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Metabolic factors of eggplant *solanum* spp. that affects hosts preference of *Leucinodes Orbonalis* Guenée (Lepidoptera: Pyralidae) and its implication in hosts- pests relationship

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Abstract
Leucinodes Orbonalis appears as the main constrain to Eggplant production. In Cameroon, many varieties of the genus *Solanum* (Solanaceae) are cultivated and their fruits compositions vary in terms of pH, carbohydrates, proteins, and polyphenols content. We investigated to see if primary and secondary metabolites content in the fruits could influence the preference of attacked due to *Leucinodes Orbonalis*. The damage due to *Leucinodes Orbonalis* were compared on two species of two cultivars each. These experimentations were carrying out both in the laboratory and on the field. On "zong", "inerme", "jakatu" and "F1 African beauty" varieties, the pH of the fruits was 5.22, 4.57, 5.4 and 5.02 respectively; the sugar content of the fruits was 6.45 mg/g, 4.79 mg/g, 7.92 mg/g and 7.85 mg/g respectively; the polyphenol content of the fruit was 5.74 mg/g, 6.79 mg/g, 5.26 mg/g and 4.63 mg/g and the protein content of the fruit was 3.02 mg/g, 1.66 mg/g, 4.48 mg/g and 4.25 mg/g respectively. The study on the susceptibility of the species/varieties of *Solanum* spp. showed that *S. melongena* var. inerme was the most resistant (with 47.8%) and that *S. Aethiopicum* var. jakatu, most susceptible (with 79.47%) to attacks due to *Leucinodes Orbonalis*. The study also showed that total sugars, total proteins and pH value levels were positively and significantly correlated with attacks due to *Leucinodes Orbonalis* (r=0.97*, r=0.86* and r=0.70* respectively) while the total polyphenols content in the fruits was negatively and significantly correlated with the same attacks due to the same fruit pests (r=0.76*). These informations can be of great importance in the varietal selections by farmers.

Keywords: Biochemical parameters, damage, *Leucinodes Orbonalis*, correlation, susceptibility

1. Introduction
Eggplant (*Solanum* spp.) is one of the important vegetables in India which contributes 9% of total vegetables [1]. It is a good source of nutrients, minerals, antioxidants, vitamins, dietary fiber and body building factors and proteins [2-3]. It is also one of the most important vegetables in Southern Cameroon, grown throughout tropical, sub-tropical and warm temperature areas of the world. Large areas of Southern Cameroon's former cocoa and coffee farms have been replaced by food crops [4]. In these food crops, gardening occupies an important position primarily in Southern Cameroon [5]. However, the fruits and stems of these crops are attacked by larvae of *Leucinodes Orbonalis* that cause economic damage and especially significantly reduce their yield by 100% if no control measures are applied [6].
Biochemical factors of the eggplant have been reported to play a vital role of resistance to various fruit insects and disease pests [7] and relatively resistant varieties contained higher amount of secondary metabolites inherently [8]. In the other hand, susceptibility of the host eggplant might be due to enrichment of essential and necessary food and materials especially carbohydrate and proteins [9-10]. The objectives of the study were: (1) to evaluate average damage due to *Leucinodes Orbonalis* on each species/variety of *Solanum* spp., (2) to compare the pH, total sugars, total polyphenols and total protein's fruits yields of different *Solanum* spp. and finally, (3) to search if the damages caused by *Leucinodes Orbonalis* on fruits were correlated to the biochemical parameters of the fruits.

2. Materials and Methods

1. Study sites: The study was conducted at the campus of the Higher Teacher Training College (03°51'35.5''N, 011°30'37.1''E, ASL. 729 m) of the University of Yaoundé I (Central Region) with humid tropical bimodal rainfall regime characterized by a succession of four seasons (Fig. 1). The fresh fruit of the *Solanum* spp. and the fruits attacked by *Leucinodes Orbonalis* were harvested in the experimental garden which we had previously set up. The extraction and determination of the pH and biochemical parameters (total proteins, total sugars and total polyphenols) of the fresh fruits were carried out using the material made available by the laboratory of Biochemistry and Vegetable Physiology from the same school. The incubations of the fruits attacked were carried out at the laboratory of Zoology of the Higher Teacher Training College. The biochemical parameters of the fruits were synchronized with the incubations of fruits attacked by *L. Orbonalis* during the same period.

