Original article

Survey of poisonous plants in Southern Ethiopia

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Abstract

Background: Though written account is wanting, many plants exist in Ethiopia that are poisonous to both humans and livestock. Some verbal reports also indicate the presence of plant species, which are employed in criminal poisoning.

Objective: We conducted this study to document empirical or local knowledge on poisonous plants to help rapid identification of the source of poisoning and provision of treatment by health professionals.

Design: The study was carried out in Southern Nations, Nationalities, and Peoples State of Ethiopia. A two stage stratified random sampling procedure was used in the selection of major ethnic groups (zones) and Weredas (sub-district). Using open-ended questionnaires, a focus group discussion involving community leaders was performed in each of the 12 selected Weredas. Using structured questionnaires, individual interviews were also held in up to three peasant associations of each Wereda.

Results: 111 plants that are locally recognised as harmful to people and/or livestock because of their use as herbal remedies, food or fodder, and other reasons were documented. The inherent traits of the plants and the environmental factors contributing to the toxicity of the species and the conditions that favour exposure of people and livestock are discussed. A few selected species that are believed to pose the greatest hazard to people were addressed in detail. A review of the active principles that are responsible for the toxicity of these plants is also presented.

Conclusion: In view of the ever expanding and unregulated trade in herbal products, there is a danger that the public could end up in buying unsafe preparations. The need for further intensified study in the area is therefore recommended as means of minimizing the risk. [*Ethiop. J. Health Dev.* 2001;15(3):209-221]

Introduction

Since antiquity, man has been exploring the plant kingdom for food, medicine, and clothing and for the best part of his effort he seems to have attained several of his objectives. In the process of learning which was by and large based on trial and error, man has undoubtedly experienced much poisoning by ingesting certain mushrooms, fruits, berries, etc. that produced various magnitudes of malaise or even death, whereas others could be taken safely. The knowledge he thus accumulated about the properties of diverse forms of plants was one of the important tools-of-the-trade in his fight against not only hunger or diseases, but against those he considered as foes or to pose threat to his ambitions.

In ancient Rome, for example, Aggripina, the wife of Emperor Claudius used poisonous mushrooms to eliminate not only the woman she thought was her potential rival for her husband, but also several other men, including Claudius himself when she learnt that he was about to name someone else as heir rather than Nero, her son (1).

Though the practice now seems to have dwindled, the paranoia of being poisoned and the need for servants or wives to taste food was a common household retinue in our own country. However, the incidence of poisoning because of other various reasons is rather on the rise and plants constitute the largest

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category. With frequent episode of famine and in the struggle for survival, people often consume wild plants that they would avoid under normal circumstances and face serious consequences to their health and/or life.

The worst potential or actual danger of exposure to toxic plants, however, appears to arise mostly from the deliberate use of plants as therapeutic agents by the majority of the people who have very little or no better alternative. It has been shown, for example, that several groups of plants that are with known toxic effects to be the most prescribed among the 721 species of medicinal flora of the country (Abebe *et al*, 2001 [unpublished observations]). This, however, does not mean that there are no plant remedies with excellent safety records, nor does it necessarily imply that the preparations are more dangerous than pharmaceutical drugs. It simply means that in the absence of regulatory mechanism, many of them could have adverse effects that do not justify their use.

With declining etiquette, all the concern of restoring health or saving life seems to be increasingly side-tracked with proliferating and burgeoning trade in medicinal plants. By and large, the genuine herbalists with the essential knowledge about the exact identity and the properties of the plant they prescribe now seem to be over-run by unscrupulous elements, especially in the big towns, whose prime and probably the only motive is profiteering. As never before, the profiteers now have at their disposal diverse forms of media (including those owned by the state) where they make implicit or even explicit touting commercials claiming cures for several dozens of health problems for their traditional remedies. These so-called remedies often contain different parts of more than one plant species. A remedy from a single source that may be harmless by itself, inevitably interact in combination with others, possibly producing unexpected negative effects. For example, the herb yohimbe, which is reputed to be an aphrodisiac, can cross-react with tyramine-rich food-such as liver or cheese causing skin rashes (2). As discomforting as this may be, the worst scenario of compounding herbs with synthetic drugs used by herb kendoos and even by certain traditional health practitioners is just beginning to unfold (Getachew *et al*, 2001 [unpublished observations]). Herbal products and conventional drugs are shown to interact, altering the way they are metabolised. The traditional Ayruvedic preparation containing the alkaloid piperine, for example, is stated to increase the toxicity of theophylline (a bronchodilator) and of phenytoin-an anticonvulsant (3). The ability to safeguard public health would thus be seriously compromised unless some form of means to regulate the herbal market, which now seems to go amok, is designed.

