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Full Length Research Paper

Endogenous practices of parasitoid biological control: Papaya sola (*Carica papaya Linnaeus.)* in the control of mealybug (*Paracoccus marginatus* Williams & Granara of Willink, 1992) in the Commune of Allada in the South of Benin

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Abstract

The parasitoid biological control of grass mealybug (*Paracoccus marginatus,* Williams & Granara de Willink, 1992) of papayas solos (*Carica papaya Linn*aeus) in Allada Commune in southern Benin is the result of endogenous practices of pest control. The overall objective of this research is to contribute to the development of plantations of papayas solos by the biological control of infestations of mealybugs. Specifically: (i) to analyze the effectiveness and efficiency of pest control against mealybug of solitary papayas; Ii) test the use of Dursban in addition to omo soap. Inputs from endogenous pest control practices, four series (A, B, C and D) and sixteen sub-series ($A_{1,2,3,4}$, $B_{1,2,3,4}$, $C_{1,2,3,4}$ And $D_{1,2,3,4}$) of combinations of inputs were formulated with respect to the volume of the black soap. From March to October 2012, 36 tests of 12 combinations of inputs were sprayed on the infested fruit, leaves and trunk of papaya solo. By applying the sixteen subsets of input combinations, only the C and D series input combinations had a significant impact on the couple (cochineal, eggs). The input combinations of the B series had a differential impact on the torque. They destroyed the mealybugs and had no impact on their eggs, which justified the reconstitution of scale insects on day 4 of the sprays. With regard to the combinations of inputs of the series A, they had no effect on the torque. From this study, the combinations of C and D series inputs were effective and efficient in the area of biological control.

Key words: Endogenous practices, Paracoccus marginatus, Inputs, Carica papaya Linnaeus, parasitoid, Allada, Benin.

Introduction

Plantations of papaya solo (*Carica papaya Leaf.)* in the Commune of Allada are infested with an unprecedented proliferation of mealybug (*Paracoccus marginatus*) (Atanu Seni and al 2012, CIRAD-GRET 2002). The chemical methods of controlling this parasitoid have been unsuccessful. The proliferation of mealybug from papayas solos has taken precedence over all the devices deployed by farmers (Germain and al., 2010, Aminou and al 2012)

The mealybug is a parasite that rarely kills its hosts, but can nevertheless cause significant damage (Calatayud 1994, Hala and al., 2004, Jardinier-Malin, 2012). The best-known mealybugs have the following scientific names: "Pseudococcus Longinus", "*Pseudococcus Affinis*" and

"*Planococcus Citris*". Covered with a cottony fluff, the mealy mealybug resembles a piece of cotton; With a soft, waxy body, it has neither carapace nor shield (Miller and al., 2002, Walker and al., 2006, Ris and al., 2010, Germain, 2011, Jardinier-Malin, 2012).

The mealybug is a small insect biting and sucking, attached to the organs of the plant (black deposit similar to soot) and visible (Partnerswith Nature, 2012,). In addition to causing the weakening of the plant, it is responsible for the sooty mold. Moreover, its secretion of honeydew attracts ants (Jardinier Malin, 2012) and it remains active all the year. The cochineal is easily recognized by the kinds of small cotton piles it forms (Partnerswith Nature, 2012).

The conventional treatment consists of the application of an anti-cochineal insecticide based on malathion (Jardinier-Malin 2012). Not all insecticides are suitable for the control of mealybugs. The soft, waxy body of the mealybug reduces the effectiveness of the pesticide, which flows on it without reaching it. To circumvent this pitfall, a systemic insecticide is used either with a wetting agent (soap) or a vegetable oil (Walker et al., 2006, Gardener-Malin 2012, Homejardin, 2012). Application of a systemic insecticide requires treatment renewal 10 days after the first application to remove the newly hatched eggs (Jardinier-Malin, 2012; Ethnoplants, 2012).

