



CARDIOVASCULAR POTENTIAL OF THE BARKS OF TRUNK OF *BUCHHOLZIA CORIACEA* (CAPPARIDACEAE) AT THE ALBINO MALE RAT

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ABSTRACT *Buchholzia coriacea* is a plant of the Congolese pharmacopeia. Her barks of trunk were the subject of aphrodisiac study in our laboratory. But her effect on the arterial pressure, the cardiac frequency and on the contractions of the heart, remain even unknown. This is how the present work aims the assessment of the cardiovascular potential of the barks of trunk of this plant at the albino male rat.

The effects on the mean arterial pressure and the cardiac frequency at the rat normotended have been valued by the method invasive whereas the classic model of drip of isolated heart of batrachian has been used to value the effects on the heart isolated of toad. The administration of the aqueous extract of the barks of trunk of *B. coriacea* (10, 20 and 40 mg/kg, i.v) decreases the mean arterial pressure and the cardiac frequency as the yohimbine (1mg/kg, i.v) and the μg acetylcholine (50 μg / Kg, i.v). This effects hypotensor and negative chronotrope are raised completely by the atropine (1 mg / kg. i.v), ce that confirms the implication of the receiving muscarinics in the mechanism of action of this extract. To the concentrations of 2; 2,5 and 3 mg / ml extracts it aqueous of the barks of trunk of *B. coriacea* decreases strength and the frequency of the contractions of the heart isolated of toad and to 4 and 5 mg/ml, it drags to a reversible stop of the contractions of the heart isolated of toad.

KEYWORDS : cardiovascular ; *Buchholzia coriacea* arterial pressure frequency cardiac

I-INTRODUCTION

The such sexual phenomena the erection and the ejaculation are bound intimately to the state of the vessels and the heart. Thus, the vessels notably the arteries and the veins assure the transportation of blood respectively toward the erectile organs at the origin of the erection and the venous return after ejaculation. The circulation of this blood provokes the reduction or the increase of the arterial pressure, heard strength exercised to the passage of blood through the vessels. Of numerous molecules of synthesis as the sildenafil or the yohimbine are to some doses at the origin of the variations of the arterial pressure at a category of individuals provoking either the atherosclerosis or the cardiac stop in full sexual intercourse with for immediate consequence it occurred of the death of one of the partners sexual. In this worry and before the cost raised to reach the products of synthesis, many men trust the aphrodisiac presumed plants currently that they suppose without risk of any accidents. Among these plants one mentions *Buchholzia coriacea*. Plant of the family of the Capparidaceae, known in congolese pharmacopeia under the name of (songokama) in lari, (lembana) in téké and (ombanda) in mbôsi (Bouquet, 1969). *B. coriacea* was the subject of the pharmacological studies in our laboratory where the aphrodisiac properties (Ondélé, 2015), the contraceptive properties (Pénémé, 2018) and well others have been demonstrated. Is the use of the Barks of this plant it without cardiovascular risk at the consumers? it is in this optics that this study initiated and has for objective: to value the impact of the aqueous extract of *B. coriacea* on the arterial pressure and the cardiac frequency at the rat normotended as well as the effects of this extract on the strength of contractions of the heart isolated of toad.

II. MATERIAL AND METHODS

II. 1. Plant material

The barks of trunk of *B. coriacea* have been used like plant material in the different pharmacological and chemical tests in the present work. A sample of *B. coriacea* harvested was identified and was compared with the sample of reference: N° 2456 (IEC) of the 17-2-1968 recorded to the national herbarium of the National institute of Research in Exact

and Natural Sciences. The barks of *B. coriacea* were harvested in Brazzaville (Republic of Congo) in the month of April 2012. This barks were in continuation dried at the laboratory, to the ambient temperature (28 - 30 °C), safe from the solar rays during 20 days and pulverized with the help of a mortar made of wood.

II.2. Animal Material.

The male adult rats aged of 20 to 24 weeks and weights understood between 200 and 250 g have been used. They have been provided by the pet shop of the Faculty of the Sciences and Technics where they are maintained in conditions standards of illumination (12 hours of light, 12 hours of obscurity) to the ambient temperature of 29 ± 1 °C. These rats had the free access to a standard food and the water of faucet. The Toads captured the nights in the humid surroundings have been used also.

II. 3. preparation of the extract:

The extract of the barks of *B. coriacea* has been prepared by decoction while putting 50 g of powder of the leaves in boiling point in 500 ml of water distilled during 15 min. After cooling, then filtration, the gotten decocte was concentrated to the bath gets married in 70 °C.

