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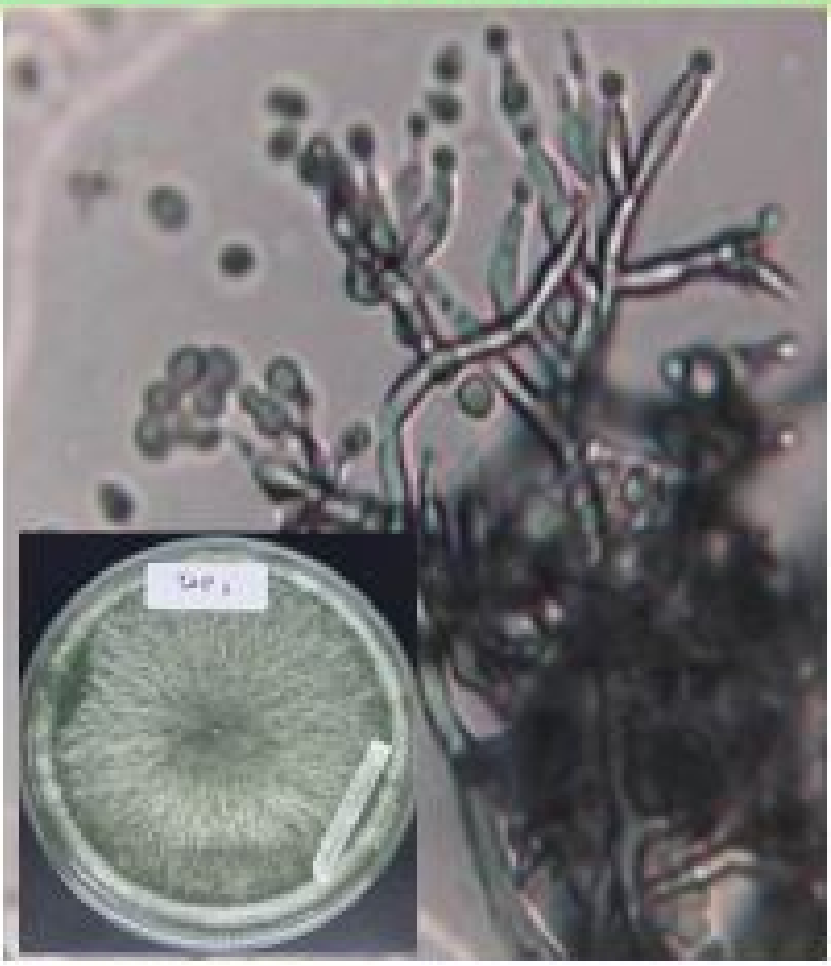

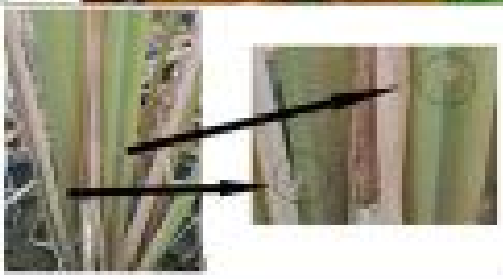

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Exploration And Characterization Of Hanjeli Nutfah Plasma (*Coix Lacrima-Jobi* L.) In West Sumatra Province

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ABSTRACT

Hanjeli is one of the alternative food crops that are high in nutrients, healthful, easy to grow, and adaptable to a wide range of environmental circumstances. Due to the limited understanding of people who believe Hanjeli is a wild plant or weed, usage of this commodity is still quite low in Indonesia. To save and prevent the loss of genetic resources, it is vital to study, inventory, and characterize Hanjeli so that plant breeders can use it to create greater varieties in the future. The goals of this study are to: (1) learn about the existence and types of Hanjeli plants in West Sumatra Province; (2) collect Hanjeli germplasm; and (3) learn about the morphological diversity and level of similarity of Hanjeli plants as a starting point for germplasm conservation of Hanjeli plants in West Sumatra. This study took place in four districts/cities in West Sumatra Province from June to November 2021. This study is carried out using a survey method with purposive sampling. The NTSYSpc2.02i application is used to present morphological data descriptively and for similarity analysis. 69 Hanjeli accessions were discovered throughout the exploration process. Hanjeli grows between 6 to 1575 meters above sea level and can thrive in a variety of environments, including arid ground and regions near water sources (starting on the outskirts of streams to the edges of rice fields). For all characters, the phenotypic similarity study of Hanjeli plants yielded similarity coefficients ranging from 0.67 to 1. At 0.67, the accessions were divided into two groups: 66 accessions in the first group, and 3 accessions in the second group.
Keywords: diversity, exploration, Hanjeli

1. INTRODUCTION

Food diversification can be utilized to reduce community reliance on a single type of commodity for consumption. If the supply of staple food is disrupted, high dependence will lead to instability; yet, if individuals begin to consume alternate food items, stability will be maintained. Food diversification through the use of carbohydrate sources from local foods may be an alternative for achieving food

self-sufficiency and reducing people's reliance on rice.

