Evaluation and selection of salacca hybrid population based on fruit characters

T Budiyanti1*, S Hadiati1, and D Fatria1
1Indonesian Tropical Fruit Institute, Solok, West Sumatera, Indonesia
E-mail: tri_budi@yahoo.com

Abstract. The variety assembly of new superior salacca leads to the character preferred by consumers which is sweet, thick flesh, not smelling and productive. These idiotypes can be obtained by hybridizing between the local elders and being selected variety based on the superior character. This research was aimed to evaluate and select salacca progenies with the characteristics of sweetness, not astringent, aromatic, high edible portion, thick flesh, and productive of 50 salacca hybrid populations. The research was conducted from January to December 2018 at the Agriculture Seed Center in Sei Lekop sub-district, East Bintan District, Bintan Regency, Riau Islands Province. The characterization and selection results got four progenies with scores above 20 points. The selected progenies were accessions with numbers 24, 524, 189, 500. The four selected progenies were further propagated by air layering the sucker as material to form a population for the observation test of prospective new superior varieties.

1. Introduction
Salacca zalacca [Gaertner] Voss is an Indonesia original fruit [1]. One of the extraordinary strengths of this fruit commodity for Indonesia is the possession of high genetic diversity that spreads in almost every province. Germplasm of the genus Salacca that has been found in the world ± 20 species, 13 species of which are spread in Southeast Asia, and most are found in Indonesia [1]. In 2013, a new salacca species from Sumatra Indonesia was discovered, namely Salacca acehensis [Areaceae] [2]. High genetic diversity has become one of the basic of salacca variety assembly.

The salacca diversity in Indonesia includes the diversity of fruit morphological characters, plant morphology, flowering type and the diversity of the ability to adapt to the environment. To assemble superior varieties, it is necessary for the elders who have wide genetic variability and the availability of the elders who have the desired character. For this reason, research has been conducted on the distribution of varieties and the collection of salacca germplasm in Indonesia. From this information, it is known that the elders possessed the desired character, including thick meat character possessed by Balinese zalacca, fruit sweetness without bitter character possessed by Pondoh zalacca, the character of the number of cobs possessed by Sidempuan, and character of fruit scales without thorns possessed [3] [4]. There are three groups of Salacca zalacca namely local salacca, salacca pondoh and salacca “Kelapa” [5]. The third group is regarded as distinct because it has only a few spines or almost non-spined snake fruit.

The new salacca superior varieties availability that is matched with the consumer’s tastes will be able to increase fruit consumption, farmer income, and export value. Salacca
consumers like sweet and fleshy fruits. The above idiotypes can be obtained by crossing between parents of local salacca. Indonesian Tropical Fruit Research Institute [ITFRI] produced a hybrid population of salacca plant from the crossing of Balinese salacca, Pondoh salacca and Javanese salacca in 2002 [6]. The hybrid salacca populations have been planted in Tanjung Pinang. From 2007 to 2009, some of the populations had been evaluated and produced 3 new superior varieties i.e. Sari Intan 48, Sari Intan 295, and Sari Intan 541 salacca [7]. However, some of salacca hybrid collections have not been evaluated yet. Their hybrids have high diversity and production, superior characters in fruit quality. Accession number 121, 335 and 524 have heavy fruit weight and thick fruit flesh. Accessions number 500, 189, 108, 551 have a sweet taste without any sour taste. Other accessions have a good taste [8]. Therefore, it is necessary to carry out further evaluation to obtain new superior variety which is more superior than the previous varieties. In addition, for the registering and releasing variety benefits, it is necessary to increase the seeds as planting material in the observation test. In the final stage before reaching the user it is necessary to test the varieties superiority through the adaptation test or the observation test. In salacca plants, the superiority test of varieties is done by observation test [Law No. 13, 2010]. Therefore, superior seedlings of salacca hybrid candidates are needed as planting material in the observation test.

The purpose of this study was to 1. obtain a data set of fruit characters from 50 salacca hybrids, 2. get two superior salacca candidates with the strength of sweetness, not astringent, aromatic, high edible portion, fleshy, and productive, and 3] produce 40 duplicate seedlings from selected hybrid salacca populations.

2. Materials and Methods
The genetic materials evaluated were hybrid populations from crossing between Balinese, Pondoh, Local Javanese, and Mawar salacca parents. These materials had been planted in 2003. The number of hybrids observed was 50 plants. This research was conducted in Sei Lekop District, Bintan Timur Regency, Bintan Regency, Riau Islands Province from January to December 2018.