II. 4. Study of the effect of the aqueous extract of *Buchholzia coriacea* on the arterial pressure and the cardiac frequency at the rat

II. 4.1. anesthesia of the rat and incubation of the femoral vein and the carotid artery

The rat is anesthetized to the urethane 15% (1,5 g/kg, i.v) at the rate of 1 g ml/100 of bodily weight (Dimo and al, 2003). The femoral vein then the carotid artery has been put respectively to high clouds and intubed with the help of end catheter in polyethylene fixed to a syringe and catheter introcan 24 G as describes by Etou Ossibi and al. (2010). The solution of NaCl 0,9 % heparine to 10 % has been injected at the rate of 0,1 ml / 100 g by the femoral vein to prevent the coagulation of blood.

II.4.2. Measure of the arterial pressure and the cardiac frequency

When the clamp is removed, the tip free of the catheter intocan 24 G fixed to the carotid is joined to the catheter connected to a translator of arterial pressure connected to a tape recorder (Biopac Student Lab of type MP 36) that him - even is joined to a computer containing the software " Biopac Student Lab" 3, 7 that permit to visualize on the screen the variations of the arterial pressure and the cardiac frequency recorded.

II. 4. 3. test of the aqueous extract of *B. coriacea*, the yohimbine and the acetylcholine on the mean arterial pressure and the cardiac frequency at the rat normotended

Thirty (30) rats normotended (RNT) distribute in six (6) groups of five (5) rats each has been used. These animals have been treated by intravenous way through the catheter placed in their femoral vein of the following manner:

- the Group 1 (witness) received the physiological solution of NaCl to 0,9%;
- the Groups 2 and 3 received the yohimbine respectively to 1 mg/kg and the acetylcholine à 5 µg/kgs of bodily weight;
- the Groups 4, 5 and 6 received the aqueous extract of the leaves of *B. Coriacea* respectively to the doses of 10, 20 et 40 mg/kg of bodily weight.

The different products were dissolved in the physiological solution of NaCl 0,9 % managed then in unique dose (at the rate of 0,1 ml/100g of bodily weight) to the animals after one period of stabilization of the arterial pressure and the cardiac frequency of 45 min about. The effects of the products on the arterial pressure and the cardiac frequency have been observed during a (1) hour after their administrations (Dimo and al., 2003; Etou Ossibi, 2010).

II. 4. 4. test of the aqueous extract of the barks of trunk of *B. coriacea* on the arterial pressure and cardiac frequency at the rat normotended pretreated to the atropine

This study has been achieved in the goal to clarify the mechanism of action likely of the aqueous extract of the barks of trunk of *B. coriacea* on the arterial pressure and the cardiac frequency in presence of an antagonist of the receiving muscarinics who is the atropine. For stalled, ten (10) male rats distributed in two (2) groups of five (5) rats each has been called by intravenous way the following manner:

- the group 1 received the aqueous extract of the barks of trunk of *B. coriacea* to 20 mg/kg of bodily weight;
- the group 2 received the atropine then 1 mg/kg five minutes after the aqueous extract of the barks of trunk of *B. coriacea* 20mg/kg of bodily weight.

As previously, the different products were dissolved in the physiological solution of NaCl 0,9 % managed then in unique dose (at the rate of 0,1 ml/100g of bodily weight) to the animals after one period of stabilization of the arterial pressure and the cardiac frequency of 45 min about. The effects on the arterial pressure and the cardiac frequency have been observed during a (1) hour after the administration of the extract.

II. 5. Study of the effect of the aqueous extract of *B. coriacea* on the heart isolated of toad

The model of Langherdoff of measure of the mechanical activity of the heart isolated of batrachian in ventricular drip to been used. The isolated heart is washed during 5 minutes about with the solution of normal Ringer until the obtaining of the rhythm cardiac contractions before its drip with the extract to the different concentrations. A new heart is prepared every time that the precedent doesn't present any normal rhythmic contractions anymore (Etou Ossibi and al., 2005).

The solutions of increasing concentrations of the aqueous extract of *B. coriacea* (2; 2,5; 3; 4 and 5mg/ml) have been tested by drip of the heart isolated of toad during five (5) minutes. The passage of a concentration to another was preceded of a "washing" of the heart with the normal Ringer until one variable time from which the heart recovered roughly or completely her initial rhythm.

Their effects on the strength of contraction of the heart that results in the amplitude of contraction and on the cardiac frequency, translated by the number of beatings of the heart by minute have been recorded.

II. 6. statistical analysis

The t test of Student - Fischer has been used. The observed difference

is meaningful when the calculated t value is in absolute value, superior to the read t value in the t table of Student for d.d.l = n1+n2 - 2 and the risk of first species of 5 %.

III. RESULTS

The figures 1 and 2 shows the registrations of the effects of the physiological solution of NaCl 0,9%, of the aqueous extract of *B. coriacea* (10, 20 and 40 mg/kg, i.v), of the Yohimbine (1 mg/kg, i.v) and of the Acetylcholine (5 µg/kgs) on the arterial pressure and the cardiac frequency at the rat normotended.

