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BIODIVERSITY IN INDIAN CAMELLIAS - PROBLEMS AND PROSPECTS OF CONSERVATION

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The availability of genetic diversity in Indian Camellias are discussed with emphasis on need for their conservation. The parts of the gene pool vary according to how they contribute useful variations. The Indian Camellias are endemic to the North-east India which are represented presently by 14 spacies in collections with over 2500 accessions. The majority of the collections are of *Camellia assamica* maintained at three locations. The weaknesses of the present collections are highlighted. The migration of Indian Camellias primarily old seed jats of Assam type presently occupying over 60 per cent of the world tea acreage is focussed. With the alarming rate of loss of genetic diversity due to fast uprooting of old seed-grown plantations in N.E. India, deforestation and difficult accessability of various areas of genetic diversity calls for global concern in conserving tea genetic resources. Future strategies for the conservation of tea germplasm in India are discussed.

Key words: Tea, *Camellia* spp., genetic diversity, conservation

Tea (*Camellia sinensis* (L) O. Kuntze) is the most important beverage crop in the world. Its consumption is fast increasing every year. Among the tea producing countries, India holds number one position as the largest producer, consumer and exporter of tea. It has one of the richest source of *Camellia* genetic wealth specially distributed in the North East. All the three cultivated species of tea namely China type (*Camellia sinensis* (L) O. Kuntze), Assam type (*C. assamica* (Masters) Wight) and Cambod type (*C. assamica* spp. *lasiocalyx* (Planch) Wight) are found in Indian sub-continent. Apart from these species, innumerable intermediate types of tea existing in the region, are the hybrid forms of cultivated species. Besides cultivated species, there are 12 different wild relatives of tea which are also found in the sub continent (Bezbaruah and Singh, 1978).

The conservation of genetic diversity in tea is essential for tailoring new cultivars to meet the ever increasing demand for more and speciality teas. Although a rich genetic diversity of Camellias exist in the North eastern region of India but their systematic survey and collection is lacking. With increasing human activities in the fields of urbanization, industries and modern agriculture

in the region, most of the Camellias genetic wealth are being lost at an alarming rate and hence need to be preserved before they are lost for ever. This paper aims to highlight the availability of biodiversity in Indian Camellias, emphasize the need for their conservation and suggest possible approaches to be adopted for their conservation by concern agencies.

ORIGIN OF INDIAN TEA

The region where tea is considered to be endemic are the hills of Assam, Nagaland, Manipur, Mizoram and Myanmar. In 1823, some indigenous tea plants was presented to Robert Bruce by a Singhpho Chief, a tribal of the region. He reported this indigenous tea plant as a possible source of commercial tea. It took another decade for its popularization as commercial tea due to its yield and quality characteristics. But tea was cultivated first in India (of China type) introduced from China in 1830. After that both China and indigenous Assam type plants grew well. Presently hybrid forms of Assam are very popular in most of the tea growing countries (Singh and Bezbaruah, 1987).

Assam tea and its wild relatives are endemic to the North East region where a rich wealth of genetic diversity exist. Planned surveys in this region for the collection of genetic variants should be taken on priority basis. The alarming rate of deforestation in the region calls for immediate action especially to preserve the endangered forms of Camellias.

GENETIC DIVERSITY AND DISTRIBUTION

Tocklai Experimental Station of the Tea Research Association at Jorhat can claim to have the largest collection of diverse types of tea. The collection is represented by 14 species with 2507 accessions maintained at three main centres (Table 1 and 2). Out of 14 collected species, maximum diversity is shown in *Camellia assamica* followed by *Camellia assamica* ssp. *lasiocalyx.*, mostly collected from the North east region of India. Among the wild relatives maximum diversity is shown in *Camellia drupifera, C. kissi* and *C. caudata* mostly found in the hills of Meghalaya and Assam (Table 1).

Presently tea collection is represented by (i) Primitive seed sources as jats, (ii) natural genetic variants of cultivated species, (iii) wild and related *Camellia* spp., (iv) improved clonal and seed cultivars and (v) natural and bred polyploids. A summary of actual accessiosns maintained at various collection centres of Tea Research Association is presented in Table 2. Although efforts to collect wide genetic diversity of tea started in the beginning of the 20th century, but its representation is far from adequate due to non systematic approach.

