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RESEARCH ARTICLE

PHYTOCHEMICAL ANALYSIS, EVALUATION OF THE ANTIOXIDANT AND ANTIBACTERIAL ACTIVITY OF *SOLANUM RUGOSUM* DUNAL FROM CÔTE D'IVOIRE

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ABSTRACT

This research is mainly focused on *Solanum rugosum* which is a well-known Solanaceae found in Côte d'Ivoire. The goal of the study was to investigate the chemical composition of the crude extract; total phenolic, flavonoid compounds, antioxidant and antibacterial activities of *S. rugosum* from Côte d'Ivoire. It was found that Ca, K, P, Cl, S, Si, Pb, Na, Fe, Al, Cu, Zn, Va, Se and Mg are the major minerals imbedded in the plant. The phytochemical screening using thin layer chromatography (TLC) carried out on the extracts of the leaves, stem bark and the roots bark has highlightedthe presence of various classes of secondary phytocompounds (coumarins, flavonoids, alkaloids, sterols, tannins and terpenes). The crude hydromethanolic extracts has shown a specific potential by reducing iron and trapping DPPH free radicalmainly in the leaves of *S. rugosum*. The extracts of the leaves showed a significant action against *Staphylococcus aureus* ATCC, *Staphylococcus aureus* 348C / 19 CNRa and *Pseudomonas aeruginosa* ATCC.

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INTRODUCTION

Côte d'Ivoire, due to its geographical location, has an abundant, rich and varied flora in which many medicinal species are found (Abderrahim, 2011). The efficiency of the plants are largely due to their content in secondary metabolites. *Solanum rugosum*is largely spreaded in Côte d'Ivoire,generally itgrows in the brush and can easily be found at the edge of the forests. *Solanum rugosum* is a shrub or small tree with spreading branches of 1 to 5 meters high. The stem is yellowish brown, cylindrical felting with a short bole up to 10 cm in diameter. The flowers are hermaphrodite yellowish white in colour and the leaves are short-petiole, simple, alternate, with stipules. The fruits are spherical in diameter, varying between 9 and 11 mm and generallycoloured in green (Anonymous 1; Agra *et al*., 2009). This plant is used in folk medicine and the leaves are used in the treatment of skin wounds and are inedible(Kamagate *et al*., 2015).The powder of the leaves obtained after grinding and drying for two weeks in the shade is commonly used to treat buruli ulcer, haemorrhoids (Trebissou *et al*., 2014) and also as contraceptive in Côte d'Ivoire (field survey). Compounds isolated from the fruits of *Solanum rugosum* have shown good antifungal activity (Pinto *et al*., 2011) and molluscicide (Silva *et al*., 2008).

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Regarding the chemical composition of *Solanum rugosum*;some glycoalkaloids (solasonin and solamargine) were isolated from the fruits, whereas ~~in~~ the leaves are rich in flavonoids (tiliroside, 7-o-α-L-ramnopyranosyl, kaempferol-3-o- [β-D-glucopyranosyl- (1- 6) -α-L-ramnopyranosyl], proline (amino acid) and eicosanoic acid (Pinto *et al*., 2011).The essential oil extracted from the leaves was mainly dominated by (E)-β-caryophyllene (33.7%), β-elemol (19.8%) and germacrene D (14.4%)(Kouao*et al*.,2019).The aim of the present work was a scientific contribution in order to evaluate the chemical composition of *Solanum rugosum*, its antioxidant potential and antibacterial activity,as very few studies have been undertaken on this species.

MATERIALS AND METHODS

Plant material: The plant material consists of leaves, stem bark and root bark of *Solanum rugosum*harvested in the month of July 2018 in the district of Abidjan. The identification was made by thebotanists ofUniversité Nangui Abrogoua and CNF (Centre National de Floristique) of Université Félix Houphouët-Boigny with references LAA 10504.

Methods

Mineral analysis by X-ray Fluorescence Spectrometry (XRF): The dry material was incinerated in an electric

ovenbranded Nabertherm More thanheart at 350 ° C. The ash obtained (4g) was intimately mixed with 1 g ofbinder powder to make a pellet. It was then analysed with an X-ray fluorescence spectrometer (AMETEK spectro Xepos. ED2000) coupled a computer which makes it possible to process the data using a specific software (Oxford Xpertease Windows).

