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Original Article

Identification of Poisonous Plants for Livestock and Their Phytochemical Screening Test in Kaffa Zone, Southwestern Ethiopia

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ABSTRACT

This study was conducted to identify livestock poisoning plants and evaluate the phytochemical constituents of those poisonous plants in the Kaffa zone in southwest Ethiopia. The cross-sectional study was conducted from *March 2022* to December 2022. The most common poisoning plants identified in the study area include *Ajuga alba, Solanum americanum, Amaranthus cruentus, Albizia gummifera, Cyperus rotundus, Uebelinia kiwuensis, Datura stramonium, Xanthium strumarium, Tribulus terestris, Medicago poly/morpha, Euphorbia tirucalli, Hedera canariensis,* and *Trifolium burchelianum*. The survey data were collected from voluntary animal owners, traditional animal healers, and animal health experts in the selected districts. Structured questionnaires were developed, and 366 individuals (300 livestock owners, 40 traditional animal healers, and 26 animal health practitioners) were interviewed voluntarily. The study revealed that 260 (94.8%) of livestock owners, 40 (100%) of traditional animal healers, and 26 (100%) of animal health practitioners complained about the presence of plant poisoning in livestock in the study area. The qualitative phytochemical analysis of alkaloids, polyphenols, terpenoids, coumarin, saponins, tannins, and flavonoids was performed by using both polar and non-polar solvents of n-hexane, dichloromethane (1:1), and methanol with occasional shaking with a shaker for 48 hours. Flavonoids, terpenoids, and polyphenols were the most abundant classes of compounds in the majority of the screened plants. And those constitute different medicinal values for the farmers according to traditional animal healers. The livestock were poisoned by leaves and other parts of the identified poisonous plants through ingestion or contact. Hence, the livestock health in the area is at high risk of exposure to these toxic plants; therefore, there is an improvement in the management of pastures using either chemical, biological, or physical controlling methods of poisonous plants from pasture, range land, hay fields, and roadsides. Further toxicological studies and possibly pharmacological activity are needed to be investigated by quantifying the toxin.

INTRODUCTION

Plants are the major part of livestock feed, while toxicosis in animals consuming these plants can be expected. Poisonous plants are one of the main causes of livestock health problems all over the world and bring significant economic losses to the producers. When pasture dries up and most hazardous plants stay green and appealing, plant poisoning is caused by either the purposeful eating of toxic plants or the unintentional ingestion of materials eaten along with grass [1, 2]. Cattle grazing land contains intricate mixtures of invasive and native species, which may raise the risk of coming into contact with hazardous plants, many of which are poorly or never classified at all. Ethiopia has a wide range of geographical diversity as well as macro- and microclimatic variability, in addition to a variety of toxic plant species. Threats to biodiversity, however, come from altered habitats, invasive species, toxic plant growth, pollution, climate change, changing demographics, poverty, and a lack of understanding and cooperation [3]. Although grazing is accepted as a standard practice in livestock management, it exposes the animals to several toxic plants, especially when there is less grain available. Treatment setbacks and unresolved instances may result in the partial or whole death of the animal. After being consumed and/or absorbed by animals, poisonous plants cause harmful consequences, which can include bodily discomfort, decreased productivity, and even death [4].

Even though plants create a large number of medicinal compounds, some plants make the toxin directly, while in others, microorganisms growing on or inside the plant produce the toxin [6]. For primary healthcare, almost 80% of people on the planet rely on traditional medicine, which primarily uses plant extracts. This could be explained by the widespread perception that these therapies are safe because they are "natural" and present a kind and safe alternative to traditional therapy. While clinical signs of certain plants may not appear for several days or weeks after consumption, others can cause illness or even death right away. Animal poisoning is typically difficult to treat. If poisonous plants are identified and taken into account in management strategies, losses will be reduced [6]. Poisonous plants contain potent toxic substances called phytochemicals that, even in small amounts, can have detrimental effects and even be lethal when ingested by an animal. Phytoconstituents such as alkaloids, terpenoids, flavonoids, tannins, coumarins, saponins, and polyphenols are detected by the phytochemical screening test. It has been shown that flavonoids exhibit a broad range of biological actions, including antibacterial, anti-inflammatory, anti-allergic, antiviral, anticancer, and antidiarrheal activity [7]. Known to possess insecticidal qualities as well, terpenoids can serve as protective agents for agricultural products [8].

Due to the plants' rapid development and the buildup of potentially hazardous substances, animals are more likely to consume poisonous plants during wet seasons, according to [9]. Additionally, animals may consume toxic plants. This is especially the case in poor pasture conditions and periods of scarcity resulting from unfavorable weather, such as drought, when most palatable plants dry up. Many toxic plants manage to stay green and attractive, serving as the main source of food for animals. Additionally, the issue is made worse by vitamin A or phosphorus deficits, which have an impact on how animals graze [10]. The presence of certain toxicologically relevant plant elements, such as alkaloids, cyanide, oxalate, alcohols, phenol, tannin, and minerals, causes a plant or portion of it to be poisonous. Plants differ in how much of the harmful compounds they contain. Similar or radically differing toxicities can also be shown by plants in the same genera. The distribution and quantity of toxins found in plants change depending on the species, portions of the plant, and growing environment. Although the concentration of hazardous chemicals can occasionally be so low as to be regarded as appropriate fodder, using the species as a main diet regularly can lead to poisoning [11].