Table 1. Particulars of various species of tea established in the field gene bank by Tocklai in North East India

Species	Source of collection	No. of accessions
Camellia assamica	Assam, Manipur Sri Lanka, S. India	2337
C. sinensis	China, Darjeeling Hills	35
C. assamica ssp *lasiocalyx*	Indo China, Myanmar, Assam	60
C. kissi (drupifera)	Meghalaya	50
C. caudata	Assam	
Eurya japonica	N. East India	7
E. acuminata	N. East India	2
Gordonia excelsa	N. East India	2
G. imbricata	Sri Lanka	2
C. japonica	U.S.A., Japan	-
C.sasanqua	U.S.A., Japan	-
C. irrawadiensis	Upper Myanmar	2
C. japonica var. Kyoniski	Japan	1
C. rosiflora	Sri Lanka	1
	Total	2507

Table 2. Collection of genetic diversity of tea in the North East India

	Location	No. of accessions
1.	**Tocklai Experimental Station Jorhat, Assam**	1699
	(i) Primitive seed sources, natural variants	1279
	(ii) Improved seed/clonal cultivars	176
	(iii) Polyploids	174
	(iv) Wild and related *Camellia* spp.	75
2.	**Nagrakata Sub Station, West Bengal**	555
	(i) Natural variants and breeding stocks	490
	(ii) Improved seed/clonal cultivars	65
3.	**Clonal Proving Station, Ging T.E., Darjeeling**	253
	(i) Natural variants and breeding stocks	193
	(ii) Improved seed/clonal cultivars	40
	Total	2507

In addition to field collections, over 1400 herbarium specimens are maintained at Tocklai Experimental Station, Jorhat. These were used extensively for taxonomic studies by Wight to rename cultivated teas into *C. assamica, C. assamica* ssp. *lasiocalyx* and *C. sinensis* (Barua, 1965).

A closer look of genetic diversity in Indian Camellias selected so far has indicated the following :

1. No systematic survey has been taken to collect diverse germplasm representing the gene pool of tea and draw their distribution map
2. Majority of the collections are of *C. assamica* and its hybrid ferms with a bias towards agronomical types.
3. Wild and related *Camellia* species are poorly represented in the collection.
4. Indo-Burma region especially the courses of Irrawaddy river is a rich gene bank for the transgressive segregants of natural hybrid forms of *C. sinensis* and *C. assamica* as *C. assamica* ssp. *lasiocalyx.*
5. The hills of Assam, Meghalaya, Manipur, Nagaland and Mizoram are rich sources of genetic diversity in *Camellia* spp.
6. The genetic diversity collected so far has been poorly evaluated for their various characteristics and
7. Majority of the collections are maintained at one location in field gene banks.

It is therefore, essential that setps should be taken to preserve full spectrum of tea germplasm for current and future use. It is also required because needs of today's plant breeders may be very different from those of 21st century, due to changing food habits and processing methods on the one hand, and projected climatic changes on the other. A systematic collection of genetic diversity in tea should represent the entire gene pool spectrum (Fig. 1) where collections from areas of diversity and cultivation as well as from breeding and research programmes are maintained.

