Morphological characters of kepel (*Stelechocarpus burahol*) from Kulon Progo, Yogyakarta, Indonesia

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Abstract. Kepel is a rare plant that becomes the identity plant of Special Region of Yogyakarta and often used as natural perfume and bio-pharmaceutical. This research was conducted to identify the vegetative characterization of kepel and to determine the variety of kepel in Kulon Progo Regency, Special Region of Yogyakarta, Indonesia. The study was conducted from December 2018 to March 2019. The research method used was survey method with sampling purpose in 12 sub-districts in Kulon Progo. Kepel plant that have produced fruits, healthy, and normal growth were used as samples. Each plant was observed and the vegetative parameters were measured including the trunk, the leaf, and the canopy. The observation variables according to the description for Annonaceae. The data were analyzed using cluster analysis. Morphological characters from 36 samples in Kulon Progo had a high diversity based on similarity analysis in 14 variables with coefficient of similarity 35-92%. There are four clusters with a similarity level of 49.5%. Cluster 1 has 10 samples (27.78%), Cluster 2 has 22 samples (61.11%), Cluster 3 has 2 samples (5.56%), and Cluster 4 has 2 samples (5.56%). Kepel Wates5 is expected to be a high-yielding variety based on the number of tubercles and tree age.

1. Introduction
Kepel (*Stelechocarpus burahol*) is the members of the family *Annonaceae* which is an endemic plant in Indonesia and that become the Identity Plant of Special Region of Yogyakarta, Indonesia based on Governor Decree No. 385/KPTS/1992 [1]. Kulon Progo is one of the five districts of the Special Province of Yogyakarta, located between 70°38’– 70°59’ Latitude and 110°1’ – 110°16’ Longitude, and total area is 586,28 km². The area divided into 12-sub-districts (Galur, Girimulyo, Kalibawang, Kokap, Lendah, Nanggulan, Panjatan, Pengasih, Samigaluh, Sentolo, Temon, dan Wates) [2]. Kulon Progo district has a very diverse altitude including lowlands (0-100 m above sea-level), medium lands (101-500 m above sea-level), and high lands (501-1000 m above sea-level) [3]. The difference in the height of a region is one of the factors that affect plant diversity [4][5].

Kepel is a unique plant that the canopy has shape resembling a triangle, the color of young leaves are pink, the flowers are unisexual monoeccious flower (male flowers are in tree branches, while female flowers are in main stem), and the fruits located on the stem. Kepel is currently listed in the "List of Rare Plants" The scarcity of Kepel has entered the category of Conversation Dependent (CD) which means that the existence of Kepel has been difficult to find because it has been scarce and if conservation is not done immediately, the status of Kepel can increase to be vulnerable. The first step that can be done for the conservation of Kepel plants is the identification and characterization of Kepel.
plants as a basis for obtaining information on the diversity of Kepel plant germplasm based on observations using plant morphological characters. The aim of this study was identification of morphological characters on Kepel (Stelechocarpus burahol) plants from Kulon Progo Regency, Special Region of Yogyakarta.

2. Materials and Methods

2.1. Study area
The vegetation survey was conducted along 12 sub-districts of Kulon Progo Regency, District of Special Region of Yogyakarta (70°38’– 70°59’ North latitudes and 110°01’ – 110°16’ East longitudes) in Java Island from December to March 2019.

![Figure 1. Location of sample collection in Kulon Progo Regency, District of Special Region of Yogyakarta.](image)

The study was conducted using a survey method with purposive sampling. Plants used as samples with the criteria of fruitful, healthy, and normal growth. Based on the initial survey throughout Kulon Progo, there were 35 trees that fulfilled the requirements as sample plants for observing the morphological characters of the Kepel. Data retrieval is done by collecting data directly through observing the vegetative characters of Kepel plants including canopy, stem, and leaves. Observation variables are based on descriptions for Annonaceae (Annona cherimolla) plants from International Biodiversity, International Plant Genetic Resources Institute (IPGRI) [6].
2.2. Data Analysis
Data from observations of plant morphology are presented in the form of scoring, then analyzed to assess the similarity matrix using the SIMQUAL (Similarity for Qualitative Data) procedure. Grouping of matrix data (cluster analysis) and making dendograms is done by the Unweighted Pair-Group Method Arithmetic Average (UPGMA) method using numerical taxonomic and multivariate system (NTSYS) version 2.02i [7].

