CNS Depressant Activity of Various Parts of *Heritiera fomes*

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Declaration:

It is declared that,

1. This experiments what is done in this thesis is my own work.
2. Except as properly cited through correct referencing, the thesis does not contain any information already published or written by anyone.
3. The thesis does not contain any material that has previously approved or submitted by anyone for any other university or other institution's degree or diploma.

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Approval

"CNS Depressant Activity of Various Parts of *Heritiera fomes*"is submitted by Umiya Taslim (ID-18146066) of Spring, 2018 has been accepted in the fulfillment of the requirement for the degree of Bachelor of Pharmacy (Hons.) on March, 2022.

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Ethics Statement

Following all test guidelines, Swiss Albino mice were used for this experiment.

Abstract:

Heritiera fomes (Family: Malvaceae) is usually known as “Sundori tree” in Bangladesh. The plant is used in pain, gastrointestinal problems, goiter, fever, diabetes etc. The present investigation was undertaken which deals with the central nervous system (CNS) depressant activity of ethanol extract of *H.fomes* in mice models. The central nervous system (CNS) depressant activity of *H.fomes* was evaluated by the classical models of depression as open field, hole cross tests in mice. The animals were divided into eight groups containing five mice each. The test groups received extract at the doses of 250 mg/kg and 500 mg/kg body weight orally whereas the control group received distilled water (10 mL/kg, p.o.). Diazepam (1 mg/kg, p.o.) was used as standard drug. The plant extract significantly decreased the locomotor activity of mice in open field and hole cross tests when compared to the control ($p < 0.05$). It is observed that the extract showed significantly ($p < 0.05$) increased in immobility time force. The present work depicts the possible CNS depressant activity of *H.fomes* in mice models. The obtained results provide support for the use of this species in traditional medicine and warrants further pharmacological investigations that could lead to novel leads in future.

Keywords: *Heritiera fomes*, Diazepam, CNS Depressant, Hole cross method, Open field method.

This work is dedicated to my parents and beloved sisters for their support and strong believes in me**.**

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List of abbreviations

EHFR- Ethanol Extract of *H.fomes* Root

EHFL- Ethanol Extract of *H.fomes* Leaves

EHFB- Ethanol Extract of *H.fomes* Bark

ANOVA- One-way Analysis of Variance

ICDDR, B- International Centre for Diarrhoeal Disease Research, Bangladesh

mg- Milligram

ml- Milliliter

SEM- Standard Error of Mean

WHO- World Health Organization

Chapter 01

Introduction

1. Introduction:

1.1 General Introduction:

Plants are an essential component of the entire planet. Plants have been used as medicine by humans from ancient time. Following various types of observations and research, plants were found as a source of medication. As a result, during the dawn of human civilization, therapy with a variety of plants started.

Plant therapeutic properties have been discovered throughout ages primarily by diligent observation, trial and error, and unintended discovery, all of which are beneficial in terms of nutrition and medicine. (Kumar Bishwajit Sutradhar, 2012). Over the last ten years,we've seen how plants can assist humans. They also discovered that the plants' negative side effects as medicine are modest. As a result, modern folks are catching their attention more these days. Instead of pharmaceutical medications, people are turning to herbal medicine. These commercial medications are extremely effective. It is both costly to develop and dangerous to contain According to the World Health Organization, 70% of the world's population is undernourished. For primary health care, he relies on plants. More than 50 important medications are derived from tropical plants which are originated on the international market. (Ghani, 2003) Around the world,17 percent of higher plants from over 250,000 species have been researched for medical potential. The diversity of plants provides an endless amount of material for use in the development of new medications. The compounds in the lead which have been isolated from a medicinal plant, can be used as a complementary medicine.

People in underdeveloped countries like Asia, Africa, and Latin America are backward, lack innovation, and accept Western technology and civilization passively.. Importing herbal medication is how these third-world countries make money. As a result, this medicine is a rallying cry to overcome any barriers. (Adodo, 2013)

Now a days, synthetic compound is becoming less popular day by day because it carries strong side effects than natural compound. Medicinal plants are used as folk medicine in many ruralareas, and they are now being studied for their curative power

1.1.1 : Herbal plant:

Medicinal plants include those whose barks, seeds, leaves, fruits, root and other parts of the plant are utilized for medicinal purposes, as well as those whose chemical compounds are created for biological functions. Tulsi, Aloe Vera and other medicinal plants are example.

1.1.2 : A Historical Overview of Medicinal Plants:

The use of plants and herbs in medicine has a long and illustrious history.They've been utilized for a long time in the healing process.. Medicinal plants have been linked to religion since their beginnings They had an impact on the cultural lives of many nations. They are now considered both an art and a science in medicine. The exact time is still unknown, and every single medicinal herb is found in the searching of new plants. The ancient Egyptian Ebbers Papyrus lists almost eight hundred medicinal herbs. 1400s to 1600s is considered as golden age of Herbalism.

1.1.3 : Importance of medicinal plant:

Medicinal plant is used for treating many diseases and help to fight against fungi, bacteria and so on,

- Alkaloids help to treat pain
- Volatile oil works as antiseptic.
- Gum-resins have analgesic properties.
- • The use of fixed oil reduces acidity.

1.2 : Traditional medicine of Bangladesh:

In Bangladesh, there are around 86,000 traditional doctors known as Kaviraj spread among 1600 villages, implying that there are 2-3 Kavirajes for every 500-800 people. In Bangladesh herbal medicines is very common here and they are applied o taken orally, topically and so

on. One of the most common herbal medicines is like Aloe Vera which helps to clean the blood or even use for brightening. Then garlic is used as antioxidant and helps to control nausea and lowering down blood glucose level in body. Then cinnamon is another common herbal medicine which helps to reduce the heart attack and lower blood level too. Then turmeric is use as an antiseptic which helps fast blood clotting too in many wound.

