IDENTIFICATION OF ANATOMY AND QUALITY OF ESSENTIAL OIL FROM PATCHOULI PLANT *(Pogostemon cablin* Benth) IN WEST PASAMAN

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Abstrak---- The research was conducted in September 2016 to March 2017. Inventory morphological character data patchouli conducted in seven subdistrict in West Pasaman there planting patchouli, namely Sub Kinali, District Luhak Nan Duo, District Pasaman, KecamatanTalamau, District of Mount Tuleh, District Valley Crossing, District Batahan aspect, District skelter Koto Balingka and Aua River District. As for the anatomical observations carried out at the Tissue Culture Laboratory of the Faculty of Agriculture Department of Agriculture Unand, testing oil yield and oil content carried out in the laboratory Balitro Laing Solok, patchouli oil quality testing is done in laboratory Balitro Bogor. For the analysis of phenotypic variability wide variety of parameters plant height, number of primary branches, the length of the primary branch, and the length of the petiole. While the character of phenotypic variability, ie on characters long narrow leaf and petiole length. Accession RB4 and accession ST2 can be used as clones of patchouli in West Pasaman yield the highest oil contained in the accession RB4 is Kadar PA highest in accession ST2 is Situak can be used as a development area of patchouli in West Pasaman

Keywords: *patchouli, genetic diversity, characterization , morphology, anatomy, quality test*

I. INTRODUCTION

Plant patchouli *(Pogostemon cablin* Benth) is a plant essential oil plantations in Indonesia. Essential oils are oils produced from the secondary metabolism of plants that have aroma, volatile, soluble in alcohol and are generally composed of terpenes or sesquiterpenes. Therefore it is so, the essential oil is called also with oil fly*(Volatileoil)*or oil of world trade eteris.Dalam essential oil called*"essential*oils".

Patchouli is the biggest foreign exchange earner among other essential crops. Indonesia is a supplier of 90% of the world patchouli oil. Patchouli oil production center was originally a Java and Sumatra. A few years back is dominated by Sulawesi which controls 80% of national production. However, the minimum standard of patchouli oil Sumatra higher based on the levels *of patchouli alcohol* is between 30-34%, compared Sulawesi between 26-30%, and at the same quality (30%), oil of patchouli Sumatra appreciated 6 USD per kilogram higher than from Sulawesi (Sumatra 56 USD / kg and Sulawesi 50 USD / kg) (Caiger, 2016).

Three types of plants that grow in Indonesian patchouli can be distinguished among other things from the characters of morphology, anatomy and the amount and quality of the oil and resistance to biotic and abiotic stresses. The third type of patchouli; Patchouli Aceh, Java patchouli and Patchouli Soap. The most widely spread and widely cultivated are patchouli Aceh, because the oil content and quality of the oil is higher than the other two types. Nilam Aceh high oil content (> 2.5%), while the Java patchouli low (<2%) (Nuryani, 2006).

Productivity patchouli in Indonesia is still relatively low and varies between centers of production. One effort that can be done to improve the productivity of agricultural crops

is by intensification. This can be done by using seeds or seedlings of superior verietas. At the patchouli oil production is determined by the variety used. To get good results in quality and quantity required patchouli plant seeds of improved varieties. Local varieties are very have an important role as a source of germplasm for these varieties belong to the type of broad and specific adapt wherewith the location setempat.Dimana local varieties have genetic diversity that is still natural.

One source of the genes used for crop improvement is to look at the natural genetic diversity remaining (Welsh, 1991 in Jambormias *et.al* 2003).

West Sumatra is an area that has a plant area that is wide enough patchouli nationally, with production centers in West Pasaman, Pasaman, Sijunjung, Mentawai District, Pesisir Selatan and Solok Selatan. According to the history of patchouli in West Sumatra were first grown in the foothills of Mount Pasaman, West Pasaman brought the Netherlands in 1895. In 1985 the Dutch broughtpatchouli plant species *Pogestemon cablin* from the Philippines to Indonesia. The first plant is used as intercrops in coffee plantations in the foothills of Pasaman, West Sumatra. After the war in Aceh, patchouli began to spread to the area around Aceh and planted as sidelines in tobacco plantations and palm oil (Hieronymus, 1990).

According to the Department of West Pasaman Plantations (2014), patchouli cultivated in West Pasaman generally done as a sideline by farmers, but patchouli always grown continuously. Kecamatan.Dengan plantations is also scattered in several production centers located in the District of Kinali, District Luhak Nan Duo, District Pasaman, District and District of Okanagan Mountain Tuleh Melintang.

