The Effectiveness of Colchisin Giving on Watermelon Ploidization (Citrullus vulgaris Schard)

Sumarji\textsuperscript{1) and Suparno\textsuperscript{2)}

\textit{Kadiri Islamic University, Kediri Jawa Timur - Indonesia}

Abstract

Changes in the number of chromosomes can occur in watermelon plants, and are a source of genetic diversity, such as removal, reversal, deletion, or chromosome doubling. Objectives a) Obtain a method of administering colchicine to produce tetraploid watermelon plants. b) Obtain the appropriate concentration of colchicine in producing tetraploid watermelon plants; c) Acquire and know the diversity of characters among plant individuals undergoing ploidation; d) Obtain compatibility between individual plants undergoing ploidization with the diploid parent; e) Acquire a triploid hybrid plant that can produce waterless seedless fruit. Conclusions: 1) Watermelon plants treated with colchicine have chromosome doubling to 26,30,34,38,40 and 44. 2) Methods of soaking the seeds with a concentration level of 0.2% colchicine can produce many individuals of tetraploid watermelon plants. 3) The character of plant individuals undergoing ploidation (chromosome doubling) with the number of chromosomes 26,30,34,38,40 and 44 undergoes phenotypic, physiological, and production diversity among individuals who have different chromosome numbers but have uniformity among individuals who have The same chromosome. 4) Individuals of plants undergoing ploidation with chromosome number 26,30,34,38,40 and 44 have compatibility with the diploid male parent and the crosses result in hybrid polyploid fruit and seeds having chromosome number 24,26,28,30 , 31 and yields triploid hybrid fruit and seeds with 33 chromosomes. 5) The offspring of a triploid hybrid plant with 33 chromosomes are able to produce waterless seedless fruit.

Keywords: Colchicine, Ploidization, Chromosome, Mutation.
I. INTRODUCTION

One of the properties of breeding material is the presence of high genetic diversity. Changes in the number of chromosomes can occur in plants, and are a source of genetic diversity, such as removal, reversal, deletion, or chromosome doubling. Changes in the number of chromosomes can be followed by morphological changes and have significance for humans (Crowder, 1990). Changes in the number of chromosomes can occur naturally, through cell regeneration, physical treatment and chemical treatment (Avery and Johnson, 1947). Chemical treatments can affect the chromosomal number change is the use of colchicine chemicals. Colchisine is an alkaloid extracted from the Colchicum autumnale L plant which has the formula C22H25O6N (Jensen, 1974).

One type of horticultural crop can be increased its economic value when treated with colchisine is watermelon (*Citrullus vulgaris* Schard), included in the family Cucurbitaceae, is a vine originating from Africa. Full light and high temperature have a good effect on plant growth and fruit development (Mohr 1986). Watermelon Plant (*Citrullus vulgaris* Schard) is one of horticultural commodities that have prospect and priority to be developed.

The cultivation of watermelon plants in Indonesia is still limited to meet the domestic market, but not closed the possibility of competing in the international market. Although it has a bright prospect but the issue of continuity guarantee, quantity and quality of results is still a constraint. The entry of the seeds of triploid watermelon to Indonesia to attract watermelon farmers to cultivate it. Unsealed watermelon fruit has been widely marketed in traditional markets and supermarkets of major cities in Indonesia. Such facts make the demand for seeds and watermelon fruit without seed increasing (Wihardjo, 2012).

Some cultivation techniques have been widely applied ranging from seed provision to post-harvest handling. One effort relates to the supply of triploid watermelon seeds with the use of a chemical compound of Colchicone, which aims to form a tetraploid watermelon, while triploid watermelon seeds obtained from descendants of tetraploid watermelon crosses as female elders with diploid as male elders (Sakaguchi and Nishimura, 1966). Seeds of triploid watermelons are still being introduced from Taiwan, Thailand, Japan, the United States and European countries. Whereas the need for triploid watermelon seeds in Indonesia, especially in the growing season is very much, otherwise the seed stock is very limited and cause the price of seeds to be expensive.

Avery and Johnson (1947) report that colchicine has important significance in plant breeding because of its properties that can double the number of chromosomes. Watermelon plant with 2n (diploid) chromosome number, if colchisine is applied chromosome number can be 4n (tetraploid). According to Danoesastro (1974) the
administration of colchicine directed at vegetative points such as seeds, sprouts and the tip of the plant.