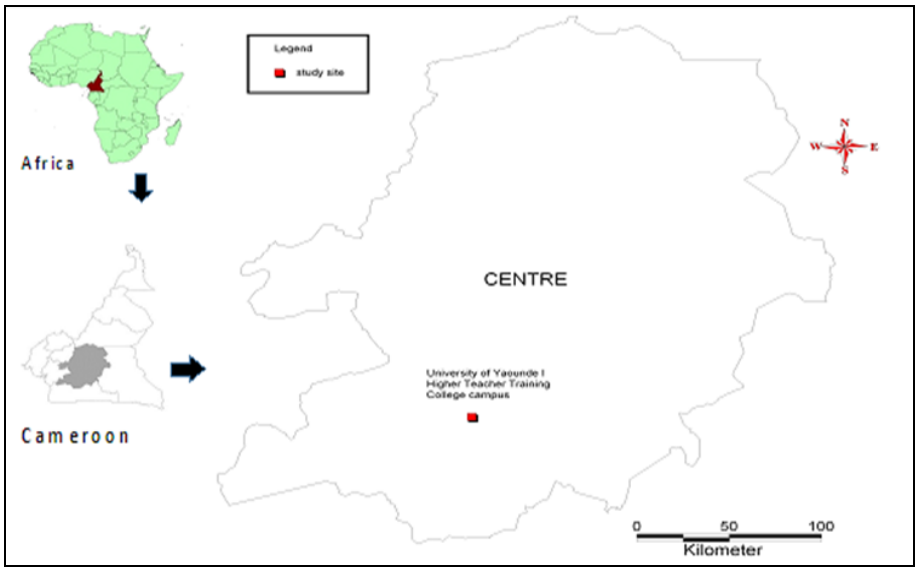


Fig 1: Study sites at Higher Teacher Training College of the University of Yaoundé I.

2. Biological material and chemical composition of fresh fruits of *Solanum* spp.

-The biological material in this study was composed of fresh harvested fruits of the four species/varieties of *Solanum* spp.: The fruits of *Solanum Aethiopicum* var. zong (less sweet) (Fig.2a), *Solanum Aethiopicum* var. jakatu (sweet) (Fig.2b), *Solanum melongena* var. inerme (bitter) (Fig.2c) and *Solanum melongena* var. F1 African beauty (neutral taste) as control (Fig.2d).

Fig 2: Mature and fresh's fruits of *Solanum* spp.: (a) *S. Aethiopicum* var. zong, (b) *S. Aethiopicum* var. jakatu, (c) *S. melongena* var. inerme and (d) *S. melongena* var. F1 African beauty (as control).

The table below presents the chemical composition of fresh fruits of *Solanum* spp. Per 100 g of fruits. From: [11-12-13-14-15-16] (Tab.1).

Table 1: Chemical composition per 100 g of comestible parts of fresh fruits of *Solanum* spp

Parameters	Fruits of *S. Aethiopicum*	Fruits of *S. Melongena*
Water	90,6 g	92 g
Energy	135 kj	75 kj
Glucids	7,2 g	4,6 g
Protids	1,5 g	1,2 g
Lipids	0,1 g	0,2 g
Fibers	2,0 g	2,5 g
Calcium (Ca)	28 mg	13 mg
Potassium (K)	47 mg	214-250 mg
Ion (Io)	1,5 mg	0,4 mg
Sodium (Na)	-	3-8 mg
Magnesium (Mg)	-	72 mg
Phosphore (P)	-	26 mg
Zinc (Zn)	-	0,6 mg
Manganese (Mn)	-	0,8 mg
Vitamin B	-	0,05 mg
Vitamin C	-	5 mg
Vitamin E	-	1,5 mg
Total minerals	-	500 mg
Organic acid	-	400 mg
B-carotene	0,35 mg	-
Thiamin	0,07 mg	-
Riboflavin	0,06 mg	-
Niacin	0,8 mg	-
Ascorbic acid	8 mg	-

Note: *S. Aethiopicum* = *Solanum Aethiopicum*, *S. Melongena* = *Solanum melongena*

3 Experimental design

At the campus of the Higher Teacher Training College, eight beds (5 m long by 1.5 m wide) with two beds per variety of *Solanum* spp. have been fitted out. Each board had two rows (rows) of legs. The number of feet of a variety per board was 10 feet at the rate of 05 feet per line for a total of 20 feet per variety and 80 feet for all varieties combined. Adjacent boards were separated by 0.5 m furrows and on each board the feet were spaced 1 m on the line and 1.3 m between the lines.

4 Data collections

4.1 Evaluation of the damages due to *Leucinodes Orbonalis*

From February to May 2018, damages were assessed from harvested fruits at the experimental garden. Fruits showing the attacks due to *L. Orbonalis* were sorted. A fruit was considered attacked when it had penetration holes or larval exit holes. Some apparently healthy fruits have been dissected to testify the presence of *L. Orbonalis* larvae. The mean damage due to *L. Orbonalis* represents the average of the weekly infestations. We used the ratio of the number of fruits of each cultivars of *Solanum* spp. having undergoes attacks on the numbers of total fruits harvested. Fruit infestation (*FI*) was calculated in per cent using the following formula:

$$\% FI = (Nif / Nthf)*100$$

Where:
% FI = Per cent fruit infestation per *Solanum* spp. variety; *Nif* = Number of infested fruits per *Solanum* spp. variety harvest's month; *Nthf* = Number of total harvested fruits per *Solanum* spp. variety.

4.2 Biochemical fruit parameters

In order to understand the influence of *Solanum* spp varieties. on the variation of the attack rate caused by *L. Orbonalis*, the fruits of *S. Aethiopicum* var. zong, *S. Aethiopicum* var. Jakatu, *S. Melongena* var. inerme and *S. melongena* var. F1 African beauty were subjected to biochemical analyzes. The pH values, total sugars, total polyphenols and total proteins contents of the fruits have been evaluated. These various chemical and biochemical parameters allowed us to understand the reaction of the host plant (susceptibility or resistance) to the attacks of *L. Orbonalis*. We performed four replications per month for each biochemical parameter and pH.