Improved productivity and quality of oil can be seen from three aspects: genetics, cultivation and post-harvest. Increasing productivity and genetic improvement mutumelalui require a high diversity in the properties of patchouli dibutuhkan.Tanaman sifatyang generally do not flower and therefore diperbanyaksecara vegetatif.Dengan properties alamihanya genetic diversity expected from natural mutation frequency is usually low (Nuryani et al. 2003).

The genetic diversity of patchouli can be improved by means of somatic hybridization. For that, at the initial level need to be collected germplasm from different regions (Nuryani *et*al.2003) .Informasi genetic diversity are also needed to support conservation activities. The amount reflects the genetic diversity of genetic resources needed for ecological adaptation in the short term and the long-term evolution (Indrawan *et al*.2007).

II. METHOD

a. Place and Time

This study was conducted in September 2016 to March 2017. Inventory morphological character data patchouli conducted in seven sub-district in West Pasaman there planting patchouli, namely Sub Kinali, District Luhak Nan Duo, District Pasaman, KecamatanTalamau, District of Mount Tuleh, District Valley Crossing, District Batahan aspect, District skelter Koto Balingka and Aua River District. As for the anatomical observations carried out at the Tissue Culture Laboratory of the Faculty of Agriculture Department of Agriculture Unand, testing oil yield and oil content carried out in the laboratory Balitro Laing Solok, patchouli oil quality testing is done in laboratory Balitro Bogor.

b. Materials and Equipment

Materials used as objects of identification are patchouli plant that has been cultivated farmers for generations and continuously for decades aged 6 months after planting with a planting area of at least 2,500 $m^{2,}$ in the nine districts in West Pasaman.

Tools used for observation include tape measure, ruler, vernier caliper, *Color Checker (Munsell Color Charts for Plant*Tissue),GPS, microscop, razor blades, a pipette, a glass object, cover glass, sack, camera.

c. Methods

This study used a descriptive non-experimental observational method, with sampling techniques intentionally*(purposivesampling)*.Pengamatan done through observation of morphological characters of local patchouli plant in West Pasaman, namely by taking 5 samples at each site patchouli crop cultivated for decades and never use the seeds of national varieties are in introduksikan by local estate agency.

d. Implementation Research

Patchouli plant samples taken are local patchouli plants, each of the five samples of each crop patchouli obtained. Sample selection is done by deliberately to choose plants that grow well and have been outstanding for more than six months, followed by determining the coordinates of the sample by using GPS and installation label.Sedangkan activities to see anatomidilaksanakandi Tissue Culture Laboratory of the Department of Agriculture, Faculty of Agriculture Unand, yield testing and oil quality in laboratory Balitro intervenes in Solok and patchouli oil quality tests conducted in the laboratory Balitro Bogor.

Identification and Characterization

Observations in the identification and nature karekterisasi do is to look at the branches, leaves, and stems.

Morphological characters were observed:

a) Leaf

color of the leaves of young and old leaves, forms the base of the leaf, the shape of the tip of the leaf, the shape of the edge of the leaf, the shape of the surface of the upper leaves and lower leaves, wake up leaves, feathers leaves, leaf length (cm), width of leaves (cm), leaf thickness (mm), length of petiole (cm), pertulangan leaves

b).stem

Highplants (cm), the color of old stems, young stems color, shape trunk, the branches, the number of primary branches, number of secondary branches, color primary branches, secondary branches color.

Anatomy of Nilam

Observation of anatomy bars to see the oil cells and trichomes, while for observation includes observations patchouli leaf oil cells and trichomes. Patchouli leaves were used to observe the anatomy of patchouli is derived from the leaves that have grown ie third leaf after the shoot, and then inserted into a clear plastic. The leaf samples were stored in a flask that had contained a mixture of ice cubes with salt. The anatomical structure of the leaf is observed through an incision paradermal.Sediaan microscopic observation of the cell density of oil made its way patchouli leaves scraped with a razor knife to get a layer of the epidermis. Furthermore, the epidermal layer is placed on an object glass and etched with a solution of sudan III, then covered with a glass lid (Saas, 1951).

Calculating Yield (%) and the Quality TestPatchouli Oil

resultsYield = Weight of the extra / dry weight x 100% herb. As for the patchouli oil quality test conducted by SNI 06-2385-2006.

