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Proximatic composition, Elemental analysis and Bioassay of *Taverniera spartea* (Burm.f.) DC

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Medicinal plants are making a significant contribution to the treatment of a wide range of illnesses. The exploration of the chemical compounds presents in these plants, known as phytochemical analysis, is gaining increasing attention due to its numerous therapeutic effects. This study aims to determine the proximate analysis, elemental analysis, antioxidant and insecticidal activities of *Taverniera spartea.* To determine the total protein content, total fat content, crude fiber, total ash content of the sample through proximate analysis. The antioxidant activity of *Taverniera spartea* was assayed using DPPH methods. The proximate study revealed that moisture contents were high (49.67%) in leaves, The ash contents were maximum (13.38%) in leaves, Fats were maximum (1.68 %) in leaves, Fibers were higher (53.65%) in stem, Proteins were maximum (18.38 %) in stem, Carbohydrates were higher (11.08%) in root, The gross energy was high (129.54 Kcal/100 g) in root. The elemental analysis showed that calcium was highest (42.63 mg/L) in leaves, Magnesium was highest (27.01mg/L) in leaves, Potassium was found highest (17.05 mg/L) in leaves, Copper was greater (0.045 mg/L) in leaves, Zinc was high (0.932 mg/L) in leaves, The manganese was greater (0.650 mg/L) in leaves, Iron, cobalt and Cadmium (Cd) also present in plant. The DPPH scavenging activity of ethyl acetate extract was 52.3±2.52, 60.4±1.60 and 72.0±2.32 %, respectively, whereas at the same concentrations, the scavenging activity of ethanol extracts was 58.5±2.42%, 64.3±1.45%,78.6±1.23%. The result of insecticidal activity *Taverniera spartea* ethanolic extract showed the higher (80.0%) mortality of Sitophilus *oryzea*, followed by (53.4 %) mortality of *Rhyzopertha dominica* at 1000 µg/ml, respectively. The concentration dependent affect was present for each extract. The lowest LD50 (82.32 µg/ml) was revealed by the ethanolic extract effective against Sitophilus oryza. The present findings revealed that ethanol extract was quite harmful to Sitophilus oryzea with LD50 = 82.32 µg/ml. *Tribolium castaneum* and *Sitophilus oryzea* had high LD50 values and appeared resistant to extract dosages. The study's findings indicated that *T. spartea* demonstrated notable efficacy in addressing proximate and elemental analysis, as well as exhibiting antioxidant and insecticidal properties. This can be explained by the existence of diverse secondary metabolites within the plant. These results provide scientific support for the traditional medicinal applications of *T. spartea.*

Keywords: Proximate, Elemental analysis, Insecticidal, Antioxidant, *Taverniera spartea*.

INTRODUCTION

Medicinal plants undergo proximate analysis as a fundamental assessment of their macro-nutrient composition, encompassing key elements like carbohydrates, fats, proteins, ash, crude moisture and fiber. This method offers a foundational understanding of their nutritional values, serving as a starting point for more in-depth investigations. It's worth noting that the specific focus of proximate analysis can vary based on the plant and its intended use, often excluding crucial components like secondary metabolites (e.g., phenolics, terpenoids, alkaloids) with potential medicinal properties (Abbas et al. 2015).

Examining the elemental composition of medicinal plants is a crucial aspect of pharmacognosy, the research into natural medication sources. This entails figuring out and calculating the concentrations of both macro elements (such, potassium, magnesium, sodium and calcium) and trace elements (including zinc, manganese, copper, iron, and molybdenum) in these plants. These components are essential to how medicinal plants function biologically, affecting both the therapeutic effects and potential toxicity (Presley et al. 2017).

The understanding of the antioxidant activities of medicinal plants has grown substantially, more research is needed to fully understand the complexities of these plants, including the interactions of different phytochemicals within the plants, the impacts of various cultivation and processing techniques, and the bioavailability and metabolism of these compounds within the human body (Dudonné et al. 2015).

Medicinal plants have been used traditionally not only for their therapeutic properties but also for their pest repellent and insecticidal activities. They produce a wide range of secondary metabolites, such as alkaloids, phenolics and terpenoids, that exhibit insecticidal activity (Dhaliwal, 2000). These secondary metabolites affect various physiological processes in insects, such as feeding, growth, reproduction, and behavior, thus controlling the pest population.

