GENETIC VARIABILITY OF FRUIT COLOR IN ORNAMENTAL PEPPER CROSSING

[1]CHRISTINA ASTRI WIRASTI, [2]AZIZ PURWANTORO

[1]Assesment Institute of Agricultural Technology (AIAT) Yogyakarta
[2]Faculty of Agriculture Gadjah Mada University

Abstract- Pepper or Capsicumis one of the commodity that can be used as an ornamental plant. Plantingpepper as an ornamental plant have different goalswithcultivationforproduction. Pepper as an ornamental plant must have qualities that can add beauty so it can be enjoyed from both the aesthetic aspect of the leaves, flowers or fruit. Diversity of pepper cultivars has the potential to be developed as an ornamental. The development of ornamental peppers are expected to be new innovations to provide good quality ornamental plants, multipurpose and can be certainly provide economic value to where it is grown.Improved varieties of ornamental pepper is generally done through the combining parental traits of ornamental pepper that has certain advantages. Fruit color character is one parameter determining who often become the basis for choosing the consumers who use pepper for garnish and cullinary applications. This study aimed to identify the genetic diversity of ornamental pepperfrom the introduction variety Razzamatazz and Minimix ornamental pepper crossingbased on the fruit color parameters. Observation of the color parameters L*, a*, b* conducted using a Chroma Meter - Konica Minolta - Minolta CM-2006, and white standard color was used for calibration. Color parameters data observation were analyzed for genetic diversity shown by the Coefficient of Genetic Diversity (KKG) and clump analysis (cluster analysis) so that the closed relationship between the ornamental pepper cultivars was known. The results showed that the color parameters a * and b * has a broad genetic diversity, whereas the color parameters L * has a narrow genetic diversity. There are 3 groups of the offspring fromRazzamatazz and Minimix crossing based on color parameters L*, a*, and b * is the group I consists of female parental (Razzamatazz), number of offspring B1, B5, B6, B8, B3 and B4, while group II consisted of a number of offspring B2 and B7, and Group III consists of male parentalMinimix. All the offspring had the fruit color similar with the female parentripe fruit color that is red color.

Keywords- genetic diversity, fruit color, ornamental pepper

I. INTRODUCTION

The demand for ornamental plants in Indonesia is growing in line with the increasing awareness of the beautiful and comfortable environment. Peppers (Capsicum sp.) in addition to commercial value is also attractive when used as an ornamental plant. Ornamental pepper is one of the plants commonly grown in pots and serve as decoration inside or outside the room [Setiadi, 2002].

Planting chili as ornamental plants have different goals with chilli cultivation for the production. Chili as ornamental plants should be enjoyed either in terms of the aesthetics of the leaves, flowers or fruit [Hessayon, 1993] and has the quality of crops that can add to the beauty. The expected quality were to have a proportional plant height when planted in a pot, has many branches, so the plants look more lush, has many pieces as an addition to the appeal of ornamental fruit plants, and has the performance that is preferred by consumers. Most of the edible ornamental chili pepper (edible) even taste very spicy. When added to food, ornamental chili peppercould be more tastythrough adding color in cooking [Cayanti, 2006]. Both of these benefits are expected to be combined to produce a new multipurpose chili cultivars, but can be consumed also be used as a garnish.

Various cultivars of chilli has the potential to be developed as an ornamental chili. However, during the chili that was developed as an ornamental chili mostly derived from the species Capsicum sinense and Capsicum pubescens. Both types of chili is still in a certain scale for a place of life who want a plateau that only in these areas can be found existence [Djarwaningsih, 1983].

Chili cultivar of the Capsicum annuum and Capsicum frutescensspecies also had characteristics that were not less interesting fruit. Both species of chili has a variety of colors, shapes, sizes and other interesting characters as well as more adaptable in the lowlands. During this time, the development of the species Capsicum annuum and Capsicum frutescenschili more as chili consumption, but also many cultivars of chilli of the species Capsicum annuum and Capsicum frutescenscould be potentially developed as an ornamental chili pepper.

Development of ornamental chili expected to be a new innovation to provide a good quality ornamental plants, multipurpose and certainly can provide economic value to those who cultivate them. With this development opportunities certainly present new challenges for breeders to further increase the genetic diversity of chili, especially in terms of beauty such as fruit color, fruit shape, type of growth, pigmentation of the leaf which is the main attraction of ornamental chili pepper.

The emergence of these kinds of new ornamental chili pepper expected later to meet consumer tastes and interests of farmers to further develop ornamental chili pepper.

Crosses were followed by the selection chosen as a method to produce new cultivars of ornamental chili pepperbecause the method is the most frequently

performed. Combining the properties of the plant through the stages of crosses hopes can improved crop qualitative character of their special characteristics. The color of the fruit is one of the decisive character for ornamental chili pepperplants and beauty supporting. The breeding program will succeed if there is diversity and inheritance are high on the character to be corrected. According to Crowder [1990], in F2 generation plants would suffer segregation according to Mendel's laws that would cause diversity. Wide genetic variability will affect the success of the selection. Thus, the selection of the F2 population will be very effective for obtaining individual plants that have properties as expected.