Similarity Analysis

Data analyzes were performed using the similarity NTSYS 2:02 to see the resemblance of patchouli in West Pasaman West Sumatra.

Variety Phenotypic

Varietyand phenotypic standard deviation is a measure of variation that is learned in basic statistics (Conservation, 2011). The calculation of the value of the phenotypic parameters based on the method used is as follows:

$$\sigma^2 p = \frac{\sum (xi - x)^2}{n-1}$$

$$\sigma p = \sqrt{\sigma^2 P}$$

III.RESULTS AND DISCUSSION

Morphological Characteristics

Based on morphological characteristics of the table above can be seen that each accession patchouli are grown in several districts in West Pasaman differences were clearly visible on both quantitative and qualitative character. Differences in quantitative characters can be seen on plant height, number of primary branches, the length of the primary branch, leaf length and width of leaves, while the qualitative character of the differences seen in the shape of the leaf base. At the base of the leaf shape character *acutus* only in accession BN, TB, and LG while the shape of the leaf base *acuminatus* contained in the accession AM, RB, BP and ST. In addition there are differences in fur character leaves on several accessions, which has coarse fur leaves a lot and seen on accession AM, RB, and ST while hairy and smooth look on accession BN, TB, TD, and LG. the root characters no difference was seen that have root fibers (Table 1.)

Table 1. Patchouli Plant Morphology Character Accession in West Pasaman Some

Characteristics	of Accession						
	AM	BN	RB	TB	TD	ST	
High Plant (cm)	123.36	124.5	124 , 135.34 111.96 123.58 123.68				
Young Trunk Color	Purple	Purple	Purple	Purple	Purple	Purple	P
ColorOld Trunk	Green yellowish	Green yellowish	Green yellowish	Green yellowish	Green yellowish	Green yellowish	G yel
Rod Shape	Square	Square	Square	Square	Square	Square	S
number of Primary Branch	10	23.2	22.6	19.2	22.8	22	
Long Branch P. Cm	92.08 104.62 116.7687.86				81.62	96.24	
Branch Primary Color	Greenpurple	yellowish Green	purplish Green	Greenpurplish	Green	Green yellowish	G
Long Leaf (cm)	7.12	11.54	11.06	10.98	8.6	7.74	
Lebar Daun (cm)	6.34	8.64	8.8	8	6.9	6.4	
Build leaves	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*D*
Form Base leaves	*Acumi Natus*	*acutus*	*acuminatus*	*acutus*	*acuminatus*	*acuminatus*	*a*
Leaf tip shape	*acutus*	*acutus*	*acutus*	*acutus*	*acutus*	*acutus*	*a*
Leaf shapeBank	*Biserratus*	*Biserratus*	*Biserratus*	*Biserratus*	*Biserratus*	*Biserratus*	*Bis*
Young Leaf Color	5 GY 4/6	5 4/6GY	5 GY6/6	GY5 4/6	5 4/6GY	5 GY4/6	5 5
Color leaves Old	GY 5 5/6	5 4/4GY	7.5 GY4/6	GY5 4/4	5 5/4GY	5 GY4/8	GY
Fur leaves	Many, rough	deal, Fine	Lots, rough	Many, Fine	Lots, Smooth	Many, rough	Mar
pertulangan Leaf	*Penninervis*	*Penninervis*	*Penninervis*	*Penninervis*	*Penninervis*	*Penninervis*	*Pen*
Root	fibers	fibers	fibers	fibers	fibers	fibers	f
Flowers		None None		None None		None None	No

Analisisis Variety phenotypic

Table 2. the obtained four (4) characters wide phenotypic variability of parameters plant height, number of primary branches, the length of the primary branch, and the length of the petiole. While the

character of phenotypic variability, ie on characters long narrow leaf and petiole length. The more extensive phenotypic variance, the greater the role of genetics in plants to show the diversity of characters, otherwise the lower the phenotypic variance, the greater the influence of environmental factors in the appearance of the character of a plant (Drajat, 1987).

Table 2. Quantitative Analysis of Total diversity Character Of the 35 Accession West Pasaman Nilam Plant

Characters	average	σ^2p	σp	VF
HighPlant	123.54	148.16	12.17	Size
Number of primary branches	18.8	41.99	6,48	Size
long Branch Primary	96.34	222.17	14.91	Size
long Leaf	7.31	1.76	1.33	Narrow
leavesWidth	9.29	4.35	2.09	Size
long Leaf stalk	4.77	0.61	0.78	Narrow

Similarity Analysis

1. Similarity Analysis of Quantitative Data

Grouping patchouli plant is divided into two major groups, namely group I and group II with figures similarities these two groups are in the 0.21 coefficient. Each major group is divided into two groups. In group I is divided into two groups on the similarity numbers around 0.34 (A, B), whereas in the second group there are only a small grouping. The division that continues to occur mainly in the first group to obtain the smallest group (Figure 1). once obtained the smallest groups it can be seen accession which has a resemblance to a 100% or not.