Although earlier research has acknowledged the presence of toxic plants in Ethiopia [12], there are currently no studies on the effects of toxic plants on cattle, particularly in the southwest region of Ethiopia where the current study is being conducted. The majority of the knowledge regarding toxic plants that are currently available in Ethiopia comes from case studies. As a result, it is a virgin (neglected) field where interested researchers can fill in the blanks about the dearth of knowledge on the effects of toxic plants on livestock. Moreover, the majority of plant poisonings that happen in the nation go unreported in the literature since it is not typical for veterinarians to write case reports. Therefore, educating experts on the impact of toxic plants on animal health and productivity is essential. To do this, a more thorough evaluation, documentation, and identification of the principal toxic compounds (phytochemicals) of these plant species as well as their dangerous plant populations in the rangelands are required. Thus, the study was initiated to identify the poisonous plants for livestock and conduct phytochemical screening tests for them in the Kaffa zone, southwestern Ethiopia.

MATERIALS AND METHODS

Description of the Study Area

This study was conducted from March to December 2022 in the Kaffa zone of southwestern Ethiopia. For the study, a total of three districts were selected based on their agroecology: lowland, midland, and highland, namely Goba, Gimbo, and Saylem, respectively. The region lies between 6.38°N and 8.28°N latitude and 35.48°E and 36.73°E longitude. The Kaffa zone in the southwestern region of Ethiopia is one of the wettest lands in the country and has a very good rainfall pattern throughout the year and fertile soil that creates a conducive environment for different plant species. The area has a varying topography and agroecology composed of lowland, midland, and highland areas that cover 22%, 70%, and 8%, respectively. The area is characterized by a tropical rainfall pattern that usually records rain every month to various extents, with an average annual rainfall of 1000 mm to 2200 mm. Rainfall starts at the end of February and ends in October, with its peak in August. The mean annual minimum and maximum temperatures range from 10.1 °C to 27.5 °C [13]. Accordingly, Goba is the lowest altitude with a partial pastoral agriculture system in the region, while Saylem has the highest altitude of up to 3000 m with a mixed farming system, and Gimbo lies in between as midland. The map of all the study areas is illustrated in Fig. 1.

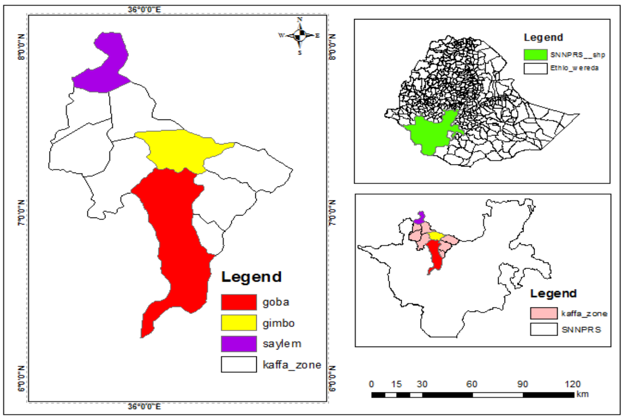

Fig. 1 Map of the study area

Study Design and Sampling Methods

A cross-sectional study was used to interview voluntary animal owners, traditional animal healers, and animal health experts. For this study, a structured questionnaire was designed to collect information related to plant poisoning on livestock in the study area. The districts were purposely selected by taking into consideration agroecology and the occurrence of a variety of plant vegetation cover in the area of those poisonous plants. Questionnaire surveys were carried out by interviewing 300 voluntary animal owners, 40 traditional animal healers, and 26 animal health experts. The questionnaire was used to collect all relevant information for the study, including types of livestock poisoning due to poisonous plants, the local name of poisonous plants, poisonous parts of the plant (leaf, seed, bark, root, flower), poisonous growth stage and state of poisoning, seasons of abundance, ways of exposure, amount to cause poisoning, and factors exposing livestock to the toxic plants of the poisonous plant. The methods employed during data collection were separate semi-structured interviews, field observations, key informants, and plant sample collection.

Study Methodology

A total of 366 individuals were interviewed from all districts by applying a face-to-face approach. The structured questionnaire was used to collect information related to toxic plants for livestock and their associated risk factors, such as climate change, agricultural expansion, drought, overgrazing, and soil erosion. These include the cost of treatment, loss of animals due to poisonous plants, encroachment and deterioration of the grazing land, production loss, and others. The plants were collected with their local names from surrounding forests and other sites where the plants were found by the interviewees. After collection, the toxin was identified for further investigation. Laboratory analysis will also be done for phytochemical screening tests and to identify the toxin in each plant species.

Collection of Plant Materials and Identification

Samples of the 13 plant materials were collected from three different agroecological areas in which a variety of poisonous plant species were grown. The collected fresh plant samples were packed in paper bags and brought to the laboratory for further processing. The plant samples were taken from mature plant parts (well-developed leaves and stems) that were fresh and free from insect damage, rust, or other visible disease. The leaves were separated, washed under running tap water, and shade-dried. The dried leaves were ground into a fine powder using a blender. The powder was preserved in an airtight bottle for further use. Voucher specimens were collected from the study areas under the guidance of people who knew the local names of the plants. At times, the field activities included taking notes on plants, taking the geographic location or altitude by GPS, and associating indigenous knowledge with preliminary identification of the plants to family and sometimes to species levels. Photographic records were also taken in the field to capture the field sites, plants, and other useful memories. The specimens were dried and deep-frozen to preserve their natural colors, and identification was made at the National Herbarium (ETH), Addis Ababa University, using taxonomic keys and descriptions given in the relevant volumes of the Flora of Ethiopia and Eritrea [14–16] and by visual comparison with authenticated herbarium specimens. Finally, the accuracy of the identifications was confirmed by a senior plant taxonomist, and the voucher specimens with labels were deposited at the Ethiopian National Herbarium.