3. Results and Discussion

3.1. Morphological Characters of Kepel in Kulon Progo Regency
Based on survey in Kulon Progo Regency, 36 samples of kepel were obtained in all of sub-districts. The sample were characterized by 16 variables of vegetative characters, including canopy, stem, and leaf characters. The data in Table 1 and Table 2 revealed the similarity of characters in leaf margin, while there were variations in canopy shape, crown diameter, stem circumference, trunk ramification, trunk colour, number of tubercles, shape of leaf blade, shape of leaf base, shape of leaf apex, leaf color, leaf length, leaf width, and stem length. Kepel plants in the Kulon Progo are almost entirely plants that grow in the yard of a home or office, and garden. Plants height were varying between 7.1 - 18 meters, and based on interviews with owners or managers, kepel age about 18-100 years.

Table 1 indicated that all plants in Kulon Progo Regency have pyramidal canopy forms with 3 different shapes, and have 1-3 trunk ramification. The canopy diameters were from 3.75 to 8.2 meters. The trunk up to 1,36 m in stem circumference with the color of trunk light brown, geige, gray to brown, and the bark covered with numerous tubercles. The number of tubercles in one meter trunk length ranges from 1 to 19 tubercles. The amount of tubercle in kepel tree can predict the amount of fruit produced. Sunarto [8] and Lim [9] mentioned that kepel tree is an erect and evergreen tree which can reach up to 25 m tall. It is dark gray-brown to black and characteristically covered with numerous thick tubercles.

Leaf blade of Kepel from 36 plants in Kulon Progo are dominated by elliptic and lanset forms (Table 2.). Leaf margins from all entire accessions do not undulate. The shape of leaf base obtuse and acute, there is no rounded and cordate form and the leaf apex acute and acuminate, none is rounded. The color of mature leaves is light green to dark green. Leaf lengths 14.5-23.6 cm, leaf width 4.6-9.7 cm, and petiole length 0.4-1.5 cm. Van Heusden [10] and Hatmi and Widayanti [11] stated that leaves of burahol are corious to subcoriaceous, occasionally membranous, more or less shiny above, less shiny beneath, (dark) brown to dry, glabrous on both sides or sometimes sparsely pubescent beneath, usually with numerous brown to red beneath, lamina (narrowly) elliptic to elliptic-oblong, sometimes too narrowly obovate, obovate-oblong. Leaves are 8-31 cm long, 2.5-9.5 cm wide, base acute, sometimes to rounded, tapering to acute, caudate, or acuminate.

Based on International Biodiversity [6], descriptor for Annonaceae plants is only represented by Annona cherimolla (Cherimoya). The descriptor is explained vegetative character of Annonaceae plant, especially in Cherimoya including tree age, height, trunk, and leaves, but there is no specific character for Stelchocarpus burahol. Canopy shape of St. burahol was like a cone or pyramid [12-13], but there were no further explanation. In this research we found that Stelchocarpus burahol in Kulon Progo have four different forms of canopy especially the top of canopy, they are: Pyramidal 1 (acute), Pyramidal 2 Acuminate, Pyramidal 3 (obtuse), and Pyramidal 4 (random). There are three forms of suckering in the descriptor for Annona cherimolla (absent, <5 suckers, and >5 suckers). In this research we found that all Kepel plants there no have suckers, all plants are erect evergreen tree, and the bark characteristically covered with numerous thick tubercles.
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Table 1. Morphological characters of canopy, trunk, and stem of 36 kepel plants in Kulon Progo, Yogyakarta, Indonesia.

