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Species of herbal spices grown in the poor farmers' home gardens of West Shoa, Highlands of Ethiopia: an Ethnobotanical account

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Abstract

Survey of local market and villages around Ambo, Western Highlands of Ethiopia identified a group of herbal species regularly used in preparation of spice mixes for traditional Ethiopian dishes. The herbal species, local (*Amheric*) names being *Basobila, Kosorat, Tosegn, Sega matbasha, Tenadam* and *Altufa,* were not reported as a group before. The specimens collected from the market and village were documented with botanical identification, ethnobotanical investigation and role in the livelihood of the poor small farmers. Field survey indicated the species being grown in home gardens of nearby villages, their cultivation, marketing, preparation of the spice mixes and dishes traditional to the women only. Information and literature survey suggest, apart from socio-economic importance, these wild herbs have bright potential for poverty alleviation, improved women's contribution to family income, small farmers' adaptability to climate change. The issues of domestication, selection / breeding, value chain analysis resulting in value addition and improved marketing, utilization of WTO's TRIPS under the protection of geographical indication (GI) were discussed.

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Introduction

Ethiopia has a very rich diversity of land, soil and climate, especially the Highlands that experience large amounts of rainfall (1000 -2000 mm/year) and have cool temperatures are known to sustain a natural vegetation of Afromontane forests, while at lower elevations giving way to broadleaf forests and wooded grasslands. In drier rocky/sandy areas, arid xerophytic vegetation flourish, the high peaks, flat valleys and steep slopes producing marked changes within short distances in rainfall, temperature, and soil types with a culmination of diverse vegetation . The Ethiopian flora is estimated at between 6000 and 7000 species of higher plants (Tewolde Berhan, 1991), and about 10-12% of these are likely to be endemic (Friis *et al.,* 1982; Thulin, 1983). The diverse vegetation (Ensermu Kelbessa *et al.* 1992; PichiSermolli 1957) and ecological conditions made the country an important center for food plant domestication and diversification (cf. Huffnagel 1961; Purseglove 1972) not only by the abundance and diversity of species and varieties of food crops (Harlan 1969) but also by their wild and weedy relatives (Edwards 1989, 1991). With changes in land use and with agriculture expansion, much of the forests disappeared and wild species became rare, rapid commercialization of agriculture also being an important driver of land use change—potentially implies decreased utilization and reliance on wild species for foods and other uses (Treweek *et al.* 2006). Even then, dominated by non-mechanised highland farming, small-scale farmers who are responsible for 95% of the cultivated land, mainly for subsistence needs (MoFED, 2007) maintain much of scattered wild vegetation within human habitats. So, Ethiopia remains as one of the few countries with an immense potential for research into the origin and changes associated with plant domestication and other ethnobotanical studies. Tapping indigenous knowledge through modern ethnobotanical techniques, not only helps us to know more about the use of the plants concerned but also gives clues to their future development, *in situ* and *ex situ* conservation, domestication and sustainable use (Hammer and Mbewe 1994). Ethnobotanical studies conducted in Ethiopia have indicated that over 300 species of wild plants are gathered and consumed by the people and there is ample scope of developing this subsector of food supply (Edwards,1991;Asfaw and Tadesse,2001;Addis *et al* 2005;Gemedo-Dalle *et al*,2005;Balemie and Kebebew,2006;Mengistu and Hager,2008; Addis, 2009).

People's knowledge of plants, what they knew and used - Ethnobotany - deals with plants in the cultural context and remains important to the present and future plant users. Documentation of ethnobotanical information is crucial for understanding which species in nature has been brought under use and in cultivation for what reasons and through what methods, how they were and are being managed under human care and how these can be improved for more intensive and sustainable utilization. This is important as domestication has given humans crops, the most important component of agriculture. The domestication of wild plants taking place under human care are to be examined from a broad spectrum of representatives of a community, the local knowledge obtained from communities needs to be utilized to understand the entire process. The domestication of annual crops began over 10,000 years ago and involved processes of cultivation, selection, breeding and adaptation of plant populations to meet diverse human needs, the major changes were to increase production and quality during cultivation to fit to particular environments (Harlan,1975).

Traditional home-gardens refer to the land surrounding a house on which a mixture of annual and perennial plants are grown representing a small-scale traditional farming systems, their primary function being growing various crops for home consumption (Hoyyeepoo, 1990; Rajasekaran and Warren, 1994; Zemede Asfaw, 2001a and 2001b). In

the rural background, the home gardens are good examples of microclimates in the traditional farming system, many studies indicated these still harboring high levels of biodiversity (Agelet *et al.*,2000; Eyzaguirre and Linares, 2001; Nair, 2001, Vogl-Lukasser *et al.*,2002; Trinh et.al,2003) with different species and varieties, than are found in the surrounding agroecosystem. They also serve both as reservoirs of genetic diversity and traditional farmers' experimental breeding grounds and so are socially constructed spaces that exist close to the home and are managed by various household members, thereby contributing not only to subsistence and commercial production, but also to the continuance and reproduction of cultural identity (Eyzaguirre and Linares 2004). Because of the diverse flora and the opportunity for year-round growth, home-gardening became a well-developed and dependable food production strategy, and continues to be the avenue for introduction and adaptation of new crops as well as domestication of wild species.

The documentation of ethnobotanical knowledge on the traditional uses of plant species by a community thus, is essential to understand the process of domestication and to develop strategies for sustainable use and conservation of these plant species. There is no detailed report of this type use of non-domesticated plant species as a group used for culinary purposes and cultivated in the home gardens of Ethiopia. This paper documents the knowledge of traditional use of herbal plant species in the West Shoa region of Highland Ethiopia as spice for cooking.