The figure 3 shows that the aqueous extract of the barks of *B. coriacea* (10, 20 and 40 mg/kg, i.v) provokes at the rat normotended a meaningful immediate decrease of the middle arterial pressure (PAM). This decrease is dose-dependent. The respective percentages of the decrease of the PAM are -113,86 ± 7,55; - 47,18 ± 11,16 et - 61,93 ± 10,68%. With the yohimbine (1 mg/kg, i.v) and the acetylcholine (5 µg/kgs), the decreases of the PAM are respectively of - 49, 33 ± 9,32 and - 25,34± 10,97%. The PAM went back up thereafter without reaching the respective initial values (safe for the dose 40 mg/kg) before relapsing meaningfully (p <0,05) from the 20è min. She relapses of the PAM led by the yohimbine being pronounced more (p <0,001) of the 10 th until the 60è min of observation of the arterial pressure.

On the other hand, a non meaningful variation of the PAM is noted during the 60 min of the experimentation at the rats normotended after the administration of the physiological solution of NaCl 0,9 %.

Concerning the cardiac frequency (Fc), the figure 4 shows that the administration of the aqueous extract of *B. coriacea* 10, 20 and 40 mg/kg, i.v), of the Yohimbine (1mg / kg, i.v) or of the acetylcholine (5µg / kg) provokes an immediate reduction of the cardiac frequency. The cardiac frequencies pass 310,19±20,36 respectively; 368,36 ± 18,14; 298,20± 22; 293,32±26,22 and 0,93±0,32 beatings by minutes to 256,94± 55,45; 357,124±21,57; 206,93±40,56; 287,01±31,95 and 8,85 ± 2,57 beatings by minute is respective decreases of the FC of - 24,12 ± 4,32; - 3,28 ± 1,36; - 34,08 ± 1,54 and - 2, 87± 0,54% For the doses of 10 and 20 mg/kg the ascent of the FC is followed of the relapse of this one of the 10è to the 60è min.

III. 1. Effect of the aqueous extract of *B. coriacea* (20 mg / Kg) on the arterial pressure at the rat previously treated to the atropine (1 g / Kg)

The figure 5 shows the registration of the effects of the aqueous extract of *B. coriacea* (20 mg/kg, i.v) on the arterial pressure and the cardiac frequency among the rat normotendu treaty 5 minutes before to the atropine (1 mg/kg, i.v). It is evident from this figure that the registration is not modified after the administration of this extract to 20 mg/kg.

The figure 6 shows that the administration of the aqueous extract of *B. coriacea* (20 mg/kg, i.v) induced an immediate decrease of the PAM of - 47,18 ± 7,43% at the rats normotended. However, among the rats treated to the atropine (1 mg/kg, i.v) 5 min before, this extract doesn't provoke the immediate decrease of the PAM more; either a total inhibition of the PAM. This inhibition is partially observed of the 25è until the 60è min of the experimentation.

Concerning the cardiac frequency, the figure 7 shows that the aqueous extract of *B. coriacea* (20 mg/kg, i.v) induced a non meaningful immediate decrease of the FC of - 3,28 ± 1,36%. The same decrease is nearly noted with this extract to 20 mg/kg at the rats pretreated to the atropine (1 mg/kg, i.v). The decrease of the FC becomes less important, from the 25è min, at the rats having received the atropine (1 mg/kg, i.v) then 5 min after the aqueous extract of *B. coriacea* (20 mg/kg, i.v) in relation to the rats whom received this extract to the same dose.

III. 2. Effect of the aqueous extract of the barks of trunk of *B. coriacea* on the frequency of the contractions of the heart isolated of toad

The figure 8 shows the variation of the frequency of contractions in percentage after drip of the heart isolated of toad with the aqueous extract of the barks of trunk of *B. coriacea*. To the concentrations of 2; 2,5; 3 and 4, this extract decreases the cardiac frequency of -20,02 ± 2,32; -14,54± 1,54; -16,94± 2,14 and 54,78±1,1, respectively. To 5mg/ml, this extract provokes a reversible stop of the beatings of the heart after drip in the Ringer.

III. 3. Effect of the aqueous extract of the barks of trunk of *B. coriacea* on the amplitude of contractions of the heart isolated of the toad

The figure 9 the variations of the amplitude of contractions in percentage after drip of the heart with the aqueous extract of *B. coriacea*.

To the concentrations of 2; 2,5; 3 and 4 mg/ml the aqueous extract of *B. coriacea* decreases meaningfully ($p < 0,001$) the amplitude of contractions of the heart isolated of toad. These reductions matches respectively to $-6,86 \pm 1,73$; $-28,27 \pm 27$; $-55,74 \pm 4,35$ and $-57,65 \pm 2,5$. To 5 mg/ml, this extract provokes a reversible stop of the beatings of the heart after drip in the Ringer.

