



Importance of wild species for the improvement of fruit crops

**SUNIL KUMAR, KULDEEP SINGH AND
SATYABRATA PRADHAN**

Division of Fruits & Horticultural Technology
ICAR - Indian Agricultural Research Institute, New Delhi-110 012
Corresponding author E-mail- mehtasunil98@gmail.com

Inchanging climate scenario there is a great challenge for us to produce more food and nutritional security. There are several constraints to achieve the desirable production and productivity level in horticultural crops especially in fruit crops. As population is increasing day by day there is a great challenge for us to overcome all these constraints like biotic and abiotic stresses. Among all technological advancement crop improvement techniques will be very useful to overcome these problems. For crop improvement availability of a desired traits /sufficient germplasm is prerequisite and there are lot of wild species are available in fruit crops. Exploitation of wild species of fruit crops to a large extent depend on the efficient use of germplasm resources available in natural habitat, which will be used as a parent. To bring a greater diversity into the breeding pool, it requires introduction of exotic and wild material. In fruit crops, wild species are of considerable importance in improvement programmed as a source for several biotic and abiotic stresses.

WHAT ARE WILD SPECIES?

Plant species in or out of captivity that have not been subject to breeding to alter them from their native (wild) state. Their potential as gene donors for crop improvement was clearly recognized by Nicolai Vavilov in the 1920s and 1930s. Some important terms which may create confusion with wild species are as follows:

- Landraces: are nothing but primitive cultivars which were selected and cultivated by the farmers for many generation.
- Primitive cultivars: an early cultivated form of a crop series, evolved from a wild population.
- Wild forms: are the wild species from which crop series were directly derived.
- Wild relatives: include all those taxa representing spontaneous wild and weedy forms and progenitors that are closely linked to domesticated species.
- Accession: plant sample, strain or population held in gene bank or breeding programme for conservation or use.
- Weedy species: plants whose virtues have not yet been discovered

IMPORTANCE OF WILD SPECIES:

- Gene flow between crops and their wild relatives produce novel genetic variability



for continued evolution, domestication and genetic improvement of crop species.

- Wild species are reservoir of genes for tolerance to biotic and abiotic stresses, early vigor, establishment, and other traits generally lacking in domesticated species.
- Wild species and their hybrids with domesticates have been utilized in the genetic improvement of scion and rootstock cultivars in fruit crops.
- As a major gene donor, wild specie play a significant part in the improvement and sustainable production of domesticated crops.

TOLERANCE TO BIOTIC STRESSES:

Fruits crops are affected by many insect, pest and diseases which results in the loss of yield and quality so there is a need to develop new variety which will tolerate/resistant these problems. Desired genes can be obtained from the wild species for improvement. Some important wild species of fruit crops which are tolerant/resistant to biotic stresses are given in Table:

S. No.	Fruit Crops	Wild Species	Important Traits
1.	Mango	Mangifera laurina Mangifera altissima	Resistant to Anthracnose Resistant to Leaf hoppers
2.	Papaya	Vasconcella cauliflora Vasconcella goudotiana Vasconcella parviflora	Resistant to PRSV Resistant to Phytophthora Resistant to Dieback
3.	Grape	Vitis rupestris Vitis champini Vitis doaniana Vitis amurensis	Resistant to Phylloxera Resistant to Nematodes Resistant to Downy mildew
4.	Citrus	Citrus jambhiri Poncirus trifoliata Citrus aurantium	Tolerant to CTV and CEV. Resistant to foot-rot, and citrus nematodes. Tolerant to Phytophthora



Vasconcella cauliflora



Vasconcella goudotiana



Poncirus trifoliata



Citrus aurantium



Vitis rupestris



Vitis amurensis



Malus zumi



Malus floribunda

*P. friedrichasthalianum**Ficus glomerata**Pyrus calleryana**Ananas bracteatus**Musa acuminata ssp. burmanica**Syzigium densiflorum*

5.	Apple	Maluszumi Malushupehensis Malus floribunda Malusastrosanguinea	Resistant to PM & moth Resistant to WAA Resistant to apple scab
6.	Guava	<i>P. friedrichasthalianum</i> <i>P. friedrichasthalianum</i> <i>P. guineese</i> <i>P. molle</i>	Tolerant to wilt Resistant to nematode Resistant to wilt Resistant to wilt
7.	Jamun	<i>Syzigiumdensiflorum</i>	Resistant to termite
8.	Fig	<i>Ficusglomerata</i>	Resistant to nematode
9.	Banana	<i>Musa acuminata ssp. burmanica</i> <i>Musa acuminatassp. malaccensis</i>	Resistant to fusarium wilt and nematodes. <i>Musa laterita</i> Tolerant to panama wilt and nematodes.
10.	Pineapple	<i>Ananasbracteatus</i> <i>Ananassegenarius</i>	Resist. to wilt, heart rot and root rot Immune to heart rot, root rot and resi. To wilt
11.	Pear	<i>Pyruscalleryana</i>	Resistant to fire blight

TOLERANCE TO ABIOTIC STRESSES:

In climate change scenario fruit crops are facing so many abiotic stresses (salinity, drought, etc.). some of the wild species of fruit crops can be used to develop varieties tolerant to abiotic stresses.