The other plants, though may not pose as much menace as those used medicinally, they too cause enormous suffering and death in people and livestock. Contamination, mistaken identity (which mainly arises through morphological similarity of the plants and/or vernacular names), and mere curiosity on the part of the individuals are some of the major factors leading to exposure to toxic or poisonous plants. Uncontrolled introduction of exotic species along with food aid and for other reasons has further aggravated the potential and actual exposure to harmful plants.

In spite of the common understanding of the existence of such harmful plants in Ethiopia, including about those that are said to be used for criminal poisoning, only scanty account is available on the subject. The present study was thus initiated to help fill this gap in knowledge. Furthermore, since toxicity in the broad sense is an indication of biological activity and considering the fact that many drugs have so far been derived from plants that are known to be poisonous (e.g. digoxin from *Digitalis*), such study may have beneficial results in the endeavor of establishing new therapeutic agents. We also believe that this study will contribute to clear the uncertainties that surround some of the plants which may be judged as toxic, medicinal, edible, or

questionable depending upon the individual consulted (4).

Methods

This study was conducted in Southern Nations, Nationalities and Peoples State of Ethiopia, between March, 2000 and February, 2001. The sampling procedure of the study area was a two stage stratified random sampling. In the first stage, the study area was divided or stratified by major ethnic groups or zones. In the second stage, three sub-districts (weredas), based on traditional agro-climatic division, *viz.*, Kola (from 0-1500m a.s.l), Weyna dega (1600-2000m a.s.l) and Dega (above 2300m a.s.l) were randomly selected and 12 weredas were involved in the study. The components of the study subjects were focus group discussion (qualitative) and interview using structured questionnaire (quantitative).

1. Focus group discussion

In each wereda one focus group discussion (FGD) was performed using open ended discussion guide lines. The group consisted of five to eight community figures that include religious or tribal leaders and/or elders, representatives from social affairs of wereda administrative council, women's affairs, health, education and agricultural bureaux.

They were selected based on the following criteria: residence in the respective study area for relatively longer periods, active involvement or highly influential in the community affairs so that the respondents will be knowledgeable with cultural, health and other aspects of the community to provide the necessary information during the survey.

The discussions were chaired by the principal investigator who used pre-tested discussion guides and recorded verbatim by the co-investigator. The basic areas covered in each of the sessions were local name of plants that pose greatest hazard to humans and/or livestock; parts of the plant (seed, bark, leaves, etc), toxic growth stage and state of toxicity; seasons of abundance of the toxic plant; ways of exposure, dose level, and toxic effects produced on exposure; agro-ecological and habitat of the toxic plant and sections of population and/or livestock mostly affected from the toxic, medicinal or edible toxic plant.

2. Interview

In order to cross-check the findings from a focus group discussion, a pre-tested structured questionnaire was used to interview 70 house holds in up to three randomly selected peasant associations in each wereda by taking agro-climatic division as a criterion. The results of interview using structured questionnaire and focus group discussion were summarized and analyzed using SPSS PC.

Besides interview through questionnaire and focus group discussion, the respondents participated in revealing the plants they considered to be toxic and reference herbarium samples were collected whenever this was possible. Authentication and determination of scientific names of the samples thus collected were performed by the senior author using standard taxonomic procedures.

Results

One hundred eleven plant species as well as inorganic fertilizer and soot were identified as important toxic agents known in the region where the study was conducted. 79 or about 70% of the plants were scientifically determined at specific level while the rest were recorded only by their vernacular names. Whenever possible, voucher specimens of the plants were collected and deposited in the herbarium of Drug Research Department (EHNRI) for future reference. There was more than 75% overlap of the plants recognized as poisonous by the participants in the FGD and the individual respondents. The combined responses from both category of participants are shown in Table 1 of the data score sheet (the plants that are recognized as toxic by both category of respondents are shown with asterisk in the Table).

