

BREEDING OF PANSY



INTRODUCTION

- Common Names: Heart's Ease, Butterfly Flower
- Pansy: **French** word pensie, meaning **thought** or **remembrance**.
- Botanical Name: *Viola tricolor hortensis*
- Origin: Southern **France**
- It is a '**Flower for all season**' and produces fragrant and edible blooms.
- Annual or short lived **perennial**, grow 15-30cm tall.
- Used as ground covering, potted plants, decorative balconies, Bay windows and stairs.

GENETICS

- $x=8,10$ or 12
- $2n = 2x = 20, 24$
- Family: *Violaceae*
- These are the group of hybrid plants cultivated as garden flowers, derived from *V. tricolor*(wild), *V. altaica* and *V. lutea* commonly called as *Viola x wittrockiana*, a complex hybrid.
- Polyploidy and Aneuploidy condition is present i.e., Diploids to Octoploids.
 - ✓ $2n=24$: *V. albida*, *V. variegata* ($2X$)
 - ✓ $2n=48$: *V. japonica*, *V. lactiflora*
 - ✓ $2n=2X=20$: *V. collina*



SPECIES

- The garden pansy, *Viola tricolor hortensis* cultivated form.
- In horticulture the term, **pansy** is normally used for **multi-colored, large-flowered** cultivars which are **raised annually or biennially** from **seed** and used extensively in **bedding**.
- The terms **viola** and **violet** are normally reserved for **small-flowered annuals or perennials**, including the wild species.
- The genus *viola* comprises of **500** species.
- **Becker**(1925) divided the genus into 14 sections, of which the north- temperate section *Nomimium* is the largest.
- *Viola tricolor* includes,
 - ✓ *Viola tricolor* subsp. *tricolor* var. *polychrome*
 - ✓ *Viola tricolor* subsp. *curtisii* var. *maritime*
 - ✓ *Viola tricolor* subsp. *arvensis*
 - ✓ *Viola arvensis* sudsp. *megalantha*