Hanjeli is a promising cereal crop with strong development prospects in Indonesia, which has significant potential in the development of alternative food sources. According to BB Biogen (2014), Hanjeli contains nutrition equivalent to rice, with 76.4 percent carbs, 14.1 percent protein, 7.9 percent vegetable fat, and 54 mg calcium per 100 g of seeds. Hanjeli also contains important amino acids (11.6%) and vitamin E (37.38 mg/kg), both of which act as antioxidants and boost the body's immunity (BB Postharvest, 2020).

Hanjeli can be found in a variety of agricultural land environments, including dry and wet climates, such as those found in Sumatra, Sulawesi, Java, and Kalimantan (Evizal, 2020). This plant can grow in the plains and highlands up to 2000 meters above sea level, and it can withstand cold conditions.

This is supported by the findings of Nira (2016), who found that Hanjeli can thrive at an altitude of 1095 meters above sea level (climate type C2 according to Oldeman's categorization).

The use of Hanjeli as a food source has begun in the West Java area with various forms of processed products, but the existence of Hanjeli plants outside of Java is minimal or non-existent due to limited knowledge of people who believe that hanjeli is simply a wild plant or weed, so that it is frequently a plant. Mechanically and chemically, its growth is closely monitored. The paucity of Hanjeli development outside of Java, one of which being West Sumatra, demonstrates this.

There is a critical condition affecting the safety of Hanjeli's existence based on this description. Of course, this situation will eventually result in Hanjeli's germplasm being lost before it can be saved and used for its beneficial features. To save and prevent the loss of genetic resources, it is vital to conduct exploration, characterization, and inventory efforts so that plant breeders can use them to create a variety in the future.

Exploration is a process of gathering and collecting all accessible sources of genetic variation in order to save it from extinction and use it as a source of improvement or the production of new superior kinds with desired features. This study is one of the first steps in preserving and understanding the diversity of Hanjeli germplasm in the province of West Sumatra, so that plant breeders can use it to create improved cultivars in the future.

2. RESEARCH METHOD

This study took place in four districts/cities in West Sumatra Province, namely Padang Pariaman Regency, Agam Regency, Padang City, and Solok Regency, from June to November 2021. This region was chosen because it exemplifies West Sumatra's varied topography and agro-climatic characteristics. Hanjeli, which has entered the generative phase, is the substance used in this study. A survey method with purposive sampling is used in this investigation. The data from the preliminary survey results were used to conduct an investigation on the existence of Hanjeli found in four districts/cities of West Sumatra Province. The information gathered can be used to determine whether sub-districts have Hanjeli plants, as well as to characterize and sample them. Furthermore, based on the

research location, providing a sample code or code number. A sample number, a sample code for each sub-district for each sample plant, and a position based on its coordinates are all included on each label.

Hanjeli characterization is done by seeing, measuring, and documenting morphological features that are directly related to the observed variables. The number of samples obtained was determined based on the presence of Hanjeli plants at the research site. The Hanjeli plant was used to collect sample data in the chosen areas. Observations on the plant's phenotypic character were made in each sample. Quantitative and qualitative features have been observed. The following formula is used to calculate the phenotypic variance:

$$\sigma^2 f = \frac{X_i^2 - (\Sigma X_i)^2/n}{(n-1)}$$

To calculate the standard deviation, use the following formula:

$$Sd\sigma^2 f = \sqrt{\frac{\sigma^2 f}{n-1}}$$

Ϭ2 f = Phenotypic variance is a term used to describe the variation in phenotypes.
n = number of examined phenotypes
Xi = mean value to I
SdϬ2f = phenotypic variance standard deviation

Pinaria (1995) defined broad and narrow phenotypic variability as follows:

If Ϭ2f ≥ 2 SdϬ2 f = wide phenotypic variance,

If Ϭ2f < 2 SdϬ2 f = phenotypic variance is narrow

Using the NTSYSpc 2.02i application, the morphological character data of the Hanjeli plant will be compared for similarities. The similarity analysis results are shown as a dendogram, which depicts the similarity relationship between plant accessions based on their physical characteristics.

3. DISCUSSION AND RESULTS

1. Experimentation

Exploration has taken place in West Sumatra Province in four regencies / cities, including Padang Pariaman Regency, Agam Regency, Padang City, and Solok Regency, in order to learn more about Hanjeli's whereabouts. The research site is shown in Table 1.