Table 1: Data score sheet

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
*Acokanthera schimperi**	Apocynaceae	Dani	1	3	1	5	2	1	1	6	1	5	NA	2	4
*Adhatoda schimperiana**	Acanthaceae	Surupa, kisha, ketso	3	1	3	1	2	6	3	1	1	5	NA	5	1
Agauria salcifolia	Ericaceae	Kale	1	2	3	–	2	1	1	5	–	–	–	2	4
*Amantia spp**	Basidiomycetes	Enguday, ferdigame	2	1	2	2	2	1	1	2	1	2	2	6	4
Amaranthus caudatus	Amaranthaceae	Gegebsa	2	1	4	4	2	6	2	1	4	–	4	2	1
*Arisaema emeaphyllum**	Araceae	Butabure	3	1	2	5	2	3	1	2	1	2	2	5	4
*Artemisia afra**	Compositae	Ariti	3	1	2	1	3	1	3	3	1	5	NA	5	1
*Balanites aegyptica**	Balanitaceae	Dimoko	2	1	3	5	1	6	1	1	1	–	3	4	4
*Balanites glabra**	Balanitaceae	Kedi	2	1	3	5	3	6	1	1	1	–	3	1	4
*Balanites sp**	Balanitaceae	Keyi bedena	2	2	4	6	3	1	3	5	4	1	3	1	4
Bersama abyssinica	Melinthaceae	Tibirako	2	2	5	6	–	1	1	5	4	–	–	5	4
*Calpurnia aurea**	Leguminosae	Digita	3	1	4	1	3	1	2	1	4	3	NA	2	4
*Catha edulis**	Celastraceae	Chat	1	1	3	11	3	7	1	3	1	5	NA	6	2
*Clutia lanceolata**	Euphorbiaceae	Fiyele fej	1	2	3	6	3	1	1	5	1	1	1	2	4
*Commelina benghalensis**	Commelinaceae	Lalunte	1	2	3	3	3	1	1	5	1	2	2	6	1
*Courbonia sp**	Capparidaceae	Guluf	3	1	1	5	3	4	3	1	1	5	5	1	4
*Croton macrostachyus**	Euphorbiaceae	Bisana	4	3	10	7	3	2	3	4	1	5	NA	6	3
*Cucumis ficifolius**	Cucurbitaceae	Yemdir embuay	3	1	1	1	2	6	3	1	1	3	NA	2	2
*Cusscuta sp**	Convolvulaceae	Hankisa	1	1	6	4	2	6	2	1	3	4	4	2	4
*Cyathea manniana**	Cyatheaceae	Sisino, sheshino	1	1	3	11	3	6	1	3	1	5	NA	2	4
*Cynodon dactylon**	Graminae	Serdo	2	2	2	6	1	1	1	5	2	2	2	6	4

Table 1: **Continued**

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
*Datura arborea**	Solanaceae	Mogn abeba	2	1	6	5	3	4	1	1	3	1	1	4	1
*Datura sramonium**	Solanaceae	Machara	1	1	11	8	2	4	3	1	5	2	2	6	2
Discopodium Penninervum	Solanaceae	Hamararicho	3	1	3	1	2	1	1	1	1	5	NA	5	1
Dodonaea sp	Sapindaceae	Mache	2	1	3	5	3	1	1	1	1	1	3	1	4
*Enset sp**	Musaceae	Yesyitan Kocho	2	1	2	5	3	1	1	1	1	5	3	2	4
*Enset ventricosum**	Museceae	Kocho	2	2	3	6	3	1	1	5	1	5	3	5	1
*Enset ventricosum esp var.**	Musaceae	Tikur enset	2	3	2	12	3	7	1	3	1	5	NA	2	1
*Euphorbia abyssinica**	Euphorbiaceae	Kulkwal	4	1	7	9	2	6	1	7	1	5	5	5	1
*E. depauperata**	Euphorbiaceae	Binjile	3	1	7	5	2	3	1	2	1	5	NA	6	2
*Euphorbia spp**	Euphorbiaceae	Various names	4	1	7	10	2	3	1	2	1	5	NA	5	4
*Euphorbia tirucalli**	Euphorbiaceae	Kinchib	1	1	7	4	2	3	1	2	1	5	5	6	1
*Ficus sp**	Moraceae	Artoko	2	1	5	5	1	6	1	2	4	–	3	1	4
*Galinsoga parvifolia**	Compositae	Bizedi, kasho	2	2	2	2	2	1	1	5	2	2	2	6	2
Gardenia lutea	Rubiaceae	Amesa	3	1	–	1	3	6	–	2	–	–	NA	4	4
*Girardinia bullosa**	Urticaceae	*Dobi, & other nettles*	1	1	18	4	2	3	3	1	1	5	5	2	4
*Gnidia sp**	Thymelaeaceae	Mejrt	3	1	-	1	3	6		1	-	-	NA	2	4
*Grewia ferruginea**	Tiliaceae	Dekeno	3	1	3	1	-	6	1	1	-	-	NA	2	4
Hypericum revolutum	Guttiferae	Gerbicho	1	3	12	3	2	1	1	2	1	5	5	5	4
*Impatiens tincotoria**	Balsaminaceae	Insosila	1	1	1	11	3	6	3	3	1	2	NA	5	4
*Jatropa curcas**	Euphorbiaceae	Tedeke	1	1	4	3	2	1	2	1	4	1	-	1	1
*Linum usitatissimum**	Linaceae	Telba	2	1	4	11	3	6	NA	3	NA	5	NA	6	1