Salacca plant maintenance was carried out as weeding, embellishment, fertilization, pest and disease control, reducing the leaves and suckers, pollination. Weeding is grass was cleaned around plants or land. Embellishment was done because salacca roots often come out on the surface of the soil. Fertilization was carried out with a mixture of fertilizers: 300 g Za + 37.5 g Urea + TSP 75 g + 175 g KCl + 200 g dolomite. 1/2 dose of this fertilizer mixture was given after harvest, and the rest was given 30 days later. Pests and disease control were done before the plants show symptoms of the attack. The number of leaves was maintained by 10 leaves and if it was more, the bottom or old leaves were removed. The maximum number of suckers was two suckers. Female flowers pollination that has bloomed from each accession or individual plant with the male flowers.

The observed variables are number of cobs/bunch [calculated the number of cobs per bunch], number of fruit/cob [counted the number of fruits harvested/cob in one bunch], fruit characters [shape, length, diameter, weight, skin color, and fruit flesh, skin weight, flesh weight, and seed weight, number of seeded and seedless flesh, flesh thickness, Total Dissolved Solids [TDS], analysis of vitamin C and tannin, total acid, and flavors [not astringent, sweet, sour, unripe]]. Accession that has been determined as a superior candidate, it was done a complete characterization of trees, leaves, thorns, flowers, and fruits which is following the BUSS salacca test instructions.

Each observed production component was calculated its average value, then evaluated based on the highest total score for the intended superior character namely sweetness/not smelling, aromatic, a high percentage of edible fruit flesh, thick flesh, and productive to determine the salacca candidate superior.
Table 1. Criteria for the quality score of salacca fruit

| Characters          | Score Number |
|---------------------|--------------|
|                     | 1            | 2            | 3            |
| Cob number          | < 2.9        | 3.0-4.99     | ≥5.0         |
| Fruit number        | < 60         | 60-99.99     | ≥100         |
| Fruit weight [g]    | < 45         | 45-59.99     | ≥60          |
| Edible portion [%]  | < 55         | 55-64.99     | ≥65          |
| Flesh thickness [cm]| < 0.5        | 0.5-0.79     | ≥0.8         |
| Sweetness           | +            | ++           | +++          |
| TSS"brix            | > 16         | 16-19.99     | ≥20          |
| Aromatic            | No Aromatic  | Medium       | Aromatic     |

Increasing the number of salacca seedlings was also carried out in this activity. As much as 2-4 salacca candidates selected from the evaluation results were propagated by air layering. Propagation stages of salacca plants according to Hadiati et al. [8]. These seedlings were separated from the parent if they had been rooted. Furthermore, the seedlings were transplanted into 20 x 30 cm polybags with a mixture of soil and organic fertilizer [1:2], and neatly arranged in sheltered nurseries. Seedlings were cared optimally through fertilizing, weeding, watering and controlling pests and diseases. During maintenance, the seedlings were fertilized with 0.7 g NPK [15-15-15] per polybag.

3. Results and Discussion
The population of evaluated salacca progeny was around 15 years old so that the plant’s appearance was high and large. Planting site was at an altitude of 50 m above sea levels and dry sandy soil conditions. The appearance of a plant is determined by genetic factors, environment, and the interaction of both. Genetic factors can be passed on from parents to their offspring. Genotype selection was directed at a character that had a high inheritance so that genetic factors that influence are quite dominant. Qualitative characters in plants are controlled by simple genes [one or two genes] and no or very little influenced by the environment [9].

Based on the observation of the fruit qualitative characters, showed that the hybrids had a sweet to sweet enough fruit flavor, only one hybrid with astringent taste, fruit flesh texture between crisp to the soft, medium and fragrant aroma, round-oval shape, fruit skin color dark brown to yellowish-brown, the color of the flesh was light-yellow [Yellow 4 D] to creamy white [White 155 A]. Hybrid number 189 had a distinctive aroma and very sweet taste so it had the potential to be preferred by consumers. The sweet taste and non-astringent was owned by 549 salacca hybrid. This was due to the main-parent coming from Pondoh and Gula Pasir salacca which had a sweet taste and non-astringent. According to Hadiati et al. [10], Gula Pasir, Pondoh, Mawar, and MWR-SDP salacca have non-astringent fruit taste even though the fruit is unripe.

