K K Gangopadhyay, Vinod Sharma,
Pragya and Kuldeep Singh

# Management of indigenous vegetable genetic resources

**India being the primary centre of origin and secondary centre of diversity of many vegetable crops also possesses large variability in many important introduced vegetable crops. The success and pace of the development depends on the efficient use of plant genetic resources, viz. landraces, traditional varieties, wild, weedy and other related species constituting primary, secondary and tertiary gene pools. Wild relatives are incredible genetic resources carrying several desirable attributes like nutritional quality parameters, resistance to biotic and abiotic stresses that are generally lacking in the cultivated allies. ICAR-National Bureau of Plant Genetic Resources, New Delhi is the nodal agency for the management of national wealth of VGR, specially working for collections, characterization, identification and documentation of new germplasm.**

INDIA is the centre of origin for a number of indigenous vegetable crops like brinjal, cucumber, ridge gourd, sponge gourd, pointed gourd and snap melon, etc. It also possesses rich diversity for vegetable crops like cowpea, okra, chilli and water melon for which it is the secondary centre. A large number of wild species have not only contributed towards food but are also rich gene pool for important traits. North-eastern region including Assam is rich in solanaceous vegetables, leafy vegetables, lesser-known legume vegetables (winged bean, jack bean, sword bean) and cucurbits (cucumber, ridge gourd, coccinia, etc.). The northern plains/ gangetic plains including *tarai* region is considered to exhibit variability in cucurbits and other aquatic leafy vegetables. The north western/Indus plain region is rich in diversity particularly in amaranth, chenopods, *Cucumis, Momordica* and *Citrullus*. The central region/plateau has more diversity in cucurbits like melon, bitter gourd, pointed gourd and ridged gourd. Western and eastern peninsular regions have considerable diversity in regionally important species like snake gourd, sponge gourd, ridged gourd and *Moringa*. The distribution of important wild relatives of vegetable crops in different phyto-geographical zones (Arora and Nayar 1984) are presented in Table 1.

**Table 1.** Phyto-geographical zones and distribution of wild relatives

| Phyto-geographical zones | Distribution of wild relatives of vegetable crops |
|---|---|
| Western Himalaya | *Abelmoschus tetraphyllus, Cucumis hardwickii, C. trigonus, Luffa echinata, L. graveolens, Solanum indicum, S. lasiocarpum, Trichosanthes multiloba, T. himalensis* |
| Eastern Himalaya | *Abelmoschus manihot, Cucumis trigonus, Luffa graveolens, Neoluffa sikkimensis* |
| North-eastern region | *Abelmoschus tetraphyllus, Alocasia macrorhiza, Amorphophallus bulbifer, Colocasia esculenta, Cucumis hystrix, C. trigonus, Dioscorea alata, Luffa graveolens, Moghania vestita, Momordica dioica, M. cochinchinensis, M. macrophylla, M. subangulata, Solanum indicum, Trichosanthes cucumerina, T. dioica, T. khasiana, T. ovata, T. truncata* |
| Gangetic plains | *Abelmoschus tuberculatus, A. tetraphyllus, Luffa echinata, Momordica cymbalaria, M. dioica, M. cochinchinesis, Solanum incanum, S. indicum Indus plains: Momordica balsamina, Citrullus colocynthis, Cucumis prophetarum* |
| Western peninsular region | *Abelmoschus angulosus, A. moschatus, A. tetraphyllus (pungens forms), A. ficulneus, Amorphophallus campanulatus, Cucumis setosus, C. trigonus, Luffa graveolens, Momordica cochinchinensis, M. subangulata, Solanum indicum, Trichosanthes anamalaiensis, T. bracteata, T. cuspidata, T. perottitiana, T. villosa* |
| Eastern peninsular region | *Amorphophallus campanulatus, Abelmoschus tetraphyllus (manihot forms), A. moschatus, Colocasia antiquorum, Cucumis hystrix, C. setosus, Luffa acutangula var. amara, L. graveolens, L. umbellata, Momordica cymbalaria, M. denticulata, M. dioica, M. cochinchinesis, M. subangulata, Solanum indicum, S. melongena (insanum types), Trichosanthes bracteata, T. cordata, T. lepiniana, T. himalensis* |