Materials and methods

The study site in Ambo (37^{O}48'59" to 37^{O}54'15"E and 8^{O}57'54" to 8^{O}59'39"N) and surrounding villages (Fig 1), situated in the Oromia Regional State, in the Western Highland of Ethiopia. The area is on an altitude of 2060-2204 masl, with total annual rainfall ranging from 800 mm -1000 mm distributed in one major (three/four months) one minor (one/two months) seasons. The landscape of the region is highland mountains with wide deforestation and land degradation (Fig 2) with a long dry season of 8 to 9 months (September to May) . The highlands, only 45% of the country accounting for over 80% of the total population and for 95% of the cropped land, has been suffering from widespread erosion, over-grazing, deforestation and loss of nutrients and consequently reduced per capita share of arable land (Adgolign 2006; Haile 2004). Entire food supply comes from rain fed subsistent agriculture and rainfall failure means loss of major livelihood source (Adgolign 2006). The use of both irrigation and water harvesting technology is almost non-existing, according to 2008 Farm Management Practices Survey of CSA, the total irrigated crop area in Ethiopia was estimated to only about 1.5% of the total crop land (CSA4, 2008), some small attempts exist covering only a very small area.

Market Survey

Visits and survey in the Ambo market (West Shoa, Ethiopia) revealed a number of fresh herbal plants traded regularly (Fig 3), discussion with the sellers about the place of collection of the plants, local knowledge on plant parts used, purpose, cultural value, and past and current management practices were obtained.

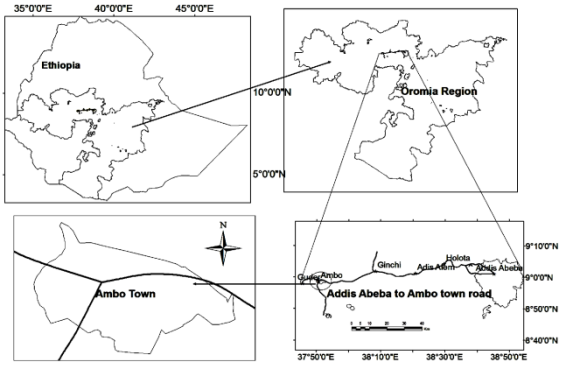

Fig. 1. The study site, Ambo and surrpouinding villages in the Highlands of Ethiopia.

Home garden survey

Data collected from the homesteads of the area (Olika and Zuberi 2013) showed the average annual income per homestead was Birr 12,583.00 (= 630.00 US$);

more than 50% being poor had lower income that the average only having less or equal to half a hectare of land. Field crops accounting for 41.00 % of this income, animals account for 15.00 % , 22.00% from home gardens (herbs), agroforestry/ trees contributing 12.00 % while off farm income contributing to the rest 10.00%. Rapid ethnobotanical surveys to the homesteads through PRA and field visits to gather qualitative information. Another approach used is the 'walk in the woods' with local participants in field trips to the places these plant species were grown (Figs 4 and 5). Information from published papers on the relevant species were collected and included.

Results

Information from the local market

Visits and the mapping of indigenous non-crop plant products in the local market of Ambo, in the Highland Ethiopia showed that items like locally grown herbal green spices, home grown coffee, dried leaves of '*Gesho*',(*Rhamnus prinioides)* , grass made brooms, hats and baskets, palm leaf brooms, fans and different types of woods/roots with fragrance, starchy roots/ tubers and fruits are regularly marketed mostly by the women. Observation indicated to a fairly large number of women (40 to 65) of different ages (10 to 70 years) bringing a large variety of plant / plant parts involving a substantial financial transaction daily. Most of the women were very poor and the income from sale they obtain were a significant contribution to their livelihood. A section of the market was regularly occupied with green leafy spices likely to attract attention , interviews with the buyers of the herbal spices indicated that the 'leafy species,' both green and dried, are regularly purchased for the preparation of '*Berbere*' (*Amharic*), a spice mixture, whose ingredients usually include other spices like zinger, chili, onion, garlic and a combination of dried herbs/leaves that are less well known. Being a key ingredient in the cuisines of the local Ethiopians with other such spice mixes, like *Mitmita*, *Mekelesha* and *Qoch-qocha (Amharic)* require combinations of many of these herbs.

Table 1. The marketed herbal spice materials in Ambo market, Central Oromia, Ethiopia.

No.	Local *(Amheric)* name	Part of the plant sold	*Status: selling/buying
1	Basobila	Fresh and dry leaves, inflorescence	++++
2	Koseret	Fresh and dry leaves, inflorescence	+++
3	Tosegn	Leaves: dry & fresh	+++
4	Tenadam	Fresh & dry leaves	+++
5	Altufa		++
6	Sega matbash	Fresh & dry leaves; shoot	++++
7	Gesho	Dry & fresh leaves, twigs	+++++
8	Ensosla	Tubers	+
9	Aritta		+

* Scale: + Least frequent and +++++ = Most frequent.

These herbal spices provide an important source of economic contribution to the extremely poor women's rural livelihood as the maintenance, production, handling and marketing are done by women. A number of group discussions with the seller ladies and girls indicated that many of the species involved being intensively exploited in the past and with the disappearance of forests are not found in the wild now, so most are being grown in their homesteads around Ambo, Wenchi and Guder areas (Fig 1). When asked about who grow these in the homesteads indicated that mostly women of various ages are involved in growing them and bring varying amounts of these locally-produced species of herbs from villages of Dalota, Altufa, Boji Gabisa, Elifeta, Haro, Gatira, Fali and Wenchi. Further survey (from

8 visits) in the Ambo market provided information about the relative importance of the herbal items (Table 1). Basobila, kosarat, gesho and Tosegn were more common items in terms of number of sellers and value (Table 2).

All the fresh materials are sold measured as a handful of fresh leaves/shoots (Fig 3), for Birr 2 (=US$ 0.1), the dried leaves in small plastic pots. The women travel from their homesteads on foot, often more than 15 km of mountainous footpaths to market the spices products, carrying the load on their head or back in sacs or baskets, the labour and time commitment being high, yet the average amount of a species is rarely more than one bag, because of perishable nature, limited demand and the impossibility of bringing back the unsold portion. On most occasions. these unsold items were left back / thrown away in the market or rarely kept for drying and selling later (Fig 7).

