International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 10, Issue 8 (August 2014), PP. 52-57

Fundamental Research: The Study of Taxonometric and Philogenetic of Local Durian Variety of Ternate and Jailolo in North Moluccas Province. Indonesia

Sundari[1], A.R Tolangara[2]
[1]*Biology Education Program, Khairun University, Ternate, (INDONESIA)*
[2]*Biology Education Program, Khairun University, Ternate, (INDONESIA)*

Abstract:- North Moluccas Province to having durio produced harvest potency that have typical characteristic corresponds to region ecological condition. Centra is typical durian producer North Moluccas Province is at Ternate and Jailolo. The research was conducted on 2 Sub District at District of Ternate and Jailolo from April until July 2013, used descriptive methods, namely by purposive sampling, location. The criteria are plants that have been observed several times fruitful and desirable community. Based on the results of research in the District of Ternate and Jailolo was found 1) taksonometrik's analise (numerik's taxonomy) varietas is local durio at Ternate and Jailolo points out to domicile on takson varietas's zoom. 2) Genetic kinship analise of varietas local durio at Ternate of 7 groups with similiar index 90,32% on local varietas code 13 and 12. Based on kinship analise of varietas local durio at Jailolo's of 5 groups with similiar index 88,66% on local varietas code 5 and 7.

Keyword:- Taksonometric, filogenetic, local varietas durio

I. BACKGROUND

Durian (*Durio zibethinus*) is one of Malcavae family which has a high economic value and is prefered by most people. Many people think that durian is so tasty fruit that people tend to named it as "the king of fruit with pungent smell characteristic that can be smelled from distance". Ternate and Jailolo are two potential places to produce durian. In a certain period, durian can be sold in a vast number. North Moluccs Province is one of potential area to produce durian which has special characteristics based on the ecological condition. The main places to produce North Moluccas durian are Ternate and Jaillolo. The result of the first observation of the study showed that there was a huge number of North Moluccas durian varieties. The diversity, then, are named local durian variety of Ternate and Jailolo for the time being by the researchers. The names of the local durian variety are: durian *pare*, durian *akesako*, durian *suleksu*, durian *mentega*, durian *nangka belanda*, durian *gajah*, and durian *koronci* (Ternate: Red).

Based on the researchers' observation, the basic research related to the identification of biological resources including local variety in this case local durian variety of Ternate and Jailolo has not been carried out yet, so that there is no information related to the biological variety and bilogical resources which belong to specific biological resources of North Moluccas Province.

The usage of the term local durian variety of Ternate and Jailolo was the idea if the researchers as the first step of the study of durian taxonomy and genetical kinship of Ternate and Jailolo. The term of variety is commonly used technically in agriculture. Unlike showing the real taxon level, the variety means the result of cultivation variety or, specifically, the result of the cross of two species. In taxonomy science, the plants that are produced from the crossing activity is called variety culture or cultivar or agriculture variety in which the name had been set in plantation nomenclature of KITT or ICBN (Tjitrosoepomo, 1998).

The study of taxonometric or numeric taxonomy is aimed at giving a new alternative in systematic science (Rasnovi, 2004). In addition, this study also facilitates the knowledge of the level of genetical kinship from various local durian variety in Ternate and Jailolo which also becomes the resource of germplasm, so that a particular licensed product or taxonomy patent rights and the topography of genetic diversity of local durian variety of North Moluccas, in this case durian from Ternate and Jailolo as the main places of durian producer, can be claimed.

The purpose of the study are as the conservation of biological diversity, especially for durian diversity of local variety of Ternate and Jailolo. Hence, information of the resource of germplasm of local durian variety in North Moluccas Province can be obtained. It is expected that in the future, the local durian can be used as the potential product or prime product of fruit of North Moluccas. The purpose of the study are specified as follow:

1. To find the biological diversity of durian from North Moluccas, in this case local durian variety of Ternate and Jailolo.

2. To find the kinship relationship of local durian variety of Ternate and Jailolo as the biological resource.
3. To make use of the potential of the product of the biological resource, namely local durian variety of Ternate and Jailolo, as the patent rights of the biological durian resource of North Moluccas for the sake of future generation
4. To be the biological resource conservation of local durian variety of North Moluccas based on the taxonometric and ecological characteristics, especially for local durian variety of Ternate and Jailolo.
5. To be the learning material in Botani Phanerogamae course in Khairun University.