Meyer (1943) in Avery and Johnson (1947) states that the influence of colchicine, chromosomes will divide and remain in one cell nucleus, since colchicine prevents the formation of core walls and cell walls, so the number of chromosomes in one cell becomes doubled and A tetraploid female tete-cell is formed. Based on the existence of the seeds there are two types of watermelon seedlings (diploid = 2 n) and seedless watermelon (triploid = 3 n). Diploid watermelons treated with colchicine may turn into a tetraploid watermelon (Kalie, 2003).

With the treatment of colchicine in watermelon plants will affect the phenotype of several properties of mutated watermelon plants (polyploid) such as plant growth, leaf size, stems, stomata and larger seeds, leaf green color, stomata and fewer seeds, various seed shape, And larger polls. Allard (1960) states that in general, chromosome doubling results in genotype imbalance, causing morphological differences with plants not having chromosomal doubling. A common result in polyploid watermelon plants is the increased size of plant vegetative organs so that the morphology is more robust and larger than the diploid.

Based on the description above can be formulated some problems as follows:

1. Which method of administration and degree of concentration of colchicine is effective in producing tetraploid watermelon plants?
2. Do the plant individuals who have undergone ploidation have diversity?
3. Individuals with ploiding plants that have compatibility when crossed with diploid parental male?
4. Individual hybrid polyploid plant how can it produce waterless seedless fruit?

The objectives of this research are:

1. Acquired an effective method of colchinisine administration to produce individual tetraploid watermelon plants.
2. Obtain the right concentration of colchisine in producing tetraploid watermelon plants
3. Acquiring and knowing the diversity of characters among plant individuals undergoing ploidization.
4. Gaining compatibility between individual plants undergoing ploidization with diploid parent.
5. Acquire a triploid hybrid plant that can produce waterless seedless fruit.
II. CONCEPTUAL FRAMEWORK AND HYPOTHESES

Research I
- Colchicine treatment
  - Method of administration and degree of colchicine
- Homozigot seeds
  - Pure strain from the results
- Obtained individuals who have multiplied chromosomes (polyploid)
  - Study of growth, morphology and physiology
- Polyploid seeds
  - Cytology study
- Planted

Research II
- Plants of polyploid
  - Study of growth, morphology and physiology
- Cross
- Polyploid hybrid seeds
  - Cytology study
- Planted

Research III
- Hybrid polyploid plants
  - Study of growth, morphology and physiology
- Cross
- Diploid plants
  - Watermelon fruit without seeds
Based on the above description, can be arranged as follows hypothesis

1. Effective method of colchisine administration can produce quickly and many individuals tetraploid watermelon plants
2. Proper colchicine concentrations can produce tetraploid watermelon plants.
3. Character among plant individuals undergoing ploidization has different levels of diversity.
4. Individuals of plants undergoing ploidization have compatibility when crossed with their diploid male parent.
5. The offspring of the triploid hybrid plant will produce watermelonless fruit.

III. RESEARCH METHODOLOGY

The research consisted of three stages: Research I: colchisine treatment on homosygous watermelon (pure results), Research II: Evaluation of Mutated Crops (Poliploid), Research III: Evaluation of Polycloid Hybrid Plant.

In general, the operational framework of the study is presented as follows:

3.1 Research I: Colchicine Treatment On Homozigot Water Melon Sea (Purifying Poultry Result)

Methods of research: Planting using factorial pattern that was prepared by using randomized block design with three replications,

- Factor 1: Method of administration of colchisine (A) which includes:
  A1: Soaking the seeds for 12 hours; A2: Soaking the sprouts for 30 minutes, A3: Drop seeds as many as 8 times for 4 days; A4: Soaking the seeds for 12 hours and soaking the sprouts for 30 minutes; A5: Soaking the seeds for 12 hours and dropping the seeds 8 times for 4 days; A6: Soaking sprouts for 30 minutes and seedling drops 8 times for 4 days; A7: Soaking the seeds for 12 hours, soaking the sprouts for 30 minutes and dropping the seeds 8 times for 4 days

- Factor 2: Colchicine concentration (K) which includes:
  K1: Concentration 0.05%; K2: Concentration 0.1%; K3: Concentration 0.15%; K4: Concentration 0.2%; K5: Concentration 0.25%

- Plant maintenance includes: Extending twigs, irrigation, sprinkling, pruning, fertilizing and pest control / disease.