Table 2. Relative importance of the species in terms of frequency of sales and estimated financial value in the Ambo market.

Local name	Scientific name	Sellers in the market (from 5 visits)	Estimated total money value (Birr) Range& mean	Reported uses
Gesho	*Rhamnus prinoides*	Range=6– 19 Mean = 13.0	520 – 1414 520.0	For brewing of traditional alcohol (Tella), extract mixed with honey to ferment Tej
Basobila	*Ocimum sp.*	Range= 20-33 Mean= 25.5	390 – 1505 751.7	Very common, Ingredient of mixed spice for cooking Berbere Medicinal purpose
Kosorat	*Lippia adoensis*	Range= 8 -18 Mean= 13.3	330-1170 681.7	Cleaning milk pots, flavoring cheese,cooking
Tosegn	*Thymus schimperi*	Range= 3 - 7 Mean= 5.7	150-430 333.3	Ingredients of mixed spice, used in cooking, medicinal
Sega matbasha	*Rosemarinus officinalis*	Range= 3 - 8 Mean= 5.7	135 – 280 221.7	Used in cooking very common, drink in tea
Tenadam	*Ruta chalepensis*	Range= 4 - 6 Mean= 5.0	50 – 255 153.5	Used in cooking, very common
Altufa	*Rubus volkensii*	Range= 1 - 6 Mean= 3.0	40 – 240 140.0	Used in cooking , common
Masarat	*Cymbopogon nervatus*	Range= 2 - 5	40 – 60	Flavoring
Ensosilla	*Impatiens tinctoria*	Range= 1 - 5 Mean= 2.6	40 – 50 30.0	Cosmetics; coloring nails

Homesteads producing wild herbs

Field visits to the village indicated that the households were mostly small, compounds generally consist of a main hut with thatched roof, where crops, fodder, and personal effects are stored, food is consumed and sleeping space for the family (Figs 4 and 5). These huts are typically round, constructed using sticks and mud with extensions for animals and cooking and were scattered widely in the rugged mountain landscape. In the homesteads' villagers grow some herbs, shrubs and trees some are cultivated like *enset* (*Ensete ventricosum* (Welw.) Cheesman, Musaceae), fruit and vegetable species but also some wild/semi wild species as they require

no inputs and regular planting, they grow and regenerate naturally, collected periodically for marketing fetching good value (Table 2). The plant species observed in the homestead of the villages included trees/shrubs (nine species with a mean number of 2.35 per home), herbaceous vegetables (eight species with a mean of 2.54 species per home) and herbaceous spice species (six species with a mean of 3.48 species per home). Among these enset (a herb) and basobila(spice herb) were very common (Table 3). They use these items for domestic consumption, cultural practice and occasionally for marketing purpose. Observations revealed that 51% of rural women preferred mostly the back yard of the kitchen for herbal plantation followed by back yard 35%, and the rest adjacent to the dwelling house (14%). When interviewed, old villagers reported that wild species were found in the past around the mountain valleys and forest edges, but now are no longer available in the wild. So, the local people began maintaining them in their home gardens, this practice was reported to be more than two generations old. These need no extra care used to meet local demand and also are marketed for extra income, all done by the women folk. Multiplication and cultivation of these species is now common in almost all the home gardens, at this stage, the women do not practice any care, only providing some waste water from the kitchen during dry spells. When asked they said they do not think about improvement of the quality of the product, adoption of specific criteria to select plants that better satisfied people needs. The seller women of the herbal products asserted during the survey that the bulk of their produces are cultivated in their homesteads (Fig 6), with little care so the abundance and diversity of these plant species decrease during the dry season (December to May) and increase after the rainy season (August to November). A large number of published papers and unpublished theses on home gardens, herbal species and spices were examined but in none of these there is a mention of these 'group of species' grown for culinary use in Ethiopia.

Table 3. Details of plant species in the home gardens from the village survey (homes visited= 33).

Items	N	Trees/shrub in home garden	Vegetable herbs in home garden	Spice herbs in home garden
Home garden	33	Range: 0 – 9	Range: 0 – 6	Range: 0 – 6
		Mean: 2.36	Mean: 2.54	Mean: 3.48
		Variance: 6.43	Variance: 2.31	Variance: 2.76
		Name No of homes	Name No of homes	Name No of homes
		----------	----------	----------
		Enset 21	Oromo potato 9	Basobila 27
		Chat 9	Sweet potato 11	Kosarat 21
		Lemon 2	Beet root 2	Enaddam 19
Species (local		Mango 1	Potato 16	Mosarat 7
names)*		Jaitun 1	Chilli 3	Rosemary 9
		Banana 1	Onion 11	Addas 1
		Avocado 1	Wild amaranth 12	
		Coffee 3	Wild brassica 15	
		Gesho 10		

*Taxonomic identification was not possible for lack of information and literature.

Botanical account of the herbs grown

Here, we report the herbal spice providing species which are grown by the women around their hut in

the village of Dalota (Figs 4 and 5) of Central Ethiopia. These are grown together as they need little care and continue to grow like wild plants once planted (Table 1). The documented products from several species have been identified and their commercial value in the market has been determined (Table 2). The plant specimens were identified by the researchers and were taken to Addis Ababa University National Herbarium (ETH) for verification; most were taxonomically identified , specimens were deposited in the Ambo University Herbarium in Biology Department. The undomesticated herbal species were distributed among 9 families and 11 genera (Table 1). Each family had one species only family Lamiaceae had three.

For easy identification, short botanical account of the species are given below and in Table 4.

Table 4. Botanical and ethnobotaniocal information about the herbal species in Ambo survey.

