

EFFECTS OF AQUEOUS EXTRACT OF ROOTS OF *BOERHAVIA DIFFUSA* LINN (NYCTAGINACEAE) ON SEXUAL PARAMETERS IN RAT

^{1*}Bassoueka D'Avila Judicaël, ¹Okassa Poma Chancelia Inès, ¹Ondele Radar, ¹Silaho Maleke
Emmanuella Divine, ¹Fourika Daisy Christie, ²Abena Ange Antoine

¹Laboratory of Pharmacodynamics and Experimental Physiopathology (L2PE), Faculty of Sciences and
Technology, Marien Ngouabi University, BP: 69 Brazzaville-Congo,

²Biochemistry and Pharmacology Laboratory, Faculty of Health Sciences, Marien Ngouabi University,
BP: 69 Brazzaville- Congo

* Author for Correspondence: basdavila@gmail.com

ABSTRACT

Boerhavia diffusa is a plant belonging to the Nyctaginaceae family and used in traditional medicine for its many therapeutic virtues, including erectile dysfunction which is a real public health problem. This study aimed to enhance the use of *Boerhavia diffusa* in reproduction. Therefore, the roots extracts of *Boerhavia diffusa* in doses of 100, 250 and 500 mg/Kg with Viagra 205 mg/kg were used on the normal and castrated male rats. Results obtained were analysed statically and it is noticed that the roots aqueous extract of *Boerhavia diffusa* significantly increased ($p < 0.05$; $p < 0.01$; $p < 0.001$) the number of sexual climbs, erections, and ejaculations. It is also perceived an increase much more expressed at the dose of 500 mg/kg and a significant decrease of the latency time between two consecutive mounts. Moreover, in castrated rats, there is a significant increase ($p < 0.001$) in the number of sexual mounts, erections and a significant decrease in the latency time with the roots aqueous extract of *Boerhavia diffusa* at the single dose of 500 mg/kg. The flavonoids and steroids reported in this extract could be responsible for the aphrodisiac effects observed.

Keywords: *Boerhavia diffusa*, Aqueous Extract, Viagra, Aphrodisiac, Flavonoids

INTRODUCTION

Sexual diseases are abundant all over the world such as the erectile dysfunction or impotence. The origins of this degeneration in the capacity of male reproduction are abundant. The impotence as clinical term is used to define the incapability to reach and preserve a sufficient and rigid penile erection during sexual contact satisfaction (Guay *et al.*, 2003). Men of all ages mainly from 40 to 70 years can be affected by erectile dysfunction which is widespread to all professional and sociocultural groups (Isidori *et al.*, 1999). The erectile dysfunction as sexual disorder sometimes is caused by hypertension, diabetes, smoking, alcoholism, and prostatic diseases (Meuleman EJ H, 2003). This serious problem on occasion leads a couple to separation. There are many treatments for erectile dysfunction depending on the life standard. The therapy for erectile dysfunction in developed countries, includes the penile prostheses implantation, intracavernous vaccinations, and the usage of certain medical products (Chevret *et al.*, 2004). However, in developing countries, for economic reasons, about 80% of the population treat erectile dysfunction by using therapeutic plants. Many plants such as *Syzygium aromaticum*, *Montanoa tomentosa*, *Fadogia agrestis*, *Massularia acuminata*, are reputed to be aphrodisiac plants. These plants have an aphrodisiac activity for the presence of phytoconstituents like phenols, sterols, amino acid, alkaloids, and saponin which improve sexual function (Kumar *et al.*, 2000; Kim *et al.*, 1998, Ondélé, 2016). Such as the case of *Boerhavia diffusa*, widely distributed in tropical Africa (Akassa *et al.*, 2019; Baka KH, 2012) and used in the current study.

Research Article (Open Access)

Boerhavia diffusa, is a plant belonging to the Nyctaginaceae family and reputed to have an aphrodisiac effect. Therefore this plant is capable of arousing sexual desire and restoring men's virility. In Congo-Brazzaville, many traditional health therapists use this plant to treat erectile dysfunction. The present study consists in evaluating the aphrodisiac effects of *Boerhavia diffusa* on the normal and castrated male rats.