- Variables observed:
  1). Vegetative growth which includes: When first leaf appears, plant length, number
of leaves, leaf area, stomata quantity and size, chlorophyll content, protein band profile.

2). Generative growth which includes: When the first male flowers appear, when the first female flower appears, the size of the pollen, the fruit circumference, the total fruit weight of the crop, the number of seeds of the fruit, the weight of 100 seeds, the weight of the seeds of the fruit.

3). Cytology that includes: counting the number of plant chromosomes due to the treatment of watermelon colchisine treated with colchisine.

- **Aim** :

1). Acquired an effective method of administration of colchicine in the production of individual tetraploid watermelon plants.

2). Obtained proper concentration of colchicine in producing tetraploid watermelon plants

- **Analysis of protein band profiles**:

The data obtained in the form of protein bands result of electrophoresis is analyzed descriptively that is by comparing bands of watermelon plant protein treated with Colchicine.

- **Data analysis** :

To know the effect of interaction of administration method and concentration of colchisine used Duncan test 5%

3.2 **Research II: Evaluation Of Mutation Plant (Poliploid)**

- **Research Methods**: Planting using a randomized block design with three replicates and crossing the mutated plant (poliploid) with its diploid parent

- **Variables observed**:

1). Vegetative growth which includes: When the first leaves appear, the length of the plant, the number of leaves, the area of leaves, the number and size of stomata, the content of chlorophyll.

2). Generative growth which includes: When the first male flower appears, when the first female flower appears, the size of pollen, plant, fruit circumference, total fruit weight of the crop, the number of seeds of the fruit, the weight of 100 seeds, the weight of the seeds of the fruit.

3). Cytology that includes: counting the number of chromosomes from mutated plants mutation (poliploid) as female elders with diploid watermelon as male elders.
- **Aim**

1). Acquire and know the diversity of characters among individuals who are platonized.

2). Gain compatibility between individual plants undergoing ploidization with the diploid male parent.

### 3.3 Research III: Evaluation Of Plant Of Hybrid Polyloid.

- **Research Methods**: Planting using a randomized block design with three replicates and to stimulate the formation of polyphoid hybrid fruit plants pollinated with male flowers from diploid plants.

- **Variables observed**:

1). Vegetative growth that includes: When the first leaf appears, the length of the plant, the number of leaves, the area of leaves, the number and size of stomata, the content of chlorophyll.

2). Generative growth which includes: When the first male flower appears, when the first female flower appears, the size of pollen, crop, fruit circumference, total fruit weight of the crop, the number of seeds of the fruit, the weight of 100 seeds, the weight of the seeds and the content of sugar.

- **Aim**:

To obtain a triploid hybrid plant that can produce waterless seedless fruit

### IV. RESULTS AND DISCUSSION

#### 4.1 Number of Chromosomes

Method of administration of colchisine with the level of concentration colchisine very significant effect on the average number of chromosomes. The effect of colchizine concentration on average number of chromosomes is significantly different in each method of colchicine. The method of soaking the seeds, the method of soaking the sprouts and the method of soaking the seeds and the determination of the seeds of increased concentration of colchisine from 0.05% to 0.2% resulted in the average number of chromosomes More and more real. In the method of penetrating the seedlings increased the concentration of colchisine from 0.05% to 0.15% the average number of chromosomes significantly became more. Methods of soaking seeds and sprouts as well as methods of soaking the seeds, soaking sprouts and sprouting seeds increased the concentration of colchisine from 0.05% to 0.1% resulting in the average number of chromosomes increased significantly. Table 1 shows that the method of soaking the seeds, the sprouting method and the method of soaking the seeds and the
penetration of seeds with a concentration of 0.2% colchinisine yielded the average number of chromosomes at most as many as 44 chromosomes.