1.3. CNS depressant activity of plant:

Drugs that depress the central nervous system (CNS) had no known mechanism of action until molecular pharmacology uncovered each drug's precise role. Drugs that depress the central nervous system (CNS) primarily act on GABA, serotonin, dopamine, opioid, cannabinoid, and adrenergic receptors that reduce CNS depressant activity and diminish the brain's level of awareness. Knowing the mechanism of action allows you to create a new medicine with the same efficacy as the prototype but fewer negative effects. Example of CNS depressant drugs is Benzodiazepines, Barbiturate-like drugs, Alcohol, Antihistamines, Opioid narcotics like heroin,

1.3.1 : Classification of CNS depressant Activity:

Based on their pharmacological activity CNS depressant can be classified. They are,

- General Anesthetics
- Sedative-Hypnotic Drugs
- Skeletal muscle relaxants
- Some types of Antihistamine

1.4. Introduction to the sample plant: *Heritiera fomes*

It is the most common mangrove tree species in Bangladesh and India's Sundarbans, accounting for over 70% of the trees in the area. *Heritiera fomes* is a significant timber

producer. Its common names include sunder, sundri. Various parts of this plant can be used as herbal medicine to treat many diseases like diabetes, pain, heart illness, diarrhea, skin problems, hepatic disorders, and goiter. Flowers of this plant aregrown in March and April which is unisexual and arranged in panicles.

Figure 1: Flower of *Heritiera fomes.* (Patil, 2022)

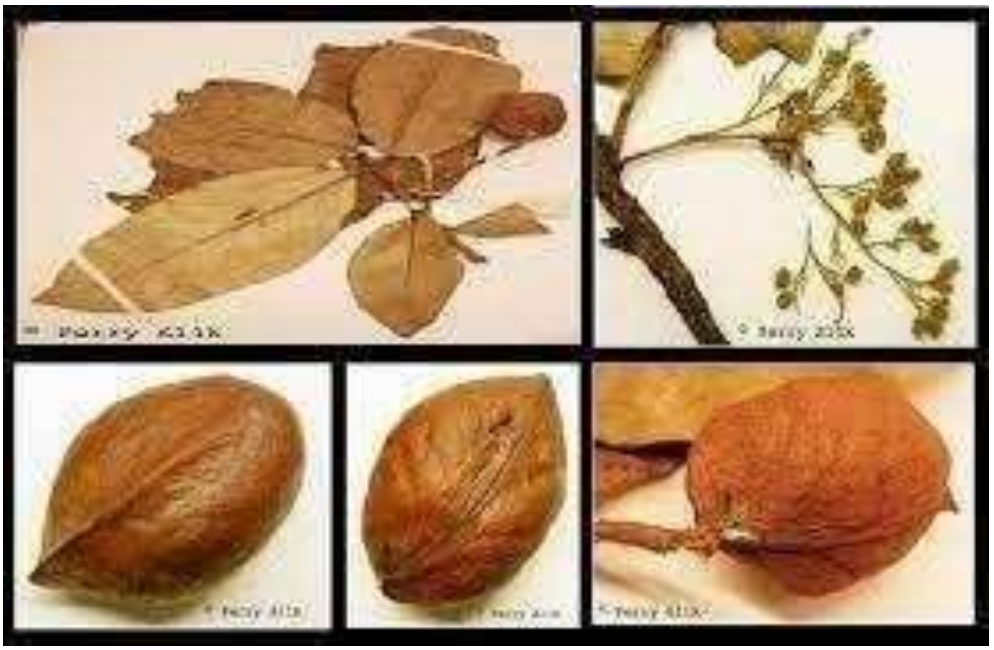

Figure 2: Fruits and leaves of *Heritiera fomes* (Halder, Chatterji, & Sanyal, 2014)

1.4.1 : Taxonomical classification of *Heritiera fomes*:

Kingdom: Plantae

Class: Dicotyledons

Order: Malvales

Family: Malvaceae

Subfamily: Sterculiaceae

Genus: *Heritiera*

Species*: H. fomes*

Local name: Sundari (Sahu, 2021)

1.4.2 : Geographical location of *H. fomes*:

The Sundarbans, the world's biggest mangrove forest, may be found in Bangladesh's southern region as well as West Bengal, India. The forest is bordered on the south by the Bay of Bengal. With temperatures ranging from 20.4°C to 31.5°C, the forest has significant ecological properties. The annual rainfall ranges between 1640 and 2000 millimeters. Heritiera fomes, unlike other mangrove species, prefers a very low saline environment. The Sundari (*Heritiera fomes*) trees, a key component of the forest, Sundarbans. It takes up 52.7 percent of the land area and 63.8 percent of the total standing volume. (Mitra & Banerjee, 2010)

Figure 3: Map of Sundarbans. (Mahmud, et al., 2014)

1.4.3 : Therapeutic use of the plant:

The different part of *H. fomes* like root, bark, leaves help to treat different disease like goiter, fever, diabetes, acute pain, gastrointestinal disorder and so on. Now, in the following table the disease which is treated with *H. fomes* part is listed.

Table 1: Medicinal uses of Different uses: (Mahmud, et al., 2014)

Different parts	Medicinal use	Mode of preparation
Leaves and seeds	Diarrhea, stomachache, Constipation.	Decoction
Twig	Toothache and oral infection	Toothbrush
Bark	Diabetes and goiter	Hot decoction
wood	Piles	Powder
Stem bark	Acne, infection, sores,itch, eczema and warts	Paste

1.4.4 : Chemical constitutes and Bioactive Reagents:

Different phytochemical constituents is obtained from different parts of the *H.fomes* like bark, stem, root, stem and so on.

Table 2: Collected phytochemical constituents from *H. fomes* parts. (Mahmud, et al., 2014)

Parts of plant	**Phytochemical constituents**
Leaf	0.25 percent Chlorophyll a 0.09 percent Chlorophyll b
Bark	7-36% tannins, proanthocyanins
Stem bark	Trimeric, Pentameric

The structure of certain chemical components reported from *Heritiera fomes* is shown below.