**Domestication of vegetables crops**

About 1,500 wild species have been originally involved in the process of domestication of cultivated vegetable crops at global levels. The Indian subcontinent has contributed to about 20-25 species of domesticated vegetables. Many species in this region are still in the process of domestication. Some important examples are creeping cucumber (*Solena amplexicaulis*) a cucurbit from Indian subcontinent (tropical Asian) under cultivation in the tribal pockets of Odisha (a delicacy vegetable), otherwise found wild in disturbed habitats. Same is true for many wild species of *Momordica* and *Amaranthus*. *M. subangulata* ssp. *renigera*, often confused with *M. cochinchinesis* and *M. dioica* is a semi-domesticated vegetables native of Assam-Mayanmar region. Fruit (are less bitter than bitter gourd) and leaves are used as vegetable. An Asian species *Colocasia gigantea* occurs wild throughout India; it is cultivated in Hawaii for export of petioles/leaves to United States of America. It is primarily used for leaves but tubers are inedible.

**Germplasm collection**

Global diversity in vegetable crops is represented by around 400 species. The regions with maximum diversity are tropical America, Asia and Mediterranean region. Indian subcontinent being one of the Vavilovian centres of origin of crop plants possesses a lot of diversity in several important vegetable crops. It represents great diversity of cultivated and wild species of vegetable crops with the occurrence of around 80 species of major and minor importance. Indian subcontinent is endowed with morphological diversity owing to center of origin of several vegetable crops namely brinjal, cucumber, ridge gourd, sponge gourd, *Trichosanthes* and *Momordica,* lablab bean etc. There are about 100 species of cucurbitacae family are reported to occur in India including 34 endemic species viz. *Cucumis hardwickii, C. trigonus, C. prophetarum, C. setosus, C. hystrix, Luffa graveolens, L. acutangula* var. *amara, L. cylindrica, L. tuberosa*, *L. echinata, L. umbellata*, *Trichosanthes anguina, T. dioica, T. dicaeleosperma, T. khasiana, T. ovata, T. truncata, T. multiloba,T. anamalaeiensis, T. bracteata, T. cuspidata, T. nervifolia, T. perotteliana*, *T. himalensis*, *Momordica cochinchinensis, M. macrophylla, M. subangulata, M. cymbalaria, M. dioica, M. cymbalaria, M. denticulata*, *M. balasamina*, *Neoluffa sikkimensis* and *Citrullus colocynthis*. However, there are several areas which need to be explored for augmentation of un-tapped variability. Some of the potential areas are given in Table 2.

Brinjal (IC 354698)

**Table 2.** Indigenous vegetable crops with their maximum diversity areas

| Crop | Areas/region to be explored |
|---|---|
| Cucumber | Indo-Gangetic plains, sub-Himalayan tract, Western Ghats and eastern peninsular tract |
| Cucumis sp | J.K., H.P., U.P., Rajasthan, A.P. and Karnataka |
| Pointed gourd | Bihar, West Bengal and Assam |
| Ivy gourd | Eastern Madhya Pradesh, West Bengal, North Eastern hill region, Uttar Pradesh, Bihar |
| Sponge and Ridge gourd | Indo-Gangetic plains, Tarai region and North Eastern plains |
| Snake gourd | Southern peninsular tract and Kerala |
| Lablab bean | Bihar, Orissa, Gujarat, Maharashtra, Goa and Eastern peninsula |
| Taro | Kerala, Andhra Pradesh, Orissa, Bihar, Uttar Pradesh, West Bengal, North East region, Nilgiri and Anamalai hills |

Some of the important indigenous vegetable collections made in the recent years are as follows:

- Orange fleshed (carotenoid-rich) cucumber from Manipur and Mizoram
- Brown-netted cold tolerant cucumber from Meghalaya
- Scented ash gourd from Arunachal Pradesh, Mizoram and Tripura
- Linear-elongate ash gourd with small seeds from Manipur
- Distinct form of *Momordica cochinchinensis* for many floral characters from middle Andaman Island is named as *Momordica cochinchinensis* subsp. *andamanica* Kattuk
- Primitive brinjal (JPJ/18-060) a rare collection from Andaman and Nicobar Islands
- Highly pungent bird-eye chilli from Mizoram