| Sample | Canopy Shape | Trunk color | Tree Age (years) | Trunk Ramification | Trunk circumference (m) | Tree Height (m) | Crown Diameter (m) | No. Tubercles |
|--------|--------------|-------------|------------------|-------------------|-----------------------|----------------|--------------------|--------------|
| A1     | Pyramidal3   | Grey        | 60               | 1                 | 0.95                  | 13.80          | 8.14               | 6            |
| A2     | Pyramidal2   | Beige       | 80               | 1                 | 1.20                  | 15.50          | 7.00               | 5            |
| B1     | Pyramidal4   | Grey        | 47               | 1                 | 1.03                  | 12.60          | 5.35               | 6            |
| B2     | Pyramidal1   | Grey        | 80               | 1                 | 0.10                  | 9.90           | 8.20               | 6            |
| B3     | Pyramidal3   | Beige       | 47               | 1                 | 0.76                  | 8.90           | 5.90               | 11           |
| B4     | Pyramidal2   | Light Brown | 15               | 1                 | 0.32                  | 8.20           | 8.00               | 5            |
| C1     | Pyramidal3   | Grey        | >100             | 3                 | 1.10                  | 11.80          | 5.00               | 11           |
| C2     | Pyramidal4   | Grey        | 100              | 1                 | 1.12                  | 12.70          | 5.00               | 10           |
| C3     | Pyramidal3   | Grey        | 89               | 1                 | 0.66                  | 9.50           | 7.42               | 19           |
| D1     | Pyramidal1   | Brown       | 15               | 1                 | 0.52                  | 7.90           | 3.75               | 2            |
| D2     | Pyramidal1   | Light Brown | 20               | 1                 | 0.57                  | 8.20           | 6.93               | 11           |
| D3     | Pyramidal3   | Light Brown | 50               | 1                 | 0.71                  | 9.30           | 6.29               | 11           |
| D4     | Pyramidal3   | Light Brown | 15               | 1                 | 0.60                  | 8.00           | 7.03               | 7            |
| D5     | Pyramidal2   | Light Brown | 80               | 1                 | 1.30                  | 9.90           | 4.90               | 6            |
| E1     | Pyramidal3   | Grey        | 80               | 1                 | 1.15                  | 7.10           | 5.91               | 15           |
| E2     | Pyramidal3   | Light Brown | 40               | 2                 | 0.50                  | 18.00          | 6.75               | 17           |
| E3     | Pyramidal2   | Light Brown | 50               | 1                 | 0.70                  | 12.70          | 6.53               | 5            |
| F1     | Pyramidal2   | Grey        | 15               | 1                 | 0.40                  | 7.50           | 6.15               | 6            |
| F2     | Pyramidal4   | Grey        | 80               | 2                 | 0.81                  | 17.30          | 7.22               | 4            |
| F3     | Pyramidal3   | Light Brown | 80               | 1                 | 0.88                  | 12.40          | 6.32               | 7            |
| F4     | Pyramidal4   | Brown       | 80               | 3                 | 0.99                  | 14.40          | 4.10               | 2            |
| G1     | Pyramidal2   | Light Brown | 65               | 1                 | 0.82                  | 13.30          | 7.55               | 10           |
| G2     | Pyramidal3   | Light Brown | 40               | 1                 | 0.57                  | 8.80           | 5.03               | 11           |
| G3     | Pyramidal2   | Grey        | 40               | 1                 | 0.64                  | 8.80           | 5.89               | 7            |
| H1     | Pyramidal4   | Light Brown | 60               | 2                 | 0.48                  | 7.20           | 4.86               | 3            |
| H2     | Pyramidal1   | Light Brown | 15               | 1                 | 0.59                  | 10.20          | 6.40               | 17           |
| I1     | Pyramidal2   | Brown       | 40               | 2                 | 0.46                  | 8.30           | 5.14               | 19           |
| I2     | Pyramidal3   | Light Brown | 40               | 2                 | 0.78                  | 9.80           | 4.95               | 9            |
| I3     | Pyramidal4   | Light Brown | 25               | 1                 | 0.78                  | 8.50           | 5.08               | 4            |
| J1     | Pyramidal3   | Light Brown | 15               | 1                 | 0.51                  | 8.30           | 4.24               | 10           |
| K1     | Pyramidal2   | Light Brown | 15               | 1                 | 0.69                  | 10.80          | 6.59               | 1            |
| K2     | Pyramidal2   | Light Brown | 90               | 1                 | 1.12                  | 12.20          | 6.76               | 2            |
| K3     | Pyramidal3   | Light Brown | 80               | 1                 | 1.08                  | 13.00          | 7.24               | 4            |
| L1     | Pyramidal3   | Light Brown | 90               | 1                 | 1.01                  | 12.60          | 6.52               | 7            |
| L2     | Pyramidal3   | Light Brown | >100             | 1                 | 1.36                  | 9.40           | 7.66               | 10           |

