Toxic Plants of Livestock in peri-urban *kebeles* of Woliso and Wonchi towns, South West Shewa Zone of Oromia Regional State, Ethiopia

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Abstract: The study was conducted from November 2016 to May 2017 to assess poisonous plants and risk of exposure of livestock. A total of 200 volunteer individuals (177 livestock owners, 15 animal health practitioners, and 8 traditional healers) were selected based on the recommendations of knowledgeable elders and local authorities, and interviewed using a structured questionnaire. The majority of the respondents (89.5%) reported the presence of plant poisoning. Twenty seven species of plants were identified as toxic to livestock. The plants that were commonly listed as toxic include *Medicago burweed* (39.7%), *Sorghum bicolor* (11.7%), *Parthenium hysterophorus* (8.9%), *Pteridium acquilinum* (6.1%), and *Urtica simensis* (5%). The driving factors for livestock exposure to toxic plants were season like rainy season (58.7%) followed by growing nature of the toxic plants (43%), hunger, shortage of feed (41.3%), nutritional deficiency (9.5%), and other reasons (6.1%) such as lack of awareness of the herder about the toxic plants. Most of the toxic plants cause livestock toxicosis by single exposure (74.3%). Cattle were the most susceptible (26.3%). The major plant parts that cause livestock toxicosis were whole plant (70.4%) followed by leaves (16.8%). Bloating, colic, salivation, weakness, and loss of appetite were the most frequently observed symptoms of toxicosis. The study revealed the existence of large number of toxic plants in the area. Therefore, intervention such as awareness creation on the impact of toxic plants to livestock, optimal pasture management, and supplementary feeding during times of adversity is necessary to reduce losses that could result from livestock toxicosis.

Keywords: *Poisoning, Risk of exposure, Woliso, Wonchi*

Introduction

Poisonous plants contain high concentration of harmful toxins that can cause serious injuries if they are ingested or touched (Turner and Szczawinski, 1991). They comprise the third largest category of poisons known in the world and form part of livestock feed. As a result, poisonous plants are expected to bring toxicosis in animals (Clarke and Clarke, 1977). According to Diaz (2011), animals are exposed to consumption of poisonous plants during rainy period because of the intense growth of the plants and accumulation of potentially toxic compounds. Animals are also exposed to consumption of poisonous plants particularly when pastures are poor and major feeds are scarce due to unfavorable conditions such as drought (Botha and Penrith, 2008). During drought, most palatable plants dry up; many of the poisonous plants remain green and become the major feed source to animals. The problem is also aggravated by deficiencies of phosphorus or vitamin A, which affect grazing behavior of animals (Hart and Carpenter, 2001).

Plant poisoning is one of the serious causes of economic lose to the livestock industry, which could be direct or indirect (Lynn, 1992). Direct loses occur due to negative effects of poisonous plants on livestock productivity and health. The indirect loses include costs incurred to prevent poisoning and medication to treat poisoned animals (Hart and Carpenter, 2001). Quantifying the magnitude of economic lose from poisonous plants to livestock production is not an easy task. Separation between loses due to diseases, accidents, and predators from loses caused by ingestion of poisonous plants can be difficult. Low reproductive performance and weight lose can be caused by disease and inadequate nutrition as well as by consumption of poisonous plants (Holechek, 2002).

According to Frohne and Pfander (1984) the poisonous nature of a plant or part thereof is due to the presence of some toxicologically significant plant constituents such as alkaloids, amino acids, proteins, and minerals. The concentration of the toxic substances varies from plant to plant. Plants from the same genera may also exhibit similar or vastly different toxicities. The amount and the distribution of the toxins present in a plant vary according to different parts of the plant, the species as well as the geographical conditions where it is grown. Sometimes the concentration of toxic substances is so low that it is considered good fodder, but repeated and the use of the species as a main feed may cause toxicity (Frohne and Pfander, 1984; Turner and Szczawinski, 1991).