Preparation of the different extracts: 10 g of powder from each organ were macerated in 125 ml of MeOH (80%) with continuous stirring for 24 h. After filtration through Büchner, the macerations obtained were combined and then evaporated with a rotary evaporator. The crude hydromethanolic extracts were subsequently used for the dosage, antioxidant, biological activity and for the preparation of all the selective extracts (4 × 25 ml of hexane, chloroform, ethyl acetate and n- butanol). Afterwards, the different organic fractions were concentrated with a rotary evaporator under a reduced pressure and then used for all the phytochemical tests.

Qualitative Test: The phytochemical screening carried out by thin layer chromatography (TLC) of the selective extracts was carried out to reveal their chemical composition. The eluents used were; Hexane extract: Hexane / AcOEt (5.5 / 1.5; v / v) for the leaves and Hexane / AcOEt (5/3; v / v) for the bark of stems and roots. For the chloroformic extract, it was used: $CHCl_3$ / EtOH / NH_3 (5/1 / 0.1; v / v / v); Ethyl acetate extract: AcOH / $CHCl_3$ / EtOH / H_2O / AcOEt (1.25 / 3 / 0.25 / 0.25 / 2; v / v / v/ v /v), finally forn-butanol extract: AcOH / $CHCl_3$ / EtOH / H_2O / AcOEt (4 / 3.75 / 0.5 / 0.5 / 4; v /v / v/ v / v). Godin (sterols,terpenes and flavonoids); $AlCl_3$ 1% m/v (flavonoids); KOH 5% m/v (coumarins, anthracenes); $FeCl_3$ 2% m/v (tannins, phenolic acids); Liebermann-Bürchard (sterols and terpenes); basic lead acetate 5% m/v (coumarins); NH_3(coumarins, anthocyanins, flavonoids); Neu (flavonoids), Dragendor'ff (alkaloids)were the reagents used to identify the different compounds. The interpretation of the obtainedresults was possible based on previous works carried out by Kabran, 2014; Konan, 2010; N'gaman, 2013; N'guessan, *et al*., 2011; Lagnika, 2005; Ekoumou, 2003; Georgievskii, *et al*., 1990.

Determination of total polyphenols: The total phenolic contentwas determined according to the Folin-Ciocalteu colorimetric method (Singleton *et al*., 1999; Heilerová *et al*., 2003) modifiedby Konan, 2010. To 1 ml of each extract, were added 1.5 ml of Na_2CO (17%, m / v) and 0.5 ml of Folin-Ciocalteu reagent (0.5N). The whole solution was incubated at 37 ° C for 30 min and the absorbanceread at 760 nm. The quantification of the total polyphenols was made according to a linear calibration lineobtained by using a standard extract of gallic acid at different concentrations (0 to 1000 µg / ml).

The total phenolic content (Q) was calculated according to the following formula:

Q = (V x C x d) / m (en µg EAG/g SM)

V: final volume of the extract (ml), C: concentration of the extract (µg / ml), d: dilution, m: mass of dry matter of the hydrolysed plant material (g)

Determination of total flavonoids: The determination of total flavonoids was carried out according to a modified method of Hariri *et al*., (1991). In fact; 2 ml of each extract were mixed with 100 µl ofNeu reagentandread at 404 nm using Quercetol as standard. The percentage of total flavonoids was calculated in quercetol equivalent according to the following formula:

F (%) = (0,05 x Aext / Aq) x 100 x d / Cext

Aext: absorption of the extract, Aq: absorption of quercetol, Cext: concentration of the extract (mg / ml), d: dilution

Dosage of tannins

Hydrolysable tannins

In this part, themethod of Dif *et al*., 2015 was used; to 1 ml of maceration (0.4 g in 20 ml MeOH 80%), 3.5 ml of a solution of $FeCl_3$ (0.01 M in 0.001 M HCl) were added, the absorbance was read at 660 nm and the content of hydrolyzable tannins was expressed in percentage (%).

Condensed tannins: The determination of condensed tannins was carried out by the $FeCl_3$ method (Broadhurst and Jones, 1978; Heilmler *et al*., 2006). To400 µl of each samples (0.5 mg / ml) were added 1.5 ml of the vanillin solution (4% in MeOH) and 0.8 ml of concentrated HCl. The mixture was then incubated for 15 min and the absorbance read at 500 nm. The concentrations of the condensed tannins were deduced from the calibration curve established with catechin (0-150 µg / ml); and were expressed in micrograms of catechin equivalent per milligram (µgETC/mg).