Hanjeli may grow in a variety of environments, including arid ground and regions near water sources, according to research findings (starting on the banks of rivers to the edges of rice fields). Table 1 further illustrates that Hanjeli may grow in both the lowlands and the hills (6-1575 m asl). This is in line with the findings of various studies, who claim that Hanjeli can grow in both the lowlands and the highlands up to a height of 2000 meters above sea level and is cold tolerant (Rahmawati, 2003). According to Ramadan et al. (2020), the pulut type Hanjeli was able to adapt effectively to soils with a pH of 4.85 and low nutrients N, P, and K.

The preliminary survey activities and interviews conducted with many people near the research location in four districts/cities of West Sumatra Province revealed that Hanjeli agricultural activities had never taken place in these areas.

Hanjeli are only permitted to develop naturally, without the use of any care or cultivation practices. Because some people only know Hanjeli as a weed or a wild plant, this plant is frequently controlled rigorously, both mechanically and chemically, as a result of their ignorance. However, some people in Canduang District, Sungai Pua District, Banuhampu District (Agam District), Batang Anai District (Padang Pariaman District), and Pauh District are aware that Hanjeli can be used as a source of food and craft materials (Padang City). The local community no longer consumes this commodity over time.

Jali-jali, Jelai, and Sabi-sabi are some of the names given to Hanjeli in different places. Because the local community is unaware of the plant's existence and application, people feel that cultivating hanjeli will result in little profit.

Table 1: Hanjeli Plant Sampling Locations in West Sumatra Province's Four Regencies/Cities

Districts/cities	Location		Access code	Altitude (mdpl)
	Subdistrict	Village/Nagari		
Padang Pariaman	Sintuk Toboh Gadang	Toboh Gadang	STG-1	20
	Patamuan	Tandikek Utara	PTA-1	218
	2 x 11 Kayu Tanam	Kayu Tanam	KT-1	146
	V Koto Kampung Dalam	Sikucur Timur	KKD-1	123
	V Koto Kampung Dalam	Sikucur	KKD-2	229
	V Koto Kampung Dalam	Sikucur	KKD-3	20
	Batang Anai	Sungai Buluah	BTA-1	11
	Batang Anai	Buaian-Lubuk Alung	BTA-2	26
	Batang Anai	Katapiang	BTA-3	28
	Batang Anai	Katapiang	BTA-4	8
	2 x 11 Enam Lingkung	Lubuk Pandan	NL-1	63
	2 x 12 Enam Lingkung	Sicincin	NL-2	88
	2 x 13 Enam Lingkung	Sungai Asam	NL-3	69
	2 x 14 Enam Lingkung	Sungai Asam	NL-4	62
	Enam Lingkung	Pakandangan	NLG-1	52
	Enam Lingkung	Pakandangan	NLG-2	39
Agam	Baso	Koto Tinggi	BS-1	983
	Baso	Koto Tinggi	BS-2	962
	Baso	Koto Tinggi	BS-3	963
	Baso	Koto Tinggi	BS-4	1025
	Baso	Koto Tinggi	BS-5	1043
	Banuhampu	Kubang Putiah	BNH-1	1046
	Banuhampu	Kubang Putiah	BNH-2	1051
	Banuhampu	Kubang Putiah	BNH-3	1049
	Sungai Pua	Sungai Pua	SPA-1	1069
	Sungai Pua	Sungai Pua	SPA-2	1076
	Sungai Pua	Sungai Pua	SPA-3	1073