MATERIALS AND METHODS

2.1. Animal material

Male and female albino rats of the Wistar strain (200-250 g), supplied by the pet store of the Institute for Research in Health Sciences (IRSSA) are used. They were acclimatized for a week before experimentation and kept under standard conditions, with free access to food and drinking water. These animals were fasted for 24 hours before experimentation.

2.2. Plant material

The fresh roots of *Boerhavia diffusa* were collected between the months of October and December 2022 in Brazzaville, Congo, political capital, exactly in the Talangaï district. A specimen of this plant roots was authenticated by Okassa Poma Chancelia Inès. A sample of this plant roots was kept in the National Herbarium of the laboratory of Pharmacodynamics and Experimental Physiopathology (L2PE), Faculty of Sciences and Technology, FST, Marien Ngouabi University, Brazzaville, under the label MPC/603. It was dried at room temperature (25-30°) for three (3) weeks and crushed using a mortar.

2.3. Methods

2.3.1. Preparation of roots aqueous extract of *Boerhavia diffusa*

50 g of *Boerhavia diffusa* powder were boiled in 500 ml of distilled water for 30 minutes. After cooling and then filtration on absorbent cotton, the decoction obtained was concentrated. This made it possible to obtain a solid residue.

2.3.2. Pharmacological tests

2.3.2. Evaluation of roots aqueous extract effect of *Boerhavia diffusa* on reproductive parameters in rats

2.3.2.1. Aphrodisiac effect of roots aqueous extract of *B. diffusa* in normal rats

The sexual capacities and performance of male rats after administration of various products were evaluated according to the method reported by Akassa *et al.* (2019). For this, groups of one (1) male rat each were formed and treated orally as follows: The negative control group received distilled water 0.5ml/100g; the positive control group received Viagra 2.5mg/kg; the test groups received the extract respectively at doses of 100, 250 and 500 mg/kg. Administrations were made daily for one week. Females are pre-treated for 72 hours with estradiol to make them receptive to males. Six (6) hours after the last administration, the animals were placed in pairs within the cages. Sexual parameters such as the number of sexual mounts, the number of erections, the number of ejaculations, the latency time, were observed for one hour from the first, the fourth and the seventh day of the treatment for the male rats.

2.3.2.2. Aphrodisiac effect of roots aqueous extract of *Boerhavia diffusa* in castrated rats

The study was performed according to the method used by Ondéle (2016), but with a little modifications. The anesthetized rat by the ether was placed in a dorsal decubitus on a tray put dissection, using scissors. Then the animal is tweezed goshawk of the testicular scrotum and an incision of muscular different layers on the median line of the scrotum was carried out. Testises are given off by using scissors, and so the wound is sutured as shown in Figure 1. 15 days after the castration, groups of three (3) rats each, were created and managed every day for a week in the following way: negative control group received distilled water 0.5 ml/100 g; the positive control group received Viagra 2.5 mg/kg; the test group received roots aqueous extract of *Boerhavia diffusa* 500 mg/kg. Sexual parameters such as the number of sexual mounts, the number of erections, the number of ejaculations, the latency time, were observed for one hour.



Figure 1: Image showing the baring of the rat's testicles

2.4. Statistical analysis

Statistical analysis was performed by using Excel software (Office 2010) in order to calculate statistical parameters. The findings were presented as mean \pm SEM and subjected to the variance analysis and the Student-Fischer t-test ($p < 0.05$, $p < 0.01$, $p < 0.001$).

RESULTS AND DISCUSSION

3.1. Statistical analysis

Statistical analysis was carried out to determine Statistical parameters using and results were expressed as \pm standard error of the mean. Then, comparisons among different treatments and measurements among groups were carried out from the Stud t test and visualised as graphs (Figures 2, 3, 4 and 5).