Scientific name/family	Native/ Range of Distribution*	Parts used	Culinary value	Ethno/ Medicinal uses	Wild/ semi wild/ wild	Reference
Ocimum sp. *O.americanum* *O. africanum* Lamiaceae	Tropics of Asia and Africa*	Leaves / inflorescence/ whole plants	yes	many	wild	Zemede Asfaw and Mesfin Tadesse,(2001/ Dawit Abebe and Ahadu Ayehu (1993)
Lippia adoensis Verbenaceae	Flora of West Tropical Africa*	Leaves / inflorescence	yes	many	wild	Zemede Asfaw and Mesfin Tadesse,(2001
Thymus schimperi Lamiaceae	Eritrea, Ethiopia*	Leaves	yes	many	wild	Flora Ethiopia
Rosemarinus officinalis Lamiaceae	Mediterranean and Asia	Leaves	yes	many	Escaped/ cultivated	Zemede Asfaw and Mesfin Tadesse,(2001
Ruta chalepensis Rutaceae	Eurasia and North Africa	Leaves/ berries	yes	numerous	wild	Zemede Asfaw and Mesfin Tadesse,(2001/ Dawit Abebe and Ahadu Ayehu (1993)
Rubus volkensii Rosaceae	Ethiopia/ East Africa	Fruits	yes	No report	wild	Flora Ethiopia
Cymbopogon Nervatus Poaceae	Asia/ cultivated	Leaves	yes	some	cultivated	Flora Ethiopia
Rhamnus prinoides Rhamnaceae	Africa / Ethiopia to South Africa	Leaves	brewing	many	Wild/ cultivated	Flora Ethiopia

* Kew web site data base (http://www.kew.org/science/tropamerica/imagedatabase.html).

O.americanum

Herb; leaves serrate, ovate; inflorescence verticillaster rather dense ; corolla2-lipped; 4-7mm long; Stamens 4, exserted beyond the lips, fruiting calyx4-7mm long; aromatic.

Rosemarinus officinalisL

Evergreen shrubs, Shrub, up to 2 m tall, fragrant, pubescent with whitish stellate hairs. Leaves sessile, linear, coriaceous, bright green and rugulose above,

whitish to mentose beneath, margin strongly revolute. Calyx3-4 mm long in the flower, 5-7 mm in the fruit. Corolla 10-12mm long, blue. Mentioned cultivated in Ethiopia altitudes; 1700-2400m.

Thymus schimperi Ronniger

Perennial herb, woody at the base, 5-40 cm long; Stems prostrate, sometimes erect in younger parts; leaves glandular on both sides, glabrous , ciliolate hairs at the margin, ovate to sub-orbicular, elliptic or lanceolate ; Corolla white to purple, 6-8mm long, tube 4-5mm long, 2-lipped,the middle lobe of the lower lip slightly larger. Common in open grassland, on bare exposed rocks, on slopes and tops of mountains in afromontane and afroalpine vegetation zones; altitude: 2250-4000m.

Impatiens tinctoria

A. Perennial herb with large tuberous root stock, up to 30 x10 cm; Leaves dark green above, paler beneath, spirally arranged,8.5-. 29(-32)x2.5-10em,glabrous, Inflorescence raceme, of 3-7flowers; Flowers white, often lower lateral petals pink or purple tinged on veins, Spur 8-13 cm long; lower sepal gradually narrowed into the spur.

Table 5. Components of *Barbere*, *Mitmita* and *Qoch-qocha* used in preparation of Ethiopian cuisines as reported by an elderly Oromia house wife in Ambo.

No	Components*	Relative proportion	No	Ingridients of *Mitmita*	Relative proportion
1	Red dried Pepper	90%	1	Red dried Pepper	94%
2	Zingbil	1%	2	Kororima	1%
3	White onion /garlic	2%	3	Black cumin	0.5%
4	Besobila	0.5%	4	Kosorat	0.5%
5	Tenadam	0.5%	5	Salt	4%
6	Tikur azmud	0.5%			
7	Netch azmud	0.5%			
8	Kororima	0.5%			
9	Kerefa/qarafa	0.5%			
10	Kundoberbere	0.5%	No	Ingredients of *Qoch-qocha*	Approximate relative proportion
11	Timiz	0.5%	1	Red dried or green pepper	85%
12	Gawuz	0.5%	2	Zingbil	3%
13	Kirunfed	0.5%	3	netch shinkurt	7%
14	Komon	0.5%	4	Besobila	1%
15	Kosorat	0.5%	5	Dimbelal	1%
16	salt	1%	6	kororima	1%
			6	salt	2%

*Kundoberbere (Wild Black pepper/ *Schinus molle* , Peruvian pepper *tree*), Cinnamomum zeylanicum (qarafa/ Cinnamon) Elettaria cardamomum (heil), Piper longum (timiz), Capsicum (berbere), Allium (shinkurt), turmeric (ird), fenugreek (abish), Foeniculum vulgare (ensilal),coriander (dimbelal), Ethiopian cardamom (korarima), ginger (zinjibil), garlic (netch shinkurt), caraway (netch azmud), Clove (Kirunfed), Fenu greek (Senafich),

Komon (Cumin), timiz (wild black pepper, *Piper* sp. grown in Ethiopia), black cumin (Tikur azmud), Gawuz (yeferenji Kororima,not grown in Ethiopia).

Lippia Adoensis

Shrub 1--3m tall; ;branches and branchlets 4-angled, pubescent. Leaves in whorls, green and smooth to scabrid above, grayish and densely tomentose below; blade elliptic to lanceolate, Corolla purple with white, yellow or purple centre, leaf scent strong and pungent; Common in disturbed areas and forest margins; altitude: 1600-3000m.

Ruta chalepensis

Herb: leaves bipinnate, alternate; Inflorescence cymose, bracts ovate. Petals yellow. Fruit an apically dehiscent capsule, each with several small seeds. Often in homegardens, used to flavor milk cheese and coffee. Range: Mediterranean or MiddleEast (Gilbert, 1989).