Preparation of the Plant Extracts

The fresh leaf material of *Ajuga alba, Solanum americanum, Amaranthus cruentus, Albizia gummifera, Cyperus rotundus, Uebelinia kiwuensis, Datura stramonium, Xanthium strumarium, Tribulus terestris, Medicago polymorpha, Euphorbia tirucalli, Hedera canariensis*, and stem material of *Trifolium burchelianum* were collected, washed thoroughly with running tap water, and air dried under shade. The root bark of *Trifolium burchelianum* was cut into small pieces using a penknife and air-dried for an additional week. All the plant samples were then chopped, crushed, and powdered with the electrical grinder, and then the dried powdered samples were stored in small plastic bags with paper labeling at room temperature for further processing [17]. The grinded leaf and stem material of 50 grams of plant sample was subjected to 100 milliliters of solvent, from non-polar to polar, to determine the solvent that extracted the most active components. Separate aliquots of plant material were used for each solvent. The solvents that were used for this experiment included n-hexane, dichloromethane (1:1), and methanol, with occasional shaking with a shaker for 48 hours.

Each extract was filtered through Whatman No. 1 filter paper and concentrated using a rotary evaporator at 40 oC.The resulting crude extracts were weighed and stored in the refrigerator until phytochemical screening tests were carried out. The extract plant samples were prepared and subjected to phytochemical analysis of their secondary metabolites for qualitative analysis of alkaloids, terpenoids, tannins, saponins, flavonoids, coumarins, and polyphenols. Workflow demonstrates the procedure for phytochemical screening of different livestock poisoning plants (Fig. 2).

Preliminary Phytochemical Screening

The extract of plant materials was subjected to standard phytochemical screening to test the presence of phytoconstituents such as alkaloids, terpenoids, flavonoids, tannins, coumarins, saponins, and polyphenols based on the standard procedure with slight modifications. The tests were based on the visual observation of color change and, in some cases, the formation of a precipitate after the addition of a particular reagent [18] for each test.

Detection of Alkaloids

0.2 grams of the crude methanolic extract were dissolved in 10 ml of a 1% HCl solution. The solution was placed in a water bath for a few minutes, and then 1 ml of the solution was placed into two test tubes. One of the tubes was treated with 2-4 drops of Dragendorff's reagent and the other with 2-4 drops of Mayer's reagent. The presence of alkaloids is indicated by the appearance of an orange-reddish precipitation for Dragendorff's test and a yellow-white precipitate for Mayer's test [19].

Detection Terpenoides

Small quantities of the methanol extract were dissolved in 2 ml of chloroform. Then 3 ml of H_2SO_4 was carefully added to form a layer. The formation of a reddish-brown interface can be used to prove the presence of terpenoids [20].

Detection of Tannins

10 ml of the ethanol solution of the crude methanol extract was taken in a test tube; a few drops of 1% ferric chloride reagent were added. The appearance of the bluish-colored mixture could be used as an indicator of the presence of tannins [21].

Detection of Polyphenols: 5 ml of a previously filtered solution of the crude extract was taken, and then 1 ml of 1% $FeCl_3$ and 1 ml of 1% K_3(Fe (CN)6) solutions were added. The appearance of a fresh reddish-blue color indicated the presence of polyphenols [22].

Detection of Flavonoids

A small quantity of the crude extract was dissolved in 5 ml of ethanol. In another test tube, a mixture of 5 ml of ethanol and 5 ml of 50% KOH was prepared. Then the two solutions were mixed. The formation of a yellow-colored product was used to confirm the presence or absence of flavonoids [23].

Detection of Coumarines

5 ml of previously filtered extracts were put in a test tube and covered by filter paper saturated in NaOH. Then, the test tube was placed in the water bath to heat it for 10 minutes. Finally, a filter paper was taken and exposed to UV light. In this test method, observation of a bright yellow color is used to confirm the presence or absence of coumarins [24].

Detection of Saponins

A small quantity of the crude extract was boiled with 5 ml of distilled water in a water bath for 10 minutes. The mixture was filtered while hot and allowed to cool. The following test was then carried out: in the 5 ml filtrate drop sodium bicarbonate solution and shaken vigorously for 3 minutes (froth formation was used as an indicator for the presence of saponins in the filtrate) [25].