Evaluation the antioxidant activity by DPPH and FRAP assay

DPPH (2,2-Diphenyl-1-picrylhydrazyl Radical)Test: The method used ~~is~~ wasthe one of Blois (1958) with slight modifications; a mixture of ethanolic extract (1 ml) of concentrations (1 mg / ml to 0.001953 mg / ml) and 2 ml of DPPH (0.03 mg / ml) was measured at 517 nm after 30 min of incubation. The positive reference control used was ascorbic acid (vitamin C); the percentage of reduction of DPPH (PR) and the effective half-concentration (EC_{50}) were calculated respectively according to equations (1) and (2).

$$\% \text{ reduction (PR)} = \left(1 - \left(\frac{\text{Absorbance extract}}{\text{Absorbance contrôle}}\right)\right) \times 100 \quad (1)$$

$$EC_{50,\,t} = \frac{CR_{50},t}{[DPPH^{\bullet}]t=0} \quad (2)$$

Test FRAP (Ferric reducing antioxidant power): The reducing power of the samples was determined according to the FRAP method (sodium acetate (300 mM, pH = 3,6), 10 mM of TPTZ solution (2, 4,6-Tri (2-pyridyl) -s-triazine) was prepared in 40 mM HCl and $FeCl_3$ (20 mM) in a volume ratio (10: 1: 1, v / v / v) freshly prepared at 37 ° C in a water bath. 100 µl of Trolox (0,187 mM; 0,375 mM; 0,75 mM and 1,5 mM) and samples prepared at a concentration of 0,25 mg / ml were added to 3 ml of FRAP reagent. The absorbance was read at 593 nm after 4 min and the results were expressed in mM equivalent Trolox (Benzie, 1996; Gong *et al*., 2016).

Antibacterial activities

Sterility test: The different extracts to be tested were seeded using a sterile swab on a Muller Hinton agar (MH) and subsequently incubated at 37 ° C for 24 h.

Bacterial strains: The strains of *Staphylococcus aureus* coded ATCC 29213 and 348C / 19 CNRa, those of *Escherichia coli*ATCC 25922 and 353UB / 19 CNRa of *Klebsiella oxytoca* 343UB / 19 CNRa and finally the strains of*Pseudomonas aeruginosa* coded ATCC 27853 and 692Ma / 19 CNRa, of Pasteur Institute of Côte d'Ivoire were used in these investigations.

Preparation of the bacterial inoculums: A well-isolated colony of a bacterial culture of 18 to 24 h was collected and then homogenized in 2 ml of a sterile glucose solution.

Inoculum count: The bacterial inoculum was homogenized and then diluted. Thus, 4 decimal dilutions from 10-1 to 10-4 were obtained. The initial bacterial inoculum and the four dilutions were inoculated, using a loop calibrated at 2 µlin a 5 cm long streak on an HD agar.

Preparation of the concentration range of the extracts: Sterile hydroalcoholic solutions of the extracts of the leaves, stem bark and root bark (200 mg / ml)were prepared. From the concentrations prepared; 5 different concentrations 100;50;25; 1.5; 6.25mg / mlwere obtained by a 2-fold dilution for each solution.

Efficiency test: The efficiency test of the extracts was carried out on 3 concentrations (200; 50 and 25 mg / ml) of the prepared solution. They were placed in wells on the top of the agars previously seeded with the different bacterial strains. A sterile distilled water solution was used as negative control. However, the antibiotics used in the treatment of pathologies linked to the tested bacteria such as; Ampicillin + Clavulanic acid (AMC), Cefotaxime (CTX), Aztreonam (ATM), Imipenem (IPM), Cefoxitin (FOX) were used as positive controls.

