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Research Article

Antitussive Activity and Toxicological Profile of the Aqueous Extract of *Chenopodium ambrosioides* (L.) Used in the Traditional Treatment of Cough in Togo

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Abstract

Introduction : Cough remains one of the most prevalent respiratory symptoms worldwide, particularly in developing countries where access to conventional therapies is often limited. *Chenopodium ambrosioides* (L.), traditionally used in Togo for the management of cough, was investigated for its antitussive activity and toxicological profile. **Design :** The aqueous extract of the aerial parts of *Chenopodium ambrosioides* (AECA) was prepared and evaluated. Antitussive activity was assessed in Wistar rats using an 25 % ammonium hydroxide solution induced cough model. Cytotoxicity was determined by the *Artemia salina* lethality assay, while acute oral toxicity was evaluated at a single dose of 5000 mg/kg body weight in rats.

Results : AECA significantly and dose-dependently prolonged the cough latency period by 55.5%, 104.8%, and 141% at 200, 400, and 800 mg/kg, respectively, compared with the negative control ($p < 0.05$). Codeine camphosulfonate (10 mg/kg) increased latency by 168% ($p < 0.05$). AECA also reduced cough frequency by 30.8%, 51.3%, and 63.3% at the same respective doses, whereas codeine induced a 70.9% inhibition ($p < 0.05$). The *Artemia salina* assay revealed an LC_{50} value of 0.70 mg/mL, classifying AECA as non-toxic according to Mousseux's scale. In acute toxicity testing, no mortality or clinical signs of toxicity were observed over 14 days, and hematological (RBC, Hb, WBC) and biochemical (ALT, AST, urea, creatinine) parameters remained within normal limits. **Conclusion :** These findings demonstrate that AECA possesses significant, dose dependent antitussive activity and excellent safety, thereby validating its traditional use in cough management in Togo.

Keywords : *Chenopodium ambrosioides* (L.) ; Antitussive activity ; Cytotoxicity ; Acute toxicity ; Cough ; Togo.

INTRODUCTION

Cough remains one of the most common symptoms leading patients to seek medical care worldwide. In sub-Saharan Africa, and particularly within rural Togolese communities, respiratory infections such as bronchitis and upper airway inflammations persist as major public health concerns[1–3]. Limited access to modern medical infrastructure compels populations to rely on traditional medicine, where medicinal plants form the cornerstone of primary health care[3,4]. Ethnobotanical investigations in Togo highlight a rich pharmacopoeia of indigenous flora employed for respiratory ailments[5,6]. Among these medicinal species, *Chenopodium ambrosioides* L. (syn. *Dysphania ambrosioides*), locally known as « magbedonde » in local language (Ewe) is widely used for its medicinal properties, particularly in the treatment of respiratory disorders such as cough [5]. A recent nationwide survey reported that approximately 73 % of healers prescribe this species for cough, frequently in polyherbal formulations[5]. Such extensive ethnomedicinal use provides a compelling rationale for systematic pharmacological and toxicological validation. Previous pharmacological studies in Togo revealed that extracts of *C. ambrosioides* exhibit antioxidant, anti-inflammatory, and antimicrobial properties[7,6]. However, investigations have also revealed in vitro cytotoxicity and in vivo toxic effects in rodents, especially at high

doses of the essential oil, which is rich in reactive monoterpenes such as ascaridole[6]. Despite its extensive use against cough, there is currently no experimental evidence evaluating the antitussive potential of *Chenopodium ambrosioides* from Togo flora. Existing toxicity data remain preliminary, and studies from other regions indicate possible hepatotoxic and nephrotoxic effects at high doses of aqueous or ethanolic extracts[8,9]. Therefore, the safety and efficacy of the aqueous preparations commonly employed by Togolese traditional healers warrant rigorous scientific assessment. This study aims to evaluate the antitussive activity and toxicological profile of the aqueous extract of *Chenopodium ambrosioides* L. used in the traditional treatment of cough in Togo. Using validated animal models of induced cough, acute toxicity, and cytotoxicity assays, the research seeks to establish both pharmacological effectiveness and safety thresholds.

1. MATERIALS AND METHODS

1.1. Plant collection and aqueous extract preparation

Samples of *Chenopodium ambrosioides* L. were collected in February 2022 from Gboto-Assigame village, Yoto Prefecture (Togo), located at 6°40'30.5'' N and 1°29'56.5'' E (figure 1). Whole plants were harvested, cleaned, and air-dried at room temperature in a shaded area to preserve thermolabile bioactive compounds. Botanical authentication was performed at the Laboratory of Botany, Faculty of Science, University of Lomé, where a voucher specimen (TOGO 15997) was deposited in the institutional herbarium for reference.

