



STUDIES OF F₁ POPULATION FROM CROSSING OF POMPOM TYPE WITH SINGLE AND DOUBLE TYPE OF KEMBANG KERTAS (*ZINNIA elegans jacq.*)

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ABSTRACT

The shape of kembang kertas which is attractive as cut flowers is pompom type. Research to get F₁ of pompom type with greater proportion was conducted through crossbreeding. Pompom type of kembang kertas is not perfect flowers (do not have male reproductive organ), so it is needed to determine which type of male (single and double type) of perfect flowers (there are male and female reproductive organs) that can give greater pompom proportion. The purpose of this study is to determine the appropriate type of male to get a descent pompom. The materials used in this study were female parents of pompom type that originated of selfing results of M₆ population (M₆S₁) and male parents of single and double type of M₇ population. The results showed that crossing between ♂double x ♀pompom types produced the pompom type flower to the proportion of 0.78 and crossing between ♂single x ♀pompom produced the pompom type flower at the proportion of 0.31.

Keywords: male, female, crossbreeding, F₁, kembang kertas (*Zinnia elegans* Jacq.)

INTRODUCTION

Cut flowers in Indonesia is still dominated by chrysanthemum (*Chrysanthemum* spp), which is an introduced plant from the Netherlands, the USA and Japan (Puspasari *et al.*, 2008). Chrysanthemums are short-day plants (Hess, 1975; Anderson, 2007) so that cultivation in Indonesia which has short for days make the size and diameter of the flower stalk is relatively short (not suitable as cut flowers). Therefore, to increase the stem length and diameter of the flower, manipulation of day length is done by giving addition of irradiation for 3-4 hours / day. Chrysanthemum seedlings used are still introduced from other countries that applying the law of protection varieties. This causes production costs to be incurred by chrysanthemum producers in Indonesia is higher.

Chrysanthemum and kembang kertas (*Zinnia* spp) are included in the same family, Asteraceae, so both have morphological similarities (Puspasari *et al.*, 2008). Kembang kertas is usually found in the tropics, so it fits well developed in Indonesia. Kembang kertas is able to grow well in a wider range of agro-climatic than chrysanthemums. Therefore kembang kertas has a great potential to be developed as a cut flower commodity, substitution to the chrysanthemum.

Kembang kertas found in Indonesia generally have a form with one ray floret and have discs flowers (no pompom) with color of beige or pink. The shape and color of the kembang kertas less attractive so not worthy of being cut flower commodity.

Breeding pompom type that has been done is through selection by selecting from double and pompom parents from M₂ generation to M₅ generation. Breeding method through selection based on flower ftype of pompom parent produced proportion shape of 0.458 on the fourth generation (M₄). In the fifth generation (M₅) the proportion of flower shape of pompom type decreased to 0.264 (Gultom *et al.*, 2014). Based on these results, the

selection method cannot be used to generate the type of pompom with proportions above 0.5, because theoretically the method of selection resulted in the maximum proportion of type pompom flowers is 0.5.

Mutation breeding methods that are commonly done is to increase diversity, continued by selection of the next generation and also held a crossbreeding between the mutant strains, or by the parents to get the F₁ hybrid plants.

LITERATURE REVIEW

Flowers of kembang kertas are attractive flowers. In the flower stalks, there are a series of ray flowers that can reach 15 cm in diameter. Flower petals consist of disc florets (ovule and stamen) and ray florets (ovule). Disc are yellowish orange or purplish brown, while the ray floret are vary greatly in color. Disc floret has pistil and stamen while ray flowers only have female reproductive organ (pistil). There is a relationship between the shapes of flower with the number of seeds produced on kembang kertas. The more of ray florets, the fewer disc florets (pistil and stamen) so that the resulting seeds is little. In addition to these genetic factors, low seed production is also due to the difficulty of pollinating agent to reach the stigma. This becomes a problem in seed production of hybrid varieties of kembang kertas (Miyajima, 1998).

X-ray irradiation given on flower seed with a single type as primary forms produce three types of flowers, namely the form of single, double and pompom on M₂ population (Pratiwi *et al.*, 2009) as shown in Figure-1. The type of single and double have disc floret and pompom type does not have a disc floret (Gultom, *et al.*, 2012).



Figure-1. Type of flower shape of mutation results.

Kembang kertas are cross-pollinated plants (pollinated crops) although some are self-pollinating. Individuals with pompom type on *Zinnia elegans* cultivars are often used as the parent to produce F_1 hybrid (Lou *et al.*, 2010). Crossbreeding is essentially a merger attempt between the genes possessed by female parents with genes of male parents combining together in an individual offspring product. Offsprings of the crossing (F_1) will inherit the genes from the parents and has same phenotype with one parent or a combination of the two parents. In the method of artificial cross males and females can be controlled so that the offspring of 100% pompom is possible. There for the research by cross needs to be done to produce new varieties with pompom type. The results of the first phase of the research was that F_1 . The F_1 seeds need evaluation to determine the type of flower and the shape proportion for each set of crosses.

Crossing (hybridization) aims to combine desirable traits from parent into superior genotypes. In open pollinated plants the diversity of genotypes is very high (heterozygous), so it is needed to do selfing to produce homozygous. Artificial crossing is able to control the parental material so that the goals are quickly achieved. Before performing the crossbreeding, is important to know the morphology (biology) of kembang kertas flowers, pollination technics and environmental conditions at the time of pollination and fertilization. Different flower shapes shows the difference in their reproductive organs. The single and double type flowers have male and female reproductive organs while the pompom types do not have male reproductive organs (not perfect flowers) (Gultom *et al.*, 2012). Imperfect flowers of kembang kertas (without the male reproductive organs) are needed as female parents at the crossbreeding because it does not require castration.

