

Original Research Article

doi: <http://dx.doi.org/10.20546/ijcmas.2016.502.053>

Hypotensive Effect of an Aqueous Extract from *Heliotropium indicum* Linn. 1753 (Boraginaceae)

ZAHOUI Ouga Stanislas*, NENE BI Semi Anthelme,
SORO Tianga Yaya and TRAORE Flavien

Department of Physiology, U.F.R Biosciences, University Felix Houphouet-Boigny,
22 B.P. 582 Abidjan 22, Côte d'Ivoire

*Corresponding author

ABSTRACT

Keywords

Heliotropium indicum,
Hypotensive potential,
Hypertensive effect

Article Info

Accepted:
23 January 2016
Available Online:
10, February 2016

The use of *Heliotropium indicum* for the treatment of various conditions has been demonstrated by many precedants works. The aim of this present study was to demonstrate the hypotensive potential of this plant. Starting from an animal model, we were able to show that this aqueous extract at doses ranging between 3.51×10^{-3} and 3.75×10^{-2} g/kg bw, induced a sustained hypotension (dose-dependent) similar to that caused by acetylcholine (Ach) at doses ranging from 5.6×10^{-7} g/kg body weight and 5.5×10^{-4} g/kg body weight in rabbits. The study of the interaction between Adrenaline (Adr), a hypertensive reference molecule to 2.5×10^{-5} g/kg bw and aqueous extract of *Heliotropium indicum* (AEH) showed that the extract has significantly reduced the hypertension induced by Adr. These results indicated that the aqueous *Heliotropium indicum* extract had a hypotensive potential. The traditional use of this plant to treat arterial hypertension was justified.

Introduction

Heliotropium indicum Linn, 1753 (Boraginaceae) commonly called "herbe papillon" or "herbe à verrues" in French, "Indian heliotrope" or "Cock's Comb" in English is a medicinal plant that intervenes in the treatment of several diseases in sub-Saharan Africa (Keita *et al.*, 1999).

The decoction is used to activate the work of Women in child birth and given to people who suffer from heart or stomach (Adjanohoun and AKE-ASSI, 1979) in Côte d'Ivoire.

The juice of this plant is also used as anti-gonococcal and anti-diarrheal (Kalanda and Omasombo, 1995; Traore *et al.*, 2007).

In Senegal the "Wolof" and "Lebu" use the powdered leaves to treat various skin diseases specifically eczema and impetigo in children (Adjanohoun *et al.*, 1989). He enters in to the treatment of the fading and of syncope (Bouquet and Debray, 1974). It is also used against malaria.

The pharmacological tests showed that the methanol extract of the leaves of *Heliotropium indicum* shows anti-inflammatory activity (Srinivas *et al.*, 2000) and curative in rats (Srinivasan, 2001; Reddy *et al.*, 2002) and the alcoholic extract also has antimicrobial activity (Rao *et al.*, 2006). Kamanzi *et al.*, 2002 showed that the methanol extract of the leaves of this plant has larvicidal properties on *Aedes aegypti*.

The purpose of this study is to highlight the hypotensive potential of the aqueous extract of *Heliotropium indicum* in order to justify its use in the treatment of hypertension.

Materials and Methods

Plant Material

The plant material used is the leaves of *Heliotropium indicum* (Boraginaceae), purchased from the herbalists of Adjamé market (Abidjan). The plant material was identified and authenticated by Professor Laurent AKE-ASSI, the Plant Biology Laboratory, from the herbarium of the National Floristic Center of University Félix Houphouët Boigny-Abidjan (Côte d'Ivoire). A voucher specimen (herbarium No. 10411 of December 12, 1968).

Extraction Method of Freeze-dried Aqueous Extract

Fifty grams of the leaves were dried in the shade at room temperature between 26 ° C and 30°C, and powdered with a microcrusher. The powder obtained (50 g) was macerated for 24 hours in a 1 liter of distilled water using magnetic stirrer. The supernatant was filtered with Whatman No 1 filter paper (3 mm) and it was evaporated using rotating evaporator. The solvent was completely removed under reduced pressure to obtain a dry mass. The aqueous extract of

Heliotropium indicum obtained was stored at -5°C. The concentrations to be tested were prepared extemporaneously by dilution in the Mac Ewen (ME) a physiological solution.

