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Differences of Seed Size Between Several *Dolichos lablab* L. Accessions in Indonesia

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Abstract. *Dolichos lablab* L. (komak bean) is a legume plant that has potency as a nutrient-rich food (fiber, protein, and minerals), however, its cultivation is still not optimal in Indonesia. Moreover, researches on *D. lablab* L. from Indonesia remains rare. This study aims to reveal the diversity of *D. lablab* L. seeds morphology which are spread in various regions in Indonesia. 13 accessions of *D. lablab* L. were obtained from Madura, Malang, Probolinggo, and West Nusa Tenggara. Morphological observations of seeds which include the parameters of length, width, thickness, and weight of seeds were carried out on all accessions collected. Furthermore, the data were analyzed using a one-way analysis of variance (ANOVA) by positioning accessions as independent variables and the size of the seeds as the dependent variable. The findings suggests significant differences in length (F = 9.335, p <.05), width (F = 2.906, p <.05), thickness (F = 6.293, p <.05), as well as seed weight parameters (F = 41,488, p <.05). In general, West Nusa Tenggara 2 and Probolinggo 1 have the largest seed size, while Probolinggo 2 has the smallest seed size. Findings that inform the size of the *D. lablab* L. seed differentiation can be used as a basis for subsequent studies.

INTRODUCTION

Dolichos lablab L. (latest name: *Lablab purpureus* L.) is a legume plant that has been widely domesticated, resulting in a high variety of species. [1]. This bean is also known as Komak Bean, Indian Bean, Egyptian Bean, Lablab Bean, Dolichos Bean, Hyacinth Bean, and several other local names [1,2]. This plant is believed to have originated from Africa and in its development spread to various parts of the world [1]. One of the countries whose territory is also overgrown with this legume is Indonesia [1,3-6].

Although its presence can be found in various regions in Indonesia, the cultivation of *D. lablab L.* is still marginalized compared to other types of beans [3]. It is worsened by the government's policy in developing grains focusing on peanuts (*Arachis hypogaea*), soya bean (*Glycine max* L.), and green beans (*Vigna radiata*) [7]. Consequently, the existence of local peas is increasingly marginalized from the planting, production, and conservation agenda, both by the wider community and the government.

The underutilization and lack of knowledge on *D. lablab* benefits observed in Indonesia are also found in several other countries [8.9]. However, although it has not been positioned as the main food source in various countries, the research on this nut is intensified. Various studies have reported that *D. lablab* L. contains various important nutrients, such as rich in fiber, protein, and various minerals [10]. *D. lablab* L. is an important legume although its use is still limited to animal feed [11]. In addition, *D. lablab* L. also contains various bioactive compounds that have the potential to treat several diseases, such as diabetes [6,12], heart disease [13,14], and tumor [15]. Several other studies have focused more on studying the diversity of this species, for example, the diversity of *D. lablab* L. in Kenya [16] and India [17-20].

In Indonesia, studies examining *D. lablab* L. are still rare and mostly focused on nutritional content [4,21] as well as bioactive compounds content [6]. In addition, several other studies focus on morphological and molecular diversity

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[5] as well as studying the anatomical profile of the trunk of *D. lablab* L [3]. Both studies were conducted in the Lombok region. Thus, no research examines the diversity of morphological characteristics of *D. lablab* L. involving several regions in Indonesia. In addition, the study of species diversity is a study that is considered both interesting and important from a conservation perspective [22-24]. Moreover, the diversity among accessions of *D. lablab* L. in Indonesia is still not optimally understood. Therefore, this study aims to examine the diversity of quantitative characters of seeds of various accessions of *D. lablab* L. found in several regions in Indonesia. Through this study, the description of diversity among *D. lablab* L. accessions found in various regions in Indonesia can be revealed. In addition, this study also possibly aid the discovery of accessions that have superior properties.

METHOD

The plant samples used in this study were *D. lablab* L. obtained from Madura, Malang, West Nusa Tenggara, and Probolinggo areas. After the seeds were collected, they were identified and their access code was determined. Based on this step, 13 accessions were obtained from D. lablab L., three from Madura, two from Malang, five from West Nusa Tenggara, and three from Probolinggo. Table 1. presents a list of accessions obtained and their codes.