Morphologically characterization more mainstream than the molecular done as easy and clearly visible. Morphological markers used a marker that is based on a simple Mendelian inheritance, such as shape, color, size, and weight. Morphological traits (phenotype) can be used as a real clue to a specific gene and a marker gene in the chromosome because the properties that affect the morphology can be derived [Sofro, 1994].

Broad genetic diversitycaused by the individuals tested had genetic differences in populations, because they come from different genetic backgrounds. Different genetic factors that would cause a different appearance, this appearance changes depending on how large the environmental changes that occur in the plant genotype growing environments. Wide phenotypic variability caused by the extent of genetic variability and environmental influences as well as the interaction between genetic and environmental factors [Jamilah et al., 2011].

The existence of a diversity of phenotypes in a population of plants is very important and can be used as a predictor of genetic diversity, in order of selection with a view to obtain superior traits can be done. The higher the phenotype diversity in nature that is not influenced by environmental factors then the chances to get bigger superior genotypes [Greech and Reits, 1971]. The diversity of phenotypes in these traits showed the diversity of genetic factors to the traits of the encoded [Knight, 1979].

The study involved two ornamental chili pepper parental who have a different character fruit color, through a cross between cultivars of ornamental chili pepper that has a different character is expected to be obtained by the descendents of the segregation of color. Based on these things, this study aimed to identify the genetic diversity of offspring breeds of ornamental chili based on fruit color parameters to be used as material selection on the program of new varieties of ornamental chili pepper.

II. MATERIALS AND METHODS

The research was initiated by planting parental and crossing (hybridization), followed by propagation of F1 seeds selected portion (F1 plants) and F2 plant. The study was conducted by planting two parental, namely Razzamatazz (red ripe fruit color) and Sweet Pepper Mnimix (the color of ripe fruit is brown). The ornamental chili pepper is grown using polythene bags (plastic bags) diameter 30 cm with a planting medium mixture of soil and manure in the ratio 1: 1. Planting begins with the nursery, then chili moved in small polybags measuring 10 cm in diameter after 20-25 days aftersowing. Each polybags planted the seeds of chili. Maintenance includes watering plants, replanting, fertilization and the removal of water shoots. Pesticides was used as pest and disease control. The observation of ripe color fruit on the ornamental chili pepperdone after a perfectly ripe fruit. Ripe fruit color observations include L* (lightness), a* (redness-grreness) and b* (yellowness-blueness) using Chroma Meter Minolta-Konica-Minolta CM-2006 and the standardization carried by raw-white color calibration. L* indicates the brightness (lightness), a* indicates redness-greenness (Redness-greeness) and b* indicates yellow-blue (yellowness-blueness). Observations were made for each crop F2 offspring and the two parents. The observed of ripe fruit color were analyzed by analysis of variance approach and to determine the genetic diversity represented by the Coefficient of Genetic Diversity (KKG), which is calculated according to the formula Singh and Chaudary (1979):

$$\sigma^2 G = \frac{KTg - KTs}{r}$$

$\sigma^2 G$ = genetic variance
KTg = genotype mean square
KTs =error mean square
KKG =genetic coefficient variability
$\overline{X}$ =average
r = replication

$$KKG = \frac{(\sqrt{\sigma^2 G})}{\overline{X}} \times 100$$

According Moedjiono and Mejaya (1994), the coefficient of genetic diversity that has been acquired can be grouped into four criteria of diversity that low diversity (0-25% of KKG highest), the diversity of medium (25-50% of KKG highest), diversity is high (50 - 75% of the highest KKG) and diversity is very high (>75% of the highest KKG). Color quantification observation data (parameters L *, a *, and b *) were analyzed using SAS software ver.9.01 based coefficient DIST / taxonomy in order to obtain the average distance dendogram.

III. RESULTS AND DISCUSSION

Ornamental chili pepper crossing with different colors produce the diversity of the offspring. The diversity that occurs can be assessed by quantifiable color parameters. The observation of the color of ripe

fruit chili chromameter of crossing two introduced cultivars that were Razzamatazz with Minimix presented in Table 2.

