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THE EFFECT OF ROOTSTOCKS ON SOURSOP (*Annona muricata* L.) GRAFTING

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ABSTRACT

Soursop *(Annona muricata* L.) is commonly propagated from seeds. Propagation by seeds will produce vary plants as a result of cross-pollination. To overcome these problem, propagation through vegetative must be done i.e., by grafting. Vegetative propagation by grafting requires the availability of rootstocks and scions. The aim of the research was to study the effect of rootstock on soursop grafting. The research was conducted at Aripan Experimental Field, Indonesian Tropical Fruit Research Institute, from July 2007 until June 2008. The treatments were the kind of rootstock i.e., *Annona muricata* L. (soursop) x *Annona muricata* L. (soursop) and *Annona montana* Macf. (Mountain soursop) x *Annona muricata* L. (soursop), each treatment consist of 48 plants. The parameters measured were percentage of graft success, percentage of grafted material success, shoot length, number of bud eye which grow per scion, leaf number per bud eye, total leaf number, rootstock diameter, graft union diameter, scion diameter, scion/rootstock ratio and graft union/rootstock ratio. The results indicated that the percentage of grafted material success of soursop on *A. montana* Macf. x *A. muricata* L. and *A. muricata* L. x *A. muricata* L. rootstocks was not descriptively different. The grafted materials of soursop on *A. montana* Macf. x *A. muricata* L. had the same shoot length with that on *A. muricata* L. x *A. muricata* L. rootstocks, but the total leaf number and scion diameter were bigger on *A. montana* Macf. x *A. muricata* L. than on *A. muricata* L. x *A. muricata* L. rootstocks. Until 3.5 months after grafting, there was no growth emphasis by *A. muricata* L. (soursop) x *A. muricata* L. (soursop) and *A. montana* Macf. (Mountain soursop) x *A. muricata* L. (soursop) rootstocks to scion. This result can be used as reference to look for the other rootstock which compatible with soursop.

Keywords: Soursop, rootstock, grafting, propagation.

INTRODUCTION

Soursop *(Annona muricata* L.) is commonly propagated from seeds. Propagation by seeds will produce vary plants as a result of cross-pollination. To overcome these problem, propagation through vegetative must be done i.e., by grafting. Vegetative propagation by grafting requires the availability of rootstocks and scions.

The wild soursop/mountain soursop *(Annona montana* Macf.) and soursop *(Annona muricata* L.) belong to one family of *Annonaceae*. The fruit of mountain soursop has a nearly round shape and dark green rind with a soft short spines, yellow fruit flesh, specific aroma, low quality, and has many pithy seeds with light brown color (Morton, 1987). The observation at the nursery showed that the growth of mountain soursop was not different from soursop seedling on 6 months old, which was reflected by plant height, stem diameter, root dry weight, top of plant dry weight and plant total dry weight.

The vegetative propagation on soursop is usually done by grafting. One of the grafting problems is the compatibility of rootstocks and scions. Extreme incompatibility can cause death. Symptoms of incompatibility will be visible after few years old i.e., the occurrence of growth inhibition, root system is weak, easily broken in union graft with the site of fault was flat, or excessive swelling in the stem above and below the graft union (Hartmann and Kester, 1983). Some varieties of plants have different compatibility depending on the varieties of scion and rootstock that are used.

Grafting of *A. diversifolia* cv. Genova Red on *A. glabra* derived from two different plants i.e., *A. glabra* 'South' and *A. Glabra* 'North' shows different results. The grafts of 'Genova Red' on 'South' rootstock were all lived and grew but began to yellow and decline after two months and were dead within eight months after grafting. The 'Genova Red' grafts on rootstock from the'North' remained green and grew vigourosly, with no sign of graft incompatibility (Ziil and Mahdeem, 1998). *A. reticulata* and *A. montana* used as rootstock in Columbia, especially for tolerance to drought and soil moisture (Cordoba, 1967 *in* Hannia, 2000).

Some studies about compatibility of rootstock and scion on the various fruit commodities had been carried out by previous researchers. The research of mangosteen compatibility on several rootstocks showed that the highest percentage of grafted material success (68%) was obtained on mangosteen rootstock, followed by that on fukugi (*Garcinia subelliptica*) rootstock (11%). Grafting mangosteen on mundu (*Garcinia dulcis* Kz.) and nyamplung (*Calophyllum inophyllum*) rootstocks did not succeed of becoming grafted materials and largely failed joined (Mansyah *et al*., 1998).