Taverniera spartea (Burm.f.) DC, commonly known as the Arabian cotton, is a perennial shrub 45-120 cm tall belonging to the Fabaceae family. It is native to the arid regions of North Africa, the Middle East, and the Arabian Peninsula. They are found in Baluchistan in Pakistan and widely distributed in Bandar abbas, minab (Iran) and also in Nepal, Sarilanka and India (Kooti et al. 2017). *Taverniera spartea* has been traditionally used in herbal medicine for its medicinal properties. Decoction of the plant is used for treating gastrointestinal disorder Nasr et al. (2019)

The present study is aimed to investigates various bioactive compounds, proximate and elemental analysis, Insecticidal, free radical (DPPH) scavenging properties of the *Taverniera spartea's*.

MATERIALS AND METHODS

Collection and identification of plant

Plant samples were collected from various location of Baluchistan area. The plant samples were given voucher number Nayab Rahman 45 and will be presented in Herbarium at Qurtuba University. The plant samples were shade dried and grind into fine powder using an electric grinder. The powder sample were used for biological activities.

Elemental Analysis

Atomic absorption spectrophotometry was used to conduct an elemental analysis on extracts from the roots, stems, and leaves of *Taverniera spartea*. A tiny quantity—0.5g of the plant sample that had been powdered—and 10ml HNO_3 were combined in a concealed flash and left overnight. The extra 4ml of chloric acid was cooked on a hot plate the next day. The test material's original yellow color transforms into white vapors when this happens, meaning digestion is complete. Then, 100ml of the distilled water is transferred after being filtered using filter paper into the plastic bottles. Atomic absorption spectrometer examination of the solution in these bottles to determine its composition (Zafar et al. 2010).

Proximate Composition:

To assess the secondary metabolites protein, carbs, ash, and fiber, among others, proximate composition of the *Taverniera spartea* extract was carried out using the procedures recommended by AOAC (2000). Following the guidelines published by the Association of Official Analytical Chemist, continuous extraction was used to determine the presence of lipids while crucibles were used to assess the moisture content at 105 C. Using a 6.25 correction factor, the Micro Kjedahl technique was used to determine the crude protein concentration. Total dietary fiber was calculated via sequential enzyme digestion, and total ash content was calculated by muffle-firing samples for 6 to 8 hours at 550 to 600 degrees Celsius. The difference was calculated using data from the total lipid, protein, fiber, moisture, ash, and total lipid contents.

Antioxidant Activity

With a few f modifications to the (Adedapo *et al.* 2009) method, the antioxidant activity of the methanolic and ethyl acetate extract of *Taverniera spartea* was assessed using the DPPH test. A solution containing 0.135 ml of DPPH was prepared, and one milliliter of this solution was mixed with three different plant extract strengths (100, 200, and 300 g/ml). The reaction mixture was stored in the dark at room temperature for 30 minutes. Ascorbic acid will function like a typical medication. A solution of 1.0 ml methanol and 1.0 ml DPPH solution was used as a control. A UV-Vis spectrophotometer was used to measure the decrease in absorbance at 517 after the reaction was performed in triplicate for 30, 60, and 90 minutes.

Insecticidal Activity

Following the method used by Naqvi and Parveen (1991), *Taverniera spartea's* insecticidal bioassay was examined. As the material and the reagents, insects *(Tribolium castaneum, Trogoderma granarium*, and *Sphenoptera dadkhani*) were used. These insects were acquired at a market close to the University of Peshawar. Methanol, chloroform, and the aqueous extract were combined to create the stock solution. Using micropipettes, test sample stock solutions were applied to filter paper in petri plates and then left overnight. On the Petri dishes with labels, the insects were transferred. The Petri plates were housed in a growth chamber at a temperature of 27°C for 24 hours with a relative humidity of 50%. The number of insects that survived in each Petri dish was counted to determine the results after 24 hours of incubation. The data was then statistically evaluated using Biostat (2006).

Statistical analysis

LSD (Least Significant Difference) test was used and the data is presented as mean of triplicate data.

RESULTS AND DISCUSSION

Proximate Analysis

In recent years, there has been a significant increase in interest in the use of medicinal plants for various purposes such as pharmaceuticals, nutritional supplements, and other health-enhancing products. This heightened attention is primarily due to their perceived safety, nutritional benefits, and therapeutic properties (Mandal et al. 2022). The World Health Organization emphasizes the importance of determining the immediate and micronutrient composition of plants found in nature as a crucial step in establishing standardized guidelines for herbal products (Naqbi et al. 2022). The study conducted a proximate analysis of *Taverniera spartea*, examining its leaves, stems, and roots to understand their nutritional importance (as shown in Table 1). The notably elevated moisture levels observed suggest that these raw plant materials are not suitable for long-term storage. (Ogbonna et al. 2021). According to the proximate analysis, leaves had high moisture contents (49.67%) and low moisture contents (7.74%) (Table 1) (Fig 1).

