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GENETIC RESOURCES AND CONSERVATION OF LEGUMES IN NBRI BOTANIC GARDEN

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NBRI Botanic Garden is the third largest and one of the oldest Botanic Gardens in India. This holds an exquisite germplasm collection of 7000 taxa representing 210 families. The genetic diversity of legumes in India is quite rich (179 genera and 1152 species) and distributed to all biogeographic zones. Considering the economic, medicinal and industrial importance, there is a world-wide attention on legumes for its genetic resources in order to screen the potential and underexploited species as a source of food. Moreover, scientific studies being carried out on different aspects viz. identification, nomenclature, preparation of check-list, conservation and its sustainable utilisation. This paper deals with the genetic resources of legumes in the NBRI Botanic Garden and their horto-botanical importance besides *ex-situ* conservation measures.

Key words : Germplasm, conservation, legumes

Botanic Garden of NBRI was established in 1800 A.D. in the heart of the city Lucknow, (Uttar Pradesh). This is the third largest and one of the oldest Botanic Gardens of India. This holds an exquisite collection of 7000 taxa comprising trees, shrubs, creepers/climbers besides herbaceous plant. The genetic diversity of plants has been displayed in the Arboretum, Shrubbery borders, Plant Houses and various other sections under *ex-situ* conservation programme. Being one of the oldest Gardens, it has well grown specimen trees which are important and interesting from botanical and aesthetic point of view. Moreover, every year germplasm collection of diversified groups of plants is enriched through seed exchange programme with the 400 leading Botanical gardens of the world specially those located in the iso-climatic zones. Thus, this Botanic Garden serves as an excellent centre for conservation of plant genetic diversity representing 210 plant families. The important ones are- Bignoneaceae, Leguminosae (Fabaceae), Lythraceae, Moraceae, Myrtaceae which have large number of representatives. The majority of plant wealth belongs to the family Leguminosae comprising trees, shrubs, creeper and climbers, besides herbaceous plants. Thus, it is pertinent to have an account of the genetic resource of the legumes in the Botanic garden and their horto-botanical importance besides conservation measures.

MATERIALS AND METHODS

Botanical importance - The family Leguminosae (Fabaceae) is the third largest family after the (Compositae), Asteraceae and Orchidaceae. It consists of about 600-650 genera and 12,000-18,000 species distributed all over the world (Everett, 1980; Wiersema *et al.*, 1990; Polhill and Raven, 1981). The species are prevalent in temperate, tropics, sub-tropics, high land, savannas, deserts, low lands and even in the aquatic form. The family includes trees, shrubs, climbers/creepers, herbs and aquatic plants of

diverse nature which are important for economic, food, forage, medicinal, industrial and ornamental purpose (Anonymous, 1979; Bailey, 1963; Bailey and Bailey, 1940; Lock, 1989). Botanically also, this family exhibits a great variations in growth habit and flower characters. Fabaceae (or Leguminosae) is divided into three sub-family viz. Caesalpinioideae, Mimosoideae and Faboideae (or Papilionoideae). Caesalpinioideae includes about 2,800 species, mainly tropical forest trees and savannas distributed in Asia, Africa and South America. About, 12,000 species which are mostly herbs and distributed world wide come under the sub-order Papilionoideae. On the contrary, Mimosoideae consist of 2,800 species of conspicuous shrubs and trees of Africa, Australia and South America (Anonymous, 1979).

Horticultural significance - The horticultural importance of this family is noteworthy. It includes genera like *Acacia, Albizia, Bauhinia, Caesalpinia, Calliandra, Cassia, Delonix, Erythrina* etc. which bear conspicuous colourful flowers and have high ornamental value. Many of the trees are excellent for avenue plantation while shrubs are equally popular as garden plants. Most of the trees and shrubs of the Leguminosae are well suited in the tropical and sub-tropical conditions. Their free flowering habit, wide adaptability to different agro-climatic conditions and easy multiplication have made them popular in the tropical and sub-tropical gardens. Aside, their exquisite flowers in a wide range of colours and form are added attraction for selecting them in landscaping.

