

# Establishing the influence of *Cymbidium* cultivars on the main characteristics and the correlation between them

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## Abstract

Orchids are among the most popular ornamental plants, with thousands of horticultural hybrids. The genus *Cymbidium* is especially valued for its refined elegance, impressive size, unique flower shapes, and distinctive colors, making it increasingly favored in both interior and exterior design. In this study, three *Cymbidium* cultivars were evaluated based on the number of pseudobulbs per plant, the number of inflorescences per plant, the number of floral buds on each inflorescence, and the correlations among these traits. Results showed that the average number of young and mature pseudobulbs per plant was highest in the 'Golden Yellow' variety (16.33 and 5.0 pseudobulbs, respectively), which plays a key role in orchid survival. Additionally, the 'Golden Yellow' cultivar proved to be the most productive, yielding the greatest number of flower spikes and a high count of floral buds per spike, whereas the 'Dusty Rose' variety produced fewer inflorescences and fewer flower buds.

**Keywords:** orchids, cultivars, morphological characteristics, correlation coefficients

## Introduction

For many flower enthusiasts, orchids embody the sublime, captivating with their remarkable diversity in terms of shape, size, fragrance, colors and disposition of the flowers [15]. Since ancient times, the Orchidaceae family has captivated and enchanted, with its allure growing stronger over the centuries and evoking emotions ranging from wonder and curiosity to admiration and passion [1].

Orchids belong to the botanical Orchidaceae family, encompassing approximately 899 genera and over 27,000 species [9; 19] and tens of thousands of cultivars [6].

Approximately 120 million years old, orchids have successfully spread across all continents and climate zones, adapting to a vast range of habitats. Today, this adaptability has made them the second most diverse plant family in the world [1]. Most orchids are native to forests and subtropical regions, with some species originating from temperate-maritime areas in Australia, North America, New Zealand, and Europe. This wide range of origins also accounts for the extensive diversity of orchid genera, species, varieties, cultivars, and hybrids [5]. Since the 20<sup>th</sup> century, an increasing number of new orchid species, unique forms, and artificial hybrids have emerged on the market [14].

Known since antiquity, orchids are also mentioned in the writings of Confucius (551-479 BC) as plants used to decorate interiors. The oldest evidence of their existence coming/comes from the prehistoric period (15-20 million years ago), represented by the pollen sac of an orchid stuck to a bee embedded in amber [7]. In one of his works, "*Historia Plantarum*" (History of Plants), written around the 3<sup>rd</sup> century BC. Theophrastus described a plant with two small ovoid tubers, which he called *orkhis* [4].

In Europe, the first tropical orchids arrived in the 16<sup>th</sup> century, being brought by explorers, traders, missionaries.

Today, in Romania, due to their good storage capacity as cut flowers and as potted plants the demand for orchids is high. Popular species include the *Cymbidium* genus, as well as *Phalaenopsis*, *Dendrobium*, and *Cattleya*, with the demand largely met by imported plants. The genus *Cymbidium* includes over 83 terrestrial or epiphytic species. The plant has persistent foliage, fleshy roots, pseudobulbs that vary in shape and size from one species to another [8].

The first *Cymbidium* orchid was brought to England from China by James Fothergill in 1778, and the first hybrid of this species was cultivated in 1889 [3]. It was not until the middle of the 19<sup>th</sup> century that *Cymbidium* orchids were cultivated on a large scale in Europe and especially in England. The greatest attention was directed to the species from India that had the larger flower, in 1878 the first hybrid of *C. lowianum* and *C. eburneum* was obtained [20]. Epiphytic species form ovoid formations, similar to bulbs, called pseudobulbs. Annually, these species produce a single new pseudobulb at the base of the old pseudobulb, from which the current flowering stem appears [13]. The pseudobulb is used as a storage organ for water, nutrients and minerals [17].

*Cymbidium* is a temperate greenhouse orchid, needing an average temperature of 20°C in the warm season and 13°C in the winter. The plant displays a clear diurnal thermoperiodism for floral induction, requiring temperature differences of 6-7°C between day and night over a period of 4-5 week/weeks [12]. The alternation between the cool night temperatures and the daytime warmth during the spring months in the regions mentioned above is essential for the bud formation in the inflorescences. The warm weather during the summer favors the development and evolution of the inflorescences, whose flowers will bloom in the cold season [11]. Excess moisture is harmful and leads to rotting of the pseudobulbs [16].

Since orchids have a particular impact in the flower market, researchers around the world have undertaken numerous scientific investigations and researches in physiology, biochemistry, genetics, ultrastructure, in order to know their biology and the ways in which their growth and productivity can be optimized. In our country only few/ a few studies are presented. This study comes to evaluate certain morpho-decorative characteristics of *Cymbidium* in order to enrich the assortment and promote some valuable cultivars on the floricultural market.