Based on quantitative characters, 50 hybrids showed a high variation [Table 2]. This can be seen from a fairly wide range of data, for example in the number of fruits/bunches [19-130 pieces], fruit weight [21-71 g], seed weight [2-5 g], flesh thickness [0.4-1.0 cm] and edible fruit percentage [EP]. This variation was due to salacca plants including cross-pollinating plants, and the salacca plants evaluated came from generative propagation [seeds]. Individuals derived from seeds in one cob did not necessarily have the same genetic and phenotypic structure. Therefore, the selection of salacca plants was done by individual plants, and then the selected candidates were propagated vegetatively.

Salacca productivity can be determined from the peeling component, the cobs number per bunch, the fruit number per bunch and the fruit weight per bunch. With the increasing
number of fruit and weight per bunch, the productivity for each plant will be higher. The fruit weight per bunch from the observed hybrids ranged from 0.63 to 7.28 kg. The hybrids that had high production potential had fruit weight per bunch greater than 4 kg. They were numbers 24, 284, 457, 524, 520, 536, 189, 303, 509, 369 and 216.

The standard size of salacca based on SNI 01-3167-1992 is divided into 3 weight sizes, namely large size [≥60 g], medium size [33 - 60 g], and small size [≤ 32 g]. Based on the SNI, the accessions that possessed small, medium, large fruit weight were 14%, 76%, and 10% respectively. From the results of the characterization noted that the high fruit weight was owned by hybrid numbers 24, 219, 524, 372 and 599 [Table 3].

Salacca consumers prefer thick flesh and a high percentage of the edible portion. From the observations, it was known that the hybrid observed had a flesh thickness ranging from 0.40 - 1.00 cm. Hybrid number 524 had the largest flesh thickness [1.00 cm]. Of all the hybrids observed, only 10% of accessions possessed fruit flesh thickness ≥0.8 cm, namely number 24, 500, 509, 549, 508, 208, 219, 187, 548, 599 and 524 [Table 3].

Salacca progenies having edible portion above 65% consisted of 16 hybrids, namely no.189, 544, 508, 228, 372, 254, 500, 524, 509, 187, 284, 549, 521, 599, 208 and 219. The total soluble solids [TSS] value in salacca had not been able to show the sweetness. This was due to the sweet taste in salacca influenced by the level of astringent, sour taste and TDS [7]. High TSS levels, low acid levels and supported by non-astringent flavors caused salacca to become sweet. The hybrids possessed TSS values ranging from 14-21° Brix. Hybrids having TSS ≥20° Brix were 19 hybrids, whereas there were 3 hybrids which had the highest TSS [21° brix] namely numbers 544, 192 and 524.

