

PHENOTYPIC, GENOTYPIC CHARACTERS AND NUTRITIONAL VALUE OF SEEDLESS WANI (*Mangifera caesia* Jack. var. Ngumpen Bali) (A Review)

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ABSTRACT

The diversity of *Mangifera caesia* Jack (Balinese name: wani) in Bali was quite high. Based on the morphological characters of the fruit, 22 cultivars had been explored in the previous research (Rai et al., 2008). One of the most superior cultivar among those and very potential to be commercially developed was seedless wani (*M. caesia* Jack. var. Ngumpen Bali). The cultivar had specific properties that were not possessed by the others. Ninety (90) % of the total fruits produced were seedless, while the remaining (10%) has small seed. Beside that, this seedless cultivar had thick flesh, very attractive skin color (glossy yellowish green), uniformity on the size and shape of fruits, a distinctive aroma, sweet, tasty, and highly nutritious. The results of RAPD analysis of 10 wani cultivars grown in Bali showed that this seedless cultivar (Ngumpen) was grouped in to different cluster, a part from others. In comparison with 4 seeded cultivars of wani, Ngumpen cultivar had a similar nutrient content, however, it had greater fiber and a greater percentage of edible part. We concluded that the Ngumpen cultivar was a specific and unique germplasm so that should be preserved and protected.

Keywords: wani, *Mangifera caesia*, seedless, phenotypic, genotypic

INTRODUCTION

Mangifera caesia Jack. (Balinese name: wani) is a tropical fruit, taxonomically classified in the same genus with mango, however, this species is not as popular as mango. In other regions of Indonesia, the species has local name such as Kemang (Sundanese and Javanese), Binje (Aceh), Bienglu (Lampung) (Ochse, 1931; Heyne, 1987), or Palung-Wanyi (Borneo) (Purnomo, 1987; Mukherji, 1985).

Diversity of wani cultivar was relatively high. Based on the morphological characters, Rai et al. (2008) found 22 different cultivars of wani were grown in Bali. One of the most superior cultivar and very potential to be commercially developed is seedless wani (named as Ngumpen cultivar). Prospect of this seedless wani is

very high due to its specific characters such as seedless fruit, thick flesh, a distinctive taste, however, the price was 3 times more expensive than that of other wani cultivars. The fruit consumed fresh or processed into juice and well preferred by consumer.

The overall population of wani in general now in Bali is about 29,204 trees, spreads around Bali, with a production of 6,626 tons/year, while seedless wani that has already produced fruit is only 4 trees.

Phenotypic characters of seedless wani

Based on habitus of tree, branching properties and morphological characteristics of leaves and flowers, 22 cultivars of wani which were found in Bali generally had similar characteristics. The characteristics was tree-shaped, dichotomous branching, single leaf (folium simplex), bone pinnate

leaves (penninervis), and average leaf edge (integer). The flowers were perfect flower, androgynous (hermaphroditus), the growing interest in the top branches, number of petals (sepala) and crown (petala) each 5 pieces and the color of flower crown purple. Morphological characters of leaves and other flowers were also same, so based on habitus of tree, branching characteristics and morphology of leaves and flowers can not be distinguished between one cultivar with and each other.

Based on fruit characters, the traits of cultivars which were found vary depending on skin color of fruit, flavor of fruit, fruit shape, fruit size, fruit flesh color/aryl, and the presence or absence of seeds in the fruit. Prominent traits of cultivars based on skin fruit color, flavor of fruit, fruit shape, fruit size, fruit flesh color, and the presence or absence of seeds in the fruit can be categorized as the specific traits of the cultivar. The specific properties that can simultaneously be used as an identifier of each cultivar. Seedless wani have the most specific properties and very prominent compared to the other cultivars namely seedless fruit, fruit flesh thickness, uniform fruit shape, and it feels very good.

