Morphological characterization and its variation of “Wirasangka” mango as the flora identity of Tegal regency, Central Java, Indonesia

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Abstract. "Wirasangka" mango (Mangifera indica L. var. Wirasangka) is a flora of identity from Tegal Regency, Central Java Province. There is a difference in understanding about Wirasangka mango among the people. Some residents mentioned that "wirasangka" mango is another name for golek, honey golek, Indian golek, okyong, and tengkoeh mangoes; while others claim that the varieties differ from one another. Therefore it is necessary to do scientific characterization to ensure the truth of the "Wirasangka" mango cultivar. The purpose of this research was to characterize the Wirasangka mango based on morphological markers and examine variations in vegetative characteristics. The research was conducted on "Wirasangka" mango habitat in several areas of Tegal Regency, Central Java. Plant material used were trees referred to by local residents as "Wirasangka" mango, golek, honey golek, Indian golek, okyong, and tengkoeh. Mango trees planted by Tegal Regency Agriculture Department employees in the Procot area were used as a reference for Wirasangka mangoes. Morphological character identification was carried out based on the Descriptor handbook for Mangoes (Mangifera indica) from the International Plant Genetic Resources Institute. Data were analyzed using the R statistical program to calculate the coefficient of variation of its vegetative characteristics and research the comparison of characters between cultivars. Based on observations of morphological character measurements, the results show that there are low morphological variations among the Wirasangka mango cultivars. The results of the dendogram cluster analysis show that the cultivar referred to by the community as the Wirasangka mango has a high similarity with the cultivar golek, the Indian golek, and okyong.

1. Introduction
Each city and regency in Central Java Province has determined one plant species as flora identity. The exploration of the flora identity from 35 cities and regency in Central Java resulted that there are species which are not cultivated, cultivated in a limited way, and cultivated intensively [1]. Based on ethno-botanical research previously, we indicate that there are several species that need to be conserved, including Wirasangka mango [2].

"Wirasangka" mango (Mangifera indica L. var. Wirasangka) is a flora identity from Tegal Regency, Central Java Province. There is a difference in understanding about Wirasangka mangoes among the people. Some residents mentioned that "wirasangka" mango is another name for mango golek, honey golek, Indian golek, okyong, and tengkoeh; while others claim that the varieties differ
from one another. Therefore it is necessary to do scientific characterization to ensure the truth of the "Wirasangka" mango variety.

Based on these facts it is necessary to increase the population of Wirasangka mangoes through cultivation development in the Tegal Regency area. The initial step needed is to characterize to ensure the correctness of Wirasangka mango varieties. Phenotype-based characterization (morphological and agronomic markers) is relatively easy to do. Agronomic markers are phenotypes related to crop yields. Although easily influenced by the environment, several studies have shown that morphological and agronomic characters are significant in identifying differences between mango varieties [3-5]. The purpose of this research was to characterize the self-reliant mango based on morphological markers and examine variations in vegetative characteristics.

2. Methods
The research was conducted where "Wirasangka" mango grown on several areas (Procot, Kramat, Pangkah, Giren, Kedungbanteng, and Lebaksiu) in Tegal Regency, Central Java. "Snowball sampling” method was used to obtain samples in this research. Selection of mango trees as samples was based on information from native residents referred to as Wirasangka mango. Other cultivars of mangoes such as golek, golek indi, and okyong were also collected and characterized as comparative data.

A minimum of five trees per area was observed as samples with 10 leaves collected from each tree. Mango trees planted by employees of Tegal District Agriculture Office in "Procot" area were used as a reference for Wirasangka cultivar. Morphological character identification was carried out based on the descriptor guidebook for Mangoes (Mangifera indica) from the International Plant Genetic Resources Institute.

Data were analyzed by R statistical program to calculate the coefficient of variation of vegetative characteristics and to analyze character similarities between varieties using UPGMA cluster dendogram.

3. Result and Discussion
Based on field observations, not many Wirasangka mango cultivar trees were planted. Observation of tree character and morphology was carried out on five plants in each region (Kramat, Procot, pangkah, Giren, and Kedungbanteng), while in Lebaksiu only one mango tree was found. Characters of Wirasangka mango tree in several locations were presented in Table 1. The youngest Wirasangka mango tree was found in Kramat (tree height 3 meters with a trunk of 51 cm and a canopy diameter of 4.4 m), while the largest tree was found in Procot area with a tree height of 10.4 m, the circumference of the trunk is 170 cm and the diameter of the canopy is 11.85 m.

Table 1. The character of Wirasangka mango cultivar tree from several regions in the district of Tegal

| Location       | Height (m) | Trunk circumference (cm) | Crown diameter (cm) | Crown shape                      | Growth habit | Foliage density |
|----------------|------------|--------------------------|---------------------|----------------------------------|--------------|-----------------|
| Kramat         | 3 - 6      | 51 - 91,5                | 430 - 898           | Broadly piramidal and semi circular | Spreading    | intermediate    |
| Pangkah        | 9.5 - 13,61| 117 - 147                | 574 - 970           | Broadly piramidal and semi circular | Spreading    | intermediate    |
| Giren          | 9.2 - 9.7  | 140 - 216                | 504 - 958           | Broadly piramidal and semi circular | spreading    | Intermediate    |
| Procot         | 9.7 - 10,4 | 125 - 170                | 787 - 1185          | semi circular                    | Spreading    | Dense           |
| Kedungbanteng  | 7.3 - 10,2 | 102 - 126                | 682 - 1000          | Broadly piramidal and semi circular | Spreading and drooping | Intermediate and dense |
The canopy shape of the self-sustaining mango tree (figure 1) in the procot area is all semi-circular with branching (figure 2) spreading and dense leaves. The shape of the canopy of the Wirasangka mango tree in other areas tends to be like a wide to semi-circular pyramid with the branching spreading to dangling and the density of the leaves being moderate to tight.