**Germplasm characterization and evaluation**

Characterization essentially means the recording of the observations on highly heritable traits, can be observed and expressed across the environment where as evaluation refers to recording of potential agronomic traits including biotic and abiotic stresses, and quality traits for its use in specific purposes and in specific environment. Besides, morphological characterization, germplasm is also characterized for biochemical (protein/ isozyme) and molecular (DNA based) markers. The evaluation of germplasm is pre-requisite for their effective utilization in vegetable improvement programme. Most of the desirable traits are polygenic in nature and are influenced by the environments. Therefore, it is better to evaluate the germplasm at multi-locations to draw unbiased conclusion about their genetic potential. In indigenous vegetable crops, a large number of germplasm have been

evaluated for different agro morphological traits and have been documented in the form of catalogues. For detailed evaluation of vegetable crops, the following parameters need attention for effective utilization:

(a) Evaluation of indigenous vegetable germplasm for agronomic, biotic and abiotic stresses, and quality parameters
(b) Evaluation of promising germplasm through biochemical and molecular markers
c) Documentation of vegetable germplasm along with characterization and evaluation data
(d) Pre breeding/genetic enhancement in indigenous vegetables using primary, secondary and tertiary gene pools

More than 12,000 accessions of vegetable crops germplasm have been characterized and evaluated and a number of promising lines have been identified and utilized in improvement programme by various researchers. Based on the information on characterization and evaluation of vegetable crops germplasm, catalogues were published. Besides this, annual report on characterization and evaluation of agri-horticultural crops are being regularly published. Recently multi-location evaluation of vegetable crops germplasm in brinjal ond okra germplasm has been initiated in collaboration with AICRP (Vegetable crops) under Consortium Research Platform (CRP) on Agro-biodiversity.

**Brinjal *(Solanum melongena)***

India, being a primary center of origin, possesses large variability for growth habit; leaf blade lobing; calyx colour; fruit shape, size, and colour; and colour distribution. The region across India and Indo-China is considered the center of diversity for brinjal. The *Solanum melongena* complex has three species, namely, the *S. melongena, S. incanum* and *S. insanum.* Wild relatives of *Solanum* viz. *Solanum torvum, S. indicum, S. insanum, S. surattense, S. pubescens, S. gilo, and S. khasianum* are widely distributed in South India, Shivalik hills and North-eastern region.

A core set of 181 accessions has been developed in brinjal from the entire collection available in the National Gene bank on the basis of agro-morphological (qualitative and quantitative) descriptors. Presently, the research objectives are focussed on development of brinjal fruit and shoot borer resistant pre-bred lines using wild species *S. incanum.*

Brinjal (IC 090785)

Brinjal (IC 265251)

**Legumes**

The rich legume biodiversity of India with 167 genera and 1,141 species hold great promise in this regard. *Lablab purpureus*, referred to as country bean is one such lesser known legumes and its tender pod is a popular vegetable in North East India, although the seeds are also consumed. In India, it is grown in North East India, Eastern and Southern India, but it is in North East India that high degree of genetic variability exists. A large number of indigenous land races are found scattered all over North East India, distinguished primarily on the basis of pod morphology and pod colouration. Wide variability is also reported from Tamil Nadu and the accessions were distinguished smoothly on the basis of pod morphology and pod, seed colouration. Analysis of North East Indian landraces of country bean for nutritive values and seed protein profile revealed that the tender pods contain good amount of crude protein (16.44 to 21.47%), total carbohydrate (14.53 to 19.61%), lipid content (0.43 to 0.96%). Whereas the protein and carbohydrate content of mature seeds of these land races are higher than the corresponding values for tender pods. Dolichos bean is an important legume crop with multiple benefits. In India, it is popularly grown in south, east and north east parts of the country. It is the major source of protein in the South Indian diet. It is grown either in pure stand or

**Table 3.** Qualitative characters of Dolichos bean genotypes

| Genotype | Plant type | Flower colour | Pod colour | Pod curvature | Seed colour |
|---|---|---|---|---|---|
| Pusa Early Prolific | Pole | White | Light green | Intermediate | Red |
| BCDB – 2 | Pole | Purple | Light green | Flat | Black |
| SEMVAR– 8 | Pole | White | Green | Flat | Yellow |
| KDB – 413 | Pole | White | Green | Slightly curved | Brown |
| JIB(V)16 | Pole | Purple | Green | Flat | Brown |
| Swarna Utkrist | Pole | Purple | green | Flat | Brown |
| KDB – 415 | Pole | Violet | Green | Slightly curved | Reddish |
| BCDB – 1 | Pole | Purple | Purple | Flat | Black |
| RCMDL – 1 | Pole | White | Light green | Slightly curved | Black |
| HADB – 4 | Pole | Purple | Light | Green Flat | Brown |
| HADB – 3 | Pole | White | Creamy white | Flat | Brown |
| Gomchi Green | Semi pole | White | Green | Straight | Orange |