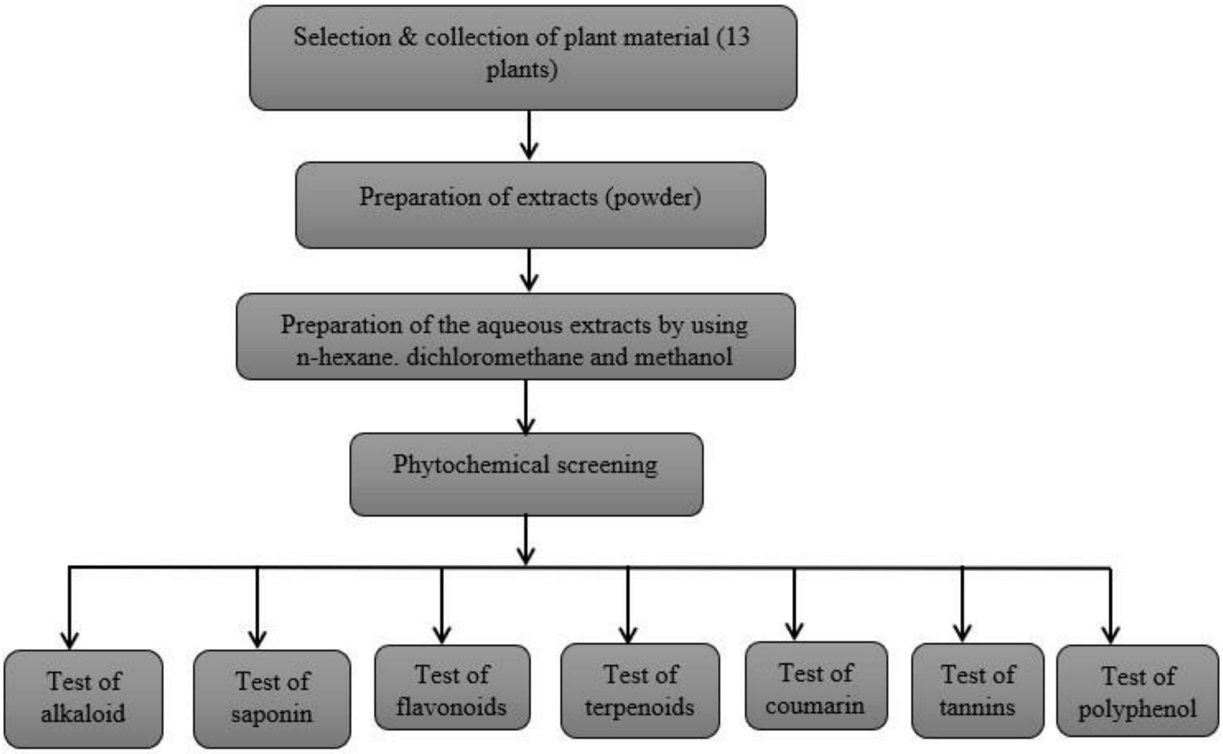

Fig. 2 Extraction procedure during lab work

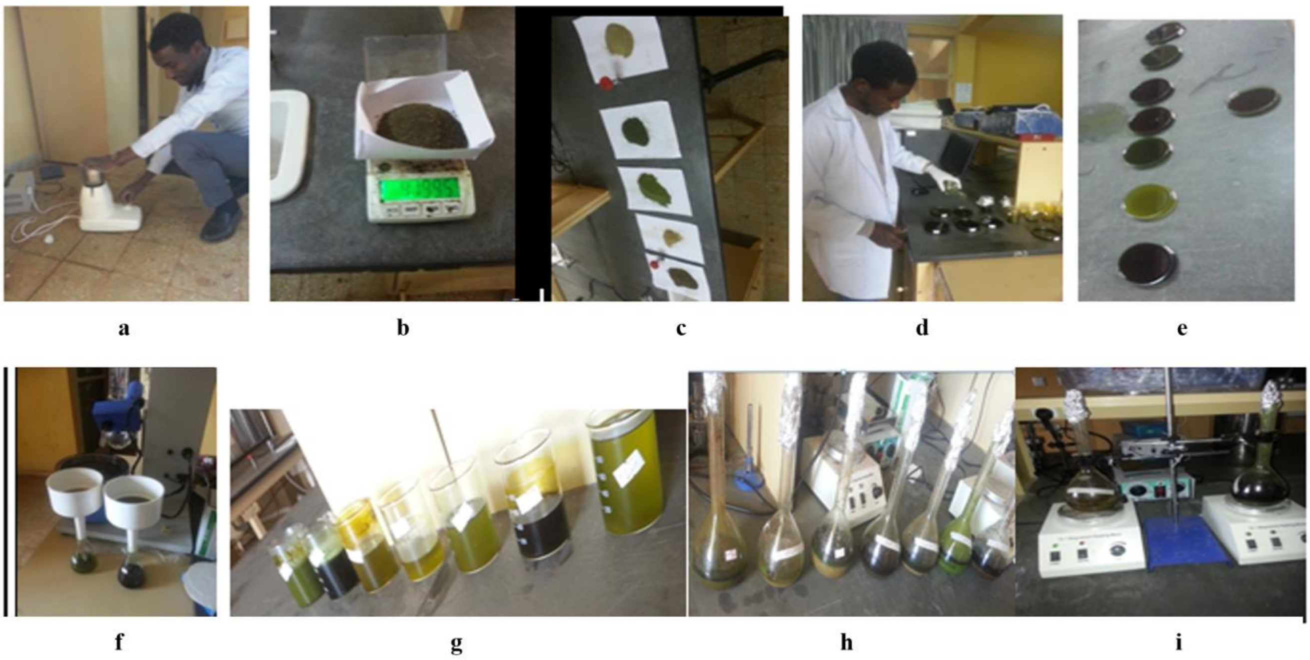

Fig. 3 Preparation of the crude extracts in the laboratory: (a) grinding plant materials, (b) weighing the sample, (c) labeling sample (d), (e) and (g) evaporation of the solvent at room temperature, (f) filtering crude extract with Whatman no.1 filter paper, (h) and (i) *Filtration and* extraction of secondary metabolite using shaker and different solvents.

Data Management and Analysis

Relevant information about the suspected poisonous plants to livestock was collected in the study area through a structured questionnaire, and the data were stored in the Microsoft Excel spreadsheet 2010. Before the analysis of the coded data, it was filtered. Finally, it is analyzed and presented using tables, graphs, and charts. Lastly, by applying descriptive statistics, frequencies and percentages were calculated. For the phytochemical screening test, part of this research was repeated three times; the experimental data were subjected to a one-way ANOVA, and a significance level of 0.05 was used for all statistical tests. Statistical Analysis System (SAS) version 9.4 was used to carry out descriptive statistics on the questionnaire data and field observation variables.

RESULT AND DISCUSSIONS

Identification of Poisonous plant

In this study, a total of 366 individuals were interviewed, of whom 300 were livestock owners, 40 were traditional animal healers, and 26 were animal health practitioners employing a structured questionnaire. Out of the interviewed interviewees, 270 (90%) individual livestock owners complained that they observed the presence of poisonous plants in the study area, whereas 30 (10%) individuals had not observed the presence of these plants in their area. Similarly, all of the interviewed traditional animal healers informed us that they observed the presence of these toxic plants (Table 1). During the present study, a total of 13 plants were identified that have poisonous effects on livestock by interviewed individuals. Among these plants, A. alba, S. americanum, X. strumarium, T. terestris, and C. rotundus were the most frequently complained-about toxic plants in all three agroecologies (Fig. 4).