Economic, medicinal and industrial importance - A large number of species of the genus Leguminosae has economic, medicinal and industrial importance. The seeds are rich in protein and starch and are eaten all over the world. These are excellent source of food as peas and beans and have tremendous agricultural importance next to Poaceae. But the diversity and number of species in cultivation all over the world are much greater for Leguminosae (Wiersema *et al.*, 1990). There are more than 50 minor tropical legumes, in addition to the major species in cultivation, which needs scientific attention for their study and exploitation (Anonymous, 1975). The seeds of tamarind which are the good source of pectin are valued for manufacturing jam and jelly (Bor and Raizada, 1954). Acacias are also economically important as they are good source of tannin, gum and timber. Moreover, some of the species are very successful in afforestation and reclamation of wasteland by their ability of fixing nitrogen. *Acacia catachu* is an important drug and an essential constituent of 'Pan' (Betel leaf). Some of the species of Caesalpineas (*C. crista*) have medicinal importance as tonic and antipyretic. *Cassia absus* is also used for ophthalmic and skin treatment. Species of *Indigofera* produces blue colour and used for dyeing purpose since time immemorial (Wlth India, 1985).

RESULTS AND DISCUSSION

World scenario - There is world-wide attention for the study of genetic resources and diversity of legumes in order to screen the potential species which are still unexploited or under-exploited as a source of food and their economic use. As a result, International Legume Database Information Service (ILDIS) has been set up in United Kingdom with regional centres engaged in preparing check list of legumes of different countries of the world. In France also, there is an international group looking after the sub-family Mimosoideae. United States Department of Agriculture (USDA) has also developed database as the Germplasm Resource Information Network through Agricultural Research Service's Plant Germplasm System. More than 6,600 legumes have been catalogued in the Technical Bulletin No. 1777. It coordinates national efforts to collect and conservation of legumes (Wiersema *et al.*, 1990).

Therefore, Legumes as a crop are very

important world-wide. Scientific studies are focusing different aspects of their identification, nomenclature, conservation, economic importance and as a source of food.

Germplasm collections at NBRI Botanic Garden - The genetic resource of legumes in India is quite rich. About 1150 taxa under 167 genera have been listed by Husain and Kapoor, 1990 which represents 7 per cent of the world's legume collection. According to a recent report, legume diversity in India is represented by 1152 species belonging to 179 genera distributed in all biogeographic zones. Out of the total legume flora, Papilionoidae constitute ca 71 per cent while Caesalpinoideae and Mimosoideae 14.6 per cent and 14.4 per cent, respectively (Rao, 1998). A good number of species are native to India while some are introduced and well acclimatized. The germplasm collection of legumes in the NBRI Botanic Garden is quite significant. Out of the total 500 species of trees in our Botanic Garden, 20 per cent comes from the family Leguminosae. These are mainly located in the arboretum, along the circular road and by side of lawns. A few of them are well grown and very old specimen trees of botanical significance viz., *Albizzia procera, Colvelia recemosa, Delonix regia, Parkia biglandulosa, Peltophorum ferrugineum, Prosopis juliflora, Tamanindus indica* etc. Out of the total 51 genera and 170 species existing in the Botanic Garden, the genus *Acacia* is having maximum number of species (26 nos.) followed by *Erythrina* - 18 species, *Cassia* - 16 species and *Bauhinia* - 15 species. The other notable genera which have less number of representation are : *Brownia, Butea, Caesalpinea, Dalbergia, Desmodium, Millettia, peltophorum, Saraca* etc.

The details of the germplasm collections are furnished here under according to sub-family besides grouping on the basis of growth habit.