Extraction Method Decoction

Seventy grams of the dried bark powder of this plant were mixed with 800 ml of water. The whole mixture was boiled for 30-45 minutes. The decoction obtained was approximately 500 ml. The decoction was then filtered on Whatman No 1 filter paper (3 mm) paper and hydrophilic cotton subsequently. The filtrate obtained was evaporated under vacuum at 70°C using a Rotavapor evaporator type "Bucchi". The resulted paste was frozen and lyophilized.

Animal Material

The animals used for the experiments were rabbits of *Oryctolagus cuniculus* species. They were used to study the action of this extract on blood pressure variation. The rabbits used weighed an average of 2 ± 0.2 kg. They came from different farms around Abidjan. Also they were acclimated for seven days at the pet guage of UFR Biosciences, University Félix Houphouët-Boigny, to regulate and harmonize their physiological state before the experiments. The animals were treated according to the principles of scientific ethics committee of Biology, on the use of laboratory animals in experimental tests.

Chemicals and Saline Chemical Products

During this work, chemicals were used viz: Acetylcholine (Ach) (Prolabo, France), Adrenaline (Adr) (Prolabo, France).

Saline

During this study, mammals were fed with normal saline - Mac Ewen at pH 7.4. It

contains NaCl 122 mM; KCl 4.9 mM; CaCl₂ 2.52 mM; NaPO₄H₂ 1.18 mM; NaHCO₃ 15.5 mM; MgCl₂ 1.2 mM and glucose 5.5 mM.

Experimental and Technical Apparatus for Recording Blood Pressure

The experimental device used for recording blood pressure is the Ludwig gauge. The rabbit was anesthetized by éthyuréthane injection intra-peritoneally; dosed at 40% in the ratio of 1 g/kg bw. Its carotid artery was exposed and intubated with a catheter connected to the manometer containing mercury. Changes in the pressure of the rabbit carotid artery were transmitted to the column of mercury. They were transcribed using a stylus listing, on a cylinder-coated paper containing lampblack. It was rotated at a constant speed. The test substances were dissolved in a solution of Mac Ewen and then injected into the rabbit (saphenous vein) before dissection.

Expression of Results

Effective Dose 50% (ED₅₀) was expressed in grams of lyophilized aqueous extract per kilogram of body weight of the animal (g/kg bw).

Treatment of Experimental Results

Recordings made on paper were smoky and tend to vanish very soon. To fix the soot it was scanned before being reversed; small corrections were done using Photo editor software and Microsoft Paint.

The statistical analysis of values and graphical representation of data were carried out respectively through Graph Pad InStat software (Microsoft, San Diego, California, United States) and GraphPad Prism 4 (Microsoft, San Diego, California, United States).

The statistical analysis such as analysis of variance (ANOVA), and multiple comparison Tukey Kramer test were performed on the obtained data with a level of significance at P <0.05. All values were expressed with the standard error of the mean and presented as means ± SEM.

Place and Period of Study

These experiments were conducted at the Laboratory of Animal Physiology of the University Felix Houphouët-Boigny (Côte d'Ivoire), between March 2008 and October 2008. Additional experiments were performed in April 2010.

Results and Discussion

The Effects of the Aqueous Extracts of *Heliotropium indicum* (AEH) on the Blood Pressure of Rabbits

Figure 1 shows the effects of aqueous extract of *Heliotropium indicum*(AEH) on blood pressure in the rabbits according to the dose. The rabbit had a normal blood pressure of a value of 108 mm Hg in our experimental conditions.

Doses of AEH between 3.1×10^{-4} g/kg bw and 3.75×10^{-2} g/kg bw caused hypotension and increased blood pressure from 9.7 ± 1.81 mm Hg to 36.66 ± 3.62 mm Hg, which corresponds to a decrease in blood pressure of the normal rabbit from 8.98% (p <0.05) to 33.94% (p <0.001).