R.volkensii Engl

Viscid shrub, with erect stems reddish brown, densely covered by a Hairs with scattered prickles; Leaves imparipinnate, leaflets ovate-elliptical; Inflorescence paniculate, few-flowered, axillary; Flower yellow-white; peduncles, pedicels and calyx densely covered by stalked glands; Montane forest and pastures, along stream, 2500-3800 m.

Ethnomedicinal use of the herbs under study

Many of the species are reported to have medicinal uses (Table 4). From literature survey many ethnobotanical uses were found. Dawit Abebe and Ahadu Ayehu (1993) in the compilation of ethnobotany of medicinal plants provided the following traditional uses among rural Ethiopians:

Lippia sp. (Kese) :Aphrodisiac uses, poisoning (in many forms).

Ruta chalepensis L.

Urinary retention, eye diseases, night blindness, deafness, nasal disorder(epistaxis), ear pest, constipation, epilepsy, Rectal prolapse, relapsing fever, miscarriage, snake bite (leaf powder with other components or whole plants boiled, decoction with honey); Mental illness/Exorcise evil spirit, stomach distention, gastritis, malaria, ascaris, venereal disease, whooping cough, trachoma, nasal affliction (whole plants powder, juice of leaves; root powder; smoke inhalation, fumigation).

Ocimum sp

whooping cough (leaf extract). *Rhamnus pirinoides* : Measles, infertility (bath in infusion with other ingredients).

Some of the reported applications of *Thymus* sp. are for the treatment of gonorrhea, cough, inflammation, spasm, thrombosis, urinary retention, mental illness, eye disease, toothache, stomach problems, leprosy, lung TB, acne, and ascaris (Abbink,1995). Zemede Asfaw and Mesfin Tadesse,(2001) mentioned the use of Thymus schimperi (Lamiaceae); O.gratissimum L.(Lamiaceae); Lippia javanica (Verbenaceae) as whole plant or / leaves/stem as condiments. Habtamu Hailu (2008) reported the marketing of *Ocimum basilicum, Lippia adoënsis* var. *koseret*; and *Rosmarinus officinalis* from the homegardens in the Sabata peri-urban town, South Western Shewa Zone of the Oromia Regional State, Ethiopia. Also Alevtina Gall and Zerihun Shenkute (2009) mentioned the medicinal use of *Ruta chalepensis (*Tenadam**)** in common cold, stomachache, diarrhea, influenza; Basil *Ocimum basilicum* (Besobila) in headache, malaria and an insect repellent. Tesfaye Awas and Sebsebe Demissew (2009) reported use of *Ocimum lamiifolium* Hochst., (Lamiaceae) Leaves for Cough, Ear diseases, Headache, Sexually transmitted diseases and also for fever of domestic animals; *Ruta chalepensis* L.(Rutaceae) Fruits & Leaves, for Abdominal pain, Dysentery and Fever of domestic animals. Moa Megersa (2010) reported *Ocimum urticifolium , Ruta chalepensis* for fibril illness, swelling and evil eye; , *Ruta chalepensis* for intestinal

parasite, diarrhea and stomachache; *Rhamnus prinoides* for tonsillitis.

It has been reported that the species of *Ocimum* commonly used in Ethiopia are wild *Ocimum africanum* and *Ocimum americanum*, which are different from *Ocimum basilicum* which is domesticated but closely related to these two (they can be identified on the basis of indumentum (hair distribution) and flower size), used as a spice and for medicinal purposes , also *Rosemarinus officinalis* L used as spice and also as a source of volatile oils; likewise *Thymus* sp used as condiments to flavour meat dishes, sausages and tea and as medicine (Inga Hedberg *et al*.2006).

Some recent research has demonstrated the basis of medicinal properties of some of these species (al-Said, M. S., *et al.* 1990; Asfaw *et al*,2000, Fullas,2003). The antioxidant effect of the ethanolic rosemary (*Rosmarinus officinalisL.*) extract on the oxidative stability of edible vegetable oils (Cordeiro,2013), *Thymus schimperi* having antioxidant activity and preservative effect when evaluated on soybean oil, butter and meat (Gebrehana Hailemariam and Shimelis Emire, 2013).
Also cosmetic use of *Impatiens tinctoria* was noted, women cook and pound the tubers into a paste and apply to the palms, hands and to the feet where it turns the skin strong, dark red and nails black and shiny. This treatment helps control fungal infections as well as toughen the skin (Inga Hedberg *et al*.2006).
Lippia adoensis: crushed leaves are also used to clean and to add fragrance to milk pots and other kitchen utensils. fragrant leaves are used by the Gurage and Oromo peoples as one of the condiments in the preparation of spiced butter (Inga Hedberg *et al*.2006).

The recent Workshop on plant conservation and local livelihoods in the High Atlas of Morocco (IUCN, 2013), the most used plants are medicinal, cosmetic, aromatic, artisanal and industrial species including Thyme (*Thymus satureioides*), rosemary (*Rosemarinus officinalis*), African pyrethrum (*Anacyclus pyrethrum*) and iris (e.g. *Iris reticulata*).

Culinary uses of the herbal species
Interviews with house wives buying the herbal spices from the market revealed that the use of herbs in major spice-mixes is an age old tradition in Ethiopia. This survey identified a wide variation in the components , especially in the use of herbs and in proportions among the the local housewives, it was noted that *Barbare* is prepared at homes from matured, dried and powdered red pepper and other components to cook "wot" (Curry). Another mix, *Mitmita* is also made of dried red pepper but is sprinkled on raw meat, injera, bread, or other cooked root/tubers/ crops just before eating. *Qoch-qoch* is used for similar purpose as *Mitmita*, but the main difference between *Mitmita* and *Qoch-qocha* is in the moisture content and shelf- life, *Mitmita* is made of all dried component so can stay for long period of time while *Qoch-qocha* is made of fresh ingredients so is wet and has short shelf- life. The variety and the number of ingredients used to make these differ widely among regions and cultures; the materials and proportions of ingredients are often used as indication of the quality, status and traditions of each home or family, these mixes being entirely homemade thus has no rigid standard recipe. Another traditional component in Ethiopian cooking is *Mekelesha* which is prepared separately and only used when the 'wot' cooking is almost completed, components in *Mekelesha* lose their quality and the purpose if they are kept on fire for longer time. One recipe from a traditional Oromia home traditionally uses the ingredients given in Table 5.