3.2. Aphrodisiac effects of the aqueous extract of *B. diffusa* roots in normal rats

3.2.1. Effect on number of sexual climbs

Figure 2 presents the effect of the aqueous extract of *Boerhavia diffusa* on number of sexual climbs in rat. From this Figure, it is noticed that the extract of *Boerhavia diffusa* like viagra, caused respectively at doses 100, 250, and 500 mg/kg a significant dose-dependent increase ($p < 0.001$) of number of sexual

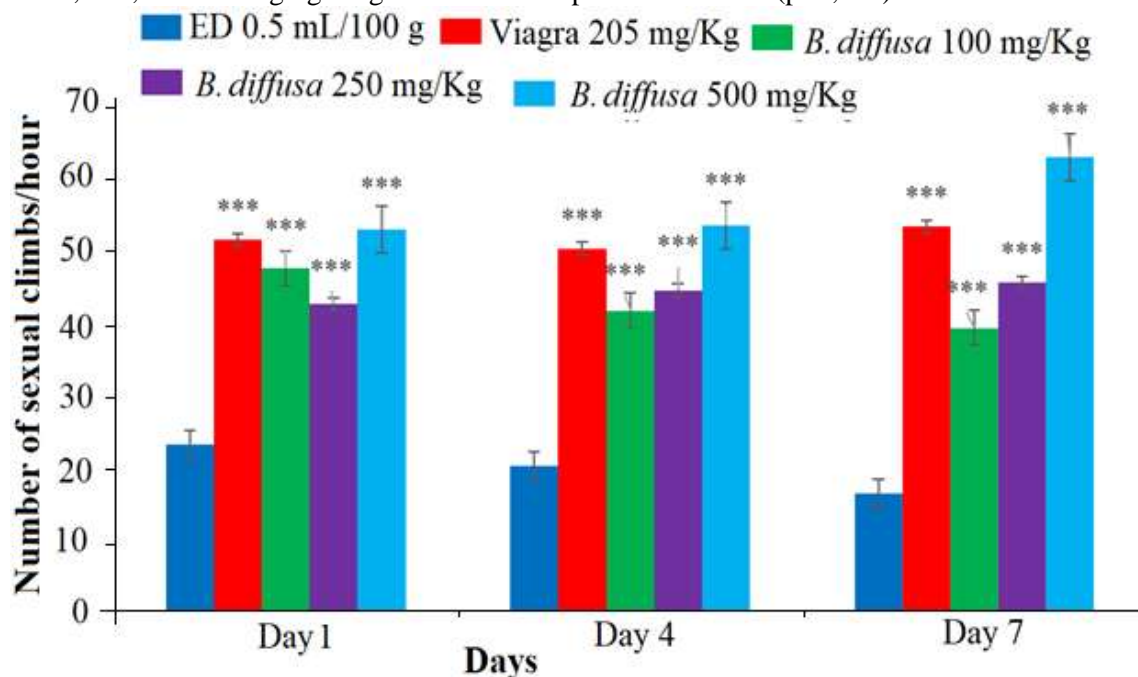


Figure 2: Effect of roots aqueous extract of *Boerhavia diffusa* on the number of sexual in rats. The values are the means \pm SEM, n=5, * $p < 0.001$, very significant difference**

Research Article (Open Access)

3.2.2. Effects on the number of erections

climbs at days 1, 4 and 7. This increase varies from 47.73 ± 8.5 ; 41.93 ± 1.08 ; 39.54 ± 0.86 for the extract at 100 mg/kg, 52.56 ± 1.19 ; 44.73 ± 1.00 ; 53.45 ± 1.16 for the extract at 250 mg/kg and 53.04 ± 0.55 ; 53.58 ± 0.87 ; 62.96 ± 3.05 for the extract at 500 mg/kg compared with the control group 23.46 ± 0.9 ; 20.46 ± 0.7 ; 16.7 ± 2.1 . At doses of 100, 250 and 500 mg/kg, the aqueous extract from the roots of *B. diffusa* caused a significant increase ($p < 0.01$); ($p < 0.001$) of the number of erections like Viagra (Figure 3). Comparing with the control group, this increase goes from 37.40 ± 2.96 ; 42.76 ± 1.77 ; 41.02 ± 0.52 for the extract at 100 mg/kg, 41.42 ± 2.16 ; 41.32 ± 1.21 ; 49.66 ± 0.21 for the extract at 250 mg/kg, 59.8 ± 2.08 ; 54.4 ± 0.92 ; 66.12 ± 0.50 for the extract at 500 mg/kg, respectively at first, fourth and seventh day at 21.92 ± 1.07 ; 20.83 ± 0.57 ; 21.55 ± 0.87 for the control group.

