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GENETIC DIVERSITY OF SECOND GENERATION (M2) LUMBU KUNING GARLIC PLANTS *(Allium sativum L.)* RESULTING FROM 60Co GAMA RAY IRRADIATION

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ABSTRACT
Local varieties of garlic in Indonesia are planted in the highlands so planting is limited. It is necessary to improve the characteristics of local varieties of garlic which can also be planted in the lowlands. This can be done by mutation breeding. Mutation is an appropriate technique for assembling new diversity that is propagated vegetatively. Land expansion needs to be carried out to obtain new superior varieties of garlic that can be planted in the lowlands. The research aims to get information about the diversity and genetic relationships of several garlic clones and to determine the level of change in the characteristics of Lumbu Kuning variety garlic plants due to mutations in the M2 generation so that they can adapt to various environments. The method used in the research is the Chlorophyll Test, analyzing genetic diversity data using calculations of the genetic diversity coefficient (KKG), phenotypic diversity coefficient (KKF), heritability (h2), standard deviation, and kinship or cluster analysis. The research results showed that plants experienced an increase in parameters in cluster B. Plants resulting from irradiation with a dose of 5 Gy were plants LK5-3, LK5-24, LK5-23, LK5-8, and LK5-7 in plants resulting from irradiation with a dose of 6 Gy, namely plants LK6-8, LK6-26, LK6-1, LK6-34, LK6-32, LK6-3, LK6-10, LK6-18, LK6-39 and LK6-28. This research concludes that second-generation Lumbu Kuning variety garlic plants resulting from 60Co gamma irradiation planted in the lowlands have high genotype diversity.
Keywords: Plant Breeding, 60Co Gamma Ray Irradiation, Land Extensification, Plant Diversity, Plant Relationships
Key findings: Effect of 60Co gamma ray irradiation on the relationship and diversity of lowland tolerant Lumbu Kuning garlic varieties.

INTRODUCTION

Garlic (Allium sativum L.) of the Lumbu Kuning variety is a local variety that is widely planted by farmers because it has high productivity with larger bulb sizes and a sharp aroma. The Lumbu Kuning variety of garlic can only be planted in the highlands so planting is limited.

The availability of new superior garlic seeds that are high quality and adaptive to conditions in Indonesia needs to be increased. Land extensification needs to be carried out to obtain new superior garlic varieties that can be planted in the lowlands. Adaptation is the process of adjusting living creatures to the environment (Baker, 2019). Plant adaptation is the ability of plants to survive by adapting to the conditions of their surrounding environment. Genetic sources that have high diversity are needed to find new superior varieties, but seed propagation among farmers is still vegetative (tubers). Seed propagation by vegetative means does not get the high genetic diversity and is therefore difficult get new superior seeds. The genetic diversity of this plant is very narrow.

Apart from that, the area for garlic production is still very limited while the demand for garlic is quite high.

Improving the characteristics of local garlic varieties can be done using the physical mutation method. Mutation Gamma irradiation is the right technique for assembling new varieties that are propagated vegetatively. The availability of quality garlic seeds that are adaptive to conditions in Indonesia is still small. The adaptability of garlic cultivars to climatic factors, soil type, and altitude is very low. The influence of the interaction between genotype and the growing environment is very close to achieving maximum productivity (Gusni Y, et al, 2019)

Genetic improvement of garlic varieties can be done through artificial mutations. Artificial mutations or induced mutations in plants can cause genetic changes and give rise to new traits. By using mutagens or substances that cause mutations, the genetic structure of plants can be changed. Changes in genetic composition will cause high diversity.

Mutation breeding can be successful if there is high diversity. One of the mutagens that are widely used to induce mutations in plants is 60Co gamma rays. The success of 60Co gamma-ray irradiation which can increase genetic diversity is determined by the radiation dose used to induce it. Giving a radiation dose that is too low results in a few mutated sectors, whereas if a dose is too high it can cause death. The level of radiosensitivity for each plant is different, measured based on the lethal dose (LD) value. The lethal dose value 50 (LD50) is the dose level that has a death value of 50% of the irradiated Estimating the diversity value of the M2 generation of garlic plants of the yellow lumber variety resulting from 60Co gamma-ray irradiation needs to be carried out to determine whether plant changes that occur are influenced by genetics or the environment. A high genetic diversity value means changes in plants are caused by plant or genetic mutations caused by gamma-ray irradiation. Conversely, if the diversity value is low then changes in plants are caused by plant population. The lethal dose value 20 (LD20) is the dose level that has a death value of 20% of the irradiated plant population. The most optimum genetic diversity can be found in administering doses at the LD50 value. The LD50 value for the number of live plants of the Lumbu Kuning variety of garlic is 2.2887 Gy and the LD20 value is 0.583467 (Ferdianto, 2021)