The registrations of the contractions of the heart isolated of toad are presented on the figure 9.

IV. DISCUSSION

The objective assigned by this work was to value the effect of the aqueous extract of *B. coriacea* on the arterial pressure and on the heart isolated of toad.

The intravenous administration of this extract (10, 20 and 40 mg/kg) at the rats normotended provokes, as the acetylcholine (5 μ g/kgs) and the yohimbine (1 mg/kg) an immediate decrease of the mean arterial pressure (PAM) consistent of an ascent then of a relapse from the 25 th minute.

This extract provokes therefore, like the two molecules of reference used, an effect hypotensor. Some previous studies showed that the sildénafil, the tadalafil, the vardénafil (Schouman, 2002.; Hanoune, 2005), the apomorphin (Hanoune, 2005) and the yohimbine (Bernard, 1993), used in clinic against the erectile dysfunction, lead an arterial hypotension at the people who use them (Boua and al., 2013). The effects hypotensors has also been recovered with several other extracts of medicinal plants. It is the case with the extracts of *Tamarindus indica* (Souza, 2005), of *Parkia biglobosa* (Yomalan Kassi and al., 2008), of *Biophytum petersianum* (Titrikou and al., 2008) and of *Lippia multiflora* (Etou Ossibi and al., 2010 and 2014) and of *Trema orientalis* (Etou Ossibi, 2017).

Otherwise, this extract provokes to the studied doses an immediate meaningful decrease of the cardiac frequency (Fc) consistent also of an ascent then of a relapse of this one. The aqueous extract of the barks of trunk of *B. coriacea* has an effect therefore negative chronotrope that could explain the effect hypotensor of this extract in part. Indeed, other authors showed that the decrease of the Fc consecutive to the administration of the extracts of plants would be at the origin of the fall of the arterial pressure (Etou Ossibi and al., 2014).

The fast ascent of the PAM could explain it self following upon by a phenomenon reflex the increase of the discharge of the catecholamines, notably of the noradrenaline (Etou Ossibi, 2010). The relapse of the mean arterial pressure from the 25 th minute following the administration of the aqueous extract of the barks of trunk of *B. coriacea* lets suppose that this one would decrease the vascular peripheral resistances. Indeed, he has been shown that the belated fall of the arterial pressure is generally due to the action of the products on the vascular peripheral resistances (Ngueléfacq, 2003).

It is admitted that the acetylcholine, free by the stimulation parasympathic drags a vasodilatation and a reduction of the frequency and the strength of cardiac contractions and would be pro-erectile (Giuliano, 1997). The study of the interaction enters the aqueous extract of the barks of trunk of *B. coriacea* (20 mg/kg) and the atropine (1 mg/kg) has been landed thus. The result of this study shows that the atropine opposes the effects of the aqueous extract of *B. coriacea*. The atropine is a competitive antagonist of the receiving cholinergics of type muscarinics. The fact that the atropine, inhibit the reduction of the arterial pressure and the cardiac frequency led by this extract, let suggest that this one would contain some substances cholinomimetics. The acetylcholine possesses to the level of the heart of the receptors of type muscarinic by which it leads an increase of the conductance potassic (Hulme, 1990.; Caulfield, 1993.; Eglén, 1994 and Robert, 2003) and a reduction of the slow calcic current (Liang, 2000), explaining his effects inotrope and negative chronotrope. Otherwise, the acetylcholine while setting on the receiving muscarinics of the vascular, induced endothelium a vasorelaxation through the intermediary of the monoxide of nitrogen (Furchgott, 1980). If the

barks of *B. coriacea* contain the substances cholinomimetics, his effects hypotensors and negative chronotropes could exercise themselves then by the same mechanism that the one of the acetylcholine. The presence of this substances cholinomimetics could also explain in part, as the acetylcholine the effects pro erectile of the aqueous extract of the barks of trunk of *B. coriacea* shown high here.

The yohimbine to 1mg/kg used like product of reference in this study, also decrease the arterial pressure among the male rats This, watch once besides a likeness of action enters the aqueous extract of *B. coriacea* and the yohimbine known like aphrodisiac and powerful vasodilator. The interval of time of about 35 minutes during which one observes the effect belated hypotensor is an important pharmacological data that would translate the beginning of the action of the aqueous extract of the bark of trunk of *B. coriacea* on the sexual stimulation. This interval of time seems to be a characteristic data of the aphrodisiacs. Indeed, in medical prescription, the aphrodisiac products are proposed to be taken one hour before the sexual intercourse.

