

SEED SET STUDIES USING DIFFERENT POLLINATION METHODS IN CHINA ASTER [*CALLISTEPHUS CHINENSIS* (L.) NEES]

S. S. BHONDAVE*¹, M. S. PATIL¹, A. R. KARALE¹ AND S. M. KATWATE²

¹Department of Horticulture, College of Agriculture, Pune - 411 005, INDIA

²Geneticist, AICRP on floriculture, Ganeshkhind, Pune - 411 005, INDIA

e-mail: sbhondave77@gmail.com

KEYWORDS

Seed setting
China aster
Seed germination
Pollination method

Received on :

08.02.2016

Accepted on :

29.07.2016

*Corresponding author

ABSTRACT

Present investigation was conducted in Modibaug farm, College of Horticulture, Pune during 2014-2015. The experiments involved three pollination methods viz., open pollination, close planting and bagging and hand emasculatation and pollination. The results revealed that average number of seeds per crossed flower and seed yield per plant was maximum in open pollination method (180.50 and 9.87 g respectively) while minimum in hand emasculatation and pollination methods (64.78 and 4.77 g respectively). Weight of 1000 seeds (2.59g) and seed germination percentage (80.90 %) was significantly maximum in hand emasculatation and pollination method. The seed setting characters were recorded from interaction effect between genotype Phule Ganesh Pink with different pollination methods. Finally it concluded that Phule Ganesh Pink and open pollination method is suitable for mixed seed production and close planting and bagging method of crossing is used for pure seed production. The cultivar Phule Ganesh Pink is more compatible than other cultivar.

INTRODUCTION

China aster (*Callistephus chinensis* (L.) Nees) an annual self pollinated flower crop (North 1979; Watts 1980) belonging to Asteraceae family and it is native to China (Navalinskien et al., 2005). It is widely cultivated owing to its wide spectrum of attractive colours and comparatively longer vase life (Chaitra and Patil, 2007). In Maharashtra, total area under floriculture is 22,000 ha. Among this area under China aster is 1,020 ha with production of 800 million tonnes (Annon, 2013). There is tremendous scope for seed production of open pollinated variety and F₁ hybrids of seasonal flowers. China aster is geitonogamous flower crop. Occasional cross pollination occurs through insects (Watts, 1980). An outcome in successful pollination is good amount of viable seed set. The maximum number of seeds per flower depends on number of ray florets per flower (Strube, 1965 and Janakiram et al., 1997). Meagre work has been done concerning the seed set studies because it is very laborious and time consuming. To make the seed production more successful, it is necessary to have information on floral biology, mode of pollination and their effect on seed set. There is limited information available about crossing technique for flower seed setting. Considering the importance of crop, present investigation was carried out to study the compatibility among different varieties, to find out suitable breeding technique for efficient seed set.

MATERIALS AND METHODS

The field experiment was conducted during *rabi* season of 2014-15 at Modibaug farm, College of Horticulture, Pune.

The experiment was laid out in a factorial randomized block design with three treatment combinations and five replications. An experiment consisted of four cultivars viz. Phule Ganesh Pink (V₁), Phule Ganesh Purple (V₂), Phule Ganesh Violet (V₃) and Phule Ganesh White (V₄). Different methods of pollination viz. open pollination (M₁), close planting and bagging method (M₂) and hand emasculatation and pollination method (M₃) were tried and their effectiveness was ascertained on the basis of seed set. Seed were sown in the nursery bed on August 26 and transplanting was done in 26 September 2014. All the recommended package of practices were followed. Biometrical observations were recorded on five randomly selected and labeled plants from each block on six distinct morphological characters. Seed yield per plant was computed by multiplication of number of flower per plant and number of seed per crossed flower. The data on different parameters were statistically analysed for ANOVA was followed as per the method described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The outcome of the investigation revealed that the mean performance of four varieties were assessed and crossed in different pollination methods and found significant variation among morphological characters is presented in Table 1.

Effect of varieties

The seed setting differed significantly among the genotypes. The number of seeds per crossed flower was significantly maximum in genotype Phule Ganesh Pink (142.49) followed by Phule Ganesh White (133.06), Phule Ganesh Violet (129.28). The minimum number of seeds was recorded in

Table 1 : Seed setting character in China aster genotypes, pollination methods and their cross combination