The results of research conducted on the growth and productivity of garlic (Allium sativum. L) of the yellow lumber variety with 60Co gamma-ray irradiation treatment showed an LD50 value of 11.6725 Gy and an LD20 value of 4.27817 Gy. Treatment with a dose of 2 Gy resulted in plants that had a higher plant length and number of leaves. Treatment with a dose of 3 Gy resulted in plants that had larger stem diameters, but some of the tubers were hollow. Treatment with a dose of 4 Gy resulted in plants that turned yellow in the middle. Treatments of 5 Gy and 6 Gy resulted in stunted plants and some were unable to grow until harvest (Erick, Moeljani, and Suhardjono, 2021).

Estimating the diversity value of the M2 generation of garlic plants of the yellow lumber variety resulting from 60Co gamma-ray irradiation needs to be carried out to determine whether plant changes that occur are influenced by genetics or the environment. A high genetic diversity value means changes in plants are caused by plant or genetic mutations caused by gamma-ray irradiation. Conversely, if the diversity value is low then changes in plants are caused by the environment. This study aims to assess the genetic diversity of the second-generation (M2) yellow lumber variety of garlic with doses of 0 Gy, 4 Gy, 5 Gy, and 6 Gy planted at lower altitudes, namely 600 mpdl.

MATERIALS AND METHODS

Plant material

The material used in this breeding research was a second generation (M2) Lumbu Kuning variety garlic seeds with a dose of 0 Gy = LK0, 4 Gy = LK4, 5 Gy = LK5 and 6 Gy = LK6. For each dose, 40 plant samples will be taken to observe genetic diversity and 10 plants for chlorophyll testing.

Chlorophyll Analysis

The chlorophyll test was carried out using 1 gram of garlic plant leaves aged 10 weeks after planting (MST) for each plant sample. The chlorophyll content was observed using a spectrophotometer. The leaves were crushed using a mortar for 5 minutes, then dissolved in 10 ml of 80% acetone. The extract solution is put into a measuring cup and then covered with plastic, then transferred to a centrifuge, and centrifuged at a speed of 650 spectrophotometer. This chlorophyll content was carried out to see the stress level of garlic plants (Ramadhan, Syarif, and Dwipa, 2019). chlorophyll and proline content. These two parameters were measured to see the stress level of garlic plants (Wallacea 2019)

According to Syahputri et al (2019), the Genetic Diversity Coefficient (KKG) is obtained from the following equation: Analysis of genetic diversity data using the calculation of the genetic diversity coefficient (KKG).

Note: $\sigma 2\ g$ = Genetic variation
X = Population average phenotypic diversity coefficient (KKF),
Note: $\sigma 2\ f$ = Variety of phenotypes
X = Population average

and standard deviation and kinship or cluster analysis are carried out. The parameters observed were plant length, number of leaves, stem diameter, wet weight, dry weight, tuber diameter, and number of cloves. Genetic diversity data analysis was carried out using Microsoft Excel, while cluster analysis used the NTSYSpc.2.2021 program.

RESULTS

Chlorophyll

Apart from being influenced by genetic factors, chlorophyll levels in a plant are also greatly influenced by the water content in the cultivation media. In this onion, the average level of chlorophyll a wavelength was 645 nm and chlorophyll b wavelength was 663 nm. This difference was indicated due to differences in temperature, humidity, and water content at the planting location. Chlorophyll content analysis was carried out on plants aged 10 WAP. The chlorophyll b content in treatments LK4, LK5, and LK6 showed an increase with increasing dose. The chlorophyll content in the LK5 treatment was the highest followed by LK6 and LK4, this also happened on total chlorophyll content (Table 1.).

Tabel 1. Average Analysis Results of Chlorophyll Content of Garlic of the Second Generation Lumbu Kuning Variety Result of 60Co Gamma Ray Irradiation

Second Generation Garlic Plants (M2)	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Total Chlorophyll (a+b) (mg/g)
LK_0 (0 Gy/Control)	1,56	1,76	39,62
LK_4 (4 Gy)	0,68	0,88	18,08
LK_5 (5 Gy)	1,15	1,56	31,10
LK_6 (6 Gy)	1,06	1,58	29,68

Table 1. Chlorophyll is used as an indication to see the cultivation location, and whether the intensity of irrigation (and several other supporting factors) has a physiological influence on the plant before symptoms appear on its morphology. From the 4 samples taken at doses of 4Gy, 5Gy, and 6Gy, the results of the chlorophyll analysis were very different compared to those without radiation. From the 4 plant treatments taken from the radiation, the results of the analysis of chlorophyll levels were different. In irradiated garlic, the average value of chlorophyll a was 0.72 mg/l and in non-irradiated garlic, the average value of chlorophyll a was 0.39 mg/l. For chlorophyll b, the radiation results obtained levels of 1.05 mg/l, and without radiation the levels obtained were 0.44 mg/l (figure 1).