II. METHOD

The present study employed descriptive method, in which the characteristics and the level of kinship of local durian variety of Ternate and Jailolo were exposed. The morphology data from each specimen were collected through direct field morphology observations and herbarium morphology observations in laboratory. The making of microscopic sample, that is a thin slice of a leaf, and a preserved sample. The colouring of the sample was done by giving saphranin 1%. The slices were put on object glasses which had been given gliserin 10% beforehand.

Based on the observed characteristics on table 3.1, the stable characteristics were chosen and recorded on STO (Operational Taxonomy Unit, OTU) character table format. The data were analyzed by implementing Heywood's (1968) procedure in Murchayani (2005), as follow:

1. based on the similarity index calculation from each OTU set by using association coefficient formula:

$$S = \frac{Ns}{\mathrm{Ns} + \mathrm{Nd}}$$

S : Association coefficient of compared an OTU set
Ns : The number of similar characters (1) for a compared OTU set
Nd : The number of different characters (1) of an OTU set towards another OTU set

2. The data of similarity index obtained were analyzed by implementing group analysis method, named Cluster Analysis. The grouping was based on the highest similarity level.

III. FINDINGS AND DISCUSSION

1. Taxonometric of Local Durian Variety of Ternate

The result of the taxonometric study towards the local durian variey of Ternate showed that there were 13 local durian varieties with 101 morphology characters. Based on the first step of classification of the morphology characters in 13 local durian varieties of Ternate, the OTU matrix could be arranged. Regarding the result of the OTU matrix calculation, the similarity index of OTU of local durian varieties of Ternate is showed in Table 1.

Table 1 The ascended order of OTU similarity index

Local Varieties of Ternate	OTU Similarity Index
(12,13)	**82,35**
(7,10)	**81,13**
(12,13,11)	**76,46**
(3,6)	**74,55**
(12,13,11,7,10)	**72,23**
(12,13,11,7,10,9)	**68,44**
(12,13,11,7,10,9,3,6)	**66,39**
(12,13,11,7,10,9,3,6,4)	**64,49**
(12,13,11,7,10,9,3,6,4,8)	**56,94**
(12,13,11,7,10,9,3,6,4,8,5)	**54,61**
(12,13,11,7,10,9,3,6,4,8,5,1)	**53,64**
(12,13,11,7,10,9,3,6,4,8,5,1,2)	**48,74**

(Source: analyzed primary data)

Based on the data of the order of OTU similarity index of 13 local durian varieties of Terate, it is showed that local durian variety numbered 12 and13 had high similarity index, i.e. 82.35.

2. Taxonometric of Local Durian Variety of Jailolo

The result of the taxonometric study towards the local durian variey of Jailolo showed that there were 7 local durian varieties with 101 morphology characters. Based on the first step of classification of the morphology characters in 7 local durian varieties of Jailolo, the OTU matrix could be arranged. Regarding the result of the OTU matrix calculation, the similarity index of OTU of local durian varieties of Jailolo is showed in Table 2.

Table 2 The ascended order of OTU similarity index

Local Variety of Jailolo	OTU Similarity Index
(5,7)	**82,69**
(5,7,6)	**68,11**
(5,7,6,4)	**61,83**
(5,7,6,4,2)	**53,70**
(5,7,6,4,2,1)	**50,39**
(5,7,6,4,2,1,3)	**47,22**

(Source: analyzed primary data)

Based on the data of the order of OTU similarity index of 7 local durian varieties of Jailolo, it is showed that local durian variety numbered 5 and7 had high similarity index, i.e. 82.69.

3. Phylogenetic of Local Durian Variety of Ternate

The data of the Phylogenetic study towards local durian variety of Ternate can be seen from the Similarity Index Value as follow.

The ascended order of similarity index value:

(12,13) = 90,32
(7,10) = 89,58
(12,13,11) = 86,64
(3,6) = 84,54
(P12,P13,P11,P7,P10) =83,81
(P12,P13,P11,P7,P10,P9) = 80,69
(P12,P13,P11,P7,P10,P9,P3,P6) = 79,32
(P12,P13,P11,P7,P10,P9,P3,P6,P4) = 77,94
(P12,P13,P11,P7,P10,P9,P3,P6,P4,P8) = 72,08
(P12,P13,P11,P7,P10,P9,P3,P6,P4,P8,P5) = 70,39
(P12,P13,P11,P7,P10,P9,P3,P6,P4,P8,P5,P1) = 69,68
(P12,P13,P11,P7,P10,P9,P3,P6,P4,P8,P5,P1,P2) = 64,22

Based on the above similarity index value, it revealed that the highest similarity index of local durian variety of Ternate is showed in that coded 12 and 13.