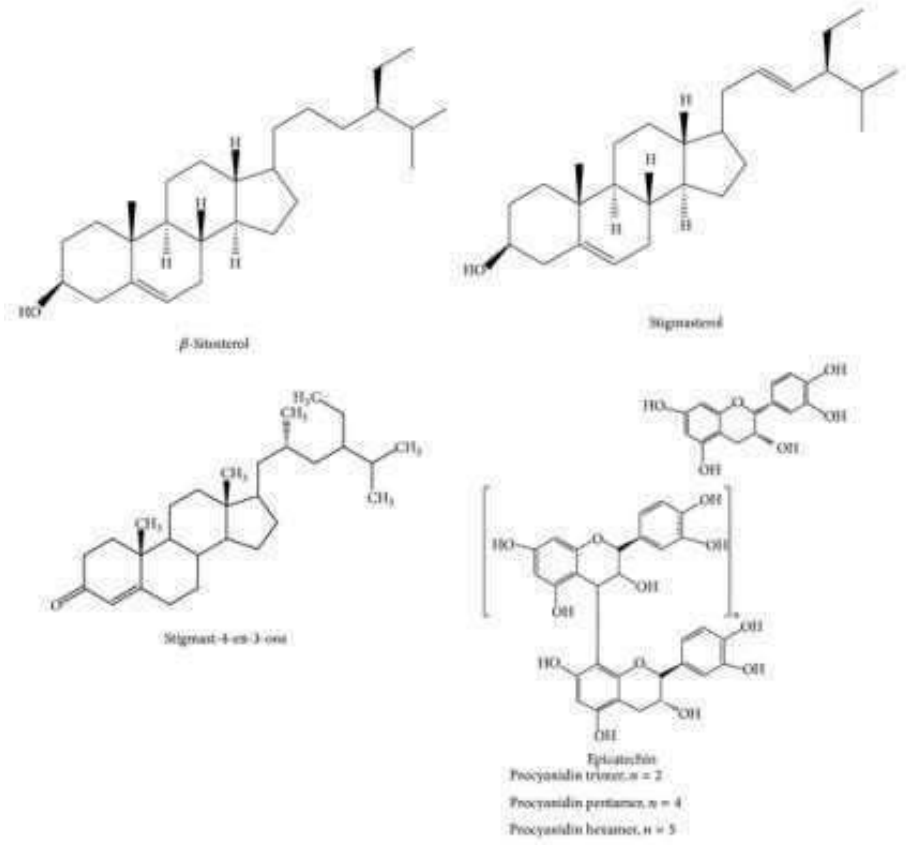

Figure 4: The structure of Phytochemical components discovered in *Heritiera fomes.* (Mahmud, et al., 2014)

1.5 : Rational of the project:

H. fomes is a typical traditional plant used as a herbal medicine to cure severe ailments such as aches, gastrointestinal disorders, acute pain, diarrhea, and so on, and it includes a variety of photochemical constituents.

1.6 : The project's goal is to:

The aim of this project is determining CNS depressant activity from different part of *H. fomes* like bark, root, and leaves.

1.7 : Objective of the project:

- The different part of *H. fomes* has different medical values that help to treatdifferent diseases.
- To determine the existence of diverse chemical ingredients that aids in identifying the bioactivities.
- The prominent purpose of this experiment is to determine the CNS depressant activity.

1.8 : Literature review:

The *H. fomes* is used for different medical purpose from the very ancient time as herbal medical treatment. Previously many researches already find out that this plant has different bioactivity like, antibacterial, cytotoxic, antineoplastic, and anthelmintic and so on because of the presence of tannins and proanthocyanins which is found in different part of *H. fomes* like bark and leaves. (Mahmud, et al., 2014) According to certain reports, different portions of H. fomes, such as the bark, have anti-inflammatory and antioxidant activities, which are assessed using *H.fomes* crude ethanolic extract. (Billah, Uddin, Shilpi, & Rouf, 2004). Another study found that the leaves of H. fomes exhibit considerable anti-nociceptive, antibacterial, and analgesic properties. (Md. Aslam Hossain, 2013).

Chapter 2

Methodology

2.Methods and materials

2.1 preparation of plant Extract *(H. fomes*):

The extraction of *Heritiera fomes* was done with three main steps. They are,

- Identification and collection of *Heritiera fomes* sections
- Drying of the parts of *Heritiera fomes*
- Extraction separately of all parts of *Heritiera fomes*

2.1.1 : Collection and Identification:

Fresh leaves, roots, streams, and bark of the plant Heritiera fomes were taken for pharmacological research. These are gathered from Sundarbans, which is also known as mangrove forest, Bagerhat district, in Bangladesh. And then it has been authenticated by a taxonomist of Bangladesh National Herbarium, Mirpur, and Dhaka (DACB Accession number: 50664).