A= Temon, B= Kokap, C = Sentolo, D = Kalibawang, E = Samigaluh, F = Girimulyo, G = Panjatan, H = Wates, I = Pengasih, J = Nanggulan, K = Galuh, L = Lendah. Number 1-5: number of samples.

3.2. Cluster Analysis
Based on similarity analysis from 12 differences observation variables, it was known that 36 kepel accessions in Kulon Progo district have a high level of variation in the vegetative character with coefficient of similarity between 36-92% or have a diversity level of 8-64%. Kepel plants until now can only be propagated using seeds and very difficult to propagated using vegetative propagation [8, 14-15] so that genetic diversity in kepel is quite high.

The results of cluster analysis indicated that with a similarity level of 36% there were two big clusters (Figure 2). Cluster A has 34 samples (94.44%) and cluster B has 2 samples (5.56%). The differences between clusters I and II are mainly in shape of leaves, shape of leaf base and leaf apex.
Furthermore, with a similarity level of 49.5%, there are four clusters. Cluster 1 has 10 samples (27.78%), cluster 2 has 22 samples (61.11%), cluster 3 has 2 samples (5.56%), and cluster 4 has 2 samples (5.56%). The formation of clusters indicated that the accession that form in the same cluster have close relationships because they have many similarities in their morphological characteristics. whereas the separation in clusters indicated a long relationship because they have many differences in their morphological characteristics [16-17]. In addition, the dendrogram based on vegetative characters of 36 samples of kepel plant also shows there are 2 pairs of plants that are really closely related with the similarity coefficient 92% or with a level of diversity of 8%. These samples were D5 and G1 (Kalibawang 5 and Panjatan 1); and also C1 and E1 (Sentolo1 and Samigaluh1). Distribution of kepel plant in Kulon Progo and distribution of kepel plants that have a high degree of similarity are shown in Figures 3.