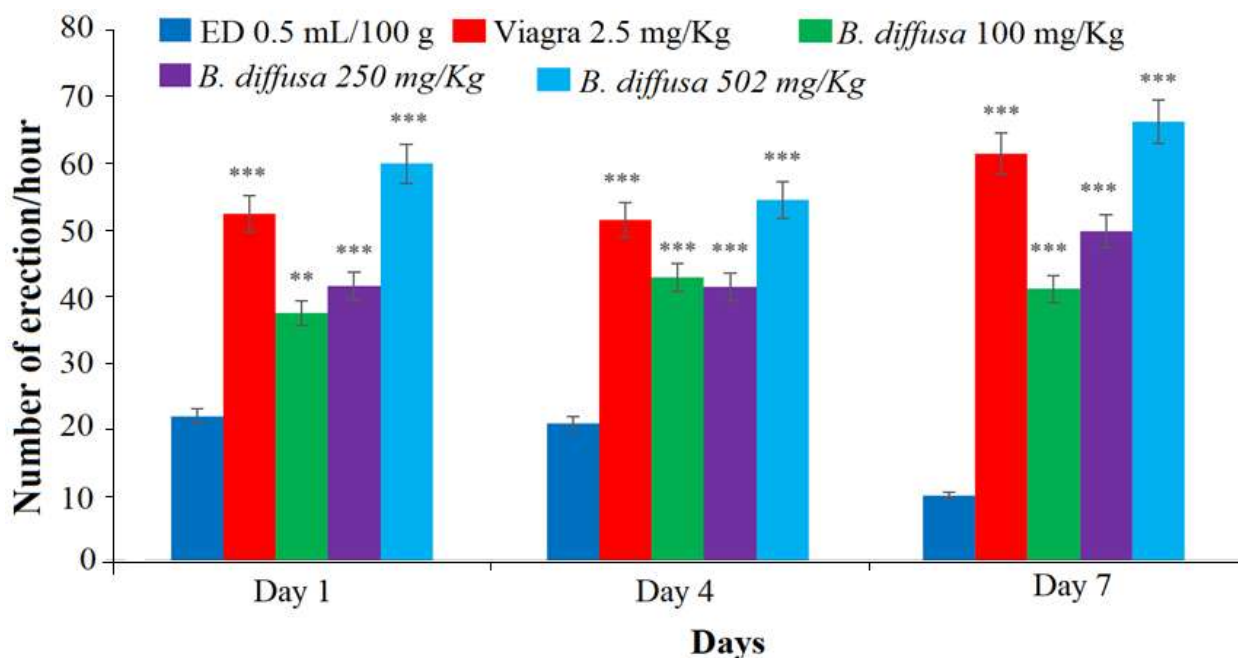


Figure 3: Effect of the aqueous extract of the roots of *Boerhavia diffusa* on the number of erections in rats. The values are the means \pm SEM, $n=3$, ns: difference not significant * $p < 0.05$, * $p < 0.01$, significant difference, * $p < 0.001$, very significant difference.**

3.2.3. Effect on the number of ejaculations

The aqueous extract from the roots of *B. diffusa* at doses of 100 and 250 mg/kg caused a non-significant increase of 0.82 ± 0.13 ; 1.03 ± 0.11 ; 1.12 ± 0.22 for the extract at dose of 100 mg/kg, 0.82 ± 0.13 ; 1.06 ± 0.11 ; 1.07 ± 0.24 for the 250 mg/kg extract, as well as a significant increase at the 500 mg/kg dose of 0.91 ± 0.03 ; 1.2 ± 0.08 ; 1.15 ± 0.21 in the number of ejaculations in the rat compared with the control group 2.27 ± 0.18 ; 2.32 ± 0.07 at first, fourth and seventh day (Figure 4).

3.2.4. Effect on latency time

Figure 5 shows the effect of the aqueous extract of *B. diffusa* on the latency time in rats. It is observed that the extract at doses of 100, 250, 500 mg/kg caused a significant dose-dependent decrease in latency time compared with the control group. 52.7 ± 4.69 ($p < 0.001$); 42 ± 0.65 ($p < 0.01$); 42.6 ± 0.37 ($p < 0.001$) for the extract at 100 mg/kg, 42.4 ± 2.88 ($p < 0.001$); 50.6 ± 0.77 ($p < 0.05$); 39.4 ± 2.35 ($p < 0.01$) for the extract at 250 mg/kg and 36.2 ± 2.25 ($p < 0.001$); 39.8 ± 0.85 ($p < 0.001$); 35.4 ± 4.17 ($p < 0.01$) for the extract at 500 mg/kg compared with the control group 85.5 ± 3.41 ; 65 ± 5.46 ; 50.29 ± 1.3 .