### Material and Method

The research was conducted at the Phytotron of the Horticultural Research Station, University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca.

The biological material consisted of three *Cymbidium* cultivars: "White Christmas" with white flowers, "Golden Yellow" with yellow flowers, and "Dusty Rose" with pink flowers. Observations were conducted on 15 plants per variant, arranged in three repetitions, totaling 45 plants. Only plants with viable flower formations were selected, focusing the study primarily on mature, flowering plants. The examined *Cymbidium* cultivars in this study are noted for their high vigor and productivity in terms of flowers count, with flowers exceeding 10 cm in diameter. The plants have sizable pseudobulbs, approximately 8-9 cm in height and 5-6 cm in diameter, encased in leaf sheaths.

The plants were placed in containers numbered 1 through 45. The soil mixture used included the following components: conifer bark 35%, sawdust 10%, peat 25%, perlite 20%, sedge 5%, river sand 5%. The observations and measurements involved evaluating the number of pseudobulbs per plant, the number of inflorescences per plant and the number of floral buds per inflorescence.

The primary focus of the study was on pseudobulbs, which play a critical role in the biology of these species. To this end, the pseudobulbs of each plant were measured at the end of the resting period over two years, recording both the count of young pseudobulbs and the total pseudobulbs per plant. In addition to examining relationships among vegetative organs, observations were made on their influence on floral organs. Floral characteristics were tracked to assess varietal productivity and understand the interrelationships among floral structures. Productivity was quantified through two variables: the number of inflorescences per bush (plant) and the number of flower buds per bush.

The collected data was statistically analyzed using the LSD test variance analysis and correlations among the studied characters were established using the Statistica 8 program [2]. Results were presented as mean values for each variant and compared to the experiment's overall mean, which served as the control.

### Results and Discussion

Table 1 shows the average values of the mature pseudobulbs, the differences between them as well as the significance compared to the control variant considered as the average of experience.

**Table 1. Average number of mature pseudobulbs/plant**

Cultivar	Average mature pseudobulbs/plant	Relative value (%)	± d	Significance of differences
<b>White Christmas</b>	2.67	72.7	-1.00	0
<b>Golden Yellow</b>	5.00	136.4	1.33	*
<b>Dusty Rose</b>	3.33	90.9	-0.33	-
<b>Average of experience</b>	3.67	100.0	-	Control
LSD (p 5%)				0.93
LSD (p 1%)				1.53
LSD (p 0.1%)				2.87

An analysis of Table 1 reveals that the cultivar "Golden Yellow" proved to be the most vigorous, forming bushes with the highest value of mature flowering individuals. This can lead to high productivity (5 pseudobulbs), the difference being significantly positive compared to the average of the experience, considered as a control. Of medium vigor is the pink cultivar "Dusty Roze" which did not register any statistical differences and the least vigorous turned out to be the white form, which with an average of 2.67 mature pseudobulbs/bush registered significant negative differences compared to control of experience.

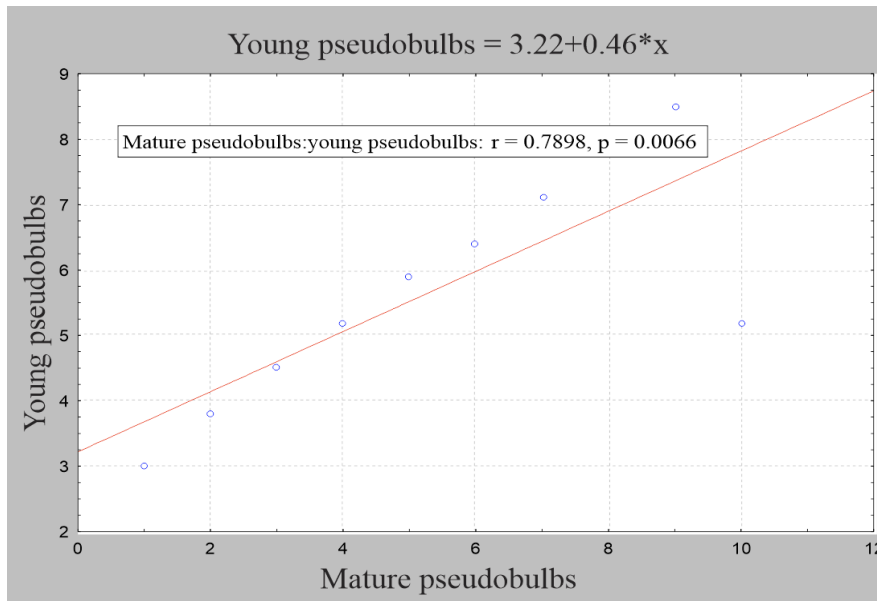
The previously presented characteristics are also reflected by the vigor of the three varieties, depending on the number of young, unformed pseudobulbs per bush (Table 2). So, the data in table 2 show that, in terms of the size and vigor of the vegetative apparatus of these forms taken in the study, the form with yellow flower has the greatest vigor, producing the richest bushes. This is also evidenced by the average number of mature pseudobulbs/bush (5.0 pseudobulbs) as well as the number of young pseudobulbs (16.33 pseudobulbs). These characteristics can lead to a high productivity of this form expressed by a large number of flowering neoformations/larger bush, which can be an unfavorable aspect because the edaphic space can be depleted more quickly. The most effective method to avoid this is to subject the plants to a biological rest in order to favor the formation of flowering stems at the expense of vegetative ones. Regarding the number of young pseudobulbs/plant, the lowest value was recorded in the case of orchids with pink flowers "Dusty Roze" where the differences were very significantly negative compared to the control variant.