The hybrids which had superior characters, namely sweet, non-astringent, fragrant, a high percentage of edible fruit, thick flesh, productive, and scores above 22 points were 4 hybrids, namely number 24, 524, 189 and 500. Also, the three selected hybrids that had a score of 18 were hybrids number 208, 599 and 509. Seven selected hybrids met the fruit weight requirements for export to China. China wants salacca class B with the criteria for fruit weight of 50-80 grams [12-18 fruits/kg] with a ripe level of 70-80%.
| No. | Hybrid No. | Form      | Skin colour  | Flesh colour | Seed Colour | Fruit Taste : | Texture | Scent |
|-----|------------|-----------|--------------|--------------|-------------|----------------|---------|-------|
| 1   | 24         | Triangle  | Brown        | White NN 155 D | Brown       | -   | +++ | + | Crispy | Aromatic |
| 2   | 187        | Egg Round | Brown        | White 155 D   | Brown       | -   | +   | - | ++ | Soft | Medium |
| 3   | 189        | Round     | Dark Brown   | White 155 D   | Brown       | -   | +++ | - | - | Quite Crispy | Aromatic |
| 4   | 191        | Round     | Brown        | White 155 A   | Brown       | -   | +   | - | - | Quite Crispy | Medium |
| 5   | 192        | Triangle  | Brown        | White 155 A   | Brown       | -   | ++ | - | - | Crispy | Medium |
| 6   | 195        | Duite oval round | Brown | Yellow 4 D | Brown       | -   | ++ | - | - | Quite Crispy | Aromatic |
| 7   | 198        | Oval      | Brown        | Yellow 4 D    | Brown       | -   | ++ | - | - | Crispy | Medium |
| 8   | 208        | Triangle  | Brown        | Yellow 4 D    | Brown       | -   | ++ | - | - | Crispy | Medium |
| 9   | 216        | Round     | Brown        | White 155 A   | Brown       | -   | ++ | - | - | Very Crispy | Medium |
| 10  | 219        | Oval      | Brown        | White NN 155 A| Brown       | -   | +++ | - | - | Crispy | Medium |
| 11  | 222        | Round     | Brown        | White 155 A   | Brown       | -   | ++ | - | - | Crispy | Medium |
| 12  | 225        | Triangle  | Dark Brown   | Yellow 4 D    | Brown       | -   | +++ | - | - | Crispy | Medium |
| 13  | 228        | Oval      | Brown        | Yellow white 158 A | Brown | -   | ++ | - | - | Quite crispy | Medium |
| 14  | 248        | Round     | Brown        | Yellow 4 D    | Brown       | -   | ++ | - | + | Soft | Medium |
| 15  | 251        | Triangle  | Brown        | Yellow 4 D    | Brown       | -   | ++ | - | - | Crispy | Medium |
| 16  | 252        | Triangle  | Dark Brown   | Yellow 4 D    | Brown       | -   | ++ | - | - | Quite Crispy | Medium |
| 17  | 254        | Triangle  | Brown        | Yellow 4 D    | Brown       | -   | ++ | - | - | Crispy | Medium |
| 18  | 257        | Oval      | Brown        | White 155 B   | Brown       | -   | +++ | - | - | Crispy | Medium |
| 19  | 258        | Round     | Brown        | White 155 A   | Brown       | -   | ++ | + | - | Crispy | Medium |
| 20  | 259        | Round     | Brown        | White 155 A   | Brown       | -   | ++ | - | - | Quite Crispy | Medium |
| 21  | 260        | Oval      | Brown        | Yellow 10 D   | Brown       | -   | ++ | - | - | Quite Crispy | Medium |
| 22  | 261        | Round     | Brown        | White 155 A   | Brown       | -   | +++ | - | - | Crispy | Medium |
| No. | Hybrid No. | Form       | Skin colour  | Flesh colour | Seed Colour | Fruit Taste : | Texture | Scent |
|-----|------------|------------|--------------|--------------|-------------|----------------|---------|-------|
| 23  | 269        | Round      | Yellowish    | Brown        | Brown       | - ++ - -        | Quite Crispy | Aromatic |
| 24  | 284        | Triangle   | Brown        | Yellow 4 D   | Brown       | - +++ + -        | Crispy  | Medium |
| 25  | 303        | Oval       | Brown        | White 155 A  | Brown       | - ++ - -        | Crispy  | Aromatic |
| 26  | 304        | Triangle   | Brown        | Yellow 10 D  | Brown       | - ++ - -        | Crispy  | Medium |
| 27  | 311        | Oval       | Brown        | White 155 A  | Yellow      | - ++ - -        | Crispy  | Medium |
| 28  | 314        | Oval       | Brown        | White 155 A  | Brown       | - ++ - +        | Soft    | Aromatic |
| 29  | 338        | Triangle   | Brown        | White NN 155 A | Brown     | - ++ - -       | Crispy  | Aromatic |
| 30  | 369        | Quite Oval | Dark Brown   | Yellow white 158 B | Brown | - ++ - -       | Crispy  | Aromatic |
| 31  | 372        | Oval       | Brown        | Yellow white 158 A | Brown | + + + -        | Crispy  | Aromatic |
| 32  | 457        | Triangle   | Brown        | White 155 A  | Brown       | - ++ - -        | Crispy  | Medium |
| 33  | 500        | Round      | Brown        | White NN 155 A | Brown     | - +++ - -       | Crispy  | Aromatic |
| 34  | 508        | Quite oval | Dark Brown   | yellow II C  | Brown       | - ++ - -       | Crispy  | Medium |
| 35  | 509        | Round      | Brown        | White 155 A  | Brown       | - ++ - +        | Crispy  | Aromatic |
| 36  | 510        | round      | Brown        | White 155 A  | Brown       | - ++ - -        | Quite Crispy | Medium |
| 37  | 520        | Round      | Brown        | Yellow white 158 A | Brown | - + - ++       | Crispy  | Medium |
| 38  | 521        | Round      | Brown        | Yellow white 158 B | Brown | - + - +        | Crispy  | Medium |
| 39  | 524        | Triangle   | Brown        | White 155 A  | Light Brown | - +++ - -       | Crispy  | Medium |
| 40  | 536        | Egg Round  | Brown        | Greyed yellow 162D | Brown | - + - ++       | Soft    | Medium |
| 41  | 537        | Round      | Brown        | White 155 A  | Brown       | - ++ + -       | Crispy  | Medium |
| 42  | 544        | Oval       | Brown        | White 155 A  | Brown       | - ++ - -       | Crispy  | Medium |
| No. | Hybrid No. | Form | Skin colour | Flesh colour | Seed Colour | Fruit Taste: |
|-----|------------|------|-------------|--------------|-------------|--------------|
| 43  | 548        | Oval | Brown       | White 155 B  | Brown       | Astringent  |
| 44  | 549        | Triangle | Brown | White NN 155 A | Brown       | Sweet |
| 45  | 551        | Triangle | Brown | Yellow white 158 B | Brown | Sour |
| 46  | 554        | Round | Brown | Yellow 10 D | Brown | unripe |
| 47  | 555        | Triangle | Brown | Yellow 4 D | Brown | Texture |
| 48  | 599        | Triangle | Brown | White 155 B | Brown | Scent |
| 49  | 600        | Round | Brown | White NN 155 A | Brown | Quite Crispy |
| 50  | 625        | Round | Dark Brown | White NN 155 A | Brown | Aromatic |

