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STUDY OF THE USE OF *Nepenthes mirabilis* EXTRACT AS FORMULA COATING ON CORN SEEDS (*Zea mays* L)

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ABSTRACT

One of the efforts to increase corn production (*Zea mays* L) is by using good quality seeds. Good quality seeds generally have good seed viability and vigor. Even though it has been tested for quality, seeds may experience a decrease in quality during the storage period. This study aims to determine the effect of applying *N. mirabilis* extract coating material to corn seeds during storage, to determine the best concentration on the viability and vigor and growth of corn seeds. This study used a one-factor Randomized Block Design (RBD) with 4 replications and 11 treatments, namely: P01 = distilled water; P02 = CMC 0.20; P03 = Dithane 2 g/l; P1 = leaf extract 1 g/l + cmc 0.20 g/ml; P2 = leaf extract 0.20 g/l + cmc 2 g/ml; P3 = leaf extract 4 g/l + cmc 0.20 g/ml; P4 = leaf extract 8 g/l + cmc 0.20 g/ml; P5 = bag extract 1 g/l + cmc 0.20 g/ml; P6 = bag extract 2 g/l + cmc 0.20 g/ml; P7 = bag extract 4 g/l + cmc 0.20 g/ml; P8 = bag extract 8 g/l + cmc 0.20 g/ml. The results showed that the P5 treatment (1 g/l *N. mirabilis* sac extract + 0.20 g/ml cmc) had a significant effect on growth parameters with a plant height of 35.16 cm and the longest root length of 21.93 cm. Meanwhile for the plant wet weight parameter, the P5 treatment also showed the highest value but had no significant effect, namely 35.81 g. While treatment P6 (*N. mirabilis* sac extract 2 g/l + cmc 0.20 g/ml), gave the highest trend in the viability and vigor parameters of corn seeds with the achievement of potential germination rate (PTM) of 81%, germination rate of 79%, growth rate (KCT) 26.83%/day, vigor index (InV) 68%, and normal sprout dry weight (BKKN) 7.81 g.

Keywords:

Nepenthes mirabilis, coating, corn seeds

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INTRODUCTION

Seed quality during storage can be maintained in various ways, one of which is by seed treatment or treatment of seeds before storage. Generally, the aim of seed treatment is to eliminate the source of seed infection (disinfection) to fight seed-borne pathogens, protect seeds when they germinate, increase germination, protect seeds from pathogens and pests from soil or storage [1]. Coating of seeds or seed coating is one method of seed treatment. Seed coating is able to maintain or improve seed quality for the better so that it can help optimize seed germination in all environmental conditions [2]. The coating formula can be derived from vegetable ingredients that have fungicide or antimicrobial properties. Antimicrobial compounds can protect seeds from pests or pathogens in the warehouse during the storage period.

Some vegetable ingredients that have been used as coatings are curcuma flour [3], forest betel leaf extract, temulawak rhizome extract, and clove oil [4]. One of the plants that has antimicrobial content and potential as a vegetable fungicide is Nepenthes. Nepenthes or Nepenthes sacs are insectivorous plants that are able to digest insects trapped in the pitchers at the tips of their leaf tendrils [5], the trapped insects are destroyed, then used as a source of nutrition (protein and nitrogen). The liquid in the Nepenthes plant bag contains various enzymes, including protease (most dominant) and nepenthesin which function to digest insects. Sulistianingsih [6] states that there is anti-microbial activity in Nepenthes leaf extract. These anti-microbial substances have been identified as compounds from the kinin group, including plumbagin, droseron, and have been developed into antibiotics. Through this research, it is hoped that these antimicrobial compounds can be used as coating materials that can affect the viability and vigor of corn seeds. Corn (*Zea mays* L.) is one of the main food crops after rice in Indonesia. The higher the current consumption of corn, the need for efforts to increase production, one of which is by using good quality seeds. It is hoped that good quality seeds will produce good productivity [7]. Quality seeds are generally closely related to seed viability and vigor [8].