Table 1: **Continued**

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
*Lippia sp**	Verbenaceae	Kefotunta	1	1	2	5	3	6	1	1	-	-	3	3	4
*Lolium temulentum**	Graminae	Enkrdad	1	3	4	3	3	4	2	4	4	-	-	5	2
*Manihot esculenta**	Euphorbiaceae	Cassava	2	3	1	5	3	6	3	1	1	5	5	4	1
*Momordica foetida**	Cucubitaceae	Kishaime	3	1	3	1	3	3	1	1	1	3	NA	2	2
*Musa paradisica**	Musaceae	Abesha muz	6	2	12	15	4	9	1	4	6	5	6	4	1
*Nicandra physalodes**	Solanaceae	Kendo	2	2	3	6	3	1	1	5	1	-	5	2	2
Nicotiana tabaccum	Solanaceae	Timbaho	3	2	3	1	3	1	1	5	1	5	NA	6	1
*Ocimum sauve**	Labiatae	Kuku	3	1	3	1	3	6	1	1	1	5	NA	2	4
*Oenanthe palustris**	Umbelliferae	Shosho, kuru, beti	1	3	12	15	2	10	1	4	1	5	3	5	4
*Oxalis sp**	Oxalidaceae	Guroroye	1	2	2	23	1	1	1	5	1	-	-	2	4
Papaver sominiferum	Papaveraceae	Martef	5	1	4	5	NA	NA	2	NA	4	-	NA	2	1
*Phaseolus sp**	Leguminosae	Boloke	2	1	4	13	3	6	3	1	-	-	-	4	1
*Phytolacca dodecandra**	Phytolacaceae	Endod	4	1	1	12	3	7	3	3	1	5	NA	5	3
*Prunus africana**	Rosaceae	Tikur enchet	2	2	5	6	3	1	1	5	4	-	1	2	4
*Rhamphicarpa heuglinii**	Scrophulariaceae	Yeset lib	1	2	2	6	3	1	1	5	1	3	-	3	4
*Ricinus communis**	Euphorbiaceae	Gulo	1	1	4	3	2	6	2	1	4	5	5	6	4
*Rumex abyssinicus**	polygonaceae	Shisho, dongicho	3	1	3	1	1	1	1	1	1	2	NA	5	2
*Rumex steudelii**	polygonaceae	Tult	1	1	1	11	3	7	3	3	2	NA	5	5	2
Scadoxus multiflorus	Amaryllidaceae	Shito	1	1	1	2	3	6	1	2	1	2	3	2	4
Senna septermtrionalis	Leguminosae	Salamak	3	3	4	1	3	6	2	4	4	1	NA	5	1
*Snowdenia povstachya**	Graminae	Muja	2	2	2	6	3	6	1	5	-	2	2	6	4