Ash is made up of inorganic substances found in plants, including oxides and salts. These inorganic compounds consist like, sulfates, phosphates, of anions, chlorides, and other halides, as well as cations like potassium (K), sodium (Na), iron (Fe), and manganese (Mn), magnesium (Mg), calcium (Ca). The amount of ash in a food item indicates the quantity of minerals it contains (Ghani et al*.* 2021). The ash contents were maximum (13.38%) in leaves and minimum (9.89 %) in roots (Table 1).

In living things, fats act as a kind of stored energy and are crucial structural elements of biological membranes, such as phospholipids and sterols (Kashyap et al. 2022). According to Babu et al. (2018), at least 2.0 milligrams of fat per 100 grams of food should be consumed daily. Fat content was highest (1.68%) in leaves and lowest (1.30%) in roots (Table 1).

Assessing the nutrient content and proximate values of plants helps determine their nutritional importance. When a plant consistently meets the established criteria for proximate composition, it can be considered safe for use as a dietary supplement or in herbal medicine (Pandey et al. 2006). The recommended daily fiber intake varies by gender and life stage. For men, it is suggested to consume between 31.00 to 38 grams per day. Women should aim for a daily intake of 25 to 26 grams of fiber. Pregnant women are advised to get around 28 grams per day, while lactating mothers should aim for approximately 29 grams of daily fiber. Fibers were higher (53.65%) in stem in and lower (15.60 %) in leaves (Table 1).

Proteins play a crucial role in the human body by serving several essential functions. They are involved in the building and repair of bodily tissues, the regulation of developmental processes, and the formation of vital enzymes and hormones. These molecules are a fundamental component of our diet, necessary for replacing damaged tissues, providing energy, and ensuring a sufficient intake of essential amino acids (Mgbemena et al. 2022). Proteins were maximum (18.38 %) in stem and minimum (16.04 %) in leaves (Table 1).

Elemental analysis

Carbohydrates serve as the primary energy source for humans when they are oxidized within cells. Additionally, they play a crucial role as building blocks for creating various cellular components. Carbohydrates were higher (11.08%) in root and lower (3.63 %) in leaves. The energy content of medicinal plants is primarily utilized to quantify the consumption of their nutritional elements in a manner similar to food components (Shemishere et al. 2018).

The root had a high gross energy content of 129.54 Kcal/100 g, while Table 1 indicated a lower energy content of 93.8 Kcal/100 g for *Taverniera spartea* parts. This variability in nutritional composition among different parts of *Taverniera spartea* may be attributed to various factors, including climate, species type, harvesting seasons, as well as factors like drought and temperature (Onyeike et al. 2015)

Table 1: Proximate Analysis of *tavernira spartea*:

Plant parts	Moisture (%)	Ash (%)	Fats (%)	Fibers (%)	Proteins (%)	Carbohydrates (%)	Gross Energy (Kcal/100g)
Leaves	49.67	13.38	1.68	15.60	16.04	3.63	93.8
Stem	8.85	11.44	1.16	53.65	18.38	6.56	110.2
Roots	7.74	9.89	1.30	51.62	18.38	11.08	129.54
Mean	**22.08**	**11.57**	**1.38**	**40.29**	**17.6**	**7.09**	**111.18**