The ecological control used in organic culture is the vaporization on all affected parts of a solution of black soap with 1% (per cent) alcohol at 90 ° C. and possibly a small amount of vegetable oil. If the infestation is limited, it is also possible to clean the leaves with a sponge impregnated with soapy water, or to remove the scales, using a cotton soaked in alcohol at 90 ° C (Pierre and al., 1991, US Department of Agriculture, 2000, US Department of Agriculture, 2002, Jardinier-Malin, 2012, Partnerswith Nature , 2012, Jardin-info, 2012, Ethnoplants, 2012).

The missions of collecting information on the endogenous practices of parasitoid biological control organized by the Department of Local Development and Endogenous Practices, of the NGO "Environment, Woman and Unhappy Childhood", made it possible to identify a number of practices often Developed by the peasants. They are essentially ecological and relate to the combination of a number of inputs: 1- omo, lemon, oil, pili-pili chili filtrate; 2-leaf filtrate of *Nicotiana tabacum* (especially against locusts), sodabi (local alcohol based on distilled palm wine), lemon; *Azadirachta indica*), omo (against mealybug), 4- filtrate of neem leaves (*Azadirachta indica)* , oil, salt, ash (against locusts and small-scale supplies), 6- black soap, oil, salt (against parasitoids).

Application tests on inputs in the usual proportions revealed that all combinations of pulverized inputs had no effect on scale clusters and their eggs. We start from the assumptions that the intervals of test portions or the usual proportions of combinations of inputs are inappropriate. Five day day-trials were also unsuccessful. To do this, the efficiency and effectiveness of the combinations of the products used depend on their mosaic and the usual proportions. However, the applications of input combinations listed roughly in all cases of recorded endogenous practices (de Souza 1985; Aminou 2012) are inefficient whatever the number of applications.

Attacks and proliferation of mealybug in solitary papaya plantations, which is the subject of the present study, alter the good development and growth of (*Carica papaya Linnaeus.)* (fig 1 and 2). El.

Fig. 1: Infestation of papayas solo by cochineal

Fig. 2: Adults and egg bags of papaya mealybug, Paracoccus marginatus *(s. Walker & al ,* 2006)

Framework for the Study

The Agro-sylvo-pastoral farm of Allada is a subsidiary of the NGO "Environment, Woman and Unhappy Childhood". It is located in the village of Tokpota-Djèmèkohoué (Togoudo District, Commune of Allada). It is bounded to the north by the Commune of Toffo, to the south by the Commune of Torri-Bossito, to the East by the Commune of Zê and to the West by the Communes of Kpomassè and Bopa. This Commune is essentially rural. It has a subequatorial climate, a period of vegetation covering between 200-265 days, rainfall ranging from 900 to 1000 mm of water per year and an average temperature of 26 ° C per year. The floor of the Commune of Allada is essentially characterized by bar land and a marshy depression; It lends itself well to food, vegetable and fruit crops, as well as to coffee growing.

Combinations of inputs

From the selected inputs (black soap, leaf filtrate from Nicotiana tabacum, sodabi, neem seed oil), twenty four (24) combinations of inputs allowed formulating sprayable solutions for six (06) groups of expressions To the volume of the black liquid soap, for a total volume of sixteen (16) liters, in particular:

Combinations of inputs of series A

1. A1: 0.25 L of black liquid soap, 0.0 L of the filtrate of i 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol), , 45 L of water;
2. A2: 0.5 L of black liquid soap, 0.0 L *of Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 15, 20 L of water;
3. A3: 0.75 L of black liquid soap, 0.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 14.95 L of water;
4. A4: 1.0 L of black liquid soap, 0.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 14.7 L of water;

Combinations of the Series B inputs

1. B1: 0.0 L of black liquid soap, 2.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 13.70 L of water;
2. B2: 0.0 L of black liquid soap, 3.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 12.7 L of water;
3. B3: 0.0 L of black liquid soap, 4.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol), 11.7 L of water;
4. B4: 0.0 L of liquid black soap, 5.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 10.7 L of water;