Brinjal fruit diversity

Sponge gourd fruit

intercropped with cereals like finger millet, pearl millet, corn and sorghum, and with other crops like groundnut, castor in rainfed ecosystems. It prefers comparatively cool season, and moreover majority of traditional cultivars are temperature-and photoperiod-sensitive and requires short days for flowering. Its green delicious immature pods and seeds are consumed as vegetable. It is very good source of protein (20-25%), amino acids (like lysine, usually lack in cereals), vitamins (A, C and riboflavin) and minerals (Ca, Fe, Mg, S, Na and P). Moreover, immature pods and seeds are rich in dietary fibre and low carbohydrates and lipids.

**Cucurbits**

India is the home of a large number of cucurbits including cucumber (*Cucumis sativus*), sponge gourd (*Luffa cylindrica*), ridge gourd (*Luffa acutangula*), spine gourd (*Momordica dioica),* pointed gourd (*Trichosanthes dioica*), snake gourd (*Trichosanthes anguina*), snapmelon (*Cucumis melo* var. *momordica*), ivy gourd (*Coccinia indica*). Luffa has rich diversity in Indian gene centre. Out of 9 species, 7 are native to India. *Luffa acutangula* and *L. cylindrica* have rich diversity throughout India, particularly North eastern parts including Sikkim, West Bengal, western, central and southern India. *Luffa* spp are growing in natural habitat in North-eastern region of India. A high yielding variety of the ridge gourd with bisexual flowers and smaller fruits in clusters, viz. *Luffa acutangula* var. *hermaphrodita,* (Hindi-meaning seven children) is also known in cultivation in the states of Bihar, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh, Andhra Pradesh, Gujarat and Rajasthan. *L. acutangula* var. *amara* occurs in Peninsular India and *L. echinata* in the western Himalaya and upper Gangetic plains. Another important species, *L. graveolens* occurs in Bihar, Sikkim, and Tamil Nadu.

The domesticated cucumber *Cucumis sativus* var. *sativus* L. originated from its wild progenitor *Cucumis sativus* var. *hardwickii* (Royle) Alef. which is found in foothills of Himalayas. In Indian sub-continent, besides the common cultivars there are several landraces under cultivation viz. 'Sikkimensis type' (*C. sativus* var. *sikkimensis* Hook. f.) prevalent in Sikkim and adjoining hilly areas with reddish-

*Cucumis callosus*

Orange fleshed cucumber from Manipur

orange hard skinned, 'Hill cucumbers (gigantic khira)', 'Silentvalley type' (*C. sativus* var. *silentvalley*) commonly consumed in Kerala, 'Madras cucumber', 'Mulsouthe' landrace in Karnataka with gigantic fruit, and round cucumber in Assam.

A number of carotenoid rich accessions' viz. IC420405, IC420422, AZMC-1, KP-1291, EOM-400, IC420446, KP-1293, JB-11/91, JB-11/69, have been reported from north eastern part of India particularly, Mizoram and Manipur. The carotenoid rich germplasm has high potential for enriching food and alleviating vitamin A deficiency in the country.

Phoot (snapmelon) designated as *Cucumis melo* var. *momordica* Duthie and Fullar is an important type with a wide distribution in North India. It has been found resistance to powdery mildew (*Sphaerotheca fuliginea*) and downy mildew (*Pseudoperonspora cubensis*) and cucumber green mottle mosaic virus (CGMMV). Besides, there are a number of indigenous cucurbits which are not yet exploited for their potential. Bankunari (*Solena amplexicaulis*) is a dioecious cucurbit, bears edible fruits which are used for vegetable as well as salad. Ripe red coloured fruits are used as dessert, tender shoots and leaves are used as a leafy vegetable while dry powder of tubers is used in several Ayurvedic medicines. Solena is found in wild state in Bihar, Uttarakhand, Assam, Tripura, Garo hills in Meghalaya, Konkan and Deccan areas.