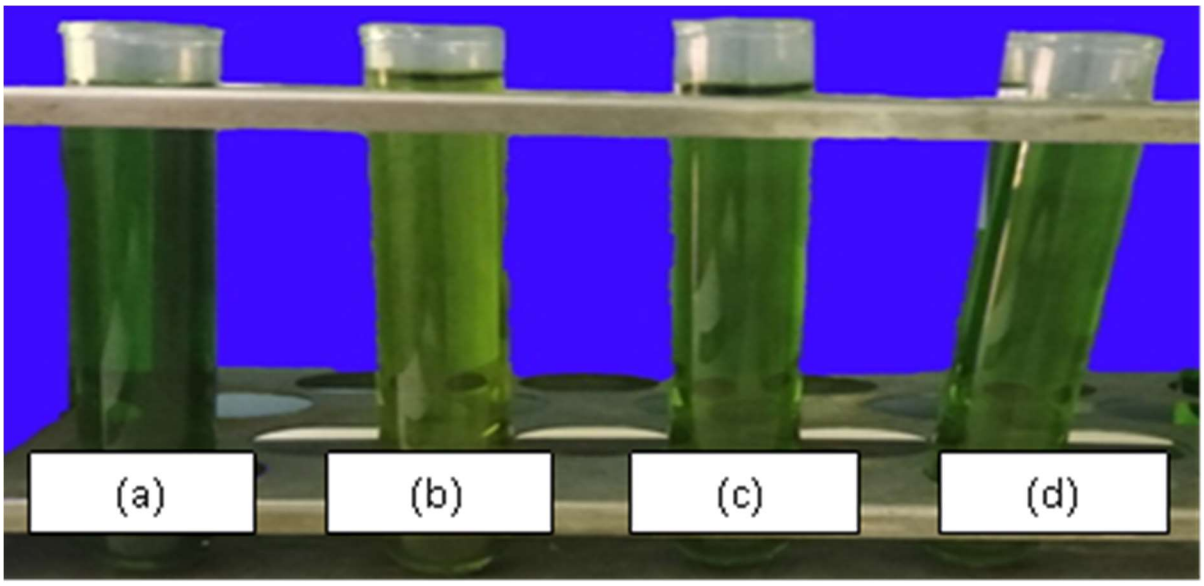

Figure 1. Chlorophyll filtrate: (a) Control, (b) 4 Gy, (c) 5 Gy, (d) 6 Gy

Figure 2. Color differences that occur from the chlorophyll filtrate between control plants (LK¬0) and plants that have been irradiated (LK¬4, LK5 ¬and LK¬6¬)¬¬. Control plants had a green filtrate color or a darker color than plants that had been irradiated. The brightest or light green filtrate is plant filtrate with an irradiation dose of 4 Gy. Meanwhile, plant filtrates with irradiation doses of 5 Gy and 6 Gy had almost the same green color. This is caused by the content of chlorophyll which has a light green color in plants resulting from irradiation at a dose of 5 Gy is greater when compared to a dose of 6 Gy. Apart from that, the chlorophyll b content has a dark green color in plants resulting from light irradiation at a dose of 6 Gy, which is slightly greater than at a dose of 5 Gy. (Ryan A, 2019).

Genetic Diversity

Genetic diversity is an important program in mutation breeding as a selection material for finding new superior seeds. Genetic parameters consist of standard deviation values, genetic diversity coefficient (KKG), phenotypic diversity coefficient (KKF), and heritability value (h2). The following are the results of calculations for estimating genetic parameters in second-generation Lumbu Kuning variety garlic plants resulting from 60Co gamma-ray irradiation which are presented in Table 2.