According to the result of the current study, livestock were mainly poisoned through contact with and/or ingestion of leaves and other parts of the poisonous plants. Out of 26 interviewed individuals, 22 (84.6%) were animal health professionals who observed that plant poisoning is posing significant livestock health problems in the area (Table 1). According to the data gathered from the respondents, the condition is brought on by a lack of forage due to a variety of factors, including overgrazing, drought, agricultural expansion, and soil erosion. These factors force animals to browse perennial shrubs and bushes, the majority of which are known to contain toxic secondary metabolites. The results of this study were consistent with research published in the Nigerian state of Sokoto [26]. Among the thirteen plant species selected, three (23%) were trees, nine (69%) were herbs, and one (8%) was grass. The leaves of the plants were the most commonly used, followed by the stem and root. Some of the plants identified in this study were similar to those identified in Horo Guduru Wollega, in which Amaranthus spp., C. rotundus, and S. americanum were the most frequently complained poisonous plants in that studied area [27]. Similarly, they explained that there were differences in the range and kind of numerous toxic plants in the Bako district.

The variations may result from different plants growing in various geographic locations with differing edaphic and climatic conditions. These variables also play a role in the differences in the chemical makeup of various toxic plants in various locations. Similarly, variations in the degree of knowledge of these plants within the community where the data was gathered may potentially account for the variation [12].

Each plant has a different concentration of harmful compounds. Different components of the plant, the species, and the growing environment all affect the quantity and distribution of toxins in a plant. When a species is repeatedly used as a main feed, toxicity may result from the low concentration of harmful chemicals, which makes it suitable fodder in some cases [11].

The findings were consistent with [28] in that the respondents claimed that these herbs, which are used in folk medicine to cure human and animal illnesses, are poisonous and that their beneficial effects frequently occur at lower dosages, while overdosing can result in poisoning. Plants can contain toxic parts in the form of leaves, branches, bark, roots, seeds, and, in certain situations, entire plants. The development of compounds including alkaloids, polyphenols, coumarin, saponins, tannins, flavonoids, and others in plant parts is what causes poisonous effects; under certain circumstances, many of these compounds are detrimental to human and animal health [29].

Table 1 Summary of the number of respondents on poisonous plants in the study area

Group interviewed	Number of interviews	Number of respondents			
		Observed plant poisoning	Not observed plant poisoning	Used traditional treatment for toxin	Not used traditional treatment for toxin
Livestock owner	300	270 (90%)	30 (10%)	210 (70%)	90 (30%)
Traditional animal healer	40	40 (100%)	0 (0%)	40 (100%)	0 (0%)
Animal health expert	26	22 (84.6%)	4 (15.4%)	10 (38.5%)	16 (61.5%)

Table 2 Summary of the identified poisonous plants according to their botanical and local (Kafinoonoo) name, poisonous parts, susceptible species, and their harmful effect.

Botanical name	Local name (Kafinoonoo (K)/Amharic (A))	Poisonous part (s)	Susceptible species of animal	Harmful effects of Toxic plant
A. alba	Qoroo (K)	Leaf	All species	Acute bloat
S. americanum	Hawute (A) Achoo (K)	Leaf	Cattle	Bloat, Weakness
A. cruentus	Aluma (A) Shulloo (K)	Seed and leaf	Cattle and sheep	Bloat, foam formation
A. gummifera	Sesa (A) Chaattoo (K)	Steam (water droplets)	All species	Irritation, parasite/worm
C. rotundus	Ketema (A) Miicoo (K)	Stem, leaf, root	Cattle	Bloat, no rumination
U. kiwuensis	Moocoo (K)	Leaf, flower	All species	Bloat, diarrhea
D. stramonium	Nefinnifoo (K)	Leaf	Cattle	No urine, bloat, no rumination
M. polymorpha	Wajima (A)	Leaf and flower	Cattle	Bloating, colic
T. terestris	Kirinchite (A)	Leaf, fruit	Cattle	Weakness, inappetence
X. strumarium	Astenagir (A)	Leaf, seed	Cattle, Sheep, and Goat	Vomiting, diarrhea Respiratory distress, trebling, coma, death
T. burchelianum	Shittoo (K)	Stem	Equine	Leg *chok* or foot and toe rot, infected toe
E. tirucalli	Kinchib (A)	Leaf, stem	All species	Irritation in the eye and skin
Hedera canariensis	Key Abeba (A) Ceelloo Abebboo (K)	Leaf, stem	All species	Irritation in the eye and skin

During the field survey, we took some poisonous plant photographs as described below