| Samples | Shape of Leaf Blade | Shape of Leaf Base | Shape of Leaf Apex | Leaf Color | Leaf Margin | Leaf Length (cm) | Leaf Width (cm) | Petiole Length (cm) |
|---------|---------------------|--------------------|--------------------|------------|-------------|------------------|------------------|---------------------|
| A1      | Lanset              | Obtuse             | Acuminate          | Green      | Entire      | 18.8             | 9.5              | 0.9                 |
| A2      | Elliptic            | Obtuse             | Acute              | Green      | Entire      | 14.8             | 7.2              | 0.5                 |
| B1      | Lanset              | Acute              | Acuminate          | Green      | Entire      | 15.0             | 7.1              | 1.0                 |
| B2      | Lanset              | Acute              | Acuminate          | Dark green | Entire      | 20.0             | 7.3              | 1.0                 |
| B3      | Elliptic            | Obtuse             | Acuminate          | Light green| Entire      | 19.8             | 7.1              | 1.0                 |
| B4      | Elliptic            | Acute              | Acuminate          | Dark green | Entire      | 14.7             | 4.6              | 1.0                 |
| C1      | Elliptic            | Obtuse             | Acuminate          | Green      | Entire      | 14.7             | 5.8              | 0.9                 |
| C2      | Lanset              | Obtuse             | Acuminate          | Dark green | Entire      | 16.1             | 6.2              | 1.0                 |
| C3      | Elliptic            | Acute              | Acuminate          | Dark green | Entire      | 14.5             | 5.9              | 1.0                 |
| C4      | Lanset              | Acute              | Acuminate          | Green      | Entire      | 19.0             | 6.4              | 1.5                 |
| D1      | Elliptic            | Obtuse             | Acuminate          | Dark green | Entire      | 19.0             | 7.3              | 0.9                 |
| D2      | Lanset              | Acute              | Acuminate          | Dark green | Entire      | 20.0             | 6.6              | 1.5                 |
| D3      | Elliptic            | Obtuse             | Acuminate          | Green      | Entire      | 21.6             | 7.4              | 1.5                 |
| D4      | Lanset              | Acute              | Acuminate          | Light green| Entire      | 17.4             | 5.6              | 1.5                 |
| D5      | Elliptic            | Obtuse             | Acuminate          | Green      | Entire      | 16.0             | 6.4              | 1.3                 |
| E1      | Elliptic            | Obtuse             | Acuminate          | Dark green | Entire      | 15.0             | 6.6              | 0.9                 |
| E2      | Ovale               | Obtuse             | Acuminate          | Green      | Entire      | 19.5             | 6.8              | 1.0                 |
| E3      | Lanset              | Acute              | Acuminate          | Green      | Entire      | 22.1             | 7.2              | 0.9                 |
| F1      | Lanset              | Acute              | Acuminate          | Light green| Entire      | 20.0             | 7.5              | 1.0                 |
| F2      | Elliptic            | Acute              | Acute              | Light green| Entire      | 22.3             | 7.6              | 1.3                 |
| F3      | Elliptic            | Acute              | Acute              | Light green| Entire      | 23.3             | 9.1              | 1.0                 |
| F4      | Elliptic            | Acute              | Acute              | Dark green | Entire      | 23.6             | 9.7              | 1.5                 |
| G1      | Elliptic            | Obtuse             | Acuminate          | Light green| Entire      | 19.2             | 7.5              | 1.1                 |
| G2      | Ovale               | Obtuse             | Acute              | Dark green | Entire      | 19.2             | 7.5              | 1.4                 |
| G3      | Elliptic            | Obtuse             | Acuminate          | Dark green | Entire      | 19.3             | 7.4              | 1.4                 |
| H1      | Elliptic            | Acute              | Acuminate          | Dark green | Entire      | 19.7             | 9.0              | 1.5                 |
| H2      | Elliptic            | Obtuse             | Acuminate          | Green      | Entire      | 20.0             | 9.3              | 0.5                 |
| I1      | Elliptic            | Obtuse             | Acuminate          | Light green| Entire      | 22.3             | 7.5              | 1.2                 |
| I2      | Elliptic            | Acute              | Acuminate          | Dark green | Entire      | 18.4             | 7.1              | 0.4                 |
| I3      | Elliptic            | Acute              | Acuminate          | Dark green | Entire      | 18.8             | 7.2              | 1.0                 |
| J1      | Elliptic            | Obtuse             | Acuminate          | Green      | Entire      | 21.7             | 8.9              | 1.5                 |
| K1      | Elliptic            | Obtuse             | Acuminate          | Dark green | Entire      | 18.3             | 7.4              | 1.1                 |
| K2      | Elliptic            | Obtuse             | Acuminate          | Light green| Entire      | 19.3             | 7.5              | 1.0                 |
| K3      | Ovale               | Acute              | Acute              | Green      | Entire      | 14.9             | 6.9              | 1.3                 |
| L1      | Elliptic            | Obtuse             | Acuminate          | Light green| Entire      | 18.0             | 6.7              | 1.0                 |
| L2      | Elliptic            | Obtuse             | Acute              | Dark green | Entire      | 18.6             | 7.3              | 0.5                 |