Viola V.bicolor



V.tricolor



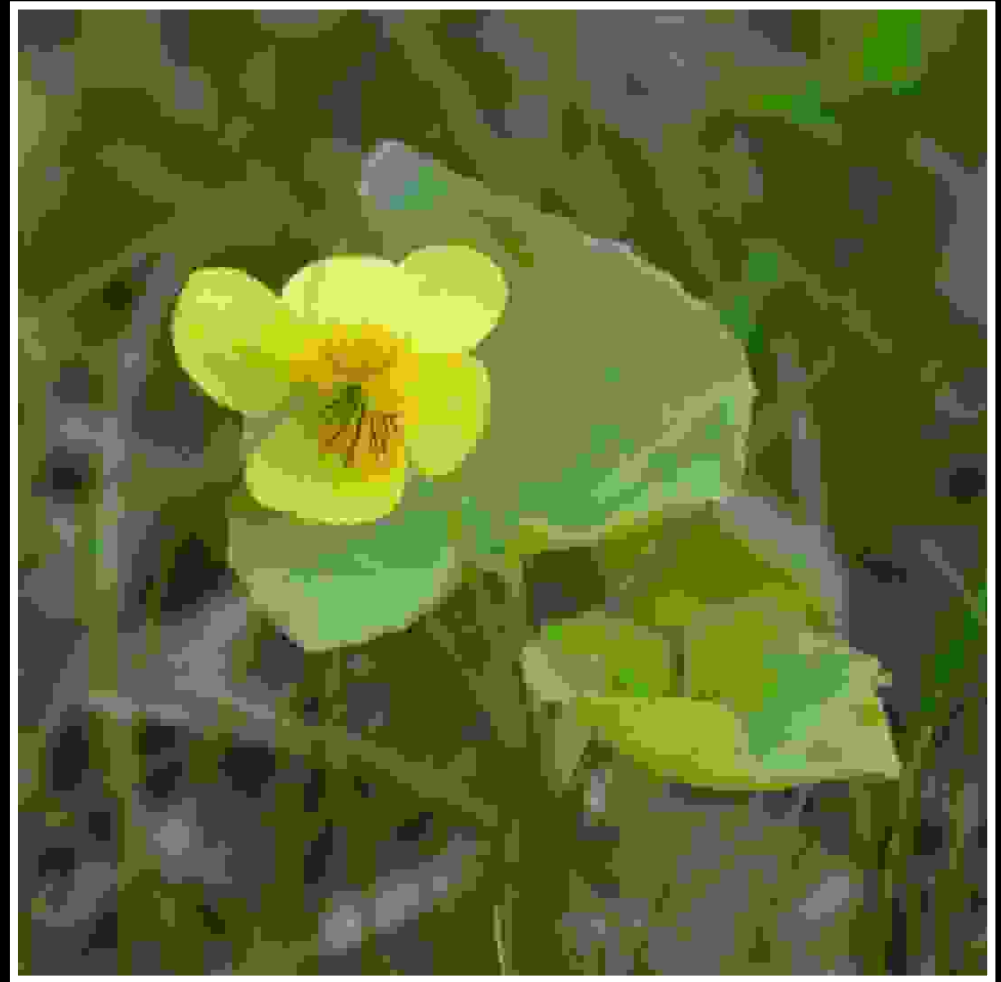
Viola riviniana



Viola sororia



Viola lutea



Viola pubescens



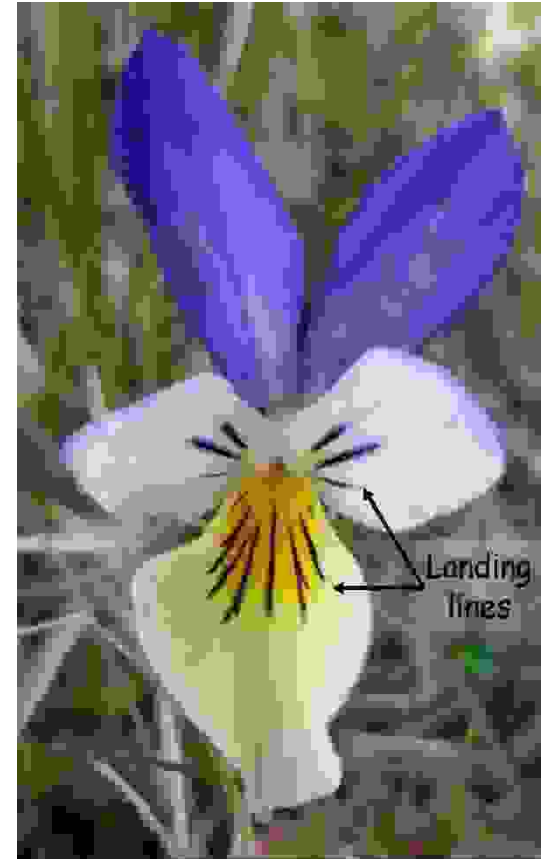
Viola pedata



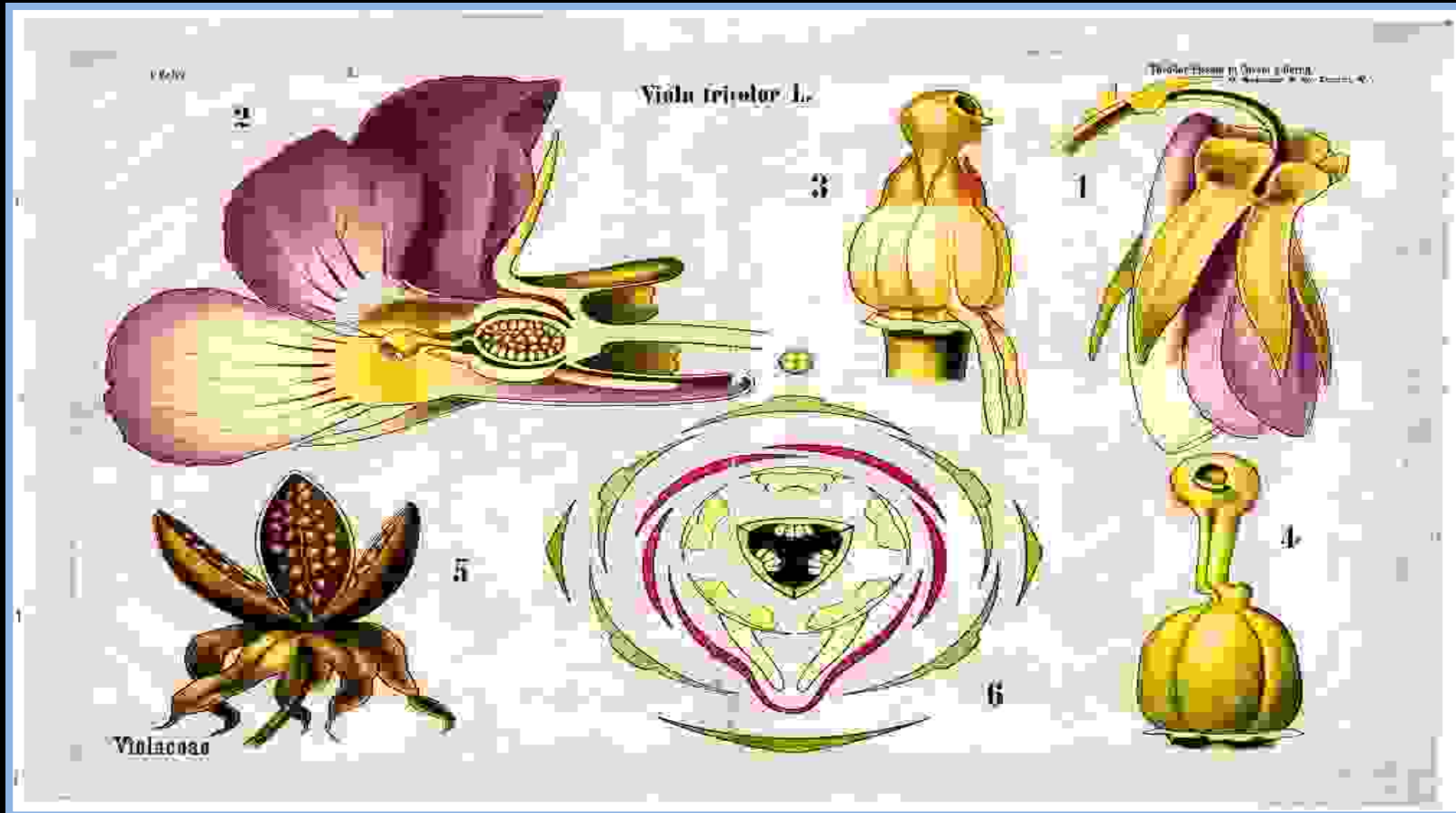
Viola alba

FLOWER MORPHOLOGY

- Flowers **single** in the leaf axil, drooping, **Bisexual**, **Zygomorphic**, often **cleistogamous**, Pedicel with two bracteoles.
- **Sepals 5**, lanceolate, persistent in fruit, each with distinct appendages.
- **Petals 5**, obovate, blue to violet, some times yellow or white or in combination.
- Some or all with dark streak which are nectar guides.
- Pansies have **four petals** pointing **upwards** and **one** pointing **down**.
- **Ovary: Superior**, unilocular, many ovules. Fruit trigonous capsule. Seeds ovoid.