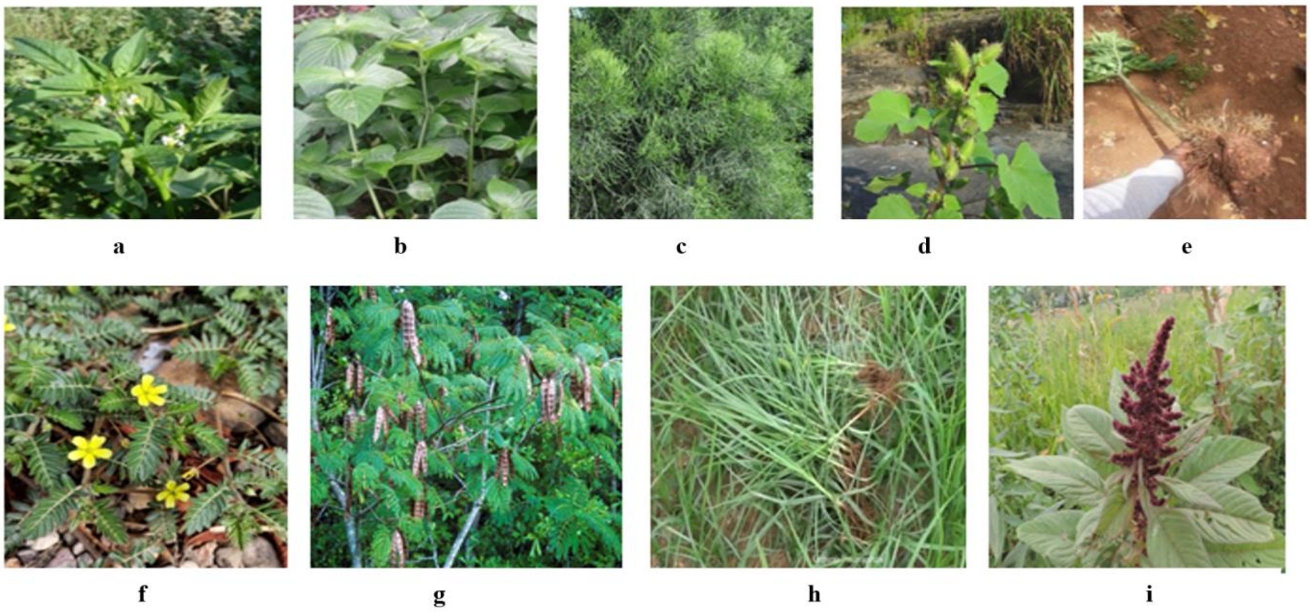

Fig. 4 Some of the livestock poisonous plants: (a) *S. americanum,* (b) *A. alba,* (c) *E. tirucalli,* (d) *X. strumarium,* (e) *T. burchelianum*, (f) *T. terestris*, (g) *A. gummifera* (h) *C. rotundus* and (i) *A. cruentus.*

Phytochemical Screening Test

The phytochemical analysis of leaf extracts of *A. alba, S. americanum, A. cruentus, A. gummifera, C. rotundus, U. kiwuensis, D. stramonium, X. strumarium, T. terestris, M. polymorpha, E. tirucalli, H. canariensis, and the* stem extract of *T. burchelianum* were analyzed for the secondary metabolite by using both polar and non-polar solvents. Seven compounds—alkaloids, polyphenols, terpenoids, flavonoids, saponins, cumarin, and tannins—were found in the early phytochemical investigation (Table 3). Numerous experiments have been carried out to identify the phytochemical components. The findings have demonstrated that several solvents can be used to extract each phytochemical. Since methanol evaporates quickly, it can be employed as an active extracting solvent. Depending on how polar the solvent is, this could vary. The leaves of *Trifolium burchelianum, Uebelinia kiwuensis, Cyperus rotundus,* and *Hedera canariensis* were thought to possess antibacterial qualities due to the presence of different secondary metabolites like alkaloids, saponins, polyphenols, and flavonoids. According to the initial phytochemical analysis, the least amount of saponin was found, and coumarin is the only ingredient in every extract. More encouraging findings using methanol extracts were found in the current study. The results of the methanol extracts contradict each other [30]. This discrepancy can result from variations in the secondary metabolite extraction process or the conditions under which the experiment was conducted.

Significant color changes demonstrated noteworthy good phytochemical outcomes for each of the chosen plant extracts (Table 3; Fig. 4). The most prevalent categories of chemicals in most of the examined plants were flavonoids, terpenoids, and polyphenols. Flavonoids were highly positive, with a significantly visible color change in the leaves of *A. cruentus, A. gummifera, H. canariensis, U. kiwuensis, D. stramonium,* and *M. polymorpha,* as well as whole parts of *C. rotundus, T. terestris, and E. tirucalli*. Terpenoids were the next most common class of compound, which were presented in *A. alba, A. cruentus, A. gummifera, C. rotundus, U. kiwuensis, M. polymorpha,* and *E. tirucalli* leaf. Polyphenols were the third phytochemical presented in the leaves of *A. alba, A. cruentus, A. gummifera, C. rotundus, U. kiwuensi,* and *E. tirucalli.* All these compounds can act as natural anticancer agents [31]. Phytochemical analysis conducted on the plant extracts revealed the presence of constituents that are known to exhibit medicinal as well as physiological activities [32].

Terpenoids are found in all of the plant extracts, while flavonoids and coumarin are found in most extracts except those obtained from *M. polymorpha* and *A. cruentus*. In contrast, *Xanthium strumarium* extract was very rich in all seven secondary metabolites. The highest contents of alkaloids were found in *Medicago polymorpha, Tribulus terestris, and A. gummifera,* while *A. alba* and *T. burchelianum* plant extracts did not contain this type of compound. Saponins were present in three studied plants, with *H. canariensis, T. burchelianum, and X. strumarium* having the highest content. While ten of the plant extracts did not contain these compounds, Phenolics are present in great quantities except in *M. polymorpha* and *H. canariensis,* which were not detected.

Numerous biological actions, including antibacterial, anti-inflammatory, anti-allergic, antiviral, anticancer, and antidiarrheal effects, have been linked to flavonoids [7]. The majority of the leaf extracts from the chosen plants tested negative for saponin and tannin. Alkaloids' analgesic, anti-inflammatory, antibacterial, and amoebicidal effects have been documented by some researchers. Because terpenoids are known to have insecticidal qualities as well, they can be utilized as protective materials for preserving agricultural products [8].

Traditional Management and Control Mechanism of Toxin

In this research, as indicated in Table 1, out of the interviewed individuals, 210 (70%) have complained that they used traditional medicine as treatment for poisonous plant toxins in their livestock, whereas 90 (30%) of the interviewed individuals did not use traditional treatment mechanisms in the study area. Similarly, 10 (38.5%) animal health experts were recommended to use traditional treatment for toxins, and 16 (61.5%) were not used; instead, they used different modern drugs by veterinarians.