Antibacterial test: The antibacterial tests were performed according to the method of dilution in a liquid medium in sterile microplates for the determination of the antibacterial parameters of the extracts; namely the Minimum Inhibitory Concentration (MIC) and the Minimum Bactericidal Concentration (MBC). 100 µl of the different concentrations of plant extract (6.25; 12.5; 25; 50; 100; 200 mg / ml) to be tested were distributed in the wells of a sterile microplate from the highest concentration to the lowest (Dosso and Faye-Kette, 2000; Koné *et al*., 2004) as well as sterile distilled water used as control (Tc).To these amounts were added 100 µl of the bacterial inoculum. The microplate was incubated at 37 ° C for 24 h. The MIC therefore corresponds to the concentration of the first experimental well in which no disorder was visually observed. MBCcorresponded to the lowest concentration of extract for which there was at most 0.01% of surviving bacteria.

RESULTS AND DISCUSSION

Quantification of macroelements and oligo-elements: Through the elementary chemical analysis carried out using the X-ray fluorescence spectrometer, it has been possible to quantify the mineral elements.

Table 1 summarizes the content of major elements contained in the various organs of *Solanum rugosun*, thus the stems barkcontains (70.72%) followed by the leaves (70.55%) and the roots bark (66.76%). The most abundant mineral elements were calcium and potassium respectively (15.22% and 32.66%) in the leaves, (37.18% and 24%) in the stems bark and for the roots bark (32.06%) and 21.61%). The microelements contained in *Solanum rugosum*are listed in Table 1. Root bark (3.46%) and stem bark (1.06%) had a higher proportion than the leaves (0.89%).Macro elementsare essential for life, furthermore; Calcium, for instance, enters in the structure and constitution of the skeleton and the teeth (Delmi *et al*., 1990), moreover it regulates the heart rate just like potassium (Nassira, 2014).

We noted the absence of lead in the stems and the roots barks, however; the leaves have 1.41%. This presence of lead in the leaves can come from the pollution of the nearby ~~its~~ environment or can be explained by the fact that plants can absorb lead from the roots, but also from the aerial organs, or by the intermediary of both. The amount of lead present in various organs of a plant depends on the transport from the outside of the roots to the inside, then on its translocation from the roots to the leaves (Patra *et al*., 2004).*Camellia sinensis* and *Gmelina arborea*have equal amounts of Fe and Mg;their content in the leaves of *Solanum rugosum* were also important. Indeed, for the leaves of *C. sinensis* and *G. arborea*; Fe and Mg were respectively (0.3% and 2.07% of mass) and (0.2% and 2% of mass) (Mossion, 2007; N'gaman, 2013)compared to those of *S. rugosum* (0.35% and 4.95% of mass). In addition to their importance as minerals in plant growth, Fe and Mg are widely used as coenzymes and are also important in thediet and health (Davidian *et al*., 2007; Mossion, 2007;N'gaman,2013).

Phytochemical screening: Phytochemical screening has made it possible to show the presence of tannins, coumarins, anthracenes, flavonoids, anthocyanins, alkaloids, sterols and terpenes in the selective extracts of the leaves, stem bark and in the root bark of the plant (Table 2). The presence of these identified secondary metabolites could justify the traditional uses of the plant and the pharmacological properties attributed. In Brazil, the work of some authors summarized in the Public Scientific Initiation book has shown the presence of alkaloids, flavonoids, terpenes, sterols, tannins and the absence of coumarins in the fruits, leaves and in the stems of *Solanum rugosum* (Anonymous 2).

However; the work of Pinto *et al*., (2011) shows the presence of flavonoids and terpenoids in the leaves of *Solanum asperum*. We found out that some coumarins, flavonoids, tannins, terpenes, sterols and alkaloids have been detected in Solanum genus according to the studies performed by Singh *et al*., 2009; LuYan *et al*., 2011; Pinto *et al*., 2013; Chen *et al*., 2013 and Francis *et al*., 2013.

Determination of total phenolic: The total phenolic compounds (Figure 1) contained in the extracts were determined from the equation of the calibration line established using different concentrations of the standard (gallic acid). The contents obtained are expressed in micrograms equivalent of gallic acid per gram of extract (µg EAG / g).Interestingly, all the studied extracts are rich in phenolic compounds, however; the leaves and the stems bark contain a significant content compared to the root bark.