The use of kawista *(Feronia limonia* L.) which is in one family with oranges *(Citrus* sp.) as rootstock in some commercial citrus varieties and species shown that there was indication of incompatibility (Supriyanto *et al*., 1994). Grapefruit 'Star Ruby' *(Citrus paradisi* Macf.) grew well on sour orange rootstock 'Texas', bittersweet orange *(C. aurantium* L.), Cleopatra and Sunki Mandarin *(C. reticulata* Blanco), sweet lime 'Columbia' *(C. limettioides* Tan.), and Troyer Citrange *(Poncirus trifoliata* (L.) Raf. x *C. sinensis* L.) OSB.). Growth of Grapefruit 'Star Ruby' on

sour orange 'Texas' and Troyer Citrange rootstocks were very vigor while on sweet lime 'Columbia' and Sunki rootstocks had developing problems i.e., *Phytopthora foot rot*. On trifoliate orange 'Christiansen' and Swingle Citrumelo occured severe chlorotic and eventually died. The growth on Citrange 'Morton' was slow, slightly chlorotic, and slightly affected by *foot rot* (Timmer, 1979).

The purpose of this research was to study the effect of rootstocks on soursop grafting.

MATERIALS AND METHODS

The research was conducted at Aripan Experimental Field, Indonesian Tropical Fruit Research Institute, Solok, West Sumatera, from July 2007 to June 2008. The treatments consisted of the kind of rootstocks i.e.

a) *Annona muricata* L. (soursop) x *Annona muricata* L. (soursop)
b) *Annona montana* Macf. (mountain soursop) x *Annona muricata* L. (soursop)

Mountain soursop and soursop seeds were obtained from mature fruits. After extracting from the fruits, the seeds should be washed with clean water and air-dried. The seeds were sown in seedbed with sandy soil. After ± 2 months old, the seedlings were transferred to polybags with soil + manure (2:1) media. Grafting was conducted on those seedlings rootstock at the age of 9 months. Scion of soursop variety used was cv. Ratu. Grafting was conducted at ± 20 cm height from soil surface of rootstocks with cleft grafting method. Each treatment consisted of 48 plants. Observation parameters include:

- Percentage of graft success that was calculated by counting the number of graft success divided by the number of samples. The graft success was observed on 3 weeks after grafting, it was observed by digging a little on base of scion. If this part was still green, the grafting was successful.
- Percentage of grafted material success, that was calculated by counting the number of grafted material success divided by the number of initial samples.
- Shoot length that was measured from the graft union to apical growth.
- The number of buds that grew on the scions. Growing buds were marked by the development of shoots and leaves on the bud eye of scion.
- The number of leaves per growing buds
- The number of total leaves per plant that was calculated from the whole leaf that grew on these scions.
- Diameter of rootstock, graft union and scion. Diameter of rootstock was observed 2cm below the graft union area. Scion diameter was observed 2cm above the graft union.

The percentage of grafted material success, shoot length, number of buds that grew on the scion, the number of leaves per bud eye of scion, total leaf number per plant, rootstock diameter, graft union diameter, and stem diameter of scion were observed 3.5 months after grafting. Analysis of those data were using t test, unless the percentage of graft success and the percentage of grafted material success were analyzed descriptively.

RESULTS AND DISCUSSIONS

The percentage of soursop graft success on soursop rootstock as much as 60%, while on the mountain soursop as much as 65%. The result obtained was not differing too much because both rootstocks visually have nearly the same vigor so that they have the same ability to form callus. While the percentage of grafted material success decrease i.e., 50% on *A. muricata* L. x *A. muricata* L. and 39.58% on *A. montana* Macf. x *A. muricata* L. (Table-1). Similar results were found in nine cultivars and species of pear grafted on Taiwan Nashi-C *(Pyrus calleryana* Decne.) rootstock that showed no difference in compatibility which was indicated by a very good graft union area with an average survival of approximately 95% (Barbosa *et al*., 1996). Furthermore, the average percentage of grafted material success decrease i.e., 17.71% on 3.5 months after grafting. The decrease was due to dry of scion on the graft success.

Table-1. The effect of rootstocks on the percentage of graft success and grafted material success of soursop.