This experiment was performed several times (n = 4) and the average values obtained have enabled us to obtain the curve in Figure 1B, reflecting the decrease in blood pressure of the rabbits according to the dose of AEH. This allowed a sigmoid graph formulation that determines the effective dose 50% (ED₅₀) which is equal to 1.25×10^{-2} g/kg bw.

Effects of Acetylcholine (Ach) on the Blood Pressure in Rabbits (Dose Dependent)

Figure 2 shows the effects of the administration of increasing doses of Ach on the blood pressure of rabbits. Normal blood pressure of rabbits under our experimental conditions was 120 mm Hg. Ach doses from 5.6×10^{-5} g/kg bw to 5.5×10^{-2} g/kg bw, caused a sustained dose-dependent hypotension, which varied from 45 ± 3.27 to 115 ± 3.45 mm Hg. This corresponds to a decrease in the normal blood pressure between 37 and 95% ($p < 0.001$). This experiment was carried out several times ($n = 3$) and the average values obtained, have enabled us to trace the curve of Figure 2B which reflects the reduction in blood

pressure of rabbits as a function of the dose of Ach. This sigmoid graph allowed the determination of an ED_{50} which is of 3×10^{-6} g/kg bw. The ED_{50} of Ach, which is a reference molecule, that showed approximately 4000 times lower than the ED_{50} of AEH (the lyophilized aqueous extract of *Heliotropium indicum*).

Effects of AEH on Hypertension Induced by Adrenaline (Adr) in Rabbits

Epinephrine was injected at 2.5×10^{-5} g/kg bw dosage level to the rabbits and induced a pressure of 76 ± 3.57 mm Hg, which represents 100% increase in the initial level of blood pressure (Figure 3).

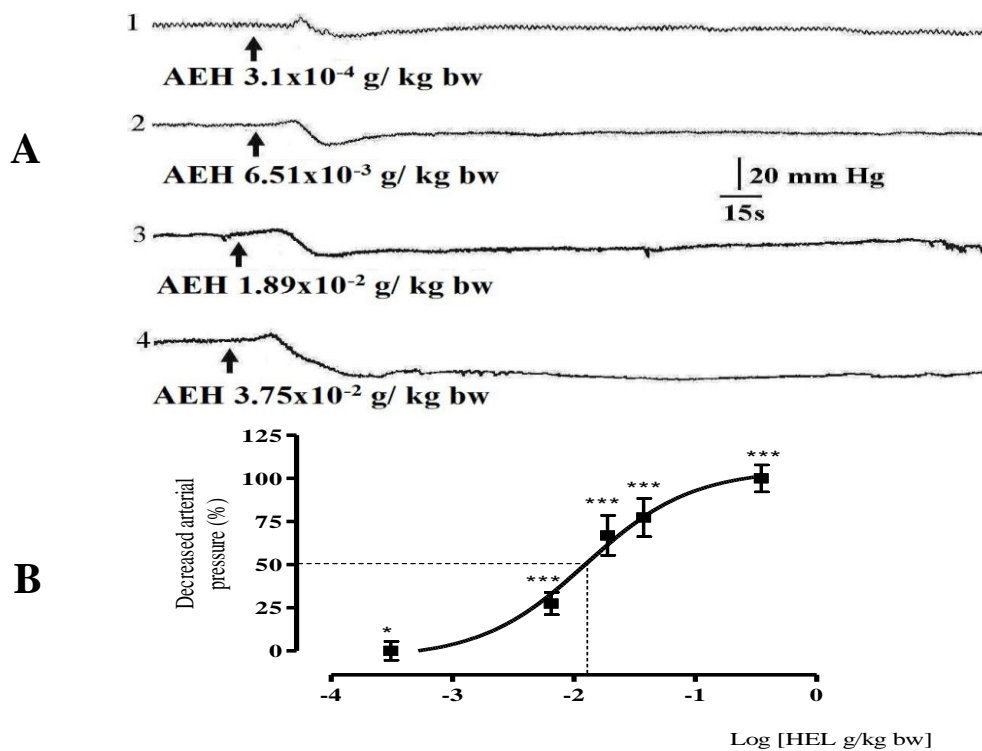


Figure.1 Effect of the Aqueous Extract of *Heliotropium indicum* on Blood Pressure of Rabbits as a Function of the Dose