ANATOMY OF THE FLOWER

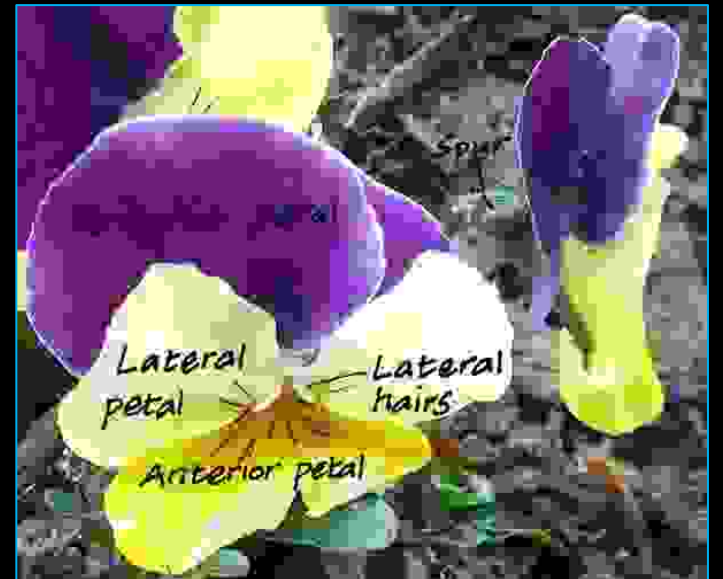
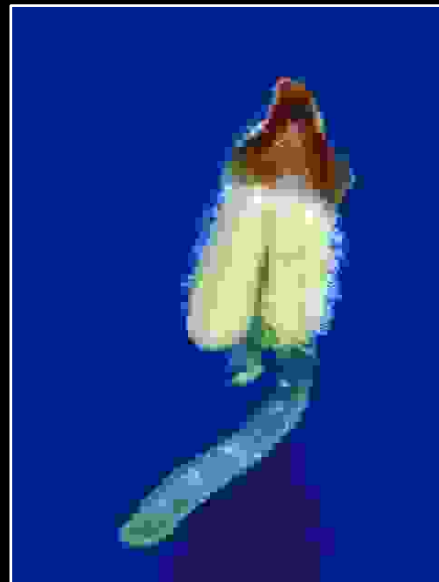
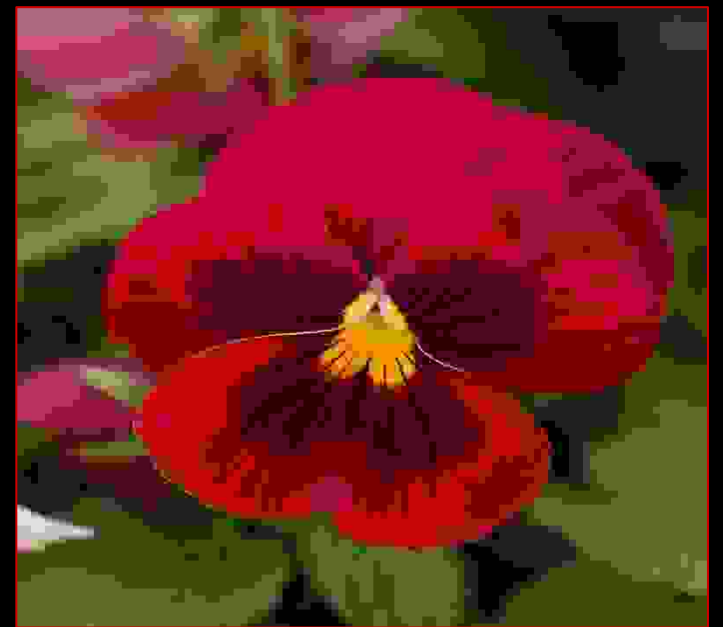


Seed capsule





ANATOMY



MODE OF POLLINATION

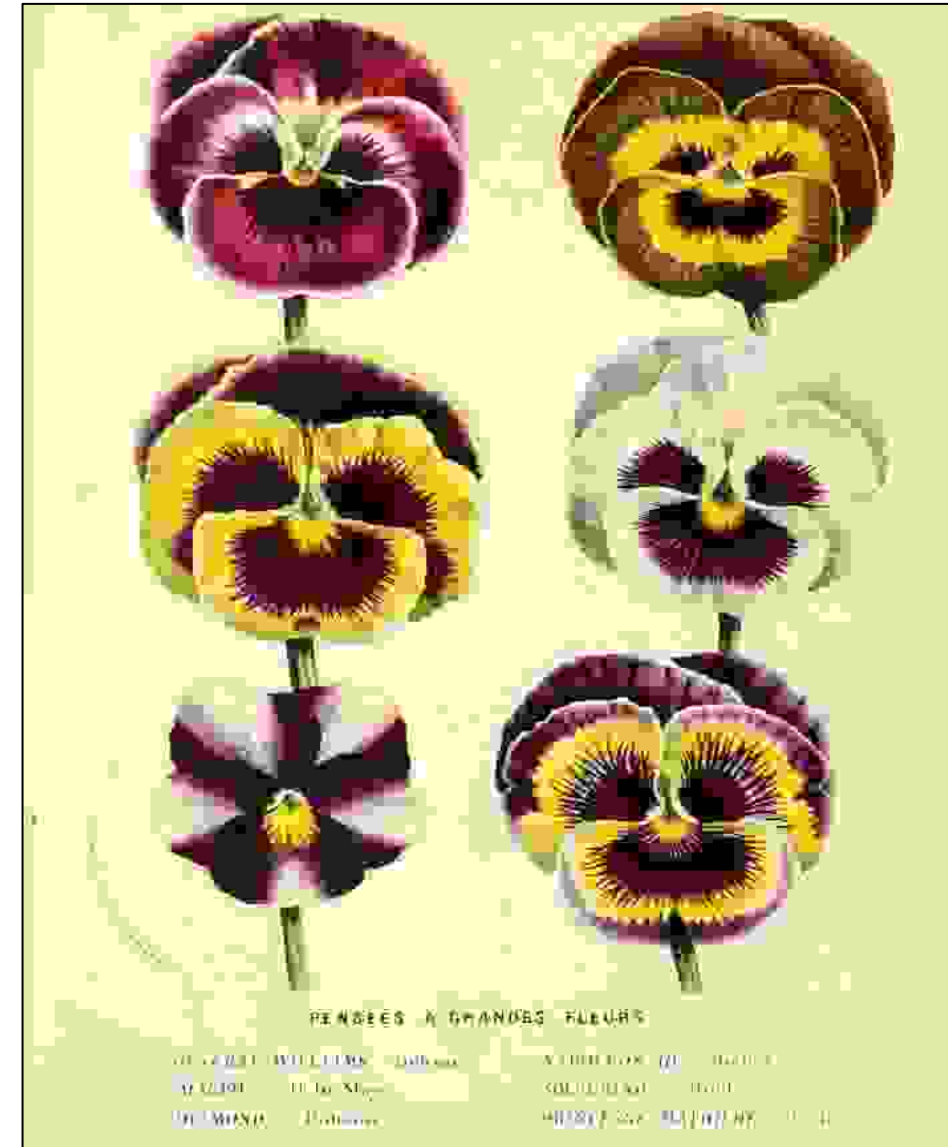
- Pansy flowers are **hermaphrodite**, **self fertile** and pollinated by **bees**.
- In cleistogamous flowers of sub section Viola, pollination occurs as a result of **pollen tube penetrating** the wall of the undehisced **anther sac** and growing to the **stigmatic** cavity nearby.
- In other groups pollen is simply released in close proximity of the recurved style.