Ethiopia is endowed with a diverse biological resource, including about 6,500 species of higher plants with approximately 12% of which endemic, and hence is one of the six plant biodiversity rich regions (Ensermu *et al.,* 1992). Even if previous studies have

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reported the existence of poisonous plants in Ethiopia (Dereje *et al*., 2014; Abriham *et al*., 2015; Dereje *et al*., 2015) studies regarding toxic plants to livestock in Ethiopia, especially, in the present study area are lacking. Furthermore, it is not customary among veterinarians to write case reports, thus most of the plant poisonings that occur in the country are not documented in literature. Hence, it is imperative to bring information to the attention of professionals about the effects of poisonous plants on animal health and productivity. This requires a more extensive assessment and documentation of poisonous plants in the rangelands and identification of the major toxic substances of the plant species. Therefore, the purpose of the present study was to identify the major plant toxicants affecting livestock and to assess their effects on livestock in South West Shewa.

Materials and Methods

Study Area

The study was conducted from November 2016 to May 2017 in peri-urban *kebeles* of Woliso and Wonchi towns, South West Shewa Zone of Oromia Regional State, Ethiopia. Woliso town is located at a distance of 114 km South West of Addis Ababa. It is situated at a latitude and longitude of 8°32' N and 37°58' E with an average elevation of 2063 meters above sea level. The average temperature of the area is 19.5°C (Figure 1). Wonchi is also located in South Western Shewa Zone. The Zone has a livestock population of about 224,334 cattle heads, 39,543 sheep, 51,042 goats, 7,625 horses, 2,101 mules, 127,679 poultry, and 16,320 donkeys (Agriculture Department of South West Shewa Zone, 2017).

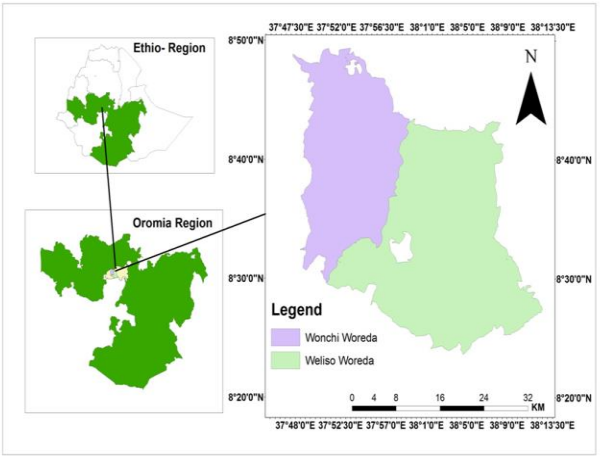

Figure 1: Map of the study area.

Study Population

A total of 200 volunteer individuals that include 177 livestock owners, 15 animal health practitioners, and 8 traditional healers were purposively selected and interviewed using a semi-structured separate questionnaire for each group. The respondents were selected based on the recommendations of knowledgeable elders and local authorities (Agricultural department of Southwest Shewa zone).

Study Design and Sampling Methods

The study area (Woliso and Wonchi) and respondents were selected purposively since the study focuses on specific information to be obtained mainly from the most knowledgeable members of the society. Woliso and Wonchi have seven and three peri-urban *kebeles,* respectively. For this study, five peri-urban *kebeles,* four from Woliso and one from Wonchi towns, were selected based on accessibility for transportation, presence of traditional animal healers, and previous records of toxicity problems reported to veterinary clinics in the area. A total of 200 individuals (40 per *kebele*) were interviewed by using a semi-structured questionnaire. The methods employed during data collection were separate semi-structured interviews, field observations, and plant sample collection. All relevant information including the local name of the plants, poisonous parts of the plant, factors exposing livestock to the toxic plants, species of animal's poisoned, and the effects of poisoning were gathered during the interviews. Identification of scientific names of the plants reported was conducted in consultation with Haramaya University's College of Agriculture and Environmental Sciences Herbarium.

Sample Collection and Identification Procedures

The plants were collected from the study areas under the guidance of the people who knows the local names of the plants. The plant samples were matured plant parts (well-developed leaves, stems, roots, flowers, and fruits) that were fresh, free from insect damage, rust or disease. The samples were immediately placed inside a folded newspaper and rolled up between the pages for drying and pressing to prevent fungal infections and preserve their natural colors. The plants were transported to the Herbarium for identification. Identification was done by the help of experienced phytologist using standard morphological characters.

Data Analysis and Management

The information gathered through questionnaire was coded and entered into Microsoft Excel 2013 spreadsheet. SPSS version 20 software was used for data analysis. Descriptive statistical methods such as percentages and frequencies were employed to summarize the data.