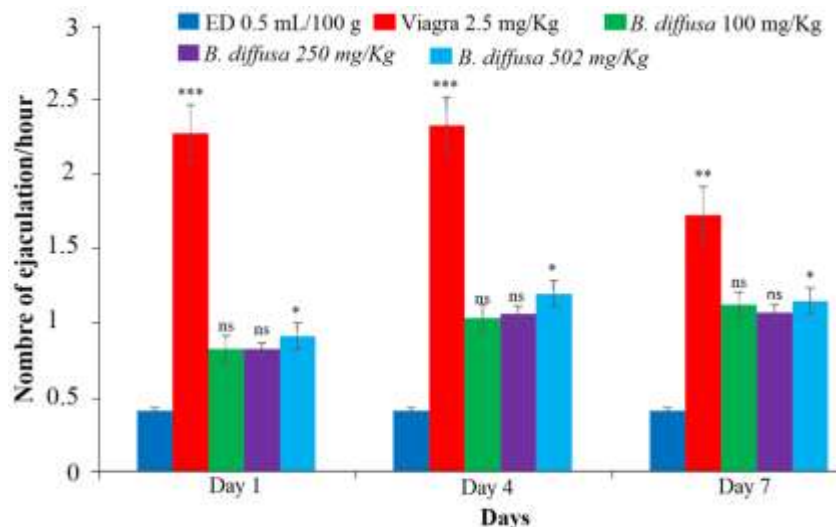


Figure 4: Effect of the aqueous extract of the roots of *Boerhavia diffusa* on the number of erections in rats. Values are means \pm SEM, n=3, ns: difference not significant *p<0.05, **p<0.01, difference significant, ***p<0.001, difference very significant.

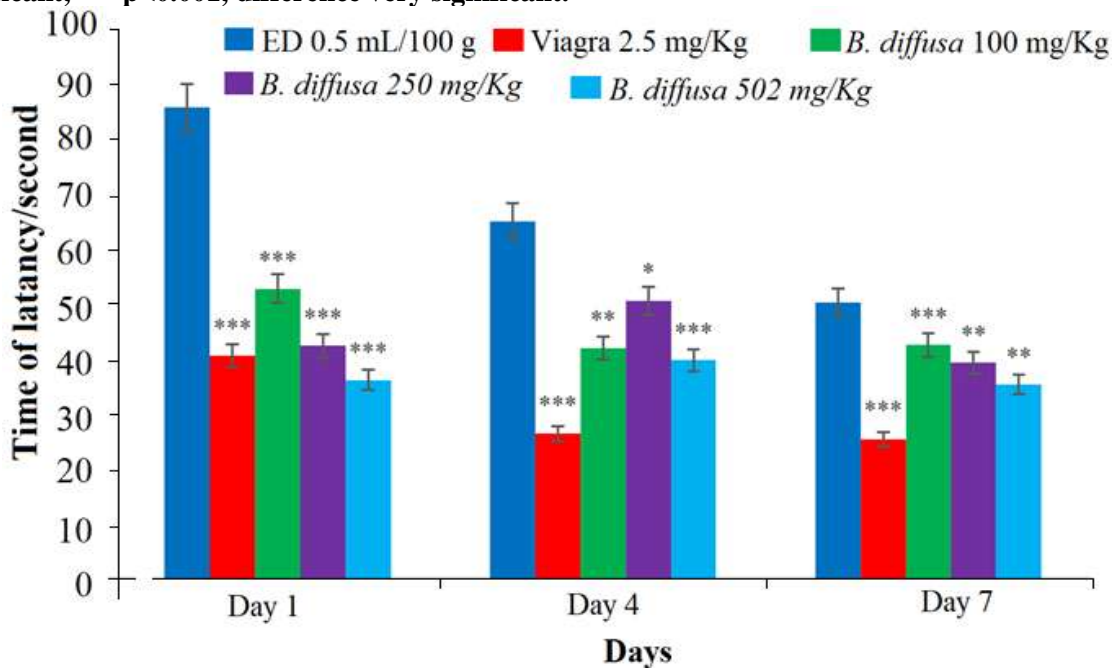


Figure 5: Effect of aqueous extract of *Boerhavia diffusa* roots on latency time in rats. Values are means \pm SEM, n=3, *p<0.05, **p<0.01, significant difference, ***p<0.001, highly significant difference