Table 2. Estimation of Genetic Parameters of Garlic Yellow Lumbu Generation Generation Second, 60Co Gamma Ray Irradiation result

Parameter	Populasi Tanaman	Rerata±SD	KKG (%)	Ket.	KKF (%)	Ket.	h^2 (%)	Ket.
Jumlah Daun	LK0 (0 Gy)	5.23 ± 1.03	20.58	L	29,.8	M	0,49	M
	LK4 (4 Gy)	5.00 ± 1.22	24.48	L	32.24	M	0,58	H
	LK5 (5 Gy)	4.75 ± 1.24	24.80	L	32.48	M	0,58	H
	LK6 (6 Gy)	4.95 ± 128	25.70	M	33,17	M	0,60	H
Panjang Tanaman	LK0 (0 Gy)	36.61± 6,35	17,02	L	26,84	M	0,40	M
	LK4 (4 Gy)	36.55± 7,44	19,92	L	28,76	M	0,48	M
	LK5 (5 Gy)	35,5 ± 9,13	24,46	L	32,07	M	0,58	H
	LK6 (6 Gy)	40,63 ±8,07	21,61	L	29,95	M	0,52	H
Diameter Batang	LK0 (0 Gy)	0,59 ± 0,13	21,99	L	45,73	M	0,23	M
	LK4 (4 Gy)	0,67 ± 0,20	34,88	M	53,14	H	0,43	M
	LK5 (5 Gy)	0,43 ± 0,31	54,13	H	67,36	H	0,65	H
	LK6 (6 Gy)	0,60 ± 0,26	44,75	M	60,08	H	0,55	H
Berat Basah	LK0 (0 Gy)	7,26 ± 2,94	43,76	M	71,72	H	0,37	M
	LK4 (4 Gy)	6,61 ± 3,33	49,58	M	75,41	H	0,43	M
	LK5 (5 Gy)	5,23 ± 4,31	64,09	H	85,66	H	0,56	H
	LK6 (6 Gy)	7,77 ± 4,29	63,82	H	85,45	H	0,56	H
Berat Kering	LK0 (0 Gy)	3,24 ± 1,87	58,50	H	84,80	H	0,48	M
	LK4 (4 Gy)	3,17 ± 1,62	50,76	H	79,67	H	0,41	M
	LK5 (5 Gy)	2,80 ± 2,28	71,41	H	94,17	H	0,58	H
	LK6 (6 Gy)	3,57 ± 1,95	61,19	T	86,68	H	0,50	M
Diameter Umbi	LK0 (0 Gy)	2,11 ± 0,47	22,17	L	35,34	M	0,39	M
	LK4 (4 Gy)	2,17 ± 0,57	26,92	M	38,49	M	0,49	M
	LK5 (5 Gy)	1,94 ± 0,70	33,31	M	43,21	M	0,59	H
	LK6 (6 Gy)	2,19 ± 0,55	26,17	M	37,97	M	0,47	M
Jumlah Siung	LK0 (0 Gy)	9,30 ± 3,98	46,74	M	67,07	H	0,49	M
	LK4 (4 Gy)	9,78 ± 4,21	49,41	M	68,96	H	0,51	H
	LK5 (5 Gy)	6,88 ± 3,52	41,28	M	63,39	H	0,42	M
	LK6 (6 Gy)	8,13 ± 4,40	51,70	H	70,61	H	0,54	H

Keterangan : T = High S = Medium, R = Low,

Standard Deviation

Standard deviation is the value of the distribution of data on observed characters to measure diversity in a plant population. A high standard deviation value indicates that the observed character has high or wide genetic diversity, while a low standard deviation value indicates that the observed character has a low or narrow level of diversity (Nur, Iriany, and Takdir, 2013).

Standard deviation is the value of the distribution of data on observed characters to measure diversity in a plant population. The highest standard deviation there are plants resulting from LK5 irradiation (dose 5 Gy and LK6 (dose 6 Gy). In LK5 plants these are found in the parameters of plant length, stem diameter, wet weight, dry weight, and tuber diameter. Meanwhile, in LK6 plants, these are in the parameters number of leaves and the number of cloves.

The standard deviation value of genetic variation from a data set has a value equal to zero, indicating that all values in the data are uniform, while a standard deviation value of genetic variation that is higher than zero indicates that individual data points are far from the average value or are said to be diverse. Trustinah and Iswanto (2012) stated that the higher the standard deviation value, the higher the diversity.

Coefficient of Genetic Diversity (KKG) and Coefficient of Phenotypic Diversity (KKF)

Success in creating new superior varieties in plant initiation is determined by the genetic diversity that occurs in a plant. The greater the genetic diversity, the greater the chance of success in the plant breeding program (Darmawan and Damanhuri, 2019).

The results of observing the coefficient of genotype diversity (KKG) and the coefficient of phenotypic diversity (KKF) on the growth and production parameters of the Lumbu Kuning variety of garlic plants are classified in the low-high category. The highest KKG value was found in the dry weight parameter of the plant population resulting from irradiation LK5 (dose 5 Gy) and LK6 (dose 6 Gy). The highest KKF value was found in the dry weight parameter of the plant population resulting from irradiation LK5 (dose 5 Gy) and LK6 (dose 6 Gy).