This study aims to determine the effect of applying *N. mirabilis* extract coating material to corn seeds and to determine the best concentration on the viability and vigor of corn seeds and seedling growth. It is hoped that this research can provide information about the use and effect of *N. mirabilis* extract as a coating formula that is compatible with corn seeds.

METHOD

Time and Place of Research

Research activities have been carried out in August 2018 – January 2019 took place at the Plant Protection Laboratory and screen house, Faculty of Agriculture, University of Borneo Tarakan.

Research Tools and Materials

The tools used in this study were petri dishes (9 cm in diameter), analytical scales, measuring cups, stationery, cameras, tape measure, blender and magnetic stirrer. The materials to be used in this study were leaf extract and sacs of *N. mirabilis*,

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local varieties of corn seeds, carboxylmethylcellulase (CMC) adhesives, label paper, filter paper, dithane M-45 80 WP and aquadest.

Research Implementation

1. Preparation of leaf extract suspension and sacs of N. mirabilis

The raw materials used for the extraction of *N. mirabilis* are leaves and bags of *N. mirabilis* plants that grow around the Amal Beach Village, East Tarakan District, Tarakan City. The good leaves of *N. mirabilis* are selected and separated from those that are damaged or black in color and then washed thoroughly so that the dirt attached to the leaves is removed. Likewise with the *N. mirabilis* sac, the inside of the bag is cleaned so that the insects contained in it are removed. The leaves and sacs of *N. mirabilis* were roughly chopped to make the drying process faster. The sample drying process was carried out by means of aerated without exposure to direct sunlight. This is so that the active compounds in the sample are not damaged and the water content in the sample is reduced. The dried samples were mashed with a blender to obtain fine powder. Refinement can simplify the extraction process. The smaller the shape, the greater the surface area, the greater the interaction of the liquid extraction fluid, so that the extraction process will be more effective. The weight of the leaf fine powder obtained was 165.17 grams while the bag fine powder obtained was 40.65 grams. Samples of leaves and sacs of *N. mirabilis* that had been mashed were macerated with 95% ethanol for 3 x 24 hours. For leaves, soaked with 700 ml of ethanol, while for bags using 1000 ml of ethanol. Macerate is evaporated at a temperature of 30 – 45 ˚C with the help of an evaporator (rotary vacuum evaporator) so that it becomes more concentrated.

2. Proses seed coating

3. Seed viability and vigor testing

After the seeds were stored for 30 days, seed viability and vigor tests were carried out for 14 days using the growing on test method of sterile soil media with the aim of representing field conditions. All seeds were planted, with each seed in a polybag (10 x 7.5 cm) containing 350 g of sterile soil.

Experimental design

This study used a randomized block design (RBD) which consisted of one factor, namely leaf extracts and sacs of *N. mirabilis*. In this experiment there were 11 treatments and each treatment was repeated four times so there were 44 experimental units. Each replication consisted of 25 seeds so that there were 100 seeds for each treatment tested. The treatments are as follows: P01 = control (without coating),

P02 = CMC 0,20 g/ml

P03 = dithane 2 g/l

P1 = ekstrak daun *N. mirabilis* 1 g/l + CMC 0,20 g/ml P2 = ekstrak daun *N. mirabilis* 2 g/l + CMC 0,20 g/ml P3 = ekstrak daun *N. mirabilis* 4 g/l + CMC 0,20 g/ml P4 = ekstrak daun *N. mirabilis* 8 g/l + CMC 0,20 g/ml

P5 = ekstrak kantung *N. mirabilis* 1 g/l + CMC 0,20 g/ml P6 = ekstrak kantung *N. mirabilis* 2 g/l +

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CMC 0,20 g/ml P7 = ekstrak kantung *N. mirabilis* 4 g/l + CMC 0,20 g/ml P8 = ekstrak kantung *N. mirabilis* 8 g/l + CMC 0,20 g/ml

Observation Parameters

Parameters for observing seed viability include maximum growth potential (PTM) and seed germination rate (DB). While the parameters for observing seed vigor include growth rate (KCT), percentage of seed vigor index (InV), normal seedling dry weight (BKKN). For growth parameters, namely plant height, longest root length, and normal wet weight of sprouts.