Table 1: Macroelements and oligo-elements content (in % of mass) in the organs of *S. rugosum*

Macroelements (%)										
	Ca	P	K	Cl	S	Mg	Si	Pb	Na	Total
Leaves	15.22	5.68	32.66	6.77	1.65	4.95	2.05	1.41	0.16	70.55
Stem bark	37.18	2.10	24	1.96	1.38	2.67	1.32	-	0.11	70.72
Root bark	32.06	2.37	21.61	1.96	1.94	5.33	1.15	-	0.34	66.76
Oligo-elements (%)										
	Fe		Al	Cu	Zn		Se	Va		Total
Leaves	0.30		-	0.31	0.28		-	-		0.89
Stem bark	0.35		0.36	0.17	0.10		-	0.11		1.09
Root bark	1.06		0.89	0.60	0.22		0.69	-		3.46

Table 2: Phytochemical screening of *S. rugosum* by TLC

Phytocompounds	*Solanum rugosum*											
	Leaves				Stem bark				Root bark			
	Hx	Chl	Ea	Bu	Hx	Chl	Ea	Bu	Hx	Chl	Ea	Bu
Alkaloids	-	-	-	+	-	+	-	+	-	+	-	+
Anthocyanins	-	+	+	+	-	+	+	+	-	++	+	+
Anthracenes	+	+	-	-	++	+	-	-	+	-	-	-
Coumarins	++	+++	+++	+++	++	+++	+++	++	++	+++	+++	++
Flavonoids	-	+++	+++	+++	-	+++	+++	+++	-	+++	+++	++
Phenol acids	-	+	+	+	-	+	+	-	-	-	-	-
Sterols	++	++	-	-	+	++	-	-	++	++	-	-
Tannins	-	+	++	+	-	+	+	+	-	+	+	+
Terpens	++	++	-	-	++	++	-	-	++	++	-	-

-: Absence; +: weak presence; ++: average presence; +++: strong presence Hx: Hexane; Chl: Chloroform; Ea: Ethyl acetate ; Bu : n-Butanol.

Table 3: Inhibition zone diameter of extracts and reference antibiotics.

Inhibition zone diameter (mm)								
	Extracts at 200mg/ml				Antibiotics			
Souches	Leaves	Stem bark	Root bark	FOX	AMC	CTX	ATM	IPM
S. aureus ATCC	9±0	0	0	20	-	-	-	
S. aureus	9±0	0	0	6	-	-	-	
E. coli ATCC	0	0	0	-	21	28	32	
E. coli	0	0	0	-	0	0	0	
K. oxytoca	0	0	0	-	6	8	0	
P. aeruginosa ATCC	9.33±0	0	0	-	-	-	-	27
P. aeruginosa	0	0	0	-	-	-	-	10

S: Staphylococcus; E: Escherichia coli; *K: Klebsiella; P: Pseudomonas;* AMC: Ampicillin + clavulanic acid; CTX: Cefotaxime; ATM: Aztreonam; IPM: Imipenem; FOX: Cefoxitin

Table 4: Antibacterial parameters of *S. rugosum* leaves

Strains	MIC (mg/mL)	MBC (mg/mL)	MBC/MIC	Interpretation
S aureus ATCC	25	25	1	Bactericide
Aureus	25	50	2	Bactericide
P aeruginosa ATCC	50	100	2	Bactericide

S: Staphylococcus; P: Pseudomonas

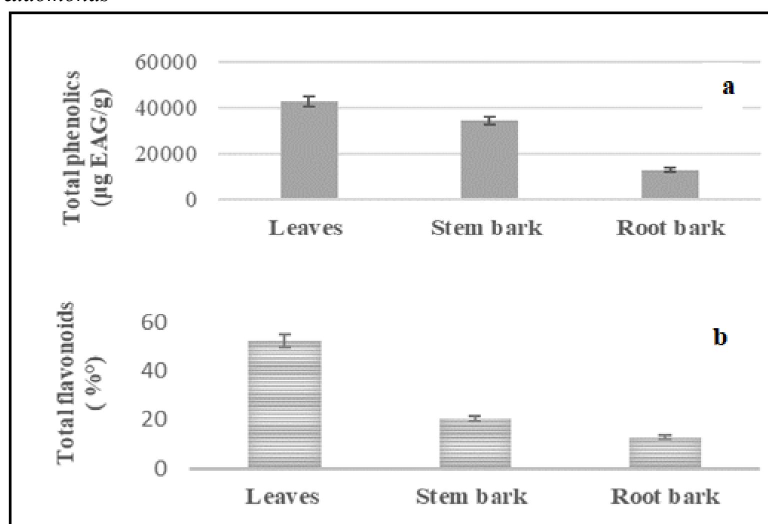

Figure 1. Content of total phenolics (a) and flavonoids (b) in the various organs of *S. rugosum*