According to Handayani and Hidayat (2016), a higher KKF value than KKG indicates that the diversity of visual characters (phenotypes) displayed is dominated by environmental factors. Therefore, selection can be done based on the phenotypic appearance of the plant characters. However, this selection risks causing deviations because it is also influenced by environmental factors. Therefore, it is necessary to carry out further genetic parameter estimation analysis using heritability values. Meanwhile, Trustinah and Iswanto (2012) stated that the KKG and KKF values which are almost the same or close together indicate that Variation in these characters is dominated by genetic factors.

Heritability (h2)

Heritability is a value that shows a character in a plant that is controlled by genetic factors or environmental factors so that it can be known to what extent this character can be passed on to the next generation (Jameela, Noor, and Soegianto, 2014).

The highest heritability values were found in plants resulting from LK5 (5 Gy dose) and LK6 (6 Gy dose) irradiation. In plants resulting from LK5 irradiation, the highest heritability values were found in the parameters of plant length, stem diameter, wet weight, dry weight, and

tuber diameter. Meanwhile, in plants resulting from LK6 irradiation, the parameters include the number of leaves, dry weight, and number of cloves.

A low heritability estimate proves that a character is influenced by a high degree of environmental variation and little influence from genetics. If the estimated heritability value is high, it shows that genetic factors have a strong influence on a character. A high heritability value also shows that these parameters can be more easily inherited from the next generation. According to Barmawi, Yushardi, and Sa'diyah (2013), if the heritability value for a character is in the high category, it indicates that the character is influenced by genetic factors that are higher than environmental factors.

Kinship Analysis (Cluster)

The following is a kinship diagram of LK4 plants (second generation resulting from 4 Gy irradiation)

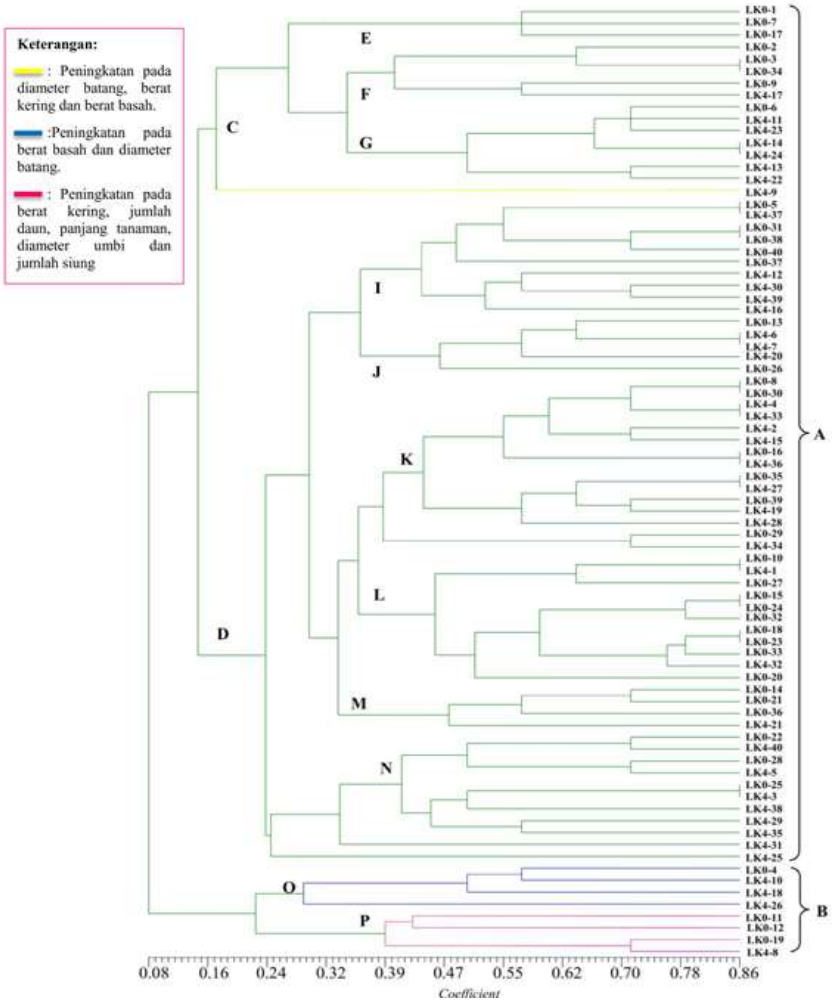

Figure 2. Similarity Dendogram of Second Generation Plants Results from 60Co Gamma Ray Irradiation Dose 4 Gy (LK4)

Figure 4.3. shows a dendrogram of the relationship between LK4 plants (the result of 60Co 4 Gy gamma-ray irradiation) and LK0 plants (control). The dendrogram consisted of 40

LK0 plants (control) and 40 LK4 plants (4 Gy). In the kinship dendrogram between LK0 and LK4 plants, two large clusters were formed, namely clusters A and B which had a kinship level of 0.08 (8%).