Combinations of C-series inputs

1. C1: 0.25 L of black liquid soap, 2.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 12.95 L of water;
2. C2: 025 L of black liquid soap, 3.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol), 11 , 95 L of water;
3. C3: 0.25 L of black liquid soap, 4.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 10.95 L of water;
4. C4: 0.25 L of black liquid soap, 5.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 9.95 L of water;

Combinations of D-series inputs

1. D1: 0.5 L of liquid black soap, 2.0 L of *Nicotiana tabacum* filtrate, 100 grams of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 12.7 L of water;
2. D2: 0.5 L of liquid black soap, 3.0 L of *Nicotiana tabacum* filtrate, 100 grams of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 11.7 L of water;
3. D3: 0.5 L of liquid black soap, 4.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta* indica oil, 0.15 L of sodabi (local alcohol), 10.7 L of water;
4. D4: 0.5 L of liquid black soap, 5.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 9.7 L of water.

Combinations of inputs of the E series

1. E1: 0.75 L of liquid black soap, 2.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 12.95 L of water;
2. E2: 0.75 liquid black soap, 3.0 L *Nicotiana tabacum* filtrate, 100 g potassium hydroxide, 0.15 L *Azadirachta indica* oil, 0.15 L sodabi (local alcohol), 11 L of water
3. E3: 0.75 L of liquid black soap, 4.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 11 L of water;
4. E4: 0.75 L of liquid black soap, 5.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 10 L of water.

Combinations of F-series inputs

1. F1: 1.0 L of liquid black soap, 2.0 L of Nicotiana tabacum filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 12.7 L of water;
2. F2: 1.0 L of liquid black soap, 3.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of

Azadirachta indica oil, 0.15 L of sodabi (local alcohol) , 11.7 L of water

3. F3: 1.0 L of liquid black soap, 4.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 10.7 L of water;
4. F4: 1.0 L of liquid black soap, 5.0 L of *Nicotiana tabacum* filtrate, 100 g of potash, 0.15 L of *Azadirachta indica* oil, 0.15 L of sodabi (local alcohol) , 9.7 L of water.

The filtrate of *Nicotiana tabacum* was obtained by filtering one kg of ground leaves of *Nicotiana tabacum* after twenty four (24) hours in twenty-five (25) liters of water and black liquid soap after Mixing two (02) kg of said soap in five (05) liters of water.

Study inputs, black liquid soap, *Nicotiana tabacum* filtrate, neem oil (*Azadirachta Indica),* potash, sodabi 1st degree (local alcohol based on distilled palm wine), rainwater was collected from the exercises Applications of these different products used in the context of the endogenous practices of control of parasitoid by the farmers. Sobabi is used for the conservation of bodies by the inhabitants. Rainwater from tanks is used for domestic purposes. Black soap is used for its antiseptic principle against skin diseases and mixed with a vegetable oil for its parasiticidal effect. Tobacco and neem oil are used as parasiticides (de Souza 1985; Aminou 2012). Potash sometimes in addition to the filtrate of *Nicotiana tabacum a*nd the sodabi 1st to fix the intestinal flora. The liquid black soap was prepared from palm kernel oil and potassium hydroxide (KOH). *Nicotiana tabacum* filtrate was obtained by hammering dry tobacco leaves from a mortar and placing 1 kg of the powder obtained in 25 liters of water. The oil of neem (*Azadirachta indica*) and the sodabi 1st degree came from the artisanal manufacture. Of the products listed and retained, 24 combinations of input stowage were formulated and grouped into 6 series. A, B, C, D, E and F were assigned to the series with respect to the volume of the black liquid soap and the filtrate of *Nicotiana tabacum.* Any combination of products per series has been indexed from 1 to 4 (Table 1).