4. Phylogenetic of Local Durian Variety of Ternate

The data of the Phylogenetic study of local durian variety of Jailolo can be seen on the following dendogram.

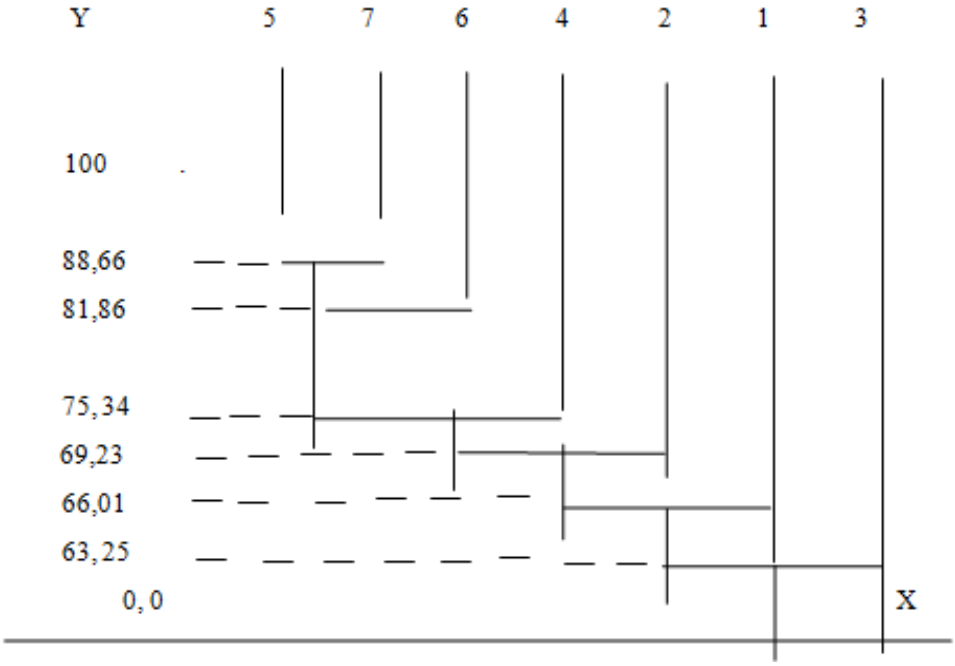

Figure 1. The dendogram of genetic kinship of 7 local durian varieties of Jailolo Based on the morphology characters

Based on the above figure, it can be seen that the highest similarity index of local durian variety of Jailolo is showed on that coded 5 and 7, i.e. 88.66.

VI. DISCUSSION

Numeric taxonomy or taxonometric is a quantitative evaluation method of similarity of characteristics of groups of organism and an arrangement of the groups based on the analysis, named cluster analysis on to taxon category regarding the similarity characteristics. There are two methods of taxonometric study, namely phylogenetic method (cladistics) and phenetic method. The cladistics method is mostly based on the phylogenic evidences, that is related to the evolution (Stuessy, 1990).

Numeric taxonomy is based on the phenetic evidences or based on the similarity showed by the object of the study being observed, not on the base of the possibility of phylogenetic development. Tjitrosoepomo (1998) stated several necessary steps to be done in taxonometric study as:

1. The Object of the Study

The object of the study can be in form of individu, furrow, variety, etc. The important thing needed to be noted that the objects must represent the population of the study and were on the same taxonomy level. The smallest units of the objects of the study were called Operational Taxonomy Unit (OTU).

2. The Numbered Chosen Characters

The number of the characteristics to be numbered should be vary, or at least 60 characters, each of which will be coded and arranged on a table or matrix. Although sixty is the recommended minimum number, yet the validity value might be less. The recommended ideal number of the character is 100-200 characters, so that it might lower the sample error (Sneath and Sokal, 1973 in Stuessy 1990).

3. Similarity Measurement

The similarity is based on the comparison of each character of each OTU. The similarity is showed by the numbers in percent, thus, the similarity index is around 0% (exactly different) to 100% (identic).

4. Cluster Analysis

The similarity matrix is rearranged so the taxonomy units which are highly similar can be categorized in the same group. It can be done through many ways which enable the taxon determination or group. The groups are called fenom and can be arranged hierarchically in a diagram called dendogram (Mursyidin and Qurrohman, 2012).