All the interviewed individuals were traditional animal healers who used medicinal plants to treat the toxins of poisonous plants (Table 1). Animal healers and farmers employed various treatment methods to alleviate the poisoning of their animals. These included administering locally accessible materials such as a soap and ash mixture or soap and milk mixed with cold water, as well as other plant roots or leaves, depending on the species and type of poisoned animal. The majority of the time, plant poisoning is an emergency that needs to be treated right away with the right precautions and, if possible, specialized antidotes. However, correctly identifying and avoiding these plants is essential to reducing issues with dangerous plants. It is crucial to look for poisonous plants in fence rows, hay fields, pastures, and roadside areas. Be extremely cautious while searching freshly designated haying or grazing areas for these plants during droughts or periods of low feed. Under normal circumstances and with enough feed available, livestock will steer clear of the majority of dangerous plants.

Table 3 Phytochemical constituents of Thirteen (13) livestock poisonous plants

Plant name	Phytochemical Constitute/ Secondary Metabolites Test Results						
	Alkaloids	Polyphenol	Tannins	Saponins	Flavonoids	Terpenoids	Coumarin
E. tirucalli	++	+++	++	-	++	++	+
A. alba	-	+++	++	-	+	+++	++
S. americanum	++	++	+	-	+	++	++
T. terestris	+++	++	+	+	+++	++	+
M. polymorpha	++	-	+	-	-	++	++
H. canariensis	++	-	-	++	+++	+	++
A. cruentus	++	++	-	-	+++	+	-
A. gummifera	+++	+++	++	-	+	++	+++
C. rotundus	++	+++	++	-	++	+++	+++
U. kiwuensis	++	++	-	+	++	+++	+
D. stramonium	++	++	++	-	+++	++	++
T. burchelianum	-	++	-	++	++	++	++
X. strumarium	+	++	++	++	+	+++	++

= the absence of chemical constituents; + = slightly detected; ++ = moderate presence; +++ = high amounts of chemical constituents presence (significantly visible color change)

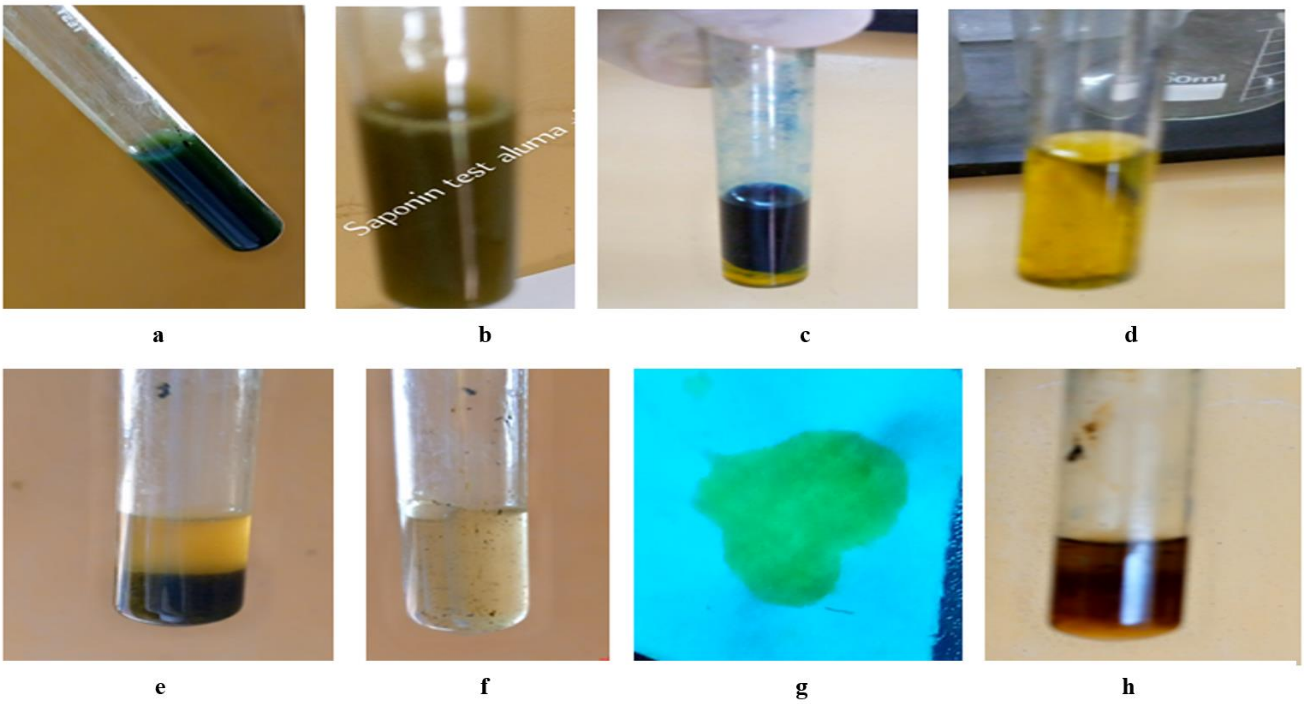

Fig. 5 phytochemical screening Tests for (a) Tannin, (b) saponins, (c) polyphenol, (d) flavonoids, (e) antraqunine, (f) alkaloids, (g) coumarin (h) terpenoides of different plant extracts.

Table 4 Summary of the identified poisonous plants according to their botanical name, clinical sign and traditional treatment mechanism.