The aqueous extract was obtained by decoction, a method commonly employed in traditional preparations. Briefly, 100 g of dried and finely powdered plant material were boiled in 1000 mL of distilled water for 15 minutes. The resulting mixture was filtered successively through absorbent cotton and Whatman filter paper to remove particulate matter. The filtrate was concentrated under reduced pressure using a Büchi rotary evaporator and then evaporated to dryness. The dried extract was stored in airtight containers at 4 °C until used.

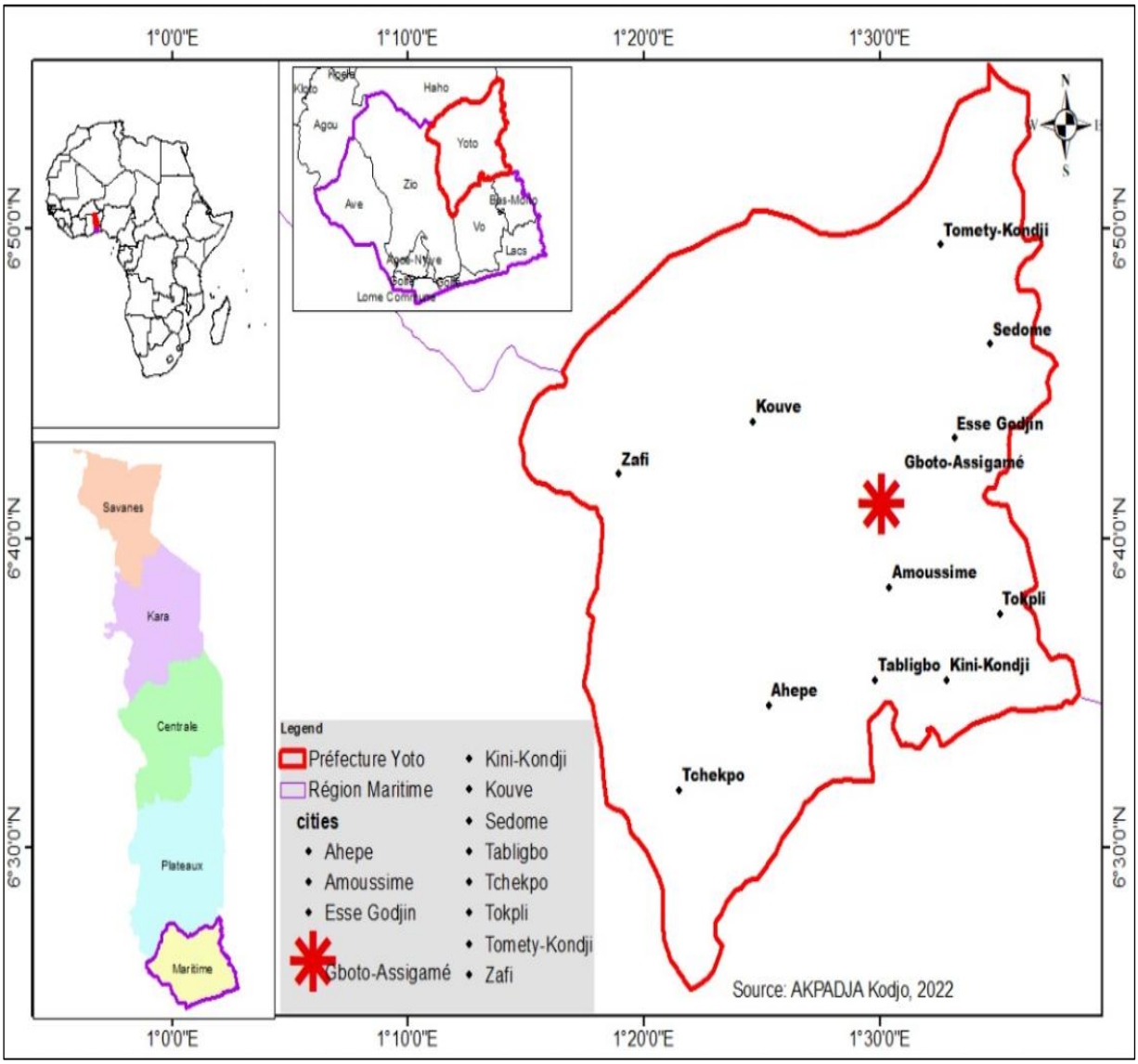

Figure 1 : Map showing the collection site of *Chenopodium ambrosioides* (L.) in Gboto-Assigame (Yoto Prefecture, Togo)

1.2. Experimental Animals

Male and female Wistar rats weighing between 120 and 200 g were used for the evaluation of antitussive activity and acute toxicity. The animals were obtained from the animal facility of the Laboratory of Physiology and Pharmacology of Natural Substances, University of Lomé (Togo).They were housed under controlled environmental conditions, with an ambient temperature of 25 ± 2 °C and a 12 hour light/dark cycle, and were provided with free access to food and water. These standardized conditions ensured optimal animal welfare and minimized potential experimental variability. For the cytotoxicity assay, Artemia salina larvae supplied by the Toxicology Laboratory of the Faculty of Health Sciences, University of Lomé, were used. The larvae were obtained by incubating Artemia eggs in 500 mL of sea water for 48 hours under continuous aeration to ensure optimal hatching conditions.