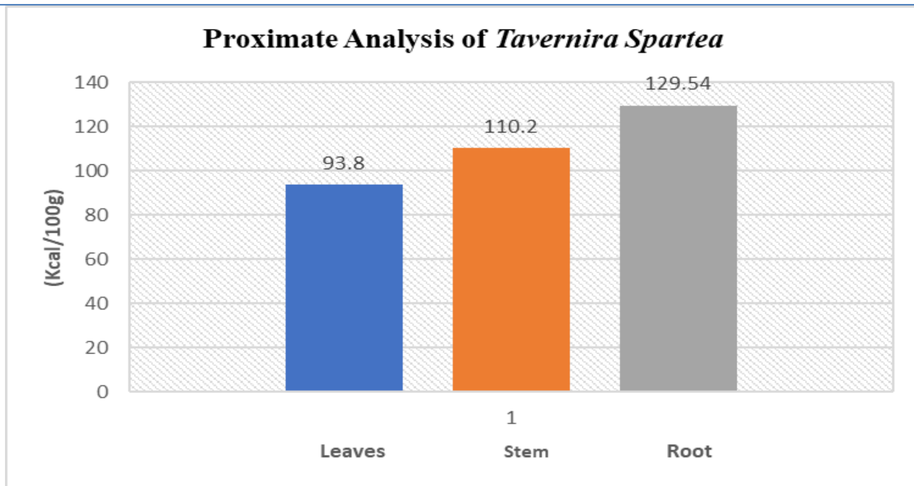

Figure1: Proximate analysis of *Tanvernira spartea*

Macronutrients:

Trace elements play a vital role in the healthy growth of plants and animals, as they are essential for various physiological and biological functions in the body, as highlighted by Ramanaiah et al. (2022). Small quantities of these components are needed. The uptake and removal of calcium from the mitochondrial matrix is one important biological function that has a considerable impact on cellular metabolism, signaling, and survival as a whole. Heart failure, stroke, neurological illnesses, diabetes, cancer, and other acquired diseases as well as hereditary neuromuscular abnormalities are all linked to disruptions in this mitochondrial calcium (mCa21) cycling process. Therefore, gaining a deeper understanding of the mechanisms responsible for mCa21 exchange holds substantial potential for advancing the treatment of these diseases, as emphasized by Garbincius and Elrod 2022. According to the findings, calcium concentrations were highest in leaves (42.63 mg/L) and lowest in stems (35.17 mg/L) (Table 2).

Magnesium (Mg) is a vital mineral in the human body, playing a crucial role in the regulation of numerous physiological processes. This micronutrient serves as a cofactor or activator in over 300 enzymatic reactions, contributes to RNA and DNA synthesis, aids in the metabolism of proteins, lipids, and carbohydrates, supports the stability of cell membranes, influences bone health and calcium (Ca) regulation, and is essential for the proper functioning of the nervous and immune systems. To ensure the optimal operation of these functions, it is necessary to obtain an adequate dietary supply of magnesium from food and beverages. The recommended daily intake of magnesium, known as the Recommended Dietary Allowance (RDA), is 320 mg for adult females and 420 mg for adult males Pelczyńska et al. (2022)**.** Magnesium had the most (27.01mg/L) in stems and lowest (6.94 mg/L) in leaves (Table 2).

Potassium is a crucial cation in the human body, with around 2% found in extracellular fluid (within the range of 3.5-5.0 mEq/L) and the remaining 98% residing in the intracellular compartment (approximately 140 mEq/L). Its significance lies in its essential role in the normal electrophysiology of cell membranes, particularly in neurons, muscle cells, and cardiac cells. Any deviations from the normal serum potassium levels can lead to disruptions in the electrical properties of these cells, potentially resulting in various adverse clinical outcomes. These outcomes encompass muscular weakness, high blood pressure, ventricular arrhythmias, and even mortality, as suggested by Sumida et al. (2023). Potassium's role in maintaining regular cardiac function and aiding in preventing constipation is dynamic. According to the National Research Council's 1974 recommendations, the Recommended Dietary Allowance for potassium intake in adults falls in the range of 1875-5625 mg per kilogram of body weight, as stated by Henneman et al. (2016). In leaves, potassium concentrations were highest (17.05 mg/L), while in roots, they were lowest (4.200 mg/L) (Table 2).

Micro nutrients

While metals such as Cobalt (Co), Nickel (Ni), Manganese (Mn), Copper (Cu), Zinc (Zn), and Iron (Fe) are considered essential for various biological processes, they can become harmful and toxic if their concentrations exceed recommended limits, as pointed out by Khan et al. (2023). The production of copper has seen a rapid increase over the last century, with global production reaching twenty million metric tons by 2017, which is twice as much as it was in 2000. Copper is a vital resource for both societal and economic progress, with over 90% of modern industrial enterprises relying on a consistent supply of copper, as highlighted by Zhang et al. (2022). Copper was greater (0.045 mg/L) in leaves and lesser (0.020 mg/L) in roots (Table 2) (Fig 2).