A= Temon, B= Kokap, C= Sentolo, D = Kalibawang, E = Samigaluh, F = Girimulyo, G = Panjatan, H = Wates, I = Pengasih, J = Nanggulan, K = Galuh, L = Lendah. Number 1-5: number of samples.
Figure 2. Dendrogram of 36 accessions of *K. pali* in Kulon Progo Regency based on 14 vegetative characters.
Distribution of kepel trees in Kulon Progo district spread in 12 sub-districts: Temon, Kokap, Sentolo, Kalibawang, Samigaluh, Girimulyo, Panjatan, Wates, Pengasih, Nanggulan, Galur, and Lendah(Fig. 3). Based on the cluster distribution (shown in the same color), it can be seen that the distribution of kepel trees on the same cluster spread from north to south. Kepel trees that have a 92% coefficient of similarity indicate that they have very close relatives. Two pairs that have close relatives are in a long distance, otherwise, the kepel plants in the short distances have high diversity. It was indicated that kepel plants in Kulon Progo have a very high diversity and it was not influenced by the proximity of the place of growth. This is possible because until now, plant propagation of kepel plants only be done generatively and it cannot be propagated by vegetative methods, so that it has a fairly high diversity.

Based on observational data of vegetative characters, it cannot be ascertained which that kepel accession has superior characteristics because the superior characteristics of kepel are determined not only by vegetative character, but also by generative characters, especially kepel fruit. However, from the data of observation and calculation of the number of tubercles in the trunk, it indicated that the number of tubercles in plant sample C4, E1, E2, H2, and I1 has the highest number of tubercles per meter trunk compared to other plants. Tubercle is small bump like round warts on the trunk of the tree and where flowers and fruit appear. Therefore, the more tubercles in the stem, it is strongly suspected that the tree is more productive in producing flowers and fruit. Further research is needed to identify not only the generative character of the kepel but also molecular character of kepel trees to get more complete information as a data base for kepel germplasm for conservation and breeding.

Figure 3. Distribution map of kepel at the 12 sub-district in Kulon Progo, Yogyakarta. The green and blue color show high degree of similarity at 92%. A = Temon, B = Kokap, C = Sentolo, D = Kalibawang, E = Samigaluh, F = Girimulyo, G = Panjatan, H = Wates, I = Pengasih, J = Nanggulan, K = Galuh, L = Lendah
Table 3. Comparison of vegetative characters from 5 selected accessions

| Vegetative Characters | Accession C4 | Accession E1 | Accession E2 | Accession H2 | Accession I1 |
|-----------------------|--------------|--------------|--------------|--------------|--------------|
| Tree age (years)      | 89.0         | 80.0         | 40.0         | 15.0         | 40.0         |
| Tree height (m)       | 9.5          | 7.1          | 18.3         | 10.2         | 8.3          |
| Crown diameter (m)    | 7.4          | 5.9          | 6.8          | 6.4          | 5.1          |
| Trunk color           | Light brown  | Grey         | Light brown  | Light brown  | Light brown  |
| Trunk circumference (m)| 0.6          | 1.2          | 0.5          | 0.6          | 0.8          |
| Trunk ramification    | 1.0          | 1.0          | 2.0          | 1.0          | 2.0          |
| Leaf blade shape      | Banset       | Elliptic     | Ovale        | Elliptic     | Elliptic     |
| Leaf base             | Acute        | Obtuse       | Obtuse       | Obtuse       | Obtuse       |
| Leaf apex             | Acuminate    | Acuminate    | Acuminate    | Acuminate    | Acuminate    |
| Leaf length (m)       | 19.0         | 15.0         | 19.5         | 20.0         | 22.3         |
| Leaf width (m)        | 6.4          | 6.6          | 6.8          | 9.3          | 7.5          |
| Petiole length (m)    | 1.5          | 0.9          | 1.0          | 0.5          | 1.2          |
| Color of mature leaf  | Green        | Dark green   | Green        | Green        | Light Green  |
| Number of tubercles   | 19.0         | 15.0         | 17.0         | 17.0         | 19.0         |

C4= Sentolo no. 4; E1= Samigaluh no. 1; E2= Samigaluh no.2; H2= Wates no. 1; I1= Pengasih no.1.