**Table 1.** The average number of chromosomes in various methods of administration and concentration of colchicine

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>Seed immersion</td>
<td>26Aa</td>
</tr>
<tr>
<td>Soaking Sprouts</td>
<td>26Aa</td>
</tr>
<tr>
<td>Seed Testing</td>
<td>26Aa</td>
</tr>
<tr>
<td>Soaking Seeds and Sprouts</td>
<td>34Ac</td>
</tr>
<tr>
<td>Seed Immersion and Seed Testing</td>
<td>34Ac</td>
</tr>
<tr>
<td>Soaking Sprouts and Seed Testing</td>
<td>30Ab</td>
</tr>
<tr>
<td>Soaking Seeds, Soaking Sprouts, and Seed Testing</td>
<td>34Ac</td>
</tr>
<tr>
<td>Control</td>
<td>22</td>
</tr>
</tbody>
</table>

Information:
- Figures followed by different capital letters on the same line show significantly different in the Duncan 5%
- Figures followed by different lowercase letters in the same column show significantly different in Duncan 5%
4.2 Fruits Weight Per Fruit, Fruit Round, Number of Seeds per Fruit, Weight Per Seeds, Weight 100 Seeds and number of chromosomes

Table 2. Average Weight of Fruit per Fruit (kg), Round of Fruit (cm), Number of Seeds per Fruit, Weight Per Seeds (g), Weight 100 Seeds (g) and number of hybrid polyploid plant chromosomes (mutated plant mutation Polyploid with diploid plants)

<table>
<thead>
<tr>
<th>Crosses of Mutated Plant (Poliploid) with piece the Diploid Plants</th>
<th>Weight Fruit per piece (kg)</th>
<th>Fruit Round (cm)</th>
<th>Number of Seeds per fruit</th>
<th>Weight Seeds Per Fruit (g)</th>
<th>Weight 100 Seed Fruit (g)</th>
<th>Number of chromosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>26♀ X 22♂</td>
<td>4,45a</td>
<td>57,74a</td>
<td>428f</td>
<td>20,85de</td>
<td>4,44a</td>
<td>24a</td>
</tr>
<tr>
<td>30♀ X 22♂</td>
<td>4,97b</td>
<td>59,4ab</td>
<td>383e</td>
<td>19,58d</td>
<td>5,2b</td>
<td>26b</td>
</tr>
<tr>
<td>34♀ X 22♂</td>
<td>5,19c</td>
<td>61,38b</td>
<td>345,33d</td>
<td>17,55c</td>
<td>5,34c</td>
<td>28c</td>
</tr>
<tr>
<td>38♀ X 22♂</td>
<td>5,92d</td>
<td>65,98c</td>
<td>273,33c</td>
<td>14,11b</td>
<td>5,5d</td>
<td>30d</td>
</tr>
<tr>
<td>40♀ X 22♂</td>
<td>6,42e</td>
<td>71,74d</td>
<td>244,33b</td>
<td>13,16b</td>
<td>6,46e</td>
<td>31e</td>
</tr>
<tr>
<td>44♀ X 22♂</td>
<td>6,82 f</td>
<td>78,14 e</td>
<td>144,67a</td>
<td>9,25a</td>
<td>7,12f</td>
<td>33f</td>
</tr>
<tr>
<td>22 (Kontrol)</td>
<td>4,17</td>
<td>56,7</td>
<td>531</td>
<td>21,77</td>
<td>4,11</td>
<td>22</td>
</tr>
</tbody>
</table>

Description: The numbers followed by different letters in the same column show significantly different in the Duncan 5%

The number of chromosomes of mutated plants (polyploid) has a very significant effect on the average weight of fruit per fruit, fruit circumference, number of seeds per fruit, seed weight per fruit, weight of 100 seeds and number of hybrid seed chromosomes (polyploid). Increasing the number of chromosomes of mutated plants (polyploid) produces fruit weight per fruit, fruit circumference, weight of 100 seeds and the number of chromosomes increases but the number of seeds per fruit, the weight of the seed per fruit decreases. In the observation of the weight of fruit per
fruit, the number of seeds per fruit, the weight of 100 seeds and the number of hybrid polyploid hybrid chromosomes, all the number of chromosomes of mutated plants (polyploid) were significantly different. While in the observation of fruit circumference and seed weight per fruit, the number of mutated plant chromosomes (polyploid) 26 showed no significant difference in effect with the number of plant chromosomes mutated (polyploid) 30 and with control. The weight of the fruit per heaviest fruit of 6.82 kg, the longest fruit circumference of 78.14 cm, the weight of 100 heaviest seeds is 7.12 g produced by the number of chromosomes of mutated plants (polyploid) 44. While the number of seeds per fruit is 428 and the weight of seed The toughest fruit of 20.85 g is produced by the number of chromosomes 26.

