Cybrids

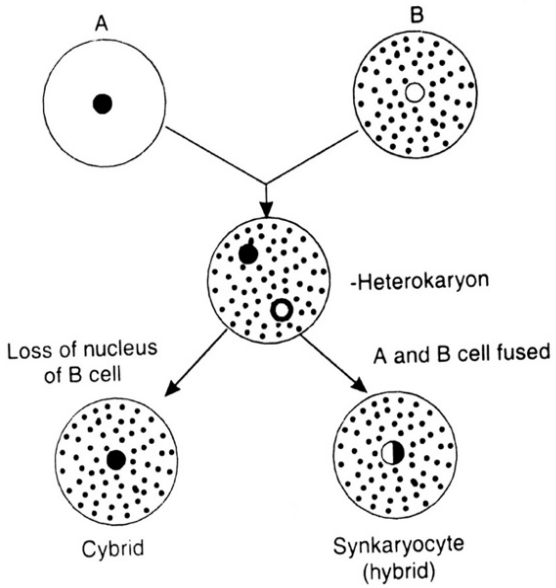
Somatic hybrids can be obtained where nucleus is derived from one parent and cytoplasm is derived from both the parents, thus resulting **cytoplasmic hybrids**, also called as **cybrids**.

Cybrids are cells or plants containing the nucleus of one species and cytoplasm of both parenteral species. These are generally produced during protoplast fusion in variable frequencies. Cybrid formation may result by fusion of normal protoplasts of one species with enucleated protoplasts (cytoplasm), elimination of the nucleus of one species from a normal heterokaryon, or gradual elimination of the chromosomes of one species from a hybrid cell during further mitotic division. The cybrids can be produced in high frequencies by irradiation of one parenteral protoplast before fusion in order to inactivate the nuclei or by preparing enucleate protoplasts of one species and fusing them with normal protoplasts of another species

Cybrids

- The cytoplasmic hybrids where the nucleus is derived from only one parent and the cytoplasm is derived from both the parents are referred to as cybrids.
- The phenomenon of formation of cybrids regarded as cybridization.
- Normally cybrids are produced when protoplast from two pythogenetically distinct species are fused.
- Genetically are hybrids only for cytoplasmic traits.

Procedure for successful somatic hybridization is as below: (i) isolation of protoplasts from suitable plants, **(ii)** mixing of protoplasts in centrifuge tube containing fusogenic chemicals i.e., chemicals promoting protoplast fusion, such as polyethylene glycol (PEG) (20%, W/V), sodium nitrate ($NaNO_3$), maintenance of high pH 10.5 and temperature 37°C (as a result of fusion of protoplasts viable heterokaryons are produced. PEG induces fusion of plant protoplasts and animal cells and produces **heterokaryon** **(iii)** wall regeneration by heterokaryotic cells, **(iv)** fusion of nuclei of heterokaryon to produce hybrid cells, **(v)** plating and production of colonies of hybrid cells, **(vi)** selection of hybrid, subculture and induction of organogenesis in the hybrid colonies, and **(vii)** transfer of mature plants from the regenerated callus.



Application of Cytoplasmic Hybridization:

- **Production of hybrid organisms:** Production of novel interspecific and intergeneric crosses between plants that are difficult or impossible to hybridize conventionally.

  Both interspecific and intergeneric hybrids can be acquired by somatic hybridization.

- **Overcomes sexual incompatibility barriers:** Somatic hybridization overcome the sexual incompatibility barriers during breeding or cross fertilization.
- **Somatic hybridization for gene transfer:**
- **For production of Disease resistance variety:** Many disease resistance genes viz. potato leaf roll virus, leaf blight, Verticillium, Phytophthora, etc. have been transferred

to *Solanum tuberosum* from other species where normal crossings would not be possible due to taxonomic or other barriers. Resistance to blackleg disease (*Phoma lingam*) has been found in *B*rassica *nigra*, *B*. *juncea* and *B*. *carinata*. And resistant hybrids have been developed after production of symmetric as well as asymmetric somatic hybrids between these gene donors and *B*. *napus* Resistance has been established in tomato against various diseases like TMV, spotted wilt virus, insect pests and also cold tolerance.

- **For production of Quality characters:** Somatic hybrids produced between *Brassica napus* and *Eruca sativa* were fertile and had low concentration of **erucic acid** content (Fahleson et al., 1993). Likewise, nicotine content character has been transferred to *N. tabacum*.
- **Transfer of Cytoplasmic male sterility:** Various agriculturally functional traits are cytoplasmically encoded, including some types of male sterility and certain antibiotic and herbicide resistance factors.
- **Production of resistant variety:** Resistance to antibiotics, herbicide as well as CMS has been introduced in so many cultivated species.
- **Production of auto-tetraploids:** Somatic hybridization can be used as an alternative to obtain tetraploids and, if this is unsuccessful, colchicine treatment can be used.

  Protoplasts of sexually sterile (haploid, triploid, aneuploid, etc.) plants can be fused to produce fertile diploids and polyploids.
- **To study cytoplasmic genes:** Somatic cell fusion is useful in the study of cytoplasmic genes and their activities. This information can be employed in plant breeding experiments.
- **Production of unique nuclear-cytoplasmic combinations**

Limitations of Somatic hybridization

- Poor regeneration of hybrid plants.
- Non-viability of fused products.
- Not successful in all plants.
- Production of unfavorable hybrids.
- Lack of an efficient method for selection of hybrids.
- No confirmation of expression of particular trait in somatic hybrids.

References

- www.biologydiscussion.com
- www.onlinebiologynotes.com
- Introduction to Plant Tissue Culture 3ED (PB 2019). M. K. Rajdan

[The information, including the figures will be used solely for academic purpose.]