TABLE 1. List of accessions of *D. lablab* from Madura, Malang, West Nusa Tenggara, and Probolinggo areas and their codes

Accessions	Code
Madura 1	Mdr1
Madura 2	Mdr2
Madura 3	Mdr3
Malang 1	Mlg1
Malang 2	Mlg2
West Nusa Tenggara 1	NTB1
West Nusa Tenggara 2	NTB2
West Nusa Tenggara 3	NTB3
West Nusa Tenggara 4	NTB4
West Nusa Tenggara 5	NTB5
Probolinggo 1	Plg1
Probolinggo 2	Plg2
Probolinggo 3	Plg3

The collected seeds were brought to the Biology Laboratory of the Universitas Muhammadiyah Malang. In the laboratory, observations of seeds from various accessions were carried out. The data examined in this study were quantitative parameter data on seed morphology. These parameters included length, width, thickness, and seed weight. The length, width, and thickness data were in centimeters (cm), while the seed weight data was measured in grams (g). Determination of the weight of *D. lablab* L. seeds used analytical balances. On the other hand, grain thickness was measured using a caliper.

The data obtained in this study were analyzed using a one-way analysis of variance (one-way ANOVA) with a significance level of 5%. Accessions were positioned as independent variables, while data on length, width, thickness, and seed weight were positioned as dependent variables. If the results of the hypothesis test suggested a significant difference, then the data analysis was continued with Duncan's test.

RESULTS AND DISCUSSION

In this study, thirteen accessions of *D. lablab* L. spread across several regions in Indonesia were collected. To determine whether there was a difference in seed size of the thirteen accessions, the measurement data were analyzed using one-way ANOVA. The results of the one-way ANOVA test are presented in Table 2. Based on Table 2, it can be seen that the morphological parameter that shows a significant difference between accessions of *D. lablab* L. is the seed length parameter. [F (12, 38) = 9.335, $p < .05$], seed width [F (12, 38) = 2,906, $p < .05$], seed thickness [F (12, 38) = 6,293, $p < .05$], and seed weight [F (12, 38) = 41,488, $p < .05$]. This indicates the differentiation of seeds from various *D. lablab* accessions found in several regions in Indonesia.

TABLE 1. List of accessions of *D. lablab* from Madura, Malang, West Nusa Tenggara, and Probolinggo areas and their codes

Sources	df	Seed length	Seed width	Seed thickness	Seed weight
Accession	12	9.335**	2.906*	6.293**	41.488**
Error	38				

** significant at 1% level, *significant at 5% level

Further, the data were analyzed using Duncan's test. A summary of the results of Duncan's test for data on length, width, thickness, and seed weight is presented in Figures 1, 2, 3, and 5, respectively. In the four graphs of Duncan's test results, accessions with the same alphabetic label shows no significant difference between accessions at a significance level of 5%.

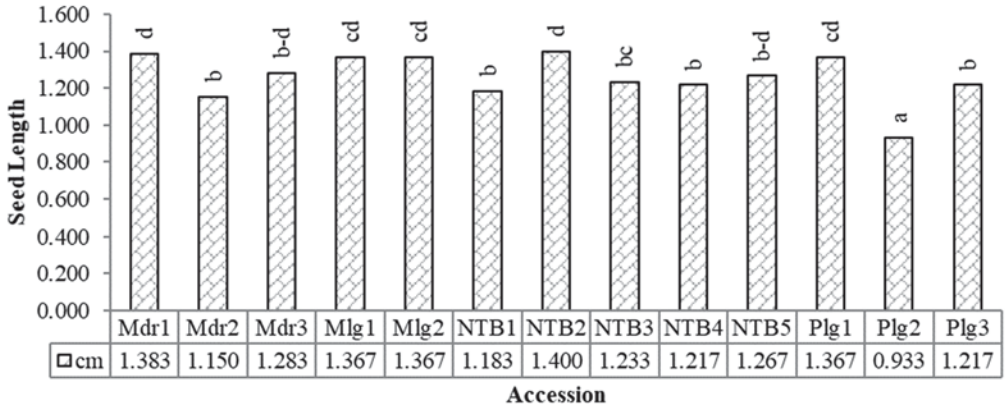

FIGURE 1. Summary of Duncan's test results on seed length parameters

Based on Figure 1, the West Nusa Tenggara 2 accession has the longest seeds. However, the seed length of these accessions is not significantly different from several other accessions, such as Madura 1, Madura 3, Malang 1, Malang 2, Nusa Tenggara Barat 5, and Probolinggo 1. On the other hand, Accessions Probolinggo 2 present a significantly larger and shorter size compared to all accessions collected in this study.