5. Discrimination

After being classified, the involved characteristics can be analyzed, in order to obtain the most redundant and valuable characteristics to create indentification key (Irawan, et al., 2007). Based on the findings and the data analysis above mentioned, it can be described as follow:

a. Taxonometric Study

Based on the table of morphology character of local durian variety of Ternate and Jailolo, it can be seen that the average height of the durian trees is between 21 metres to 40 metres, the average height of the bough is between 5 metres to 15 metres, thick bark, the diameter of the trunk is about 24 cm to less than 3.24 metres, monopodial branches, the shape of the leaves are vary, they are oval, elliptic, and oblong, the tip of the leaves are acute and most of the leaves are green and dark olive green. The length of the leaves is about 4.7 cm to 19.2 cm, and the width is about 2 cm to 11.7 cm. the length of the stalk is about 3 cm to 6.4 cm. The colour of the fruit is green yellow with diameter from 48 cm to 71 cm. The diameter of the stalk is between 3 cm to 4.8 cm. There are 1 to 5 fruit in each stem, 5 sheaths, and the fruits are 2 cm thick. The peel is 0.1 cm to 1.5 cm thick, the colour of the fruit are vary, they are ivory to lemonchiffon. some of the fruits are gully and some are not. The shapes of the thorns are big sharp and small sharp, the texture of some fruits is fibrous and some of them is not. The length of the fruit is about 7 cm to 20 cm with 11 to 13 seeds in it. There are 2 to 6 fruit on each sheath and the length of the seeds is between 4.3 cm to 6 cm, the width is between 0.5 cm to 1.5 cm, while the colours of the seed are beige to brown.

Generally, the characteristics showed on all local durian varieties are continuous. The continuous characteristics are shown on the diameter of the trees, the diameter of the fruit, and seeds, and the length and width of the leaves, and seeds. The uncontinuous characteristics are shown on several local durian varieties from bigger group and considered as deviation of the characteristics of the group. All of the local durian varieties are categorized as one big group of Durio.

There are some characteristics of each durian that can be differed from other types of durian, especially in terms of the leaves and flower. The surface, the tip, the type, and the base of the leaves might differ one leaf from others. In the case of flower, the size, the calyx, the colour, and the length of pollen and bud might differ one flower and others.

Some of the characteristics that can be used to differ among the local varieties are the characteristics from interval data such as length, width, and diameter. From those interval data, it is revealed that there are difference characteristics in one group of local variety. There are also main characteristics to differ among local variety.

Local variety is the result of the isolation of durian from several areas. Each local variety can

possess unique characteristics, in terms of the size, the taste, the colour, and the smell of the fruit. These characteristics can only be possessed by durian from narrow areas. All morphology characteristics of the fruit cannot be used as the point to differentiate since the environment changes factor (nutrition, temperature, humidity, and climate) also influence the differences. The local variety, basically, is a characteristic variation of the population in a certain area. Generally, the wide of the geographic and ecologic is the core factor that causes the morphology changes. The extrinsic and intrinsic isolation of allopatric type differences are the main aspect of speciation (Ehrendorfer, 1968).

Sivarajan (1984) stated that differentiation of habitat contribute to the variation gap and specialty of characteristics is the cause of the distinctiveness of distribution in habitat. Therefore, there are some groups of species that is categorized as infra species group of infra specific group. Infra species group is a taxon below species level. In orderly, the arrangement of taxonomy unit after species are: sub type, variety, sub variety, forma, and individu (Stuessy, 1964).

Rothmaller in Core (1962) stated that sub type is an individual group that shows morphological or area differences from the counterpart. Besides, it has inseparable genetic characteristics with each other so it causes intergradation.

b. Phylogenetic Study

Based on the observed characteristics, it was chosen the same characters and different characters for each OTU. The characteristics were then recorded on a matrix TOU table and the similarity index of the OTU was calculated by using association coefficient formula. The result of the association coefficient or kinship relation of local variety calculation based on the similar morphology characteristics are showed on a taxonomy hierarchy dendogram.

Based on the similarity index of local durian variety of Ternate, it is revealed that the similarity level of all local durian variety of Ternate observed was 64.22%. The variety was considered as the species of *Durrio zibethinus*. That species was grouped into 7 groups, namely Group I consists of local variety of Ternate coded as 1,2,5,8,4 with similarity index 72.08%; Group II consists of local variety of Ternate coded as 4,6,3 with similarity index 77.94%; Group III consists of local variety of Ternate coded as 9,6,3 with similarity index 89.32%; Group IV consists of local variety of Ternate coded as 9,10,7 with similarity index 84.64%; Group V consists of local variety of Ternate coded as 11,13,12 with similarity index 86.64%; Group VI consists of local variety of Ternate coded as 10 and 7 with similarity index 89.58%; and Group VIII consists of local variety of Ternate coded as 12 and 13 with similarity index 90.32%.