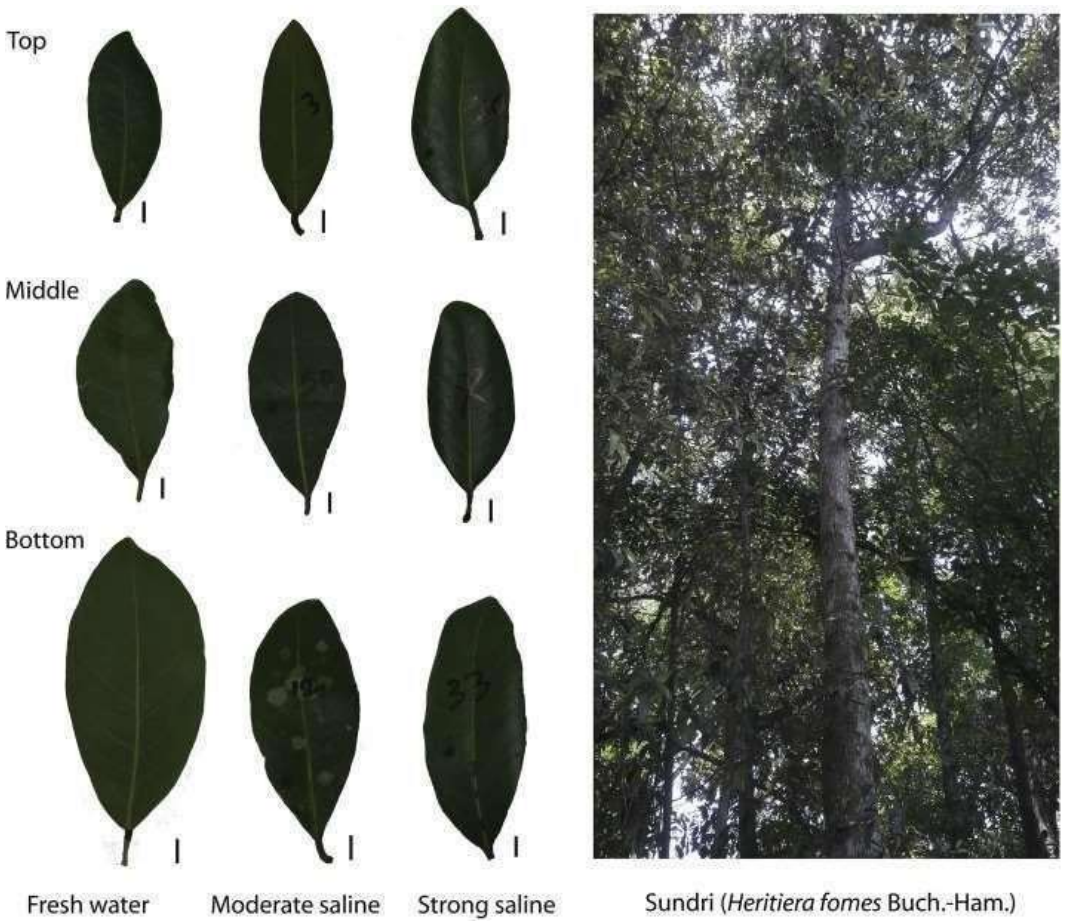

Figure 5: Leaves of *Heritiera fomes.* (Khan, Khatun, Azad, & Mollick, 2020)

Figure 6: Bark of *Heritiera fomes*. (Mahmud, et al., 2014)

Figure 7: Root of *Heritiera fomes.* (Mahmud, et al., 2014)

2.1.2 : Preparation of plant sample:

The experimental part of the plant like leaves, root, bark, stem was separated, and they are being cut down in small pieces and washed carefully with the distilled water and no dirt was there. Then they were dried for almost 5 days in the sunlight so that no water was left there. After a thorough drying procedure, the dried portions of Heritiera fomes, such as leaves, roots, and bark, were pulverized into coarse powder using an appropriate grinding machine. To ensure that no contamination occurred, the grinder was thoroughly cleaned to remove any foreign particles. The energies of all pieces were then carefully kept separately in airtight glasses for future use. And it's stored somewhere dry and cool until the experiments begin.

2.1.3 : Extraction of powder samples:

Following that, extraction is carried out. The weight machine was used to weigh about 250 grams of powdered *Heritiera fomes* leaves, bark, and root, which were then steeped in one liter Ethanol in three separate large glass containers. It was maintained in a dark position at room temperature (25°C) for practically a week, following which two-layer phases were noticed and coarse filtration was performed using a soft clean cotton cloth. The filtrated solutions were then placed in various glass containers, and the sediments were discarded. After that the glasses were coated with aluminum foil and then there was created some pores so that it could evaporate naturally and collected the concentrated solution which is about 10 ml. and then solution is labeled as the following EHFR (Ethanol extract of *H. fomes* Root), EHFL (Ethanol extract of *H.fomes* Leaves), EHFB (Ethanol extract of *H.fomes* Bark).

2.1.4 : Drugs:

Diazepam is used for this purpose which is collected from Square Pharmaceutical Ltd. Bangladesh.

2.1.5 : Experimental Animal:

For this study, Swiss Albino mice were obtained from the Animal Resources Branch of the International Center for Diarrheal Diseases and Research (ICDDRB) in Bangladesh. (Shilpi, Uddin, Rouf, & Billah, 2017). They were healthy and kept to a standard weight of 22-15 grams, and they were kept in a standard environment (humidity of 55-65 percent, 12-hour light-dark cycle, and room temperature of 25°C) while receiving clean food and water. Before the testing, all mice were fasted for the night and given free access to tap water. A great contribution was done by Swiss Albino mice in these pharmacological experiments. (Irena, et al., 2016)

Figure 8: Swiss albino Mice. (Irena, et al., 2016)

2.1.6 : Ethical approval:

The test guidelines are being accepted by the Department of Pharmacy, Jahangirnagar University. And the guidelines of Institutional animal ethical committee were followed for animal testing. (Zimmermann,1983)

2.2: Plant extract Pharmacological investigation:

The determination of pharmacological activity (Central nervous system depressant) is obtained from the crude extraction of *H. fomes* parts.

2.2.1 :CNS Depressant Study that effect of EHFR, EHFB and EHFL extracts:

CNS depressant medications relax and calm the muscles, slowing down brain activity for the treatment of sleeplessness, seizures, and anxiety or panic attacks. This type of medication works by slowing the action of the brain's GABA neurotransmitter.

Swiss albino mice were used to test the Central Nervous System depressive activity of *H.fomes* plant leaves, bark, and root extract by comparing with a standard Diazepam. The following two approaches are used to activate the CNS depressant action. These are,

- Open field method
- Hole cross method.

2.2.1.1 :CNS Depressant Experiments were designed as followed:

For both Open field method and Hole cross method forty Swiss Albino Mice were used which were then divided into eight groups and in each group 5 mice were taken. All healthy mice were weighted accurately before starting the experiments and each individual group were run specific tests for the purpose of CNS depressant activity. All the mice were marked, and dose is being adjusted according to the body weight for the accuracy of the tests result.

