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Plant Variety Protection in Floriculture: Status, Opportunities and Challenges

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With its diverse agro-ecological condition, India is rich in several flower crops and ornamental species that are being widely cultivated. India is a land of multiple religion and multiple culture and all of that have nurtured the use of flowers in its culture and religious ceremonies. For many of our culture, flowers are way of expressing celebrations as well as mourning. Irrespective of religion and region, flowers are parts and parcel of Indian culture. Flowers are used in different forms in India. Unlike in western countries where flower crops are used mainly either as cut flowers with long stem or as an ornamental plant for landscape; in India, flowers are mainly harvested only with pedicel that are commonly termed as 'loose flowers' which are stringed together in the form of garlands or as simple flower strings. Traditional and popular form of utility on daily basis is flower strings and garlands used in daily rituals, for decoration in marriage and cultural programs.

Flower cultivation in India

Indian floriculture is expanding over the years and as per 2016-17 data available, area under flower crop cultivation is 0.3 million hectares with a production of 1.7 million metric tons loose flowers and 59.3 million stems of cut flowers.

In addition to local demand, flowers are also exported. There are more than 300 export-oriented units in India. As per the report of APEDA (Agricultural and Processed Food Products Export Development Authority), India's total export of floriculture was Rs. 548.74 crores in 2016-17. The major importing countries were United States, Netherlands, Germany, United Kingdom, United Arab Emirates, Japan and Canada.

Status of Plant Variety Protection in Floriculture:

India has diverse varieties in flower crops. Cultivation of varieties ranges from farmers varieties, varieties released from Public sector, and several imported varieties. Considering the commercial importance of the flower crop, Protection of Plant Varieties & Farmers' Rights Authority (PPV & FRA) of India has finalised DUS testing guidelines and notified 24 flower crop species for varietal protection. Besides, these 24 spp., work is in progress in several other species to formulate the DUS testing guidelines.

Another important step taken by the PPV & FR Authority is establishment of 'National Rose Repository' considering the importance of the crop in global trade. In case of rose, several international breeders have introduced their varieties into the

Table 2: List of flower crops notified for Plant Variety Protection.

Sl No.	Crop	Species
1.	Rose	<i>Rosa spp. L.</i>
2.	Damask Rose	<i>Rosa damascena Mill</i>
3.	China aster	<i>Callistephus chinensis (L.) Nees.</i>
4.	Carnation	<i>Dianthus caryophyllus L</i>
5.	Chrysanthemum	<i>Chrysanthemum</i>
6.	Gladiolus	<i>Gladiolus L.</i>
7.	Jasmine	<i>Jasminum auriculatum. L.</i>
8.	Jasmine	<i>Jasminum sambac</i>
9.	Jasmine	<i>Jasminum multiflorum</i>
10.	Jasmine	<i>Jasminum grandiflorum</i>
11.	Tuberose	<i>Polyanthes tuberosa L.</i>
12.	Orchid	<i>Oncidium Sw.</i>
13.	Orchid	<i>Cattleya Lindl.</i>
14.	Orchid	<i>Phalaenopsis Blume</i>
15.	Orchid	<i>Cymbidium Sw.</i>
16.	Orchid	<i>Dendrobium Sw.</i>
17.	Orchid	<i>Vanda Jones ex R.Br.</i>
18.	Orchid	<i>Paphiopedilum Pfitz.</i>
19.	Bougainvillea	<i>Bougainvillea Comm. ex Juss.</i>
20.	Canna	<i>Canna L.</i>
21.	Marigold	<i>Tagetes sp.</i>
22.	Crossandra	<i>Crossandra infundibuliformis</i>
23.	Gerbera	<i>Gerbera spp</i>
24.	Pertwinkle	<i>Catharanthus roseus L: G Don.</i>

country and maximum export is being done. National Repository takes the responsibility of establishing digital repository of the commercially traded varieties besides maintenance of live repository in field and polyhouse. National Repository was established to act as supporting mechanism for the PPV&FRA in deciding upon the Novelty issues.

Protection of farmers varieties

Based on utility and significance of its use, different states and region have their own land races and farmer varieties. For instance, Rajasthan and Uttar Pradesh states cultivate rose particularly for extraction of rose oil, attar, rose water and preparation of 'gulband' a traditional processed food item that is traded for flavor and health benefits. Local varieties of fragrant roses are utilized for that. Many varieties have derived

their names associated with the place of cultivation. Haladhighat gulab, Pushakar gulab, Kakinada rose, Andhra Rose, Calcutta rose, Ganganagari are some of the fragrant rose varieties that are associated with their regional names. Similarly, marigold varieties popularly known as Calcutta genda or laddu genda, is popularly cultivated in several states of North India. Mysore Mallige, Udupi Mallige, Madhurai Malli are the Jasmine varieties that have been allotted with GI (Geographical indication) tags considering the importance of these varieties. Gundumalli, Single Mogra, Double Mogra, Ramabhanam, Iruvatchi, Devi Hosur Local, Shankarapuram Malligae, Hadagali mallige are some of the popular farmer varieties of Jasmine.

