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**Original Research Article**

# Genetic Variability and Heritability Studies in *Alstroemeria*

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**Keywords**

Alstroemeria, Cultivar, Heritibility, Coefficient, Variability

**A B S T R A C T**

Eight cultivars of Alstroemeri were evaluated to determine the correlation, Variability and Heritability studies (Broad sense) as mean percent of 12 characters. Significant variations were observed for all the characters studied. Phenotypic and genotypic coefficients of variation were highest for the days taken to sprout followed by spike fresh weight, spike fresh weight loss, days taken from bud to flower and water uptake indicate sufficient genetic variability for selection in these traits. High heritability estimates for the characters days taken for maximum bud to open, days taken for first bud to open, number of cymes per spike, stalk diameter, vase life and peduncle length.

## Introduction

*Alstroemeria hybrids* which is commonly known as Alstroemeria or as lily of the Incas or Peruvian lily belongs to the family Alstroemeriaceae, which bears flowers of attractive colour and an extended shelf life. It is used for cut flowers or as potted or garden plants (Bridgen, 1997). It is an indigenous to South America (De Hertogh, 1989 and Robinson, 1983). Almost all of the species of *Alstroemeria* origins are restricted to one of two distinct centres of diversity, one in central Chile, the other in eastern Brazil. Species of *Alstroemeria* from Chile are winter-growing plants while those of Brazil are summer-growing. The flowers are available in numerous colors like yellow, orange, pink through scarlet to purple and violet (Norbaek *et al*., 1996). It is introduced in India as a new cut flower crop and has gaining popularity in markets having a long stem flowers, prolonged vase life and various colour.

The genus comprises numerous species which are cultivated as ornamental cut, garden and pot flowers (Bond and Alderson, 1993). Now days this plant is considered one of the most important and popular cut flowers globally for its beautiful and durable flowers (Khaleghi *et al*., 2008) crop improvement is the need of the time to sustain the availability of desirable cultivars. Improvement through selection depends upon the variability existing in the available genotypes, which may be either due to different genetic constitution of cultivars or variations in the growing environments. The immense genetic variation present in the genus *Alstroemeria* offers wide range of variation in colour and ornamental properties which increases the economic importance of cut flower. In many countries the international demand for *Alstroemeria* flowers has also expanded and it has become one of the most important commercial cut flower for presentation and interior decoration. However, there exists

variability in terms of plant height, flower yield, colour, and adaptability which largely influence the acceptability and market demand. In addition to genotypic factors, the morphological character of *Alstroemeria* like all other flowering plants are directly or indirectly influenced by the environmental factors like temperature, humidity, wind, soil type etc. and all the varieties responses differently. It is essential for plant breeders to estimate the type of variation available in the germplasm. The type of breeding programme for developing suitable varieties depends largely on the availability of genetic variability in a given species. Heritability estimated, gave a measure of transmission of characters from one generation to the other, as consistency in the performance of the selection depends on the heritable portion of the variability (Falconer, 1981). Thus, the variation and the estimates of the heritability and genetic advance are the important parameters on which the success of selection lies. With this background in view, the present study was undertaken to assess and estimate the magnitude and nature of variation among 8 genotypes of *Alstroemeria* hybrid with respect to various vegetative and flowering attributes which could be utilized in crop improvement programme.

## Materials and Methods

The experiment was carried out on eight cultivars of Alstroemeriaviz, Rosita (V1), Picanto (V2), New Pink (V3), Tiara (V4), Reena (V5), Aladdin (V6), Unknown (V7), Lemon (V8) at Sribadam west Sikkim under poly house conditions. Plants were planted in raised bed of 30 cm and 1 m width and length of 6 m at spacing of 50×50 under completely randomized system with 4 replications. The recommended package of practices was followed evenly for all cultivars. Twenty plants from each eight cultivars were selected randomly from net plot and were tagged for recording the observations. The average was worked out and results were used to study genetic parameters on various vegetative growth, flowering and vase life. Parameters of variability and Heritability in broad sense were calculated as per formula given by Burton and Devane (1953).

## Results and Discussions

Results in Table 1 indicated a considerable range of variation with respect to Phenotypic, Genotypic coefficient of variation among different *Alstromeria* cultivars. The range was maximum in case of spike length while minimum in case of peduncle length and spike fresh weight loss.

The study revealed that, the estimates of Phenotypic Coefficient of Variation (PCV) were higher than their corresponding values of Genotypic Coefficient of Variation (GCV) for days taken to sprout (PCV=46.62, GCV=42.66) followed by spike fresh weight (PCV= 37.26, GCV=25.61), spike fresh weight loss (PCV=35.83, GCV=34.74) and days taken from bud to flower (PCV=25.24, GCV=23.85), water uptake (PCV=25.71, GCV=20.11) indicating high variation in these characters, predicting greater scope for improvement of these characters.