Table 1: Series and combinations of sub-sets of inputs and indexing

Designation	**Inputs**					
	Liquid soap Black / liter	Filtrate *Nicotiana Tabacum* / liter	Potash/ G	*Azadirachta* oil *Indica* / liter	Sodabi / liter	Water/ liter
Series A						
A $_{1.3}$	0.25	-	100	0.15	0.15	15.45
A $_{2.3}$	0.5	-	100	0.15	0.15	15.20
A $_{3.3}$	0.75	-	100	0.15	0.15	14.45
A $_{4.3}$	1.0	-	100	0.15	0 , 15	14.70
Series B						
B $_{1.3}$	-	2	100	0.15	0.15	13.7
B $_{2.3}$	-	3	100	0.15	0.15	12.7
B $_{3.3}$	-	4	100	0.15	0.15	11.7
B $_{4.3}$	-	5	100	0.15	0 , 15	10.7
C Series						
C $_{1.3}$	0.25	2.0	100	0.15	0.15	13, 45
C $_{2.3}$	0.25	3.0	100	0.15	0.15	12, 45
C $_{3.3}$	0.25	4.0	100	0.15	0.15	11, 45
C $_{4.3}$	0.25	5.0	100	0.15	0.15	10, 45
Series D						
D $_{1.3}$	0.5	2.0	100	0.15	0.15	13, 2
D $_{2.3}$	0.5	3.0	100	0.15	0.15	12, 2
D $_{3.3}$	0.5	4.0	100	0.15	0.15	11, 2
D $_{4.3}$	0.5	5.0	100	0.15	0.15	10, 2
E Series						
E $_{1.3}$	0.75	2.0	100	0.15	0.15	12, 95
E $_{2.3}$	0.75	3.0	100	0.15	0.15	11, 95
E $_{3.3}$	0.75	4.0	100	0.15	0.15	10, 95
E $_{4.3}$	0.75	5.0	100	0.15	0.15	9, 95
F Series						
F $_{1.3}$	1.0	2.0	100	0.15	0.15	12.7
F $_{2.3}$	1.0	3.0	100	0.15	0.15	11.7
F $_{3.3}$	1.0	4.0	100	0.15	0.15	10.7
F $_{4.3}$	1.0	5.0	100	0.15	0.15	9.7

Indexed 3: Means 3 test samples

Experimental apparatus

The area of the solo papaya plantation of the Agro-sylvo-pastoral farm of Allada was divided into 625 plots of 16 m2. Within each plot were 9 solo papayers. Of the 625 plots, 12 were allocated to each of the input combinations. For the identification of blocks of parcels by combination of inputs, small slates of 16 cm x 11 cm were immobilized on stakes of 0.5 m high. On the slates were the indexed letters of the numbers 1-4, which simultaneously denoted the order of the series, sub-series of input combinations and plots. The studied plots were separated by a 4 mx 10 m strip of 2 mx 5 m rows of solo papayers. The whole of the plots and the separation strip were arranged in a rosary. The rosaries were isolated by a hedge of solitary papayers of 10 m × 10 m as shown (Diagram 1). The treatments allocated to it took into account the direction of the wind.