**Table 3.** Fruit quantitative characters of 50 salacca hybrids

| No. | Hybrid Number | Cop number/bunch | Fruit number/bunch | Fruit weight/bunch [kg] | Fruit size [cm] | Weight [g] | Seed/ Fruit |
|-----|---------------|------------------|-------------------|-------------------------|-----------------|------------|-------------|
| 1   | 24            | 3.00             | 121.00            | 7.28                    | 6.432           | 4.936      | 60.15       |
| 2   | 187           | 4.00             | 19.00             | 0.98                    | 5.50            | 4.22       | 51.79       |
| 3   | 189           | 3.00             | 60.00             | 5.40                    | 8.35            | 5.66       | 92.00       |
| 4   | 191           | 4.00             | 75.00             | 2.91                    | 4.52            | 4.20       | 38.86       |
| 5   | 192           | 7.00             | 125.00            | 4.89                    | 4.99            | 4.07       | 39.10       |
| 6   | 195           | 5.00             | 120.00            | 4.71                    | 5.29            | 4.11       | 39.21       |
| 7   | 198           | 2.00             | 45.00             | 1.61                    | 5.59            | 4.05       | 35.83       |
| 8   | 208           | 4.00             | 73.00             | 3.41                    | 6.01            | 4.59       | 46.75       |
| No. | Hybrid Number | Cop number/bunch | Fruit number/bunch | Fruit weight/bunch [kg] | Fruit size [cm] | Weight [g] |
|-----|---------------|------------------|-------------------|------------------------|----------------|-----------|
|     |               |                  |                   |                        | Length         | Diameter   | Fruit | Skin | Flesh | Total seed | Seed/Fruit |
| 9   | 216           | 7.00             | 79.00             | 3.62                   | 4.50           | 4.42      | 45.84 | 7.82 | 27.41 | 10.61      | 3.54       |
| 10  | 219           | 2.00             | 52.00             | 3.14                   | 6.80           | 4.78      | 60.35 | 8.57 | 43.44 | 8.33       | 3.47       |
| 11  | 222           | 3.00             | 42.00             | 1.31                   | 4.24           | 3.98      | 31.12 | 6.58 | 18.76 | 5.79       | 2.89       |
| 12  | 225           | 4.00             | 96.00             | 3.52                   | 5.48           | 4.12      | 36.65 | 7.27 | 20.30 | 9.08       | 3.89       |
| 13  | 228           | 4.00             | 45.00             | 2.06                   | 5.39           | 4.39      | 45.74 | 7.99 | 30.31 | 7.44       | 2.86       |
| 14  | 248           | 3.00             | 68.00             | 2.54                   | 4.47           | 4.27      | 37.39 | 11.43 | 18.48 | 7.48       | 4.49       |
| 15  | 251           | 6.00             | 109.00            | 3.56                   | 4.80           | 3.97      | 32.68 | 4.35 | 20.47 | 7.87       | 2.62       |
| 16  | 252           | 2.00             | 81.00             | 2.78                   | 5.36           | 4.28      | 34.30 | 9.18 | 18.45 | 6.67       | 3.34       |
| 17  | 254           | 3.00             | 60.00             | 3.25                   | 6.22           | 4.74      | 54.21 | 10.05 | 36.07 | 8.09       | 2.70       |
| 18  | 257           | 3.00             | 130.00            | 5.58                   | 6.16           | 4.31      | 42.93 | 7.33 | 27.90 | 7.70       | 2.57       |
| 19  | 258           | 6.00             | 86.00             | 3.72                   | 4.66           | 4.30      | 43.24 | 8.79 | 24.04 | 10.40      | 3.47       |
| 20  | 259           | 4.00             | 37.00             | 1.05                   | 4.17           | 3.70      | 28.27 | 7.25 | 15.12 | 5.90       | 4.92       |
| 21  | 260           | 4.00             | 56.00             | 2.95                   | 6.06           | 4.69      | 52.63 | 10.78 | 32.72 | 9.14       | 4.06       |
| 22  | 261           | 2.00             | 29.00             | 0.63                   | 3.86           | 3.38      | 21.76 | 8.22 | 10.76 | 2.78       | 2.78       |
| 23  | 269           | 3.00             | 30.00             | 1.17                   | 4.84           | 4.35      | 38.93 | 7.40 | 24.47 | 7.07       | 2.94       |
| 24  | 284           | 7.00             | 130.00            | 5.04                   | 5.11           | 4.07      | 38.77 | 6.23 | 26.37 | 6.18       | 2.06       |