**Table 2. Average number of young pseudobulbs/plant**

Cultivar	Average young pseudobulbs/plant	Relative value (%)	± d	Significance of differences
<b>White Christmas</b>	12.33	105.7	0.67	-
<b>Golden Yellow</b>	16.33	140.0	4.67	***
<b>Dusty Rose</b>	6.33	54.3	-5.33	000
<b>Average of experience</b>	11.67	100.0	-	Control
LSD (p 5%)				1.33
LSD (p 1%)				2.12
LSD (p 0.1%)				3.71

***The correlation between the count of mature and young pseudobulbs***

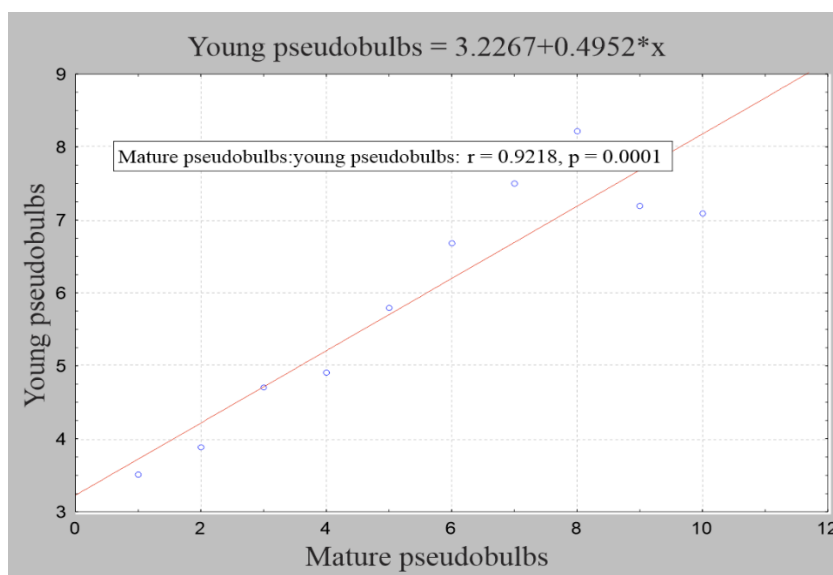
The aspect of the relationship between the number of mature pseudobulbs and the number of young pseudobulbs was established using correlation coefficients. Thus, the extent to which the number of mature pseudobulbs influences plant prolificacy through the appearance of young pseudobulbs was determined. These aspects are highlighted in the following figures.



**Figure 1. The correlation between the number of mature and young pseudobulbs, in cultivars `White Christmas`**

Figure 1 reflects the relationship between the two variables in the cultivar with white flowers "White Christmas". From the obtained results it can be observed that the number of young pseudobulbs differs substantially depending on the number of mature pseudobulbs. The value of the correlation coefficient is 0.7898, which shows us that there is a high positive correlation between the number of mature pseudobulbs and the number of young pseudobulbs.

Figure 2 further demonstrates that there is a high degree of correlation between the two variables and the decrease above a certain value in the number of young pseudobulbs can be explained by the fact that due to the prolificacy of mature pseudobulbs, the plant nutrition space is reduced.



**Figure 2. The correlation between the number of mature and young pseudobulbs, in cultivars `Golden Yellow`**

A particular case was the cultivar with pink flowers “Dusty Rose”, which, due to the small number of mature pseudobulbs on the bush, did not suffer from the lack of nutrient space. As seen in Figure 3, the low vigor of these plants refers only to the prolificacy of the pseudobulbs and not to their dimensions, which are obviously inversely proportional to their number.