4.2.1 pH measure

The pH was measured according to the method described by Anonymous 4 (AOAC). Two (02) grams of fresh material of the four species/varieties of *Solanum* spp. are crushed to the ''Sayon'' brand blender. Then 20 ml of water previously boiled using a ''Gallenham'' hot plate are added. The whole is stirred with a magnetic strip for 3 minutes placed on a magnetic stirrer of mark ''Bensun MC-'' and then it is immediately filtered in a tube. The whole is left to stand until the temperature is 20 °C. The pH is then measured at the pH meter.

4.2.2 Extraction

4.2.2.1 Total sugars extraction

Extraction of the total sugars was carried out according to the method described by [18]. Two hundred (200) grams of fresh material of the four species/varieties of *Solanum* spp. are finely ground in 80° ethanol (0.2g/ml). The mixture is centrifuged at 3000 rpm for 30 minutes. The supernatant is recovered and constitutes an alcoholic extract of the soluble sugars and the amino acids for the assay.

4.2.2.2 Total polyphenols extraction

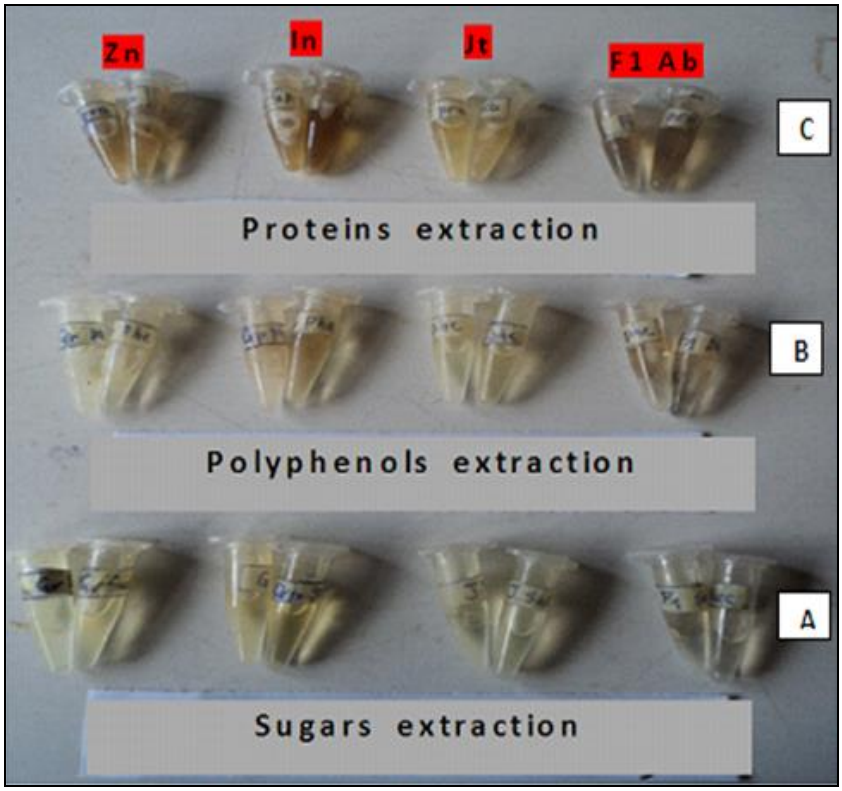
Extraction of the total polyphenols was carried out according to the method described by [19]. Three (03) grams of fresh material of each substrate are ground at 4°C in 9 ml of 0.1 HCl N. After incubation at 4°C for 20 minutes, the ground

material is centrifuged at 3000 × g for 30 minutes. The supernatant is collected and then the suspended pellet is treated as before. The two supernatants are mixed and then constitute the crude extract of the soluble phenols.

4.2.2.3 Total proteins extraction

Extraction of the total proteins was carried out according to the method described by [17]. Two (02) grams of fresh plant material from the 04 species/varieties of *Solanum* spp. are weighed using a "Metlar MT 500" electronic scale and crushed in 6 ml of buffer Tris-HCl 0.1 M pH 7.2 containing 0.25 M sucrose and 1 mM MgCl 2. The mixture is incubated at 4°C for 20 minutes at which time it is centrifuged at 3000 x g for 40 minutes using a centrifuge of the brand "G 3 Select LW Scientific 800-726-7345". The supernatant S1 obtained constitutes the fraction of the soluble proteins.

Extracts of total sugars, total polyphenols and total proteins from fruits of *Solanum* spp. are illustrated in (Fig. 3).



Note: Zn=*S. Aethiopicum* var. zong, In=*S. melongena* var. inerme, Jt=*S. Aethiopicum* var. jakatu and F1 Ab=*S. melongena* var. F1 African beauty.