Seedless wani plants were trees towering above with a round crown shape, standing upright and sturdy stems, bark surface rough and fissured, gray-brown color. The form of a cylindrical stem, the stem \pm 40 m high (age > 100 years) with a width of canopy \pm 10 m. Trunk circumference of 310 cm (at a height of 1.0 m from soil surface). Rarely branched with dichotomous branching shapes, standing upright to horizontal branches, uneven structure leads to all direction.

Leaves of seedless wani was oblongus and belong to a single leaf (folium simplex),

because there was only one leaf at stalk of leaf. The leaves including incomplete leaf because it only consists of a petiole (petiolus) and leaf blade (lamina). Type of leaf was called sessile leaves. Upper leaf surface yellowish green, while the lower leaf surface light green. The position of the leaves on a stem that was scattered (folia sparsa). The tip of leaves pointed (acutus) while the basal blunt (obtusus). The leaf edge flat (integer). The composition of leaves bone pinnate (penninervis), main bone of leaf blackish green and clearly visible, whereas branches bone faintly visible. The widest part was in the middle of the leaf, petiole length reaches 3-4 cm, leaf blade length of 18-19 cm, and the width of the leaf blade 4-6 cm.

Flowers grow at the tip of the stem (flos terminalis), androgynous (hermaphroditus), and monoecious. The flowers arrangement as a panicle, purplish green colour. Panicle length ranged from 20.7 to 40 cm, number of flowers per cluster on average 2,128 pieces, and number of bunches per tree average of 300 bunches. Flower parts consists of petals flower (calyx), crowns flower (corolla), stamens, and carpellum. Flower parts were arranged in a circle. By observing the parts of the flower, it can be said that flowers of seedless wani was a perfect flower (flos completus). Leaf petals (sepala) numbered 5 with purplish white colour, \pm 2 mm long, and oval shaped. Leaf canopy (petala) numbered also 5 and length of 5-10 mm.. Color of petals (corolla) purple, trumpet-shaped (hypocrateriformis). Position of petals (calyx) and crown of flowers (corolla) alternate. Color of filamentum purplish white, 3-5 mm long. Stamen of flowers sitting on the crown, dark purple-black colour. Pistil length 6-8 mm and number of constituent leaves pistil (carpella) 5.

Fruit of seedless wani was a true single fleshy fruit. Oval fruit shape, average weight per fruit 208.24 g, fruit length 14.09 cm, diameter 6.37 cm, and thick of fruit on average 3.2 cm. Young fruit color is milk-white and change to be brownish white after ripe. Young fruit skin reddish green at the basal, while the rest green, but ripe fruit skin glossy yellowish green and there are few small spots of blackish brown. The flesh is slightly sweet flavor and result on organoleptic test indicated that panelist was considerably very like to its flavor with score of 4 (scale 1-5).

Based on the presence and absence of seeds fruit, seedless wani was very specific cultivars. That cultivar had specific properties that was not possessed by the other cultivars, namely 90% of the total fruits produced are seedless, thick flesh, very attractive skin color (glossy yellowish green), and 10% of the total fruit produced remaining had small seed size, much smaller than the seed size of the other cultivars. In addition, the size and shape of its fruits uniform, the flavor preferred by consumers because the flesh had a distinctive aroma, sweet, tasty, and highly nutritious. In seeded fruit all parts of the fruit swell out so no one side was more prominent than the other side. While the non-seeded fruit swelling occurs only at one side but at the other side flat. Based on observations, the seeded fruits always grow from the tip of the fruit bunches. If flowers grow at the tip of bunches not successfully develop into fruit, the whole fruit in bunches produced seedless fruit. Interestingly, the flower that grown on the tip of bunches was very few succeed to be fruit. Seed of seeded fruit on seedless wani have smaller size compared to other cultivars seeds. Average seed weight of 45.60 grams. Seed length of 2.42 cm whiles the diameter of the seed 2.18 cm. The seeds

were yellowish white wrapped by a very thin yellowish-green skin. Figure 1 shows fruit of seedless wani (Ngumpen cultivar) in comparison with seede wani (Gadang cultivar).