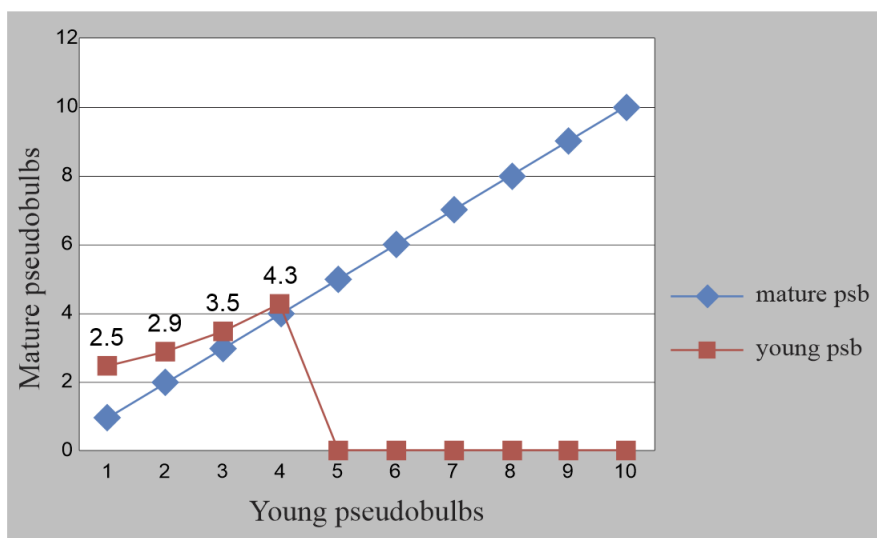


Figure 3. The number of mature pseudobulbs in relation to young ones in cultivar ‘Dusty Rose’

The results align with those reported by [10], which highlighted the crucial role of pseudobulbs in orchid survival. Additionally, literature reviews of studies [18] indicate that orchid pseudobulbs participate in numerous physiological processes essential for growth and survival.

**Results on the qualitative characteristics of Cymbidium orchids**

Only a portion of the total mature pseudobulbs produce annual inflorescences, influenced by various factors, with nutrient availability being the most significant. It is rare for all mature pseudobulbs on a single bush to generate flower buds within the same year [15]. Table 3 highlights that the highest number of inflorescences was recorded for the cultivar with white flowers “White Christmas” where the differences compared to the control were significantly positive followed by the cultivar with yellow flowers “Golden Yellow”, only that in this case the differences from the average were not statistically ensured.

Table 3. Number of inflorescences per plant (bush)

Cultivar	No. inflorescence/ plant	Relative value (%)	± d	Significance of differences
White Christmas	3.33	136.4	0.89	*
Golden Yellow	2.33	95.5	-0.11	-
Dusty Rose	1.67	68.2	-0.78	0
Average of experience	2.44	100.0	-	Control
LSD (p 5%)				0.76
LSD (p 1%)				1.25
LSD (p 0.1%)				2.34

From the data presented in table 4, it can be concluded that the cultivar "White Christmas" stands out not only for the large number of inflorescences but also for the number of buds on the floral stem (24 pcs.), the results being statistically ensured leading to very significant meanings positive. The "Dusty Rose" cultivar is located at the opposite pole producing a reduced number of spikes and a reduced number of floral buds, the differences being very significantly negative compared to the average of the experience considered as control, behaving unsatisfactory/unsatisfactorily in the experimental conditions.

**Table 4. Number of flower buds on the inflorescence**

Cultivar	No. of buds\ inflorescence	Relative value (%)	± d	Significance of differences
White Christmas	24.00	153.2	8.33	***
Golden Yellow	19.67	125.5	4.00	*
Dusty Rose	3.33	21.3	-12.33	000
Average of experience	15.67	100.0	-	Control
LSD (p 5%)				2.45
LSD (p 1%)				4.06
LSD (p 0.1%)				7.59

### Conclusion

In summary, our results reveal that:

The higher number of pseudobulbs observed in the “Golden Yellow” cultivar significantly contributes to orchid survival, as these structures serve as vital water and nutrient storage organs. This increased pseudobulb count provides an effective reservoir, helping protect these plants from both short- and long-term water shortages.

In terms of inflorescence and flower bud counts, the “White Christmas” and “Golden Yellow” cultivars showed the highest numbers, which is notable as *Cymbidium* orchids are renowned for their striking flower spikes.

Future research should therefore concentrate on detailed studies of the morpho-decorative traits across a broader range of orchid varieties to support and promote valuable cultivars among producers in our country.

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