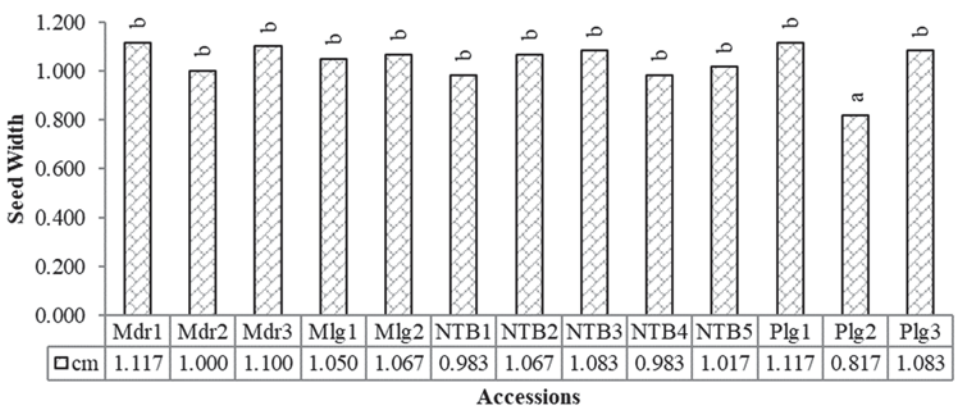

FIGURE 2. Summary of Duncan test results for seed width data

Based on Figure 2 apart from Probolinggo 2 accessions, all accessions collected in this study have significantly different seed widths. The twelve accessions also present significantly wider seed sizes than the Probolinggo 2 accessions. Based on the graph presented in Figure 2, the Probolinggo 1 accession has the thickest seed means. However, the seed thickness of this accession is not significantly different from that of the other accessions of Madura 2, Malang 1, Malang 2, West Nusa Tenggara 1, and West Nusa Tenggara 2. From Figure 3, Probolinggo 2 accessions have the thinnest seeds. However, the seed size of these accessions is not significantly different from several other accessions, including Madura 1, Madura 3, Nusa Tenggara Barat 3, and Nusa Tenggara Barat 5.

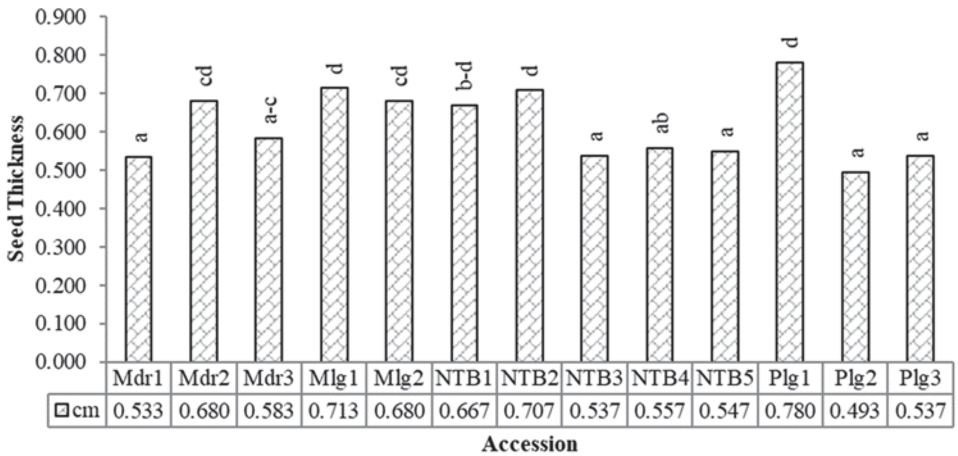

FIGURE 3. Graph of Duncan test results for seed thickness variable

Based on the results of Duncan's test on the seed weight data presented in Figure 4, two accessions have significantly heavier seed weights compared to other accessions, namely West Nusa Tenggara 2 and Probolinggo 1. On the other hand, similar to the results of analysis on the variable length and width of seeds, accessions Probolinggo 2 also has significantly lower seed weights compared to other accessions studied in the study.

