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Breeding Program in Pumpkin (*Cucurbita moschata*) and Pointed Gourd (*Trichosanthes dioca*)

(*Somyashree Patel, Dr. Vijay Bahadur and Dr. Anita Kerketta)
Department of Horticulture, SHUATS, Prayagraj, Uttar Pradesh, India
*Corresponding Author's email: somyashreepatel8@gmail.com

Abstract
The goal of breeding program is to contribute to sustainable and efficient food production while addressing the demands of consumers and changing agricultural conditions. this often includes improving characteristics such as yield, disease resistance, adaptability to different environments, nutritional content, and overall quality. Pumpkin (Cucurbita moschata) is an important cucurbit which is originated in south America which has a wide adaptability in India and owns a prominent place among the vegetables owing its high productivity, nutritive value, good storability, and long period of availability and better transport potentialities. Pointed gourd *(Trichosanthes dioica)* is a tropical vine belonging to Cucurbitaceae family It is native to the Indian subcontinent and is widely cultivated in South Asia, particularly in countries like India, Bangladesh, and Nepal. Pointed gourd is valued for its culinary versatility and nutritional benefits. Rich in vitamins, minerals, and dietary fiber, pointed gourd contributes to a healthy diet and is particularly prized for its potential medicinal properties in traditional medicine systems like Ayurveda. This review article orients on origin, biology, health benefits, breeding objectives, breeding programme and important varieties.

Pumpkin
Introduction: Pumpkin, scientifically known as *Cucurbita moschata* .and belonging to the family Cucurbitaceae, is an edible They are native to North America and have been cultivated for thousands of years. Pumpkins are known for their large size, typically orange colour, and thick, edible flesh. pumpkins are often carved into jack-o'-lanterns for Halloween decorations. It is a cross-pollinated crop, with a chromosome count 2n=2X=40 which is an Amphidiploid.

Origin: North America

Pumpkin is native to Latin America and has been widely cultivated for over 10,000 years in North America and more than 500 years in Europe. Pumpkin is a Northen hemisphere vegetable with several variety found in North America, Continental Europe, New Zealand, Australia and India.

Health benefits: Pumpkins are rich in rich in essential nutrients like vit A (1600IU) and vit C fiber and potassium. High level of beta-carotene contributes better vision also health skin and Fiber, potassium and antioxidants contribute to heart health also support immune system, Pumpkin seed contain antioxidants that protect body cell from damage and the magnesium content regulate blood pressure. The magnesium content regulates blood pressure, Pumpkin seed contain tryptophan that contribute better sleeping .

Botany: The plant is monoecious annual trailing herb, stem is thick, angular, trailing, they spread along the ground covering a considerable area or climb using tendrils to support

themselves. The leaves are large, 5 lobed and typically have a rough texture because it is hairy. Flowers are unisexual, solitary and lemon yellow in color. Sepals are 5 in number lobed and are adnate to ovary. Corolla is campanulate, 5lobbed half way down and gamopetalous. Stamens are 3 in number in male flower and male flower are smaller. Ovary is inferior. Fruit is fleshy and many seeded and varies in shape, color. They have a hard rind with smooth surface varying in shape.. The sex ratio of pumpkin staminate: pistillate is 20:1. Staminate flower opened after 55-70 days, pistillate flower opened after 60-75 days of seed sowing. Nectar is produced by both staminate and pistillate flower.

Objective

- **Yield improvement:** Breeders aim to develop pumpkin varieties with higher yields, ensuring that farmers can maximize their production and meet market demands more effectively.
- **Disease resistance:** Developing pumpkins with resistance to common diseases such as- powdery mildew, downy mildew, and various viruses is a crucial breeding goal. This helps to reduce the need for chemical pesticides and enhance crop resilience.
- **Pest resistance:** Breeding for resistance to common pests like cucumber beetles and aphids can contribute to sustainable and environmentally friendly pumpkin cultivation.
- **Fruit quality:** improving the quality of pumpkin fruits is a key breeding objective. This includes traits such as fruit size, shape, color, texture and taste making pumpkins more appealing to consumers.
- **Adaptability:** Creating pumpkin varieties that are well adapted to specific environmental conditions, including different climates and soil types, helps ensure successful cultivation in various regions.
- **Storage and Shelf Life:** Developing pumpkins with extended storage life and improved shelf stability is important for reducing post-harvest losses and ensuring a longer availability of fresh produce.
- **Early Maturity:** Breeding for early maturity allows farmers to harvest pumpkins sooner, providing flexibility in planting and potentially avoiding adverse weather conditions.
- **Uniformity:** Achieving uniformity in size, shape, and maturation of pumpkins within a crop is essential for efficient harvesting and marketing.
- **Nutritional Content:** Breeding for enhanced nutritional content, such as increased levels of vitamins, minerals and antioxidants, contributes to the health benefits of consuming pumpkins.
- **Resistance to Environmental Stress:** Developing pumpkins that are resistant to environmental stresses, including drought or extreme temperatures, enhances their ability to thrive under challenging conditions.