Group-G1- 1% Tween 80 in water

Group-G2- Diazepam which is used as standard

Group-G3- EHFB 250 mg/kg

Group-G4- EHFB 500 mg/kg

Group-G5- EHFR 250 mg/kg

Group-G6- EHFR 500 mg/kg

Group-G7- EHFL 250 mg/kg

Group-G8- EHFL 500 mg/kg

2.2.1.2 : Reagents, Chemical and Equipment:

Table 03: For the CNS depressant activity tests the used reagents, equipment, and chemicals,

Reagents, Chemicals and Equipment	**Source**
1% Tween 80 in water which is used as vehicle	BDH Chemicals Ltd.
Diazepam which is used as standard	Square Pharmaceutical Ltd, Bangladesh
Electronic weight machine	Denver Instruments M-220/USA
Normal saline solution (0.9% NaCl)	Beximco Ltd.

2.2.1.3 : preparation of drug and chemicals:

To begin, a dosage of 10 mg/kg diazepam was prepared. The required amount of diazepam was then dissolved in 0.9 percent NaCl saline water, and each Swish Albino was given 0.5 mL of the suspension orally.

Based on the body weight of each mouse, crude extract was prepared at doses of 250 mg/kg and 500 mg/kg. After that, doses were calculated, and each preparation was given a small amount of tween 80. The saline solution was then gradually added. Each mouse got 0.5 ml of the preparation after the final volume was calculated.

Table 04: For determination of CNS depressant activity of *H. fomes* plants test samples wereused.

Group	Treatment	Dose, route of administration
Group-G1 (control)	1 % Tween 80 in water	0.1 mL/10 gm body weight, orally
Group-G2 (standard)	Diazepam	1 mg/kg, orally
Group-G3 (Extract)	EHFB	250 mg/kg
Group-G4 (Extract)	EHFB	500 mg/kg
Group-G5 (Extract)	EHFR	250 mg/kg
Group-G6 (Extract)	EHFR	500 mg/kg
Group-G7 (Extract)	EHFL	250 mg/kg
Group-G8 (Extract)	EHFL	500 mg/kg

2.2.1.4 : Open Field Test:

This experiment was done to determine a variety of anxiety induced locomotor activity and exploratory behavior in Swish Albino mice. This test was done according to Gupta's open field method (Gupta, Dandya, & Gupta, 1971). Like black and white chess board, the box was half square in size and divided into eight squares which have forty-centimeter-high wall. After oral administration of the experimental crude extracts, the number of squares visited by the animals was calculated for 3 minutes, 0, 30, 60, 90, and 120 minutes.

Now, here is given a flowchart of procedure of evaluating the activity of CNS depressant by open field method is given below,

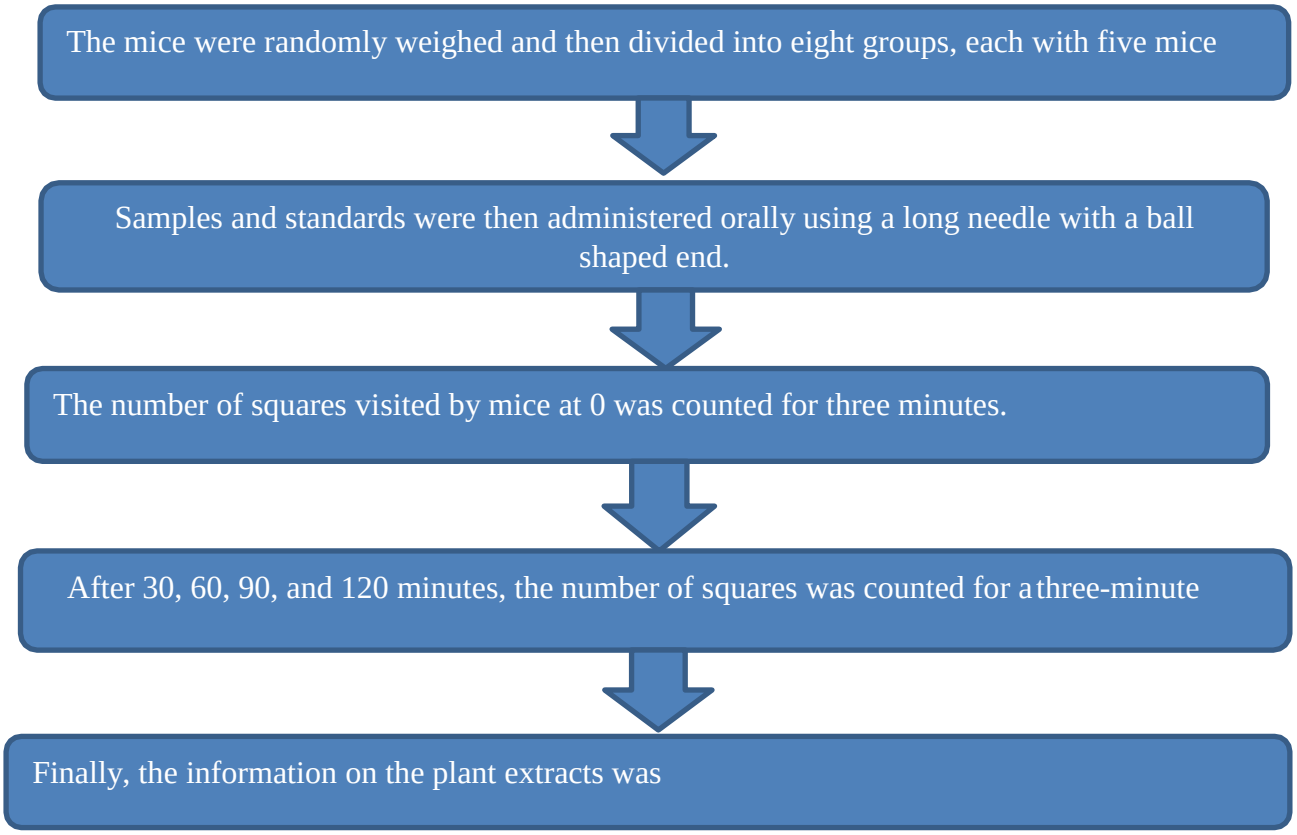

Figure 09: Flow chart of process for CNS Depressant activity on Swish Albino mice by open field test (Gupta, Dandya, & Gupta, 1971)