CAESALPINIACEAE

Trees : *Bauhinia blakeana* Dunn, *B. hookeri* F. Muell., *B. monandra* Kurz, *B. purpurea* L., *B. roxburghiana* Voigt, *B. variabilis* Hort. ex Gentil, *B. variegata* L., *Brownea ariza* Benth., *Caesalpinia cacalcao* Humb. & Bonpl., *C. coriaria* (Jacq.) Willd., *C. pannosa* Brandegee, *Cassia excelsa* Schrad., *C. fistula* L., *C. grandis* L.f., *C. javanica* l., *C. marginata* Roxb., *C. nodosa* Buch. - Ham. ex Roxb., *C. renigera* Wallich ex Benth., *C. roxburghii* DC., *C. siamea* Lamk., *Colophospermum mopane* (J. Kirk ex Benth.) J. Leon., *Colvillea racemosa* Bojer, Delonix elata (L.) Gamble, *D. regia* (Bojer) Raf., *Gleditsia ferox* Desf., *G. sinensis* Lam., *G. tricanthos* L., *Hardwickia binata* Roxb., *Parkinsonia aculeata* L., *Peltophorum ferrugineum* Benth., *Saraca asoca* (Roxb.) De Wilde, *S declinata* (Jack) Miq. (32 species).

Shrubs : *Bauhinia acuminata* L., *B. galpinii* N.E. Br., *B. glauca* Wallich, *B. tomentosa* L., *Caesalpinia elata* Sw., *C. pulcherrima* (L) Sw., *C. mexicana* A. Gray., *Calliandra brevipes* Benth., *C. confusa* T. Sprague & Riley., *C. emarginata* Benth., *C haematocephala* Hassk., *C. portoricensis* (Jacq. Benth.), *C. tweedii* Benth., *Cassia alata* L., *C. australis* Sims., *C. didymobotrya* Fresen, *C. hirsuta* L., *C. laevigata* Willd., *C. surattensis* burm. f., *Gleditsia bispinosa.* (20 species).

Climbers

Bauhinia vahlii Wight & Arn., *Caesalpinia bonduc* (L.) Roxb. (2 species)

FABACEAE

Trees : *Bolusanthus speciosus* (Bolus) Harms, *Butea monosperma* (Lamb.) Taub., *Castanospermum australe* A. Cunn. ex Frappier, *Dalbergia lanceolaria* L.f., *D. latifolia* Roxb., *D. melanoxylon* Guill. & Perr., *D. sissoo* Roxb., *Derris indica* (Lamk.) Bennet, *Erythrina indica* Lam., *E. lithosperma* Blume ex Miq., *E. princeps* A. Dietr., *E. resuparcellii* Srivastava, *E. suberosa* Roxb., *E. subumbrans* (Hassk.) Merr., *E. variegata* L. var. alba, *E. variegata* L. var. orientalis (L.) Merr., *E. variegata* var. picta (L.) Baker, *E. velutina* Willd., *E.*

vespertilio Benth., *Gliricidia maculata* (H.B. & K) Steud., *G. sepium* (Jacq.) Kunth ex Walp., *Millettia tetraptera* Kurz, *M. thonningii* Baker, *M. ovalifolia* Kurz, *Pterocarpus indicus* Willd., *P. marsupium* Roxb., *Tamarindus indica* L (27 species).

Shrubs

Desmenthus sp., *Desmodium cephalotes* Wallich, *D. canedense* DC., *D. diffusum* DC., *D. gangeticum* DC., *D. gyrans* DC., *D. pulchellum* Benth., *Erythrina blakei, E. resupinata* Roxb., *Indigofera suffruticosa* Mill., *Moghania macrophylla* Blume, *M. strobilifera* jaume St. Hil., *Petaladium barbrioides* Nees, *Sophora japonica* L., *S. secundiflora* (Ort.) Lag. ex DC., *S. tomentosa* L., *Uraria macrostachya* Wallich. (17 species).

Climbers

Abrus precatorius L., *A. precatorius* L. var. albus Hort., (Lamb.) Taub., *Butea superba* Roxb., *Clitoria ternatea* L., *Derris scanden* bength., *Lathyrus odoratum* L., *Milletia extensa* Benth., *Wisteria sinensis* Sims (8 species).