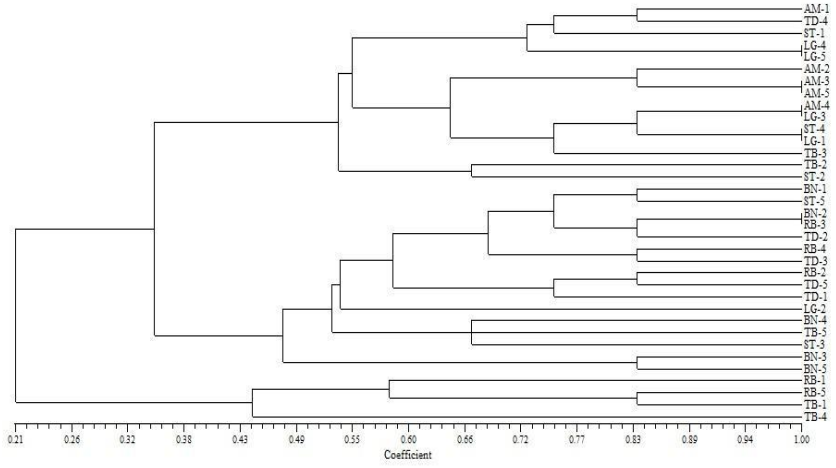

Figure 1. Quantitative data Dendogram morphology 7 accessions of patchouli West Pasaman

2. Similarity Analysis of Qualitative Data

Based on the analysis we found some groups of plants with similarities ranging from 66 to 100%. (Figure 2.).

Grouping of patchouli is divided into two major groups, namely group I and group II with figures similarities these two groups was 66%. Each major group is divided into two groups. In group I happened division of the two groups at approximately 68.2% similarity numbers (A, B), whereas in group II occurs division of the group at around 73.8% similarity number (C, D). The group division continues to obtain the smallest group (Figure 4). The smallest group will look at whether there are accessions of plants that have the degree of similarity of 100% or not.

Based on the results dendogram qualitative data with the degree of similarity is high (100%) in group I (A) formed by the accession of ST-1 and ST-3, ST-4 and ST-5, Group I (B) formed by the NII accession RB-2 and RB-4 and TD-2 and TD-3. Whereas in group II (C) formed by the accession BN and BN-3-5. Of the analyzed accession number there were 10 accessions that have similar 100%, meaning that the percentage of similarity of the plant by 35% (10 / 35x100%) and the percentage of 60% of plant diversity. These values also indicate that the diversity of characters large enough kualitattif patchouli.

