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Selection and Breeding Methodology of Orchids

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Abstract**—** *For evolution of ecosystem, conservation of advanced organism is important. Orchids are one of the advanced plants. But most of the orchid species are endangered because of lack of endosperm, self - pollination inhibiting nature. Also, insects destroy orchid seeds unconscious for food. And so orchid breeding and conservation is important. Orchids are very much known for medicine, ornamentation along with devotional believes. In this chapter we have discussed about cross breeding, mutation breeding, selection breeding, molecular marker assisted breeding, polyploidy breeding and transgenic breeding.*

Keywords**—** ***Orchid Breeding, Orchid Cultivation, Orchid Selection and breeding Methodology, Dendrobium breeding***

I. INTRODUCTION

Orchid is one of the biggest family of angiosperms (monocotyledons). Flowering plants in the worldwide distribution, consisting of a 28000 species, subspecies 800 [1]. They are present throughout the world. Orchids plants have attractive flowers. They come in different colors and sizes. Orchids flowers have 3 petals. Most orchids blooms once a year. Flower usually remains 6 to 10 weeks. The flowers have secreted nectar. Orchids are believed to bring good luck, weath and prosperity. Orchids are suitable for indoor growth. Botanical and economical role of orchids in modern cultivation structures take part in use of horticulture and environments which increase with control of proper weather, especially temperature which permits the induction of flowering regardless of the time of year, specially aiming scheduled on the delivery of potted flower market. Seed plants of species 6-11%. The biggest genera are *Bulbophyllum* (2000), *Epidendrun* (1500), *Dendrobium* (1,000). The genera *Dendrobium, Gastrodia* and *Bletilla* used for medicinal and Chinese medicine purposes [2]. Additionally includes *vanilla* (The genus of vanilla plant)utilization of food purposes [3]. Because the creation of tropical species into cultivation in the 19th century, horticulturists produced greater than 100,000 hybrids and cultivars. Those are bilateral symmetry of the zygomorphism flower, many resupinate flowers, almost usually exceptionally modified petal, fused stamens and carpels and extremely small seeds. Commercial classification for orchids individually from botanical classification . In order to produce the most flowers from a given genus, interspecific crosses must be made. These crosses must involve species from the same genus as well as species from other genuses (intergenic hybrids). As an illustration, Doritis in crossings with Phalaenopsis result in the hybrid genus known as Doritaenopsis [4,5]. Phalaenopsis is another name for commercial hybrids. In plant families, it is feasible to produce such a large number of fertile progenies from very different morphologically distinct species and genera. Breeders incorporate many traits from single plants, the modern aspect of flower production as the advancement in breeding, the use of those identical commonly fertile hybrids, the development of generation of crosses, and the creation of new hybrids[6]. The hybridization process of early protocorm improvement and embryogenic growth in orchids. It has been hypothesised that in other species, loss of hybridization and hybrid seed absorption are linked to appropriate endosperm development or an imbalance between endosperm and embryo development. Moreover, embryo development occurs in the absence of the endosperm in the family of orchidaceae during zygotic embryogenesis [7]. One of an orchid's most valuable components, the zygomorphic flower has three sepals, two petals, a specific labellum, an appendage or a basal spur or nectary or not, and a gynostemium united by style and at the very least a portion of the androecium [8]. With an increase in trade volume, orchids, which are potted plants that don't produce as many flowers, are moving more widely throughout the market [9]. Orchids are employed in the pharmaceutical, food, and beverage industries for their polysaccharides, alkaloids, and other chemical components[10].

II. CROSS BREEDING

Among flowering plants, Orchidaceae family shows the majority of diversity. The family include more than 28000 Species, which shows numerous breeding strategy and attribute. *Acianthera aphthosa* has a character of self pollinating flowers, has fewer seeds missing embryos than cross pollinated flowers [11]. Each natural and artificial cross breed process combine the exceptional traits of the two parent in cross breed offspring. One of the earliest artificial orchids, Calanthe, was created from the cross-breeding of Calanthe masuca and Calanthe furcata and was first documented by Dominy in 1856. *Phaaenopsis inrermedia*, a hybrid of P. aphrodite and P. rosea that was originally described in 1853, is one of the natural hybrids. Cross breeding is easy cultivating method of orchids. While doing cross breeding, a number of factors, including the hybrid combination's fertility, the evaluation of the goal features, and the selection of better hybrid progeny, should be taken into account [13]. The F1 offspring of two parents often exhibits phenotypic variations, with one parent having long blooming time and tiny flowers in size, and the other having large flowers in size but short flowering time. For instance, lonmesa popcorn Flowers produced by Haruri are distinct from those of its parents [14,15]. A suitable nurturing strategy is needed after obtaining hybrid seeds to keep the population expanding. The in-vitro method of propagation is a crucial part of orchid breeding since orchid seeds are difficult to grow in their natural habitat. Seed age, culture conditions, and culture media all have an impact on how effective in-vitro propagation is. The genera Cymbidium, Phalaenopsis, Dendrobium, Oncidium, Dactylorhiza, and Calanthealliance contain a large number of orchid species [16,17]. Breeding cycle, improvements of the hybrid grex and and a shorting, the principle targets of in-vitro propagation, and considerable development has been made in achieving those objects.