| 25  | 303           | 3.00             | 60.00             | 2.73                   | 6.21           | 4.28      | 45.53 | 8.44 | 26.61 | 10.48      | 3.49       |
| 26  | 304           | 4.00             | 106.00            | 3.91                   | 5.23           | 4.32      | 36.85 | 6.54 | 23.21 | 7.10       | 3.15       |
| 27  | 311           | 3.00             | 64.00             | 2.24                   | 4.98           | 3.96      | 34.97 | 6.73 | 19.65 | 8.59       | 3.58       |
| 28  | 314           | 3.00             | 40.00             | 1.34                   | 5.04           | 3.82      | 33.46 | 8.53 | 19.82 | 5.11       | 5.11       |
| 29  | 338           | 3.00             | 83.00             | 2.11                   | 4.72           | 3.42      | 25.48 | 6.03 | 15.95 | 3.51       | 2.92       |
| 30  | 369           | 6.00             | 96.00             | 4.25                   | 5.46           | 4.38      | 44.30 | 8.55 | 28.09 | 7.66       | 3.83       |
| 31  | 372           | 2.00             | 42.00             | 2.95                   | 6.54           | 4.83      | 70.22 | 12.05 | 46.64 | 11.54      | 3.85       |
| 32  | 457           | 3.00             | 86.00             | 4.22                   | 5.48           | 4.60      | 49.02 | 8.78 | 29.33 | 10.91      | 3.64       |
| No. | Hybrid Number | Cop number/bunch | Fruit number/bunch | Fruit weight/bunch [kg] | Fruit size [cm] | Weight [g] | | | |
|-----|---------------|------------------|-------------------|------------------------|----------------|------------| | | |
| 33  | 500           | 5.00             | 83.00             | 4.61                   | 5.11           | 4.75   | 55.51 | 9.83 | 37.25 | 8.43 | 3.51 |
| 34  | 508           | 3.00             | 40.00             | 2.09                   | 4.86           | 4.47   | 52.36 | -   | 35.01 | 8.16 | 3.32 |
| 35  | 509           | 6.00             | 81.00             | 3.56                   | 5.24           | 4.49   | 43.91 | 8.72 | 29.70 | 5.49 | 3.43 |
| 36  | 510           | 5.00             | 90.00             | 4.10                   | 4.90           | 4.49   | 45.57 | 8.62 | 28.24 | 8.71 | 3.11 |
| 37  | 520           | 3.00             | 52.00             | 2.15                   | 4.73           | 4.32   | 41.27 | 9.61 | 26.30 | 5.36 | 3.35 |
| 38  | 521           | 5.00             | 110.00            | 5.46                   | 5.58           | 4.61   | 49.67 | 9.34 | 34.33 | 6.00 | 3.00 |
| 39  | 524           | 5.00             | 31.00             | 1.89                   | 6.89           | 4.74   | 61.04 | 10.85| 41.09 | 9.09 | 2.87 |
| 40  | 536           | 6.00             | 50.00             | 1.47                   | 4.69           | 3.47   | 29.38 | 8.58 | 16.04 | 4.76 | 4.76 |
| 41  | 537           | 8.00             | 73.00             | 3.02                   | 4.96           | 4.45   | 41.37 | 7.54 | 26.10 | 7.73 | 3.22 |
| 42  | 544           | 3.00             | 43.00             | 1.80                   | 6.11           | 4.26   | 41.90 | 8.64 | 27.26 | 6.00 | 2.57 |
| 43  | 548           | 2.00             | 70.00             | 3.04                   | 6.35           | 4.42   | 43.37 | 10.26| 26.96 | 6.16 | 4.54 |
| 44  | 549           | 4.00             | 55.00             | 3.11                   | 5.91           | 4.72   | 56.52 | 9.58 | 38.68 | 8.26 | 3.44 |
| 45  | 551           | 3.00             | 47.00             | 2.08                   | 5.62           | 4.38   | 44.18 | 7.83 | 27.36 | 8.99 | 3.21 |
| 46  | 554           | 3.00             | 25.00             | 0.80                   | 4.49           | 3.79   | 32.12 | 6.44 | 19.89 | 5.79 | 2.63 |
| 47  | 555           | 3.00             | 56.00             | 2.21                   | 5.80           | 3.94   | 39.48 | 7.30 | 22.88 | 9.30 | 3.10 |
| 48  | 599           | 4.00             | 74.00             | 5.31                   | 6.30           | 5.42   | 71.72 | 13.31| 50.06 | 8.35 | 3.80 |
| 49  | 600           | 2.00             | 47.00             | 2.77                   | 5.40           | 4.85   | 58.85 | 8.97 | 41.39 | 8.48 | 3.02 |
| 50  | 625           | 6.00             | 45.00             | 1.39                   | 4.24           | 3.79   | 30.98 | 6.75 | 20.01 | 4.22 | 4.22 |
Table 4. Flesh Thickness, Edible portion [EP], Total Soluble Solid [TSS] on 50 salacca hybrids