1.3. Experimental method for antitussive activity assessment

The antitussive activity of the aqueous extract of *Chenopodium ambrosioides* (AECA) was evaluated using the ammonium hydroxide–induced cough model in rats, as previously described by Petros (2020)[10] and Uwaya et al. (2022)[11] with slight modifications. Wistar rats were randomly divided into five groups (six animals per group) and treated orally for three consecutive days as follows: the negative control group received 2 mL of sterile distilled water/day; the test groups received AECA at doses of 200, 400, and 800 mg/kg/day; and the positive control group was administered codeine camphosulfonate (10 mg/kg/day). Thirty minutes after the last oral administration, each rat was individually placed in a desiccator chamber containing 0.3 mL of 25% ammonium hydroxide solution absorbed on a piece of cotton for 2 minutes to induce coughing. The animals were then immediately transferred to an observation chamber, and the number of cough episodes produced within five minutes was recorded using a stopwatch. Cough was identified by a sudden contraction of thoracic and abdominal muscles, accompanied by mouth opening and a characteristic cough sound, followed by jerky movements of the forebody. Both the latency period before the first cough and the total number of coughs within five minutes were recorded.

The antitussive effect of the extract was expressed as the percentage inhibition of cough frequency compared with the control group, calculated according to Guo et al. (2016)[12] using the formula : $\left[\text{Inhibition (\%)} = \frac{(C_0 - C_t)}{C_0} \times 100\right]$ where C_0 is the mean number of coughs in the control group and C_t is the mean number in the treated group. This method allowed for a quantitative assessment of the dose-dependent cough-suppressing activity of the aqueous extract of *Chenopodium ambrosioides*, providing comparative data with the standard reference drug, codeine camphosulfonate.

1.4. Cytotoxicity assessment using the *Artemia salina* bioassay

The larval cytotoxicity assay was performed using *Artemia salina* (Leach) nauplii, a simple yet reliable biological model widely employed for the preliminary evaluation of the toxicity of plant extracts. This non-clinical test is based on the survival rate of *Artemia salina* larvae exposed to different concentrations of the aqueous extract of *Chenopodium ambrosioides* in seawater. The procedure followed the method described by Meyer et al. (1982)[13] and subsequently adapted by Kaboua et al. (2021)[14]. For the preparation of the test solutions, the aqueous extract of *C. ambrosioides* was first prepared by decoction and diluted to obtain a stock concentration of 50 mg/mL. Serial two-fold dilutions were then performed using natural filtered seawater to achieve the following concentrations : 25, 12.5, 6.25, 3.125, 1.582, 0.781, 0.391, 0.195, 0.098, and 0.049 mg/mL. The control tube contained only seawater and 16 larvae, without extract exposure.

For larval hatching, *Artemia salina* eggs were incubated in a 500 mL Erlenmeyer flask containing filtered seawater collected from the Atlantic Ocean. The mixture was kept under continuous agitation for 48 hours, allowing the eggs to hatch into viable larvae. A colony of 16 actives larvae was then transferred into each test tube containing one of the graded extract concentrations. All tubes, including the control, were maintained under gentle agitation for 24 hours. After incubation, larval mortality was recorded by counting the number of immobile larvae. A larva was considered dead if it showed no movement for 30 seconds under visual observation. Each test was performed in triplicate to ensure reproducibility and statistical reliability. To confirm that larval death resulted solely from the extract and not from starvation, the control group was used as a reference, since *Artemia salina* larvae can survive up to 48 hours without external food sources, relying on their endogenous yolk reserves[15]. This assay provided a rapid and sensitive screening of the cytotoxic potential of the aqueous extract of *Chenopodium ambrosioides*, expressed as the median lethal concentration (LC_{50}) after 24 hours of exposure.