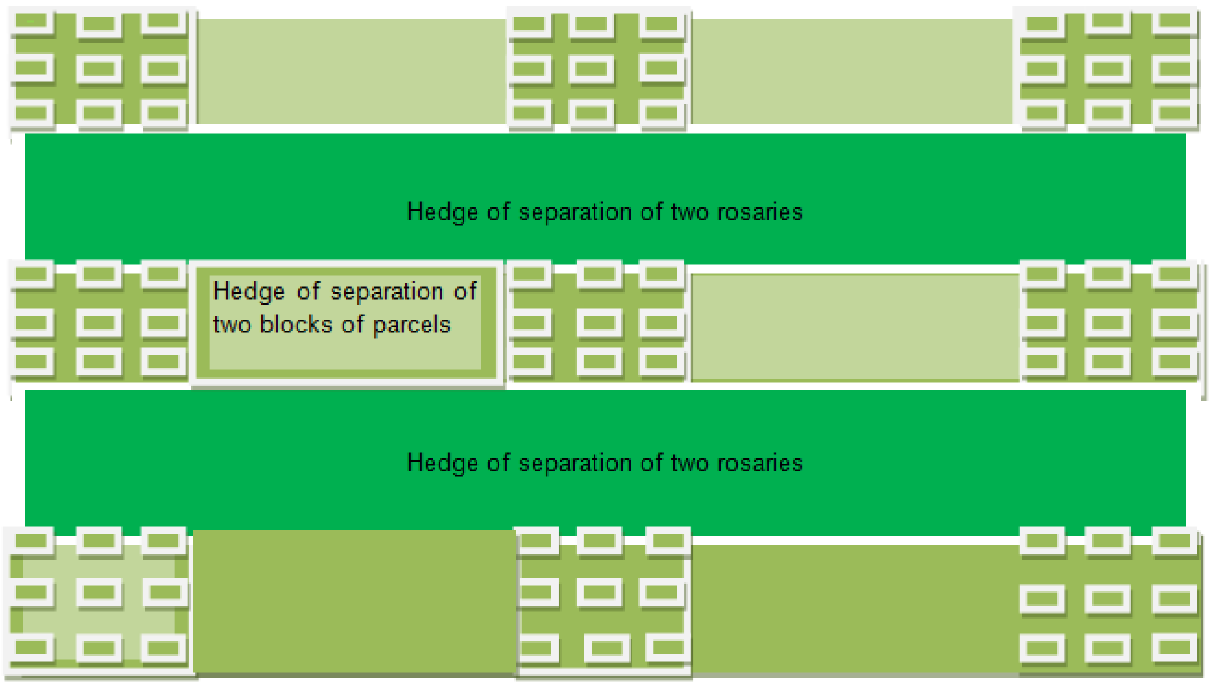

Diagram 1**:** Experimental field

Tests and repeats

To each series of input combinations was allocated twelve plots randomized into three frequencies. The plots were allocated according to the frequency index and at 7-day intervals (first test portion). The sprays were carried out for about 300 seconds to reach the entire surface of the papayas, leaves, trunk and the foot of the papaya solo in order to avoid the migration of male scale insects and the transport of eggs from a plant To another by the ants who were in search of the molasses of the mealybugs. With regard to the impacts that have been observed, tests have been repeated. For the purposes of the definition of the impact frequency interval, the duration of the spraying frequencies was shortened from 7 days to 3 days and then to 1 day, respectively. For the antiparasitic efficacy test, 24 feet of papaya solo (*Carica papaya Linnaeus.),* the most affected were retained per perimeter. These feet were divided into 8 lots of 4 solo papayers.
The sub-series B2, C1, D1 and Dursban were sprayed into six test samples each for analysis of their efficacy and pest control efficacy.

Collection of data

Fecal Egg Count Reduction (FECRT) counting method was used to provide an estimate of the effectiveness of stowage or combination of product stowage by comparing the number of mealybug and of their eggs before and after treatments. Data were recorded over a 21-day period. In addition to the general zero day counting, each sampling acted as a special order per plot. The FECRT were undertaken with numbers that were taken on days 0, 7, 21 days of treatment. The hundred percent reduction in mealybug and their eggs was calculated by reference to zero day (pre-treatment) cochineal level and their eggs on a weekly basis. The percentage reduction in the number of mealybug and their eggs (FECRT) for post-treatment was calculated on the basis of the geometric mean of the differences in cochineal numbers and their eggs between processing frequencies using the method Described by

The following criteria were used: 100% reduction (1-Zt / Zc) where Z is the arithmetic mean, t-represents the number of plots treated at the end of the third week (21 days) after treatment and it's the number of cochineal at zero days (control).