A - Effect of dose response AEH

Effect of AEH in 3.1×10^{-4} g; 6.51×10^{-3} g / kg of bw (2); 1.89×10^{-2} g / kg bw (3); 3.75×10^{-2} g / kg bw (4)

B - Decreased blood pressure according to the dose of AEH

The values express the maximum percentage decrease in pressure relative to normal blood pressure (Mean \pm SEM; $n = 4$; * $P < 0.05$, *** $p < 0.001$). AEH causes a dose-dependent hypotension; $ED_{50} = 1.25 \times 10^{-2}$ g/kg bw

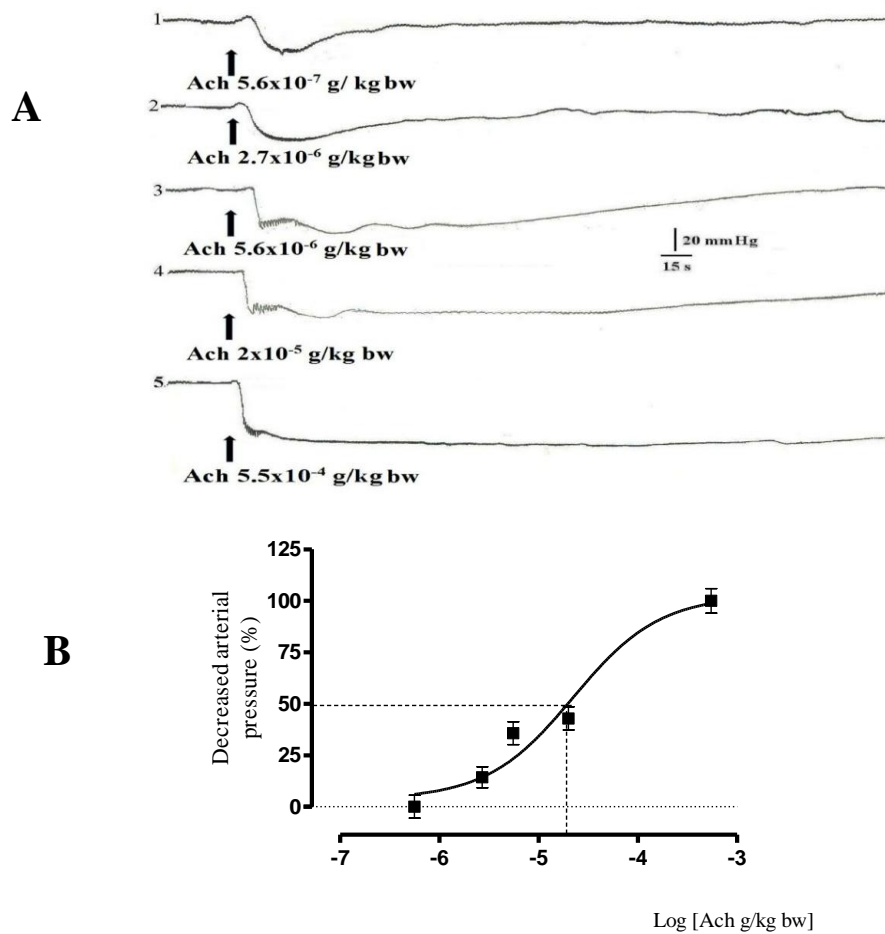


Figure.2 Effects of Ach on Blood Pressure of Rabbits as a Function of the Dose

A - Effect of Ach Depending on the Dose

Effect of Ach 5.6×10^{-7} g/kg bw (1); $2.7 \cdot 10^{-6}$ g/kg bw (2); 5.5×10^{-6} g/kg bw (3); $2 \cdot 10^{-5}$ g/kg bw (4); 5.5×10^{-4} g/kg bw (5)

The Ach lowers blood pressure rabbit between 5.6×10^{-5} and 5.5×10^{-4} g/kg bw

B - Decreased Blood Pressure Rabbit According to the Dose of Ach

The values express the maximum percentage decrease in pressure relative to normal blood pressure (mean \pm SEM; n = 4; * p < 0.05; ** p < 0.01; *** p < 0.001)

