CITRUS GENETIC RESOURCES IN INDIA

PRESENT STATUS AND MANAGEMENT

SK Malik, R Chaudhury,
S Kumar, OP Dhariwal
and DC Bhandari

National Bureau of Plant Genetic Resources
Pusa Campus, New Delhi 110 012, India
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SK Malik
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National Bureau of Plant Genetic Resources
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The National Bureau of Plant Genetic Resources (NBPGR), is a nodal organization under the aegis of Indian Council of Agricultural Research (ICAR) for the management of plant genetic resources in India. NBPGR operates as per the mandate of the Government of India and actively contributes to the global efforts in ensuring food and nutritional security. The institute also recognizes the need to integrate ex situ and in situ conservation approaches in a network mode with all its stakeholders. NBPGR’s mission is to ensure the country’s agricultural growth and development by ensuring unrestricted availability of germplasm and associated information for use in research, development and utilization as per the national and international legislations.

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View of Nokrek Biosphere Reserve and wild & semi-wild species of Citrus

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Citrus is the third most important fruit crop of India with several species recorded to have originated especially in parts of Northeast. India with World’s third highest Citrus production after China and USA, is regarded as home of Citrus due to the presence of vast genetic diversity of important species. Citrus fruits are rich in antioxidants and have nutraceutical properties which make this fruit a prime choice of daily diet in developed countries. Low consumption of fruits and vegetables leading to increase in risk of various diseases in developing countries has now led to public awareness and search for nutritious fruits and juices. Quality planting materials and improved cultivars are the prime need of farmers to increase productivity and quality of citrus fruits. Genetic resources are the backbone of any crop improvement programme and for a diverse fruit like Citrus their importance is incredible. Hence, in the national context management of genetic resources of citrus assumes immense significance.

In the present publication, authors have provided the details of Citrus germplasm management undertaken for the past one and half decades at NBPR and other institutions in India. The exhaustive survey and exploration to difficult areas of Northeast India for collection of Citrus diversity and wide range of wild and semi-wild species germplasm collected during these explorations is elaborated in this publication. The basic information on origin, distribution, threat perception, variability analyses, description of various species, presence of diverse indigenous and exotic cultivars along with traditional usages and socio-economic importance has been admirably compiled. Data generated in the field and during elaborate experiments undertaken in the laboratory for various cryobanking studies have been presented for several Citrus species.

The advent of Convention on Biological Diversity (CBD) and the FAO International Treaty on Plant Genetic Resources for Food and Agriculture
(ITPGFRA) has refocused national and international biodiversity conservation through in situ approaches and for economic plants on on-farm, field genebanks and traditional seed genebanks and cryogenebanks. With the realization of value of crop wild relatives (CWR) and landraces, with inherent ability to face vagaries of nature, the concept of handling of entire Crop Genepool rather than single genera and few related species has now advanced. Agrobiodiversity conservation with participatory approach of all stakeholders is still to take visible shape. Collaborative efforts and consultation with other institutions and departments during various PGR management activities have led to this publication on Citrus genetic resources and I congratulate the authors for an excellent compilation.

I am confident this publication would be a useful source of information to environmentalists, horticulturists, PGR workers, seed biologists, policy makers, faculty and students who wish to refer it for their research work. Geographical distribution of Citrus variability keenly surveyed and documented by the authors is a useful guideline for other explorers. Variability assessed as per characterised data represents genetic background for breeders to utilize and select elite types of mother plants for developing specific progenies. Complementarity of different conservation approaches is the need of the hour. The isolated activities of the different institutes spread over the country have been synthesised in this publication to project the overall national perspective. This is to maximise effectiveness of achieving the common goal of successful in situ and ex situ conservation and utilization of the Indian Citrus germplasm.

I compliment the authors for bringing out this informative publication on Citrus genetic resources reiterating the leading role of NBPGR in Indian PGR management and in this instance for Citrus, the most diverse horticultural crop of India.

(K.C. Bansal)
Citrus genetic resources spanning across 5 major groups namely, Acids, Oranges, Pummelo-grapefruit, Mandarins, Wild and semi-wild species and other related genera, hold great economic significance for Indian fruit industry. India, a natural home of several Citrus species harbours vast reservoir of diverse types/forms. Genetic diversity of Citrus is mainly concentrated in the Northeastern and Northwestern part of India. Study on genetic resources of Citrus in Northeastern India indicated the presence of 23 species, one subspecies and 68 varieties, thus according this area a special status as a treasure house of Citrus germplasm. Due to the long history of cultivation and natural interspecific crossing among the Citrus species vast variability has come up in nature. This caused an ambiguity in identification of different species, cultivars, hybrids, etc and presented a challenging task leading to initiation of deeper investigations. Documentation of present genetic resource status, traditional knowledge associated with these species and economic potential and threat perception of wild and semi-wild species of Citrus occurring in India especially in Northeastern parts were essentially required for designing a suitable genetic resources management strategy. Survey, exploration, sustainable utilization, conservation and preservation of invaluable Citrus germplasm have been the priority for NBPGR, India. To protect these invaluable genetic resources of citrus, NBPGR (ICAR) took initiative way back in 1981 by establishing the “Citrus Gene Sanctuary”, probably first of its kind in the World, in the Garo hills of Meghalaya. It is endowed with highly specified microclimate and is a part of buffer zone of Nokrek Biosphere Reserve in Meghalaya. With only 12-13% of the earth’s surface devoted to protected areas and other conservation areas, it is understandable that all species diversity cannot be secured in them. Ex situ conservation, with several options, are thus required to be adopted. Introduction of desirable Citrus germplasm into country by NBPGR and other organizations have enriched the diversity and strengthened the Indian Citrus Industry. With challenge of climate change looming large, wild and weedy relatives assume significance. Due to breadth of genetic diversity present in Citrus, which are adapted to a range of environmental conditions, they are likely to be needed more than ever before to maintain the adaptability of commercial Citrus cultivars. At NBPGR, New Delhi various Citrus accessions collected during explorations from field genebanks, farmer’s fields, orchards and natural habitats have been characterised for leaf,
fruit and seed characters using IPGRI descriptors to define range of diversity present and to classify the variability for more than 600 accessions.

It has been pointed out that erosion of genetic resources of *Citrus* due to various biotic and abiotic factors have resulted in loss of gene pools from nature and as well as from different centers of collections. Conservationists face the task of deciding how to best conserve these large *Citrus* species complex. Seed banking is one of the most powerful and practical *ex situ* conservation tools available to combat the loss of biodiversity while complementing the *in situ* conservation. NBPGR has thus worked with integrated approach by cryobanking of seeds, embryos and embryonic axes and a cryobase collection of about 700 accessions has been successfully established. Investigations on 29 species for their seed storage behaviour led to decision making for handling and processing for storage using desired methodology. Accessions wise data of each *Citrus* species for exploration and characterization is provided in this publication. It is important to provide a coherent, coordinated and complementary approach to conservation and utilization of Citrus genetic resources. This publication entails the efforts made by NBPGR for PGR management of Citrus taking into consideration a truly complementary conservation decision making in consultation with other stakeholders and especially in coordination with NRC Citrus, Nagpur, Field Genebanks of SAU’s, State Horticulture Stations and most valued Citrus farmers in various parts of India. We gratefully acknowledge everyone who had contributed and assisted whole heartedly in preparation of this publication. We profusely thank all the past Directors of NBPGR who encouraged us to undertake these activities. Authors welcome any valued suggestion from the readers for the improvement of the presented information.
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