4.3 Weight Per Fruit, Fruit Round, Number of Seeds per Fruit, Weight Per Seeds, 100 Weight Seeds, Sugar content in fruit

Variance analysis showed that the chromosome number of hybrid polyploid plants had a very significant effect on the average fruit weight per fruit, fruit circumference, number of seeds per fruit, seed weight per fruit, weight of 100 seeds and sugar content in fruit (%). Increasing the number of chromosomes of hybrid polyploid plants yields the average weight of fruit per fruit, fruit circumference, and the content of sugar in the fruit increases, while the number of seeds per fruit and the weight of the seeds per fruit decreases to a zero value (no seed) on the number of plant chromosomes Polyploid hybrids 31 and 33, which means no seeds in the fruit. At 100 grain weight observations, the weight average of 100 seeds increased up to the number of polyploid hybrid plant chromosomes by 30, while on the hybrid chromosome number of polyploid poles 31 and 33 the weight average of 100 seeds was zero because of no seed.

The weight of fruit per heaviest fruit of 6.71 kg, the longest fruit circumference of 77.46 cm, the highest sugar content of 12.24% is produced by the number of chromosomes of polyploid hybrid plants as much as 33. While the number of seeds per fruit is 526.92 and The weight of seeds per heaviest fruit that is 21.64 g produced by the control plants. The 100th weight of the largest seed is produced by the number of polyploid hybrid plant chromosomes of 30 by 5.43 g.
Table 3. Average Weight Per Fruit (kg), Fruit Round (cm), Number of Seeds per Fruit, Weight Per Seeds (g), Weight 100 Seed (g), Sugar content in fruit (%)

<table>
<thead>
<tr>
<th>Number Polyploid Hybrid Chromosomes</th>
<th>Weight of Fruit per piece (kg)</th>
<th>Fruit Round (cm)</th>
<th>Number of Seeds per fruit</th>
<th>Weight Seeds Per Fruit (g)</th>
<th>Weight 100 Seed (g)</th>
<th>The content of sugar in fruit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>4,28a</td>
<td>57,22a</td>
<td>426,14e</td>
<td>20,25e</td>
<td>4,33b</td>
<td>8,84a</td>
</tr>
<tr>
<td>26</td>
<td>4,85b</td>
<td>58,35b</td>
<td>377,36d</td>
<td>19,21d</td>
<td>5,18c</td>
<td>9,17b</td>
</tr>
<tr>
<td>28</td>
<td>5,1c</td>
<td>60,33c</td>
<td>340,47c</td>
<td>17,18c</td>
<td>5,28d</td>
<td>9,86c</td>
</tr>
<tr>
<td>30</td>
<td>5,75d</td>
<td>64,56d</td>
<td>268,39b</td>
<td>14,07b</td>
<td>5,43e</td>
<td>10,22d</td>
</tr>
<tr>
<td>31</td>
<td>6,25e</td>
<td>70,81e</td>
<td>0,00a</td>
<td>0,00a</td>
<td>0,00a</td>
<td>11,16e</td>
</tr>
<tr>
<td>33</td>
<td>6,71f</td>
<td>77,46f</td>
<td>0,00a</td>
<td>0,00a</td>
<td>0,00a</td>
<td>12,24f</td>
</tr>
<tr>
<td>22 (kontrol)</td>
<td>4,10</td>
<td>56,12</td>
<td>526,92</td>
<td>21,64</td>
<td>4,09</td>
<td>8,16</td>
</tr>
</tbody>
</table>

Description: The numbers followed by different letters in the same column show significantly different in the Duncan 5%

The plants undergoing chromosomal multiplication have the number of seeds of the fruit and the total weight of the seeds tend to be smaller. This is due to the low fertility rate of the plant on chromosome multiplication resulting in a low percentage of pineapple seeds, which will affect the weight of the seed of the fruit to be low. Mohr (1986) states that watermelon tetraploid treated by colchisin has fewer seeds than diploid. This is because the pollen plants that have doubled the chromosome has a lower fertility than plants that do not have a doubling of chromosomes.