Table 1: **Continued**

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
*Solanacio sp**	Compositae	Gumo	3	2	3	1	3	6	1	5	1	5	NA	2	1
*Solanum incanum**	Solanaceae	Embuay	1	1	5	11	3	7	1	3	4	5	NA	6	2
*Solanum sp**	Solanaceae		3	2	1	1	3	6	3	5	1	5	NA	6	2
*Sorghum bicolor**	Graminae	Mashilla	2	2	9	14	3	1	1	5	2	1	1	4	1
*Synadenium compactum**	*Eurphorbiaceae*		1	1	7	4	2	8	1	2	1	5	5	6	1
*Syzygium guneense**	Mytaceae	Dokma	1	2	3	5	3	1	3	5	1	5	NA	2	4
*Tamarindus indica**	Leguminosae	Roka	2	1	5	5	9	1	1	1	4	-	-	4	4
*Tribulus terrestris**	Zygophylaceae	Kurnchit	6	3	12	15	2	10	3	4	4	4	1	3	2
*Trifolium burchellianum**	Leguminosae	Magashimo	2	2	2	6	2	1	1	5	2	2	2	2	4
*Trifolium campestre**	Leguminosae	Sidisa	2	2	2	6	3	6	1	5	2	2	2	5	4
*Trigonella foenum-graecum**	Leguminosae	Abish	3	1	4	1	3	6	NA	2	NA	5	NA	6	1
*Triticum aestivum esp var.**	Graminae	Sinde	2	3	11	13	3	1	1	4	4	3	NA	2	1
*Vigna sp**	Leguminosae	Adengware ayinet	2	1	4	13	3	1	2	1	4	-	-	4	1
Withania somenifera	Solanaceae	Gizawa	1	1	2	5	1	5	2	6	1	5	NA	5	2
Zea mays esp. var.	Graminae	Bokolo	2	1	4	13	-	6	1	1	4	3	-	4	1
		Soot	1	1	NA	11	3	6	NA	3	NA	NA	NA	NA	NA
		Inorganic fertilizer	1	2	NA	6	3	6	NA	5	NA	NA	NA	NA	NA
		Burgudo	1	1	5	5	3	1	-	1	-	-	-	-	-
	Leguminosae	Koke*	2	2	3	6	3	1	1	5	1	2	2	2	4
	Amaranthaceae	Chumade*	1	1	3	2	3	1	1	1	2	1	3	5	2
		Chanko*	1	2	–	6	3	1	–	5	–	–	3	1	4

Table 1: **Continued**

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
		Yisincha	1	2	4	6	3	1	3	5	4	–	–	2	4
		Godana*	1	2	–	6	3	1	–	5	–	–	–	1	4
		Kochko	2	1	1	5	2	6	3	2	–	–	2	2	4
		Shiraro	2	2	5	6	3	1	–	5	4	–	3	1	4
		Becha*	2	2	5	6	3	1	–	5	4	–	–	1	4
		Dampridо*	1	1	3	5	3	6	1	1	–	–	3	2	4
		Kirja*	2	1	5	5	3	6	1	1	4	–	–	1	4
		Zinek*	2	1	3	5	3	6	1	1	2	–	–	1	4
		Kurta*	1	2	2	6	3	1	–	5	–	–	–	1	4
		Mudakale*	2	1	3	5	1	6	1	1	–	1	3	1	4
		Bekaza*	2	1	5	5	2	1	11	1	4	1	3	1	4
		Yetota arekote*	2	1	5	5	3	6	1	1	4	–	3	2	4
		Gora kechi*	2	1	1	5	3	6	1	1	–	1	3	2	4
		Yadinsin	3	1	3	1	3	6	1	1	NA	–	NA	2	4
	Malvaceae	Yewusato*	1	1	8	4	2	8	2	1	4	1	1	1	2
		Totu*	2	2	3	6	2	1	1	5	1	–	–	3	4
		Lolohe*	3	2	–	1	3	6	–	5	NA	–	NA	1	4
		Chankwa	1	2	–	6	3	1	–	5	1	–	NA	2	4
		Lanticho	1	3	3	2	2	1	–	4	–	–	–	4	4
		Mukulo*	1	2	2	6	2	1	3	1	5	–	–	2	4
		Gursha*	1	2	3	–	2	1	1	5	–	2	–	2	4

Table 1: ***Continued***

Species	Family	Local name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
		Dadako	3	1	4	1	2	1	1	1	–	–	NA	2	4
		Butbulas	1	1	3	3	2	1	1	1	–	–	–	2	4
		Bishako*	1	2	3	3	2	1	1	5	–	–	–	1	4
		Erderts	1	3	–	3	2	1	–	4	1	5	–	2	4
		Demeshit	3	3	3	1	–	1	3	4	–	–	NA	2	4
		Kimot*	3	1	3	1	–	6	–	1	1	5	NA	2	4