3.3. Aphrodisiac effects of the aqueous extract of the *Boerhavia diffusa* roots in castrated rats

Table 1 presents the effect of the aqueous extract of *Boerhavia diffusa* roots in castrated rats. These results suggest that at a dose of 500 mg/kg, the aqueous extract of *Boerhavia diffusa* caused a very significant increase (p<0.001) in the number of mounts and erections on the first and fourth day, as well

Research Article (Open Access)

as a reduction in the latency time. The extract of *Boerhavia diffusa* like Viagra had no effect on sexual parameters such as mounts, erections and the number of ejaculations on day.

Table 1: Aphrodisiac effects of the aqueous extract of the roots of *B. diffusa* in castrated rats

Treatments	Number of sexual mounts			Number of erections			Number of ejaculations			Latency time		
	J1	J4	J7	J1	J4	J7	J1	J4	J7	J1	J4	J7
Distilled water 0.5ml/100g	0±0	0±0	0±0	0±0	0±0	0±0	0±0	0±0	0±0	0±0	0±0	0±0
Viagra 2.5mg/kg	15.33±0.88***	8.12±0.44***	0±0	13.7±1.65***	1.33±0.33*	0±0	0±0	0±0	0±0	171.83±1.96***	161.18±2.46**	0±0
<i>B. diffusa</i> 500mg/kg	14.38±2.88***	1.51±0.24**	0±0	6.46±0.29***	0±0	0±0	0±0	0±0	0±0	119.77±10.08***	153.83±2.309***	0±0

The values are the means ±SEM, n=3, **p<0.05, ***p<0.001, significant difference compared to the distilled water control of 0.5 ml.

DISCUSSION

The aim of this work was to evaluate the effects of the aqueous extract of *Boerhavia diffusa* roots on the reproductive parameters in male rats. Oral administration of *Boerhavia diffusa* roots at doses of 100, 250 and 500 mg/kg caused an increase in the number of sexual mounts which reinforces physical contact and bonding between animals. This suggests that this extract stimulates sexual desire in male rats (Ondélé *et al.*, 2015, Egbe, 2017, Dau-Thuy, 2019). The increase in the number of erections observed in animals treated with different doses of the aqueous extract of *Boerhavia diffusa* roots suggests that this extract would act positively on the blood flow in the penis. In other words, it would increase the sexual capacities of the rat male. Sexual stimulation causes the release of carbon monoxide which is one of the main mediators of the erection. The licks observed in animals treated with the aqueous extract of *Boerhavia diffusa* roots suggest that this extract would act as a reference molecule (Watcho, 2010). Concerning ejaculations, *Boerhavia diffusa* caused an increase in the number of ejaculations marked by several licks after intromission. These results suggest that the aqueous extract from the *Boerhavia diffusa* roots would provide libido. The same nerve impulses that activated the erection continue to increase in intensity up to a certain critical threshold that will lead to ejaculation (Tang, 2019, Fouche, 2015). The decrease in the latency time observed with the aqueous extract of the roots of *Boerhavia diffusa* recommends that it would act constructively on the performance and sexual resistance of the rat (Akassa *et al.* 2019, Morabandza *et al.*, 2017). The treatment of castrated rats with the aqueous extract of the *Boerhavia diffusa* roots showed a maintenance of sexual activity such as sexual mounts and erections. This maintenance advises that this extract contains analogy of androgens (phytohormones) which is responsible for maintaining sexual activity observed in rats (Watcho, 2010).

CONCLUSIONS

It can be well-known on the basic results obtained that the erectile dysfunction can be treated by traditional medicines being effective and economical. From this evaluation, *Boerhavia diffusa* was identified for the erectile dysfunction treatment.