Results

Among the 200 interviewed individuals, 179 (89.5%) reported the presence of plant poisoning of livestock. While 21 (10.5%) of the total respondent, 18 (9%) livestock owners and 3 (1.5%) animal health practitioners, stated they did not recognize the existence of toxic plants in the area (Table 1).

The major risk factors exposing livestock to consumption of poisonous plants include hunger and shortage of feed (41%), rainy season (59%), single

exposure to the plant (74%), habitat (93%), and physiological stage of the plant where green stage (94%) is the most poisonous than dry. Other factors such as lack of awareness of the herder about the effect of toxic nature of the plant, hence they purposively offer it with the expectation to increase milk production or feeding for fattening and overdosing during treating different animal diseases while drenching or pasting were also mentioned as risk factors (Table 2).

Table 1. Proportion of respondents reported the presence of poisonous plants to livestock

Groups interviewed	№ interviewed	№ of respondents reported the presence of toxic plant (%)
Livestock owners	177	159(89.83)
Animal health practitioners	15	12(80)
Traditional healers	8	8(100)
Total	**200**	**179(89.5)**

Twenty seven toxic plant species were identified with details of information regarding their scientific and local names, habitat, parts associated with poisonous effects, and species of livestock mainly affected. Among the toxic plants reported in the present study, *Medicago burweed*, *Sorghum bicolor*, *Parthenium hysterophorus*, *Pteridium aquilinum*, *Urtica simensis*, *Agave lecheguilla,* and *Ricinus communis* were the most frequently mentioned as toxic plants by respondents. Some of the toxic plants mentioned by respondents are also reported to be used as medicinal plants. These include *Solanum incanum, Ricinus communis*, *Nicotiana tabacum,* and *Phytolacca dodecandra,* which are used to treat wounds in cattle, constipation in donkey, tick infestation in cattle, and calf diarrhea, respectively. Most of the poisonous plants were reported to occur in rangelands and farmlands followed by river bank and at water points. The result also revealed that most of the reported plants were shrubs, followed by weeds, crops, grasses, vegetables, trees, and other flowering plants (Table 3). Parts of the plants that are perceived to cause poisoning in livestock differ among respondents. However, the major plant parts that were reported as toxic include whole plants, leaves, seeds and leaves, leaves and fruits, juice, and other parts such as barks and roots (Figure 2). The most frequently observed poisoning manifestations on the animals in the study area as mentioned by the respondents includes bloating, colic, diarrhea, weakness, salivation, and loss of appetite (Table 3).

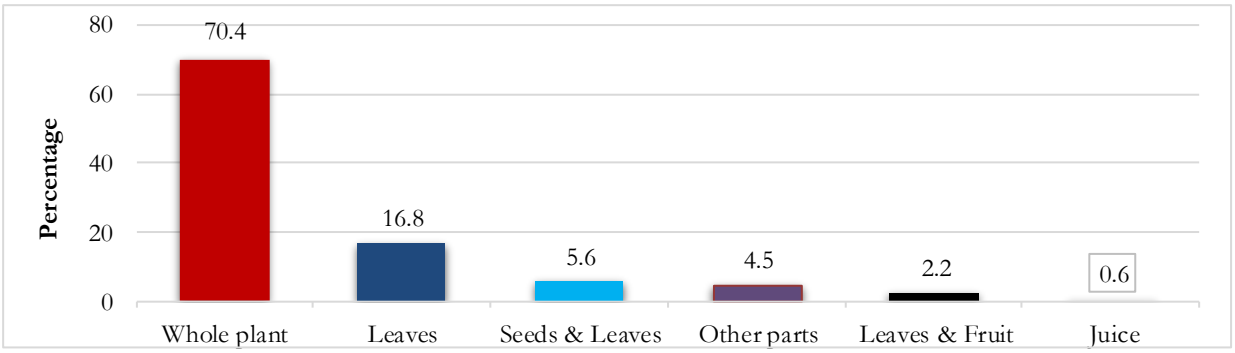

Figure 2. Proportion of parts of toxic plants containing poison.