Fig 3: Extraction product of: (A) Total sugars, (B) Total polyphenols and (C) Total proteins on *Solanum* spp. fruits from February to May 2018

4.2.3 Dosage

4.2.3.1 Total sugars dosage

The total sugars were assayed by the anthrone method [21]. (Yemm and Willis, 1954). This method uses the property of simple sugars with at least five carbon atoms to be dehydrated and converted into furfural or furfural derivatives in concentrated acid and hot media. Pentoses are transformed into furfural and hexoses into 5-hydroxymethylfurfural. These furfural derivatives are capable of combining with various phenolic substances possessing mobile H (anthrone, orcinol and resorcinol) to give colored products whose properties are characteristic of the starting carbohydrates. Therefore, in the presence of anthrone, these furfural derivatives give a colored complex in green.

4.2.3.2 Total polyphenols dosage

The content of soluble phenolic compounds of the various substrates is determined according to the method of [20].using the reagent Folin and Ciocalteu (mixture of phosphomolybdic and phosphotungstic acids). This method is based on the fact that this reagent is reduced in the presence of phenol to a molybdenum blue complex. This complex has a maximum absorption in the vicinity of 725 nm. For the assay, 30 µl of phenolic extract, 200 µl of Folin and Ciocalteu reagent, 2.5 ml of distilled water and 0.5 ml of 20% sodium carbonate are incubated at 40 ºC for 20 minutes. The absorbance of the blue complex formed is read by the spectrophotometer at 725 nm against a white in which the phenolic extract is replaced by 0.1 N HCl.

4.2.3.3 Total proteins dosage

The total proteins assay was carried out according to the method of [22]. In a tube, 2 ml of the Bradford reagent are added to 50 µl of protein extract. The whole is left to stand at room temperature for 2 minutes, then the optical density is read at 595 nm on the spectrophotometer against a blank in which the protein extract is replaced by the extraction buffer.

The content of total phenols, sugars and proteins is expressed in mg equivalent Gallic acid/g of fresh material according to formula:

$$QFM\ (mg/g) = (\Delta\ OD * V.b) / (V.\ extract * a * FW)$$

Where:

QFM = Quantity of fresh material (mg/g), OD = Optical Density, $V._t$ = Volume of buffer (ml), a = Slope of the calibration line, $V._{extract}$ = Volume of extract used (µl), F W= Fresh weight of plant material (g).

5 Relationship between the pH, the biochemical parameters and fruit damage due to *L. Orbonalis*

The means pH values, total proteins, total sugars and mean total polyphenols contents of the attacked fruits of each *Solanum* species/variety were correlated to the mean attack rates due to *Leucinodes Orbonalis*.

6 Statistical analysis

The damage of *Leucinodes Orbonalis* was recorded by counting total number with the damaged once. Four monthly data on different biochemical fruit parameters were also recorded. Data so obtained were then subjected to statistical analysis for correlation and test of significance. Because the data were continuous and temporally independent, we use ANOVA test to appreciate the variation of attack rate on species/varieties of *Solanum* spp. The nonparametric correlation of Spearman was used to analyze the relationship between biochemical fruit parameters and fruit losses. This was doing in version 6.0 of STATISTICA software. All probabilities were appreciated at 5%.

7. Results

1. Mean damage due to *Leucinodes Orbonalis* on fruits of *Solanum* spp.

Damages due to *Leucinodes Orbonalis* on the fruits are presented in Table 2. Analyses of these data showed that the damage caused by the pests were significantly different within species/varieties F =58.08, df = 3, $p < 0.05$). The fruits of *S. Aethiopicum* var. jakatu suffered the highest average damage (79.47 ± 7.97%) and those of *S. melongena* var. inerme, the lowest average damage (47.8 ± 7.15%). The fruits of the two species/varieties of Solanum spp. are respectively susceptible and resistant to attacks caused by *Leucinodes Orbonalis*.

Table 2: Mean damage due to *Leucinodes Orbonalis* on species/varieties of *Solanum* spp

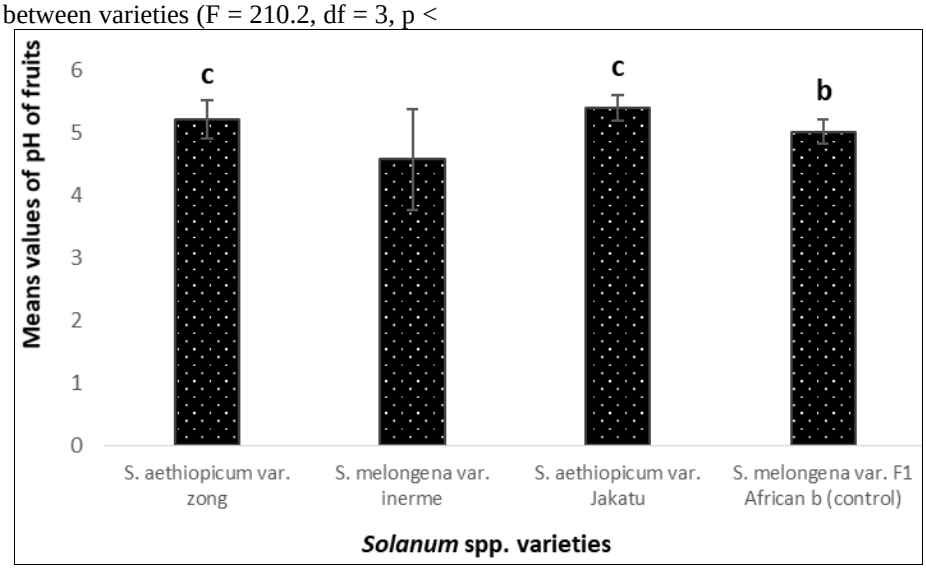
Species/varieties of *Solanum* spp.	Mean damage (%) ± SD
Solanum Aethiopicum var. zong	62.51±9.44% **b**
Solanum Aethiopicum var. jakatu	79.47±7.97% **c**
Solanum melongena var. inerme	47.8±7.15% **a**
Mean ± SD	63.26±14.17
P-value	< 0.05