	Sungai Pua	Sungai Pua	SPA-4	1073
	Sungai Pua	Padang Laweh	SPA-5	1055
	Matur	Matur Mudiak	MTR-1	1063
	Canduang	Bukik Batabuah	CND-1	980
	Canduang	Lasi	CND-2	1110
	Palupuah	Koto Rantang	PLH-1	637
	Ampek Angkek	Panampuang	APA-1	880
	IV Koto	Koto Tuo	KTO-1	1009
	IV Koto	Koto Tuo	KTO-2	998
	IV Koto	Koto Tuo	KTO-3	979
	Tanjung Raya	Maninjau	TJR-1	492
	Tanjung Raya	Bayua	TJR-2	464
	Tanjung Raya	Koto Malintang	TJR-3	461
	Malalak	Malalak Utara	MLK-1	850
	Malalak	Malalak Selatan	MLK-2	852
	Malalak	Malalak Timur	MLK-3	833
	Malalak	Malalak Timur	MLK-4	831
Padang	Pauh	Lambung Bukit	PH-1	96
	Pauh	Limau Manis	PH-2	110
	Pauh	Limau Manis Selatan	PH-3	191
	Pauh	Limau Manis Selatan	PH-4	206
	Pauh	Kapalo Koto	PH-5	123
	Kuranji	Kalumbuk	KRJ-1	29
	Kuranji	Kalumbuk	KRJ-2	28
	Kuranji	Gunung Sarik	KRJ-3	18
	Kuranji	Gunung Sarik	KRJ-4	26
	Kuranji	Gunung Sarik	KRJ-5	22
	Kuranji	Pasar Ambacang	KRJ-6	38
	Kuranji	Pasar Ambacang	KRJ-7	34
	Kuranji	Pasar Ambacang	KRJ-8	32
	Nanggalo	Surau Gadang	NGL-1	20
	Nanggalo	Kurao Pagang	NGL-2	6
	Koto Tangah	Lubuk Minturun	KTH-1	22
	Koto Tangah	Lubuk Minturun	KTH-2	21
Solok	Gunung Talang	Batang Barus	GT-1	1209
	Gunung Talang	Aie Batumbuak	GT-2	1387
	Danau Kembar	Simpang Tj. Nan IV	DK-1	1575
	Lembah Gumanti	Air Dingin	LG-1	1476
	Lembah Gumanti	Air Dingin	LG-2	1531
	X Koto Singkarak	Singkarak	KSK-1	618
	X Koto Singkarak	Aripan	KSK-2	646
	Kubung	Tanjung Bingkung	KBG-1	454
Total access			69	

Phenotypic Variability is the second factor to consider.

Hanjeli phenotypic variability varies between four districts/cities in West Sumatra Province. Stem diameter, stem form, stem surface, stem growth direction, leaf arrangement, upper leaf surface condition, lower leaf surface condition, and flower layout all displayed narrow phenotypic variable values. When the range values are compared to characters with broad criteria, it is clear that the very wide range values have a lot of phenotypic variability. Because the range value for characteristics with tight requirements does not reveal a wide range of values, the phenotypic variation is less than twice the standard deviation.

Table 2: Hanjeli Plant Phenotypic Variability in Four Regencies/Cities in West Sumatra Province.

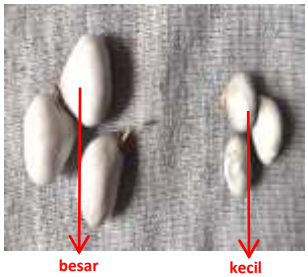
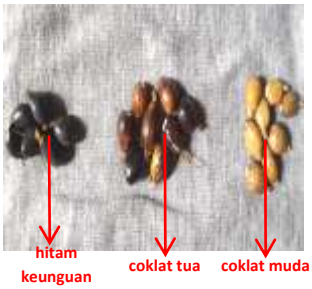
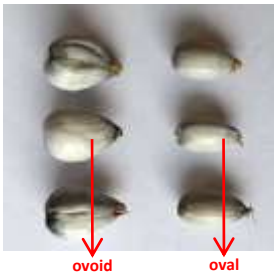
No.	Karakter	Kisaran	Rata-Rata	$\sigma^2 f$	$2Sd\ \sigma^2 f$	Kriteria
1.	Tinggi Tanaman (cm)	61,8 - 220,80	137,16	2516,94	1,48	Luas
2.	Diameter Batang (cm)	0,35 - 1,39	0,77	∞	∞	Sempit
3.	Jumlah Anakan Total	4 - 53	14,41	122,02	0,32	Luas
4.	Jumlah Anakan Berbunga	2 -50	12,04	102,78	0,30	Luas
5.	Panjang Helaian Daun (cm)	17 - 60	36,61	129,85	0,34	Luas
6.	Lebar Helaian Daun (cm)	1,8 - 5,50	3,89	1,01	0,03	Luas
7.	Jarak Antar Helaian Daun (cm)	9 - 35,21	16,44	30,14	0,16	Luas
8.	Panjang Tangkai Bunga (cm)	2,33 - 8,10	4,97	2,96	0,05	Luas
9.	Bobot 100 Biji (gram)	11,86 - 41,43	26,05	96,70	0,29	Luas
10.	Bentuk Batang	Bulat	Bulat	∞	∞	Sempit
11.	Permukaan Batang	Licin	Licin	∞	∞	Sempit
12.	Arah Tumbuh Batang	Tegak	Tegak	∞	∞	Sempit
13.	Warna Ruas Batang	Hijau muda - Hijau tua	Hijau kekuningan	2,52	0,05	Luas
14.	Warna Nodus	Hijau muda - Hijau tua	Hijau muda	1,25	0,03	Luas
15.	Tipe Daun	Tidak lengkap	Tidak lengkap	0,31	0,02	Luas
16.	Bangun Daun	Bangun pita	Bangun pita	0,31	0,02	Luas
17.	Bentuk Ujung Daun	Runcing	Runcing	0,03	0,01	Sempit
18.	Pertulangan Daun	Sejajar	Sejajar	1,69	0,04	Luas
19.	Tepi Daun	Rata	Rata	∞	∞	Sempit
20.	Tekstur Permukaan Daun	Kasap	Kasap	0,86	0,03	Luas
21.	Warna Helai Daun	Hijau muda - Hijau tua	Hijau tua	1,83	0,04	Luas
22.	Bentuk Pangkal Daun	Rompang	Rompang	2,79	0,05	Luas
23.	Warna Pucuk Muda	Hijau muda - Hijau tua	Hijau muda	1,58	0,04	Luas
24.	Susunan Daun	Berseling	Berseling	∞	∞	Sempit
25.	Keadaan Permukaan Atas Daun	Tidak mengkilap	Tidak mengkilap	∞	∞	Sempit
26.	Keadaan Permukaan Bawah Daun	Tidak mengkilap	Tidak mengkilap	∞	∞	Sempit
27.	Warna Tulang Daun	Hijau muda - Hijau tua	Hijau muda	1,61	0,04	Luas
28.	Warna Tangkai Bunga	Hijau muda - Hijau tua	Hijau muda	1,04	0,03	Luas
29.	Tata Letak Bunga	Ujung batang dan ketiak daun	Ujung batang dan ketiak daun	∞	∞	Sempit
30.	Warna Anther	Kuning keputihan - Kuning tua	Kuning	1,11	0,03	Luas
31.	Warna Stigma	Ungu muda - Ungu tua	Ungu tua	1,90	0,04	Luas
32.	Pematangan Buah	Tidak merata - Merata	Tidak merata	1,16	0,03	Luas
33.	Bentuk Buah	Oval - Ovoid	Ovoid	11,05	0,10	Luas
34.	Warna Biji	Hitam keunguan - Coklat tua	Hitam keunguan	0,84	0,03	Luas
35.	Ukuran Biji	Kecil - Besar	Sedang	1,73	0,04	Luas