Data analysis

The data obtained were tested by single factor analysis of variance and further tested by DMRT at the 5% level if significant.

RESULT AND DISCUSSION

Result

Coating Treatment of Seed Viability and Vigor

The results of the analysis of variance showed that the coating on corn seeds had a very significant effect on plant height and longest root length, but had no significant effect on seed viability including the parameters of maximum growth potential (PTM), germination capacity (DB) and normal sprout dry weight (BKKN). Coating treatment also had no significant effect on seed vigor in the parameters of growth rate (KCT) and vigor index (IV) as well as plant wet weight.

A. Maximum Growth Potential (PTM)

Based on the analysis of variance (Appendix 1), it shows that the seed coating treatment has no significant effect on the maximum growth potential (PTM) of corn seeds. The PTM value of corn seeds produced from the P6 treatment was 81%, which tended to be higher than the other treatments. Meanwhile, the P7 treatment tended to give lower results than other treatments, namely 42%. PTM value data for corn seeds are in Table 2.

B. Germination Power (DB)

The seed coating treatment had no significant effect on the germination capacity (DB) of corn seeds (analysis of variance in Appendix 1). In Table 2, it can be seen that the DB value of the seeds in the P6 treatment tended to give higher yields compared to other treatments, namely 79%. While the P7 treatment tended to give lower results, namely 41%.

C. Plant Dry Weight

Normal sprout dry weight is a measure of potential viability. Based on the results of the analysis of variance, the application of *N. mirabilis* extract as a coating for corn seeds had no significant effect on the dry weight variable of normal sprouts (Appendix 1). Based on Table 2, the P2 treatment gives a value that tends to be higher than the other treatments, namely equal to 7.81 g. Meanwhile, the P8 treatment showed that the value tended to be lower, namely 3.76 g.

D. Growth Speed of KCT

Based on the results of the analysis of variance, the application of *N. mirabilis* extract as a coating on corn seeds had no significant effect on the KCT parameters (Appendix 1). The average value of the

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growth speed of the seeds tested ranged from 12.51% - 26.83% with the P6 treatment tending to have a higher KCT value and the P03 treatment tending to have a lower KCT value.

E. Vigor Index (InV)

The vigor index is a measure of the vigor of seed growth vigor (VKT). The results of the analysis of variance showed no significant effect on the vigor index variable (Appendix 1). The average InV value of the seeds tested was around 35% - 68% with the P6 treatment giving a higher InV value, while the P03 treatment tended to have a lower InV value than the other treatments.

Coating Treatment of Corn Seed Growth

Several growth parameters observed in this study were plant height, primary root length, and normal wet weight of sprouts. On plant height variables, the results of the analysis of variance showed that the extract of *N. mirabilis* as a coating for corn seeds had a very significant effect (Appendix 1). Based on Table 3, it can be seen that the highest average plant height was in the P5 treatment of 35.16 cm. While the P3 treatment had the lowest average value of 13.42 cm. Even though it was the highest, treatment P5 was not significantly different from treatment P6 and for treatment P3, even though it gave the lowest value, was also not significantly different from P1, P2, and P4.

A very significant effect is also seen in the longest root length parameter (Appendix 1). As seen in Table 3, the highest average value of the longest root length was in the P5 treatment of 21.93 cm. Even though it gave the highest score, treatment P5 was not significantly different from treatment P02, P2, P3, P4, P6, and P7. Meanwhile, treatment P03 had the lowest average primary root length, which was 14.57 cm and was not significantly different from treatments P01, P1, P4, and P8.