The Ach causes a dose-dependent hypotension, $ED_{50} = 3 \times 10^{-6}$ g/kg bw

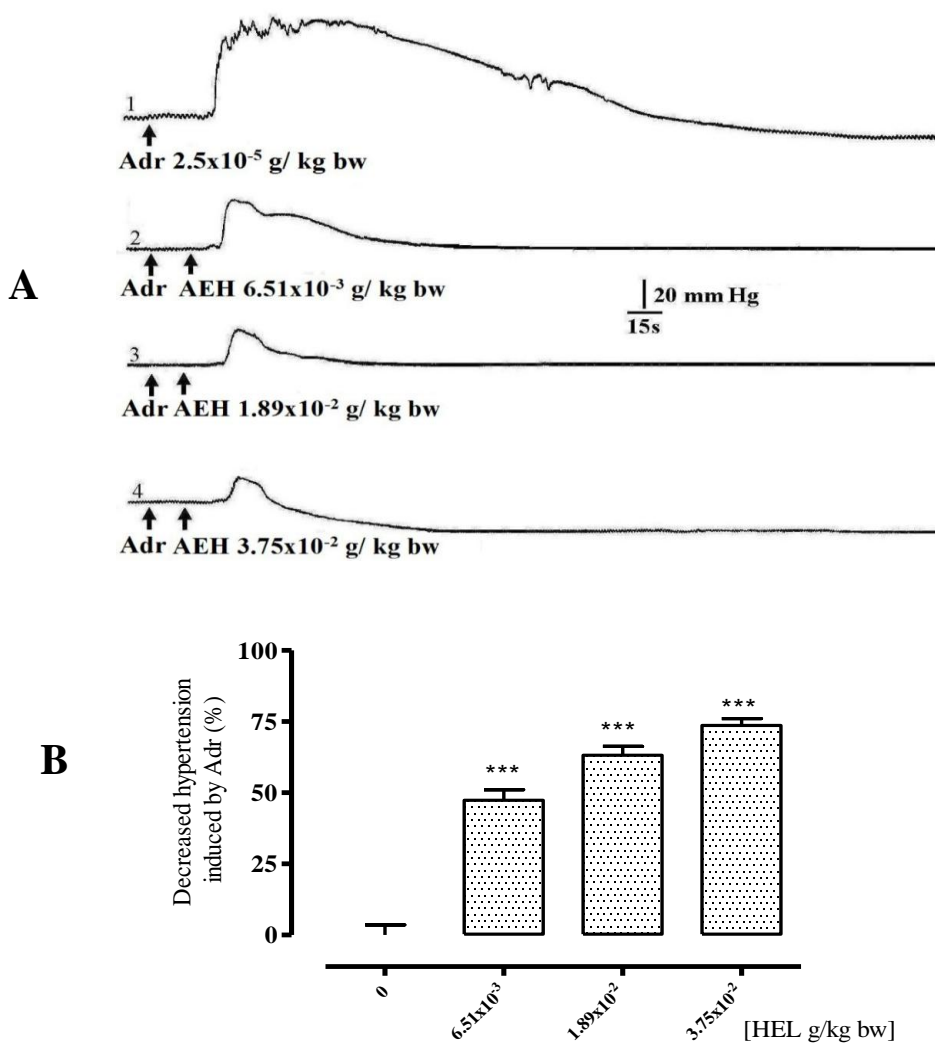


Figure.3 Effects of the Aqueous Extract of *Heliotropium indicum* on Hypertension Induced by Adrenaline in Rabbits

A - Interaction Adr-AEH

1 - Effect of Adr to 2.5×10^{-5} g/kg bw

2 to 4 - Effect of AEH to 6.51×10^{-3} g/kg bw (2); 1.89×10^{-2} g/kg bw (3); 3.75×10^{-2} g/kg bw (4) (second arrow) preceded by the effect of the Adr to 2.5×10^{-5} g/kg bw (first arrow).

B - Reduction of Hypertension Induced by Adrenaline in Function of the Dose of *Heliotropium indicum*

The values express the pressure reduction percentages relative to control (Mean \pm SEM; n = 3; * P <0.05; ** p <0.01, *** p <0.001).