Keterangan: ∞ = memiliki nilai yang sama karena datanya seragam

Plant breeding activities require a high level of diversity; without it, breeding efforts would not be successful in assembling the necessary superior cultivars (Fauza, 2005). Because selection will be successful or effective if the plant population to be selected has vast variety, the narrow phenotypic variability in observed morphological features cannot be used as a basis for selection in plant breeding efforts. Jalata et al. (2011) state that the selection process will only be successful if there is a lot of genetic diversity. In plant

development, the genetic diversity of an inherited feature is extremely useful. Selection is a crucial step in the development of the anticipated improved cultivars. To properly select the appropriate genotypes, information on phenotypic appearance, genetic diversity, and heritability is required. The importance of genotypic and phenotypic diversity in selecting the desirable traits cannot be overstated. In order to assess inheritance and the selection technique for the features generated, the predictive value of heritability is also highly significant in addition to variability (Bello, 2012).

Hanjeli is a clump-shaped plant, and the total number of tillers and the number of productive tillers in one clump ranged from 4 to 53 stems with an average of 14.41 stems, while the number of productive tillers in one clump ranged from 2 to 50 stems with an average of 12.04 stems, indicating that the percentage of stems that formed fruit was 83.55 percent of all observational accessions. The four Hanjeli genotypes have a range of 7-18.33 tillers, with an average of 13.10 tillers, according to Qosim et al. (2013). Flowers and fruit form a clump on each stem of Hanjeli. Flowers and fruit are located at the end of the stem and in the leaf axils, with an irregular fruit ripening phase. The constituent parts of the Hanjeli flower show that it is an incomplete flower, but it is a perfect flower. Hanjeli flowers have male and female reproductive components rather than calix and corolla sections. Some accessions exhibited various hues for the anther and stigma, with the anther ranging from whitish yellow to dark yellow and the stigma varying from light purple to dark purple. Table 3 shows the morphology of Hanjeli flowers and seeds in four West Sumatra regencies/cities