While the results of the analysis of variance for the application of *N. mirabilis* extract as a corn seed coating on the wet weight parameter of normal sprouts gave no significant effect. Based on Table 3 it can be seen the tendency for the highest value was in the P5 treatment of 35.81 grams, and the lowest value trend was in the P03 treatment of 13.57 grams.

Discussion

Coating Treatment on Seed Viability and Vigor

Coating of seeds is a seed treatment technology that aims to maintain and maintain seed quality [9]. With maintained quality, the seeds are able to produce healthy plants and can grow optimally. Seed quality is related to seed viability and vigor. High quality seeds will have high vigor and viability. Seed viability is the vitality of the seed which can be shown through metabolic symptoms and/or growth symptoms. While vigor is a number of seed characteristics that identify the rapid and uniform growth and development of sprouts in a wide range of field conditions.

The viability test in this study was carried out by calculating the percentage of maximum growth potential (PTM) and germination capacity (DB). Maximum growth potential is a measure of total seed viability. The total viability of seeds can detect the vitality of seeds which is shown by the symptoms of seed life through the symptoms of its metabolism. While germination is a measure of

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potential seed viability (VPT). Potential seed viability is the ability of seeds to grow into normal plants under optimum environmental conditions. The P6 coating treatment of *N. mirabilis* sac extract 2 g/l + cmc 0.20 g/ml had the highest PTM and DB percentage values, namely 81% and 79% respectively.

According to Kartasapoetra [10], high quality corn seeds have a viability of more than 90%. With 90% seed quality, plants are able to grow normally under sub-optimum conditions and can produce optimally. While the standard value of the Directorate General of Food Crop Agriculture for corn seed germination is more than 80%. From the results of applying *N. mirabilis* extract as a coating, the germination rate of local corn seeds has shown a value that is close to the standard, namely 79% and has a better tendency compared to the control.

The effect of seed coating on dry weight showed the same results not real. Normal sprout dry weight is a measure of potential viability. Seeds that have high potential viability will also have high dry weight of normal sprouts. High normal sprout dry weight value indicates the reactions that occur during seed metabolism are not hampered by respiration and energy is still available, so that the sprouts can grow and develop normally. According to Winarti et al. [11] the use of polysaccharide materials in coating materials can prevent loss of water vapor, blocking oxygen and physical stress during storage so that cell membranes do not experience cell leakage. The activity of enzymes, especially respiration enzymes, can be suppressed and the decline in food reserves can be slowed down by coating the seeds.

The vigor index is a measure of the vigor of seed growth vigor (VKT). According to Copeland and McDonald [2] the seed vigor index value is the germination value at the first count, which is one of the benchmarks that can be used to determine seed vigor. The lower the germination value on the first count indicates the lower the seed vigor.

Seed growth speed is a benchmark that indicates growth vigor (VKT) and is a more sensitive benchmark than DB [12]. KCT is measured by the additional number of normal germinations per day or etmal during the germination period at optimum conditions. Seeds that are able to germinate normally in a relatively short time show high vigor and are expected to grow simultaneously in the field [13]. The results showed that the seeds tested had a low growth rate and indicated low vigor. This is because according to Sadjad's criteria [14], if the seed growth rate is above 30%, it means that the seed has a strong growth vigor, while the yield of *N. mirabilis* extract as a coating is only able to reach 26%. The low growth rate indicates that seed vigor has decreased during storage during seed coating.