Plants undergoing chromosome doubling with low mutation rates due to 0.05% and 0.25% concentration of colchisin treatment resulted in large quantities of seeds and showed that the plants still had high levels of fertility of the pollen. While plants doubled by duplication chromosomes due to colchicine treatment concentrations of 0.1% - 0.2% yielded seeds in small amounts due to having a pollen with a low fertility rate.
The observed number of chromosomes observed that two chromosomes doubled (tetraploid) compared to diploid (control), either at a concentration of 0.1%; 0.15% and 0.2%. But there are also only multiplication of some chromosomes only at the concentration of 0.05% and 0.25%. Saisingtong (2006) states that long-term administration of colchicine in each meristematic tissue with high concentrations leads to increased chromosome doubling.

The result of correlation analysis is known that with the increasing number of chromosomes, the number of stomata will decrease, the number of seeds is less and the weight of the seed of the fruit becomes lighter. But with the increase in the number of chromosomes, the age of the first leaves will be longer, the percentage of the higher mutated plants, the longer the length of the plant, the more leaves, the larger the leaf area, the higher total chlorophyll content, the larger the stomata size. Male and female first the longer, the greater the size of the pollen, the weight of the fruit the more severe, the wider the fruit circle, the weight of 100 seeds the more weight.

Plants treated with colchicine at various methods of concentration levels have doubled the number of chromosomes from the initial chromosome 22 to 26, 30, 34, 38, 40 and 44. The ability of a high autopoliploid mechanism is achieved by duplicating a number of genomes, The number of chromosomes has passed a certain amount is usually difficult to live normal and very weak and the endurance of each type of plant to autopoliploid quite varied. As a consequence of colchicine treatment causes an increase in chlorophyll content, so protein can affect the phenotype of the plant. This is because plants that multiply the number of chromosomes leads to an increase in the number, size of cells and genes that cause DNA to increase and followed by the addition of RNA that encodes proteins (enzymes and functional proteins), while physiologically functional proteins of existing enzymes will affect chlorophyll content.

And protein. By increasing the content of chlorophyll on the leaves of the mutated plants causing photosynthesis resulting from photosynthesis increases and is transcribed throughout the plant for the formation of vegetative or generative organs that will affect the phenotype of each mutated plant.

Individuals of mutated plants (polyploids) have a uniform phenotype of growth, morphology, physiology, and crop production including plant length, leaf area, chlorophyll content, number of protein band profiles, number and size of stomata, size of pollen, fruit weight, Fruit circumference, number of seeds of fruit, weight of fruit per fruit, weight of 100 seeds, and number of chromosomes on each individual having the same number of chromosomes.

The chromosome is a double helical spiral consisting of DNA. DNA is composed of organic adenine base groups, thymine, cytosine, and guanine attached to sugar molecules and interconnected by phosphorus. Organic bases make up the writings of
the genetic language of life. The gene is defined as a base sequence in a DNA segment. DNA can be duplicated repeatedly and any duplication can be inherited from the mother to the offspring. The duplication of the nature of this DNA results in the transfer of genetic information from one generation to the next with almost no errors. Functionally DNA provides information from the genetic code to direct the organism’s physiological mechanism. This information is obtained by reading a series of codes from parts of a strand transacting open DNA and through another system called RNA to be expressed in the form of certain protein enzymes that have specific functions in cell activity. The combination of DNA information with the environment produces an individual phenotype expression so that if the individual has the same number of chromosomes the phenotypic expression becomes uniform. Whereas between individuals who have different chromosome numbers then the phenotype expression becomes diverse.

Quality fruits and seeds are obtained from poliploid plants that are crossed with diploid plants as male elders. The result of a mutated plant crosses (polyploid) as a female parent with diploid plants as the male elders all yields fruit and seeds of pith (hybrid polyploid seeds).

High compatibility between mutated plants (polyploid) as female parent with diploid plant as male elder because each has a homologous gamete. And miosis is a specific cell division because it only takes place during the formation of gametes only where the number of chromosomes is removed from the tetraploid state (4n) becomes diploid, and from the diploid state (2n) becomes haploid (n). In the process of fertilization occurs union of diploid and haploid gametes to create a triploid zygote. Genetic information separates regularly into gametes so that the offspring will have genetic information from each of the female and male parent.

Mutated plants (polyploid) have greater fruit and circle weight, lower number of seeds and weight of 100 fruit tends to increase. Based on the observation of the number of chromosomes resulting from the mutation of the mutated plants (polyploid) as the female parent with the diploid watermelon as the male elder, successively produce hybrid polyploid with chromosome number 24,26,28,30,31, and triploid hybrid with 33 chromosome number.