III. MUTATION BREEDING

Many species of ornamental plant breeding process propagated easily, with the natural and artificial process. Several breeding process exhibit seeds to chemicals, radiations and enzymes [18,19]. Benefits of mutation individual traits [20]. Phenotypic trait of used the breeding process, content material and medicinal instruments. The common technique of mutation breeding is polyplodization. Ploidy breeding in this breeding process plants include two paired sets of chromosome are increased. Increases in cell size features that organs are vegetative and reproductive. Cymbium, Dendrobium, and Oncidium are only a few of the polyploidy breeding orchid species. Colchicine hybrids produce tetraploid plants with deeper stem colours, slower charge increases, thick leaves, roots, and rhizomes [21]. To increase the alkaloid concentration of medicinal Dendrobium generated by tissue culture, nitric oxide provider sodium nitroprusside was added to the protocorm of the hybrid Dendrobium huoshanensi plant. D. catenatum seedlings were more recently exposed to UV light, which led to an increase in the total amount of polysaccharides, flavonoids, alkaloids, and many significant secondary metabolisms [22]. Increase in orchid heterozygocity raises the apparent genetic variation and causes a rapid cycle of extraordinary mutation types. Nevertheless, random mutations in the genome might result in harmful changes, which are frequently acquired by the smallest single adjustments [23].

IV. SELECTION BREEDING

As the only source of material for the selective breeding process, natural variants of existing kinds are used [25]. Heritability, genetic correlations between phenotypes, and interactions between genotype and environment as well as by genetic material are the three basic genetic parameters. Hybridization, selection, and in vitro propagation were used to create the new Phalaenopsis cultivar "SM 333." Plant somaclonal mutation determined on lines screening, genetic characterization, tissue culture, and multifactor testing were used to create the new Oncidium variety "jinhui." Moreover, three lines of *Calanthe nipponica* with pure yellow sepals and petals were found during the area survey; nonetheless, the plant's typical colour is purple-brown. Since mutation is heritable, it would provide for excellent stock for selective breeding.

V. MARKER ASSISTED BREEDING

Using genotype-based selection rather than visible qualities, a plant is chosen using molecular markers. Use of molecular biotechnology in practical breeding and selection, advantages of speed and accuracy, and impact of environmental factors [28]. The following are relevant in terms of prevalence and potential among the numerous kinds of molecular markers available to scientists and breeders. Simple sequence repeats employed in breeding outcomes, RELP, AFLP, and SNP [29]. Cymbidium encifolium may be used with many orchid species for mapping investigations and genetic connection assessments. These marker types will aid in locating candidate genes with distinct functions in combination with the helpful annotations provided by unigenes. Papniopedium concolor root transcriptome sequencing has shed light on the process and the genes involved in root secondary metabolism [30,31]. SSR genes are critical for genetic modification breeding because they are connected to floral colour, shape, and resistance in Phalaenopsis. In order to assess the efficacy of predicting flower colour and aid in the breeding of the most recent phalaenopsis variants, the genetic diversity of distinct species of phalaenopsis was examined using gene specific single nucleotide amplified polymorphism markers [32]. In addition to providing an exceptional resource for improving the breeding performance of horticultural orchids, integrating the phalaenopsis genome with an SNP-based genetic linkage map and validating it through optical mapping has contributed significantly to studies on the difference genomics of epiphytes for future reference.