The tendency for the highest yield of *N. mirabilis* extract showed that the coating treatment was able to maintain and maintain quality, especially the physiological quality of the seeds which included good germination and vigor. Good germination is the result of healthy seeds. Healthy seeds mean that the seeds are free from infection or contamination. Efforts to protect seeds using *N. mirabilis* extract coatings are also carried out with the aim of maintaining nutrients or food reserves contained in the seeds. These nutrients are then used as a source

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of energy for germination. Without protection, inhibiting factors will appear in seed germination, one of which is interference from pathogens. All types of pathogens, both fungi, bacteria and viruses can attack the seeds and use the nutrients in the seeds for their life. If the chemical composition in the seeds or nutrients is reduced or depleted, it will cause damage to the seeds. This will trigger losses or impacts in the short and long term. According to Rahayu [15] these short-term losses are decreased germination, weak vigor, seeds or young plants that are abnormal and even die, as well as other damage at every stage of plant growth up to harvest and post-harvest.

The low vigor of seeds can be caused by several things, such as genetic, morphological, cytological, mechanical, microbial and physiological. Under physiological conditions, what can cause low seed vigor is immaturity or under-ripeness of seeds at harvest and deterioration of seeds during storage. In essence, seed vigor must be relevant to the level of production, meaning that high-vigor seeds can achieve high production levels [16].

Coating Treatment of Growth Parameters

The addition of root length is a root response to the availability of water and nutrients. Root length can be an indicator of the decline in the quality of a seed. Muqnishah and Nakamura [17] said that the length of the primary root and the length of the hypocotyl can be used to assess the vigor of seed sprouts. Root length affects the ability of a plant to absorb nutrients. This is why in this study, the length of the longest root is directly proportional to the height of the plant. P5 treatment (bag extract 1 g/l + cmc 0.20 g/ml) was able to have a significant effect on plant height and longest root length.

The results showed that the extract of the sac of *N. mirabilis* had a tendency to produce higher yields in the P5 and P6 treatments with the administration of *N. mirabilis* leaf extract. This is because there are differences in nutrients in the sacks and leaves of *N. mirabilis*. These elements include assimilated macronutrients in the sacs and leaves contained in the plant body of *N. mirabilis* such as Nitrogen (N), Phosphorus (P), and Potassium (K). Osunkoya et al. [18] reported that 1.0 g of *N. mirabilis* sac samples contained 1.15% Nitrogen, 0.23% Phosphorus, 1.81% Potassium. While the leaves of *N. mirabilis* contained 0.96% Nitrogen, 0.22% Phosphorus, and 1.41% Potassium. Nitrogen plays a role in helping the formation of plant cells and tissues, Phosphorus plays a role in seed growth and improves root structure, while Potassium plays a role as a regulator of plant physiological processes. So from this function it is suspected that the administration of *N. mirabilis* sac extract has an effect on plant height and longest root length.

CONCLUSION

Coating with *N. mirabilis* extract was able to affect the viability and vigor as well as the growth of corn seeds, especially the sac extract which could give the highest value. Treatment of P5 sac extract of *N. mirabilis* 1 g/l + cmc 0.20 g/ml for corn seeds had a significant effect on growth parameters with a plant height of 35.16 cm and the longest root length 21.93 cm. Meanwhile for the plant wet weight parameter, the treatment of 1 g/l *N. mirabilis* sac extract + 0.20 g/ml cmc also showed the highest

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value but had no significant effect, namely 35.81 grams. P6 treatment of sac extract of *N. mirabilis* 2 g/l + cmc 0.20 g/ml gave the highest trend in the viability and vigor of corn seeds with the achievement of potential germination capacity (PTM) of 81%, germination rate of 79%, growth rate (KCT) 26.83%/day, vigor index (InV) 68%, and normal sprout dry weight (BKKN) 7.81 grams.

REFERENCES

[1] Desai BB, Kotecha PM, Salunkhe DK. 1997. Seeds Handbook: Biology, Production, Processing, and Storage. Marcel Dekkerm, New York.

[2] Copeland LO, McDonald MB. 2001. Principles of Seed Science and Technology. Fourth Edition. Kluwer Academic. London. 408 p.