The data were collected by flattening Worndas on the surface of papayas solos. Within the Worndas a square cavity of 4 cm x 4 cm was made to facilitate the counting of clumps of mealybugs. In short, two clumps of mealybug were counted per cavity of Wornda. The clumps of mealybug were counted on day zero (pretreatment) and on the 7th day of each treatment. A conventional treatment based on a systemic insecticide Dursban was used in addition to omo soap.

Results

1. Use of Dursban in addition to omo soap

The sprays allocated to Dursban (200ml / 15 liters of water) have had no impact on mealybugs and their eggs. The soft, waxy body of the mealybug reduces the effectiveness of the pesticide, which flows on it without reaching it. To get around this pitfall, two teaspoons of omo soap were added to the Dursban solution. At the first 7-day frequency sprays of the Dursban in addition to the omo soap, no evidence of attack of the cochineal clusters was observed on all treated papaya solos. The test specimens were renewed at an interval interval of 3 days. The results were mixed after a series of 4 sprays. In addition, spraying was successful after 5 to 6 close sprays at one-day intervals. The impact of these applications is shown in Table 2.

2. Effectiveness and Efficacy of Anti-Parasitoid Control

The sprays that were carried out were filled with combinations of inputs with differential efficiency on the clumps of mealybugs and their eggs. The impacts of these sprays are shown in Tables 3, 4, 5 and 6. The pest control efficacy of C and D series input combinations was obtained at the first spray frequency. To do so, the tests taken for the E and F series were suspended.

From the analysis of the data reported, (Tables 3, 4, 5 and 6) sprays of C, D series input combinations were very efficient on clumps of mealybugs and their eggs. Their impact is limited to an eradication of mealybugs noted by the appearance of thin beige spots on the fruit without hatching eggs. In the case of the B-series sprays, the recurring impact was an annihilation of the cochineal clusters, followed by its reconstitution following hatching of the eggs before the second spray frequency. With respect to spraying of the A-series input combinations, no evidence of attack of cochineal clumps was observed on all of the treated sola papayas. For a frequency of close-coupled sprays at three days and one day intervals of the series A sub-series, no recurring impact was observed.

For a frequency of spraying close to three days apart for sub-series B2 of series B, the extinction of clumps and eggs of mealybugs was observed. On the other hand, the recurrent impact was obtained by spraying only the C1 and D1 sub-series of series C and D (photos 4 and 5). In view of the density of the input combinations of sub-series C_1 and D_1, the hypothesis of an alteration in the fruit market quality due to the volume ratio of the combinations of inputs used (black knowledge, *Nicotiana tabacum* filtrate) Was formulated. The efficiency and effectiveness tests of the C_2, C_3, C_4, D_2, D_3 and D_4 sub-series have been abandoned as a function of the referential impacts of sub-series C_1 and D_1.

Table 2: Impact of Dursban on mealybug

Designation	Dursban in addition to soap omo											
Block	57	58	59	60	61	62	63	64	65	66	67	68
Treatment	1	2	3	4	5	6	1	2	3	1	2	3
Effect	ni	ni	ni	pn	-	-	p	-	-	p	-	-
Hatching of eggs	*eh*	eh	eh	*eh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*
Impact	ni	ni	ni	i	i	i	i	i	i	i	i	i

pn = positive on clusters and negative on eggs, ni = no impact, eh = egg hatch, i = impact on clusters, neh = no egg hatch

Table 3: Impacts of stowage combinations of inputs A Series of clusters of scale insects and their eggs