Cluster A consists of 72 plants and cluster B consists of 8 plants. Cluster A is divided into 2 large clusters, namely Cluster C and Cluster D. The level of relationship between the closest LK0 and LK4 plants is 1.00 (100%). The farthest level of relationship between plants was 0.169 (16.9%) in cluster C, namely the LK4-09 plant. The other furthest level of kinship is 0.24 (24%) in cluster N, namely the LK4-25 plant.

The increase in plant parameters resulting from irradiation is also visible in the dendrogram results (Appendix 4.). Cluster B has plants that have greater parameter yields than other clusters. In cluster O, plants have an increase in the parameters of stem diameter and Gross weight. The average stem diameter in cluster O was 0.94 cm, while the average diameter of control plants was 0.54 cm. The wet weight parameter for cluster O has an average of 13.1 g, while the average wet weight of control plants is 7.26 g.

In the P cluster, plants had an increase in the parameters of the number of leaves, plant length, dry weight, tuber diameter, and number of cloves. The average number of leaves in cluster P was 7, while the average number of leaves in control plants was 5.35. The average length of plants in cluster P is 49.5 cm, this has increased compared to the average length of control plants, namely 36.61 cm. The average dry weight in cluster P was 7.125 g, much greater than the average wet weight of control plants, namely 3.24 g. The average tuber diameter of plants in cluster P was 3.05 cm, while that of control plants was 2.11 cm. Lastly, there was an increase in the number of cloves in the P cluster, namely 14 cloves, compared to control plants, namely 9.3 clove.

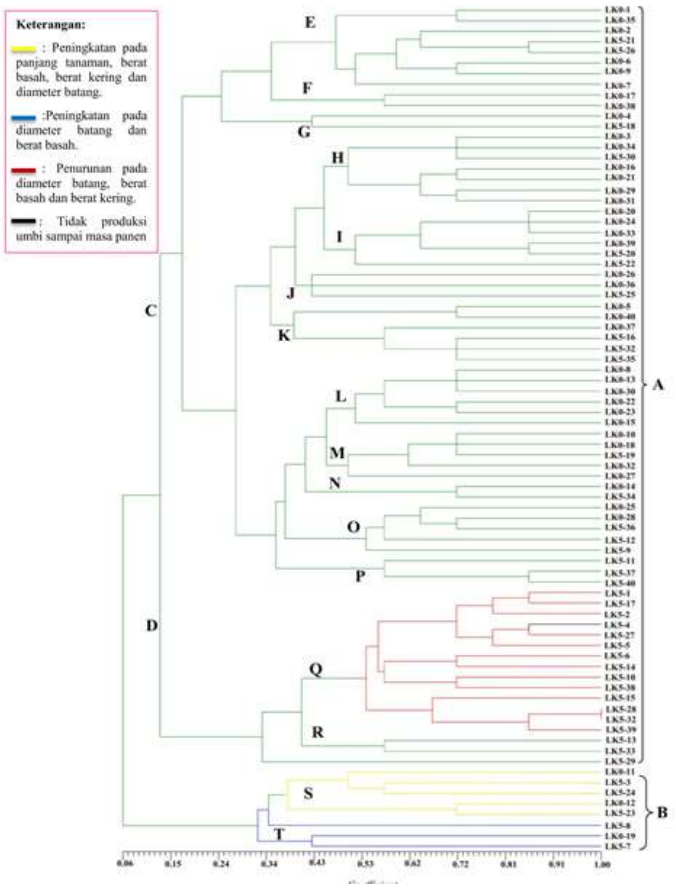

Figure 3. Similarity Dendogram of Second Generation Plants Results from 5 Gy Dose Irradiation (LK5)

Figure 3 shows the relationship graph between LK5 plants (the result of 60Co 5 Gy gamma-ray irradiation) and LK0 plants (control). The dendrogram consisted of 40 LK0 plants (control) and 40 LK5 plants (5 Gy). In the dendrogram between plants LK0 and LK5 two large clusters are formed, namely cluster A and cluster B which have a relationship level of 6%. the nearest is 1.00 (100%) and the farthest is 0.33 (33%). The initial clusters formed were Cluster A consisting of 72 plants and Cluster B consisting of 8 plants. The farthest relationship between LK0 and LK5 plants is 33%, while the closest relationship is 100%.