1.5. Acute toxicity evaluation method

The acute oral toxicity of the aqueous extract of *Chenopodium ambrosioides* was assessed following the OECD Guideline 425 (OECD, 2022)[16] and the method described by Agban et al. (2020)[17]. A single dose of 5000 mg/kg body weight of the aqueous extract was administered to evaluate potential toxic effects. The study was conducted on ten healthy female Wistar rats, approximately 12 weeks old and weighing 130 - 180 g. After a 24hour fasting period, animals were randomly divided into two groups of five rats each. The control group received distilled water (10 mL/kg), while the treated group received the aqueous extract of *C. ambrosioides* by oral gavage, at a volume of 1 mL per 100 g body weight. The animals were continuously observed during the first four hours post-administration and thereafter daily for 14 days to detect any signs of toxicity. Parameters monitored included changes in coat

appearance, motor activity, tremors, grooming behavior, respiration, and stool characteristics. Body weights were recorded at the beginning and end of the study, as significant weight loss can indicate an adverse response to the treatment. At the end of the 14 days observation period, blood samples were collected from the retro-orbital plexus under anesthesia. Samples were collected into dry tubes for biochemical analyses and EDTA tubes for hematological evaluations. Serum was separated by centrifugation at 3000 rpm for 10 minutes at 4 °C, and biochemical parameters including AST, ALT, urea, creatinine, and alkaline phosphatase were determined. Hematological parameters such as red and white blood cell counts, hematocrit, hemoglobin concentration, mean corpuscular hemoglobin concentration (MCHC), and mean platelet volume (MPV) were also measured[16–19].

1.6. Statistical analysis

All experimental data obtained from the antitussive activity, larval cytotoxicity and acute toxicity assays were statistically analyzed. Results were expressed as mean ± standard error of the mean (SEM). Data from the antitussive tests (cough frequency and latency) and acute toxicity parameters (biochemical and hematological) were analyzed using one-way analysis of variance (ANOVA) test to compare differences among groups. For the larval cytotoxicity assay, mortality rates were plotted against the logarithm of extract concentrations, and the median lethal concentration (LC_{50}) was calculated using nonlinear regression analysis. A p-value < 0.05 was considered statistically significant for all comparisons. Statistical analyses were performed using GraphPad Prism software (version 6.01)

2. RESULTS

2.1. Results of the assessment of the antitussive activity of the aqueous extract

The antitussive potential of the aqueous extract of *Chenopodium ambrosioides* L. (AECA) was investigated using an 25 % ammonium hydroxide solution induced cough model in rats. The extract was tested at different doses and compared with a reference antitussive drug (Codeine camphosulfonate). The figures 2 and 3 present the effects of AECA on cough latency and frequency, showing its dose-dependent ability to delay cough onset and reduce cough episodes. These findings highlight the potential of AECA as a natural cough suppressant consistent with its traditional use in respiratory therapy

2.1.1. Effect of the aqueous extract of *Chenopodium ambrosioides* on 25 % of ammonium hydroxide induced cough latency

The aqueous extract of Chenopodium ambrosioides (AECA) significantly increased the latency period of cough induced by 25% ammonium hydroxide in rats. As presented in figure 2, AECA at doses of 800, 400, and 200 mg/kg prolonged cough latency by 151.7%, 118.4%, and 62.8%, respectively, compared with the control group. The highest latency was observed with 800 mg/kg), which produced a 151.7% increase. The prolongation of latency indicates a delay in cough onset, reflecting the central antitussive potential of AECA. Statistical analysis confirmed significant differences among groups ($p < 0.05$), demonstrating a dose-dependent cough suppressing effect.