Figure 1. crown shape type of Wirasangka mango; (A) broadly pyramidal and (B) semi-circular

Figure 2. Tree growth habit of Wirasangka mango; (A) spreading and (B) Drooping

Almost all of cultivated mango cultivar trees in all observed areas have similar qualitative characters (Table 2), namely oblong leaf shaped with horizontal leaf attitude in relation to branch, wavy leaf margin and coriaceous leaf texture. The angle of leaf vein are widens (>60°) with no secondary leaf vein arches. All leaves are hairless with mild to strong fragrance.
**Table 2.** Qualitative morphological characters of Wirasangka Mango cultivars from several regions in Tegal Regency

| Location     | Leaf shape | Leaf attitude in relation to branch | Angle of secondary vein to midrib | Curvature of secondary vein | Leaf Texture | Leaf apex shape | Leaf base shape | Leaf margin | Leaf hair | Fragrance |
|--------------|------------|------------------------------------|----------------------------------|----------------------------|--------------|----------------|----------------|-------------|-----------|-----------|
| Procot       | oblong     | horizontal                         | wide                             | absent                     | coriaceous   | acuminate      | Acutus - obtuse | wavy        | none      | slight    |
| Kramat       | oblong     | horizontal                         | wide                             | absent                     | coriaceous   | acuminate      | Acutus - obtuse | wavy        | none      | slight    |
| Pangkah      | oblong     | horizontal                         | wide                             | absent                     | coriaceous   | acuminate      | Acutus - obtuse | wavy        | none      | slight    |
| Giren        | oblong     | horizontal                         | wide                             | absent                     | coriaceous   | acuminate      | Acutus - obtuse | wavy        | none      | strong    |
| Kedung Banteng | oblong   | horizontal                         | wide                             | absent                     | coriaceous   | acuminate      | Acutus - obtuse | wavy        | none      | strong    |

Vegetative morphological variations of Wirasangka mango based on the coefficient of variation in Table 3 show that the lowest variation in leaf width characteristics (2 - 6% for each region, and 10% for all cultivars from all regions). The highest variation is in the length of the petiole (11 - 28% for each region and 24% for the whole sample).

**Table 3.** The mean value, standard deviation, and coefficient of variation in quantitative character of Wirasangka mango varieties from several regions in Tegal regency.

| Location     | Leaf blade length Mean | Leaf blade width Mean | Petiole length Mean | Thickness of pelvin Mean |
|--------------|------------------------|-----------------------|---------------------|--------------------------|
|              | SD         | CV       | SD         | CV       | SD         | CV       | SD         | CV       | SD         | CV       |
| Procot       | 26.86      | 3.78     | 14.10      | 6.72     | 0.42     | 6.38     | 4.18     | 0.49     | 11.75      | 1.45     |
| Kramat       | 20.47      | 0.69     | 3.39       | 5.59     | 0.24     | 4.45     | 2.90     | 0.32     | 11.25      | 3.87     |
| Giren        | 25.21      | 1.68     | 6.68       | 6.27     | 0.13     | 2.09     | 4.36     | 1.22     | 28.00      | 4.38     |
| Pangkah      | 20.45      | 1.34     | 6.56       | 5.29     | 0.22     | 4.29     | 3.09     | 0.38     | 12.47      | 4.77     |
| Kedung Banteng | 22.06     | 2.40     | 10.88      | 6.01     | 0.63     | 10.47    | 4.00     | 0.73     | 18.35      | 3.75     |
| Semua kultivar| 23.00      | 3.27     | 14.25      | 5.97     | 0.60     | 10.18    | 3.67     | 0.89     | 24.37      | 4.21     |
Figure 3. Cluster Dendogram of Wirasangka, golek, Indian golek, and okyong mango cultivars

Based on the results of the dendogram cluster analysis (figure 3), it is known that the varieties referred to by the community as Wirasangka mango in Tegal district are divided into three main groups. The first group consists of "Wirasangka" mango varieties from the procot area, the second group consists of giren regions, while the third group consists of "Wirasangka" mangoes from the Kramat and Pangkah regions. The Wirasangka mango cultivars in the Kedungbanteng area turned out to be similar to those of other regions.

High similarity (> 90%) was found in all samples of mango cultivars observed (Wirasangka, okyong, golek, and golek india). Only golek mango cultivar from Pangkah area is the most different from other cultivars.

4. Conclusion
Based on observations of morphological character measurements, the results show that there are low morphological variations among Wirasangka mango cultivars. The results of the group analysis showed that the cultivar referred to by the community as the Wirasangka mango had a high resemblance to golek, Indian golek, and okyong.

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