Plants have developed distinctive tactics to maintain their cellular and physiological integrity when exposed to challenging environmental conditions such as extreme temperatures and high concentrations of toxic elements like Cadmium (Cd), Arsenic (As), and Lead (Pb). In order to adapt to these fluctuating environmental stressors, plants employ a range of metabolic processes that result in the production of secondary metabolites, as described by Asare et al. (2023). study. In Table 2, it is evident that the stem contains the highest Lead concentration at 2.27 mg/L, while the leaves have the lowest concentration at 2.20 mg/L. There is no potential health risk to users from the level of Pb discovered in this study.

Zinc (Zn) is a crucial micronutrient in all living organisms, existing primarily in its oxidized state as a positively charged divalent ion (Zn2+), as explained by Andreini *et al*. in 2006. Recent estimations indicate that Zn is used in the functioning of approximately 6% of prokaryotic proteins and 9% of eukaryotic proteins, making it the second most prevalent metal cofactor, following iron (Fe). Most of the Zn within cells is bound to proteins, resulting in total Zn concentrations in eukaryotic cells in the hundreds of micromolar range, while only small, highly regulated pools of free or loosely bound Zn2+ exist in picomolar and nanomolar concentrations, as described by Stanton et al. (2022). The recommended maximum allowable level of Zinc in plants by the World Health Organization (WHO) is 50 milligrams per kilogram (mg/kg). Zinc was high (0.932 mg/L) in leaves and low (0.725 mg/L) (Table 2)

A deficiency of selenium in the human body can complicate the treatment of coronavirus disease, whereas the addition of selenium supplements can lead to a quicker recovery from it. Manganese, serving as a co-factor for enzymes, plays a significant role in various aspects of human metabolism, including antioxidant defense and immune response (Chuparina et al. 2022). The daily intake advised of manganese that is non-toxic and suitable ranges from 1.2 to 1.5 mg per day for children under 8 years old, 1.9 to 2.3 mg per day for males up to 70 years old, and 1.6 to 1.8 mg per day for females up to 70 years old (Olaniyi et al. 2019). The manganese was greater (0.650 mg/L) in leaves and lesser (0.341 mg/L) in stem (Table 2).

Iron (Fe) is a crucial nutrient essential for the proper growth and development of plants. It plays a vital role in various chemical processes, such as photosynthesis and respiration, thanks to its capacity to readily accept and release electrons, making it redox-active. When plants lack sufficient iron, it typically results in a decline in their overall health and vitality. According to Liang in (2022), soil is the main source of iron for plants. Iron concentrations were highest in the roots (4.408 mg/L) and lowest in the stem (2.364 mg/L) (Table 2). The local communities can receive the maximum amount of Fe from this plant, which thrives at high elevations, thereby eradicating their nutritional inadequacies.

Table 2: Elemental analysis of *Taverniera spartea*

Plant parts	macronutrients (mg/L)				Micro nutrients (mg/L)					
	Ca	Mg	K	Cu	Pb	Zn	Mn	Fe	Co	Cd
Leaves	42.63 ±0.14	27.01 ±15.68	17.05 ±0.001	0.045 ±0.002	2.20 ±0.92	0.932 ±0.02	0.650 ±0.02	2.641 ±0.05	0.007 ±0.007	0.022 ±0.001
Stem	35.17 ±0.12	6.94 ±1.59	8.65 ±0.06	0.004 ±0.02	2.27 ±0.37	0.725 ±0.009	0.341 ±0.03	2.364 ±0.02	0.029 ±0.01	0.028 ±0.002
Roots	41.69 ±0.31	7.914 ±0.98	4.200 ±0.18	0.020 ±0.004	2.21 ±0.23	0.813 ±0.01	0.492 ±0.04	4.408 ±0.02	0.006 ±0.02	0.021 ±0.013
Mean value	**39.83**	**41.86**	**29.9**	**0.069**	**2.22**	**0.82**	**0.49**	**3.14**	**0.01**	**0.02**