2.2.1.5 : Hole Cross test:

A hyperemotional response to novel environmental stimuli is the most reliable behavioral change. The method was described by Takagi's method (Takagi K, 1971). The box size was 30 x 20 x 14 cm and, in the middle, where a 3 cm hole which was placed there was. And this text helps to determine the emotional behavior of rodent at 0,30,60,90 and 120 minutes which was followed oral administration of conventional Diazepam (1 mg/kg) and EHFR, EHFB, EHFL extract at the doses of 250 mg/kg and 500 mg/kg body weight, the number of times a rat passed through the hole from one chamber to the other was counted for a duration of 3 minutes.

Now, here is given a flowchart of procedure of evaluating the activity of CNS depressant by Hole cross test is given below,

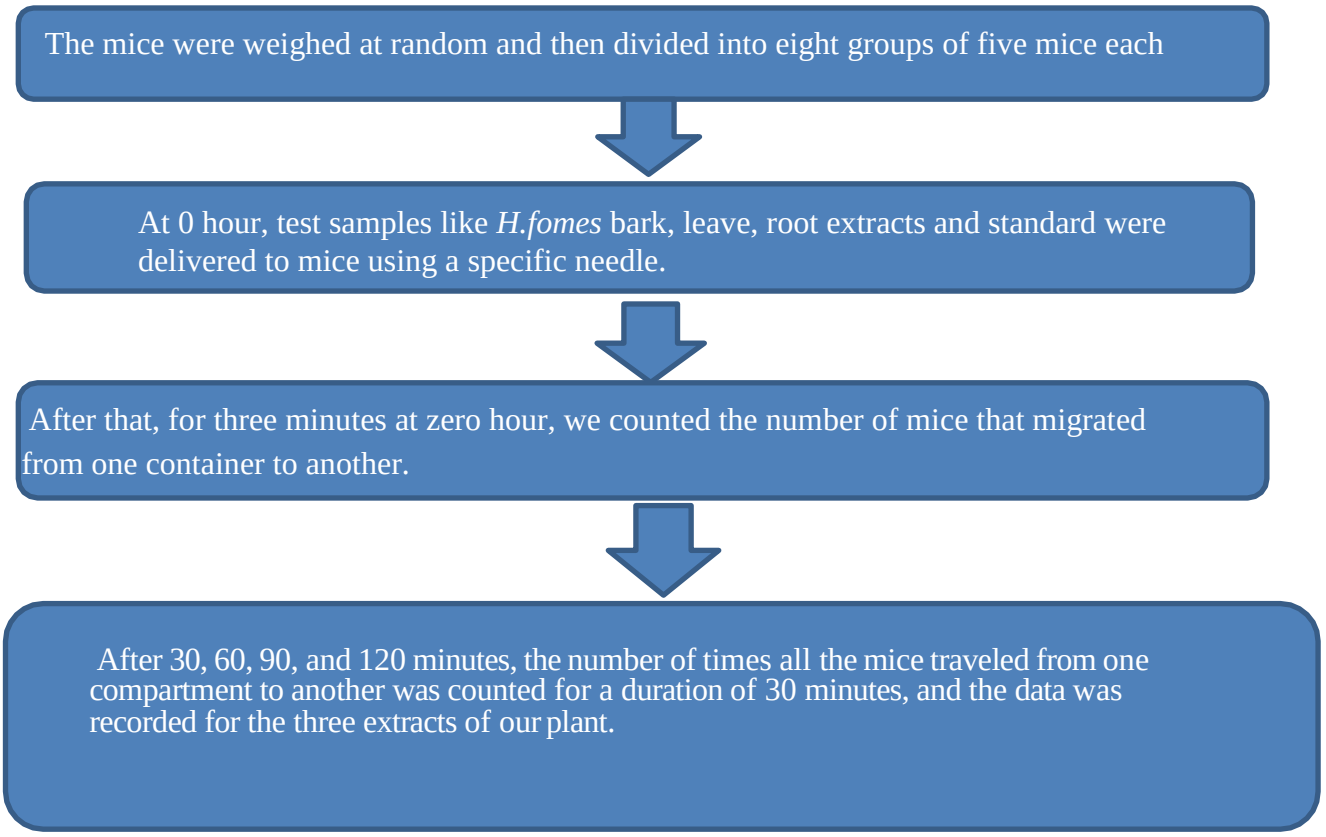

Figure 10: Flow chart of process for CNS Depressant activity on Swish Albino mice by Hole crosses method. (Takagi K, 1971)

2.3: Statistical analysis:

Data are provided as mean standard error of the mean (SEM) and analyzed using Analysis of Variance (ANOVA) and Dunnet's multiple comparisons test using SPSS 16.00. (USA). At $p < 0.01$, differences in mean across groups were considered significant.

Chapter 03

Result & Discussion

3. Results and discussion:

3.1 : Results of CNS Depressant activity of plant extracts on mice:

Gupta's method was followed by the open field method. (Gupta, Dandya, & Gupta, 1971) and Takagi's approach was used to create the Hole cross. (Takagi K, 1971) for determining the action of a CNS depressant,Below are the results of both strategies.

3.1.1 : The Open Field Method's Results:

In the following table, the experimental result was given where *Heritiera fomes* barks root and plant crude extraction were used and in the result we can see that the movement of the Swish albino mice was reducing where 250mg/kg and 500 mg/kg were used. At 30 minutes time interval, the lowering movement was observed from 0 minutes to 120 minutes. This movement reduction is the significate effect of CNS depressant which is most common to antipsychotics.

Table 05:Data from an open field test of H.fomes plant extracts for CNS depressant effects.