SOLITARY BEE POLLINATION

INHERITANCE OF FLOWER COLOUR

- In *V. tricolor* inbreed lines of distinct petal colours, such as white, **yellow**, orange, purplish red, purple were inter crossed.
- The hybrids(F_1) were self-pollinated and backcrossed.
- The lines with **yellow** petals showed **dominance**.



HERITABILITY AND GENETIC ADVANCE

- **Dominance effect** is applied to **most** of traits.
- **Additive effect** is applied to the plant **height** and **no. of flowers**.
- Additive epistatic effect applied to the plant size and thickness of the petals.
- Significant correlation (-) existed between the **flower size** and **flower no.**
- **No significant correlation** existed **between** the **flower size** and vegetative traits such as **Plant height, plant size, No. of branches** and single leaf area.

BREEDING OBJECTIVE

- Plant **vigour**
- Free flowering
- Large flower **size**
- Flower **number**
- Unique flower colour
- Temperature tolerance.



BREEDING METHODS

- Introduction
- Selection
- Hybridization
- Polyploidy
- Mutation
- Biotechnology- Tissue culture and Molecular breeding.

INTRODUCTION

Many varieties from different countries have been introduced to India by

- ✓ PAU, Ludhiana
- ✓ Division of Floriculture, IARI, New Delhi



PANSY VARIETIES INTRODUCED FROM DIFFERENT COUNTRIES

S. No	COUNTRY	VARIETIES
1	UK	Mid Night Blue, White Blue, Knight Blue, Dark Blue
2	USA	Swiss Giant, Swiss Orange, Coronation Gold
3	France	Ice Berg, Vilmorim, Zenith, Safari, Demon.
4	Australia	F ₁ hybrid Champion, F ₁ hybrid Majestic Giant
5	Canada	Sunny Boy, Clear Crystal Blend, Clear Crystal Light blue, Clear Crystal Scarlet.

SELECTION

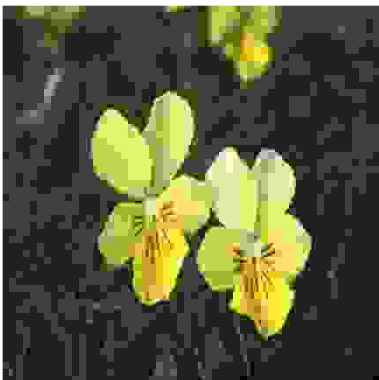
Some selection have been made in Pansy with **scented** and beautiful flower **colour**.