Key to Table 1. C1 = Category (1: Toxic only; 2: Nutritional toxic; 3: Medicinal toxic; 4: Known both as toxic & medicinal toxic; 5: Known only as nutritional; 6: Known both as nutritional toxic (and toxic)
C2 = Toxicity to (1: Humans; 2: Animals; 3: Both)
C3 = Part toxic (1: Root; 2: Whole; 3: Leaf; 4: seed; 5: Fruit; 6: Flower; 7: Latex; 8: Hair; 9: Budding shoot; 10: Leaf & Bark; 11: Leaf & seed; 12: Leaf & sap; 13: Fruit & Leaf)
C4 = Reason for exposure (1: Use as remedy; 2: Mistaken identity; 3: contamination; 4: Accidental contact; 5: *Other reasons*; 6: *Use as livestock feed*; 7: Use as remedy, livestock feed & as abortifacient; 8: Mistaken identity, contamination & other reasons; 9: Accidental contact & use as abortifacient; 10: Use as remedy & other reasons; 11: Use as abortifacient; 12: Use as abortifacient & remedy; 13: Similarity to native or familiar species, 14: Use as *livestock feed & other reasons*; 15: Use as livestock feed & accidental contact)
C5 = Toxic dose (1: Dose dependent; 2: Any dose is dangerous; 3: Dose unknown; 4: any dose is dangerous or dose unknown)
C6 = *Effect of toxicity may lead to* (1: *Death*; 2: Abortion; 3: Inflammation and/or irritation; 4: Inebriation; 5: Hallucination; 6: Other health and life risks and/or death; 7: Abortion and/or other health & life risks; 8: Irritation; inflammation and/or blindness; 9: inflammation and/or irritation and other health and life risks; 10: death and physical injury)
C7 = Toxic state (1: Fresh; 2: Dry; 3: Both)
C8 = Most affected by the plant (1: All section; 2: Mostly children; 3: Mostly women; 4: People & livestock; 5: Livestock only; 6: Others; 7: Women & all sections)
C9 = Toxic or useful growth stage of the plant (1: All stages; 2: Before flowering; 3: During or after flowering; 4: During or after fruiting; 5: Before flowering & during or after fruiting; 6: All stages and during fruiting)
C10 = Season of abundance (1: Dry season; 2: Wet season; 3: Autumn; 4: Spring; 5: All Seasons)
C11 = The season by which it is most hazardous (1: Dry season; 2: Wet season; 3: *Drought periods*; 4: *Harvesting season*; 5: All seasons; 6: Drought periods and harvesting season)
C12 = agro-climate (1: Kola; 2: Weyna dega; 3: Dega; 4: Kola & Weyna dega; 5: Dega & Weyna dega; 6: All)
C13 = Habitat (1: *Cultivated and/or around human dwelling*; 2: Weed; 3: In most habitats; 4: Others)
NA = Not applicable;
– = *Data not available*
* = where FGD and Individual responses overlap

Forty three species were recognized as toxic only, while 39 and 29 plants comprise nutritional toxic (toxicity due to ingestion as food and/or fodder) and medicinal and/or nutritional toxic, respectively. There are more number of plants (about 66 species) that produce toxicity in people compared to the number of plants (about 35 species) that affect livestock; while about 12 species were believed to elicit adverse reactions both in people and livestock. About 49 species were stated to cause inevitable death of people and/or livestock following ingestion or administration. 64 species were stated to pose greatest health hazard in their fresh state; and aerial parts (especially leaves, fruits and/or seeds) account for the toxicity of most of the plants recorded (63 species). 48 species were reported to be toxic before their flowering stage while 24 others were identified to be poisonous during or after setting fruit. 40 toxic plants were found to grow in close quarters of human residences as weedy species or even deliberately nurtured by people through cultivation for variety of reasons.

Discussion

Toxicity of a given plant may generally be considered as a function of more than a single factor. Thus, a plant customarily recognized as innocuous may prove harmful or toxic depending on the susceptibility of the individual, the part used, the growth stage the plant is to be found, the way it is prepared, the season in which it is used, the purpose it is used for, so on and so forth. It is within this framework that the responses of the individual participants and those of the FGD should be construed.