Group	Treatment	Dose, Route	Movements Number				
			0 min	30 min	60 min	90 min	120 min
Group-G_1(Control)	1% tween 80 in water	10ml/kg, p.o	122.2	120.5	119.8	119.2	119.6
Group-G_2(Standard)	Diazepam	1mg/kg, p.o	120.4±1.2	71.4±0.33*	43.8±0.58*	27.4±0.88	11.3±0.78*
Group-G_3 (Extract)	EHFB	250mg/kg	123.2±1.23	95.2±0.56*	64.2±1.88	37.4±0.92*	28.2±1.28
Group-G_4(Extract)	EHFB	500mg/kg	125.5±1.02	74.2±0.89	46.2±1.33*	28.1±0.87*	18.8±0.87
Group-G_5(Extract)	EHFR	250mg/kg	123.6±1.15	98.3±1.43*	64.2±1.55	38.6±0.92*	31.1±0.78*
Group-G_6(Extract)	EHFR	500mg/kg	131.6±1.53	71.4±1.23*	46.6±0.88*	27.7±1.15*	16.7±0.33*
Group-G_7 (Extract)	EHFL	250mg/kg	130.2±0.78	98.4±0.78	67.6±0.55*	41.2±0.67*	32.4±0.87*
Group-G_8 (Extract)	EHFL	500mg/kg	128.8±0.48	71.2±1.23*	46.4±0.87*	29.8±0.43	18.6±0.33*

All values are conveyed as mean ± SEM (n=5); One-Way Analysis of Variance (ANOVA) trailed by Dunnet's test. *P<0.05 significant evaluated to control

3.1.2 : Result of Hole Cross method:

The rodents were given two separate solvent extractions (250 mg/kg and 500 mg/kg), which resulted in a dose-dependent reduction in locomotor activity comparable to that of the standard medication, Diazepam. From the send observation to the last observation, the decrease movement was visible.

Table 06: Data from a Hole cross method CNS depressant activity test of H. fomes plant (EHFB, EHFR, EHFL) extracts:

Group	**Treatment**	**Dose, Route**	**Number of Movements**				
			0 min	**30 min**	**60 min**	**90 min**	**120 min**
Group-G_1(Control)	1% tween 80 in water	10ml/kg, p.o	16.0±23	15.6±1.23	15.1±1.115	16.2±1.33	15.2±0.92
Group-G_2(Standard)	Diazepam	1mg/kg, p.o	15.2±0.87	9.2±0.66*	6.4±1.33	3.2±1.43*	2.4±0.78*
Group-G_3(Extract)	EHFB	250mg/kg	11.1±1.13	10.3±0.66	7.4±0.56*	5.2±0.88*	5.8±1.29*
Group-G_4 (Extract)	EHFB	500mg/kg	16.8±1.02	9.4±0.56*	6.4±1.43*	3.8±0.71	3.2±0.92*
Group-G_5(Extract)	EHFR	250mg/kg	20.4±1.06*	12.8±1.33	10.8±1.53	6.8±1.06	5.4±0.58
Group-G_6(Extract)	EHFR	500mg/kg	17.2±0.66	9.4±0.71*	5.6±1.45*	4.2±1.07*	3.6±0.78
Group-G_7(Extract)	EHFL	250mg/kg	19.7±1.23	16.4±0.89	11.6±1.05	6.6±0.89*	5.8±0.56*
Group-G_8(Extract)	EHFL	500mg/kg	19.6±1.47	10.4±0.66*	6.2±1.07*	4.4±1.88*	1.2±0.87

All values are conveyed as mean ± SEM (n=5); One-Way Analysis of Variance (ANOVA) trailed by Dunnet's test. *P<0.05 significant evaluated to control

3.2 : Discussion:

Drugs that target the central nervous system (CNS) can have a variety of physiological and psychological side effects. Agents that help to impact the function of the CNS are utilized in the treatment of CNS disorders. (Billah, Uddin, Shilpi, & Rouf, 2004)

Besides, The rise in locomotor activity was seen, while the decrease in locomotor activity was interpreted as a sedative effect. A variety of methodologies have been developed to assess the effects of substances on the CNS.Two approaches are used to observe this CNS depressing activity in this investigation.

In dose-dependent Hole cross and Open field tests, the extracts revealed a considerable CNS depressive effect when compared to the standard medication Diazepam. The central nervous system's main inhibitory neurotransmitter is gamma-aminobutyric acid (GABA). GABAA is elucidating the effect of various anxiolytic, and sedative-hypnotic medications.(Mihic & Harris)

The sedation could be caused by a reaction with benzodiazepine-like substances. The *H. fomes* bark, root and leaves extraction may work by potentiating GABAergic inhibition in the CNS by membrane hyperpolarization by directly activating GABA receptors. So, it's possible that phytoconstituents like Alkaloids, Flavonoids etc. are to blame for its CNS depressive properties. (Ripa, Dash, & Faruk, 2015)

Chapter 04

Conclusion

4.Conclusion and future work

4.1 : Conclusion:

The most prominent plant in the Mangrove Forest is *Heritiera fomes*, also known as Sundari. This plant needs salty environment for growing and found in Sundarbans easily. Different part of this plants helps to treat different diseases with less side effects. *H.fomes* bark, root and leaves shows CNS depressant activity which is done by Hole cross method and open field test.

After conducting more detailed research on the topic, CNS depressant activity medications could be developed using the plant in the near future. This could open up new possibilities in the field of modern medicine.

4.2 : Future Works:

The study of the plant is limited to the three *H.fomes* preparations. Other extraction processes can be used in the future to learn more about the plant's bioactivities which helps to treat precisely to mankind.

Chapter 05

References

References

Adodo, A. (2013). Nature Power: Natural Medicine in Tropical Africa. UK: Authorhouse.