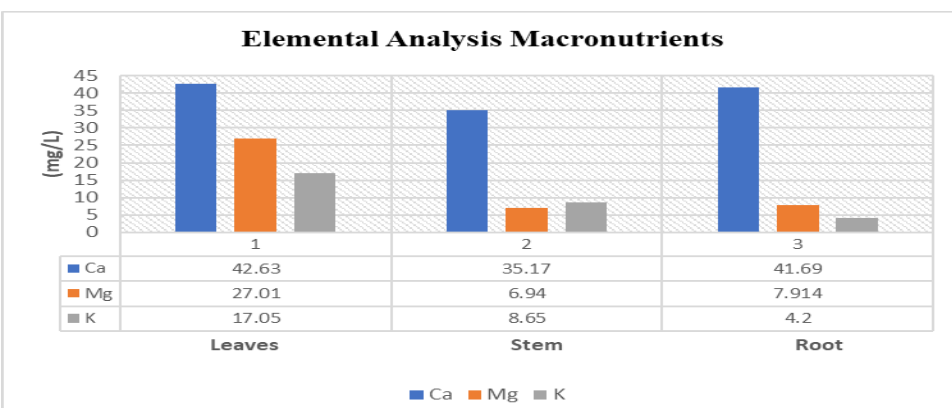

Figure 2: Elemental Analysis of Macronutrients of *Taverniera spartea*

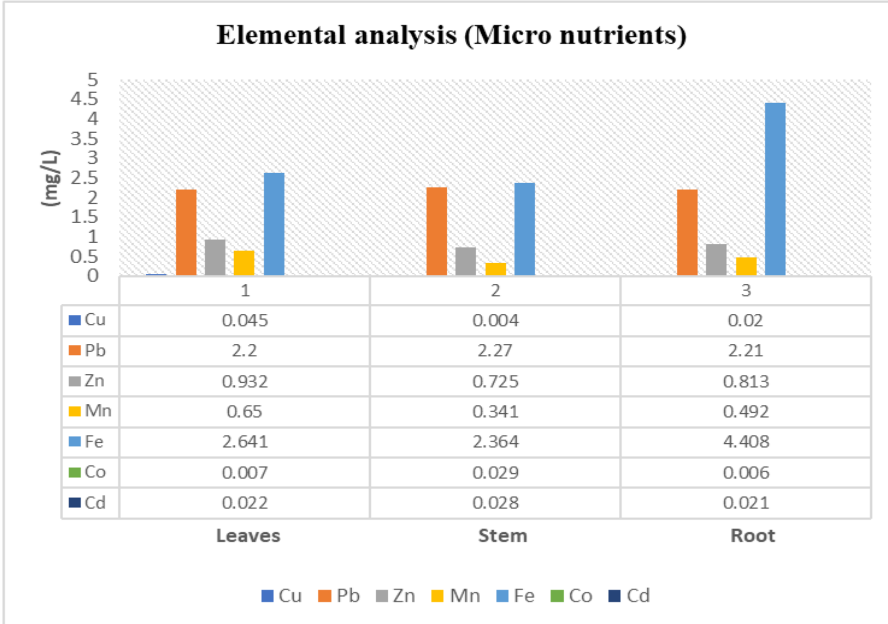

Figure 3: Elemental Analysis of Micronutrients of *Taverniera spartea*

Cobalt and iron are elements that often vie for attention in various contexts because they typically exist in the same oxidation states (2+ and 3+) and share similar chemical characteristics. Iron is widely recognized as a carcinogenic substance in both animal and human studies. (Ćwiertnia et al. 2022). The current components exhibited low Co concentrations compared to WHO values, indicating that plant components are safe.

Cadmium (Cd) is a hazardous environmental pollutant that is not essential for human health and is known to be highly toxic. It poses significant threats to the environment and agriculture on a global scale. Excessive exposure to cadmium can lead to cancer in humans and is categorized as a Group 1 carcinogen. It is ranked seventh among the top 20 most toxic metals. The typical range of cadmium intake through dietary sources (66.5–116 µg Cd per kg of body weight per month) is significantly higher than the maximum limit recommended by the FAO/WHO, which is 25 µg Cd per kg of body weight per month (Khanna et al. 2022). Cadmium was maximum in stem (0.028 mg/L) and minimum (0.021 mg/L) in roots (Table 2) (Fig 3).