The aim of this study is to determine the type of male parent to produce offspring with a large proportion of pompom type.

MATERIALS AND METHODS

The experiment was conducted at the farmer experimental garden located at Jl. Jamin Ginting Km 9. Medan. North Sumatera Indonesia (April-October 2014). **The material for plant were:** (1). Seeds from cross pompom type (♀) x single type (♂) as many as 101 of seed and (2). Seeds from cross pompom type (♀) x double type (♂) as many as 226 seeds (Gultom and Gultom, 2014). The equipment used in this study were: hoe,

polybags, paper label, manure, polybags, and insecticides. pottray, paper label, thread, scissors, and stationery .

Research Procedure

Planting activity were conducted in a standard cultivation, namely seeding, transplanting, maintenance includes weeding, pest and disease eradication and observations of flower type.

Seeding is conducted in four pottrays. Planting is conducted in size of 25 cm x 30 cm polybags. Weeding is conducted by unplugging the grass growing in the polybags and also between polybags. Eradication of pests and diseases is conducted at the time of the attack emerged. Observations were made at the time the flowers have bloomed perfectly. Observations were made by counting plants with single, double and pompoms type flowers.

RESULTS AND DISCUSSIONS

Crossbreeding made between pompom female parents with male parent single type and the pompoms female parents with male parents double type, produced three types of flower shapes as single, double and pompom as shown in Figure -2.



Figure-2. The shape of flowers in the F_1 population.

F_1 plants from crossing result of pompom x single type gave the distribution of double type (0.52), pompom type (0.31) and single type (0.17) flower. F_1 populations from crossing result of ♀ pompom x ♂double type yielded a range of plants with the largest proportion of pompom type (0.78) while the proportion of plants with double and single type 0.15 and 0.07, respectively. The results are shown above is the proportion of the F_1 population of ♀ pompom x ♂single and ♀pompom x ♂double (Figure-3).

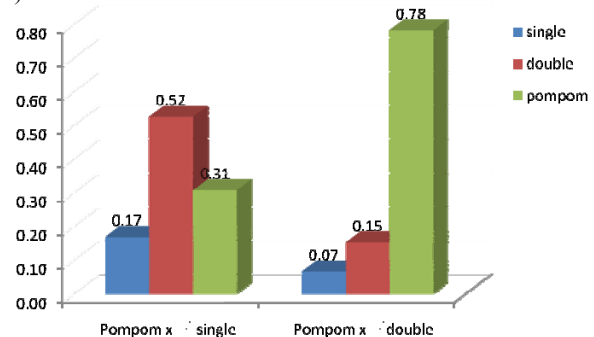


Figure-3. Histogram proportion of flower type in F_1 population from crossing result of pompom female Parents with single and double male parents.



Double type male parents used in this study were a type of double that have one or more ray floret and still have a disc florets. As a sample that double male parent used in the crossbreeding to produce offspring 100% pompom type is double type with shape almost like pompom. From the histogram (Figure -3) can be explained that possibility of pompom female parents is not yet a pure strain so that the offspring not 100% of type pompom.

menggunakan Kolkhisin. Tesis. Fakultas Pertanian UGM, Yogyakarta.

Pratiwi D. P. and Aziz-Purwantoro dan Toekidjo. 2010. Keragaman sifat tanaman bunga kertas (*Zinnia elegans* Jacq.) generasi M2 hasil iradiasi sinar X. Skripsi. Fakultas Pertanian UGM, Yogyakarta.

CONCLUSIONS

Double type as male parents produce the greater proportion of pompom type (0.78) in the F1 population.

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REFERENCES

- Anderson N.O. 2007. Flower breeding and genetics: issues. Challenges and opportunities for the 21st century. Kluwer Academic Publishers. Dordrecht, The Netherlands.
- Gultom T., Aziz-Purwantoro, Endang Sulistyarningsih dan Nasrullah. 2012. Biologi Bunga Kembang Kertas (*Zinnia elegans* Jacq) Populasi M2 Hasil Iradiasi sinar X. VISI. Majalah Ilmiah Universitas HKBP Nommensen. 20(2).
- Gultom T., Aziz-Purwantoro, Endang Sulistyarningsih dan Nasrullah. 2014. Mass Selection to Get Parent Type to Produce Pompom Flower Type of Kembang Kertas (*Zinnia Elegans* Jacq.). Prosiding Semirata IPB.
- Gultom. T. dan Endang S. Gultom. 2014. Crossing Between Single And Double Type With Pompom Type of Kembang Kertas (*Zinnia Elegans* Jacq.) 2014. Prosiding Seminar Nasional Universitas Negeri Medan. Tanggal 23 Agustus.
- Hess D. 1975. Plant Physiology. Molecular, Biochemical, and Physiological Fundamentals of Metabolism and Development. Springer-Verlag Berlin-Heidelberg, New York, USA.
- Lou X.Y., Q.S. Hu., M.Z. Bao and Y.M. Ye. 2010. Analysis of combining ability of two -types of male sterile and four restorer lines of *Zinnia elegans*. Euphytica. 174: 91-103.
- Miyazima D. and Nakayama M. 1994. *Zinnia capitulum* composition. Journal of the America society for Horticulture Science. 119: 683-686.
- Puspasari D., Aziz-Purwantoro and Ambarwati E. 2008. Induksi keragaman bunga kertas (*Zinnia* sp.) dengan