Alkattan, A., Ahmed, A., & Alsalameen, E. (2021, january 25). Central Nervous System Depressant Drugs:Updated Review. Saudi Arabia: www.preprints.org. doi:10.20944/preprints202101.0503.v1

Bhosale, U. A., Yegnanarayan, R., Pophale, P. D., Zambare, M. R., & Somani, R. S. (2011). Study of centralnervous system depressant and behavioral activity of an ethanol extract of Achyranthes aspera (Agadha) in different animal models. International Journal of Applied Basic Medical Research, 1(2), 104-108. doi:10.4103/2229-516X.9115

Billah, M. M., Uddin, S. J., Shilpi, J. A., & Rouf, R. (2004, December). Oriental Pharmacy and Experimental Medicine. Central nervous system depressant activity of Diospyros peregrina bark, 4(4), pp. 249-252. doi:10.3742/OPEM.2004.4.4.249

Ghani, A. (2003). Medicinal Plants of Bangladesh: Chemical Constituents & Uses. Dhaka: Asiatic Societyof Bangladesh.

Gupta, B., Dandya, P., & Gupta, M. (1971). A psycho-pharmacological analysis of behaviour in rats. Japanese Journal of Pharmacology, 3(21), 293-298. Retrieved fromhttps://psycnet.apa.org/doi/10.1254/jjp.21.293

Halder, R., Chatterji, S. G., & Sanyal, P. (2014, April). MICRO-NUTRIENT ACTIVITY OF

SUNDARI (Heritierafomes), THE MANGROVE PLANT. International Journal of Botany and Research (IJBR), 4(2), 11- 18.

Helle Wangensteena, H. C. (2009). Antioxidant and Antimicrobial Effects of the Mangrove Tree Heritierafomes. NPC: Natural Product Communications, 4(3), 371-376.

Irena, Ž., Irena, R., Rajna, M., Katarina, M., Iva, A., Jasminka3, K., & Vladimir, P. (2016, august 22). Characterization of Intor:Swiss Albino Mice Adopted in the Institute of Virology, Vaccines and Sera – Torlak, Belgrade in the Early Twentieth Century. Acta Veterinaria-Beograd, 3(66), pp. 279-293. doi:10.1515/acve-2016-0025

Khan, M. I., Khatun, S., Azad, M. S., & Mollick, A. S. (2020). Leaf morphological and anatomical plasticityin Sundri (Heritiera fomes Buch.-Ham.) along different canopy light and salinity zones in the Sundarbans mangrove forest, Bangladesh. Global Ecology and Conservation, 23.

Kumar Bishwajit Sutradhar, N. F. (2012). Analgesic and CNS depressant activity of the crude extract of Sesbania grandiflora . International Current Pharmaceutical Journal, 1(3), 56-61. Retrieved fromhttp://www.icpjonline.com/documents/Vol1Issue3/03.pdf

Mahmud, I., Islam, M. K., Saha, S., Barman, A. K., Rahman, M. M., Anisuzzman, M., . . . Rahmatullah, M.(2014, july). Pharmacological and Ethnomedicinal Overview of Heritiera fomes: Future Prospects. (M. Labieniec-Watala, Ed.) Hindawi Publishing Corporation International Scholarly Research Notices, 12. Retrieved from https://doi.org/10.1155/2014/938543

Md. Aslam Hossain, S. P. (2013). Phytochemical and Pharmacological Assessment of the Ethanol LeavesExtract of Heritiera fomes Buch. Ham. (Family- Sterculiaceae). Journal of Pharmacognosy and Phytochemistry 2, 2(3), 95-101.

Mihic, S. J., & Harris, R. A. (n.d.). Chapter 17: Hypnotics and sedatives. In M. S. Charney D, Goodman andGilman's The Pharmacological Basis of Therapeutic. 10th ed. (p. 413). Mc-Graw-Hill, USA: Hardman JG, Limbird LE.

Mitra, A., & Banerjee, K. (2010). Pigments of Heritiera fomes seedlings under different salinity conditions: perspective sea level rise. Mesopotamian Journal of Marine Science, 25(1), 1-10.

Patil, H. (2022, January 14). Heritiera fomes.

Rahman, M. (2001). Diseases and disorders of mangroves and their management in Proceeding of theNational Workshop on Management of Mangrove. Chittagong: Bangladesh Forest Research Institute.

Ripa, F. A., Dash, P. R., & Faruk, M. O. (2015). CNS depressant, analgesic and anti-

inflammatory activitiesof methanolic seed extract of Calamus rotang Linn. fruits in rat. Journal of Pharmacognosy and Phytochemistry, 3(5), 121-125. Retrieved from https://www.researchgate.net/publication/292281622

Sahu, S. M. (2021). Population status of Heritiera fomes Buch.-Ham., a threatened species from Mahanadi Mangrove Wetland, India. (A. requested., Ed.) Journal of Threatened Taxa , 12(13),19791-19798. Retrieved from https://doi.org/10.11609/jott.7018.13.12.19791-19798

Shilpi, J. A., Uddin, S. J., Rouf, R., & Billah, M. M. (2017, july 04). Oriental Pharmacy and Experimental Medicine. Central nervous system depressant activity of Diospyros peregrina bark, 4(4), pp. 249-252. doi:10.3742/OPEM.2004.4.4.249

Suman Sura, P. R. (2016, april-june). CNS depressant activity of ethyl acetate leaf extract of Avicennia officinalis in mice. International Journal of Research in Pharmacology & Pharmacotherapeutics,5(2), 101-107. Retrieved from https://www.researchgate.net/publication/318785676

Takagi K, W. M. (1971, december). Studies of the spontaneous movement of animals by the hole cross test; effect of 2-dimethyl-aminoethanol and its acyl esters on the central nervous system. The Japanese Journal of Pharmacology, 6(21), 797-810. doi:10.1254/jjp.21.797

Trease, G. a. (2001). Plants in Medicine: pharmacology of origin. In W. C. Evans, A Textbook ofPharmacognosy (5th ed., pp. 262-270). WB Saunders, London.

Zimmermann, M. (1983, june). Ethical guidelines for investigations of experimental pain in consciousanimals. PubMed.gov advanced, 2(16), 109-110. doi: 10.1016/0304-3959(83)90201-4

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