| No. | Hybrid number | Flesh Thickness [cm] | EP [%] | TDS [° brix] |
|-----|---------------|----------------------|--------|--------------|
| 1   | 24            | 0.80                 | 62.47  | 18.56        |
| 2   | 187           | 0.95                 | 67.96  | 14.00        |
| 3   | 189           | 1.04                 | 65.45  | 19.00        |
| 4   | 191           | 0.52                 | 61.19  | 20.25        |
| 5   | 192           | 0.55                 | 55.83  | 21.20        |
| 6   | 195           | 0.55                 | 61.55  | 18.40        |
| 7   | 198           | 0.50                 | 62.47  | 14.87        |
| 8   | 208           | 0.84                 | 69.94  | 20.40        |
| 9   | 216           | 0.52                 | 59.80  | 20.00        |
| 10  | 219           | 0.87                 | 71.99  | 17.80        |
| 11  | 222           | 0.50                 | 60.27  | 20.28        |
| 12  | 225           | 0.54                 | 55.39  | 20.44        |
| 13  | 228           | 0.60                 | 66.27  | 18.40        |
| 14  | 248           | 0.42                 | 49.42  | 19.67        |
| 15  | 251           | 0.52                 | 62.63  | 19.64        |
| 16  | 252           | 0.63                 | 53.80  | 20.00        |
| 17  | 254           | 0.53                 | 66.54  | 19.73        |
| 18  | 257           | 0.59                 | 64.99  | 20.20        |
| 19  | 258           | 0.52                 | 55.61  | 19.88        |
| 20  | 259           | 0.52                 | 53.47  | 19.80        |
| 21  | 260           | 0.76                 | 62.17  | 20.30        |
| 22  | 261           | 0.47                 | 49.44  | 20.10        |
| 23  | 269           | 0.66                 | 62.84  | 19.40        |
| 24  | 284           | 0.70                 | 68.01  | 19.73        |
| 25  | 303           | 0.71                 | 58.43  | 19.20        |
| 26  | 304           | 0.53                 | 63.00  | 18.60        |
| 27  | 311           | 0.49                 | 56.19  | 20.60        |
| 28  | 314           | 0.69                 | 59.24  | 18.84        |
| 29  | 338           | 0.75                 | 62.58  | 19.84        |
| 30  | 369           | 0.69                 | 63.40  | 18.20        |
| 31  | 372           | 0.68                 | 66.41  | 20.60        |
| 32  | 457           | 0.59                 | 59.83  | 20.20        |
| 33  | 500           | 0.80                 | 67.10  | 17.96        |
| 34  | 508           | 0.83                 | 66.07  | 18.24        |
| 35  | 509           | 0.80                 | 67.65  | 17.92        |
| 36  | 510           | 0.56                 | 61.98  | 20.72        |
| 37  | 520           | 0.67                 | 63.72  | 15.52        |
| 38  | 521           | 0.69                 | 69.12  | 16.52        |
| 39  | 524           | 0.91                 | 67.32  | 21.40        |
| 40  | 536           | 0.73                 | 54.60  | 17.48        |
| 41  | 537           | 0.59                 | 63.09  | 20.84        |
Table 5. Selection based on the highest score for 7 [seven] superior fruit characters on 50 salacca hybrids