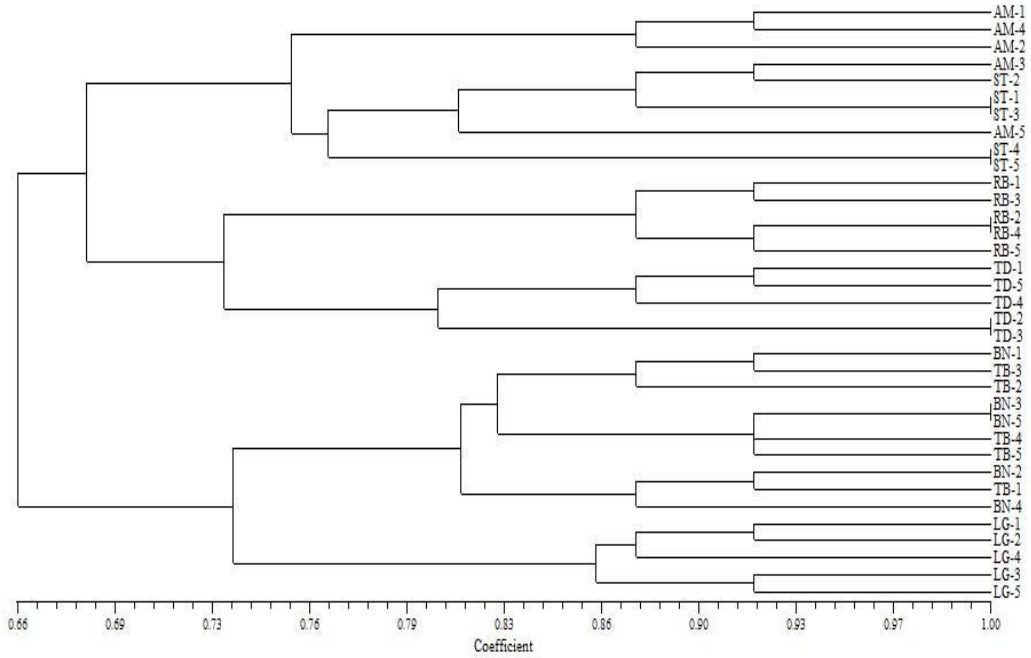

Figure 2. qualitative data Dendogram morphology 7 Accession patchouli West Pasaman

3. Similarity Analysis Quantitative and Qualitative Data

Based on the analysis of the merger dendogram quantitative and qualitative data obtained some level group of plants with similarities ranging from 51% to 94%. Grouping of patchouli divided into two groups in number by 51% similarity to that group I as the largest group stood at 57% similarity followed by small groups and group II stands at 84% similarity which only showed a small group of plants. Relations closest similarity with the numbers 94% similarity only in the first group that is contained in the accession TD-2 and TD-3, BN-3 and BN-5.

The combined number of characters from the data analyzed quantitative and qualitative there are only 4 accessions that have similar 94%, meaning that the percentage of similarity crop of 10.74% (4 / 35x100%) and the percentage of 89.26% of plant diversity. These values also indicate that the diversity of characters is huge patchouli.

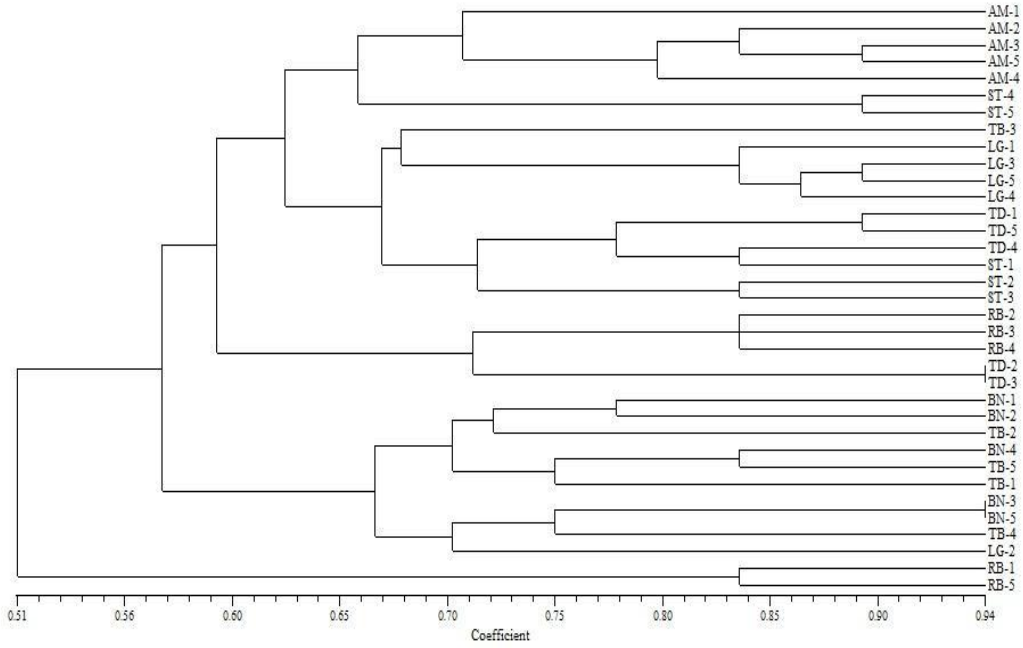

Figure 3. Dendogram incorporation of quantitative and qualitative data morphology 7 accessions of patchouli in the district of West Pasaman

Anatomy Patchouli Leaf and Stem Plants

On patchouli leaf cells or oil glands are found in the tissues of palisade and spongy parenchyma. The number of cells found more oil in the palisade cells as close to the surface of the epidermis of leaves that get more sunlight so that the metabolism of cells forming a more perfect oil. The oil glands is one cell that can produce essential oils brownish-yellow, reddish yellow to yellow shiny (Haryudin *et*al.,2002). This is consistent with observations of oil into seven cells accession patchouli leaves and stems of brownish-yellow to yellow, shiny, oval (Figures 4 and 5).