AEH between 6.51×10^{-3} and 3.75×10^{-2} g/kg bw strongly inhibits hypertension induced by adrenaline

In the presence of AEH to increasing doses of between 6.51×10^{-3} g/kg bw and 3.75×10^{-2} g/kg bw adrenaline at the dose of 2.5×10^{-5}

g/kg bw, Adr induced hypertension whose amplitude is less significant, ranging from 40 ± 3.66 mm Hg to 10 ± 2.39 mm Hg. This

corresponded to 47.37% ($p < 0.001$) and 73.63% ($p < 0.001$) decrease in the level of hypertension. These hypertensions were followed by hypotension to 20 ± 2.85 mm Hg at doses of greater than or equal to 3.75×10^{-2} g/kg bw of AEH. The histogram of Figure 4 reflects the average variations ($n = 4$) in the level of adrenaline induced hypertension in rabbits according to the dose of AEH.

AEH between 3.1×10^{-4} and 3.75×10^{-2} g/kg bw, induced a dose-dependent sustained hypotension. Further, this crude extract significantly reduced blood pressure induced by adrenaline to 2.5×10^{-5} g/kg bw.

These results indicate that AEH has an antihypertensive potential. They justify the traditional use of *Heliotropium indicum* to treat hypertension.

The hypotensive effects of AEH are comparable to those of African medicinal plants such as *Ceasalpinia bonduc* (Ceasalpinaceae) (Datte *et al.*, 2004), *Swartzia madagascariensis* (Ceasalpinaceae) (Soro *et al.*, 2004) and *Zanthoxylum zanthoxyloides* (Rutaceae) (Zahoui *et al.*, 2010).

Under similar experimental conditions Abo *et al.*, (1998) and Datte *et al.*, (2004) showed that aqueous extracts of *Mareya micrantha* (Euphorbiaceae) and *Ceasalpinia bonduc* (Ceasalpinaceae) contain cholinomimetic substances which induce hypotension in the rabbit between 5×10^{-6} and 5×10^{-2} g/kg bw range concentrations comparable to that of AEH.

The hypotensive effect of AEH could therefore be related to the presence of cholinomimetic substances in this extract.

Indeed, it is known that acetylcholine induced on blood pressure in a dose-dependent hypotension (Belemtougri *et al.*, 2001).

The ionic mechanisms responsible for cholinergic excitation involves an increase in potassium conductance (Parkington *et al.*, 2002) and a reduction of the slow calcium current (Gielsand Noble, 1976; Wang *et al.*, 2004). Hypotensive active principles of AEH could act according to the same mechanism of action.

References

- Abo, K.J-C., Aka, K.J., Ehile E.E., Traore, F., and Guede-Guina, F. 1998. Effets cholinergiques de la fraction 2 (F2) d'un extrait aqueux de *Mareya micrantha* (MAR) sur la pression artérielle et l'activité cardiaque. *Ann. Univ; Benin, Sér. Sciences*, Tome XIV : 57-76.
- Adjanohoun, E.J., and Ake A.L. 1979. Contribution au recensement des plantes médicinales de Côte d'Ivoire. Centre National de Floristique de l'Université Nationale de Côte d'Ivoire. (CNF), Tome 1, 23 (30) : 358 pages.
- Belemtougri, R., Mounanga, C., Ouedraogo, Y., and Sanogo, L. 2001. Effets de l'extrait aqueux total de *Lantana camara* L; (Verbenaceae) sur la pression artérielle de lapin. *Rev. Méd. Pharm. Afr.*, 15: 1-13.
- Bouquet and Debray. 1974. Plantes médicinales de la Côte d'Ivoire. *ORSTOM*, Paris, 232 pages.
- Datte, Y.J., Yapo, A.P., Kouame K.G.G., Kati, C.S., Amoikon, K.E., and Offoumou, A.M. 2004. Lead extract of *Caesalpinia bonduc* (Caesalpinaceae) induces an increase of contractile force in rat skeletal muscle in situ. *Phytomedicine*, 11 : 235-241.
- Giels, W.R., and Noble, S.J. 1976. Changes in membrane current in bullfrog atrium