Note: SD=Standard Deviation, Var. = Solanum spp. variety, Mean damage affected of the different letters are significantly different according ANOVA (HSD Tukey test) at the threshold of 5%.

2 Biochemical values of *Solanum* spp. fruits

2.1 pH

The different varieties of *Solanum* spp. were also compare on the base of their pH. The different pH values showed significant variations between varieties (F = 210.2, df = 3, $p < 0.01$). The mean values were: 5.22 ± 0.3, 4.57 ± 0.8, 5.4 ± 0.2 and 5.02 ± 0.2 (N = 4) respectively for *S. Aethiopicum* var. zong, *S. melongena* var. inerme, *S. Aethiopicum* var. jakatu and *S. melongena* var. F1 African beauty, of (Fig. 4)

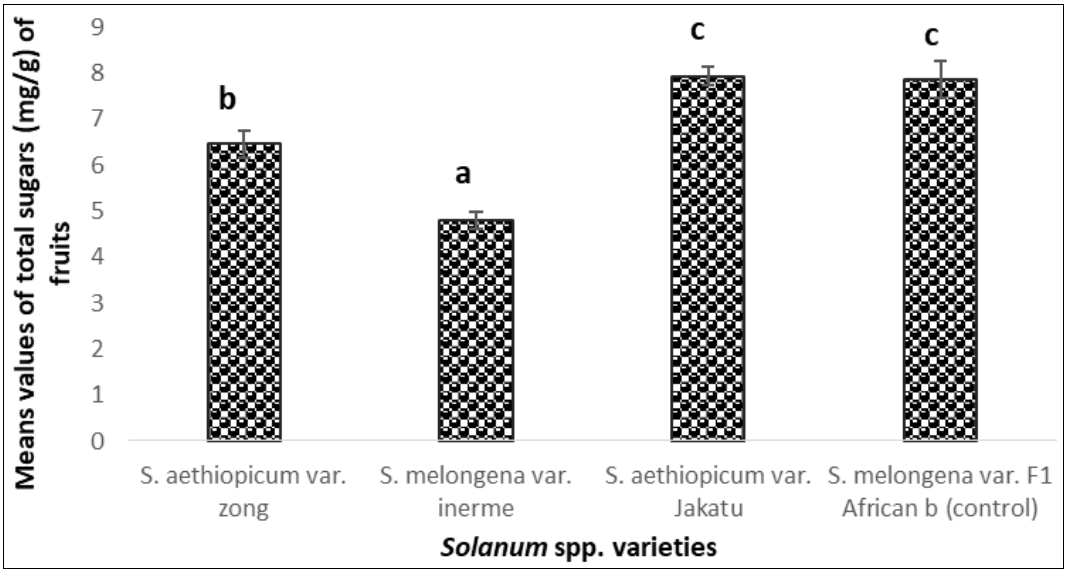


Note: a, b, c: Mean followed by the different letter (s) differ significantly at $p<0.05$ (HSD Tukey *test*) and followed by the common letter (s) do not differ significantly ($p\geq0.05$, HSD Tukey *test*).

Fig 4: Mean values of pH of *Solanum* spp fruits.

2.2 Total sugars

Statistical comparisons of the average sugar content of *Solanum* spp. fruits showed significant variations between varieties (F = 92.581, df = 3, $p < 0.01$). For *S. Aethiopicum* var. zong, *S. melongena* var. inerme, *S. Aethiopicum* var. jakatu and *S. melongena* var. F1 African beauty, this content was respectively of: 6.45 ± 0.3 mg/g, 4.79 ± 0.2 mg/g, of 7.92 ± 0.2 mg/g and 7.85 ± 0.4 mg/g (N = 4) (Fig. 5).