Treatments	Avg. number of seeds per crossed flower	Weight of 1000 seeds (g)	Seed germination percentage (%)	Average number of flower per plant	Seed yield per plant (g)
Variety (V)					
V ₁	142.49	1.80	72.77	21.94	5.65
V ₂	116.84	1.90	68.53	32.07	6.43
V ₃	129.28	2.12	63.49	35.74	8.03
V ₄	133.06	1.74	58.68	26.52	6.17
S.E. ±	1.98	0.05	0.39	1.78	0.12
C.D. @ 5%	5.69	0.15	1.12	5.12	0.33
Pollination method (M)					
M ₁	180.50	1.87	62.18	29.15	9.87
M ₂	145.98	1.21	54.53	29.11	5.07
M ₃	64.78	2.59	80.90	28.94	4.77
S.E. ±	1.71	0.05	0.33	1.54	0.10
C.D. @ 5%	4.93	0.13	0.97	NS	0.29
Interaction effect (V x M)					
V ₁ M ₁	181.78	1.92	80.01	21.88	7.57
V ₁ M ₂	150.19	1.17	58.31	21.92	3.94
V ₁ M ₃	95.52	2.32	80.00	22.01	5.43
V ₂ M ₁	157.76	1.90	59.99	32.00	9.65
V ₂ M ₂	142.38	1.15	65.28	32.31	5.45
V ₂ M ₃	50.37	2.65	80.32	31.89	4.19
V ₃ M ₁	173.02	1.93	64.43	35.89	11.60
V ₃ M ₂	147.94	1.56	44.45	35.74	6.26
V ₃ M ₃	66.88	2.87	81.60	35.59	6.24
V ₄ M ₁	209.42	1.73	44.32	26.84	10.67
V ₄ M ₂	143.42	0.95	50.05	26.45	4.62
V ₄ M ₃	46.35	2.53	81.68	26.28	3.22
S.E. ±	3.42	0.09	0.67	3.08	0.20
C.D. @ 5%	9.85	0.26	1.94	NS	0.58

Where, V₁ - Phule Ganesh Pink; V₂ - Phule Ganesh Purple, V₃ - Phule Ganesh Violet; V₄ - Phule Ganesh White, M₁ - Open pollination method, M₂ - Close planting and bagging, M₃ - Hand emasculatation and pollination, NS - Non significant, S. E. ± Standard error of mean, C. D. - Critical difference

genotype Phule Ganesh Purple (116.84). Similar result was obtained by Khangjarkpam *et al.* (2014) in China aster. The maximum weight of 1000 seeds was recorded in Phule Ganesh Violet (2.12 g) and significantly superior over all other genotypes while minimum weight was recorded in Phule Ganesh White (1.74g). These result was similar with Venu devan *et al.* (2011) in glory lily. The higher seed germination percentage was noted in Phule Ganesh Pink (72.77 %) which was at par with other genotypes while lower in Phule Ganesh White (58.68 %). Similar result were reported by Ravi kumar (2002) and Shantappa *et al.* (2004) in China aster, who reported maximum germination percentage was recorded in cv. Phule Ganesh White (65.23 %) while minimum in cv. Phule Ganesh Pink (60.88 %). The significantly maximum number of flower per plant and seed yield per plant was observed in Phule Ganesh Purple (35.74 and 8.03 g, respectively) which was at par with other genotype while minimum in Phule Ganesh Pink (21.94 and 5.65 g, respectively). Similar findings were recorded by Khangjarkpam *et al.* (2014) in China aster.

Effect of pollination methods

Among pollination methods maximum numbers of seeds per crossed flower (180.50) was recorded in open pollination method which was significantly higher than that of close planting and bagging and hand emasculatation and pollination methods (145.98 and 64.78, respectively). The results are in

conformity with the result of Dalbato *et al.* (2013) in pansies and Goodwilline (1999) in *Linanthus parviflorus*. Kumar and Lenin (2000); Prasad *et al.* (1989) found highest seed yield of *Brassica juncea* in open pollinated pods. Goswami and Khan observed that highest percentage pod set was in open pollination (83.42%) method. The maximum weight of 1000 seeds (2.59 g) was recorded in hand emasculatation and pollination methods which was at par with open pollination (1.87 g) and close planting and bagging method (1.21 g). These findings were also in conformity with Venudevan *et al.* (2011) in glory lily. The highest seed germination percentage was recorded in hand emasculatation and pollination methods (80.90 %) which was at par with open pollination method (62.18 %) while minimum seed germination percentage was observed in close planting and bagging method (54.53 %). Colling *et al.* (2004) reported in *Scorzonera humili* that maximum seed germination in open pollination than other methods. The seed yield per plant was significantly maximum recorded in open pollination method (9.87 g) which was at par with close planting and bagging (5.07 g) and hand emasculatation and pollination method (4.77 g). There were no significant differences observed in all the pollination methods related to number of flower per plant.

Interaction effect

The seed set of China aster had significantly influenced due to interaction to varieties and pollination methods. The cv. Phule