The vegetative characters of 5 selected accession of Kepel tree with 14 variables indicates a difference. Accession H2 located in Wates sub-district is estimated to have the potential as a plant with superior character. This is shown in the Comparison of vegetative characters from 5 samples selected (Table 3). The H2 (Wates 2), which is in the tree age 15 years with 10.2 tree height, crown diameter 7.9 m, and 3 trunks ramification, it has 17 tubercles in 1 m trunk length. Wates 5 really has the potential to have the highest productivity, however, it need further research in generative character, especially, fruit performances

4. Conclusion
Vegetative character from 36 samples of Kepel plants in Kulon Progo, Yogyakarta city has a high diversity based on similarity analysis in 14 variables with coefficient of similarity 35-92%. The results of cluster analysis indicated that there are four clusters with a similarity level of 49.5%. Cluster 1 has 10 samples (27.78%), cluster 2 has 22 samples (61.11%), cluster 3 has 2 samples (5.56%), and cluster 4 has 2 samples (5.56%). Kepel sample E5 located in Wates sub-district (Wates5) is expected to be a high-yielding variety based on the number of tubercles and tree age.

References
[1] Gubernur-DIY 1996 Keputusan Gubernur Kepala Daerah Istimewa Yogyakarta Nomor: No. 385/KPTS/1992. Tentang PenetapanLogo Identitas Flora dan Fauna Identitas Propinsi Daerah Istimewa Yogyakarta.
[2] BPKP Kulon Progo 2019 Profil Kabupaten Kulon Progo http://www.bpkp.go.id/diy/konten/834/Profil-Kabupaten-Kulonprogo.
[3] Nasution Z 2008 Farm development and rural poverty comparison among villages in Kulon Progo Regency of Yogyakarta special province of Indonesia.
[4] Hadi E E W, Widyastuti S M and Wahyuono S 2016 Jurnal Manusia dan Lingkungan 23 206–214.
[5] Djufri D 2010 Jurnal Biologi Edukasi 2 45–68.
[6] Internasional Biodiversity 2008 Descriptors for Cherimoya (Annona cherimola Mill.) (Rome, Italy: EarthPrint).
[7] Rohlf F J 1998 NTSYSpc numerical taxonomy and multivariate analysis system version 2.0 user guide (Setauket, NY: Exeter Software).
[8] Sunarto A F 1992 *Plant Resources of South-East Asia* 290–291.
[9] Lim T K 2012 *Edible medicinal and non-medicinal plants* (Dordrecht, New York: Springer).
[10] Van Heusden E C H 1995 *Blumea* 40 429–438.
[11] Hatmi R U and Widyayanti S 2015 *Prosiding Seminar Nasional Sumber Daya Genetik Pertanian* (Bogor, Indonesia).
[12] Haryjanto L 2012 *Mitra Hutan Tanaman* 7 11-17.
[13] Heriyanto N M and Garsetiasih R 2007 *BPN* 11 65p.
[14] Isnaeni E and Habibah N 2014 *Jurnal Mipa* 37 105-14.
[15] Rahardjo M, Djauharia E and Darwati I 2014 *Buletin Penelitian Tanaman Rempah dan Obat* 25 21-16.
[16] Aziz-Purwantoro E A and Setyaningsih F 2005 *Ilmu Pertanian* 12.
[17] Hasan A E Z, Bermawie N, Julistiono H, Riyanti E I, Artika I M and Khana P 2017 *Ann. Res. Rev. Biol.* 14 1-7.