Botanic name	Clinical sign	Traditional treatment
E. tirucalli	Irritation in the eye and skin	Soap wash the infected area with tap water
A. alba	Acute bloat depression, loss of appetite, muscle spasm, weakness	Mix Soap and ash, then provide through the mouth
S. americanum	Bloat, loss of appetite, incoordination	Provide Liquid dung by mix, if not, use troaca and canula
T. terestris	Weakness, inappetence	Provide cold water
M. polymorpha	Bloating, colic, muscle spasm, weakness,	Mix Soap and ash and then provide through the mouth.
H. canariensis	Irritation of skin and eye infection	Soap wash with tap water.
A. cruentus	Bloat, foam formation, depression, loss of appetite, incoordination	Mix Alcohol and sheep tail fat. Put them over the fire, squeeze the liquid out of the bundle, and provide through the mouth.
A. gummifera	Irritation, parasite/worm	Clinic treatment
C. rotundus	Bloat, depression, weakness, reluctance to move, coma and death	Provide soap and ash mixture through the mouth.
U. kiwuensis	Bloat, diarrhea, loss of appetite, weakness	Provide soap through the mouth.
D. stramonium	No urine, bloat, no rumination	Provide garlic and "*feto"* by mixing in tap water.
T. burchelianum	Leg *chok* or foot and toe rot, infected toe	Put the root of *Trifolium burchelianum* on fire the treat the infected area by putting on it to burn.
X. strumarium	Depression, loss of appetite, incoordination, lying down, paddling of limb, and convulsion followed by coma and death	Mix soap and milk; then provide through the mouth

Livestock are compelled to eat during the dry season due to a severe lack of forage. Thus, one of the best strategies to reduce the risk of plant poisoning in the area is to practice excellent range management. Our study revealed that the most effective method of avoiding toxic weed invasions is to maintain a well-managed pasture. It may also be beneficial to fence off infected regions and eradicate them by uprooting [33]. Elderly and local people pass on the knowledge of the traditional method of treating these dangerous plants from one generation to the next. Toxicological studies and popular awareness are greatly aided by this understanding [34]. According to this study, plant poisoning has severely harmed cattle's health and had a big effect on livestock producers. For millennia, Ethiopians, particularly farmers and traditional animal healers, have used several herbs to treat livestock ailments. However, due to incorrect usage, these plants may have harmed livestock health [35]. In Ethiopia, medicinal plants have remained the most readily available and reasonably priced means of treating a variety of illnesses in people and animals. The aforementioned toxic plant contains a variety of secondary metabolites, each with a unique purpose: saponins have antifungal activity, certain alkaloids are effective against HIV infection, flavonoids have potent anticancer activity, and tannins have antibacterial activity [36]. The majority of people are not familiar with the plants that can be dangerous if consumed, injected, or come into contact with the skin. Additionally, most plants only poison animals when they are inadvertently consumed [37]. The milk-like droplets from *Euphorbia tirucalli* and *Hedera canariensis* hurt the animals' skin and eyes; farmers typically use these animals as fencing.

Terpenoids and tannins, two plant extracts with analgesic and anti-inflammatory properties, have been found through phytochemical screening [38]. Due to their astringent qualities, tannins speed up the healing process for irritated mucous membranes and wounds [39]. The presence of the above compounds in *A. alba*, *S. americanum*, *A. cruentus*, *A. gummifera*, *C. rotundus*, *U. kiwuensis*, *Datura stramonium*, *X. strumarium*, *T. terestris*, *M. polymorpha*, *E. tirucalli*, *H. canariensis*, and *T. burchelianum* showed their effective medicinal properties. Higher concentrations of flavonoids, phenolics, and alkaloids in *Tribulus terestris* and *Albizia gummifera* have been linked to several beneficial biological processes, including cardiovascular protection, anti-atherosclerosis, anticarcinogen, anti-apoptosis, inhibition of angiogenesis, and cell proliferation [36].

These substances, known as secondary metabolites, can be obtained from any part of the plant, including the bark, leaves, flowers, seeds, and so on. Understanding the chemical components of plants is important since it will help with the creation of new bioactive compounds that can be used to treat particular diseases. Alkaloids have been shown by some researchers to possess analgesic, antispasmodic, and antibacterial qualities [40]. A wide variety of biological actions are exhibited by the bioactive substances under study. Some researchers claim that factors such as plant development phase, genotype, extraction method, and environmental factors affect the amount and makeup of bioactive chemicals found in plants [41].

CONCLUSION

The phytochemical analysis showed that the n-hexane, methanol, and dichloromethane extracts of the leaves of *A. alba, S. americanum, A. cruentus, A. gummifera, C. rotundus, U.a kiwuensis, D. stramonium, X. strumarium, T. terestris, M. polymorpha, E. tirucalli, H. canariensis,* and the stem of *T. burchelianum* contain a mixture of phytochemicals as alkaloids, flavonoids, phenols, coumarin, tannins, and terpenoids but lack saponins. Based on this investigation, it was shown that plant poisoning causes serious health issues for animals and has a substantial effect on livestock producers. The majority of respondents acknowledged the presence of toxic plants, and over 50% expressed dissatisfaction regarding various effects on growers. The current study's findings also showed that the majority of livestock production in the studied area was of the extensive type, with a very small number of animals maintained in intensive production methods. The complex mixtures of invasive and native plants on land used for livestock grazing raise the possibility of coming into contact with hazardous plants. In summary, the current study's findings indicate that chemical toxicity and herbal poisoning are two major contributors to health issues in and around the Kaffa zone. The most often implicated hazardous plant species were the ones listed above. In this research region, poor pasture management, a lack of drinking water, and pasture scarcity are some of the risk factors for toxicosis.

Based on the current study's findings, it is generally feasible to conclude that one of the cattle health issues in the Kaffa zone in southwest Ethiopia was plant poisoning. Bioactive substances such as alkaloids, saponins, tannins, coumarin, terpenoids, polyphenols, and flavonoids are present in all the plants under investigation. Animal difficulties are caused by toxic plants, particularly those evergreens that are present throughout the dry season, as demonstrated by the current study. The harmful impact of those poisonous plants on livestock health is something that both animal health professionals and livestock owners need to be aware of. The study also revealed that animals can obtain chemical toxicants via water or grazing pasture in addition to the poisoned plant. For example, the use of insecticides and weedkillers has skyrocketed in recent years. Livestock exposed to these substances have been reported to experience severe health issues.

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Conflict of Interests

The authors declared that there is no conflict of interest.

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