Ganesh White obtained maximum seed set (209.42) when pollinated with open pollination method which was at par with cv. Phule Ganesh Pink (181.78) when pollinated with open pollination method while minimum seed set was recorded in interaction between Phule Ganesh White and hand emasculating and pollination method (46.35). These findings are in resemblance with Khangjarakpam *et al.* (2014) in China aster and Sun *et al.* (2010) in Florist's chrysanthemum. The interaction between cv. Phule Ganesh Violet and hand emasculating and pollination produced maximum weight of 1000 seeds (2.87 g) which was superior over all interaction effect while minimum seed weight was recorded in interaction between cv. Phule Ganesh White and close planting and bagging method (0.95 g). Similar result was supported by Sun *et al.* (2010). Percentage of seed germination was significantly maximum in interaction between cv. Phule Ganesh White and hand emasculating and pollination (81.68 %) which was at par with cv. Phule Ganesh Violet and hand emasculating and pollination (81.60 %), cv. Phule Ganesh Purple and hand emasculating and pollination (80.32 %) while minimum seed germination percentage was recorded in cv. Phule Ganesh White and open pollination (44.3 %). The results are in agreement with Tejaswini and Bhat (1996), who reported in carnation that minimum seed germination in inter specific hybridization (10.16 %) and maximum seed germination in intraspecific hybridization (40.03 %). The maximum seed yield was obtained in interaction between cv. Phule Ganesh Violet and open pollination (11.60 g) which was at par with cv. Phule Ganesh White and open pollination (10.67 g). Similar findings were documented by Khangjarakpam *et al.* (2014) in China aster. There were no significant differences observed among crossing methods and varieties on number of flower per plant. Thus, from existing exploration it could be concluded that varieties cv. Phule Ganesh Pink are good for mixed seed production under open condition at Pune. For pure seed production we can prefer close planting and bagging method because of less cost investment as compared to hand emasculating and pollination method. Seed set was recorded in all cross combination between cultivar and crossing method. Therefore, no self-incompatibility was observed in China aster cultivar at Pune condition.

REFERENCES

- Chaitra, R. and Patil, V. S. 2007. Integrated nutrient management studies in China aster (*Callistephus chinensis* (L.) Nees). *Karnataka J. of Agric. Sci.* **20**(3): 689-690.
- Colling, G., Reckinger, C. and Matthies, D. 2004. Effect of pollen quantity and quality on reproduction and offspring vigour in the rare plant *Scorzonera humilis*. *Amer. J. Bot.* **91**(11): 1774-1782.
- Dalbato, A. L., Kobza, F. and Karlsson, L. M. 2013. Effect of polyploidy and pollination method on capsule and seed set of pansies (*Viola x wittrockiana* Gams). *Hort. Sci. (Prague)*. **40**: 22-33.
- Goodwilline, C. 1999. Wind pollination and reproductive assurance in *Linanthus parviflorus* (Polemoniaceae) as self-incompatible annual. *Amer. J. Bot.* **86**(7): 948-954.
- Goswami, V. and Khan, M. S. 2014. Impact of honey bee pollination on pod set of mustard (*Brassica juncea* L.) at Pantnagar. *The Bioscan*. **9**(1): 75-78.
- Janakiram, T. 1997. Production technology of China aster. In: *Prog. Flori.* pp. 137-142.
- Khangjarakpam, G., Kumar, R., Seetharamu, G. K., Manjunatha Rao, T., Dhananjaya, M. V., Venugopalan, R. and Padmini, K. 2014. Seed setting studies in China aster (*Callistephus chinensis* Nees). *Prog. Agric.* **14**(1): 189-191.
- Kumar, R. and Lenin, J. K. 2000. Insect pollinators and effect of cross pollination on yield attributes of sesame (*Sesamum indicum* L.). *Indian B. J.* **62**: 80-88.
- Navalinskien, M., Samuitien, M. and Jomantiene, R. 2005. Molecular detection and characterization of phytoplasma infecting *Callistephus chinensis* plants in Lithuania. *Phytopathology Polonica*. **35**: 109-112.
- North, C. 1979. Plant breeding and genetics in horticulture. *Mac Millan Press Ltd.*, London. p.107.
- Panase, V. G. and Sukhatme, P. V. 1985. Statistical method for agricultural workers. *Indian Council of Agricultural Research*, New Delhi. pp. 145-152.
- Prasad, D., Hameed, S. P., Singh, R. and Singh, B. 1999. Foraging behaviour of insect pollinators on brown mustard, *Brassica juncea* in Bihar, India. *Indian Bee J.* **51**(4): 131-133.
- Ravi, K. 2002. Evaluation of China aster (*Callistephus chinensis* (L.) Nees) genotypes under transitional zone of north Karnataka. *Thesis (M. Sc. Agri.) submitted to U. A. S. Dharwad, Karnataka, India.*
- Shantappa, T., Chavan, M., Devappa, V., Reddy, B. S. and Laxman, K. 2004. A study on seed quality parameters in different genotypes of China aster (*Callistephus chinensis* L. Nees). *J. Orna. Hort.* **7**(4): 125-127.
- Strube, H. 1965. Floral biology of China aster (*Callistephus chinensis*). *Dischem Gartenbau*. **12**: 134-136.
- Sun, C. Q., Chen, F. D., Teng, N. J., Liu, Z. L., Fang, W. M. and Hou, X. L. 2010. Factors affecting seed set in crosses between *Dendranthema grandiflorum* Kitamura and its wild species. *Euphytica*. **171**: 181-192.
- Tejaswini and Bhat, R. N. 1996. Studies on interspecific hybridization in *Dianthus* L. *Indian J. Hort.* **53**(4): 317-320.
- Venudevan, B., Sundareswaran, S., Vijayakumar, A. and Rajamani, K. 2011. Studies on improving seed set and quality in glory lily through pollination methods. *The Madras Agril. J.* **98**(1-3): 33-35.
- Watts, L. 1980. Flower and vegetable breeding. *Grower Books*, London, p. 182.