In flower crops, mostly it is farmers' varieties and varieties developed by Public Sector Research organizations that are under cultivation. National seed companies have not played significant role as most of the flower crops are vegetatively propagated. Nurseries have played major role in introduction of varieties from around the globe and are being traded in India mainly for landscape. In case of rose, several rose hobbyists have also developed varieties and are being cultivated for its value in landscape. Many commercial growers involved in flower export have introduced several cut flower varieties that are being cultivated under protected cultivation.

Natural diversity, domestication and claiming the rights

India is one of the 17 mega biodiversity centers of the world. With its varied ecosystems that include mountains, deserts, coastal, grassland and forests each one with its own floral diversity, the country offers umpteen opportunities for the floriculturists to collect, select, domesticate and to claim the rights over them. Himalayan belt, Western Ghats, Andaman-Nicobar Islands, North Eastern region have huge natural wealth with lots of ornamental value that can be brought to main commercial utility. Flowering tree species, foliage and aromatic herbs need to be searched in these wide diversity regions and needs to be domesticated with appropriate propagation and cultivation practices. With the existence of PPV & FRA in the country, it also offers the opportunities to get the rights over the intellectual inputs that is added to improve the existing genetic diversity.

International trade and issues related

- UPOV has provision for product protection, viz., plant varieties once get protected in UPOV countries will also get product protection.

Accordingly, even if the variety is not protected in India, Indian growers have to pay royalty if they want to export the flowers to any of the countries where the variety is protected.

- Many times, varieties get different names in different countries. Most of the flower crops being highly heterozygous throws out natural bud sports and gets adapted to the region of domestication. Its important to identify such variants and to protect them for the benefit of National Floriculture sector.
- Flowers are like fashion and always there is demand for change and novelty. The life of variety in the market is short. It easily gets replaced for new colour and new form. There is always demand for something new. For a variety already existing in International market irrespective of its entry into India, the variety loses its novelty for global trade.
- Most of the flower varieties are traded in International market and free flow of material in and out of the country is going on. In such case, the question is for the varieties that have completed the protection period in other countries and it is important to have global agreement to get the new varieties and also to protect the interest of farmers.
- Trend of floriculture industry keeps changing. Premium price is cornered by new varieties.
- Export oriented growers are ready to pay royalty for new varieties. However, breeders should protect their new varieties in India so that the new varieties will be remaining only with those growers who pay the royalty and will be able to corner the advantage.
- Collaboration between the countries and bilateral agreements to minimize the process of registration will boost the floriculture industry with new varieties.
- International breeders should disclose the exact production and quality in India while protecting their varieties in India and farmers should get compensation under the Farmers' Right provision available under the act in case they don't realize the claimed productivity.

Issues and importance of flower crops are different from that of food crop. With rich diversity available, India can showcase variability and multiple utilities of flower crops. With growing economy, India also acts as major consumer besides producing and exporting flowers. In the interest of Indian farmers and encouraging the global trade, Plant Variety Protection gives a new dimension to floriculture.

Water Resource Management Technologies for Managing the Climate Impacts on Hill Agriculture in North Eastern Region

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Climate change and its impact on water resources and agriculture are major global concerns of this century. The rising temperature has alarming influence on the hydrologic cycle and water resources (Huntington 2006; Oki and Kanai 2006). Human interventions in the Energy-Land-Water-Climate (ELWC) nexus are severely affecting earth's ecosystems including its land and water resources (Vitousek et al. 1997; Do" ll and Bunn 2014).

According to the fifth assessment report of IPCC (AR 5), renewable water resources are reported to decrease in some region and increase in other and in other increase, though with large uncertainty in many

places. In general water resources may decrease in many mid-latitude and dry subtropical regions, and increase at high latitudes and in many humid mid-latitude regions (Jiménez Cisneros et al. 2014). Though there could be short term shortages even in the areas where increases are projected, due to more variable stream flow and seasonal reductions of water supply because of diminishing snow and ice caps. Climate change has altered observed stream flow seasonality in regions receiving snowfall. Except in very cold regions, Global warming has reduced the spring maximum snow depth and advanced the spring maximum of snowmelt discharge; has resulted in smaller snowmelt floods