Breeding methods: Pumpkin is highly cross pollinated due to its monoecious nature and entomophily. No breeding depression has been observed due to the fact that original form of cucurbits is hermaphrodite. Estimation of variability, heritability and correlation among polygenic characters are important to choose appropriate breeding methods to improve specific characters.in absence of inbreeding depression, selfing can be done to develop uniform strain from heterogeneous open pollinated cultivars. Pedigree and mass selection procedures are used to bred for improved more uniform strains of open pollinated cultivars.

Pedigree method: Pedigree breeding is a systematic method used in plant breeding, to improve and maintain desirable traits over generations. The process involves carefully recording the parentage of each plant and selecting individual with the best combination of characteristics to be the parents of next generation.

Mass selection: Mass selection is a breeding method that involves selecting and propagating plant with desirable traits from a population without detailed individual plant records. This

method is particularly useful for pumpkins, where traits such as fruit quality, yield, and disease resistance can be observed easily.

Emasculation and hand pollination: Since male flowers are large with lo pedicels and fewer in number, they can be detected and removed from female parent easily. Male and female parents are planted in the ratio of 1:10 in isolation fields. Male flowers are pinched off as Soon as they appear from female parent and either hand, insect pollination is resorted to produce hybrid seeds.

Interspecific Hybridization: This method has been successfully utilized in crop improvement Interspecific hybridization refers to the breeding of individuals from different species to produce hybrids. The aim is to combine desirable traits from different species in the offspring, creating hybrids with characteristics that may not be present in either parent species. Munger maintained interspecific population obtained through tissue culture from Yantee Hybrid a yellow straight neck summer squash (C. pepo) pollinated by Butternut (C. moschata).

Resistance breeding: Resistance breeding involves developing plants or crops with enhanced resistance to diseases, pests, or environmental stresses. This is typically achieved through selective breeding, where individuals with natural resistance traits are crossbred to produce offspring with a higher level of resistance. It is mainly done by back cross method.

It is repotted that C. foetidissima was a good source of resistance to three viruses and C. martinezzivas resistant only to two viruses but could be used to transfer resistance to CMV in C. moschata.

Varieties:

Pusa Vishwas	Pusa Vikas
Pusa Hybrid 1	Arka Suryamukhi
Arka Chandan	Kashi Harit
CO 1	CO 2
Azad Pumpkin-1	N. Agrim
N. Amrit	N. Abhooshan

Case study:

Hazra Pranab, Mandal Alok Kumar, Dutta Avijit Kumar Ram Harihar (2007). Breeding pumpkin (Cucurbita moschata Duch. Ex poir.) for fruit yield and other character, *international journal of plant breeding.*

Pumpkin (Cucurbita moschata Duch. Ex Poir.) with its origin in the western part of south America is the most important and extensive cultivated cucurbit in India, Africa, Latin America, South Asia and The United States and occupies a prominent place among vegetables owing to its high productivity, nutritive value, good storability, long period of availability and better transport potential. This review article orients on origin and taxonomy, breeding behavior, inheritance of important characters, breeding methods and biotechnological applications in breeding pumpkin for fruit yield and quality. *International journal of plant breeding*

Pointed Gourd

Introduction: Pointed gourd (Trichosanthes dioica) locally named as “parwal”, “palwal” or “potol” is one of the most popular summer vegetables in Bangladesh and India. Parwal is morphologically different from other cucurbits because of it is perennial, dioceous, and vegetative propagation method where other propagate by seeds. Seed propagation of pointed gourd is undesirable due to poor germination unpredictable sex expression and delay in flowering. For that matter pointed gourd is propagated through cuttings (stem and root cuttings).. It is a cross-pollinated crop with chromosome number 2n=22. It becomes dormant during winter but will sprout and begin growing from the perennial base in the spring.

Origin: India

Trichosanthes is a large genus of Indo-Malayan distribution with about 44 species, of which 22 are found in India. De Candolle (1882) concluded that the species of Trichosanthes, especially dioica, originated in the Old World, most probably in India. Assam-Bengal region of India was the primary center of origin including Bangladesh.

Health benefits: In the traditional ayurvedic system of medicine, T. dioica fruit have been described to posses anthelminthic, diuretic, appetizing, digestive, effects. Leaves and tuberous roots of pointed gourd are also used in Ayurvedic medicine Pointed gourd has higher nutrient content than other cucurbits, its fruits are rich in vitamin A, protein percentage is 10 times higher than bottle gourd and 4 times higher than snake gourd, ridge gourd, and ash gourd. Aqueous extracts of T. dioica leaves were reported to have a hypoglycemic effect.