Table 2. Summary of risks of exposure to toxic plants

Variables	Risk factors for toxic plant exposure	Total № of respondents	Percentage
Reason for consumption of the toxic plant	Hunger & shortage of feed	74	41.3
	Nutritional deficiency	17	9.5
	Growing nature of the toxic plant	77	43
	Other reasons	11	6.1
Season	Rainy	105	58.7
	Dry	5	2.8
	All Season	69	38.5
Exposure	Single	133	74.3
	Multiple	44	24.6
	Unknown	2	1.1
Common habitat	Range/Farmlands	167	93.3
	River bank/Water point	12	6.7
Physiological stage of plants	Green	169	94.4
	Dry	0	0
	Both	5	2.8
	Other	5	2.8

Table 3. Summary of poisonous plants and their characteristics

Botanical Name	Family Name	Local Name	Frequency (%)	Voucher Number	Habitat	Toxic Plant Parts	Type of the Plant	Season of Exposure	Frequency of Exposure	Poisonous effects	Species affected
Acacia lahai	Fabaceae	Laafto (Afan Oromo)	1 (0.6%)	TP-353	Range/ farmlands	Leaves	Tree	All	Single	Bloating	Cattle Sheep Goats
Agave lechuguilla	Asparagaceae	Cheke (Afan Oromo)	7 (3.9%)	TP-357	Range/ farmlands	Other part	Shrub	All	Single	Weakness, Depression, Lesion on mouth	Cattle Sheep
Brassica integrifolia	Brassicaceae	Rafu (Afan Oromo) /Gomen (Amharic)	5 (2.8%)	TP-259	Range/ farmlands	Whole	Vegetable	All	Multiple	Bloating Colic Loss of appetite	Cattle Sheep
Cynodon dactylon	Poaceae	Serdo (Amharic)	2 (1.1%)	TP-277	Range/ farmlands	Whole	Grass	Rainy	Multiple	Bloating Colic	Cattle
Datura stramonium	Solanaceae	Banji (Afan Oromo) /Atefaris (Amharic)	3 (1.7%)	TP-310	Range/ farmlands	Leaves and Seed	Shrub	All	Single	Constipation Restlessness	Cattle Sheep
Euphorbia tirucalli	Euphorbiaceae	Kinchib (Amharic)	1 (0.6%)	TP-389	Range/ farmlands	Juice	Shrub	All	Single	Blindness	All animals
Hibiscus esculentus	Malvaceae	Hincinnii (Afan Oromo)	1 (0.6%)	TP-369	Range/ farmlands	Leaves	Flowering plant	All	Multiple	Bloating	Sheep Goats
Hyparrhenia rufa	Poaceae	Senbelit (Amharic)	2 (1.1%)	TP-333	Range/ farmlands	Whole	Grass	Rainy	Multiple	Bloating	Cattle
Lantana camara	Verbenaceae	Ye-wefqolo (Amharic)	2 (1.1%)	TP-327	Range/ farmlands	Leaves	Flowering plant	All	Single	Weakness Photosensitization	Cattle Sheep
Lathyrus sativus	Fabaceae	Gayoo (Afan Oromo) / Guaya (Amharic)	1 (0.6%)	TP-368	Range/ farmlands	Whole	Crop	Rainy	Single	Lameness	Goats
Medicao burweed	Asteraceae	Sidisa (Afan Oromo)	71 (39.7%)	TP-242	Range/ farmlands	Whole	Weed	Rainy	Single	Bloating Colic	Cattle Sheep
Melilotus suaveolens	Fabaceae	Alfa alfa	1 (0.6%)	TP-364	Range/ farmlands	Whole	Grass	All	Multiple	Bloating	Cattle
Nerium oleander	Apocynaceae	Oleander	1 (0.6%)	TP-318	Range/ farmlands	Leaves	Flowering plant	All	Single	Diarrhea Weakness	All animals
Nicotiana tabacum	Solanaceae	Timbo (Amharic)	1 (0.6%)	TP-427	Range/ farmlands	Whole	Shrub	All	Single	Salivation Colic Diarrhea	All animals

'Table 3 continued'