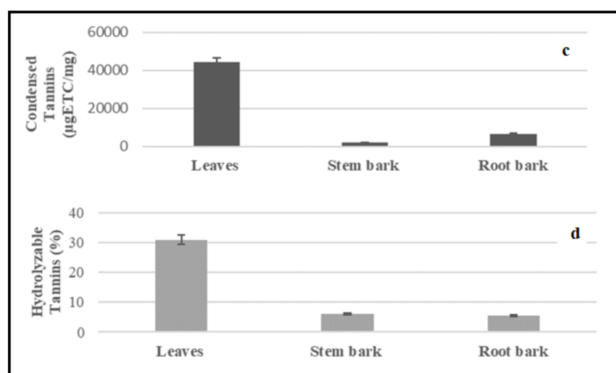

Figure 2: Content of condensed (c) and hydrolyzable (d) tannins in *S. rugosum*

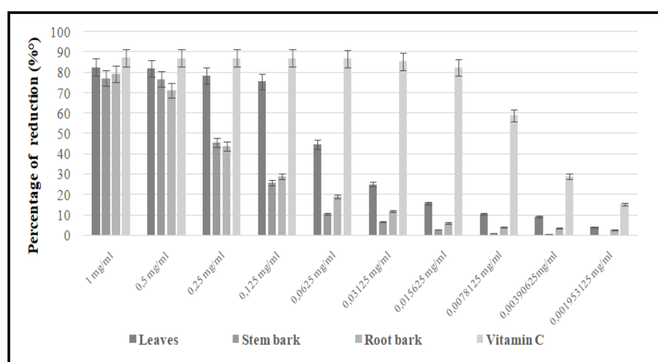

Figure 3: DPPH reduction percentages of extracts and vitamin C

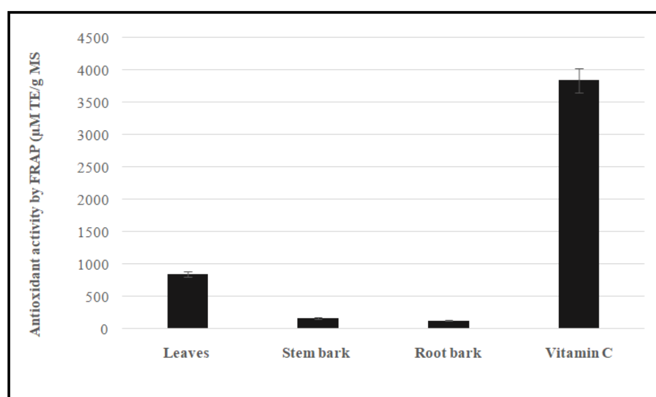

Figure 4: FRAP antioxidant profiles (µM TE / g MS) of extracts and vitamin C

Determination of total flavonoids: The results of the quantitative analysis of flavonoids in the organs of *S. rugosum*, showed the notable presence of flavonoids in variable proportions (Figure 1). The contents of total flavonoids were also higher in the leaves than in the bark of stems and the roots. This result is in accordance with the chromatograms of the selective extracts obtained from the crude hydromethanolic extracts. It appears that several molecular fingerprints of flavonoids had been detected in the chloroform, ethyl acetate and n-butanol extracts. The findings are in accordance with those of Gelhin *et al*., 2006; they concluded that, plants synthesize more flavonoids for their protection when they are exposed to environmental aggressions, such as geographic and climatic conditions. The studied plant was harvested in the district of Abidjan which is regularly under variable climatic conditions throughout the year.

Dosage of tannins: The contents of hydrolyzable and condensed tannins were determined in the *S. rugosum* organs; the amount of condensed tannins was determined in µg EC / mg of extract from the catechin calibration line while the content of hydrolyzable tannins was expressed in percentage. The results obtained are illustrated in the histograms (Figure 2). The extracts are mostly rich in condensed tannins than hydrolysable tannins and the leaves have remarkable contents than the other organs.