Designation	Series A											
	A_1			A_2			A_3			A_4		
Block	9	10	11	12	13	14	15	16	17	18	19	20
Treatment	1	2	3	1	2	3	1	2	3	1	2	3
Effect	neh	neh	neh	neh	neh	neh	neh	neh	neh	neh	neh	neh
Hatching of eggs	eh	eh	eh	eh	eh	eh	eh	eh	eh	eh	eh	eh
Impact	ni	ni	ni	ni	ni	ni	ni	ni	ni	ni	ni	ni

p = positive, ni = no impact, ee = egg hatch; neh = no egg hatch

Table 4: Impact tie downs combinations of Series B inputs on the mealybug

Designation	Series B											
	B_1			B_2			B_3			B_4		
Block	21	22	23	24	25	26	27	28	29	thirty	31	32
Treatment	1	2	3	1	2	3	1	2	3	1	2	3
Effect	pn	pn	pn	pn	pn	pn	pn	pn	pn	pn	pn	pn
Hatching of eggs	*eh*	eh	eh	neh	neh	eh	eh	eh	eh	eh	eh	eh
Impact	ni	ni	ni	i	i	i	i	i	i	i	i	i

pn = positive and negative on clusters of eggs, no = no impact, eh = egg hatch, neh= no egg hatch, i = impact on clusters

Table 5: Impact of docking of C-series input combinations on mealybug

Designation	C Series											
	C_1			C_2			C_3			C_4		
Block	33	34	35	36	37	38	39	40	41	42	43	44
Treatment	1	2	3	1	2	3	1	2	3	1	2	3
Effect	p	-	-	p	-	-	p	-	-	p	-	-
Hatching of eggs	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*
Impact	i	i	i	i	i	i	i	i	i	i	i	i

P = positive, neh = no egg hatch, i = impact

Table 6: Impact of combinations of series D inputs lashings on the mealybug

Designation	Series D											
	D_1			D_2			D3			D_4		
Block	45	46	47	48	49	50	51	52	53	54	55	56
Treatment	1	2	3	1	2	3	1	2	3	1	2	3
Effect	P	-	-	P	-	-	P	-	-	P	-	-
Hatching of eggs	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*	*neh*
Impact	i	i	i	i	i	i	i	i	i	i	i	i

P = positive, neh = no egg hatch, i = impact

Fig. 3**:** Spraying at C 1

Fig.4**:** Before spraying at C1

Fig.5**:** After spraying at C1

Discussion

The lashings of the A series input combinations have a 250 mL liquid soap volume while a volume change of the *Nicotiana tabacum* filtrate (2000 to 5000 mL) is imposed. In view of the perceived impacts after the sprays of this series, it was then hypothesized that the combined effects of the inputs used are not so efficient as to destroy the mealybugs and their eggs. Mealybugs are sucking-sucking insects that pump the sap. Only female insects attack plants, winged males with antennae, with a short life, do not feed. The attacked plants weaken, showing their stress by discoloration and the premature fall of the foliage. The sucking off of mealybugs (honeydew) attracts different species of ants that feed on them. The harmfulness of mealybugs comes from their impressive reproductive capacity, with only one female able to lay a thousand eggs. Honeydew is also a preferred medium for sooty mold, a kind of black soot produced by various fungi and which covers the attacked leaves, hindering their photosynthesis. However, the efficiency of the impact of sub-series C1 and D1 of docking of input combinations of series C and D is referential. At the first test of application, both the clumps of mealybugs and their eggs were destroyed, contrary to that which had been proved by other authors (Germain, 2011, Ris et al., 2010, de Sousa, 1985, Hala Et al., 2014, Miller et al., 2002 and 1999, Calatayud, 1994). Efficiency tests carried out using the applications suggested by other authors (Germain, 2011, Calatayud, 1994) required several tests to achieve the impacts. Renewals of test samples carried out at close intervals of one day interval based on the randomly ordered combinations of inputs had no impact on both the mealybugs and their eggs. Under the first sprays of the input combinations of sub-series B2, C1 and D2, we note efficiency at various stages. For sub-series B1, the expected impact is partially perceived at the third close spraying (2 days apart instead of 7). For the combinations of inputs B2, B3 and B4, a partial impact is established at the first observations, but the reconstitution of the clumps of mealybugs is observed on the 4th day of the first spray following the hatching of the eggs. In other words, the combinations of inputs in the B series are not symptomatic in relation to the input volumes used in the combinations.