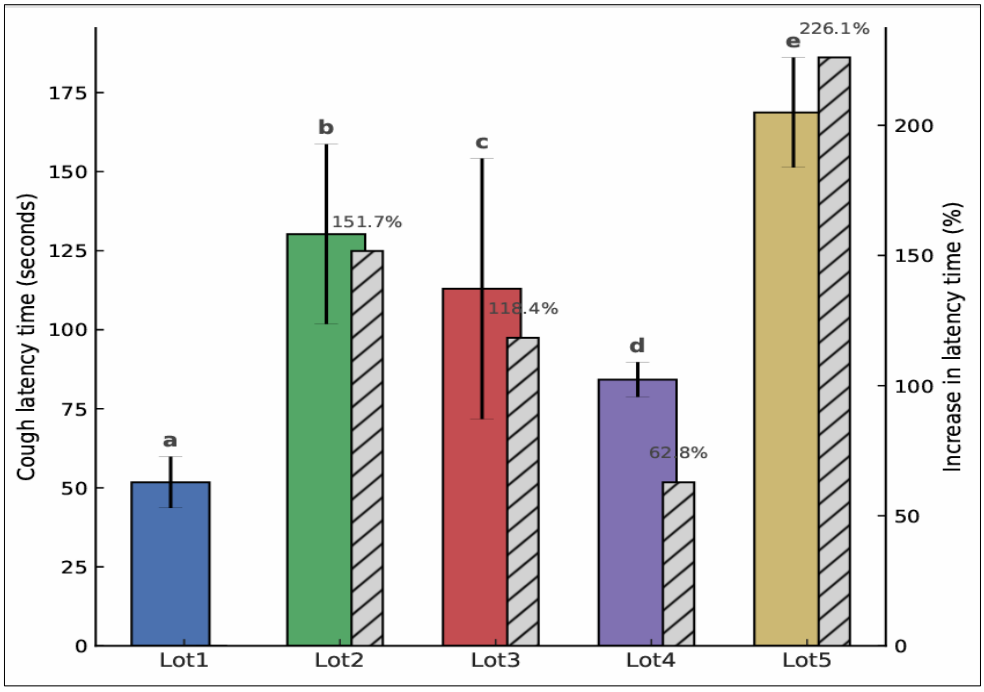

Figure 2 : *Effect of the aqueous extract of Chenopodium ambrosioides L. on the latency time of cough induced by 25% ammonium hydroxide solution in rats. Each bar represents the mean ± SEM of six animals per group. Lot 1 : negative control (distilled water) ; Lots 2, 3, and 4 : AECA at 800, 400, and 200 mg/kg ; Lot 5 : positive control (codeine 10 mg/kg). Different letters (a–e) above the bars indicate statistically significant differences between groups (p < 0.05, one-way ANOVA followed by Tukey's post hoc test).*

2.1.2. Effect of the aqueous extract of *Chenopodium ambrosioides* (L.) on the frequency of cough induced by 25% ammonium hydroxide solution

The aqueous extract of *Chenopodium ambrosioides* (AECA) significantly reduced the frequency of cough induced by 25% ammonium hydroxide in rats. As shown in figure 3, AECA at doses of 800, 400, and 200 mg/kg decreased cough frequency by 56.86%, 41.18%, and 21.57%, respectively, compared with the control group. The reduction was dose-dependent, with the 800 mg/kg dose showing the strongest effect (56.86%). The reference drug, codeine (10 mg/kg), produced the highest inhibition (70.59%), confirming the model's validity. Statistical analysis revealed significant differences among treatment groups ($p < 0.05$), indicating a potent antitussive effect of AECA.