Stigma	Seeds								
	Sizes			Clors			Forms		
PH-4	NLG-1	KT-1	TJR-1	BNH-3	KKD-3	KRJ-8	STG-1	PTA-1	
									
ungu muda	ungu tua	besar	kecil	hitam keunguan	coklat tua	coklat muda	ovoid	oval	

The size of Hanjeli seeds was split into three categories in this study: small seeds (15 g/100 seeds), medium seeds (15-29 g/100 seeds), and giant seeds (30/100 seeds). When 100 seeds were weighed, the Hanjeli accession was found to have a weight range of 11.86 g (small) to 41.43 g (big), with an average

of 26.05 g. (medium). KT-1, BS-1, BS-2, BS-3, BS-4, BS-5, BNH-1, BNH-2, SPA-1, SPA-2, SPA-3, SPA-4, SPA-5, APA-1, KTO-1, KTO-2, KTO-3, TJR-3, GT-1, GT-2, and DK-1 were among the accessions with big seed sizes. NLG-1, TJR-1, TJR-2, PH-4, and KRJ-8 are accessions with tiny seed sizes. The remaining 43 accessions, on the other hand, were Hanjeli with medium seed size. The weight of 100 grains of the four genotypes studied ranged from 9.39 g to 18.16 g, according to the findings of Qosim et al. (2013).

3. Analyze Similarities

In order to evaluate the level of kinship in the 69 Hanjeli accessions in the four districts/cities that became the observation locations, a similarity analysis was performed. The dendogram depicts the findings of the analysis of the similarity of the relationship between 69 Hanjeli accessions (Figure 1). According to the findings, the coefficient of similarity of all Hanjeli accession samples found in four districts/cities in West Sumatra Province ranges from 0.67 to 1. The coefficient value describes the degree of similarity between the two accessions. If the similarity coefficient value is little, the degree of similarity of the accessions being compared will be closer. If the similarity coefficient value is large, the level of similarity of each accession being compared will be further away.

Table 4: Phenotypic Character Dendogram Grouping of 69 Hanjeli Germplasm Accessions

The main group	The sub group	Genetic Similarity Coefficient Value	The main group
A	A1	78	STG-1; KKD-1; NL-1; KKD-2; MLK-3; MLK-4; NGL-1; NGL-2; NL-3; PH-1; PH-2; PH-3; KRJ-1; KRJ-2; KRJ-4; KRJ-6; KTH-2; PH-5; KRJ-5; KRJ-3; KKD-3; LG-1; LG-2; KSK-1; KSK-2; KBG-1; BTA-3; BNH-3; CND-2; MLK-2; MLK-1; KTH-1; KRJ-7; NL-2; CND-1; TJR-1; TJR-2; NLG-1; NLG-2; PLH-1; MTR-1; KT-1; GT-1; GT-2; DK-1; BTA-1; BTA-4; TJR-3; KTO-1; KTO-2; KTO-3; SPA-1; SPA-2; SPA-3; SPA-4; SPA-5; BS-1; BS-2;BS-3; APA-1; BS-4; BS-5; BNH-1; BNH-2
	A2	84	BTA-2; NL-4
B	B1	100	PTA-1
	B2	96	PH-4; KRJ-8

The coefficient numbers that phenotypically indicate the degree of dissimilarity between the samples being compared are referred to as taxonomic distance. The greater the similarity between two individuals (narrower variability), the lower the dissimilarity value; conversely, the greater the dissimilarity number, the lower the level of similarity between individuals (larger variability) (varies). Meanwhile, the dissimilarity coefficient between the two people is zero (Fauza, 2009).