S. No	Variety	PARENTAGE	Characteristics
1	Carol	Chance seedling of <i>V. odorata</i>	Large and scented pink flowers
2	Carol Lockton	Chance seedling of <i>V. odorata</i> Opera	Large and scented flowers with distinct mid blue. Spur mauve.
3	Charles Winston Groves	Seedling of <i>V. odorata</i> Less Peachy Pink	Large white scented flowers, petals pointed at the tip.
4	Diana Groves	seedling of <i>V. Odorata</i> Clive Grove	Claret purple flowers, early bloom with best quality.
5	Ellie	seedling of <i>V. Odorata</i> Perky	Flowers medium size, scented, dusky pink, white margins on each petals.
6	Joyce Mary Paul	seedling of <i>Viola</i> Susan Chilcott	Strong scented, early blooming.
7	La Valade	Rosea	Flowers are single , white, splashed with pink.
8	Marie Rose	Seedling of <i>V. Odorata</i> Princess of Wales	Large, dark pink flowers.

S. No	Variety	PARENTAGE	Characteristics
9	Mulberry	Seedling of <i>V. Odorata</i>	Medium/ large, scented flowers, squashed mulberry fruit colour.
10	Parchment	Seedling of <i>V. Odorata</i>	Scented, dull purple flowers.
11	Roxy	Seedling of <i>V. Odorata</i>	Strongly scented, white flowers streaked with dark purple.
12	Susan chilcott	Seedling of <i>Viola</i> Governor Herrick	Lightly scented, large round violet colour.

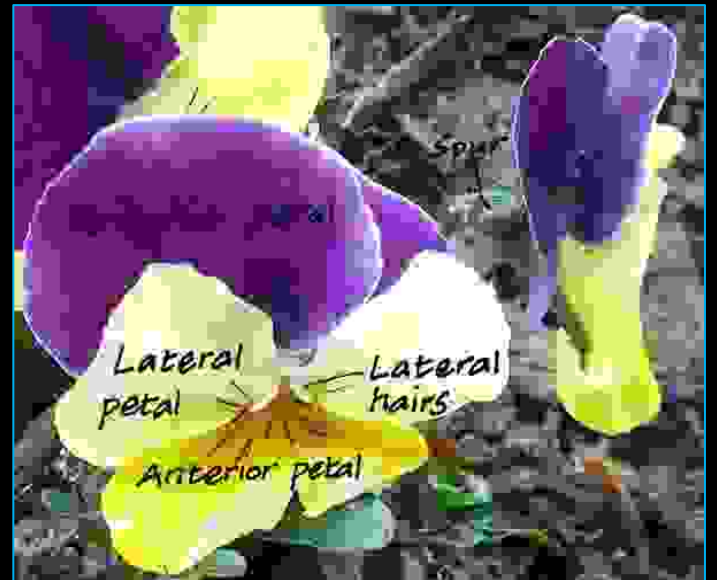
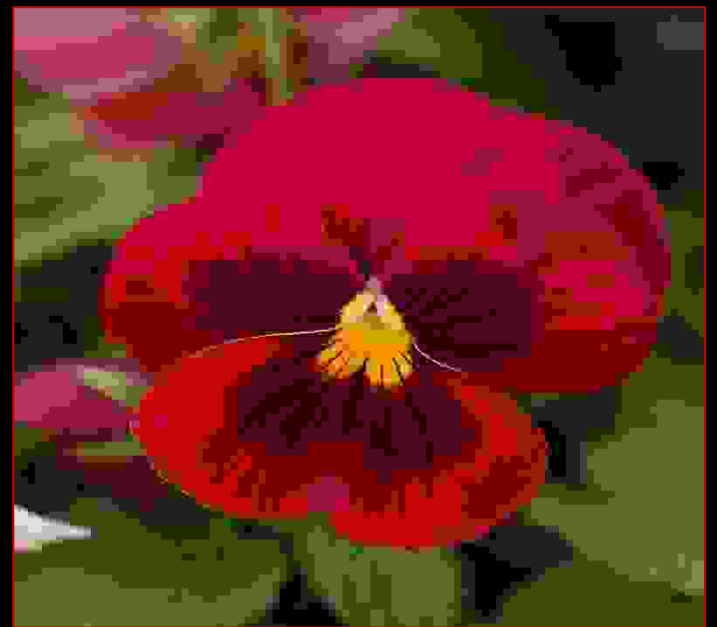
HYBRIDIZATION

- In the early 1800's Lord Gambier and his gardener William Thompson began crossing various species of *Viola*.
- *V. tricolor*, *V. lutea*, *V. altacea*.
- Hybridization was done to breed more **vigour** and flowers that had **no dark lines**.
- Two groups of Pansies - 1. **Clear** types have one solid colour
- 2. **Faced** multi-coloured