Antioxidant evaluation

DPPH test: The percentage of reduction of the samples reflects their capacity to reduce the $DPPH^{\bullet}$ radical; Figure 3 shows us that all extracts have a smaller reduction percentage than that of vitamin C taken as a reference. The percentage of reduction in $DPPH^{\bullet}$varies according to the concentration and according to the plant organs. The leaves have a better capacity to reduce $DPPH^{\bullet}$ radical compared to the other organs. This observed anti-free radical action could be explained by the presence of the identified bioactive compounds. The works of Lakshmidevi *et al*., (2016); Sujatha *et al*., (2013) show that the antioxidant activity of the leaves and stems of *S. erianthum*are essentially due to their phytochemical constituents, in our case; the leaves have shown better activity compared to the stems.

FRAP test: The antioxidant activity of *S. rugosum* extracts was evaluated using the FRAP method. It is based on the ability of the extracts to reduce ferric iron Fe^{3+} to ferrous iron Fe^{2+}. The results obtained show that all the extracts have dose-dependent activity and their capacity to reduce iron was different. The reducing power of the extract of the leaves(841.899 µM TE / g DM) is much greater than that of the stem bark (167.382 µM TE / g DM) and the one of the root bark (126.939 µM TE / g DM). The high activity of the leaves extract was due to its high content in phenolic compounds. All the extracts have a weak activity compared to vitamin C (3840 µM TE / g DM) used as a reference (Figure 4).

Antibacterial activity: The sterility test made it possible to show that all the crude hydroalcoholic extracts obtained from *S. rugosum* were sterile because no germ was observed on the various dishes after 24 h of incubation. Only the methanolic extract of the leaves showed an inhibitory effect against the bacterial strains of *Staphylococcus aureus* coded ATCC 29213 and 348C / 19 CNRa and of *Pseudomonas aeruginosa* ATCC 27853 at 200 mg / ml with an inhibition diameter ranged from 9 ± 0 to 9.33 ± 0 mm. Indeed, according to Ponce *et al*., (2003), a bacterium is said to be resistant to an extract when its inhibition diameter on this extract is ≤ 8mm and sensitive if this diameter is between 9 and 14 mm, more; it is said to be very sensitive when it is between 15 and 19 mm and extremely sensitive for all diameter greater than 20 mm. Compared to other bacterial strains, our extracts have been shown to be ineffective (Table 3). The antibiotics tested gave some inhibitory diameters ranged from 0 to 32 mm with regard to the different bacterial strains. These results confirm the phenotypes of the strains tested. After 24 h of incubation at 37 ° C, we observed a trend of a progressive decrease in the growth of the bacteria in the wells and the microplates while increasing the concentrations of the tested extracts. The antibacterial parameters obtained for each bacterial strain are detailed in Table 4. MBC / MIC reported made it possible to specify the mode of action of the substances. If this ratio was less or equal to 2, the substance was said to be bactericidal and

strictly greater than 2, the concerned substance is bacteriostatic. According to these results, we can say that the extract from the leaves of *S. rugosum* is bactericidal against the strains tested. Thus, compared to the growth control, the tests in liquid medium of the analysed extracts have revealed a decreasing variation in the density of the bacteria in the experimental wells which is linked to an increase in the concentration of the extracts. Additionally; the determination of MIC, MBC and MBC / MIC, demonstrated the antibacterial activity of the extract of the leaves (Table 4) with a MBC / MIC ratio ≤ 2. These biological activities were due to the action of the chemical compounds present in the leaves. This could justify the traditional use of the leaves in the treatment of skin wounds for which the strains of *Staphylococcus aureus* dwell the main cause.

Conclusion

The present report is the first study of the secondary metabolite found in *Solanum rugosum*, furthermore, it was possible to determine the total phenolic, total flavonoids content, antioxidant and antibacterial activity of *Solanum rugosum* species from Côte d'Ivoire. The phytochemical screening carried out revealed the richness of our plant in secondary metabolites, mainly in flavonoids, alkaloids, tannins, sterols, terpenes and coumarins. The antioxidant power of the leaves extracts was important compared to the other organs of the plant. This result was confirmed by two methods: the reduction of iron and the trapping of free radical using DPPH test; it comes out that *Staphylococcus aureus* was sensitive to extracts from the leaves at 200mg / ml.

Conflit of interest: None

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