**Leafy vegetables**

India is the home of a large number of leafy vegetables including Indian spinach (*Basella alba*), drumstick (*Moringa oleifera*), curry leaf (*Murraya koenigii*), etc. and a number of lesser known leafy vegetables, which are available seasonally and are grown in small pockets. A number of underutilized leafy vegetables which are generally used as day to day vegetables with small area of cultivation. Apart from this a number of species like *Bacopa monnieri, Boerhavia diffusa, Centella asiatica* etc. are also used as leafy vegetables basically for therapeutic value. Rural people from North-eastern parts of India prefer non-traditional vegetables like runner and petioles of *Colocasia* spp and *Xanthosoma* spp, bamboo shoots, elephant foot yam petiole, and leafy vegetables like fern shoot (*Ceratopteris*), poi (*Basella alba*). The majority of the indigenous leafy vegetables are grown in wild, semi-wild or stray conditions but are the main source of vitamins and minerals to the rural and tribal communities. Concentration of genetic diversity comprising native species and landraces occurs more in Werstern ghats, Eastern ghats and North-eastern Himalayas.

**Table 4.** Distribution of cucurbitaceous species including rare/endangered species in India

| Species | Distribution |
|---|---|
| *Cucumis hardwickii, Cucumis trigonus, Luffa graveolens, Trichosanthes multiloba, Trichosanthes himalensis* | Western Himalaya |
| *Cucumis trigonus, Luffa graveolens, Neoluffa sikkimensis* | Eastern Himalaya |
| *Cucumis hystrix, C. trigonus, Luffa graveolens, Momordica cochinchinensis, M. macrophylla, M. subangulata, Trichosanthes anguina, T. dioica, T. dicaleosperma, T. khasiana, T. ovata, T. truncata* | North-eastern region |
| *Luffa echinata, Momordica cymbalaria, M. dioica, M. cochinchinensis* | Gangetic plains |
| *Momordica balasamina, Citrullus colocynthis, Cucumis prophetarum* | Indus plains |
| *Cucumis setosus, C. trigonus, Luffa graveolens, Momordica cochinchinenis, M. subangulata, Trichosanthes anamalaeiensis, T. bracteata, T. cuspidata, T. horsfieldii, T. perottitiana, T. nerifocia, T. villosa* | Western peninsular tract |
| *Cucumis hystrix, C. setosus, Luffa acutangula var. amara, Luffa graveolens, Luffa umbellata Momordic cymbalurea, M. denticulata, M. dioica, M. cochinchinenis, Trichosanthes bracteata, T. cordata, T. lepiniana, T. himalensis, T. multiloba.* | Eastern peninsular tract |
| **Rare and endangered species** | |
| *Coralloocarpus gracillipes (Naud.) Cogn.* | Western Ghats |
| *Gomphogyne macrocarpa Cogn.* | Eastern Himalaya |
| *Indofevillea khasiana Chatterjee* | North Eastern Region |
| *Luffa umbellata (Kleir) Roem* | Western Ghats |
| *Melothria amplexicaulis Cogn.* | Deccan Plateau |
| *Momordica subangulata* | Deccan Plateau, Western Ghats |
| *Trichosanthes lepiniana (Naud) Cogn.* | Deccan Plateau, Western Ghats |
| *Trichosanthes perrotteliana Cogn.* | Western Ghats |
| *Trichosanthes villosula Cogn.* | Deccan Plateau, Western Ghats |