Olea africana	Oleaceae	Ejersa (Afan Oromo) / Weyira (Amharic)	2 (1.1%)	TP-372	Range/ farmlands	Leaves	Tree	All	Single	Bloating	Cattle
Parthenium hysterophorus	Asteraceae	Faramsiisa (Afan Oromo)	16 (8.9%)	TP-246	Range/ farmlands	Whole	Weed	All	Single	Salivation Sour milk	Cattle
Phytolacca dodecandra	Phytolaccaceae	Endod (Amharic)	1 (0.6%)	TP-400	Range/ farmlands	Whole	Shrub	All	Single	Skin lesions Diarrhea	Cattle Camel
Plantago lanceolata	Plantaginaceae	Qortobi (Afan Oromo)	5 (2.8%)	TP-288	Range/ farmlands	Whole	Weed	Rainy	Multiple	Bloating	Cattle Sheep Goats
Pteridium aquilinum	Dennstaedtiaceae	Tiirmii (Afan Oromo)	11 (6.1%)	TP-251	Range/ farmlands	Whole	Weed	Dry	Multiple	Bloody urine Excessive salivation Incoordination	Cattle Horse Sheep
Ricinus communis	Euphorbiaceae	Qobo **(**Afan Oromo) /Gulo (Amharic)	7 (3.9%)	TP-249	Range/ farmlands	Leaves and Seed	Shrub	All	Single	Bloating Colic Salivation	Cattle
Rumex abyssinicus	Polygonaceae	Tuult (Afan Oromo/Amharic)	1 (0.6%)	TP-405	Range/ farmlands	Whole	Weed	Rainy	Multiple	Weakness Dullness Incoordination	Cattle
Salix Subserrata	Acanthaceae	Alaltuu (Afan Oromo)	1 (0.6%)	TP-376	Range/ farmlands	Leaves	Tree	All	Single	Bloody urine	Cattle
Solanum incanum	Solanaceae	Hiddiiy (Afan Oromo) / Embuay (Amharic)	4 (2.2%)	TP-263	Range/ farmlands	Leaves and Fruit	Shrub	All	Single	Salivation Loss of appetite Vomiting (Cattle)	Cattle Sheep Goats Horse
Sorghum bicolor	Poaceae	Mashila (Amharic)	21 (11.7%)	TP-243	Range/ farmlands	Leaves	Crop	Rainy	Single	Bloating Colic Incoordination Salivation	Cattle Sheep Horse
Triticum aestivum	Poaceae	Qamadi (Afan Oromo)/ Sende (Amharic)	1 (0.6%)	TP-425	Range/ farmlands	Whole	Crop	Rainy	Single	Salivation, Diarrhea	Cattle Sheep
Urtica Simensis	Urticaceae	Doobbii (Afan Oromo)/ Sama (Amharic)	9 (5%)	TP-341	Range/ farmlands	Whole	Weed	Rainy	Single	Restlessness Itching	All animals
Xanthium spinosum	Ateraceae	Darbattee (Afan Oromo)	1 (0.6%)	TP-392	Range/ farmlands	Other part	Shrub	All	Single	Restlessness	Donkey

Discussion

The results of the present study revealed that phytopoisoning are among causes of ill health in livestock in Woliso and Wonchi areas. Many of the plants identified in the present study were also reported elsewhere in the world; among these are *Lantana camara* (Fourie *et al*., 1987), *Pteridium aquilinum* (bracken fern) and *Datura species* (Ogwang, 1997, Cortinovis and Caloni, 2013), *Ricinus communis* (Agaie *et al*., 2007) and *Medicago burweed,* and *Sorghum bicolar* (Aslani *et al.,* 2007) which were reported in South Africa, Europe, Nigeria, and Columbia, respectively. Presence of *Medicago burweed, Ricinus communis, Pteridium aquilinum, Amaranthus species, Lantana camara* and *Acacia species* were reported in Ethiopia, specifically from Adama (Dereje *et al*., 2014), Horro Gudurru and Nekemte areas (Abriham *et al*., 2015; Dereje *et al*., 2015). Plants grow under different edaphic and climatic factors, which contribute to the chemical compositions of the plants causing variability among toxic plants in different geographical areas. Adaptations are unique features that allow a plant or an animal to live in a particular place or habitat. However, some of the plants recorded in this study were reported to have similar effect on livestock elsewhere. For instance *Medicago burweed* which is predominantly found in the study area was known to cause poisoning of cattle in Central Ethiopia (Dereje *et al*., 2014). These plants were known to contain nitrate in their tissues (Munro, 2009). Similarly, the importance of *Acacia* and *Sorghum species* as causes of livestock poisoning was previously published (Osweiler *et al*., 1985). *Pteridium aquilinum* (Bracken fern) is also widely distributed in many parts of the world. It has been mainly associated with a disease in cattle known as bovine enzootic hematuria, which causes economic loses in cattle. Its major sign is hematuria caused by the development of multiple bleeding tumors in the bladder mucosa (Scala *et al*., 2014). In Ethiopia, its existence and importance as a cause of enzootic hematuria was reported in different regions of the country (Dereje *et al*., 2015).