Increased parameters in plants resulting from irradiation are often found in cluster B (Appendix 5.). The S cluster had a higher average wet weight than the tall control plants, namely 15.92 g, while the average of the control plants was 7.26 g. Cluster S also had a greater average dry weight than control plants, namely 9.6 g, while the average of control plants was 3.24 g. An increase in plant length parameters was also seen in cluster S, namely 50.33 cm, while control plants had an average plant length of 36.61 cm. S cluster also experienced an increase in stem diameter parameters with an average of 1.02 cm, while the average for control plants was 0.59 cm. In cluster S, the irradiated plant that has the highest stem diameter is the LK5-8 plant, namely 1.20 cm. This plant also has a high wet weight, namely 17.2 g.

Cluster Q shows if there is a decrease in parameters in plants resulting from irradiation. One plant in cluster Q could not develop well so until harvest time it did not produce cloves, namely the irradiated plant LK5-14. Plants resulting from LK5-4 irradiation also had several cloves below the average, namely 3 cloves. In cluster Q, the parameters of stem diameter, wet

weight, and dry weight have the class with the lowest average. The average stem diameter of plants in cluster Q was 0.14 cm while the average stem diameter of control plants was 0.59. The average wet weight of plants in cluster Q was 1.73 g while the average wet weight of control plants was 7.26 g. The average dry weight of plants in cluster Q was 0.79 g while the average dry weight of control plants was 3.24 g.