The single most important reason for exposure of people to the toxic agents arises from use as a remedy as demonstrated by significantly high number of species, 25 plants. Other solitary reasons responsible for exposure to a lesser number of species include use as food source in time of food crisis, 10 plants; contamination and/or mistaken identity, 14 plants; use as abortifacient, 7 plants. All other reasons, including use as narcotic, use to harm others, use to perform male circumcision or enlarge male genital, etc. account for about 14% of the species.

In addition to being subjected to the possible toxic effects of 42 plants that are stated to affect all sections of the population, children are further exposed to 13 more plants than adults. Attractive fruits, berries, etc. coupled with morphological similarity and/or same vernacular name seem to be responsible for children to be lured to more of the harmful plants than the adults. Similarly, though women are subjected to the effects of an array of toxic plants that affect other sections of the population or even livestock, gender seems to play part for exposure of women to more number of poisonous agents (7 plants) than their men counterparts. This is in consistent with the recourse women make to plants in their desperate effort to terminate unwanted pregnancies and to a lesser extent their use of plants to relieve birth pain or facilitate labor.

The toxicity of only 7 plants is known to be dose dependent while for 34 plants, any dose is considered as dangerous. Though the toxic dose range for 70 plants is not known, the very fact that they are toxic seems to be reason enough to regard any dose as potentially detrimental to health and well-being. Prognosis after exposure to 49 plants is stated to be death; reversible or irreversible health risks and possibly death, 44 plants; irritation and/or inflammation, 7 plants; inebriation and/or mental confusion and hallucination, 6 plants. Most of the plants (about 58%) impart their toxic effect at their fresh state in which leaves, followed by fruits and/or seeds taking the major blame in the untoward effect of 57% of the plants identified.

Though data is not available or not applicable (as in case of medicinal agents) for 65 plants regarding the season by which they become most hazardous, 18 plants pose serious toxicity problem during drought periods. This is in conformity with the anticipated situation during

food and fodder scarcity that such periods impose upon people and livestock.

Inhabitants of Weyna dega agro-climatic zone are exposed to more number of poisonous plants (35%) than their counterparts in Kolla or Dega zones who are potentially exposed to 16% and c.4% of the plants, respectively. The plausible explanation for this seems to be the moderate climate of the Weyna dega zone, which favors acclimatization, and diversification of plant species including poisonous ones.

Seventy one plants occur in habitats relatively considered afar field and therefore, seldom pose grave danger. On the other hand, 40 plants are found grown as weeds or cultivated around human dwellings thus presenting a constant and ever present danger to people, especially children. One of the important families consisting of several species of plants that are grown as hedges or ornamentals is the Euphorbiaceae. Rightly so, all most all the respondents consider the plants in this family as the most serious menace to people. Most genera and species in this family are characterized by their milky latex, which is caustic and irritant or pro-inflammatory. The constituents responsible for these effects are phorbol esters, which are also, by and large, tumor-promoters.

Acokanthera schimperi, the source of arrow poison by the Maale tribe, southern Ethiopia, according to eight of our respondents (4%) is the most dreaded of all the toxic agents. Being a silent killer, it is still preferred to modern AK-47 assault rifle to bring down game animals and occasionally foes. Although an arrow can deliver up to 5g of the poisonous viscous decoction of the root bark, an amount as small as 2g is stated to be sufficient to cause demise of the victim (5). Cardiac glycosides, *viz.*, oubain and to a lesser extent G-strophantin are the active principles responsible for the toxicity of the plant (6). The entire plant is considered by the respondents to be dangerous even though it is reported that the ripe fruit can be consumed with impunity (5).