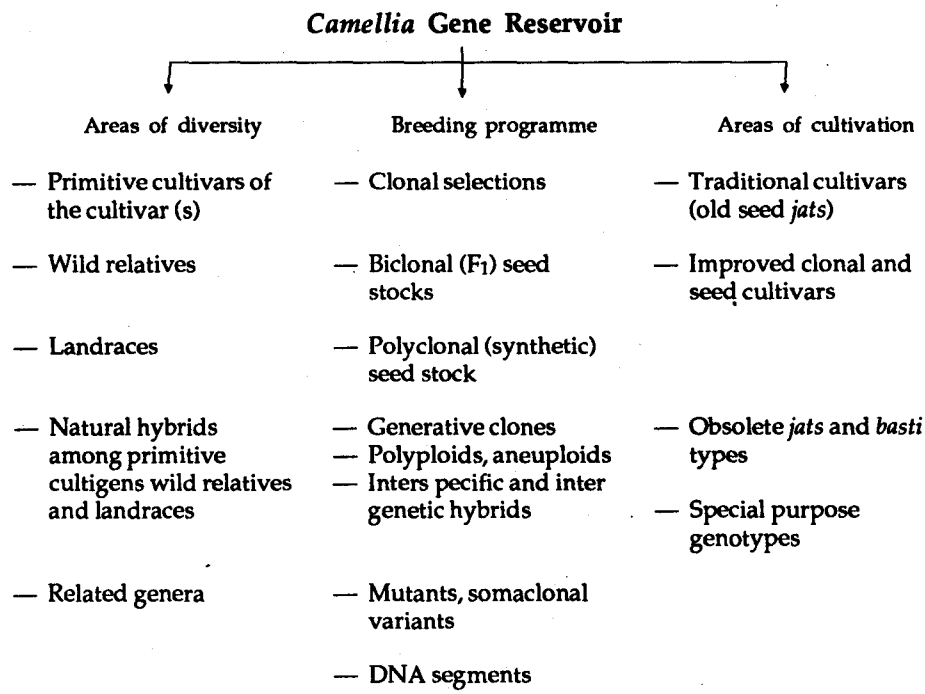

Fig. 1. A *Camellia* gene reservoir full spectrum and its possible sources

MIGRATION OF INDIAN CAMELLIAS FROM NORTH EAST INDIA

The commercial tea plantations in major tea growing areas of India as well as world have received early planting materials primarily from the North east India. Such materials occupy over 60 per cent of the world tea acreage (Singh, 1979). Among the major recipients of early tranditional tea cultivars (seed *jats*) are S. India, Sri Lanka, Mauritius, Bangladesh, East Africa, Central Africa, Iran, Indonesia, and Malaysia. Majority of the seed *jats* which were taken are of *C. assamica* type wherein selection practiced has resulted into the development of many superior clonal cultivars. Among the notable clonal releases are of UPASI series (1 to 30) from the United Planters Association of S. India, TRI 2000 series from the Tea Research Institute of Sri Lanka and many clones released from the Tea Research Foundation of Central Africa, Malawi. The nature of planting materials migrated from the N.E. India to other countries indicate presence of limited genetic diversity regarding the tea gene pool. Hence, the scope of collecting tea germplasm of *C. assamica* and its related species through exotic introductions from abroad is limited. Therefore, attempts should be made to collect the representative gene pool of *C. assamica* from different sources within the country.

CONSERVING TEA GENETIC RESOURCES

Tea is taken as a beverage in most part of the World. Among all the beverages, by far, tea is considered the cheapest. It has medicinal properties also. Tea has been used in pharmaceutical formulations. Demand for more tea of better quality as well as speciality teas is increasing. Tea is cultivated as a perennial crop. All these warrant for collection of diverse tea germplasm to tailor future plants to meet consumers requirements. Rich genetic diversity in tea is found in economically weak geographical regions of China, North East India and Myanmar primarily in the hilly tracts. Accessability to such regions is restricted. It is an alarming problem specially in N.E. India where uprooting of old teas takes place at 2.00 - 2.5 per cent annually besides high rate of deforestation. Therefore, an integrated conservation strategy at the global level ranging from *in situ* conservation of populations to conservation at the molecular level should be developed.

It will be desirable if tea biodiversity reserves are created as an instrument for *in situ* conservation of its genetic diversity. Under this programme, old seed grown sections of tea plantations in N.E. India whose seed sources do not exist, are kept as reserve. Since tea is endemic to N.E. Indian Sub- continent, establishment of tea biodiversity reserves in such areas are important. The cooperation of various national and international agencies engaged in tea cultivation trade and R & D programmes are needed to draw and implement a global plan for the conservation of genetic diversity in tea.

The modernisation of India tea industry for higher productivity of better quality tea through the development schemes like uprooting and replanting is undesirable for conservation of tea genes. The rate of uprooting of old seed grown sections @ 2.5 per cent annually in N.E. India, which are the gold mines of tea genes, is resulting into the loss of valuable genetic diversity almost @ 2.5 per cent annually. If this rate continues within 40- 45 years, all the original sources of tea genes will be lost due to uprooting and would be replaced with few popular clones/seed stocks representing a narrow genetic base. Thus, an integrated action plan is needed to conserve the valuable genes from such seed-grown plantations.

A District Selection Scheme initiated by Tocklai Experimental Station, Jorhat in early seventies with the objective of collecting valuable tea germplasm from old seed grown sections of tea plantations in N.E. India and developing superior clones have paid us rich dividend. Over 7348 ha. of old seed grown sections have been surveyed representing only 3.2 per cent of such acreage and over 115 agronomically superior clonal cultivars developed. Interestingly one clone per ha. has been found. With this rate, another 1500 - 1800 clones could be developed if all the old seed-grown sections are surveyed in the

N.E. India. However, the scheme has not been able to fulfil its desired objectives of collecting germplasm due to biased approach in selecting for agronomical types. The scheme needs to be strengthened for collecting diverse germplasm.

The recalcitrant nature of tea seed, perennial growth habit, slow rate of vegetative propagation/multiplication, widely spaced planting of collections in the field gene bank (100 - 120 cm) × 60 -75 cm apart) requiring considerable land area and lack of proper cryopreservation techniques cause slow progress in conservation.

APPROACHES IN CONSERVATION OF TEA GERMPLASM

While formulating new strategies for collection of genetic diversity, care must be taken to eliminate the weaknesses of earlier collections. Following approaches/points need to be considered while drawing collection strategies:

1. Collection should represent full spectrum of the gene pool.
2. Surveys and collections to be made os as to draw geographical distribution of Indian Camellias which is presently far from adequate.
3. Attempt should be made to collect population (specific) diversity and not plant diversity as specimen plants.
4. Attempts should be made to collect diverse germplasm of wild and related species besides cultivated species from hilly tracts of N.E. India and Myanmar.
5. In addition o ex situ conservation in field gene banks, *in situ* as well as *in vitro* methods of conservation should also be adopted.
6. Bulk of the germplasm collections should be maintained atleast 2- 3 places in the country to safeguard against natural çalamities.
7. The old seed grown sections going under uprooting should be surveyed on priority basis for conserving valuable genetic diversity.

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