There are many web site which advertise and market the spices mixes (especially *barbere* and *mitmita*) in Ethiopia and in other countries including USA and UK), some sites providing the components and the process of preparation too. When compared, the internet recipes for blends *berbere and mitmita* , a number of very different component profiles were observed; also the recipe listed in Wikipedia differed

from the Ethiopian descriptions. Obviously many of these are commercial mixes, only with major ingredients which are easily available like paprika, chili pepper, fenugreek, coriander, ginger, cardamom, cloves, cinnamon, allspice, and nutmeg. Many commercial brands available in the market (through internet) were also only with major spice mix, as few as six (cf. Karl's *Berbere* Spice Blend : 3 Tbs. paprika Sweet , 2 Tbs. Spanish paprika, 1 Tbs. Indian chili power, 1 tsp. ajwain, 1 tsp. basil, dried, 1 tsp. cardamom seeds, 1 tsp. fenugreek, 1 tsp. ginger, powered, 1 tsp. nigella (black cumin). Also, Karl's *Mekelesha* Spice Blend:1 tsp. black pepper, ½ tsp. cardamom seeds, ½ tsp. cinnamon, power, ½ tsp. cumin, 4 cloves, whole, ¼ tsp. nutmeg, fresh grated). These are not at all like traditional *barbere/ Mekelesha* mix, but all these companies and restaurants use these terms. It was noted from the survey that *Mekelesha* (or *Wot Kimem*), added to the Ethiopian dishes as a "finishing" spice blend also prepared with different traditional herbal components and combinations, while most commercial/internet versions had : black pepper, cardamom, cinnamon, cloves, cumin and nutmeg. Many housewives and also in internet recipes often mentioned 'other components' or 'sebet qimen' or seven spices or 'dried leaves' but the answer to the question what these other spice elements often not clear.

Discussion

Species of herbal spices plants: strengthening diversity of home production system

Homes are important production units in traditional production systems, farmers often use home gardens as site of introduction, experimentation and domestication of plants (Engels, 2002; Shrestha *et al.*, 2002; Shrestha *et al.*,2004). In the study area, more than 80% households belong to the small farmers having 6- 25 species in their home gardens (Olika, 2013), the seed and planting materials of home garden species here and in other regions are maintained by the owners of the home garden themselves (Rana *et al*; 1998; Shrestha,1998; Sunwar, 2003). It was also observed that the selection, collection and management of the desirable species for home gardens was done by the women. One important aspect of this traditional agriculture identified in the study area is its high level of diversification both in the components (cereals, pulses, vegetables, tree/shrub crops, spices, animals and off farm activities) and also in species composition. Each household has several species of animals, wide diversity of trees/shrubs and herb, thus contribution to the household's livelihood comes from varied and diverse sources providing an inborn stability from various alternatives (Olika, 2013).

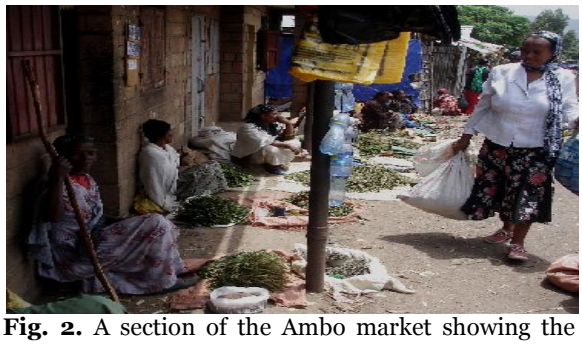

Fig. 2. A section of the Ambo market showing the herbal spices sellers with their products.

The useful role of home gardens to the conservation of biological diversity and sustainable development strategies by improving household food production, nutritional status, income and biodiversity management has been recently documented (Cleveland and Soleri, 1987; Albuquerque *et al.*2005, Fraser *et al.*2011, Innerhofer & Bernhardt 2011). Likewise, the women's tradition in the maintenance of home gardens, both materially and symbolically, has also been recognized (Tapia and De la Torre 1998). In the Ambo villages, all the management work including marketing of the herbal species done by women, the production is rain-fed, the herbal species always planted near kitchen, the waste water from kitchen provide necessary water for survival in the dry season. The species being wild need little fertilizers, for soil fertility improvement, most farms visited had vegetable plots in areas with high nutrient concentrations, such as kitchen waste dumping sites, cattle sheds and home yard margins. Not only in Ethiopia, women's particular responsibility for the

management of home gardens has been extensively documented in other parts of the world (Boncodin and Vega, 1999. It has been observed that in the hill and mountain regions of Nepal, women play an important role in the management as well as benefit sharing from home gardens, due to their responsibility in ensuring household food security (Subedi, *et al*.,2004), who reported a total of 20 different species of spices have been recorded, out of them different varieties of chilli, ginger, garlic, onion, turmeric, perilla, and coriander are the most frequently grown spices in Nepal. The role of women in the informal sector is especially strong and as domestic production is dominated by smallholders, there will always be a need for an informal market, again dominated by the women, so both the producer and consumers are benefited, as much lower entry costs are involved.

Fig. 3. A home garden of a poor farmer growing spice herbs and enset behind her cottege.