In the present study, it is shown that the intravenous administration of the aqueous extract of the barks of trunk of *B. coriacea* provokes a reduction of the cardiac frequency. This result supposes a direct action of this extract on the cardiac contractions. To confirm this action, the effects of this extract on strength and the frequency of the contractions of the heart isolated of toad have been valued.

The results show that the drip of the heart isolated of toad with this extract to the concentrations of 2; 2,5 and 3 mg/ml drags to an immediate reduction of the amplitude and the frequency of the cardiac contractions. The stop of the heart observed to the concentrations of 4 and 5 mg/ml is reversible after administration of the normal physiological solution of Ringer. This extract has a cardio-moderator effect who could oppose the intense tachycardia at the origin of the cardiac stops in systole to the important discharges adrenergics that precedes the ejaculations stimulated by the conventional aphrodisiacs therefore as the yohimbine. Indeed, the yohimbine provokes an increase measures out dependent of the systolic blood pressure as well as the cardiac rhythm by stimulation of the system adrénergic consecutive to the growth of the concentration in noradrenaline (Barbin., 2011).

V. CONCLUSION

To the look of the results gotten after this study, it agrees to note that:

- the aqueous extract of the barks of trunk of *Buchholzia coriacea* (10, 20, et 40 mg/Kg) decreases as the acetylcholine the mean arterial pressure and the cardiac frequency.
- The aqueous extract of the bark of trunk of *Buchholzia coriacea* to the concentrations of 2; 2,5; 3 mg / ml, decrease the amplitude and the cardiac contraction frequency. The stop of the heart is observed to the concentrations of 4 and 5 mg/ml. This stop is reversible after administration of the physiological solution of ringer. This plant has an effect cardiomodulators therefore. Thus, the aqueous extract of *Buchholzia coriacea*, by the properties hypotensives and cardiomoderator is therefore favorable to the dilation of the vessels and for it would avoid the accidents occurring during the sexual intercourse with use of the aphrodisiac presumed substances.

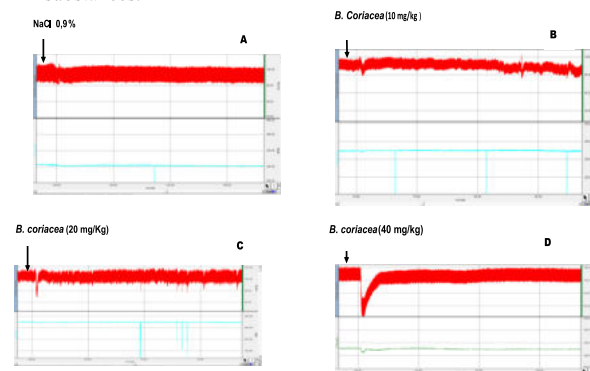


Figure 1: Registrations showing the effects of NaCl 0,9% (TO) and of the aqueous extract of barks of trunk of *Buchholzia coriacea* (*B. coriacea*) to the doses of 10 mg/kg (B), 20 mg/kg (C) and of 40 mg/kg (D) on the arterial pressure (tracings red) and the cardiac frequency (bruisse-fluore tracings)

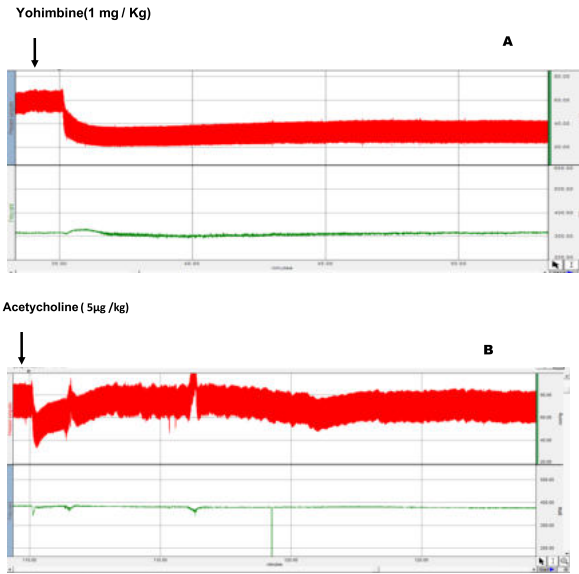


Figure 2: Registrations showing the effects of the yohimbine to 1mg/kg (TO) and of the acetylcholine (5 µg/kg) (B) on the arterial pressure (tracings red) and the cardiac frequency (bruisse-voice tracings)