Antioxidant Activity

DPPH radical scavenging activity:

Table 3 showed the free radical scavenging activity of the ethyl acetate and ethanolic extracts and standard drug ascorbic acid. Among the extracts, the ethanol extracts possessed the highest scavenging activity. At a concentration of 100 µg/mL, 200 and 300, the scavenging activity of ethyl acetate extract was 52.3±2.52, 60.4±1.60 and 72.0±2.32 %, respectively, whereas at the same concentrations, the scavenging activity of ethanol extracts was 58.5±2.42%, 64.3±1.45%,78.6±1.23% (Table 3). The scavenging activity of standard drug ascorbic acid at a concentration of 100 µg/mL, 200 and 300 was 60.3±2.21%, 68.5±1.53% and 86.4±2.42%. The lowest IC_{50} 54.32 µg/ml was observed for ascorbic acid followed by ethanol extract which showed IC_{50} value of 86.41 µg/ml. Because of their ability to donate hydrogen, antioxidants are thought to have an impact on DPPH. To prevent free radicals from contributing negatively to a range of illnesses, including cancer, radical scavenging actions are essential. The DPPH free radical scavenging method is a well-known way to assess the antioxidant activity of plant extracts. In the DPPH assay, the addition of the extract results in the reduction of the violet-colored DPPH solution to diphenyl picryl hydrazine, which produces a yellow-colored result. This method has been used frequently to forecast antioxidant activity because of the processing time, which is very short (Rahman et al. 2015). Comparing the ethanolic extract to regular ascorbic acid, our findings demonstrated that the ethanolic extract had a much higher capacity to scavenge free radicals (Table 3) (Fig 4). By having the ability to donate hydrogen, phenol and flavonoid content found in plant extracts may be to blame for scavenging DPPH radicals (Proestos et al. 2013). The findings of this study indicate that plant extracts exhibit high levels of radical scavenging action by electron transfer or hydrogen donation. In comparison, the activity of the ethanolic extract was higher than that of the ethyl acetate extract.

Table 3: Antioxidant activity of *Taverniera spartea*:

Sample	Conc. (µg/ml)	% of DPPH radical scavenger activity	
			IC_{50} (µg/ml)
Ascorbic acid	100	60.3±2.21	54.32
	200	68.5±1.53	
	300	86.4±2.42	
Ethyl acetate	100	52.3±2.52	147.60
	200	60.4±1.60	
	300	72.0±2.32	
Ethanol	100	58.5±2.42	86.41
	200	64.3±1.45	
	300	78.6±1.23	

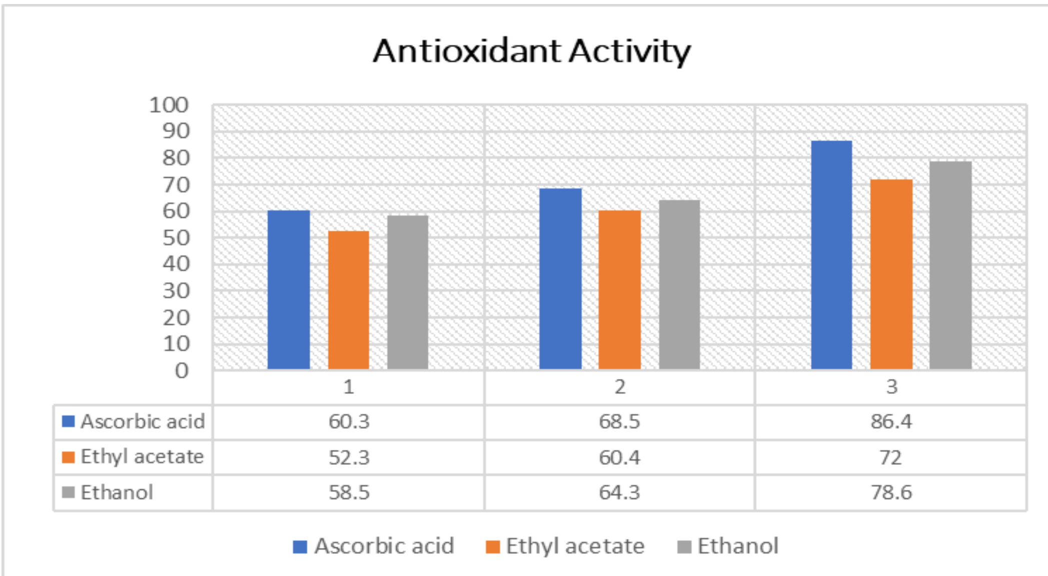

Figure 4: Antioxidant activity of *Taverniera spartea*:

Insecticidal Activity

In this current investigation, we explored the insecticidal activity of ethanolic and ethyl acetate extracts against three distinct insect species: *Rhyzopertha dominica*, *Tribolium castaneum*, and *Sitophilus oryzea* (as indicated in Table 4). Among these extracts, the ethanolic extract exhibited the highest efficacy, resulting in an 80.0% mortality rate for Sitophilus oryzea and a 53.4% mortality rate for *Rhyzopertha dominica* at a concentration of 1000 µg/ml (as shown in Table 4). It's worth noting that all extracts demonstrated a concentration-dependent effect. The lowest LD_{50} value, specifically 82.32 µg/ml, was observed with the ethanolic extract against *Sitophilus oryzea* (as detailed in Table 4). These findings underscore the significant toxicity of the ethanol extract against *Sitophilus oryzea*, as evidenced by an LD_{50} value of 82.32 µg/ml (refer to Table 4).