Botany: The plant is Perennial climber, dioecious in nature. Pointed gourd plants grow as vine, is usually grown in open field plant is,2-5 m in height. Vines require training on some form of aerial support system to achieve maximum fruit production. In India 'Diara' lands in Bihar and Uttar Pradesh it is highly cultivated, however in Assam, Bengal, Orissa, it is also grown in loamy soils. It has tuberous roots and long tap root system leaves are simple heart shaped with pointed edge and arranged in alternate pattern. Pointed gourd is distinct from other cucurbits due to its well-established. Flower of pointed gourd is solitary, bracteate and produces small, yellowish-white flowers. Staminate flowers have three stamens and short filaments inserted on calyx tube; anthers are syngenesis, very less or not free. Inflorescence is racemose, flowers are sessile, solitary, bracteate with oblong-cylindrical calyx tube. Flower has 5 number of sepals, gamosepalous and 5 petals, gamopetalous. Have 3 number of stamen. The fruits are globose, oblong and smooth, which is the main edible portion each fruit contains 18-20 seeds. Anthesis commences between 7:00 pm and continues up to 9 pm Pollen viability is quite high at anthesis but gradually declines to zero 54 h after anthesis the stigma remains receptive up to 24 hours after anthesis. fruit set is low, mainly due to poor pollination, but fruit set can be increased by hand pollination.

Objectives

1. **Yield Improvement:** Enhance the productivity of pointed gourd plants to ensure higher yields per unit area, addressing food security concerns.
2. **Disease Resistance:** Develop varieties with increased resistance to common diseases affecting pointed gourd, minimizing crop losses and reducing the need for chemical interventions.
3. **Fruit Quality:** improving the quality of pointed gourd fruits, considering factors such as size, shape, color, and taste, to meet consumer preferences and market demands.
4. **Nutritional Enhancement:** Increase the nutritional content of pointed gourd to provide a more healthful product, potentially through breeding for higher vitamin or mineral levels.
5. **Adaptability:** Breed varieties that are adaptable to a range of environmental conditions, ensuring resilience to variations in temperature, soil types, and water availability.
6. **Pest Resistance:** Develop pointed gourd varieties with resistance to common pests, reducing the reliance on pesticides and promoting more sustainable cultivation practices.
7. **Shelf-Life Extension**: Improve the post-harvest shelf life of pointed gourd fruits to reduce spoilage during storage and transportation, ultimately benefiting both farmers and consumers.
8. **Stress Tolerance**: Enhance the tolerance of pointed gourd plants to abiotic stresses such as drought, salinity, or extreme temperatures, making them more resilient in diverse agroecological settings.
9. **Environmental Sustainability:** Consider breeding objectives that promote sustainable agriculture, such as reduced resource inputs, lower environmental impact, and improved overall ecological compatibility.

Breeding methods: Pointed gourd mainly propagated through cuttings vegetatively not sexually so improved cultivars of pointed gourd development mainly based on selection from domesticated clones. Also, recently because of crossing between domestic clones some hybrids have been developed. The choice of cultivar generally depends on regional consumer preferences for fruit shape, color, and striation pattern. The main breeding objectives are developing high-yielding selections having disease and pest resistance. Pointed gourd is highly cross-pollinated crop so, heterozygosity can be seen. selection of individual plants with desirable characteristics from local and popular clones may form the basis of a new cultivars. For commercial cultivation selections are recommended, and for commercial cultivation two clonally propagated F1 hybrid selections have been released. Once a plant with vigor and desirable features is obtained, it is easily maintained by vegetative propagation to become a new cultivar. The use of hybrid seed is not practical because of poor germination.

Varieties

Rajendra Parwal-1	Rajendra Parwal-2
Swarna Rekha	Swarna Alaukik
CHES Hybrid-1	CHES Hybrid-2
Faizabad Parwal-1	Faizabad parwal-3

Case study

KABIR M. Y. M. Y., KHAN A. S. M. M. R. &HASSAIN M. S.(2009). Genetic Divergence in Pointed Gourd, *Journal of Agriculture & Rural Development.*

The experiment was conducted at the Regional Agricultural Research Station, Ishurdi, Pabna during the growing season 2005-2006 to estimate the genetic diversity among 24 genotypes of pointed gourd by using Mahalanobis D2 statistics for nine characters. The genotypes were grouped in to five clusters. The cluster I and III consisted of highest number of genotypes and it was six. The cluster IV contained the lowest number of genotypes and it was three. The clustering pattern of the genotypes under this study revealed that the genotypes collected from the same location were grouped into different clusters. The genotypes of Kushtia were distributed in different clusters. The inter cluster distance were larger than the intra cluster distance suggesting wider genetic diversity among the genotypes of different groups. The highest intra cluster distance was computed for cluster IV (35.80) and the minimum intra cluster distance was found in cluster III (18.37). The clusters IV and II were more diverse as indicated by maximum inter cluster distances between them (41.56) and the minimum inter cluster divergence was observed between cluster III and II (6.84). Cluster II had the highest cluster mean value for number of fruits per plant (391), weight of fruit per plant (11.72kg) andyield (35.28t/ha). Genotypes of the cluster V had late maturity. *Journal of Agriculture & Rural Development*

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