As traditional farming systems, homes are among the oldest agro-ecosystems that continue to exist and sustain throughout the world (Soemarwoto, 1987; Karyono, 2000; Okigbo, 1990; Millat-e-Mustafa, 1997, Soemarwoto and Conway, 1992) with rich species diversity that is of immediate use in the homes is the most prominent feature of home gardens (Soemarwoto, 1987; Hoggerbrugge and Fresco, 1993). Thus, home gardens can contribute not only to the additional income to the poor small farmers, also can play important role in attaining food security and adaptation to changes. Ethiopian agriculture contributes about 43% of the Gross Domestic Product (GDP), 80% of employment and 90% of export (Demese *et al*., 2010), dominated by small holder traditional farmers, improving agricultural production is of paramount importance for the country's economic progress(World Bank 2006, 2010). Most Ethiopians depend on subsistence rainfed agriculture as source of their livelihoods (CSA, 2008/09, Tilaye, 2010) and thus are readily vulnerable to climate change impacts (IPCC, 2007). The mixed farming system with cereals crops, herbs/vegetable/horticulture, livestock and trees / shrubs, all the components are climate dependant, the Ethiopian communities are more vulnerable because their livelihoods are highly sensitive to changes in rainfall and temperature and depend on finite, natural resources (Olika, 2013, Olika and Zuberi, 2013. Ethiopian farmers and pastoralists have already been hit hard by climate variability, losing harvests and livestock to drought, watching floods destroy vital infrastructure, and struggling to grow staple crops amid changing rainfall patterns (Conway and Schipper, 2011). Any agricultural failure directly exacerbates poverty and food insecurity , with intensifying climate change and environmental degradation, the rural communities are now facing big challenges (DFID, 2005). Under such situation, traditional home gardens provide a sustainable agricultural practice, environmentally friendly and providing diverse products to support the poor farmers under stress. (Zemede Asfaw and Ayele Nigatu,1995; Zemede Asfaw, 1997, 2001a and 2001b; Feleke Woldeyes, 2000: Belachew Wassihum *et al*., 2003 and Talemos Seta, 2007). Here also in the present study, the herbal spices can be a good sub-sector, most of these species are weedy and have a broad range of altitudinal distribution (1250–2300 masl). They become abundant after short rain and their ability to grow fast and become harvestable within short periods makes them useful in sustaining homestead requirements in periods of dry seasons. In a very recent study (Mekonnen Amberber *et al*, 2014) the home gardens of a near by town of Holeta (located at 9°02‟ N and 38°29‟ E) , a total of 112 plant species belonging to 93 genera and 43 families were identified of which 35 were wild while 7 species

were domesticated, 13% were medicinal plants, but there was no mention of any spices producing herbal species except *Ocimum basilicum*. Thus, the group of herbal spice producing species seems to be a feature of the Ambo area.

The herbal species: what future awaiting for the innovative production

Ethiopia is one of the ten countries in the world where spices are used the most, in particular in meat-based recipes, also important, some spices are used both as culinary or medicinal products (Tadesse, 1991,1994). Jansen (1981) listed 12 spice plant species providing a detailed account of the taxonomy, husbandry, distribution, culinary and medicinal uses, and chemistry of these spices. Most of these spice species being grown in home gardens, his account included only two species, *Rhamnus prinoides, Thymus schimperi* found in the home gardens studied here. Goettsch (1991) in his account of spices germplasm of Ethiopia, emphasized that although spices are considered as minor crop, their significance for Ethiopian people can hardly be overestimated. Most of the spices in Ethiopia grown as field or garden crops, although some grow in the wild, while mentioning 12 spices, which originated in Ethiopia or were introduced very long ago and considered to be of importance: *Capsicum annuum* (red pepper) *berbere*; *Trigonella foenum-graecum* (fenugreek) *abish*; *Nigella sativa* (black cumin) *tikur azmud*; *Trachyspermum ammi* (Ethiopian caraway), *nech azmud*;*Coriandrum sativum* (coriander), dimbilal; *Aframomum korarima* (false cardamom); *korarima*; *Cuminum cyminum* (cumin); *kamun*; *Foeniculum vulgare* (fennel) *insilal*; *Pimpinella anisum* (anise) *insilal*; *Ruta chalepensis* (rue), *tena-addam*; *Ocimum basilicum* (basil), *basobila*, *Piper longum* (Indian long pepper), *timiz*; and *Rhamnus prinoides* (buckthorn), *gesho* (although '***gesho***' is not a typical spice, it is included since it is of extreme importance in the flavouring of beverages (Jansen, 1981). So it is obvious that the species reported in this study are not considered as 'formal spice' excepting *basobila*. This also point out that all the herbal species, *Basobila, Kosorot, addas, Tenadem*, *Masaro*t (*Teji sar*), *Sega matbasha,, aritta* and *Koddo* grown in the home gardens of Ambo area, are wild and semi wild. *However, basobila* may include two/three species as reported in the literature, one being cultivated *(O. basilicum),* this *and* rosemary may be escaped to the wild in the past. As observed in the study area, wild species shifted from their original wild habitats, are grown under less care, usually subjected to rather limited selection pressure and weak management at early stage of incipient domestication (Miller and Gross 2011). With time, intensive and long period of domestication often lead to genetic changes that render the plants concerned unable to survive unaided in the wild, a change which is not desirable to the very species. Because, over a long period of cycles of reproduction and adaptation, human selection causes cultivated populations to rapidly change morphologically and genetically from their wild progenitors (Clement, 1999 ; Emshwiller, 2006 ; Pickersgill, 2007), thus producing a continuum of plant populations, ranging from exploited wild plants to incipient domesticates to cultivated populations, the final product, the crop, eventually lost the ability to survive without human intervention (Clement, 1999 ; Pickersgill, 2007 ; Clement *et al.*,2010). Further study of the herbal species may identify such an array of different stages in domestication especially in *basobila* and *kosorot* which are more widely cultivated.

Fig. 4. Another home garden with spice species, wild vegetable (wild cabbage) and enset.