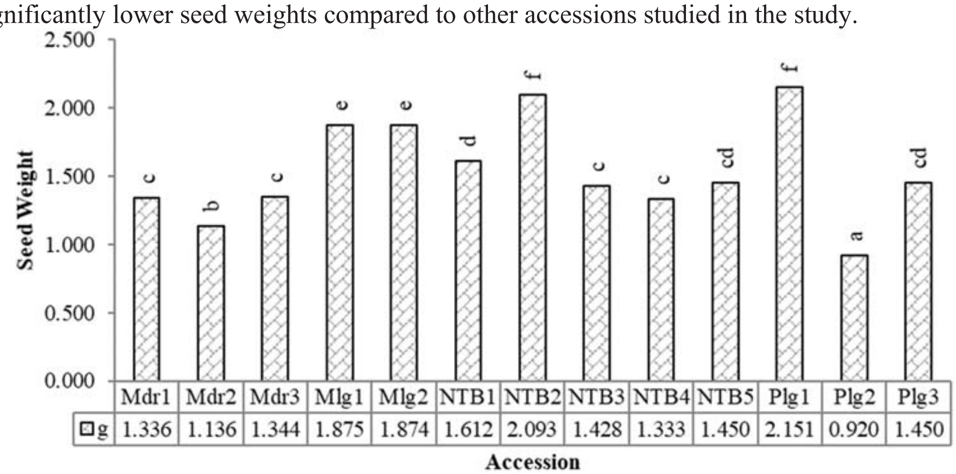

FIGURE 4. Graph depicting Duncan's test results on seed weight data

Indonesia is one of the countries that are rich in local food sources [25,26]. Various flora in Indonesia has the potential as a source of highly nutritious food for the people of this country. In this regard, one of the most diverse plant groups in Indonesia is the legume group [25,27]. Legumes are a group of plants that have been known to contain various important nutrients, such as fiber, protein, minerals, to various bioactive compounds that are important for health [6,25,28–33]. Through a study that explores the potential of various local beans in Indonesia, the nutritional crisis that occurs in several levels of society in Indonesia can be minimized.

In addition to having a high diversity of legume species, Indonesia also has intra-species diversity of various legumes spread across various regions of Indonesia. One of the local legumes that can be found in various regions in Indonesia and consists of many accessions is *D. lablab* L. Based on the findings obtained in this study, some information regarding the diversity of morphological characters of *D. lablab* L. accessions has been disclosed. One of the pieces of information is that several accessions consistently, namely NTB 2 and Probolinggo 1, show a larger size compared to other accessions. Based on Figures 1, 2, and 3, the two accessions are included in the accession group with the same notation. The results of the analysis are also in line with the results of the analysis of seed weight data which showed that both accessions are significantly heavier than the other accessions (Figure 4). On the other hand, the Probolinggo 2 accession shows the opposite. This accession has a significantly lower length, width, and seed weight compared to other accessions. Through this finding, other information that can be obtained is that several accessions originating from the same region may not necessarily have similar morphological characters. The results of this study showed that the accession of Probolinggo 1 is included in the accession that produced the largest seeds, but Probolinggo 2 is included in the accession that produced the smallest seeds.

Regarding the size diversity of *D. lablab* L. found in this study, the differences in morphology of various plant accessions can be caused by two main causes, namely genetic factors and environmental factors. Each plant accession can carry a different variety of alleles. Different alleles will sometimes be expressed into different phenotypic characters [34-37]. Therefore, this assumption can be used as the basis for designing further studies that examine the diversity of accessions of *D. lablab* L from a genetic point of view.

On the other hand, various previous researchers have also reported that environmental factors can affect the condition of a population [38] as well as the morphological conditions of the individuals making up the population [39,40]. Various environmental factors will interact with genetic factors to influence the characters raised by living things, including plants [41]. These environmental factors can be in the form of chemical compositions available in the soil [39] as well as differences in the physical parameters surrounding the plant [39,41,42].

Based on the findings obtained from this study, it appears that *D. lablab* L. located in the Java, Madura, and Nusa Tenggara regions has diversity in terms of seed size. Findings showing the difference in seed size of *D. lablab* L. can be developed as a basis for diversity studies or studies of phylogenetic relationships between accessions of this bean species in Indonesia. In addition, the differences in morphological characters in these findings need to be confirmed by molecular genetic diversity studies which are recommended to be carried out in future studies.

SUMMARY

In this study, the variation in seed size of *D. lablab* L. accessions found in East Java, Madura, and West Nusa Tenggara was assessed. From the survey results, 13 accessions of *D. lablab* L. were obtained from various regions, namely Malang, Probolinggo, Madura, and West Nusa Tenggara. The finding obtained from this study signifies that the seed size between the accessions of *D. lablab* L. presents a significant difference. These significant differences are found, both in the length and weight parameters of seeds. Further research that examines the diversity of *D. lablab* L. from other parameters needs to be carried out. These parameters include protein diversity and genetic diversity. Such a study will provide a broader picture of the diversity of *D. lablab* L. in Indonesia. In addition, it is also recommended to conduct a study that aims to examine the phylogenetic relationship between accessions of *D. lablab* L. found in various regions in Indonesia.

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