- produced by acetylcholine. *J. l of Physiol.*, 261: 103-123.
- Kalanda and Omasombo 1995. Contribution à la connaissance des plantes médicinales du Haut Zaïre : plantes utilisées dans le traitement des maux d'estomac dans la ville de Kisangani. *Rev. Méd. Pharm. Afr.*, 9 (1): 59-69.
- Kamanzi, A.K., Kone, M., and Traore, D. 2002. Activités larvicide et molluscicide des plantes médicinales de Côte d'Ivoire. *Bioterre*, N° special: 23-29.
- Keita S.M., Arnason, J.T., Baum, B.R., Marles, R., Camara, F., and Traore, A.K. 1999 Etude ethnopharmacologique traditionnelle de quelques plantes médicinales anthelminthiques de la Haute Guinée (République de Guinée). *Rev. Méd. Pharm. Afr.*, 13: 49-65.
- Parkington, H.C., Evans, R.G., Coleman, H.A., and Tare, M. 2002. Role for endothelium-derived hyperpolarizing factor in rat mesenteric and hindlimb circulation in vivo. *J. Physiol.* (London), 542: 929-93.
- Rao, S., Shaw, R., Brindis, R., Klein, L., Weintraub, W., and Peterson, E. 2006. On versus off label use of drug eluting Coronary Stents in Clinical Practice (Report from the American College of Cardiology National Cardiovascular Data Registry [NCDR]). *Am. J. Cardiol.*, 97 (10): 1478 – 1481.
- Reddy, J.S., Rao, R.P., and Reddy, M.S. 2002. Wound healing effects of *Heliotropium indicum*, *Plumbago zeylanicum* and *Acalypha indica* in rats. *J. Ethnopharmacol.*, 79 : 249-251.
- Soro, Y.T., Traore, F., Zahoui, O.S., and Kone, P.P. 2004. Effets pharmacologiques de *Swartzia madagacariensis* (Caesalpiniaceae) sur le système cardiovasculaire de Mammifères. *Rev. Méd. Pharm. Afr.*, 18: 59-70.
- Srinivas, K., Rao, M.E.B., and Rao, S.S. 2000. Anti-inflammatory activity of *Heliotropium indicum* Linn and *Leucas aspera* Spreng. in albinos rats. *Indian J. Pharmacol.*, 32: 37-38.
- Srinivasan, D., Nathan, S., Suresh, J., and Perumalsamy, P.L. 2001. Antimicrobial activity of certain Indian medicinal plants. *J. Ethnopharmacol.*, 74: 217-220.
- Traore, F., Zahoui, O.S., Nene-Bi, A., and Kone, P.P. 2007. Effets pharmacologiques de *Heliotropium indicum* (Boraginaceae) sur la respiration et le système cardiovasculaire de Mammifères. *Rev. Méd. Pharm. Afr.*, 20 : 79-91.
- Wang, G.J., Liao, J.F., Hintz, K.K., Chen, W.P., Su, M.J., Chen, C.F., and Ren, J. 2004. Calcium-antagonizing activity of S-petasin, a hypotensive sesquiterpene from *Petasites* for mosarrus, on inotropic and chronotropic responses in isolated rat atria and cardiac myocytes. *Naunyn Schmiedebergs Arch. Pharmacol.*, 369 (3): 322-329.
- Zahoui, S.O., Zirihi, N.G., Soro, Y.T., and Traore, F. 2010. Effet hypotenseur d'un extrait aqueux de *Zanthoxylum zanthoxyloides* (Lam.) Waterman (Rutaceae). *Phytothérapie* 8:359–369.

How to cite this article:

ZAHOUI Ouga Stanislas, NENE BI Semi Anthelme, SORO Tianga Yaya and TRAORE Flavien. 2016. Hypotensive Effect of an Aqueous Extract from *Heliotropium indicum* Linn. 1753 (Boraginaceae). *Int.J.Curr.Microbiol.App.Sci.* 5(2): 475-482.
doi: <http://dx.doi.org/10.20546/ijcmas.2016.502.053>