Research Article (Open Access)

The current work evaluated the aphrodisiac effects of the aqueous extract of the *Boerhavia diffusa* roots in rats. Then the results obtained showed that the aqueous extract of the *Boerhavia diffusa* roots has an aphrodisiac effect in normal rats at doses of 100, 250 and 500mg/kg and in castrated rats at 500mg/kg.

REFERENCES

- Chevret M, Jaudinot E, Sullivan K, Marrel A, and De Gendre AS (2004).** Impact of Erectile Dysfunction (ED) on sexual life of female partners: assessment with the Index of Sexual Life (ISL) questionnaire. *Journal of Sex and Marital Therapy*, vol. 30, no. 3, pp. 157–172.
- Kumar PKS, Subramoniam A, and Pushpangada P (2000).** Aphrodisiac activity of *Vanda tessellata* (Roxb.) Hook. ex Don extract in male mice. *Indian Journal of Pharmacology*, vol. 32, no. 5, pp. 300–304.
- Kim HJ, Woo DS,, Lee and Kim JJ (1998).** The relaxation effects of ginseng saponin in rabbit corporal smooth muscle: is it a nitric oxide donor. *British Journal of Urology*, vol. 82, no. 5, pp. 744– 748.
- Ondélé R (2016).** Aphrodisiac and cardiovascular effects of the aqueous extract of the bark of the trunk of *Buchholziacoriacea* Engl. (Capparidaceae) in the male wistar rat. Doctoral thesis. Marien Ngouabi University, 10: 22-32.
- Akassa H, Ondélé R, Pénémé BML, Etou Ossibi AW, Morabandza CJ, Tamboura HH, Abena AA (2019).** Aphrodisiac activity and study of the mechanism of action of the aqueous extract of *Pausinystalia yohimbekschum* (Rubiaceae) in the wistar rat. *Journal of animal and plant sciences*, 1: 6372-6383.
- Baka KH (2012).** Prevalence of erectile dysfunction in patients consulting in urology. Doctoral thesis. Cadi Ayyad University, 17: 15-32.
- Ondélé R, Etou Ossibi AW, Bassoueka DJ, Pénémé BML, Elion Itou RDG, Massengo A, Abena AA (2015).** Acute toxicity and aphrodisiac effect of the aqueous extract of *Rauvolfia obscura* K. Schum (apocynaceae). *Africa science*, 6: 4-10.
- Egbe BB, Ateufack G, Kamanyi A (2017).** Validating sex-enhancing potentials of aqueous extract of *Pseudopanax arboreus* (Araliaceae) (L.F. Phillipson) on normal male rats. *International journal of multidisciplinary and current research*, 2:43-53.
- Dau Thuy D, Le Minh H, Nguyen TTGH, Dang TNM, Do TNGQ, Tran QT (2020).** Effects of *Cnidium Monnieri* cuss fruit extract on sexual behaviors in male rats. *Clinical phytoscience*, 5:9-15.
- Watcho P, Nchegang B, Nguelefack TB, Kamanyi A (2010). Evaluation of the prosexual effects of *Bridelia ferruginea* extracts in naïve male rats. *Andrologie*, 20(3):209-2015.
- Tang X., Opeyemi J. Olatunyi, Zhou Yfeng, Hou X (2017).** In vitro and in vivo aphrodisiac properties of the seed extract from *Allium tuberosum* on corpus cavernosum smooth muscle relaxation and sexual behavior parameters in male wistar rat. *Food Research International*, 102, 681-689.
- Fouche G, Afolayan A, Wintola O, Korombi TE, Senabe J (2015).** Effect of the aqueous extract of the aerial parts of *Monsonia angustifolia* E. Mey. Ex A. Rich, on the sexual behavior of male wistar rats. *BMC Complementary Medicine and Therapies*, 8:3-11.
- Morabandza CJ, Ondélé R, Elion Itou RDG, Etou Ossibi AW, Imbella C, Mokondjimobe E, Ongoka RP, Abena AA (2017).** Aphrodisiac activity of aqueous and hydroethanolic extracts of the stem Bark of *Strychnos camptoneura* (Longaniaceae) in wistar rat. *Asian journal of science and technology*, 4:5-9.