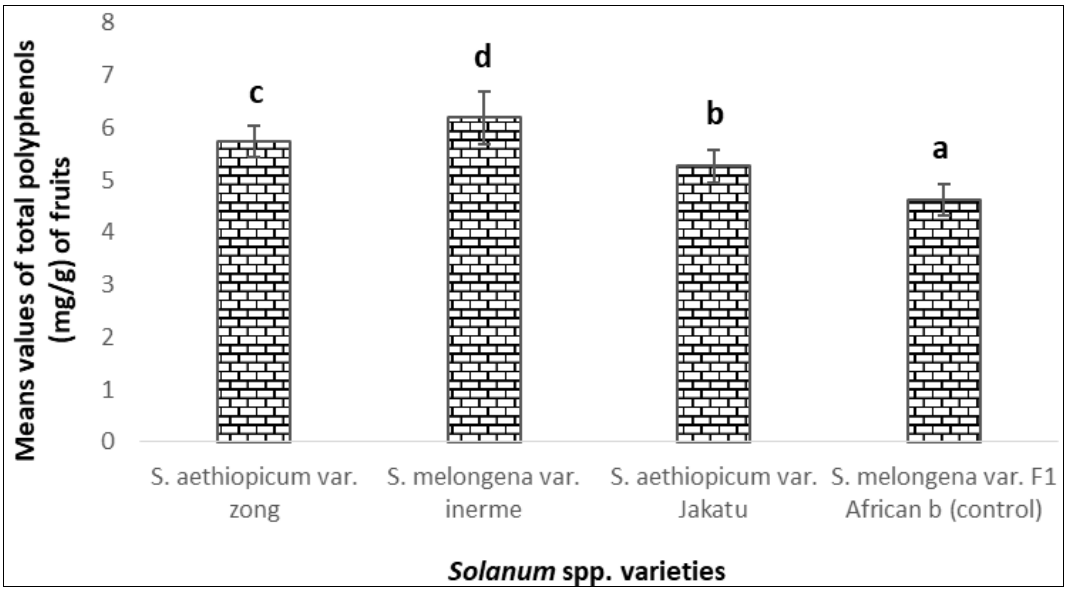


Note: a, b, c: Mean followed by the different letter (s) differ significantly at p<0.05 (HSD Tukey *test*) and AR followed by the common letter (s) do not differ significantly (p≥0.05, HSD Tukey *test*).

Fig 5: Mean values of total sugars fruits of *Solanum* spp.

2.3 Total polyphenols

The average polyphenols content of *Solanum* spp. fruits showed significant variations between the different species/varieties (F = 52.08, df = 3, p<0.01). It is: 5.74 ± 0.3 mg/g of fresh material for *S. Aethiopicum* var. zong, 6.19 ± 0.5 mg/g of fresh material for *S. melongena* var. inerme, of 5.26 ± 0.3 mg/g of fresh material for *S. Aethiopicum* var. jakatu and 4.63 ± 0.3 mg/g of fresh material for *S. melongena* var. F1 African beauty (N = 4) (Fig. 6).

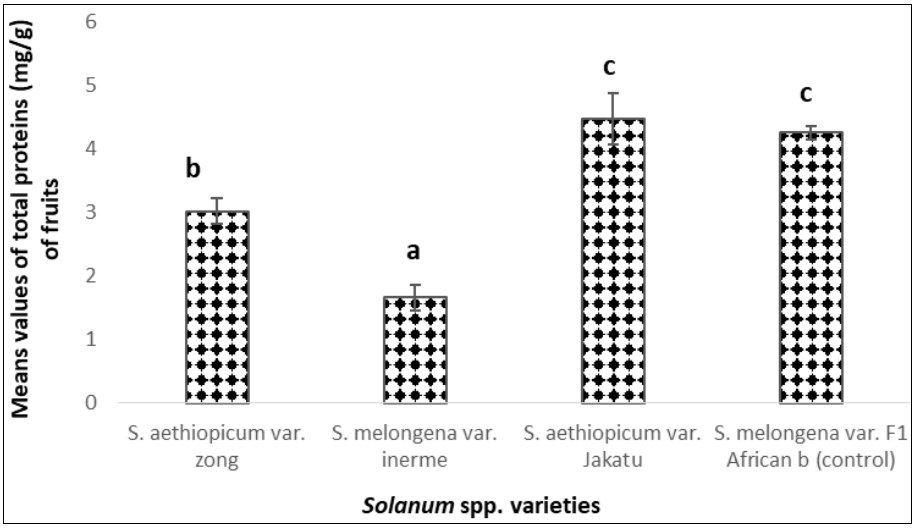


Note: a, b, c, d: Mean followed by the different letter (s) differ significantly at p<0.05 (HSD Tukey *test*) and AR followed by the common letter (s) do not differ significantly (p≥0.05, HSD Tukey *test*).

Fig 6: Mean values of total polyphenols fruits of *Solanum* spp.

2.4 Total proteins

As for the average total proteins content, statistical comparisons between the varieties of eggplants show significant variations (F = 159.25, df = 3, p < 0.01). This content is: 3.02 ± 0.2 mg/g for *S. Aethiopicum* var. zong; of 1.66 ± 0.2 mg/g for *S. melongena* var. inerme; of 4.48 ± 0.4 mg/g for *S. Aethiopicum* var. jakatu and 4.25 ± 0.1 mg/g for *S. melongena* var. F1 African beauty (N=4) (Fig. 7).



Note: a, b, c: Mean followed by the different letter (s) differ significantly at p<0.05 (HSD Tukey *test*) and AR followed by the common letter (s) do not differ significantly (p≥0.05, HSD Tukey *test*).

Fig 7: Mean values of total proteins fruits of *Solanum* spp.

It should be noted that *S. Aethiopicum* var. jakatu is therefore richer in proteins, followed by *S. Aethiopicum* var. zong. They also have a less acidic pH compared to other *Solanum* spp. These two varieties have a biotope that is conducive to the effective development of *Leucinodes Orbonalis* larvae, because in these two varieties the attack rates were higher throughout the study (Tab. 3).