Based on the dendogram, all of the observed local durian varieties of Jailolo have similarity level of 63.25%, which is considered as the species of *Durio zibethinus*. This species is grouped into 5, namely Group I consists of local variety of Jailolo coded as 1,2,4,5,7 with similarity index 66.01%; Group II consists of local variety of Jailolo coded as 2,4,5,7 with similarity index 69.23%; Group III consists of local variety of Jailolo coded as 4,5,7 with similarity index 75.34%; consists of local variety of Jailolo coded as 6,5,7 with similarity index 81.86%; and Group V consists of local variety of Jailolo coded as 5,7 with similarity index 88.66%.

Generally, when the similarity index of the observed local durian variety is above 50%, it means the variety has a high similarity, or closely related. If all of the observed group include in a species taxon level, it means the group of local durian varieties have subspecies taxon level. It is in line with Verheij and Coronel's (1992) and Stuessy's (1980) statements that the dendogram of each OTU might be from one species. Therefore, each individu belongs to variety/subspecies. According to Rasnovi (2004) within phenetic analysis, not all groups are considered as species, either paraphyletic or poliphiletic. Yet, that group might belong to one of the species.

Based on the concept of infra species taxon level, the must possessed criteria of one group to be able to be categorized as taxon after species is it should possess at least a big morphology variation among group variety, different habitat from the habitat of the sub type of the same group, morphology characteristics which are considered as the counterpart of the ecotype for the criteria of sub species (Darsono, 2003). The species of a group might be a little bit different in terms of the morphological characteristics and grow in a narrow area for the criteria of variety. The individual group which possess sporadic deviation from the species group might be able to be differentiated from the group by considering the sole characteristic of several morphology characteristics and possess diffusion area with the species group for the forma concept (Core, 1962)

The results of the study show that the level of local durian variety of Ternate and Jailolo is variety taxon. Regarding the study was conducted to several local durian varieties from narrow area, the morphology data can only be obtained by showing the characters of one place or habitat.

IV. CONCLUSIONS

Based on the results of the study, it can be concluded that:

1. The taxonomy study (numeric taxonomy) of local durian variety in Ternate and Jailolo showed variety taxon level.
2. Based on the genetic kinship study of various local durian variety in Ternate, there were 7 groups of durian with the highest similarity index value 90.32% for local variety coded 13 and 12, while based on the kinship relation of Jailolo local durian variety, there were 5 groups of durian with the highest similarity index value 88.66% for local variety coded 5 and 7.

REFERENCES

[1]. Core, Earl. L. 1962. Plant Taxonomy. New York: Englewood, N.J: Prentice-Hall, Inc
[2]. Darsono. 2003. High Plant Taxonomy. Yogyakarta: Universitas Negeri Yogyakarta
[3]. Ehrendorfer, F. 1968. Geographical and Ecological Aspect Of Infraspecific Differentiation.
[4]. Heywood, V.H (Ed). Modern Methods in Plant Taxonomic. London: Botanical Society of the British Isles
[5]. Irawan, B., J Kusmoro dan S R Rahayuningsih. 2007. Taxonomic Study of Durian Cultivars in Subang Regency of West Java. http://pustaka.unpad.ac.id. Retrieved on 3rd March 2010.
[6]. Mursyidin dan Qurrohman. 2012. Phylogenetic Kinship 15 types of Durian (durio spp.) Based Bioinformatics Analysis of Gene 5.8s rRNA dan ITS REGION. Bioscientiae
[7]. Rasnovi,S. 2004. The concept of species: Why Fenetik or Phylogenetic?. Floribunda, vol 2, No 5. Bogor:Puslit Biologi LIPI
[8]. Stuessy, Tod, F. 1990. Plant Taxonomy. New York: Columbia University Press
[9]. Sivarajan, V. 1984. Introduction to Principles of Plant Taxonomy. New Delhi: Oxford Publishing.Co
[10]. Tjitrosoepomo, G. 1998. Plant Taxonomic. Yogyakarta: Gadjah Mada University Press
[11]. Verheid, E.W.m & Coronel (eds). 1992. Plant Resources south East Asia 2. Bogor: Prosea Bogor