

Cucurbits: A Study of Their Diverse Sexual Forms and Evolution

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Introduction

Among the vegetables, cucurbits comprise the largest group with their wide adaption to arid climates to the humid tropics. The family Cucurbitaceae consists of about 900 species in around 130 genera. In Asia, nearly 23 edible major and minor cucurbits are grown and consumed. Important genera of this family are *Lagenaria*, *Momordica*, *Luffa*, *Cucurbita*, *Cucumis* and *Citrullus*.

In the cucurbits male and female flowers borne separately, the pollination and fruit setting are governed by insect pollinators. Spray of plant growth regulators helps a lot in modifying sex expression and inducing femaleness. Such manipulation of sex leads to easy production of hybrids. Cucurbits share about 5.6 per cent of the total vegetable production of India. In Gujarat area under cucurbits are about 0.91 lakh ha having annual production of 14.38 lakh tones (2019-20)

Importance of Cucurbits

- Promote hydration & aid in weight loss
- Carbohydrate, Minerals & Vitamins
- Antioxidant, Anticancer, Antimicrobial, & Antidiabetic activity
- Polyphenols and tannins
- Treatment for stomach & intestinal disorders
- Improve blood sugar control

Male Flowers of Cucurbits



Female Flowers of Cucurbits

Floral Biology



Cucurbits exhibit unique floral biology with male and female flowers borne separately on the same or different plants. Pollination, primarily facilitated by insect pollinators, is crucial for fruit setting. Plant growth regulators are often employed to modify sex expression, enhancing femaleness and promoting hybrid production.

- **Male Flowers:** These emerge earlier and produce pollen.
- **Female Flowers:** Identified by the ovary at the base, which develops into fruit upon pollination.
- **Neutral Flowers:** Some cucurbits also bear neutral flowers, which lack functional reproductive organs and do not contribute directly to fruit formation.

Types of Sex forms in Cucurbits

Cucurbits showcase a variety of sexual forms, highlighting their evolutionary diversity:

1. **Hermaphrodite:** Both male and female structures in one flower (*e.g.*, Ridge gourd)
2. **Monoecious:** Male and female flowers on the same plant (*e.g.*, Cucumber, Pumpkin, Watermelon)
3. **Andromonoecious:** Male and hermaphrodite flowers on the same plant (*e.g.*, Musk melon, Cucumber)

4. **Gynomonoecious:** Female and hermaphrodite flowers on the same plant (*e.g.*, Cucumber, Ridge gourd)
5. **Gynoecious:** Only female flowers, commonly used in hybrid production (*e.g.*, Bitter gourd, Musk melon)
6. **Trimonoecious:** Male, female, and hermaphrodite flowers on the same plant (*e.g.*, Cucumber)
7. **Androecious:** Only male flowers (*e.g.*, Cucumber)
8. **Dioecious:** Male and female flowers on separate plants (*e.g.*, Pointed gourd, Ivy gourd).

Evolution of sex forms in cucurbits

- Original form- Hermaphrodite
- Intermediate form- Andromonoecious, Tri-monoecious, Gynomonoecious
- End form- Monoecious, Gynoecious

Genetic Basis of Sex Determination

- **Cucumber:** Governed by three genes (**F/f, M/m, A/a**)
- **Musk melon:** Determined by two recessive genes (**ggmm**)
- **Bitter gourd:** Controlled by one recessive gene (**gy-1**)
- **Watermelon:** Regulated by a single recessive gene (**so**).

Influencing Factors

1. **Environmental:** High temperatures promote male flowers, while cooler temperatures favour female flowers.
2. **Pollination:** Bees and other pollinators are vital for fruit set. Artificial methods are used when natural pollination is insufficient.
3. **Hybrid Development:** Gynoecious lines are essential for hybrid seed production, aided by marker-assisted selection (MAS).

Conclusion

Cucurbits are vital to global agriculture, present nutritional and economic benefits. Considerate their diverse sex forms and the factors influencing them is essential for improving cultivation, productivity, and hybrid development, ensuring their continued contribution to food security and human health.