Forty of the respondents (19%) are of the opinion that consumption of wild mushrooms (variously referred to as enguday, yejib tila, ferdigame, etc.) constitutes the most serious threat to the well being of children. It was brought to the attention of the investigators by one of the FGD participants (from Boreda Abaya) that there were hospital admissions and even death of several children after consumption of certain wild mushroom. Even though there are different species in different genera that are implicated in mushroom poisoning (mycetism), the most serious effect is produced by *Galerina* species and by *Amantia phalloides* and other *Amantia* species which are said to account for over 90% of all fatal cases in other parts of the world. The principal toxins are the amatoxins, a group of cyclic octapeptides that inhibit RNA polymerase II and hence block the synthesis of mRNA resulting in cell death. Symptoms include diarrhea and abdominal colic before death occurs from renal and hepatic failure. As confusing as the diversity of species that are implicated in mushroom poisoning so is the literature information regarding which species are edible or not, and the drugs to be used as antidote or for treatment. For example, the False Death Cap, *Amantia citrina*is stated to be the edible while it is *Agaricus bisporus* and some allied species which are considered to be as the only edible fungi (7, 8). Therefore, although the raw potato smell, *inter alia*, is the distinguishing character of the edible from the toxic, the cardinal rule children should be made to observe would be not to try it.

Forty three respondents (c.21%) consider *Datura stramonium* (astenagir, meracha, etc.) to be one of the few plants which may cause toxicity not only as contaminant of grain or green stuff, but also used by the wicked as a sole ingredient to harm people. The respondents also revealed that grain consumed contaminated with the seed of this plant, resulted in the hospitalization of about 30 people as recently as 1998. Similar previous

outbreak of acute toxicity by consumption of food contaminated with *Datura* seed in the Middle Awash Agricultural Enterprise was also reported (9). Mydriasis, tachycardia, delirium, and loss of motor power are characteristic symptoms of poisoning by the plant. Because of the confusion it creates in the mind, the plant is used as inebriant to facilitate robbery and rape. The seeds of this plant are said to be used frequently by Turkish women and, consumed in a certain way, cause such inebriation that these women do not heed all the lechery that they commit and which they cannot remember when they are sober (10). The toxic principles are hyoscine and L-hyoscine, both of which are neuro-toxic (11, 12).

Among the exotic or introduced species that is regarded as most detrimental is *Manihot esculenta* (cassava). Sixty-six or 31% of the respondents consider it as deadly toxic and there seems to be disagreement among them as to the method that should be followed to get rid of the poisonous principle before serving it as food. Some blame the season for its toxicity while others associate the danger to the bark or inner part of the root, and still others to the method of preparation such as repeated washing and/or cooking. Because of such uncertainties as to the exact cause of toxicity, death was noted among people, especially children as well as livestock that forage on the leaf. Cassava is introduced to Ethiopia and other tropical Africa relatively recently. It is the only toxic plant that has become one of the 13 major world food plants (13,14). The toxic constituent of the root and leaf is a cynogenic glycoside related to hydrocyanic acid (prussic acid) which can be removed from the root by heating or cooking preceded by overnight soaking (15).

Phytolacca dodecandra (endod) and *Oenanthe palustris* (beti, kuru, gudign) are some of the other plants which are believed to produce serious adverse effects including several fatalities. Forty (19%) of our respondents stated that endod poses serious health hazard when taken as remedy and a number of deaths in women who used it as abortifacient. The toxic principle of the plant is steroid saponin, which is powerful convulsant, haemolytic, respiratory, and GIT irritant (16,1). Nineteen respondents consider *Oenanthe palustris* to be the most deadly poison to livestock. The sap of the plant is also said to be irritant to human skin. Oenanthotoxin, the compound that is said to be responsible to the untoward effect of the plant, was isolated from the related species *O. crocata*, which is also recognized as most poisonous in other countries (18).

Conclusion

With increasing orientation towards free market economy and worldwide popularity of herbal remedies, poisonous plants can find their way to many homes. Furthermore, given the large majority of the population relying on herbal remedies and the tendency of the clientele for medicaments with obvious and stronger pharmacological effects to those with insidious action, the danger from toxic plants is a real cause for concern. Rapid identification of the possible source of poisons is, therefore, essential if most effective treatment is to be given or to prevent poisoning. Thus, documentation and dissemination of local knowledge of which plants or the parts thereof considered to be poisonous among the local flora is important initial step for the realization of the adage 'forewarned is forearmed'. Local knowledge about poisonous plants can also help in regulating the market of plant-based remedies, which is fast expanding and probably bifurcating to include narcotics in contravention of the laws of the country. Toxins in herbal products are not the only problem. Advance knowledge is also crucial and has to be further strengthened to prevent or contain the untoward effects of many plants that produce havoc as a result of accidental contact or because of mistaken identity, contamination, etc.

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