**Table 5.** Promising accessions of indigenous vegetables

| Crop | Trait(s) | Promising accession |
|---|---|---|
| Brinjal | Long deep purple | IC126879, NIC5938, EC304992 |
| | Purple Long | IC90764, IC112312, IC90975, IC126869, IC144084 |
| | Green Long | IC74209A, IC136142, IC144083, NIC4573 |
| | Deep Purple Oblong | IC14405, NIC13009 |
| | Purple oblong | IC90957, IC127239, IC113802, IC112821 |
| | White with purple stripe oblong | IC127163 |
| | Creamy white oblong | IC137748, IC144078, IC136328 |
| | Early flowering (<60 days) | IC89953, IC99676, IC137770 |
| | Dwarf (<40 cm) | IC89964, IC112588, IC112692 |
| | Cluster bearing | EC304951, IC99747, NIC5904 |
| | Long fruit (>35 cm) | IC90102, IC90157, IC11384 |
| | Fruit and shoot borer resistance | *Solanum incanum:* IC256181, IC203595-C, IC541208-A, IC241664-A, IC531754-A, IC531769, IC539833, IC421594 |
| | Fruit weight (≥120 g) at TNAU and IIHR | IC433547, IC316201, IC090871 |
| | Yield per plant (≥2.15 kg) at TNAU and HARP | IC261843, IC374904, IC354546, IC090907 |
| | Bacterial wilt survival of plants at 90 DAT (>80%) at HARP and IIHR | IC305048, IC545931 |
| | Resistance to fruit and shoot borer (>85%) at TNAU | IC354546, IC112736 |
| | Fruit and shoot borer | EC385380, EC038474, EC383372, EC316294, IC074196, IC089929-A, IC090144, IC090785, IC111415, IC111439, IC249319, IC383195, IC394877, IC279555 (<10% infestation) |
| Cucumber | Extended shelf life | IC203838, IC203839 |
| | Early and determinate | EC398030 |
| | Gynoecious line | EC382739, EC 382739 |
| | High yielding | EC 237658, IC 203838, VJ/98-176, VJ/98-151 |
| | Anthracnose resistance | PI 197087, Poinsett |
| | Downy mildew resistance | PI 197087 |
| | Powdery mildew resistance | Poinsett, Yomaki, PI 79376 |
| | Cucumber scab resistance | Wisconsin SMR 9 |
| | Angular leaf spot resistance | Poinsett, MSU 9402, PI 169400 |
| | Bacterial wilt resistance | PI 200815, PI 200818 |
| | Cucumber green mottle mosaic virus resistance | *Cucumis anguria, C. africanus, C. ficifolius* |
| | White fly resistance | *Cucumis asper, C. dinteri, C. sagittatus* |
| | Carotenoid content (>20 µg/g fresh pulp) | IC420405, IC420422, IC420446, KP-1291 |
| Pointed gourd | High yielder | VRPG-13, VRPG-44, VRPG-70, VRPG-72, VRPG-93 |
| | Number of fruit/plant | VRPG-13, VRPG-44, VRPG-70, VRPG-72, VRPG-88, VRPG-93, VRPG-113 |
| | Heat tolerance | VRPG-72, VRPG-99, VRPG-19, U-34/BP/DR/07, VRPG-110, VRPG-110A, VRPG-110B |
| | Resistance to gall forming nematode | U-34/BP/DR/44, VRPG-72, VRPG-18, VRPG-96 |
| Ivy gourd | High yielder | VRK-05, VRK-10, VRK-20, VRK-3 |
| | Stem diameter | U-325/DA/DR/20, 325/DA/DR/36 |
| | Internode length | U-35/DA/DR/48 |
| | Resistance to mosaic virus | VRK-05, VRK-10, VRK-20, VRK-35 |
| | Resistance to leaf miner | VRK-01, VRK-06, VRK-22, VRK-04, VRK-31, VRK-33, VRK-55 |

| Crop | Trait(s) | Promising accession |
|---|---|---|
| Sponge gourd | Early types | IC92779, IC92797, IC92604, IC93445, IC3367601, IC 284897 NIC1023, NIC 13236, NIC 110235, NIC 597 |
| | High yielding | NIC 23288, NIC 23291, NIC 23292 |
| | Long and heavy fruits | EC305688, IC201217, IC 201229, IC92721, IC92727, IC92475, IC92751 |
| | High primary branches (>11) | IC417970, IC284767 |
| | Fruit weight (>512 g) | IC342824, IC355635 |
| | Node no. at which first female flower appears (<11) | IC284844, IC398578, IC284767, IC398538 |
| | Fruit length (>36 cm) | IC264897, IC411904, IC411891 |
| Ridge gourd | Early types | NIC20402 |
| | High yielding | IC93399, IC12136, NIC957, NIC10216, NIC10224, NIC20213 |
| | Cluster bearing | NIC10222, NIC10232, NIC10288, NIC10213, NIC10215 |
| | Node no. at which 1st female flower appear (<14) | IC427676, IC424548, IC418476, IC424549 |
| | Fruit length (>20 cm) | IC427163, IC427131, NIC22409 |
| | Primary branches (>12.9) | IC417716 |
| | Fruit weight (>187g) | IC276403, IC893393 |