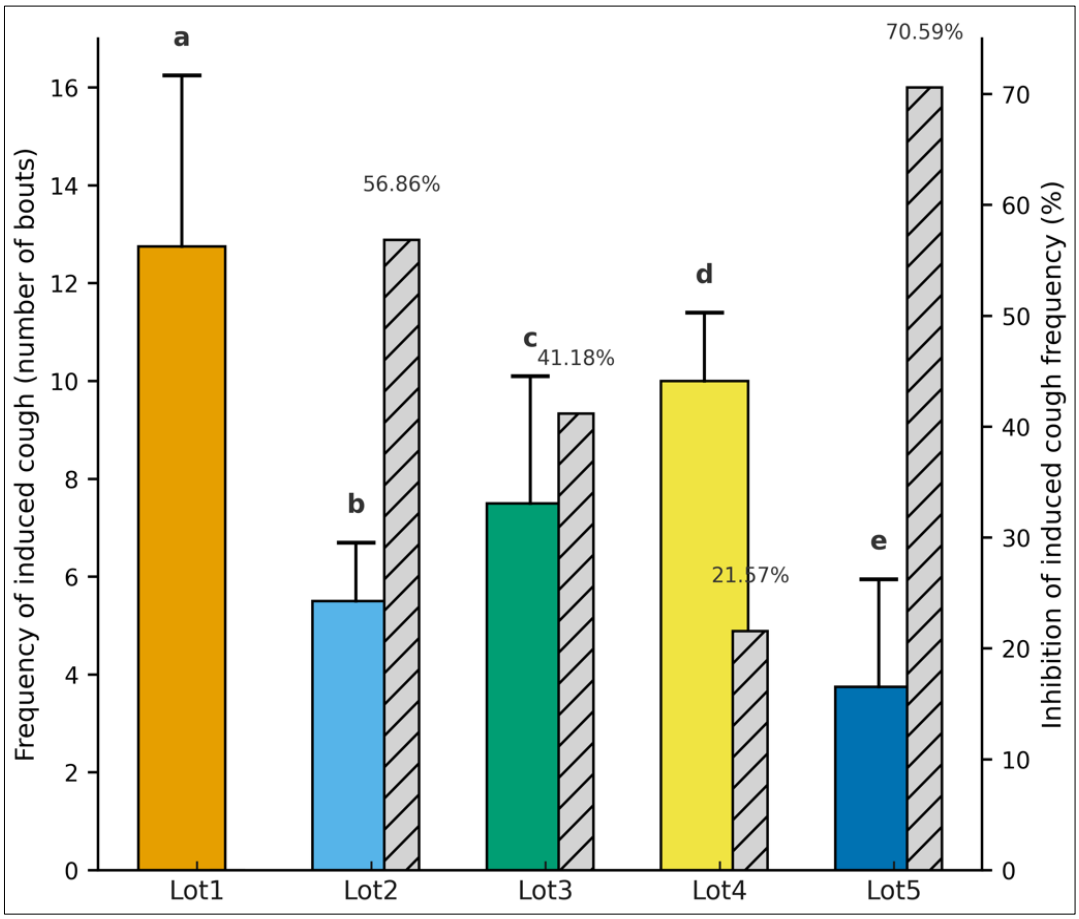

Figure 3 *: Effect of the aqueous extract of Chenopodium ambrosioides L. on the frequency of cough induced by 25% ammonium hydroxide solution in rats. Each column represents the mean ± SEM of six animals per group. Lot 1 : negative control (distilled water) ; Lots 2, 3, and 4 : AECA at 800, 400, and 200 mg/kg ; Lot 5 : positive control (codeine 10 mg/kg). Percent values above the bars indicate the percentage inhibition of cough frequency relative to the control group. Bars with different letters (a–e) differ significantly (p < 0.05, one-way ANOVA followed by Tukey's post hoc test).*

2.2. Results of the evaluation of the toxicological profile of the aqueous extract

The toxicological profile of the aqueous extract of *Chenopodium ambrosioides* (AECA) was assessed through larval cytotoxicity and acute oral toxicity assays. The *Artemia salina* lethality bioassay provided an initial screening of the extract's cytotoxic potential, while the acute toxicity study in Wistar rats assessed behavioral, biochemical, and hematological parameters. These combined analyses aimed to determine the safety margin of AECA and to identify possible adverse effects related to its traditional therapeutic use. The results obtained are presented below and discussed according to the evaluated parameters.

2.2.1. Results of brine shrimp cytotoxicity screening

The larvae cytotoxicity results is expressed in terms of concentration lethality using linear regression curves ($Y = 0{,}1935\ln(x) + 0{,}5691$ with $R^2 = 0{,}8798$). The curve describe the mortality rate of *Artemia salina* exposed to different concentrations of the aqueous extract, providing preliminary insights into its toxicological profile and safety threshold (figure 4). The number of dead larvae in each test tube was used to plot a logarithmic trend curve showing larval mortality as a function of extract concentration. From this trend curve, the median lethal concentration (LC_{50}) was determined.

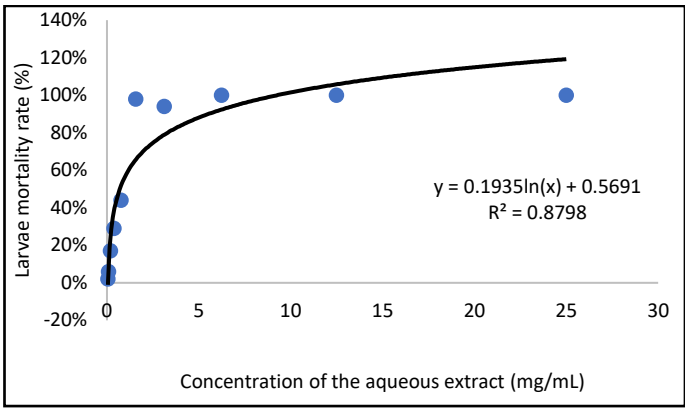

Figure 4 : *In vitro* cytotoxicity of *Chenopodium ambrosioides* (L.) on *Artemia salina* larvae

2.2.2. Determination of the Median Lethal Concentration (LC_{50})

Based on the analysis of the logarithmic trend curve, the LC_{50} value was estimated to lie between 1.58 mg/mL and 0.78 mg/mL, and thus greater than 0.1 mg/mL, according to the toxicity classification scale of Mousseux. The median lethal concentration (LC_{50}) was calculated as 0.70 mg/mL from the logarithmic equation y = 0.1935 ln(x) + 0.5691. This indicates that at this concentration, 50% of the *Artemia salina* larvae exposed to the aqueous extract of *Chenopodium ambrosioides* died. This result allowed us to assess the toxicity level of the extract according to the Mousseux classification scale, a reference system widely used for estimating substance toxicity based on LC_{50} values (figure 4)