Tabel 2.The genetic variants of fruit color parameter (L*, a*, dan b*) from the offspring of ornamental chili pepper crossing

Parental/Offspring	Color parameters		
	L^*	a^*	b^*
1. Female Parental (BX)	29,36	36,63	9,73
2. Male Parental (BY)	24,76	8,30	3,41
3. Offspring B1	30,54	36,21	9,43
4. Offspring B2	29,40	33,92	9,14
5. Offspring B3	30,44	37,96	10,14
6. Offspring B4	29,96	38,52	10,79
7. Offspring B5	30,32	35,98	9,29
8. Offspring B6	30,34	35,29	9,07
9. Offspring B7	29,79	32,80	7,90
10.Offspring B8	31,47	35,88	10,03
Average ($\overline{X}$)	29,64	33,15	8,89
$\sigma^2 g$	13,26	316,41	17,22
$\sigma^2 e$	2,93	13,33	3,28
CGD (%)	5,42	26,26	20,99
Relative value	20,63 (R)	100	79,94 (ST)
Diversity criteria	Narrow	Broad	Broad

Keterangan:σ^2 g = genotipe variant, $\sigma^{2\,e}$ = environmental variant, ST = very high /very broad, T =broad, S = middle, R = narrow

In Table 2 shows that the variant genotype in all parameters of color is higher than the environmental variants. It shows that the diversity of color parameters L* a* b* is influenced by genetic factors rather than environmental factors. The parameter is influenced by genetic factors influenced by a few genes (the qualitative nature). It is appropriate Mangoendidjojo opinion [2003] that the qualitative nature is governed by one or two genes, little influenced by the environment so that the way the election/selection can be done visually.

The analysis showed a color variable a* has the highest Coefficient Genetic Diversity value (KKG) (Table 2) amounted to 26.26%, the set as a relative value of 100%, so the the color parameter b* has the very high diversity (broad diversity) while the L * has the narrow genetic diversity. The trait that has a very high and high value of genetic diversity indicates that improvement through selection (direct selection) is possible. The nature of the values the diversity of high and very high levels can be said to have genetic diversity that is broad, and traits that have a low and medium value of genetic diversity can be said to have narrow genetic diversity, so it can be said that the color parameters a * and b * has a broad genetic diversity while the color parameters L* has a narrow genetic diversity.

Broad variability is one of the requirements to selection on the desired traits due to the nature of the selection process will be more efficient. In accordance with Bahar and Zein [1993] that if the genetic diversity within a large population, it shows people in a diverse population, the opportunity to obtain genotypes is expected to be large. The broader the genetic diversity possessed the greater the chances of success of breeding programs. In addition, the enormous variation can also improve the response of selection (selection response) for the selection of the response is proportional to the genetic diversity [Fehr, 1987; Hallauer and Miranda, 1988; Simmonds, 1986].

Grouping by color parameters will help the identification process of the offspring from a cross of two parental. Grouping the offsprings will help the selection process to determine the offspring from crossing be grouped with one of the parental that are similar or segregating. The offspring and parental who were in one group will show the similarity or the same traits.

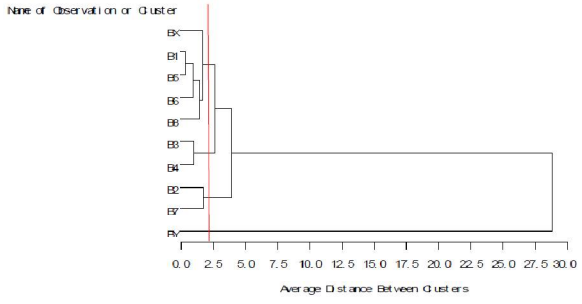


Figure 1. Dendogram grouping results by the color parameters L *, a *, and b * in the offspring of crossing Razzamataz and Minimix. BX = Razzamatazz parental; B1, B2, B3, B4, B5, B6, B7 and B8 = number of offspring; BY = Minimix parental.

Distance on dendogram can be used to see the degree of similarity cultivars. In dendogram Figure 1 appears that at taxonomy distance 2.5 gained 3 groups: group I consists of female parental (Razzamatazz), offspring number B1, B5, B6, B8, B3 and B4, while group II

consisted of offspring numbers B2 and B7 and Group III consists of male parental Minimix. The result of crossbreeding offspring B1, B5, B6 and B8 has a similarity coefficient closest distance with Razzamatazz female parents. The yield on the dendogram showed that all of the resulting offspring tend to follow the color of the fruit of the female parental in comparison with the male parental visible from a distance coefficient resemblance male parental have the farthest distance. All of the offspring of crossing have red color ripe fruit. With the introduction of cultivars and based on that grouping the cultivars that are in one group have the same color parameter or nearly the same or have a close genetic relationship so as to cross just choose parental crosses representing the group.

Estimation of genetic relationships in plant breeding is very useful to manage germplasm, identify cultivars, crossing parental assist selection as well as reducing the number of individuals required to take an example with the wide range of diversity [Julisaniah et al., 2008]. The results of this study can be used as a guide (guide) in the selection of ornamental chili in the development of varieties with the use of color as an indicator of practical parameters for selection.

CONCLUSION

1. Variable color a* and b* has a broad genetic diversity, whereas the color variables L * has a narrow genetic diversity.
2. There are three groups of offspring from crosses by the color parameters L*, a *, and b *, which is the group I consists of female parental (Razzamatazz), offspring number B1, B5, B6, B8, B3 and B4, while group II consisted descendants of numbers B2 and B7, and Group III consists of male parental Minimix.

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