The estimates of heritability in broad sense give a measure of transmission of characters from one generation to another, thus giving an idea of heritable portion of variability and enabling the plant breeder in isolating the elite selection in the crop. The estimates of heritability in broad sense specifying the heritable portion of total variation, helps in identification of the appropriate characters for selection. High estimates of heritability were recorded for days taken for maximum bud to open, days taken for first bud to open, number of cymes per spike, stalk diameter, vase life and peduncle length.

**Table.1** Range, grand mean, phenotypic variance, genetic variance, phenotypic co-efficient of variance, genotypic co-efficient of variance and heritability different *Alstroemeria* cultivars

| Parameter | Range | Grand mean | Phenotypic variance | Genetic variance | Phenotypic co-efficient of variance | Genotypic co-efficient of variance | Heritability |
|---|---|---|---|---|---|---|---|
| Days taken for rhizome to sprout | 11.85-27.85 | 17.16 | 64.02 | 53.59 | 46.62 | 42.66 | 11.43 |
| No of leaves per plant at bud emergence | 20.5-26.5 | 23.03 | 9.07 | 3.76 | 13.07 | 8.41 | 21.37 |
| No of leaves per plant at flowering stage | 27.13-38.48 | 32.73 | 21.24 | 16.70 | 14.08 | 12.48 | 19.23 |
| Spike length | 80.50-138.50 | 100.85 | 495.22 | 395.04 | 22.06 | 19.70 | 4.01 |
| Stalk diameter | 5.73-8.83 | 6.66 | 1.14 | 0.92 | 16.03 | 14.40 | 84.13 |
| Peduncle length | 3.48-7.13 | 5.10 | 1.67 | 1.32 | 25.33 | 22.52 | 68.79 |
| Days taken for bud emergence | 61.10-78.10 | 70.33 | 75.31 | 51.07 | 12.33 | 10.16 | 9.48 |
| Days taken from bud to flower | 12.60-24.60 | 19.09 | 23.23 | 20.73 | 25.24 | 23.85 | 19.54 |
| No of cymes per spike | 4.05-6.28 | 5.22 | 0.87 | 0.54 | 17.86 | 14.07 | 84.46 |
| No of florets per spike | 7.73-13.79 | 10.60 | 5.67 | 2.61 | 22.46 | 15.24 | 28.49 |
| Days taken for first floret to open | 3.68-5.43 | 4.31 | 0.57 | 0.33 | 17.51 | 13.32 | 100.78 |
| Days taken for maximum florets to open | 5.45-7.48 | 6.12 | 0.58 | 0.39 | 12.44 | 10.20 | 107.67 |

**Table.2** Phenotypic correlation co-efficient between different characters in selected cultivars of *Alstroemeria*

| Pearson's r | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 |
|---|---|---|---|---|---|---|---|---|---|
| X1 | - | -0.196 | -0.365 | -0.461 | 0.010 | -0.775* | -0.400 | -0.543 | -0.344 |
| X2 | -0.196 | - | -0.225 | -0.110 | -0.625 | 0.258 | -0.006 | 0.030 | -0.080 |
| X3 | -0.365 | -0.225 | - | 0.942 | 0.694 | 0.234 | 0.672 | 0.793* | 0.825* |
| X4 | -0.461 | -0.110 | 0.942** | - | 0.665 | 0.295 | 0.782* | 0.881** | 0.818 |
| X5 | 0.010 | -0.625 | 0.694 | 0.665 | - | 0.028 | 0.667 | 0.652 | 0.688 |
| X6 | -0.775* | 0.258 | 0.234 | 0.295 | 0.028 | - | 0.529 | 0.370 | 0.088 |
| X7 | -0.400 | -0.006 | 0.672 | 0.782* | 0.667 | 0.529 | - | 0.848** | 0.622 |
| X8 | -0.543 | 0.030 | 0.793* | 0.881* | 0.652 | 0.370 | 0.848** | - | 0.913 |
| X9 | -0.344 | -0.080 | 0.825* | 0.818* | 0.688 | 0.088 | 0.622 | 0.913** | - |
| X10 | 0.029 | 0.159 | 0.444 | 0.602 | 0.290 | -0.316 | 0.469 | 0.576 | 0.538 |
| X11 | 0.205 | 0.004 | -0.118 | -0.137 | -0.245 | -0.412 | -0.092 | -0.131 | -0.150 |
| X12 | 0.458 | 0.261 | -0.329 | -0.318 | -0.344 | -0.434 | -0.100 | -0.256 | -0.296 |
| X13 | -0.281 | -0.572 | 0.338 | 0.368 | 0.778* | 0.432 | 0.591 | 0.479 | 0.368 |
| X14 | -0.018 | -0.752* | 0.579 | 0.537 | 0.958** | 0.064 | 0.618 | 0.546 | 0.545 |
| X15 | 0.315 | -0.016 | -0.542 | -0.572 | -0.068 | -0.039 | -0.383 | -0.394 | -0.288 |
| X16 | -0.465 | -0.203 | 0.584 | 0.637 | 0.715* | 0.310 | 0.756 | 0.889** | 0.820* |
| X17 | -0.424 | -0.604 | 0.288 | 0.139 | 0.441 | 0.420 | 0.223 | 0.235 | 0.230 |