Variability in flower and pod colour of *Dolichos*

## Genomic resources of vegetable crops

Genomic resources are whole or parts of the genome (DNA) or its functional unit (RNA) of actual or potential value. Genomic resources for model horticultural crops are increasing with great pace, however many of them are still not being exploited. Genomic resources are available in the form of genomic, mitochondrial or chloroplast DNA, RNA, DNA markers, probes, primers, whole genome sequence, ESTs, large-insert genomic libraries and high-density genetic maps in a range of vegetable crops. These resources have been used for sequencing and annotation, mapping and cloning of genes or quantitative trait loci (QTL), and marker assisted selection (MAS) in important vegetable crops. Advances in technologies for identifying accurate genetic polymorphisms have accelerated the discovery of molecular markers. The most popular markers developed from the genomic resources include SSR, SNP and conserved ortholog set (COS) markers. SSR and EST markers have been developed in a number of indigenous vegetable crops including brinjal and

Fruit variability in Okra

cucumber that can be used for studying synteny between distantly related species and breeders can take advantage of these findings to identify markers for traits of interest in their specialist crops. Markers tightly linked to major genes responsible for the expression of important traits have been developed in many horticultural crops and are being used for marker assisted selection. A large number of indigenous vegetable genetic resources are being conserved in National Genebank, New Delhi which caters the need of various vegetable breeders throughout NARS for their germplasm requirement. The status of NGB is presented in Table 6.

**Table 6.** Status of indigenous vegetables in National gene bank

| Crop | No. of accssions. available |
|---|---|
| Brinjal (*Solanum melongena*) | 3739 |
| Wild Brinjal (*Solanum* spp) | 412 |
| Cucumber | 624 |
| Ridge gourd | 326 |
| Sponge gourd | 408 |
| *Luffa* spp | 95 |
| *Trichosanthes* spp | 274 |
| Snap melon | 206 |
| Ivy gourd | 34 |
| *Solena amplexicaulis* | 08 |
| *Basella* | 88 |
| *Portulaca oleracea* | 23 |
| *Ipomoea aquatica* | 15 |
| *Diplazium esculentum* | 01 |
| *Lasia spinosa* | 04 |
| *Colocasia esculenta* | 2410 |
| *Oxalis corniculata* | 16 |
| *Moringa oleifera* | 197 |
| *Murraya koenigii* | 24 |
| *Lasia spinosa* | 04 |

**Table 7.** List of registered germplasm conserved at NBPGR, New Delhi

| Crop | Accs. | Unique character(s) |
|---|---|---|
| Brinjal | 6 | Bacterial wilt resistance, Better ratooning and semi-spreading |
| Sponge gourd | 2 | Cluster bearing fruiting, Highly resistant to TLCNDV |
| Cucumber | 3 | Long fruit, Small fruit, High carotenoid content |
| Snap melon | 3 | Drought hardy and high yielding, downy mildew resistance |
| Kachri | 2 | Salad type, pickle type |
| Pointed gourd | 1 | Obligate parthenocarpic and seedless fruit |
| Sword bean | 1 | Drought tolerant |

Small fruited Cucumber (INGR 18030)

Fruit variability in Cucumber


## SUMMARY

There is lot of vegetable crops diversity available in India. Over the years this diversity in major vegetable crops has been captured, augmented, characterized, evaluated and conserved through systematic PGR management. There is still need to explore the indigenous minor vegetable crops (under-utilized vegetable crops used locally) especially leafy vegetable crops as well as on trait-specific germplasm. The characterization and evaluation of major vegetable crops need to be strengthened in a network mode involving multi-disciplinary approaches on priority. In the context of climate change, the wild relatives play an important source for genes/gene complex, need to be evaluated and utilized with suitable tools and techniques. To increase the germplasm utilization, more importance needs to be given from trait specific evaluation to trait discovery.



For further interaction please write to:
**Drs K. K. Gangopadhyay, Vinod Sharma, Pragya, Kuldeep Singh,** ICAR-National Bureau of Plant Genetic Resources, New Delhi. *Email:* krishna.gangopadhyay@icar.gov.in