S.No.	Fruit Crops	Wild Species	Important Traits
1.	Mango	<i>Mangiferadecandra</i> <i>Mangiferagedebe</i> <i>Mangiferaincarpoides</i>	Rootstock for waterlogged conditions

2.	Citrus	Citrus limonia Poncitrifoliata Citrus jambhiri Citrus aurantium	Tolerant of high saline and calcareous soil condition. Extremely freeze hardy. Drought tolerant.
3.	Papaya	Vasconcellapentagona V.candamarcensis	Frost resistant species
4.	Grape	Vitisarizonica Vitis monticola V. Viniferasspsylvestris var. Typica V. Viniferasspsylvestris var. Balcanika V. Viniferasspsylvestris var. aberrans	Resistant to drought Short season and cold hardy.
5.	Apple	MalusPrunifolia Malusbaccata	Cold resistant
6.	Aonla	Phyllanthusacidus	Frost tolerant
7.	Ber	Ziziphusrotundifolia	Salt tolernt
8.	Pear	Pyrusbrestschniederi Pyrusussurensis	Cold tolerant Resistant to low temp.
9.	Peach	Prunusdavidiana	Tolerant to drought
10.	Walnut	Jugalnushindsii Jugalnusmicrocarpes Jugalnushindsii	Tolerant to waterlogged cond. Tolerant to B, Cl & pH Salt tolerant
11.	Cherry	Prunusmahaleb	Most drought tolerant
12.	Custard apple	Annonaglabra	Tolerant to flood
13.	Passion Fruit	Passifloraincarnata Passifloracaerulea	Cold tolerant Very cold hardy
14.	Strawberry	Fragariaovalis	Resistant to drought & low temperature.



Mangifera gedeba



Citrus limonia



Vitis monticola



Vasconcella pentagona



Citrus aurantium



Malus prunifolia

QUALITY TRAITS:

For nutritional security and export point of view quality is a major concern in the fruit crops. The wild species of fruit crops having some quality traits are as follows:

S.No.	Fruit Crops	Wild Species	Important Traits
1.	Mango	Mangifera caesia Mangifera Indica var. Mekongensis Mangifera pajang Mangifera similis Mangifera odorata Mangifera magnifica	White pulp, sweet, fragrant. Fruits twice a year and hence a good parent. Peeled like banana Freestone mangoes Highest TSS species Fiberless pulp
2.	Guava	Psidium pumilum Psidium cujavillii	Highest sugar content Highest vitamin- C
3.	Banana	Musa acuminata ssp. malaccensis Musa basjoo Musa textilis	Flower used as vegetable Fibre yielding species
4.	Citrus	Citrus limonia Poncirus trifoliata Citrus aurantium	Better juice content Reduce bitterness Big fruit size, smooth skin , juice good keeping quality
5.	Papaya	Vasconcella quercifolia	High papain content



Mangifera caesia



Mangifera pajang



Mangifera similis



Mangifera odorata



Musa acuminata ssp. malaccensis



Musa textilis

*Annona purpurea**Malus hupenhensis**Diospyros lotus**Pyrus nivalis**Flying dragon**Malus siversii**Ziziphus nummularia**P. friedrichsthalianum*

HORTICULTURAL AND OTHER TRAITS:

S. No.	Fruit Crops	Wild Species	Important Traits
1.	Guava	<i>P. friedrichsthalianum</i> <i>P. pumilum</i>	Dwarfing rootstock Dwarfing rootstock
2.	Ber	<i>Ziziphusnummularia</i>	Dwarfing rootstock
3.	Apple	<i>Malussiversii</i>	Sucker free species
4.	Citrus	<i>Flying dragon</i> <i>Troyer citrange</i>	Dwarfing rootstock Dwarfing rootstock for kinnow
5.	Custard apple	<i>Annonapurpurea</i>	Skin resistant to craking
6.	Apple	<i>Malushupenhensis</i> <i>Malustoringoides</i> <i>Malussargenti</i> <i>Malussikkimensis</i>	Apomictic rootstock
7.	Persimmon	<i>Diospyros lotus</i> <i>Diospyrosoleifera</i>	Tannin source
8.	Ber	<i>Ziziphusxylopyrus</i>	Lac host and for tannin
9.	Pear	<i>Pyrusnivalis</i>	Source of pear cider
10.	Datepalm	<i>Phoenix sylvestris</i>	Source of tadi / neera

CONCLUSION:

- Wild species are treasure for fruit crops improvement.
- Wild species are very important source of novel traits/genes.
- Wild species play important role in crop evolution.
- These wild species are able to sustain the fruit production either through conventional and non-conventional mean of fruit improvement.
- Wild species is of special concern as these are rich in genetic diversity and carry genes particularly for resistance/tolerance to biotic and abiotic stresses.