Where X1 = Days for rhizome to sprout; X2 = Day to flower bud emergence; X3 = No. of leaves at flower bud emergence; X4 = No. leaves at harvesting stage; X5 = Stalk diameter; X6 = Spike length; X7 = Peduncle length; X8 = No. of cymes; X9 = No. of florets; X10 = Days from flower bud emergence to flowering; X11 = Day for one floret to open; X12 = Days for maximum floret to open; X13 = Total number of florets opened; X14 = Fresh weight; X15 = Fresh weight loss; X16 = Water uptake; X17 = Vase life

*.Correlation is significant at the 0.05 level; **.Correlation is significant at the 0.01 level

| Pearson's r | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|
| X1 | 0.029 | 0.205 | 0.458 | -0.281 | -0.018 | 0.315 | -0.465 | -0.424 |
| X2 | 0.159 | 0.004 | 0.261 | -0.572 | -0.752 | -0.016 | -0.203 | -0.604 |
| X3 | 0.444 | -0.118 | -0.329 | 0.338 | 0.579 | -0.542 | 0.584 | 0.288 |
| X4 | 0.602 | -0.137 | -0.318 | 0.368 | 0.537 | -0.572 | 0.637 | 0.139 |
| X5 | 0.290 | -0.245 | -0.344 | 0.778* | 0.958** | -0.068 | 0.715* | 0.441 |
| X6 | -0.316 | -0.412 | -0.434 | 0.432 | 0.064 | -0.039 | 0.310 | 0.420 |
| X7 | 0.469 | -0.092 | -0.100 | 0.591 | 0.618 | -0.383 | 0.756* | 0.223 |
| X8 | 0.576 | -0.131 | -0.256 | 0.479 | 0.546 | -0.394 | 0.889 | 0.235 |
| X9 | 0.538 | -0.150 | -0.296 | 0.368 | 0.545 | -0.288 | 0.820 | 0.230 |
| X10 | - | 0.420 | 0.391 | -0.165 | 0.162 | -0.629 | 0.366 | -0.470 |
| X11 | 0.420 | - | 0.880** | -0.472 | -0.124 | -0.654 | -0.071 | -0.132 |
| X12 | 0.391 | 0.880** | - | -0.558 | -0.277 | -0.393 | -0.220 | -0.416 |
| X13 | -0.165 | -0.472 | -0.558 | - | 0.842** | 0.238 | 0.683 | 0.690 |
| X14 | 0.162 | -0.124 | -0.277 | 0.842** | - | -0.086 | 0.707* | 0.609 |
| X15 | -0.629 | -0.654 | -0.393 | 0.238 | -0.086 | - | -0.189 | 0.032 |
| X16 | 0.366 | -0.071 | -0.220 | 0.683 | 0.707* | -0.189 | - | 0.512 |
| X17 | -0.470 | -0.132 | -0.416 | 0.690 | 0.609 | 0.032 | 0.512 | - |

Where X1 = Days for rhizome to sprout; X2 = Day to flower bud emergence; X3 = No. of leaves at flower bud emergence; X4 = No. leaves at harvesting stage; X5 = Stalk diameter; X6 = Spike length; X7 = Peduncle length; X8 = No. of cymes; X9 = No. of florets; X10 = Days from flower bud emergence to flowering; X11 = Day for one floret to open; X12 = Days for maximum floret to open; X13 = Total number of florets opened; X14 = Fresh weight; X15 = Fresh weight loss; X16 = Water uptake; X17 = Vase life

*.Correlation is significant at the 0.05 level; **.Correlation is significant at the 0.01 level

The data presented in Table 2. High and significant correlation were observed among the traits, this is indicative of strong inheritance association in among the different characters studied hence it can be taken into consideration for improvement. There was highly positive correlation among number of leaves at bud emergence, number of leaves at flowering stage, number of florets and number of cymes. Highly positive correlation was observed between spike fresh weight and stalk diameter were

also recorded to be positively correlated with stalk diameter, total florets opened per spike and water uptake. Stalk diameter was found to be highly positive correlation with spike fresh weight, water uptake and total florets opened per spike. Highly positive correlation was observed between water uptake, stalk diameter, peduncle length, number of cymes per spike and number of florets. Number of cymes per spike was found to be highly positive correlation with number of leaves per plant at bud emergence, peduncle length, number of leaves per plant at flowering stage, number of florets and water uptake.

It is concluded, in the present study there is the huge chance of improvement as there is sufficient variability, high heritability in most of the traits of *Alstroemeria*, beside significant strong positive correlation among the different traits were also exhibited in present cultivars might therefore be effective for crop improvement.

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