Genotypic characters of seedless wani

Genetically, seedless wani most different genotype than the other cultivars. The most different genotype of seedless wani was reflected from results test of genetic variability based on RAPD Markers. From 10 examples of kultivar wani which were analyzed its genetic variability with RAPD marker (based on consideration of representation of production centers, a prominent characteristic of cultivars, high economic value, and potential for development), the result showed that seedles wani had the most different genotype. In the test, total plant DNA was measured by grinding leaves sample with liquid nitrogen, then testing the quantity and quality of DNA. DNA amplification was done based on the method of Williams *et al.*, (1990) and then result of isolation was amplified using 10 random primer 10-mer (Operon Alameda Tech.). The composition of the PCR reaction was buffer (10 x stronger), dNTPs (10 mM), primers (10 pmol), Tag DNA polymerase (5u/μl) and template DNA (25 ng), with a final reaction volume of 25 μl. The reaction took place by 45 cycles of amplification in PCR machine (Thermal Cycler Thermolyne 1) which was arranged : 94° C for 1 min to denatured DNA template, 36° C for 1 min for annealing of primer, and 72° C for 2 min for primer elongation. Amplification product then electrophoresed on a 2.0% agarose gel with a voltage 50 volts for one hour and then took photo by using Polaroid films. Observation of RAPD band profile showed that all primers used capable to amplified

ten cultivars of wani, with a number of bands 1-7 pieces and its sized between 200-4000 bp. Genetic diversity based on UPGMA and genetic diversity matrix which was calculated from the difference between the percentage of similarity value of 100% based on data RAPD, showed that ten

samples of cultivar wani were divided into three groups with the variety of genetic level reached 43%. Seedless wani was the only wani clustered alone, while others formed two groups with similarity rate 78-82%. Figure 2 shows a Dendrogram based on RAPD analysis.

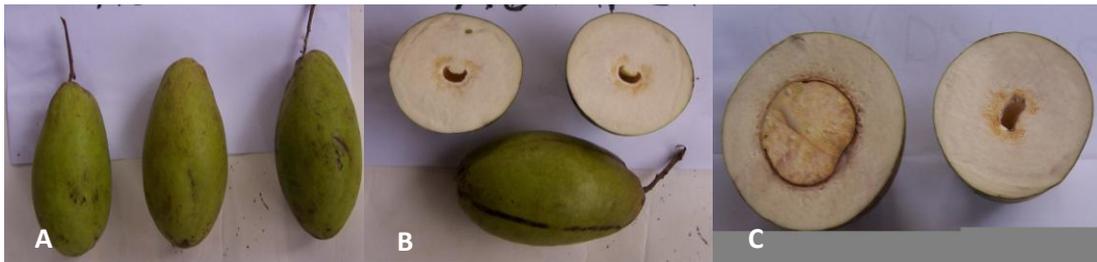


Fig. 1. The fruit of Seedless wani (Ngumpen cultivar) A. Fruit appearance in a whole of seedless wani; B. Cross section of fruit of seedless wani ; C. The comparison between seeded wani (Gadang cultivar) and seedless wani (Ngumpen cultivar) in cross-section