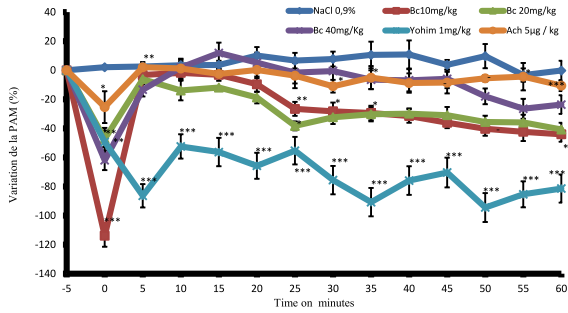


Figure 3: Effects of the aqueous extract of the barks of *Buchholzia coriacea* (Bc) on the mean arterial pressure (PAM) at the rat normotendu. The results are mean ± ESMS with n = 5, * p < 0,05; ** p < 0,01 et *** p < 0,001 meaningful difference in relation to the initial value. Yohim = Yohimbine; Ach = Acetylcholine

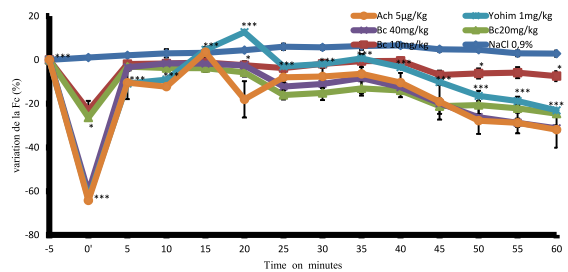


Figure 4: Effects of the aqueous extract of the barks of *Buchholzia coriacea* (Bc) on the cardiac frequency (Fc) at the rat normotendu. The results are mean ± ESMS with n = 5, * p < 0,05; ** p < 0,01 et *** p < 0,001 meaningful difference in relation to the initial value. Yohim = Yohimbine; Ach = Acetylcholine

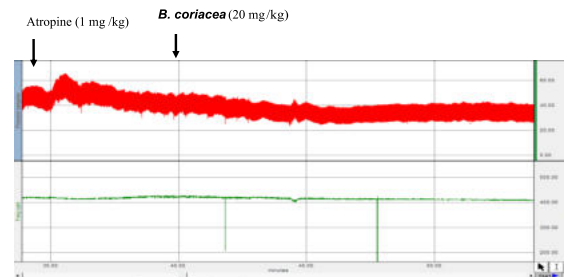


Figure 5: Registration showing the effect of the aqueous excerpt of

Buchholzia coriacea (B. coriacea) to the dose of 20mg/kg, on the arterial pressure (red tracing) and the cardiac frequency (blue-fluore tracing) among the rat male normotendu pretreated to the atropine (1 mg/kg)

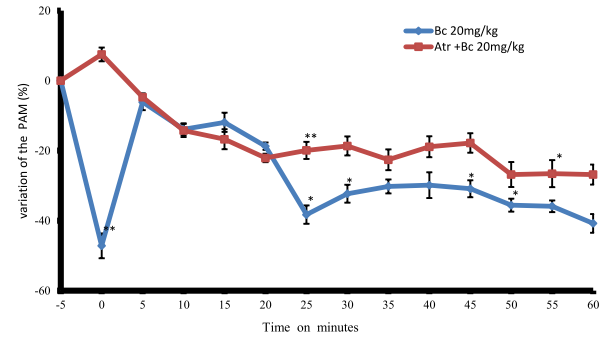


Figure 6: Effects of the aqueous extract of the barks of *Buchholzia coriacea* (Bc) on the middle arterial pressure (PAM) among the rat pretreated to the atropine (Atr). The values are mean ± ESMS with n = 5, * p < 0,05 and * p < 0,01 meaningful difference in relation to the initial value

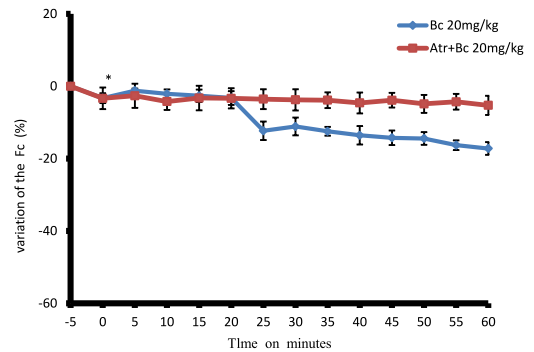


Figure 7: Effect of the aqueous extract of the barks of *Buchholzia coriacea* (B. coriacea) on the cardiac frequency, at the rat pretreated to the atropine. The values are mean ± ESMS with n = 5, * p < 0,05; * p < 0,01 meaningful difference in relation to the initial value

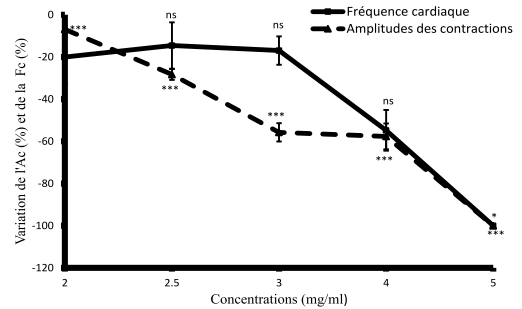


Figure 8: Variation of frequency of contractions (Fc) and of the amplitude of the contractions (AC) of the heart isolated of the toad according to the concentration of the aqueous excerpt of the peels of trunk of *Buchholzia coriacea* (B. coriacea). The values are mean ± ESMS with n = 5, * p < 0,05 et *** p < 0,05 ns = difference no