Respondents in this study revealed cattle to be the most frequently affected animals. This result agreed with the finding of Dereje *et al.* (2015). Large animals spend more time foraging and are less selective. In contrast, small ruminants requires less feed, they are more selective feeders and spend more time searching for high-quality forage (Lyons and Machen, 2000; Mosavat and Chamani, 2013); as a result, they are less sensitive to poisonous plants (Hernandez and Sanchez, 2014; Dereje *et al*., 2015).

Results of the survey showed that most of the animals were poisoned by a single exposure to plants, which could be an attribute of high dose of ingredients of toxic chemicals in the plants (Apollo *et al*., 2006). According to the respondents, animal poisoning most commonly occurred during the rainy season, which could be due to the extensive growth and presence of very common toxic plant called *Sidisa (Medicago burweed)* in the area, which mainly occur during the rainy season. As stated in many literatures as well as information obtained from respondents of the present study, toxic plants may grow together with major forage plants and are therefore readily accessible to grazing animals (Marczewski, 1983; Panter *et al.,* 2011). Hungry animals are less selective of forages and consume large quantities of toxic plants within a short period of time (Rook *et al*., 2004). Animals on a good plane of nutrition are less likely to eat poisonous plants and are better able to detoxify the small amount consumed (Lopez-Ortiz *et al*., 2004). Nutritional deficiency can also increase the probability of livestock ingesting toxic plants. The present study also showed that growing nature of the toxic plant lack of awareness and familiarity of the herder with toxic plant may also serve as a predisposing factor to poisoning. When it is difficult to differentiate between toxic and nontoxic plants due to their growing nature, animals may consume indiscriminately to the volume that may cause poisoning. If livestock owners are not aware of the effect of toxic plants, they may offer it to the animal with the expectation of increased milk and meat production.

The commonest clinical symptoms observed by the poisonous plants were bloating, colic, diarrhea, weakness, salivation, loss of appetite, incoordination and restlessness. The effect of poisonous plants is complex and can affect various organ systems as a result of the presence of several toxic compounds in some plants that affect different body systems. The dominant effect depends on several factors such as condition of plant, stage of plant growth, part of the plant, the amount ingested, species of the plant, and susceptibility of the victim (Botha and Penrith, 2008).

Some of the plants identified in the present study were also used to cure different animal ailments. Among these plants *Ricinus communis and Phytolacca dodecandra* were previously reported to be both medicinal and toxic by Dereje *et al.* (2015) and Clarke and Clarke (1977). The reason why these poisonous plants are used as medicinal plants without imparting ill effect could be associated with the beneficial effect of the plant ingredients when used in small dosage or the use of non-poisonous parts of the plant used and season when poisonous chemicals are in small quantity. As mentioned by Botha and Penrith (2008) poisonous plants could also be used as medicinal plants due to the therapeutic efficacy of such plants at low dose, but with a poisonous effect when greater dose of it is used.

Conclusion

The study area harbors diverse plant species and twenty seven potential toxic plant species were recorded in this study. The most frequently mentioned toxic plants include *Medicago burweed, Sorghum bicolor, Parthenium hysterophorus, Pteridium aquilinum, Urtica simensis, Agave lecheguilla, and Ricinus communis*. The common symptoms displayed by livestock poisoned by these plants include bloating, colic, diarrhea, weakness, and salivation. The majority of the toxic plant species were found in range/farmlands. Therefore, interventions such as

awareness creation on the impact of toxic plants to livestock and preventing growth of toxic plants mixed with crops in the farmlands by frequent weeding, optimal pasture management, and supplementary feeding during time of high presence of the toxic plants is necessary to reduce loses that could result from livestock toxicosis. Moreover, further research work is suggested to examine phytochemistry and toxicology of the identified plants.

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Conflict of Interests

The authors declare that they have no competing interests.

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