2.2.3. Acute toxicity evaluation results of the aqueous extract of *Chenopodium ambrosioides* (L.)

The acute oral toxicity of the aqueous extract of *Chenopodium ambrosioides* (AECA) was evaluated in Wistar rats according to OECD guideline 425. The objective was to assess potential adverse effects following a single administration of 5000 mg/kg body weight. Throughout the 14 days observation period, animals were monitored for behavioral, clinical, biochemical, and hematological changes. The following results summarize the general observations, biochemical parameters, and hematological profiles, providing insight into the safety of AECA and its potential for safe therapeutic use in traditional medicine.

a) General observations and clinical signs

During the 14 day observation period following a single oral administration of the aqueous extract of *Chenopodium ambrosioides* (AECA) at a dose of 5000 mg/kg body weight, no signs of acute toxicity were observed in wistar rats. The animals showed no changes in skin or fur appearance, no alteration in locomotor activity or behavior, and no abnormal clinical manifestations such as tremors, lethargy, or respiratory distress. All rats survived the observation period, indicating that the extract was well tolerated at the administered dose. These findings suggest that AECA possesses a high safety margin and is non-toxic under the tested conditions.

b) Effect of the aqueous extract of *Chenopodium ambrosioides* on hematological parameters

This section presents the hematological results obtained after administering a single 5000 mg/kg dose of the aqueous extract of *Chenopodium ambrosioides* to Wistar rats during the acute toxicity study

Table 1 : Effect of a single 5000 mg/kg dose of the aqueous extract of *Chenopodium ambrosioides* on hematological parameters in wistar rats. Each value represents the mean ± sd (n = 5)

Hematological parameters	Control group	Treated group	p<0,05
WBC (10^9/L)	15,77 ± 0,89	24,20 ± 3,20*	0,04
RBC (10^{12}/L)	6,76 ± 0,17	7,37 ± 0,11*	0,03
Hb (g/dL)	15,43 ± 0,56	16,05 ± 0,15	0,08
HCT (%)	42,70 ± 0,20	44,15 ± 1,25	0,06
MCV (fL)	63,17 ± 1,96	60,00 ± 2,60	0,09
MCH (pg)	22,87 ± 1,38	21,80 ± 0,60	0,07
MCHC (%)	36,13 ± 1,36	36,40 ± 0,60	0,15
PLT (10^9/L)	839,33 ± 54,89	1053,00 ± 90,00*	0,02
LYM (%)	79,57 ± 8,04	70,45 ± 10,25	0,10
MON (%)	7,23 ± 1,58	5,35 ± 2,15	0,12
GRAN (%)	13,20 ± 6,47	9,75 ± 2,05	0,08

WBC : White Blood Cells; RBC : Red Blood Cells; Hb: Hemoglobin Level; HCT : Hematocrit; MCV : Mean Corpuscular Volume ; MCH : Mean Corpuscular Hemoglobin; MCHC : Mean Corpuscular Hemoglobin Concentration ; PLT : Platelets; LYM : Lymphocytes ; MON : Monocytes ; GRAN : Granulocytes (Neutrophils + Basophils + Eosinophils). p < 0.05 = significant difference*

c) Effect of the aqueous extract of *Chenopodium ambrosioides* on the biochemical parameters of wistar rats

This section presents the biochemical findings obtained after administering a single 5000 mg/kg dose of the aqueous extract of *Chenopodium ambrosioides* to wistar rats during the acute toxicity assessment.

Table 2 **:** Effect of a Single 5000 mg/kg Body Weight Dose of the Aqueous Extract of *Chenopodium ambrosioides* on the Biochemical Parameters of Wistar Rats. Each value represents the mean ± sd (n = 5).

Biochemical parameters	Control group	Treated group	p<0,05
AST (UI/L)	154,00 ± 16,67	173,40 ± 16,88	0,06
ALT (UI/L)	71,00 ± 13,33	60,20 ± 14,24	0,09
GGT (UI/L)	4,33 ± 1,78	3,60 ± 1,52	0,12
ALP (UI/L)	482,00 ± 42,00	494,20 ± 105,36	0,10
Uremia (g/dL)	0,19 ± 0,02	0,18 ± 0,01	0,15
Creatinine (mg/dL)	8,33 ± 1,78	7,00 ± 0,40*	0,03
Blood Glucose (g/dL)	1,23 ± 0,17	0,99 ± 0,10*	0,02
Total Cholesterol (g/L)	0,83 ± 0,05	0,72± 0,11*	0,04
Triglycerides (g/L)	0,49 ± 0,04	0,52 ± 0,11	0,20

AST : Aspartate Aminotransferase; ALT : Alanine Aminotransferase; GGT : Gamma-Glutamyl Transferase ; ALP : Alkaline Phosphatase. p < 0.05 = significant difference.*