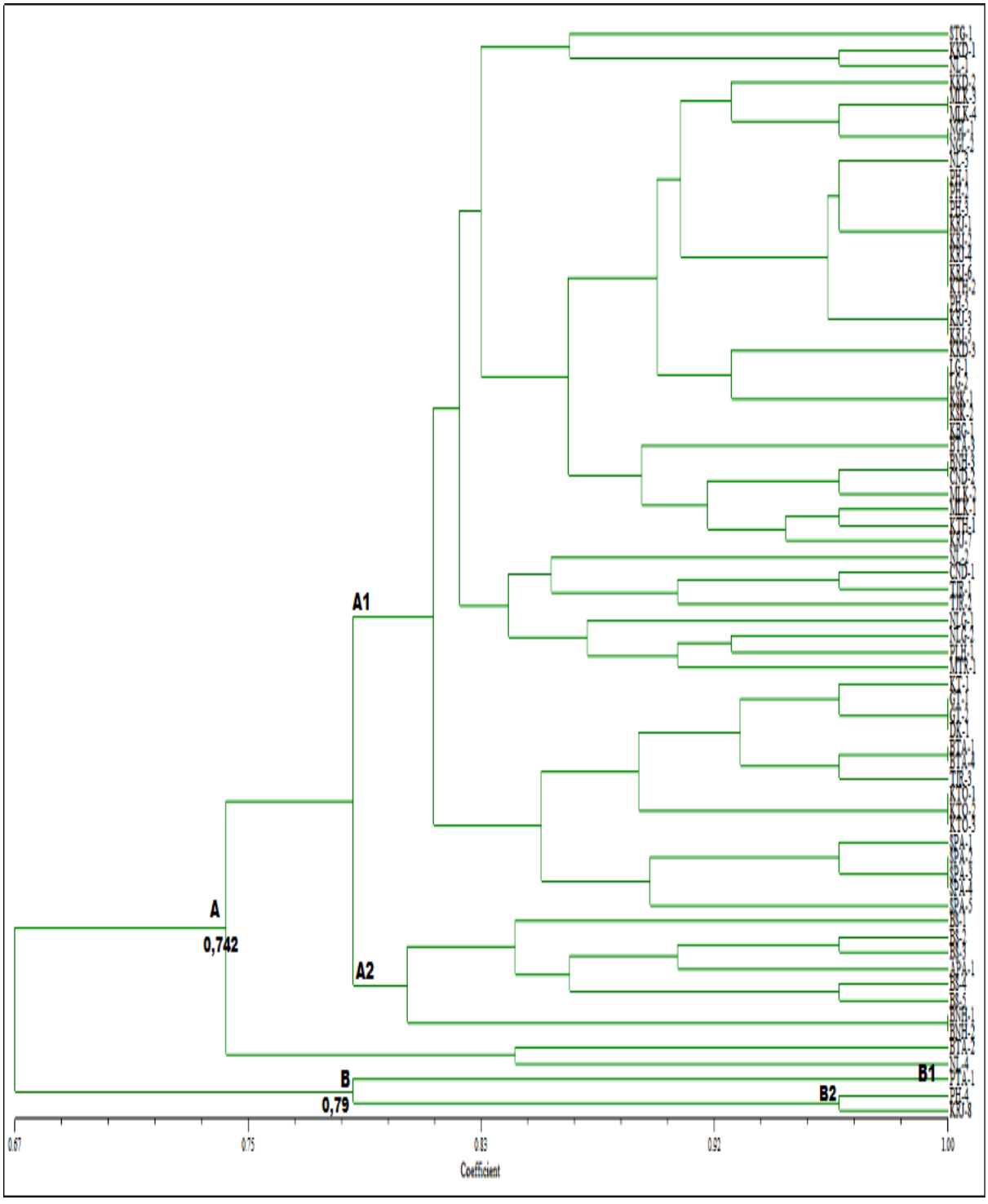


Figure 1: Phenotypic Characteristics of 69 Hanjeli Plant Samples from Four Regencies/Cities in West Sumatra Province

At a similarity level of 0.67, the dendogram of phenotypic traits of 69 Hanjeli accessions in four districts/cities of West Sumatra Province revealed that all accessions were divided into two groups. The genetic gap between these two groups is relatively substantial, indicating that their relationship is quite distant. According to Cahyarini et al. (2004), if the similarity is less than 0.6 or 60%, it is considered distant. Individuals that are closely related have a little genetic distance, while those who are far related have a long genetic distance. The first set of accessions (coefficient 0.74) was divided into two subgroups, with the first subgroup containing 64 accessions and the second subgroup containing two accessions, BTA-2 and NL-4, and the second group (coefficient 0.79) containing three accessions, PTA-1, PH-4, and KRJ-8.

Cultivars from the same region aren't necessarily grouped together. This suggests that genetic diversity is not always linked to geographic variety. According to Daradjad et al. (1991), the wide distance between the lines in the cluster, as well as the distance between the clusters, indicate quantitative genetic diversity. Divine (2020) reported that Hanjeli genotypes from the same area were not always in the same cluster, as evidenced by the results of a phenotypic similarity analysis performed on Hanjeli in the Payakumbuh district for all characters with similarity coefficient values ranging from 0.07 to 0.63; at a coefficient of 0.07, the accessions were divided into two groups, indicating a low level of similarity between accessions.

4. CONCLUSION

According to the findings of the research, there were 69 Hanjeli accessions discovered during the discovery of Hanjeli in West Sumatra Province in four regencies/cities: Padang Pariaman Regency, Agam Regency, Padang City, and Solok Regency. Hanjeli grows between 6 to 1575 meters above sea level and can thrive in a variety of environments, including dry ground and regions near water sources (starting on the outskirts of streams to the edges of rice fields). For all characters, the phenotypic similarity study of Hanjeli plants yielded similarity coefficients ranging from 0.67 to 1. At 0.67, the accessions were divided into two groups: 66 accessions in the first group, and 3 accessions in the second group.

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REFERENCES

Astuti SR. 2004. Eksplorasi plasma nutfah tanaman angan di Provinsi Kalimantan Barat. Balai Besar Penelitian dan Pengembangan Bioteknologi dan Sumberdaya Genetika Pertanian. Bogor. Vol. 10 No.1.