On the other hand, we note an improvement in these combined effects (cochineal clusters, eggs) following the applications of the input combinations of the C1 and D1 sub-series. These combinations appear to be the most effective (Tables 2, 3, 4 and 5) in comparison with spraying of combinations of B-series inputs on mealybugs and their eggs. The application tests of the combination of inputs of sub-series B2, B3 and B4 of series B carried out at other plantations reinforced the hypotheses of this study and allowed to prove the partial efficiency Of said sub-series to the third close-up application (3 days apart).

The development of a large population of mealybugs can cause the death of papaya. Organized chemical control at the onset of plantation infestation with Dursban spray solution (200 ml / 15l) had no effect on both cochineal clumps and their eggs (Aminou et al., 2012). In addition to the ineffective chemical control methods, biological control programs have been developed in the Pacific Islands with parasitoid hymenotopteres imported from Central America (Jean-François, Germain et al., 2010) . During the plantation infestation cycle by mealybug, colonization of the plantation was observed by green, spider and hymenotopter frogs. From the analysis of the observations that were made, the velocity of the proliferation of mealybugs was greater than the capacity of their annihilation by parasitoids. Such observations confirm the mixed results that have been obtained from biological control programs that have been developed in the Pacific Islands with parasitoid hymenotoptera.

At the first sprays of the combinations of inputs of sub-series C1 and D1, there is noted an annihilation of both clumps of cochineal and their eggs. The use of each of these combinations also allowed us to evoke the asphyxiating power, the efficiency and the efficiency of the said combinations. Fears of loss of market value of papayas were a concern, given the consistency of the sprayable solutions used. These fears were justified following the collection of some treated papaya solos. At the collection, they looked like a ripe papaya, peeled, they were early (figure 5). On the other hand, papaya pulverized to combinations of inputs B2, B3 and B4 of series B retained their commercial appearance (photos 6 and 7).

With regard to the spraying of the B-series input combinations, we noticed the annihilation of the clumps of mealybugs and their reconstitution following egg hatching, the first or even the second spray. The use of the B-series input combinations poses the recurring problem of their impact over time on mealybug eggs. It was justified by the reconstitution of the clumps of mealybugs in the interval of the spray frequency (7 days). At the second and third spraying, egg hatching was always observed. Even for close spraying at a frequency of 3 days, similar impacts were noted. The effectiveness and efficiency of the combinations of inputs used are symptomatic of the volume proportions of the black liquid soap inputs and the *Nicotiana tobacco* filtrate. The applications which have been made based on Dursban in addition to soap known as "omo" have been conclusive after 6 sprays close to each other at a one-day interval. These applications also had environmental and public health risks with respect to the synthetic chemical that was used.

Fig. 6**:** Papaya sprayed in series C

Fig. 7: Papaya sprayed B2 da Series B

Conclusion

Recursive analysis of the efficiency and effectiveness of combinations of inputs, C1 and D1 sub-series, noted allowed to bridge the conjugate effects of volumes of liquid black soap and *Nicotiana tobacco* filtrate On the annihilation of clusters and eggs of mealybugs. The homogeneity of volumes of liquid black soap and *Nicotiana tobacco* filtrate from the combination of inputs of the sub-series was very effective against the proliferation of paracoccus marginatus (Paracoccus marginatus) from solitary papayas and their eggs. Expression of a product called "Waus 43". However, the application of input combinations of the C1 sub-series causes early ripening, a shortening of the shelf life (less than 24 hours) and an organoleptic modification of the pulverized sola papayas. To this end, it will be necessary to deepen the knowledge on the quality of the black liquid soap used or even its replacement. The impacts of C and D series input combinations appear to be very effective and efficient in the treatment of recurrent planting of papayas solos by mealybug. However, due to the loss of the market value of papayas solos due to the very high concentration of liquid black soap and Nicotiana tobacco filtrate, a mechanism of their production is required. The spraying tests carried out using the combinations of series C and D reinforced our hypothesis (6 and 7).

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