MIMOSACEAE

Trees

Acacia auriculaeformis A. Cunn. ex Benth., *A. brachystachya* Benth., *A. brachystachya* Benth., *A. burkittii* F. Muell. ex Benth., *A. catechu* (L.f.) Willd., *A. coriacea* DC., *A. erubescens* Welw. ex Oliver, *A. farnesiana* (L.) Willd., *A. galpinii* Davy, *A. gerrardii* Benth., *A. karroo* Hayne, *A. lenticularis* Buch. - Ham. ex Benth., *A. modesta* Wallich, *A. monoliformis* A. Cunn. ex Benth., *A. nilotica* (L.) Del. ssp. *indica* (Benth.) Brenan, *A. nilotica* (L.) Del. ssp. *cupressiformis* (Stewart) Ali & Farid, *A polycantha* Willd., *A. polycantha* Willd. ssp. *polycantha, A. salicina* Lindl., *A. siamia* Lamk., *A sieberana* DC., *A. welwitschii* Oliver, *Adenanthera pavonina* L., *Albizia amara* Boine, *A. lebbek* (L.) Willd., *A. lucidior* (Steud.) Nielsen, *A. petersiana* Oliver, *A. procera* (Roxb.) Benth., *A. richardiana* (Wallich ex Voigt) King and Prain, *Haemotoxylon campechianum* L., *Leucaena glauca* L., *L. leucocephala* Lam., *Parkia biglandulosa* Wight & Arn., *P. pendunculata* (Roxb.) Macbr., *Pithecellobium dulce* (Roxb.) Benth., *Prosopis cineraria* (L.) Druce, *P. juliflora* (Sw.) DC., *Samanea saman* (Jacq.) Merr. (37 species).

Shrubs

Acacia farnesiana Willd., *Mimosa pudica* L., *Pithecellobium unguiscati* Mart. (3 species).

II. ANNUAL HERBS

Fabaceae

Alysicarpus monolifer (L.) DC., *Clianthus dampieri* Cunn. ex Lindley, *Lathyrus odoratus* L., *Lupinus hartwegii* Lindl., *Melilotus indica* All., *Rhynchosia sericea* Span. (6 species).

Endangered species : *Sophora mollis* Royle

Rare species : *Erythrina resupinata* Roxb.

III. NEW INTRODUCTIONS

CAESALPINIACEAE

Bauhinia grandiflora Juss., *B. rufescens* Lam., *B. saigonensis* Pierc. ex Gagnepain, *Calliandra surinamensis* Benth., *Caesalpinia gilliesii* Wallich ex Hook, *C. velutina* Brotton & Rose, *Cassia corymbosa* Ortega (7 species).

MIMOSACEAE

Acacia elata A. Cunn. ex Benth. *A. concianna* (Willd.) DC, *A. rothii* Bailey, *A. senegal* (L.) Willd., *Proposis chilensis* Molina (Stcontz) (5 species)

FABACEAE

Erythrina americana Miller, *E. herbacea* L., *E. lysistemon* Hutch., *E. sandwicensis* Degener (4 species).

CONCLUSION

***Ex-situ* conservation measures** : *Ex-situ* conservation is defined as the maintenance of organism out side or away from their natural habitat such as in the Botanic Gardens, in the field gene banks or by storage in the form of seeds, pollens, vegetative propagules, tissue or cell culture (Anonymous, 1989). The objective is to

simulate the habitat requirements for the conservation of diversified groups of plants to serve as the plant genetic resources for posterity.

Therefore, the efforts are underway for the effective conservation of the legumes in our Botanic Garden by paying regular attention with regard to their cultural requirements. The population of rare and endangered species are being monitored and efforts are underway to increase their population through multiplication. Propagation is the best way to increase the number of population and also helps in the better conservation because a limited number of population is always at risk of disappearance. The greatest advantage of the Legumes is their seed bearing character and thereby offer a unique potential for their future preservation. By exploiting this, seeds of these plant species are being collected for preservation in Seed Bank as well as seed exchange programme. Aside, some of the shrubs are being multiplied vegetatively also. Exchange of surplus planting material (live plants/seeds) is another noble way which enhance the possibility of survival of the genetic resources since it drastically reduces the chance of catastrophic loss of genetic diversity.

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