Balai Besar Litbang Bioteknologi dan Sumber Daya Genetik Pertanian. 2014. Hanjeli dan Potensinya sebagai Bahan Pangan. http://biogen. litbang.pertanian.go.id/2014/10/Hanje

li-dan-potensinya-sebagai-bahan-pangan/ [diakses 24 Februari 2020].

Balai Besar Litbang Pascapanen Pertanian. 2020. Buku saku - Bahan pangan potensial untuk aniti virus dan imun *booster.* Kementan.

Bello, OB. 2012. Heritability and genetic advance for grain yield and its related attributes in maize (*Zea mays* L.). J. Instasci. Micro. Biotech. 2:1-14

Cahyarini RD, Yunus A, dan Purwanto E. 2004. Identifikasi Keragaman Genetik Beberapa Varietas Lokal Kedelai di Jawa Berdasarkan Analisis Isozim. Agrosains 6 (2):79-83.

Daradjat, A.A., M. Noch, dan M.T. Danakusuma. 1991. Diversitas Genetik pada Beberapa Sifat Kuantitatif Tanaman Terigu (*Triticum aestivum* L.). Zuariat. 2 (1) : 21 – 25.

Evizal, R. 2020. Review Etnoagronomi perladangan pangan di Indonesia. Jurnal Agrotropika 19 (1) : 1-10.

Fauza, H. 2005. Gambir (*Uncaria gambir* (Hunter) Roxb.). Dalam: Baihaki, A., Hasanuddin, Elfis, P. Hidayat, A. Sugianto, dan Z. Syarif (Eds.) Kondisi Berapa Plasma Nutfah Komoditi Pertanian Penting Dewasa ini. PPS UnpadKNPN Litbang Deptan. Hal 167-186.

_____ 2009. Identifikasi Karakteristik Gambir (*Uncaria* spp.) di Sumatera Barat dan Analisis RAPD. Disertasi Fakultas Pertanian Universitas Padjadjaran. Bandung. 308 hal.

Ilahi, AY. 2020. Keragaman Fenotipe dan Kemiripan Morfologis Hanjeli (*Coix lacrima-jobi* L.) di Kabupaten Lima Puluh Kota. JIPI, 22(2) : 130-135.

Jalata, Z., A. Ayana, dan H. Zeleke. 2011. Variability, heritability and genetic advance for some yield and yield related traits in Ethiopian barley (*Hordeum vulgare* L.) landraces and crosses. Int. J. Plant Breed. Genet. 5:44-52.

Lee, M. 1998. DNA Markers for Detecting Genetic Realtionship among Germplasm Revealed for Establishing Heterotic Groups. Presented at The Maize Training Course, CIMMYT, Texcoco, Mexico, August 25 1998.

Nira,T,D. 2016. Pengaruh jarak tanam berbeda dan berbagai dosis pupuk kandang ayam terhadap pertumbuhan dan hasil hanjeli pulut (*Coix lacrima-jobi.*L) di dataran tinggi Punclut. [skripsi]. Universitas Padjadjaran. Bandung.

Nurmala T dan Irwan AW. 2007. Pangan Alternatif: Berbasis Serealia Minor. Penerbit Giratuna. Bandung.

Qasim,WA., Nurmala, T., Irwan, A.W., dan Damanik, M.C. 2013. Pengaruh Pupuk NPK dan Pupuk Hayati BPF terhadap Karakter Pertumbuhan dan Hasil Empat Genotip Hanjeli (Coix lacrima jobi L.). Jurnal Pangan, 22 (2) : 357 - 364.

Rahmawati DE. 2003. Estimasi Heretabilitas dengan Metode Regresi Tetua-Turunan dan Kemajuan Genetik Beberapa Karakter Penting Hanjeli (*Coix lacrima-job*i L.) di Arjasari [skripsi]. Universitas Padjadjaran. Bandung.

Ramadhan, N., Martinsyah, RH. dan Dwipa, I. 2020. Pertumbuhan Hanjeli (*Coix lacrima-jobi* L.). pada Kepadatan Populasi Berbeda di lahan

Sub Optimal. Jurnal Agroekoteknologi, 12 (2) :128-137.

Simangunsong, A.D., dan Damanhuri, R. 2017. Eksplorasi dan karaktyerisasi pisang mas di Kabupaten Nganjuk, Mojokerto, Lumajang dan Kediri. Jurnal Produksi TAnaman, 5(3), 363–367.

Siregar, UJ, dan Olivia R.D. 2012. Keragaman Genetik Populasi Sengon (*Paraserianthes falcataria* (L) Nielsen) pada Hutan Rakyat di Jawa Berdasarkan Penanda RAPD. Jurnal Sivikultur Tropika. 3:130-136.