27.

A practical means to control translucent flesh disorder of mangosteen fruit

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Introduction

Translucent sarcocarps and gamboges are the major flesh disorders of the mangosteen fruit. The translucent flesh disorder shows the symptom of stiff texture and washy taste, and gamboge disorder shows the symptom of bitter yellow sticky latex oozing into the flesh. Those disorders spoil the fruit value severely and are the most serious problems for mangosteen growers. The incidence of translucent flesh increases drastically and reaches as much as 70% or more in rainy season. The mechanism of the occurrence is suggested to relate the tree water dynamics, plant nutrition such as Ca and B, Al-toxicity of acid soils, and so on. Consequently, the applications of Ca, soil improvement programs, and active managements of soil moisture have been attempted, but attained no practical resolution. Authors have already ascertained that the fruit suffered from thrips or mites developed less epidermis wax (Table 1) and such fruit was hard to generate translucent flesh. Getting hint from this fact, we tried and succeeded to establish a new practical means to reduce the occurrence of the translucent flesh by controlling the fruit transpiration.

Materials and Methods

More than 200 fruits were selected and tagged at 2, 4, 6 weeks after anthesis, and were subjected to wax removal (2% ethyl oleate +2.5% K_2CO_3) or artificial coating of fruit wax (KF-8000DX, Koto) in a commercial orchard in Rayong Province, Thailand. At harvest, remained 178 and 121 of ethyl-oleate and waxed fruits, respectively, were collected to search for flesh disorders. Fruit surface transpiration which is considered to relate the disorder occurrence was estimated from weight losses for the ethyl-oleate treated, wax coated, and thrips damaged fruits. The appearances of the epidermis wax of those fruits were observed by microscope.

Results and Discussion

The translucent fruit increase in rainy season as well as cracked fruit. Those are apparently related to the water dynamics of the fruit. Under increasing humidity and soil water conditions, the suppressed surface transpiration from the fruit might cause the disorder. Our results showed 95% of cracked fruit had translucent flesh disorder (Table 1), whereas the injured fruits by thrips and mites indicated drastically low incidence of translucent disorder. If the surface transpiration rate was maintained at high level, the fruit might hardly tend to be disordered. To verify this hypothesis, the effectiveness of ethyl-oleate treatment was tested. The fruit subjected to the ethyl oleate 2 weeks before maturity increased the transpiration by 20%, although it was not as much as thrips injured fruit. Wax coating depressed the transpiration by 30% (Table 2). Subsequently, this technique was applied to wash the natural wax out. The incidence of disorder was reduced significantly (Table 3). Especially, seriously disordered fruit was scarcely observed so that the degree of the disorder was markedly improved. The ethyl-oleate treatment, however, left the trace of water-drop marks on the epidermis (Plate 1), which would decrease the commercial value. The observation of the fruit surface revealed the thin wax layer on the epidermis and rough surface of the wax (Table 4 and Plate 2) that could upraise the fruit transpiration.

Table 1. Incidence of fruit flesh disorder as affected by fruit cracking and incect plagues at epidermis.

	Number of fruit	Incidence of fruit flesh disorder (%)
Fruit with cracking at epidermis	49	95.9
Fruit without cracking	836	61.4
Fruit with imprint of thrips (Thysanoptera)	41	7.3
Fruit with imprint of spider mite (Acarina)	23	8.7
Fruit without insect plague	821	67.6

Table 2. Weight losses percentages of mangosteen fruits 3 days after wax removal (by ethyle oreate) and artificial wax coating treatments as compared with that of thrips injury fruit.

Treatment	Weight loss (%)
Control	1.13 c
Ethyl oleate (to remove natural fruit wax)	1.36 b
Coating with artifitial wax	0.81 d
Injured fruit by Thrips (Thysanoptera)	1.76 a

Different letters indicate significant difference at $p<0.05$ by Tukey HSD test.

Table 3. Effect of wax removal and coating on the control of flesh disorder of mangosteen fruit.

		Degree of flesh disorder[z]		Incidences of flesh disorder (%)	
Treatment	Number of fruit	Translucent	Gamboge	Translucent	Gamboge
Control	307	2.5	1.1	67.8	9.1
Ethyle-oleate	178	2.3 *	1.2	58.7 *	10.6
2 weeks after anthesis	51	2.1 *	1.2	52.9 *	17.6
4 weeks after anthesis	52	1.9 *	1.0	51.9 *	1.9
6 weeks after anthesis	75	2.7	1.2	68.0	12.0
Wax coating	121	2.8 *	1.2	73.6	13.2
2 weeks after anthesis	25	2.9	1.3	68.0	20.0
4 weeks after anthesis	29	2.4	1.1	62.1	10.3
6 weeks after anthesis	67	2.9 *	1.2	80.6 *	11.9

[z]: The degree of flesh disorder was estimated at 5 levels (1:no troubles - 5: whole fruit completely damaged)
*: There is a significant difference at $p<0.05$ as compared with control.

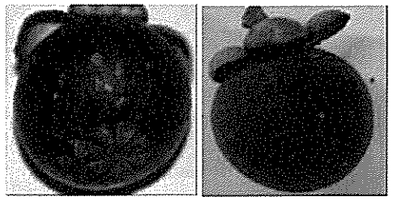

Plate 1. Surface appearance of mangosteen epidermis with traces of ethyle-oleate application (left), imprint of thrips plagues (right).

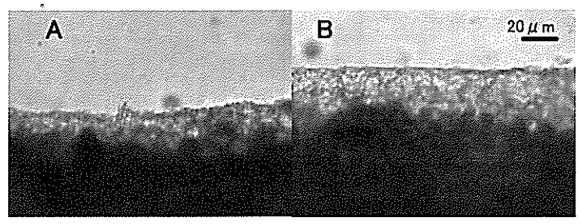

Plate 2. Cross section of epidermis of mangosteen fruits as treated with ethyle-oleate to remove natural generated wax (A) and normal fruit (B). A translucent layer is the wax accumulation.

Table 4. The thickness of the wax remained on the epidermis of mangosteen fruit after the treatment of Ethyl-oleate and artificial wax coating.

Treatment	Period of the treatment	Number of fruits	Thickness of wax
Control		23	29.5 b
Ethyl-oleate	2 weeks after anthesis	20	20.4 c
	6 weeks after anthesis	44	18.2 c
Wax coating	2 weeks after anthesis	34	19.0 c
	6 weeks after anthesis	43	35.9 a

Different letters indicate significant differences at $p<0.05$ by Tukey test.