VI. POLYPLOIDY BREEDING

Polyploidy is defined as two or more sets of chromosomes and may occur naturally. The fundamental characteristic of plants, polyploidy is what allows for species adaptability, diversity, evolution, and development. [33]. Their evolutionary history all through polyploidy approximately 70% of angiosperms [34]. Duplication of genetic material the maximum frequency have been particularly discovered in domesticated plants in place of wild plants [64]. Chromosome duplication the angiosperm genome as minimum [35]. According to their origin polyploidy classified into autopolyploidy (increase in basic number of chromosome), alloploypoidy (The presence of more than two basic sets of distinct chromosomes indicates that two separate species have hybridised) [36,37]. Assumed that almost all of flowering plants are allopolyploidy [38,39]. Unique species variant genome presents and possibilities novel diversity, with the introduced benefit that gene excess may mask recessive deleterious alleles by dominant one [40]. In addition, the expression of genes essential for chromatid cohesion and meiosis can be enhanced, as discovered in the *Arabidopsis suecica* allopolyploidy [41]. More than three chromosome pairs used as cytological element to differentiate auto and allpolyploids. For example, multivalent pairing at metaphase can also additionally factor to homology between chromosome set and consequently (42). Although dissimilarity, bivalent formation is high at diakinesis from pairing between non-homologous parental chromosome sets, which may suggest alloploidy. Phalaenopsis micholitzi (with more than one little spike) and Phalaenopsis tetraspis are two species that are crossed during orchid breeding to improve cultivars with more than one spike (lengthy spikes). Tetralitz P.Tzu-Chiang grows five spikes. Tissue culture frequently causes hybrids to spontaneously become polyploid, although this process is tedious and requires repeated crossings to keep the progeny's developmental balance. Early artificial allopolyploid generations involved extensive restructuring of the combined genomes, including chromosomal rearrangements and changes to chromosome diversity, as well as epigenetic changes such as transposon activation, chromatin alterations, and altered methylation patterns. Actually, micronuclei in tetrads and chromosomal rearrangement are commonly seen in meiocytes of presumed orchid allopolyploids. These micronuclei human cancer cells and arise from hypomethylation in peri-centromeric DNA, poor organization of the spindle.

VII. TRANSGENIC BREEDING

A breeding method Genetically engineered transgenic plants to make plant a new characteristics, identified as a type of genetically modified organisms (GMO). Transgenic breeding method is time consuming, characters of plants and more useful traits at common sexual hybridization technique almost unsuitable. Molecular genetic technique to transform orchid biotechnology. Gene transformation systems associated with rapid selection and regeneration and technique for the production advanced diversity of orchids with proper characters. Experiment/study of transgenic orchids formation and developing of gene transformation procedure, with specific significance use of different selectable marker. A selectable marker gene present into cell, specially a bacterium cell in culture that characteristic appropriate for artificial selection. Some selectable marker used in transgenic breeding-aminoglycoside antibiotic resistance, herbicide resistance and other antibiotics, pathogen resistance, visual selection. Agrobacterium-mediated transformation, particle bombardment, pollen tube route, electrophoresis, and polyethylene glycol are examples of genetic transformation techniques. Technique of Agrobacterium- mediated and particle bombardment used in orchid breeding [29]. Orchid variations first reported in V*anda* [30] and *dendrobium* [31,32] mediated via particle. Powerful transformation structures have been established for a few commercial orchids, such as *Vanda* [33], *Cymbidium* [34], *Dendrobium* [35,36], *Cattleya* [37] and *Erycina pusilla* [38]. Using electrophoresis, Griesbach and Hammond (1993) inserted an anthocyanin synthesis gene into the powders of Doritis pulcherrima and acquired fleeting expression in flowers, which served as an alternative in the colour of the petals [39]. To create transgenic plants resistant to kanamycin, the bombardment approach was employed to introduce a plastid containing the NPTll and GUS marker genes into Cymbidium orchids [40] RAPD was then utilised to identify genes related to smell. With regard to floral characteristics, plant architecture, and biotic and abiotic tolerance, transgenic breeding technology is a crucial way of orchid cultivation [41,42].For many years, Orchidaceae family transgenic studies in first development and specially transgenic plants to the ornamental orchid genera such *as Cymbidium, Phalalaenopsis , Dendrobium* and *oncidium*. Agrobacterium mediated and particle bounded technique used whereas the ovary injection and pollen tube method pathway generally used.

VIII. CONCLUSION

Orchid breeding and production advance things to be a– manufacture of high variety clones by micropropagation. Breeding new varieties by application of biotechnology is important for conservation of those spesies. Essential gene development To produce extraordinary offspring with objective developments, substratum forward as well as reversed genetic, other traditional breeding, or molecular breeding are used. Each strategy has advantages and limitations, and if used alone will not speed up the breeding process. The use of polyploidization in orchid breeding is crucial to its success. As a result, it is necessary to combine a number of approaches and research concepts to enable the development of orchids with distinctive flower morphologies, innovative colours, and powerful floral aromas.

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