Table 3: Mean values of total proteins, polyphenols, sugars (in mg/g of fresh material) and pH values of *Solanum* spp. fruits

	***Solanum* spp. varieties**				
Means values of pH and biochemical parameters	***Solanum Aethiopicum* var. zong**	***Solanum melongena* var. inerme**	***Solanum Aethiopicum* var. Jakatu**	***Solanum melongena* var. F1 Africa beauty (control)**	**N**
pH	5.22±0.03c	4.58±0.08a	5.40±0.02c	5.02±0.02b	4
Total sugars	6,45±0,02b	4,79±0,02a	7,92±0,02c	7,85±0,03c	4
Total polyphenols	5,74±0,02d	6,19±0,04a	5,26±0,02c	4,63±0,03b	4
Total proteins	3,02±0,01c	1,66±0,02b	4,48±0,03c	1,04±0,01a	4

Note: a, b, c, d: Mean followed by the different letter (s) differ significantly at p<0.05 (HSD Tukey test) and followed by the common letter (s) do not differ significantly (p≥0.05, HSD Tukey test). N=number of replication

3. Correlation between biochemical fruits parameters and fruits damage due to *L. Orbonalis*

The average pH values of the fruits showed a positive and significant correlation with the damage due to *L. Orbonalis* (r = 0.70, R^2 = 0.65, y = 21.267x-41.15). It also showed a positive and significant correlation with proteins content (r = 0.9, p < 0.05) and sugars content (r = 0.88, p < 0.05). On the other hand, the pH values showed a negative and significant correlation with the total polyphenols content of the fruit (r = -0.91, p < 0.05) (Table 4). *Solanum Aethiopicum* var. jakatu which has a high pH value also has the highest attack rate. The pH would play a major role in fruit loss.

The average total polyphenols content of the *Solanum* spp. fruits showed a negative and significant correlation with the damage due to *L. Orbonalis* (r = -0.76, R^2 = 0.92, y = -23.53x + 201.48). It also showed a negative and significant correlation with the proteins content (r = -0.91, p < 0.05) and with the sugars content (r = -0.88, p < 0.05) (Table 4). *Solanum melongena* var. inerme which has a higher polyphenols value also has the lowest infestation rate. The phenolic compounds contained in the fruit tissues would make it possible to resist attacks by pests.

The average total proteins content of *Solanum* spp. fruits showed a positive and significant correlation with the damage due to *Leucinodes Orbonalis* (r = 0.88, R^2 = 0.91, y = 7.739x + 42.95). It also showed a positive and significant correlation with the sugars content (r = 0.93, p < 0.05) (Table 4). Proteins could also play a positive role in the susceptibility of some *Solanum* spp. to pest attacks. Proteins are probably substances that play a role in the growth of larvae in fruits.

The average total sugars content of the *Solanum* spp. fruits showed a positive and significant correlation with the damage due to *Leucinodes Orbonalis* (r = 0.91, R^2 = 0.88, y = 6.838x+22.91).

Like the proteins, the sugars contained in the fruits would allow a favorable development to the larvae and thus cause a greater susceptibility of the fruits to the attacks of the pests. We observe a positive linear relation between the pH values, total proteins and total sugars content of the fruits and the damage due to *L. Orbonalis* and a negative linear relationship between the polyphenols content of the fruits and the same damage. Thus, the fruits of *S. Aethiopicum* var. jakatu which have a higher content of sugars, higher pH, higher proteins and lower polyphenols have also been the most attacked. The fruits of *S. Aethiopicum* var. zong which have a moderately high content of sugars, proteins, pH values and polyphenols have been moderately attacked. On the other hand, the fruits of *S. melongena* var. inerme with lower levels of sugars, proteins and pH values and a higher polyphenols content were less affected. This species/variety therefore remains resistant to attacks due to *L. Orbonalis*.

In view of our results, we can say that if the fruit of a

Solanum spp. is rich in sugars, proteins and low in polyphenols, it remains susceptible to attack because the larvae find an environment favorable to their development and growth. On the other hand, if the fruit is rich in polyphenols and low in sugars and proteins, it is more resistant to attack because larvae find an unfavorable environment. The varieties with intermediate levels of sugars, proteins and polyphenols in fruits are then moderately attacked.

Table 4: Correlation and linear regression between biochemical parameters of *Solanum* spp. fruits and damage due to *Leucinodes Orbonalis*

Species/varieties of *Solanum* spp.	Means damage (%)§	pH§ values	Total polyphenols (mg/g)§	Total proteins (mg/g)§	Total sugar (en mg/g)§
S. aethiopicum var. zong	62,51%^{b}	5,22^{b}	5,74^{b}	3,02^{b}	6,45^{b}
S. melongena var. inerme	47,8%^{a}	4,57^{a}	6,19^{c}	1,66^{a}	4,79^{a}
S. aethiopicum var. jakatu	79,47%^{c}	5,40^{b}	5,26^{a}	4,48^{c}	7,92^{c}
Means	63,26	5,06	5,73	3,05	6,39
±SD	±14,17	±0,39	±0,41	±1,26	±1,40
pH	-	-	-0,91*	0,9*	0,88*
Total polyphenols (mg/g)	-	-	-	-0,91*	-0,88*
Total proteins (mg/g)	-	-	-	-	0,93*
Total sugars (mg/g)	-	-	-	-	-
r	-	0,70*	-0,76*	0,86*	0,91*
R^2	-	0,656	0,9157	0,915	0,882
Y	-	21,267x -41,15	-23,53x +201,48	7,739x +42,95	6,838x +22,91

§: Mean of four replications per month; The means followed by different letters on the same column show significative difference;
*: Significative at $p<0.05$; y=ax + b: regression equation (a and b, constants).