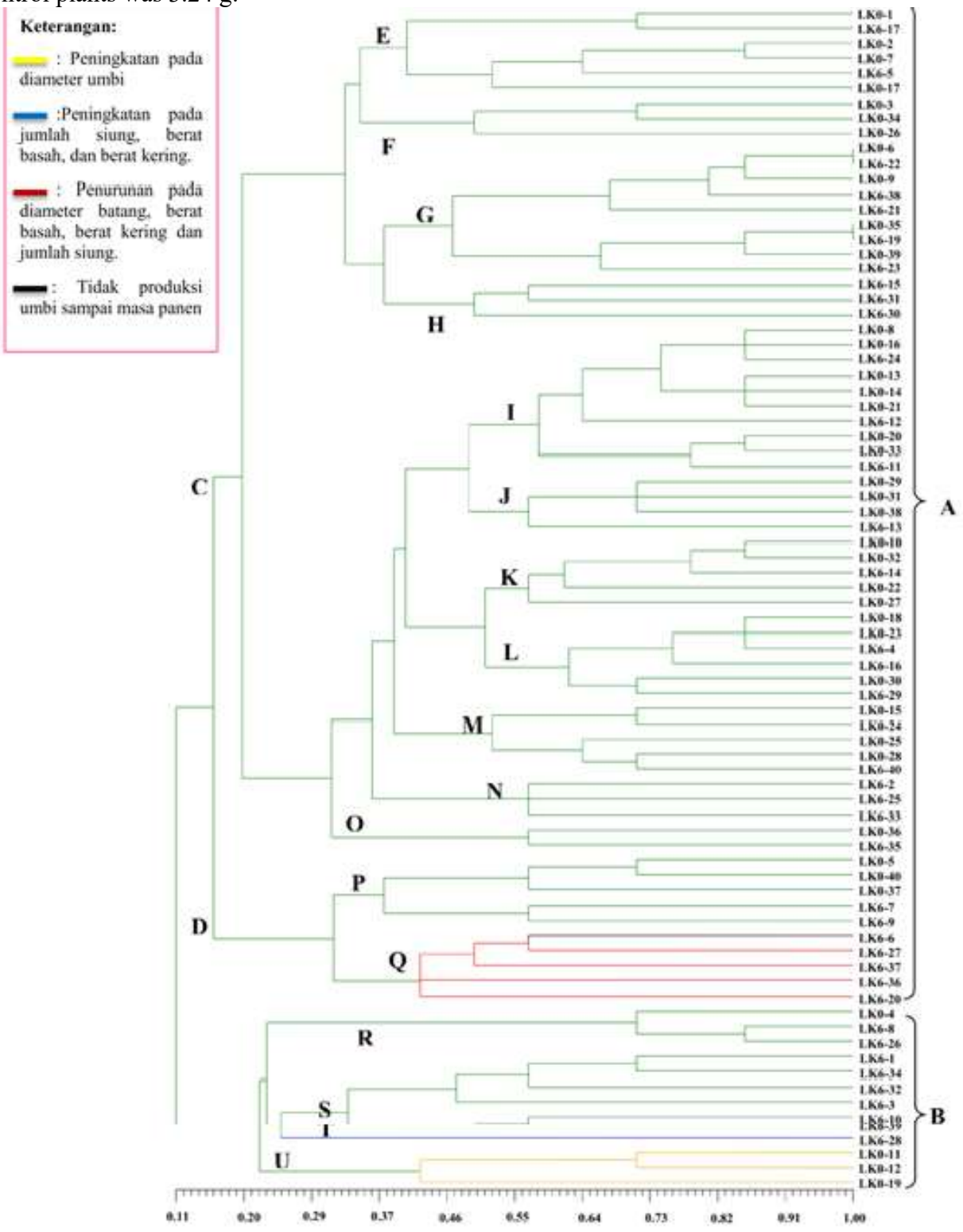

Figure 4. Similarity Dendogram of Second Generation Plants Results from Irradiation with a Dose of 6 Gy (LK6)

Figure 4 shows the relationship graph between LK6 plants (the result of 60Co 6 Gy gamma-ray irradiation) and LK0 plants (control). The dendrogram consisted of 40 LK0 plants (control) and 40 LK6 plants (6 Gy). The initial clusters formed were Cluster A consisting of 76 plants and Cluster B consisting of 14 plants. The level of kinship between cluster A and cluster B is 0.11 (11%). The closest relationship level between LK0 and LK6 plants is 1.00 (100%) in cluster C and the furthest level of relationship is 0.25 (25%) in cluster B.

The increase in plant parameters resulting from irradiation are mostly grouped in cluster B. Plants that have a larger tuber diameter than other plants are in cluster U which has an average of 3.18 cm, while control plants have an average tuber diameter of 2.11 cm. In cluster T, plants resulting from LK6-28 irradiation had the largest number of cloves, namely 25 cloves, while the average number of cloves in control plants was 9.3 cloves. LK6-28 plants also had the largest wet weight, namely 20.5 g, while the average wet weight of control plants was 7.26. Plant LK6-28 too had the largest dry weight, namely 10.4 g, while the average dry weight of control plants was 3.24 g. Cluster B experienced an increase in plant length parameters with an average of 47.5 cm while the average length of control plants was 36.61 cm.

Cluster Q shows if there is a decrease in parameters in plants resulting from irradiation. One plant in cluster Q could not develop well so until harvest time it did not produce cloves, namely the irradiated plant LK6-6. In cluster Q, the parameters of stem diameter, wet weight, dry weight, and number of cloves have the class with the lowest average. The average stem diameter of plants in cluster Q was 0.16 cm while the average stem diameter of control plants was 0.59. The average wet weight of plants in cluster Q was 2.66 g while the average wet weight of control plants was 7.26 g. The average dry weight of plants in cluster Q was 1.28 g while the average dry weight of control plants was 3.24 g. The average number of cloves on plants in cluster Q was 3.4 cloves, while the average number of cloves on control plants was 9.3 cloves.

Kinship level analysis (Cluster) is a statistical analysis that aims to group data so that data in the same group has relatively homogeneous characteristics compared to data in different groups (Mainaiki, Restuhadi, and Rossi, 2016). Genetic diversity A plant also has a kinship relationship. Plants that are distantly related will have great genetic diversity. This is by Julisaniah, Liliek, and Sugiharto (2008) who stated that the further the relationship between samples, the greater the possibility of obtaining superior genotypes. Rahayu and Handayani 2010 also stated that the greater the genetic distance between accessions, the higher the heterosis effect.

DISCUSSION

The second generation of Lumbu Kuning variety garlic plants resulting from 60Co gamma-ray irradiation which were planted in the lower plains had high diversity in their genotypes. Plants resulting from LK6 irradiation have superior genotypes with high diversity in parameters number of leaves and number of cloves. Plants resulting from LK5 irradiation have superior genotypes with high diversity in the parameters of plant length, stem diameter, wet weight, dry weight, and stem diameter. The dendrogram results show that the plants have increased parameters in cluster B. The plants resulting from irradiation with a dose of 5 Gy are plants LK5-3, LK5-24, LK5-23, LK5-8, and LK5-7. In plants resulting from irradiation with a dose of 6 Gy, namely plants LK6-8, LK6-26, LK6-1, LK6-34, LK6-32, LK6-3, LK6-10, LK6-18, LK6-39 and LK6-28.

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