| No | Hybrid Number | Cop number/bunch | Fruit number/bunch | Fruit weight | EP [%] | Flesh Thickness | Sweetness | TDS | Fruit Flesh Aroma | Total Score |
|----|---------------|------------------|-------------------|--------------|--------|----------------|-----------|-----|------------------|-------------|
| 1  | 24            | 2                | 3                 | 3            | 3      | 3              | 3         | 2   | 3                | 22          |
| 2  | 187           | 2                | 1                 | 2            | 3      | 3              | 1         | 1   | 1                | 14          |
| 3  | 189           | 2                | 2                 | 3            | 3      | 3              | 3         | 3   | 3                | 22          |
| 4  | 191           | 2                | 2                 | 1            | 2      | 2              | 1         | 3   | 1                | 14          |
| 5  | 192           | 3                | 3                 | 1            | 2      | 2              | 2         | 3   | 1                | 17          |
| 6  | 195           | 3                | 3                 | 1            | 2      | 2              | 2         | 2   | 2                | 17          |
| 7  | 198           | 1                | 1                 | 1            | 2      | 1              | 1         | 1   | 1                | 10          |
| 8  | 208           | 2                | 2                 | 3            | 3      | 3              | 2         | 3   | 1                | 18          |
| 9  | 216           | 3                | 2                 | 2            | 2      | 2              | 2         | 3   | 1                | 17          |
| 10 | 219           | 1                | 1                 | 3            | 3      | 3              | 3         | 1   | 1                | 16          |
| 11 | 222           | 2                | 1                 | 1            | 2      | 1              | 2         | 3   | 1                | 13          |
| 12 | 225           | 2                | 1                 | 2            | 2      | 3              | 3         | 1   | 1                | 16          |
| 13 | 228           | 2                | 1                 | 2            | 3      | 2              | 2         | 2   | 1                | 15          |
| 14 | 248           | 2                | 2                 | 1            | 1      | 1              | 2         | 2   | 1                | 12          |
| 15 | 251           | 3                | 3                 | 1            | 2      | 2              | 2         | 2   | 1                | 16          |
| 16 | 252           | 1                | 2                 | 1            | 1      | 1              | 2         | 3   | 1                | 12          |
| 17 | 254           | 2                | 1                 | 2            | 3      | 2              | 2         | 2   | 1                | 15          |
| 18 | 257           | 2                | 3                 | 1            | 2      | 2              | 3         | 3   | 1                | 17          |
| 19 | 258           | 3                | 2                 | 1            | 2      | 2              | 2         | 2   | 1                | 15          |
| 20 | 259           | 2                | 1                 | 1            | 1      | 2              | 2         | 2   | 1                | 12          |
| 21 | 260           | 2                | 1                 | 2            | 2      | 2              | 2         | 3   | 1                | 15          |
| 22 | 261           | 1                | 1                 | 1            | 1      | 3              | 3         | 1   | 1                | 12          |
| 23 | 269           | 1                | 1                 | 1            | 2      | 2              | 2         | 2   | 1                | 13          |
| 24 | 284           | 3                | 3                 | 1            | 3      | 2              | 2         | 2   | 1                | 17          |
| 25 | 303           | 2                | 1                 | 2            | 2      | 2              | 3         | 2   | 2                | 16          |
| 26 | 304           | 2                | 3                 | 1            | 2      | 2              | 2         | 2   | 1                | 15          |
| 27 | 311           | 2                | 2                 | 1            | 2      | 1              | 2         | 3   | 1                | 14          |
| 28 | 314           | 2                | 1                 | 1            | 2      | 2              | 2         | 2   | 2                | 14          |
| 29 | 338           | 2                | 2                 | 1            | 2      | 2              | 2         | 2   | 2                | 15          |
4. Conclusion

The results of the characterization and selection got four hybrids with scores above 20 points. These selected hybrids were 24, 524, 189, 500. The four selected hybrids which had been reproduced by transplanting the offspring as material to form a population for the observation test of new superior varieties.

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