3. DISCUSSION

The results obtained (Figures 2 and 3) demonstrate a significant antitussive activity of the aqueous extract of *Chenopodium ambrosioides* (AECA) and the evidence is showed by a dose-dependent increase in cough latency (Figure 2) and a reduction in cough frequency (Figure 3). The prolongation of the latency period suggests that AECA delays the activation of the cough reflex, likely through inhibition of airway sensory receptors. This results aligns with the findings of Loufoua et al. (2015)[20] in Gabon, who reported similar effects for *Chenopodium ambrosioides*, and Sharma et al. (2014)[21], who demonstrated that flavonoids reduce cough reflex sensitivity and prolong cough onset in experimental models. The observed effects can be attributed to bioactive phytochemicals such as flavonoids, alkaloids, terpenoids, and saponins, well-known for their anti-inflammatory, antispasmodic, and antioxidant properties[6,20]. Although AECA exhibited lower efficacy than codeine camphosulfonate, its natural origin suggest a promising alternative to opioid-based antitussives, particularly in traditional and resource limited health settings[22,23].

The toxicological evaluation of the aqueous extract of *Chenopodium ambrosioides* (AECA) demonstrated a favorable safety profile, supported by both the larvae cytotoxicity test and the acute oral toxicity study. In the *Artemia salina* lethality assay, the extract produced an LC_{50} value of 0.70 mg/mL, classifying it as non-toxic according to the Mousseux scale[14]. This cytotoxicity result suggests that AECA possesses a broad safety threshold, which agrees with previous findings by Ouadja et al. (2021)[6], who reported similar results for aqueous and hydroethanolic extracts of *Chenopodium ambrosioides* collected in Togo. Comparable outcomes were also observed in the studies of Koba et al. (2009)[24] and Kasali et al. (2021)[4], which showed that aqueous extracts generally exhibit lower toxicity than essential oils of the same species. In the acute oral toxicity test, a single dose administration of 5000 mg/kg body weight caused no mortality or visible signs of toxicity during the 14 day observation period. No alterations in fur appearance, locomotion activity, respiration, or feeding behavior were observed, confirming that AECA is well tolerated at this dose. According to OECD guideline 425 (2022), this classifies the extract as practically non toxic, consistent with findings by Layibo et al. (2023)[19]. Furthermore, biochemical and hematological parameters remained within normal limits. No significant changes were observed in serum levels of AST, ALT, ALP, urea, and creatinine, indicating preserved liver and kidney functions. Hematological indices (RBC, WBC, Hb, PLT) also remained stable, reflecting the absence of hematopoietic toxicity. These results, in line with Agban et al. (2020)[17], confirm that the aqueous extract of *C. ambrosioides* can be considered safe for therapeutic use, supporting its traditional application in respiratory care in Togo.

LIMITATIONS OF THE STUDY

This study, while revealing promising results, has some limitations. The antitussive activity was assessed only in an acute rat model, which may not fully represent chronic cough mechanisms in humans. The work focused solely on the aqueous extract of *Chenopodium ambrosioides*, without comparing other solvent extracts that might differ in potency or composition. Toxicological evaluation was limited to acute and larval assays, excluding long-term toxicity assessment. Moreover, the bioactive compounds responsible for the observed effects were not isolated or characterized, highlighting the need for further phytochemical and mechanistic

investigations to clarify the plant's therapeutic action and safety.

CONCLUSION

This study demonstrated that the Aqueous Extract of *Chenopodium ambrosioides* (AECA) possesses a significant antitussive activity, characterized by a dose-dependent increase in cough latency and a reduction in cough frequency in rats exposed to 25% ammonium hydroxide. These effects support its traditional use in the treatment of respiratory ailments such as cough. Furthermore, the toxicological assessment revealed a favorable safety profile, with low larval cytotoxicity and no observable acute toxicity in Wistar rats, as evidenced by normal biochemical and hematological parameters. Together, these findings suggest that AECA is both effective and safe at therapeutic doses, making it a promising natural alternative to synthetic antitussive agents such as codeine. However, further phytochemical, subchronic, and clinical studies are required to identify the active compounds responsible for the observed effects, elucidate their mechanisms of action, and confirm the extract's safety and efficacy in human applications.

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Conflict of interest: The authors declare that there is no conflict of interest.

Author contributions: All authors made significant contributions to the conception and design of the study, sample collection, laboratory experiments, data analysis, manuscript writing, and final review of the paper.

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Informed consent statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Ethical approval: Ethical approval was obtained from the ethics committee of the of the Laboratory of Physiology and Pharmacology, Faculty of Sciences, University of Lome (Togo), where all animal experiments were conducted.

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