The results of Pickering’s (1991) study on triploid plants crossed between Hordeum Vulgare L. (2 n = 4 x = 28) with H. bulbosum L. (2 n = 2 x = 14) resulted in triploids with varying chromosome numbers ranging from 19 to 22. In the Pickering study, metaphase I was found to be 7 bivalent and several univalent, while trivalent was very rare. Based on the results of Pickering research can be assumed that watermelon research (Citrullus vulgaris Schard) chromosomal conditions are also so that the possibility of the resulting number of chromosomes that vary.

The result of a mutated plant mutation (polyploid) with diploid watermelon as male
elder produces hybrid polyploid seeds which have chromosomes 24, 26, 28, 30, 31 and 33 respectively. The seeds of polyploid hybrid are planted and evaluated the existence of seeds in the fruit.

The presence of the seed in the polyploid hybrid offspring is the number of hybrid chromosomes of polyploid 24 yielding seeds, the number of polyploid hybrid chromosomes 26 yielding seeds, the number of polyploid hybrid chromosomes 28 yielding seeds, the number of polyploid hybrid chromosomes 30 yielding seeds, the number of polyploid hybrid chromosomes 31 yields Deflated fruit, the number of triploid hybrid chromosomes 33 yields seedless fruit (without seeds).

The polyploid hybrid plant as a whole shows the average age of the first leaf appears slower. Smith (1991) states that seedlings of triploid watermelon seedlings in early growth of slow and abnormal growing seedlings, small cotyledone and have a spurt gain of 27.5 - 85%. Plant length, number of leaves and leaf area of hybrid polyploid plants at the beginning of vegetative growth were lower than controls but subsequent vegetative growth until harvest showed vigor or greater growth.

Polyploid hybrid plants have larger and thicker leaf sizes, increased chlorophyll content, larger leaf hairs, followed by stomata size and leaf epidermal cells, large stombata covering cells, the amount of stomata in a single area of epidermal tissue becomes reduced Increase photosynthesis that affects vegetative and generative growth better.

Phenotypes of polyploid hybrid plants have a high degree of uniformity of growth, morphology, physiology and crop production including plant length, leaf area, leaf color, stomatal quantities and size, chlorophyll content, protein band profiles, pollen size, fruit weight, fruit circumference, amount Seeds per fruit, the weight of the seeds of the fruit, and the weight of 100 seeds on each individual having the same number of chromosomes. Stebbin (1949) states that the plant phenotype is a measurable characteristic or real property possessed by individual plants. Phenotypes may be visible to the eye, such as leaf color, flower color, or may require special testing for identification. Phenotypes are gene products expressed in the environment, in other words phenotypes are the resultant of innate factors (genotypes) and environmental factors.

The increasing number of chromosomes in hybrid polyploid plants has a tendency to average the blooming blooms of males and females more slowly. This is as a result of the long vegetative growth of hybrid polyploid plants. As for the size of the flower is larger and has a pollen with a high level of sterility so that to stimulate fertilization must be crossed with diploid watermelon as male elders. Research conducted by Tsai and Yeh (2011) which observed pole germination process and pollen tube growth process showed that the sterility in F1 of interspesic hybridization on Glycine genus was not caused by germinated pole failure or tube tube failure reaching ovule, but due
to the nature of the plant Triploid.

The main cause of triploid plant sterility is the segregation of chromosomes during irregular meiosis resulting in bivalent and univalent, or trivalent, or three univalents. As a result the resulting gametes have an incomplete genome. When gametes meet in a zygote process, an incomplete genome causes the genetic information to be carried to be incomplete, so the resulting seed is not viable or even unable to produce seed (Brar 1978)

V. CONCLUSION

Watermelon plants treated with colchicine can produce offspring of triploid hybrid plants that have 33 chromosomes capable of producing waterless seedless fruit.

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AUTHOR BIOGRAPHY

1) Prof. Dr. SUMARJI, SP, MP. Dosen Kadiri Islamic University, Kediri, Jawa Timur Indonesia

2) Dr. SUPARNO, SP, MMA, MH. Dosen Kadiri Islamic University, Kediri, Jawa Timur Indonesia