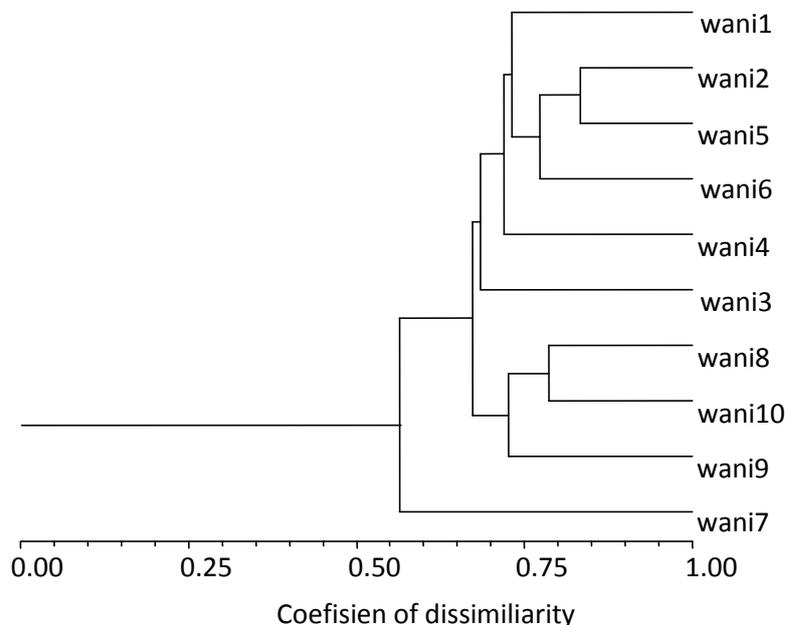


Fig. 2. A dendrogram based on RAPD analysis

Wani 7 is a seedless Ngumpen cultivar, others are cultivars of wani grown in Bali (Source: Rai *et al.* , 2008)

Table 1. Results of analysis nutrient fruit content of seedless wani and other cultivars

No	Type of analysis	Name of Wani				
		Seedless (Ngumpen)	Pucung	Gula	Gadang	Beligo
1	Total sugar (% weight/weight)	14,16	14,37	10,93	10,26	8,83
2	Reducing sugar (% weight/weight)	2,70	3,31	2,21	2,55	3,82
3	pH (acidity)	4,40	4,50	4,50	4,30	4,7
4	Vitamin C (mg/100 g)	3,73	5,09	28,35	4,28	26,20
5	Total acid (% weight/weight)	0,86	0,63	0,44	0,86	0,18
6	Water content (% weight/weight)	83,20	79,71	77,46	80,06	85,96
7	Total dissolved solids (% brix)	21,60	18,00	18,90	17,40	15,00
8	Crude fiber (% weight/weight)	2,07	1,58	3,44	1,85	1,83
9	Ratio of TPT/TA (% weight/weight)	25,11	28,57	42,95	20,23	23,33
10	Edible part (% weight/weight)	95,51	73,00	72,82	82,01	67,92
11	Non-edible part (% weight/weight)	4,49	27,00	17,98	27,18	32,08
12	Weight Flesh/aril (g)	308,24	329,14	305,77	410,10	360,00
13	Alcohol					
	- Ethanol (%)	nd	nd	nd	nd	nd
	- Methanol (%)	nd	nd	nd	nd	nd
14	Texture (kg/cm ²)	5,20	4,64	5,56	5,32	5,46

nd: not detected

Analysis was conducted at Agricultural Technology Laboratory, Udayana University

Wani Pucun : specific properties such as bottle fruit shape. Fruit of this wani was a champion at the contest which was held by Agricultural Bali Province institution in 2005.

Wani Gula : the specific characters of the fruit is sweet like honey

Wani Gadang: the specific characters has uniform size of fruit with glossy green skin color

Wani Beligo : the specific characters has the highest fruit size and high production per tree.

Nutrient content of fruit of seedless wani percentage of edible fruit i.e. 21.60% and 95.51 brix 5 w/w, respectively.

Table 1 showed the nutrient content of seedless wani relatively no different than that of other cultivars. However, seedless wani had the highest total dissolved solids and

CONCLUSION

Seedless wani (Ngumpen cultivar) was the most superior cultivar among wani cultivars grown in Bali and very potential to

be commercially developed. The cultivar had distinctive phenotypic characters compared to other cultivars. Based on RAPD analysis, the seedless Ngumpen was grouped in a different cluster from other cultivars, indicated the cultivar genetically was different with others. Nutrient content of the fruit of Ngumpen cultivar was relatively similar to others, however it had greater fiber content and greater percentage of the edible part.

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