



## Breeding Programme in Broccoli (*Brassica oleracea* var. *italica*) and Pumpkin (*Cucurbita moschata*)

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### Abstract

Broccoli is one of the most important vegetable crops cultivated worldwide. The market demand for broccoli is still increasing due to its richness in vitamins, anthocyanins, mineral substances, fiber, secondary metabolites and nutrients. The famous secondary metabolites, glucosinolates, sulforaphane and selenium have protective effects against cancer.

There is a diverse variety of pumpkin types found in nature, and their potential as source of pro-vitamin A can be evaluated with goal of using them in traditional plant breeding or breeding objectives with the goal of increasing the beta-carotene content, high yields of the crop.

**Keywords-** Broccoli (*Brassica oleracea* L. var. *italica*) and Pumpkin (*Cucurbita moschata*) introduction, breeding objectives, varieties.

### Introduction

Breeding a vegetable crop for adaptation to a temperature regime that is higher than the recognized optimum for the species in question is an example of breeding for abiotic stress tolerance. Before embarking on a project to breed for such stress tolerance, we propose that several critical considerations or questions must be addressed. the following: What is the effect of the abiotic stress on the crop to be improved; what will be the conditions of the selection environment what germplasm is available that contains the necessary genetic variation to initiate improvement; what breeding scheme will be used to facilitate improvement; and broccoli to breed for adaptation to high-temperature environments to provide examples of how each of these considerations might be addressed in developing an improvement effort. broccoli quality and performance under high-temperature summer environments has been improved, insights are provided that should be useful to future attempts to breed vegetables more tolerant of an abiotic stress.

### Broccoli (*Brassica oleracea* var. *italica*)

- Family: Brassicaceae
- Chromosome no.:  $2n=18$
- Origin: Mediterranean region
- Rich sources of vitamins and minerals
- It also contains antioxidants.

It has two type of head: heading types and sprouting (green and purple)

**Heading type :** Having large head made up of florets that are attached to a thick stalk . Green Sprouting broccoli: Having firm and compact crown heads are more in demand in india.

- Seed production conducted only in temperate regions.

- Bud pollination by emasculation by 2 days of anther dehiscence.

The reason of cross pollination is heteromorphism, male sterility and self incompatibility.

#### **Breeding Objectives**

- Compact, dark green, small bud, yellow eye and brown bud free head.
- Glycoalkaloid rich,
- Size of head
- Color (purple) high anthocyanin
- Biotic and abiotic stress
- Biotic: black rot, damping off, powdery mildew, downy mildew
- Abiotic: high temp., salinity, alkalinity, drought.
- Broad, soft, string free leaves
- Self incompatibility but cross compatible inbreds to produce hybrids.

**Methods:** The broccoli breeding program follows a one year breeding cycle. Cuttings from hybrids and inbreds are brought from the field in the fall and rooted in the greenhouse. Upon flowering during the winter, inbreds are bud pollinated to self-pollinate them and crossed with other inbreds to produce F1 hybrid seed. In May and June, selfed and crossed seed is collected and is used to start transplants for planting yield trials and the breeding nursery. After evaluation, the cycle repeats with harvest of cuttings in the fall. New inbreds are derived by repeated self-pollination of F1 hybrids. Four to five generations of selfing is required before inbreds can be tested for hybrid seed production. The inbreds, experimental hybrids and commercial hybrids grown in the main fall planting are evaluated for head size, shape, and exertion, segmentation, floret texture and color, maturity and disease resistance. The size of the replicated main fall season trial varies with the number of crosses that can be made (which is a function of the amount of labor available to make hand crosses) but up to 15. These are transplanted in one row plots 30 feet in length and replicated four times.