Figure 4. Cells Leaf Oil

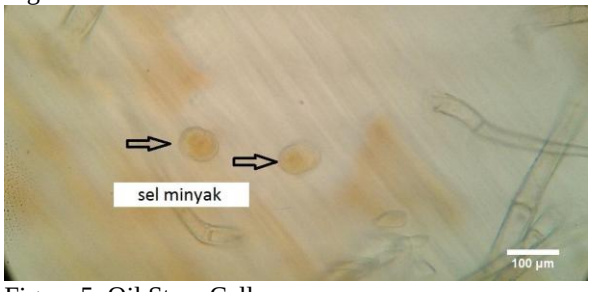

Figure 5. Oil Stem Cells

Observation trichomes

Based on observations made on 7 accessions of patchouli in West Pasaman generally include the type of glandular and non-glandular trichomes (Figures 6 and 7).

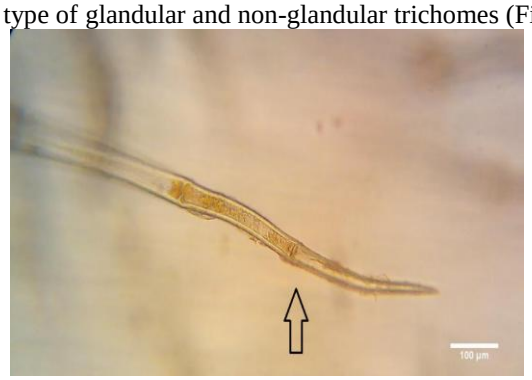

Figure 6.leaf trichomes

Figure 7. trichomesStem

Quality Essential Oils PlantPatchouli

1. YieldPatchouli Oil

Patchouli production in Indonesia average of three seed varieties that have been released Balitro namely Tapak Tuan, Lhokseumawe and productivity Sidikalang with herb and oil yield respectively 13, 28 t / ha and 2.83%, 11.09 t / ha and 3.21% and 10.50 t / ha and 2.89% (Wahyudi and Ermiati, 2012). From the results obtained patchouli oil yield is 2.46% RB4, ST2 2.37%, 2.30% SO 2, BN2 2.11%, 1.57% AM2, TD2 1.27%, 1.16% LG1 still below the average yield of the high-yielding varieties. It is caused by factors of cultivation techniques, the environment, how to harvest and post-harvest treatment. These factors greatly affect the quality of the resulting dried herb.

2. Quality Test Patchouli Oil

Quality Patchouli oil obtained in the preliminary examination of the content of *patchouli alcohol* and *Acid Value* to seven accessions of patchouli results from testing at PT AROMA Lubuk Accession ST2 PA Minturun is 28.04% 2.58% AV, TB2 Accession PA 27 , 02% AV 1.75%, Accession AM2 PA 25.75 AV of 1.48%, 25.03% PA LG1 Accession AV 6.87%, 24.81% PA RB4 Accession AV 1.67%, Accession TD2 PA AV 4.75 24.24% and 19.77% PA BN2 Accession AV 1.58%.

From the above results showed that the highest PA contained in the Accession Situak (ST2) and the lowest in the Accession Bukik PA Nilam (BN2). Further testing according to the standard ISO 2006 patchouli oil is conducted at the Laboratory Balitro Cimanggu Bogor. Oil quality test in the Accession ST2 with 31.45% PA and PA accession BN2 with 25.15%. From the test results of oil quality in Bogor Balitro found that PA PA patchouli ST2 meet ISO 2006.

Figure 8. Oil Nilam

From Figure 8 it can be seen that the color of patchouli oil refining dihasil from light yellow to brownish yellow, the result meets the ISO-06 -2385- 2006 that patchouli oil light yellow to brownish red. This is due to the refining process is done with a good SOP procedure and do in Balitro Silaiang Solok using distillation methods of distillation. Which according to Nature (2007), oil refining is done by simple distillation method and a small capacity to produce quality oils and optimal unfavorable.

CONCLUSION

From the observation characteristic morphology, anatomy and plant quality can be concluded that:

1) Accession RB4 and accession ST2 can be used as clones of patchouli in West Pasaman
2) yield the highest oil contained in the accession RB4 is
3) Kadar PA highest in accession ST2 is
4) Situak can be used as a development area patchouli in West Pasaman

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