Discussion

Biochemical parameters of fruits and mean damage due to *Leucinodes Orbonalis*

The biochemical parameters namely sugars, polyphenols and proteins were obtained on the fruits of solanum spp. [11] found that the proteins and sugars concentration, on the fruits of *S. Macrocarpon*, were higher but close to ours on the proteins and sugars content (4.25mg/g and 7.85mg/g respectively) of the fruits of *S. melongena* var. F1 African beauty. We noted that this difference was not significant. The results obtained by [11] concerning proteins and carbohydrates are similar to ours on *S. melongena* var. inerme (1.66 mg/g for proteins content) and *S. melongena* var. F1 African beauty (7.92 mg/g for sugars content). On the other hand, we observed in our study that *Solanum* with high sugars and low polyphenols content were the most attacked (*S. Aethiopicum* var. Jakatu) and *Solanum* with low sugars and high polyphenols content, the least attacked (case of *S. melongena* var. inerme). On the other hand, *Solanum* with average sugars and polyphenols content showed average damage (*S. Aethiopicum* var. zong).

The work of [10] in Bangladesh showed that the Melongena EG075 (susceptible) variety with a sugars content of 4.58 mg/100mg ps and a polyphenols content of 3.04 mg/g had a higher attack rate of 75.29% and Melongena TURBO (resistant) with 2.78 mg/100 mg of sugars level and 7.09 mg/g of polyphenols content, with a lower attack rate of 32.63%. On the other hand, [23] in India show that Sweta (resistant), Green Gold (tolerant) and Bejo Sheetal (very susceptible) with damage of 9.8%, 20.4% and 35.7% respectively, have total sugars, total phenols and total chlorophylls of 5.76 mg/g; 7.61 mg/g and 1.23 mg/g (for the first variety), 11.91 mg/g; 3.87 mg/g and 1.47 mg/g (for the second variety) and 18.02 mg/g; 1.95 mg/g and 1.86 mg/g (for the third variety).

In fact *Solanum* spp. with a high Chlorophyll content are also the most attacked such as those with a high sugars content and a lower polyphenols content. Less damage on fruits of *S. melongena* var. inerme due to *L. Orbonalis* in our study sites show that this variety is more resistant and less susceptible to attacks because of the lower chlorophyll content of its tissues, its pH which tends toward (lower) acid, and with lower levels of sugars and proteins [24]. The work of [25] also showed that some local varieties of eggplant (unsweetened and bitter) had strong resistance to *L. Orbonalis* attacks with an infestation rate ranging from 1 to 10% only.

Correlation between fruit damage due to *Leucinodes Orbonalis* and biochemical fruits parameters

The damage due to *L. Orbonalis* on the fruits of *Solanum* spp. showed positive and significant correlations with the pH, sugars, proteins and a negative and significant correlation with the polyphenols content. Similar results were obtained by [10] where the percentage of infestation due to *L. Orbonalis* on brinjal eggplant fruit showed a negative and significant correlation with the content of polyphenols (r=-0.792) and a positive and significant correlation with sugar content (r=0.972**). [23] Also showed that pest damage on brinjal eggplant stems showed positive correlations with total chlorophylls (r=0.99), total sugars (r=0.897), and negative correlation with the total polyphenols (r=-0.886).

The degrees of infestation of the fruits of the three species/varieties of *Solanum* spp. due to *L. Orbonalis* are not the same probably due to the biophysical properties of the fruits of each species/variety. The fruits of *S. Aethiopicum* var. are elongated, broad and sweet with higher pH, sugars and proteins. The fruits of *S. Aethiopicum* var. zong are short, broad and less sweet with a medium pH, sugars and proteins content and fruits of *S. melongena* var. inerme are less elongated, less broad and bitter with low contents of the same parameters. Females of *L. Orbonalis* would prefer to lay on the larger, sweet, protein-rich and less acidic varieties for optimal larval development.

Conclusion

The study revealed that *Solanum* varieties that are richer in sugars, proteins and with low polyphenols quantity are more susceptible to attack of *Leucinodes Orbonalis* larvae. More over the varieties with intermediate levels of sugars, proteins and polyphenols content in their fruits are moderately attacked. Lastly, *Solanum* varieties richer in polyphenols and low in sugars and proteins are more resistant to attack because

larvae find an unfavorable environment. Polyphenols confer a selective advantage to *S. melongena* var. inerme, against *Leucinodes Orbonalis*.

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