Additionally, *Sitophilus oryzea* and *Tribolium castaneum* also had relatively high LD_{50} values, showing some resistance to the extract doses. As the extract content rose, the death rate showed an upward trend, according to the results. This insecticidal activity can be attributed to various phytochemicals found in the plant extracts, including alkaloids, phenols, flavonoids, triterpenoids, and tannins. These results are consistent with those of other research by Diouf et al. (2016) and El Ouali Lalami et al. (2016), which also found that flavonoids, alkaloids, phenols, steroids, and tannins present in diverse plants have insecticidal effects. Tannins, for instance, have an impact on the growth, development, and fertility of many insects, diminishing egg production and influencing the survival and health of subsequent generations. Phenols disrupt the natural motility of insects, as highlighted by Diouf et al. (2016).

Table 4: Insecticidal Activity of *Taverniera spartea*

Test Insects	Extract	Dose (µg/ml)	Total No. of insects	No. of insects in control	No. of insect's survival	No. of dead insects	Percent mortality	LD_{50} (µg/ml)
Tribolium castaneum	**Ethyl acetate**	10	30	30	23	07	23.3	94.09
		100	30	30	17	13	43.3	
		1000	30	30	12	18	60.0	
	Ethanol	10	30	30	20	10	33.4	89.40
		100	30	30	15	15	50.0	
		1000	30	30	09	21	70.0	
Rhyzopertha dominica	**Ethyl acetate**	10	30	30	26	04	13.4	106.27
		100	30	30	19	11	36.7	
		1000	30	30	14	16	53.4	
	Ethanol	10	30	30	18	12	40.0	90.85
		100	30	30	14	16	53.4	
		1000	30	30	8	22	73.4	
Sitophilus oryzea	**Ethyl acetate**	10	30	30	24	06	20.0	114.42
		100	30	30	16	14	46.7	
		1000	30	30	10	20	66.7	
	Ethanol	10	30	30	20	10	33.4	82.32
		100	30	30	11	19	63.4	
		1000	30	30	06	24	80.0	

CONCLUSIONS

From the current study following conclusion are derived.

The nutritional analysis of *Taverniera spartea* demonstrated the presence of various inorganic compounds, including phosphates, chlorides, sulfates, and other halides, together with cations like, potassium, sodium, magnesium, calcium, manganese and iron. These findings suggest that *T. spartea* possesses a favorable chemical composition with medicinal value.

Furthermore, the proximate composition of *T. spartea's* leaves, stem, and roots revealed the existence of ash, fats, proteins, moisture content, fibers, carbohydrates, and gross energy (Kcal/100g). The presence of these nutritional elements underscores the pharmacological and pharmaceutical significance of this plant.

In terms of antioxidant activity, the results indicated that the ethanol extract displayed the highest antioxidant potential at elevated concentrations, followed by the ethyl acetate extract. This underscores *T. spartea's* potential as a natural source of antioxidants.

Regarding insecticidal activity, both ethyl acetate and ethanol fractions exhibited a dose-dependent effect. Phytochemicals such as alkaloids, phenols, flavonoids, triterpenoids, and tannins present in the plant extracts are likely contributors to its insecticidal properties

Supplementary materials

The supplementary material / supporting for this article can be found online and downloaded at: https://www.isisn.org/article/

Author contributions

Nayab Rehman: Investigation, Data collection and analysis. Muhammad Adil: Project Administration, supervision, original draft writing, Sumayya: Analysis of data.Atta Ur Rahman: Software, Faiza: Resources,Ayaz Ali Sher:Resources,Emama Rauf: Formal Analysis,Atifa Quddoos: Writing review and Editing, Methodology,
Fakhr e Alam: Validation.Sunila Atshan Mir: Resources

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Not applicable

Informed Consent Statement

Not applicable.

Data Availability Statement

The data such as the source file associated with this finding are available from the corresponding author upon request.

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Conflict of interest

The authors declare that they have no conflict of interest.

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