ANATOMY



HAND POLLINATION

- **Selection** of the male and female parent
- **Emasculation** is done in **female** flower
- Pollen grains are placed on a tweezers with sharp edge and pushed against the mucilage, spreading inside the stigmatic cavity.
- Stigma receptivity is high on the day of **anthesis** and declined to zero on fifth day.
- After **10-11** days flower wither.
- Capsule are harvested **20** days after pollination.
- **Varieties:** Alba minor, Gypsy moth, Kitten, Spider, Victoria's Blush
- Colour variations: Red, purple, blue, apricot, white, orange, yellow, pink and black.

POLYPLOIDY

- Chromosome no. of 18, populations of *Viola inconspicua blume* polyploidy complex were observed.
- The chromosome numbers of 4 populations were $2n=4x=24$ and
- 14 populations were $2n=8x=48$.



MUTATION

- Six var. (Pure yellow, Rose, Atlas red, Macular and Binge pure yellow) were **irradiated** at a dose of 300 Gy by ^{60}Co gamma-rays.
- The result shows that different varieties had different **blooming periods** and **floral traits** in M_1 ,
- **Blooming period** of Pure yellow, Rose blue and Atlas red were **later** than control.
- **Blooming** period of Macular and Binge pure yellow **earlier** than 10 days.
- Plant **height**, **corolla diameter**, and **pedicel length** of most var. **larger** than control.

SPORTS ALONG PARENTS AND CHARACTERS

S.No	SPORTS	PARENTS	CHARACTERISTICS
1	Lydia's Legacy	Lydia Groves (<i>Viola odorata</i>)	Scented, medium size, bright pink with purple blotch.
2	Poussieres d'Etoiles	Reid's crimson Carpet (<i>Viola odorata</i>)	Pink flowers, big size, waved petals.
3	Zampieri	Mrs. R. Barton (<i>Viola odorata</i>)	Lilac blue flowers, white centre, fragrant.
4	Dudine	Sport from Venice	Large blue flowers, strong perfume

TISSUE CULTURE

- The callus obtained from **hypocotyl** and **root segment** showed **differentiation** of roots,
- Callus derived from cotyledonary segment produced green translucent structures.
- *Viola partrinii* petiole explants were used for inducing Calli. Significant callus proliferation was observed on MS media supplemented with 16.12micro M NAA and 13.33 micro MBA.

MOLECULAR BREEDING

Inter- simple sequence repeat(IISR) molecular markers were used to characterize the inter and intra population genetic diversity.



INDIAN VARIETIES

Varieties developed by Punjab Agriculture University, Ludhiana:

✓ **Punjab Sunaina (2017) (Selection)**

Dwarf, purple-yellow colour flower, early variety suitable for bedding and pot plant.

✓ **Punjab Neelma (2007) (Selection)**

Purple colour flower, early type and suitable for bedding and pot plant.

✓ **Punjab Purple Wave (2013)**

✓ **Punjab Choco Gold (2013)**

EXOTIC VARIETIES

- **Accord series**-These pansies have **large blooms** on short, sturdy stems. There are eight single colors, both faced and clear, and a mix. **Abundant** blooms are produced on strong plants.
- **Lyric series**-Freedom of bloom and weather tolerance are two qualities of the Lyric series. It is available in five colors, all faced, or in a mix. It was bred in 1985.
- **Majestic Giant series**-This series has withstood the test of time e.g. Majestic Giant Mix and Majestic Giant White Face. The series has a free-flowering habit and stands up to heat and cold particularly well. There are six colors and a mix, all with faces.

- **Medallion series**-The pansies in the Medallion series have extra large flowers in six colors, and a mixture. All have the pansy face.
- **Swiss Giants**-Swiss Giant is an old-fashioned European pansy bred in Switzerland. The large flowers on long stems are good for cut flower bouquets. Many of today's hybrid varieties were developed from Swiss Giants.
- **Mariposa**-Colors and choices for multiple seasons. A hardy root system establishes in the garden quickly and enhances overwintering performance for repeat blooming in the spring.
- **Delta**- Delta is the original large-flowered pansy that set the world standard for series uniformity.
- **Colossus**- Colossus is the perfect solution for growers who face high **temperatures**.



THANK YOU