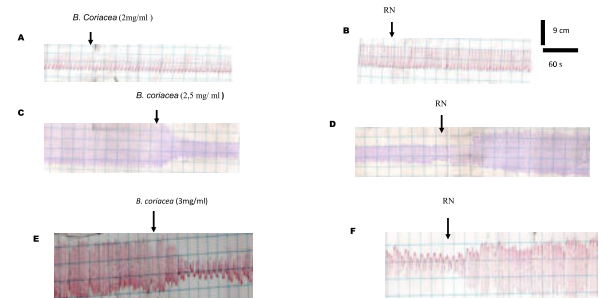


Figure 9: Registrations showing the effects of the aqueous extract of

thebarks of trunk of *Buchholzia coriacea* (*B. coriacea*) on the mechanical activity of isolated heart of toad. To: action of *B. coriacea*(2mg/ml); B: continuation of to followed of the return to the normal ringer (RN); C: action of *B. coriacea* (2,5 mg/ml); D: continuation of consistent C of the return to the normal ringer (RN); E: action of *B. coriacea* (3 mg/ml); F: continuation of consistent E of the return to the normal ringer (RN).

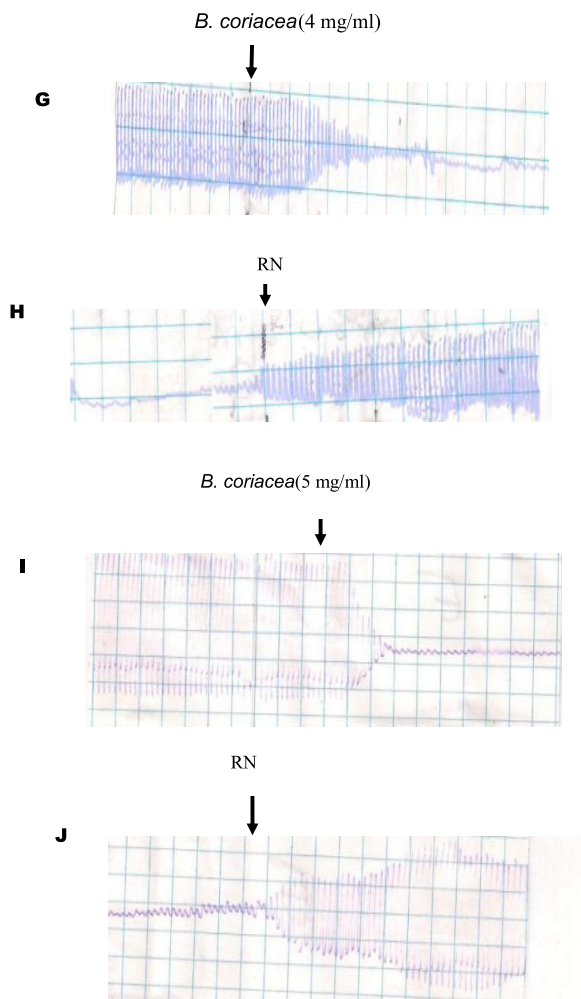


Figure 9 (continuation): Registrations showing the effects of the aqueous extract of the barks of trunk of *Buchholzia coriacea* (*B. coriacea*) on the mechanical activity of isolated heart of toad. G: action of *B. coriacea*(4 mg/ml); Hs: continuation of consistent G of the return to the normal ringer (RN); I: action of *B. coriacea*(5 mg/ml); J: continuation of consistent I of the return to the normal ringer (RN).