**Varieties:** Pusa broccoli, Katrain sel-1, Palam samridhi, Palamkanchan, Palamvichitra (purple heading type), Punjab broccoli 1, Pusch, Aishwarya, Solan green, Lucky, Fiesta

#### **Pumpkin (*Cucurbita moschata*)**

Chromosome no.  $2n=40$

The common terms “pumpkin”, “squash”, “gourd”, “cushaw”, “ayote”, “zapallo”, “calabaza”, etc. are often applied indiscriminately to different cultivated species of the New World genus *Cucurbita* L. (Cucurbitaceae): *C. pepo* L., *C. maxima* Duchesne, *C. moschata* Duchesne, *C. argyrosperma* C. Huber and *C. ficifolia* Bouché. These species are mainly grown for their fruits (botanically a pepo) which are a significant source of carbohydrates and vitamins (Whitaker and Davis, 1962). The fruits can be picked either when immature or fully mature, and this type of use conditions the culture techniques, cultivar selection and breeding objectives. “Pumpkin” is mostly used to refer to cultivars with round fruits which are used when mature for baking or for feeding livestock. “Squash”, by contrast, is differentially applied to cultivars grown for their edible immature fruits and to cultivars grown for their mature fruits that store well and are not usually round. Despite the supposedly differential characteristics that make “summer” and “winter squashes” two different crops, these common terms overlap, generating confusion which also affects production statistics. *C. pepo* is today the most economically important species distributed worldwide. Although its great economic value is based mainly on the culinary use of immature fruits (“Zucchini”) horticultural groups,

#### **Objectives:**

- Earliness
- High female:male sex ratio
- Evaluation for beta-carotene

- High fruit yield with multiple later branching system, thick flesh and narrow small seed cavity and medium vine characteristic
- Resistance to common diseases like powdery mildew, downy mildew and virus
- Resistance to insects like red pumpkin beetle
- To improve stability of the crops against disease, heat, drought, etc.
- Resistance to insects like red pumpkin beetle
- To improve stability of the crops against disease, heat, drought, etc
- To increase productivity
- Improve nutrition

**Pollination on Cucurbita:** The pistillate and staminate flower buds are located a day before anthesis and are protected by tying the tip of corolla tube. The following morning, as soon as the pollen sacs dehisce, the staminate flower is taken out and pollen is applied on the receptive stigma of the pistillate flower. This is easily done by rubbing the anthers against the stigma. Pollination can be done from morning till noon.

**For better fruit setting it is desirable:**

1. To pollinate first few pistillate flowers (ii) To remove the previously set fruit by open-pollination. Crossed fruits should be properly tagged and a stake may be placed adjacent to the pollinated fruit to mark its location.
2. Breeding Methods/Selection Criteria of Cucurbita:

**Inbreeding:** Numerous experiments have failed to demonstrate marked inbreeding depression in Cucurbita, even after prolonged selfing, therefore inbreeding along with selection could be adopted as one of the breeding methods as applicable to any other cucurbit.

**Hybrid Breeding:** Heterosis has been demonstrated in summer squash (*C. pepo*), hence hybrid breeding is also becoming popular in squash and pumpkin.

**The common methods of commercial F<sub>1</sub> hybrid seed production are as follows:**

**Manual Pollination/Use of Insects:** In this system female and male parents are planted in a ratio of several rows of female alternated with 1 row of male parent. Since Cucurbita flowers are large, male buds are detected and removed several days before anthesis from the female rows. The female flowers of the female rows are hand pollinated by the male flowers of the male parent row or the female flowers are left for pollination by insects in nature. Most Cucurbita types are monoecious. The blossoms open in the morning and are pollinated primarily by specially-adapted solitary bees. The large, connated corollas can be tied up both in male and female flowers to prevent pollinator entry the day before anthesis when the colour of the petals begins to turn to yellowish-orange. Male flowers produce big pollen grains which can be directly deposited on the fleshy stigmas the next morning. Petals of the female flowers can then be tied up again until fruits are developed. Usually, manual pollinations are carried out with fresh pollen, although pollen from pre-anthesis flowers that are kept for a few days at low temperatures and high humidity can also be used. **Use of Chemicals:** The application of 250 ppm of ethephon prevents the development of staminate flowers for extended periods, but does not affect the development of pistillate flowers. By the time two-three fertile fruits have developed on each mother plant the ethrel effect has gone. Further sprays would not be effective and at this stage, development of lateral male flowers is stopped by cutting off the plants growing point with a knife.

## References

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