for improvement which have been gladly accepted.

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