VI. REFERENCES

1. Barbin A., (2011). La dysfonction érectile. Thèse de Doctorat en pharmacie, Faculté de Pharmacie, Université de Nantes, Nantes, France 249 p.
2. Bernard L., (1993). Dictionnaire Thérapeutique, L.S.C., Paris (France). 1022 p.
3. Boua Bona B., Mamyrbekova-Bekro J.A., Kouame Bosson A., Bekro Y.A., (2013). Criblage Phytochimique et potentiel érectile de *Turraea heterophylla* de Côte d'Ivoire. J. Appl. Biosci., 68: 5394-5403.
4. Bouquet A., (1969). Féticheurs et Médecine Traditionnelle du Congo-Brazzaville, Mémoire ORSTOM, n 36, 11 p.
5. Caulfield M.P., (1993). Muscarinic receptors-characterization, coupling and function pharmacol Ther., 58: 319-79.
6. Dimo T., Nguetfack T.B., Tan P.V., Yewah M.P., Dongo E., Rakotonirina S.V., Kamany A.I., Bopet M., (2003). Possible mechanisms of action of the neutral extract from *Bidens pilosa* L. leaves on the cardiovascular system of anaesthetized rats. Phyther Research, 17: 1135-1139.
7. Eglen R.M., Reddy H., Watson N., Challis R.A.J., (1994). Muscarinic acetylcholine receptor subtypes in smooth muscle. Trends pharmacol Sci, 15: 114-9.
8. Epa C., Elion Itou R.D.G., Etou Ossibi A.W., Attibayeba, Ongoka P.R., Abena A.A., (2015). Effet anti-inflammatoire et cicatrisant des extraits aqueux et éthanolique des écorces du tronc de *B. coriacea* Engl. (Capparidaceae). J. Appl. Biosci., 94: 8858-8868.
9. Etou Ossibi A.W., (2010). Effets cardiovasculaires et antioxydants des extraits aqueux et hydroéthanolique de *Lippia multiflora* Moldenke (verbenaceae). Thèse de Doctorat unique, Université Marien Ngouabi - République du Congo, 175 p.
10. Etou Ossibi A. W., Elion Itou R. D. G., Nzonzi J., et al. (2014). Effets de l'extrait aqueux de *Lippia multiflora* Moldenke (verbenaceae) sur la pression artérielle, la fréquence cardiaque et les ondes de l'électrocardiogramme chez le rat normotendu. Revue CAMES-Série Pharm. Méd. Trad.Afr., 17(1): 1-9.
11. Etou Ossibi A. W., Ondélé R., Ampa R., Ngolo E., Malonga C. Q., Nkounkou

12. Loupangou C., Abena A. A. (2017). Evaluation des effets cardiovasculaires de l'extrait aqueux des feuilles de *Trema orientalis* (Linn.) blume (Ulmaceae). J. Anim. Plant Sci, 2: 5134- 5145
13. Furchgott R.F. et Zawadzki J.V., (1980). The obligatory role of endothelial cells in the relaxation of arterial smooth muscle by acetylcholine. Nature, 288: 373-6.
14. Giuliano F., Rampin O., Benoit G., Jardin A., (1997). Pharmacologie périphérique de l'érection Prog.Urol., 7:24-33.
15. Hanoune J., (2005). Les avancées pharmacologiques récentes dans le traitement médical de l'impuissance. Mise au point médecine de la reproduction 7:133-142.
16. Hulme E.C. Birdsall N.J., Buckley N.C., (1990). Muscarinic receptors subtypes. Annu Rev Pharmacol Toxicol., 30: 633-73.
17. Koffi A., Traoré F., Adjougou A.L., Diafouka F. (2008). Effets pharmacologiques de *Ziziphus mauritiana* Lam. (Rhamnaceae) sur la pression artérielle de lapin. Phytothérapie, 6: 219-227.
18. Liang H. Tang M. Liu C., (2004). Muscarinic cholinergic regulation of L-type calcium channel in heart of embryonic mice at different developpement stage. Acta pharmacol Sin, 25(11): 1450-7
19. Nguetfack T.B., (2008). Effets analgésiques et cardiovasculaires des extraits de feuilles de *Kalanchoe crenata* (Andrews) Haworth. Thèse de Doctorat PhD, Université de Yaoundé I, Yaoundé- Cameroun. 162 p.
20. Ondélé R., Etou Ossibi A. W. Pénéme M. B. L., Elion Itou R.D.G. Moranbandza C. J., Nsonde Ntandou G. F., Binimbi Massengo A. Abena A. A. (2015). Study potentialities aphrodisiac of the peels of *Buchholzia coriacea* Engl.(Caparidaceae) at the male mice. World journal of pharmaceutical sciences, 2380 - 2387 P
21. Pénéme B.M.L. Etou ossibi A.W., Ondélé R., Nsonde Ntandou F.G., Elion Itou R.D.G, Akassa H., Abena A. A. (2018). Effet sur les parametres de reproduction de la ratte de deux plantes presumes contraceptives et leurs activités antioxydantes. International journal of multidisciplinary and current Research . 1305 - 1311 P.
22. Robert D.H., Andriy E.B., (2003). Muscarinic regulation of cardiac channels Br J. Pharmacol, 139: 1074-84.
23. Schouman M., (2002). Nouveaux traitements oraux de l'impuissance, Angéiologie, 54(4): 65-68.
24. Titrikou S., Eklou-Gadegbeku K., Aklikokou A. K., Gbeassor M., (2008). Effets de *Biophytum petersianum* (Oxalidaceae) sur la pression artérielle chez le rat wistar. Phytothérapie, 6: 215-218.