[3] Setiyowati H, Surahman M, Wiyono S. 2007. Pengaruh pelapis benih dengan fungisida benomil dan tepung curcuma terhadap patogen antraknosa terbawa benih dan viabilitas benih cabai besar (Capsicum annum L.). Bul.Agron. 35: 176-182.

[4] Zainal A, Anwar A, Ilyas S, Sudarsono, Giyanto. 2010. Efektifitas ekstrak tumbuhan untuk mengeliminasi Clavibacter michiganensisn sub sp. michiganensis pada benih tomat. J. Agron. Indonesia 38(1): 52-59.

[5] Mansur M. 2000. Koleksi Nepenthes di Herbarium Bogoriense: Prospeknya sebagai Tanaman Hias. Proceeding: Seminar Hari Cinta Puspa dan satwa Liar. Hal 244 - 253.

[6] Sulistiyaningsih. 2008. Identifikasi Isolat Bakteri Penghasil Zat Antibakteri dari Cairan Kantung Semar (N. ampularia Jack). [Skripsi]. Universitas Padjajaran, Bandung. [Indonesia].

[7] Nurhasybi, Suita, E, Sudrajat DJ. 2006. Pengembangan sumber benih untuk pengadaan benih bermutu. Makalah utama dalam prosiding seminar hasil- hasil penelitian balai litbang. Teknologi perbenihan “Teknologi Perbenihan untuk Pengadaan Benih Bermutu”. Bogor. Hal 77 - 85.

[8] Lesilolo MK, Riry J, Matatula E. 2013. Pengujian viabilitas dan vigor benih beberapa jenis tanaman yang beredar di pasaran kota ambon. Jurnal Agrologia 2 (1): 1-9.

[9] Chen Z, Castaing JC, Peng-Fei JI, Cristobal G. 2012. Seed Coatings, Coating and Methods for Use. United States Patent. Pub.No US2012/0220454 A1.

[10] Kartasapoetra AG. 2003. Teknologi Benih Pengolahan Benih dan Tuntunan Praktikum. Rineka Cipta : Jakarta.

[11] Winarti C, Miskiyah M, Widianingrum W. 2012. Teknologi Produksidan Aplikasi Pengemas Edible Antimikroba Berbasis Pati. Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian 31 (3) : 85 – 93.

[12] Rahayu E, Widajati E. 2007. Pengaruh kemasan, kondisi ruang simpan, dan periode simpan terhadap viabilitas benih caisin (Brassica chinensis L.). Bul. Agron. (35)3:191–196.

ISBN : 978-623-161-062-1
Managed By: Faculty Of Agriculture, University Of Borneo Tarakan

[13] Winarni TB. 2009. Pengaruh Perlakuan Pendahuluan dan Berat Benih terhadap Perkecambahan Benih Kayu Afrika (Maesopsis eminii Engl.). [Skripsi]. Institut Pertanian Bogor, Bogor. [Indonesia].

[14] Sadjad S. 1993. Dari Benih kepada Benih. PT Gramedia Widiasarana Indonesia, Jakarta. 144 hlm.

[15] Rahayu, Mudji. 2016. Patologi dan Teknis Pengujian Kesehatan Benih Tanaman Aneka Kacang. Bul. Palawija. Indonesia 14 (2): 78 – 88.

[16] Sutopo L. 1998. Teknologi Benih. PT Raja Grafindo. Jakarta. Sutopo L. 1984. Teknologi Biji. CV Rajawali, Jakarta. 245 hlm

[17] Muqnisyah WQ, Nakamura S. 1984. Vigor of Soyben Seed Produce from A Different Nitrogen and Phosphorus Fertilizer Application. Seed Sci. and Tech. 12 : 475 – 482.

[18] Osunkoya O, Daud SD, Di-Giusto B, Wimmer FL, Holige TM. 2007. Construction costs and physico-chemical properties of the assimilatory organs of Nepenthes species in Northern Borneo. Annalisis of Botany. 99:895-90.