Rootstock	**Graft success** (%)	**Grafted material success** (%)
A. muricata L. x *A. muricata* L.	60.00	50.00
A. montana Macf. x *A. muricata* L.	65.00	39.58

Using different rootstock had no effect on the growth of shoot length, number of buds growing, and number of leaves per bud eye, but had significant effect on total leaf number per plant. Shoot length in both types of grafted materials that were not significantly different was followed by the difference in the total number of leaves. This was probably caused by the number of bud eye that grew per scion and the number of leaf per bud eye on *A. montana* Macf. x *A. muricata* L. relatively higher than on *A. muricata* L. x *A. muricata* L. rootstocks.

Table-2. The effect of rootstock on shoot length, number of bud eye which grew per scion, leaf number per bud eye and total leaf number per plant on 3.5 months after grafting.

Rootstock	**Shoot length** (cm)	**Number of bud eye that grow per scion**	**Leaf number per bud eye**	**Total leaf number**
A. muricata L. x *A. muricata* L.	27.03 ns	3.55 ns	8.28 ns	23.35 a
A.montana Macf. x *A. muricata* L.	31.66	4.57	8.43	35.52 b

Note: ns = not significant
Letters not followed by the same letter in one column mean that it is significantly difference according to t-test at p = 0.05

Grafting of soursop scion on soursop and mountain soursop rootstocks indicated vigorous growth and was compatible enough as shown by the growth of stem diameter (Table-3). This was contrast to Morton (1987), which states that the soursop rootstock is generally the best rootstock for soursop propagation, despite the grafting so successful on *A. squamosa* L., A. *montana* Macf. or *A. glabra* rootstocks.

The diameter of rootstock and graft union was not different significantly on both rootstocks, while the diameter of stem above the graft union on *A. montana* Macf. x *A. muricata* L. was greater than on *A. muricata* L. x *A. muricata* L. rootstocks. This was caused by the total number of scion leaves on *A. montana* Macf. x *A. muricata* L. were more than on *A. muricata* L x *A. muricata* L, so that the photosynthesa results were more and give better growth.

Table-3. The effect of rootstocks on rootstock diameter, scion diameter, graft union diameter, scion/rootstock ratio and graft union/rootstock ratio on 3.5 months after grafting.

	Diameter			**Ratio**	
Rootstock	**Rootstock**	**Scion**	**Graft union**	**Scion/root stock**	**Graft union/ rootstock**
A. muricata L x *A. muricata* L	6.53 ns	5.39 a	7.45 ns	0.83 ns	1.40 ns
A.montana Macf. X *A. muricata* L.	6.81	6.31 b	8.31	0.93	1.33

Note: ns = not significant
Letters not followed by the same letter in one column mean that it is significantly difference according to t-test at p = 0.05

A compatible graft union was first characterized by the formation of callus tissue (parenchymal cells) in the area of both rootstock and scion. In grafting, parenchymal cells closed to rootstock and scion cambium differentiated and formed new cambium. The formation of this cambium is continue, and eventually formed a direct graft union between the cambium of rootstock and scion. And then, these new cambium functioned to form new xylem and phloem tissue (Hartmann and Kester, 1983).

The stem diameter of graft union usually larger than rootstock and scion. This is commonly occurring in the practice of grafting due to process of wound healing (Suprijadji and Sahali, 1995). The greater diameter of graft union indicated by the ratio of graft union/rootstock diameter is more than 1. The ratio of scion and rootstock diameter less than 1 indicates that there is no suppression of growth by the scions to the rootstock. Similar results were also shown by the scion of coffee Catimor Jaluk that grafted on Robusta and Arabica Typica rootstocks (Nur *et al.*, 1999).

CONCLUSIONS

The percentage of grafted material success of soursop on *A. montana* Macf. x *A. muricata* L. and *A. muricata* L. x *A. muricata* L. rootstocks was not descriptively different. The soursop grafted material on *A. montana* Macf. x *A. muricata* L. had the same shoot length with that on *A. muricata* L. x *A. muricata* L. rootstocks but the total leaf number and scion diameter were bigger on *A. montana* Macf. X *A. muricata* L. than on *A. muricata* L. x *A. muricata* L. rootstocks. Until 3.5 months after grafting, there was no growth emphasis by *A. muricata* L. (soursop) x *A. muricata* L. (soursop) and *A. montana* Macf. (Mountain soursop) x *A. muricata* L. (soursop) rootstocks to scion.

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