Other aspects of the production and use system of the herbal spices also need research and documentation

especially to assess their genetic diversity in the wild, in the cultivated populations and their conservation status. Where the species concerned are wild and semi-wild, an important possibility is to consider under what conditions the domestication could be a viable option for sustainable production . Also, knowledge of the genetic diversity of the species and ethnobotany could be useful in improving the selection and breeding strategies of local producers. Post-harvest techniques (including storage and processing) need to be improved and the knowledge diffused among the women in the villages to aid in the safe and wider consumption of these species. A combination of research and development interventions to support marketing systems could make the species of traditional herbs more appropriate to the eating habits of urban populations and could create, expand and raise the satisfaction of consumers in home and abroad. While most of the species are wild, some may have rudimentary agrobotanic and sociocultural evidence of anthropogenic influence, while many others seem to be in the pipeline towards developing into domesticated crops. The conservation and efficient utilization of wild plants has never been undertaken by any development-oriented agency nor by the agricultural sector in Ethiopia, there being no planned conservation program focused to this group either, so many species are endangered as a result of habitat destruction and genetic erosion (Ensermu Kelbessa *et al*. 1992). Following the course of domestication, increased improvement of these species through cultivation, selection, breeding will clearly bring smallholders greater opportunities in the future.

Fig. 5. Herbal spice species grown under near natural condition with little care in home gardens of Dalota near Ambo.

Herbs and spices used in most Ethiopian cooking are ingredients also used in traditional healing. The preparation of the spices for cooking requires skill, knowledge and care, not only for safe consumption but also to reflect the Ethiopian tradition. For example, *Tossegn* , Ethiopian Thyme is a good source of iron and is widely used in Ethiopian cooking, in tea as medicinal remedy to improve respiratory function, also widely used for all sauces (including pasta sauce). Like wise, *kosseret* is used as a spice mix in clarified butter and in seasoning oil, *Tena addam*, literally translates to 'Adam's health', is combined with *Besobela* to make *Berbere* also is used in most dairy products to season yogurt, cheese, is also used to flavor tea. But, as the compiled ethnobotanical information showed, all these species are also used widely in traditional medicine. Many of them have active ingredients which may interfere with modern medical drugs, an aspect which has important health implications (cf. Alevtina Gall and Zerihun Shenkute, 2009).

Fig. 6. Some dried leaves marketed in the Ambo hebal market.

The preliminary evidences from market analysis and commercialization of the herbal species documented here may go far beyond the impact on rural communities only but little research has been done on the contribution of these items to the urban and peri-urban livelihoods (Zuberi, 2012; Zuberi *et al*, 2013). Detailed study of the entire local supply chain of the herbal product and their stakeholders along with the

rural–urban linkages should be made (cf. Stoian, 2005; Shackleton *et al*., 2007, 2008). It can be imagined, as has been stated by the old farmers in the villages, when the supply of the wild resources (including the herbal spices) from forests being gradually diminished but the demand for herbal items traditionally used in cooking by the urban/peri-urban population remained, the market has been accessed by the poor mountain homestead producers. This indicates that farmers' knowledge and skill are not simply the knowledge of plant growing, use and their agronomy, but more often in the farmer's ability to execute a performance (cf.Stone, 2004; Richards,1989, 1993); often farmers can innovate in the face of extreme poverty and need finding out opportunities to utilize available resources and this performance, if prove successful becomes an opportunity adopted by the community at large (cf. Hildebrand, 2003). But we observed that this innovation and agricultural performance has a rather rigid boundary, in the peri-urban market (like in Ambo), the demand is limited and while more and more women farmers continue to expand their homestead production, there is a quick dampening of market, often products remained unsold and to be thrown away. Empirical studies have also shown that homegardens in remote villages tend to be cultivated for subsistence needs, whereas villages closer to urban centers plant them more for commercial production (Eyzaguirre and Linares 2004). In Ambo areas most of the herbal species have been grown for marketing, the poor families rarely make spice mixes like *barbere* or *mitmita* for own consumption. So, improved marketing and providing technical support for creating new opportunities for the rural poor in important.

Tradition and culture : wider implications - WTO, TRIPS and GI

Many citizens of Ambo proudly mentioned that, the use of the indigenous spice for food preparation is a part of the cultural heritage of Ethiopia, playing an important role in customs and traditions, also important in maintaining satisfaction and happiness within the family and also attested that the especial features in food and dishes on the family table depends largely on the women of the family. Not only in families, in many local food shops and restaurant there being demand for the special food items and has been a good business with cash income for the food producers or traders, which have to be maintained or increased by improved cultural practices and better processing of the products. Traditional recipes allow food to acquire its own language, fascination and thus developing into a complex cultural product shaped by the close interaction between the community, climate, plants/animals/spices, not over-emphasizing the need for good health, nutrition also for satisfaction and pleasure. The Ethiopian national dish, *wat* (hot curry / stew) accompanied by *injera* (traditional spongy pancake from *teff* a small grain grown on the Ethiopian highlands). Many varieties of *wat*, (chicken, beef, lamb, vegetables, lentils, and ground split peas) stewed with hot spice, *berbere ,* following different cooking methods. There is a wide diversity in the tradition of food preparation and demand for the ingredients especially the spices within Ethiopia, also there are large number of Ethiopian restaurants offering traditional food and many agencies/shops for marketing the spice – mix or spice like *barbere* and *mitmita* all over the world. This is a big business, about 300 or more such restaurants can be found for the USA (cf. internet sites http://www.restaurantsethiopia.com/usa or List of Ethiopian Restaurants in America-2005 www.EthiopianRestaurant.com or http://www.ethiopianrestaurant.com/).

As indicated from the results, there is a wide variation in the composition and components of the traditional spices like *barbere* and *mitmita*, but being associated with the local culture they have 'traditional recipe' for a region, ethnic group or family. But many commercial recipes are simply mixes of the major spices used in modern cooking, nothing like the Ethiopian traditional spice mixes. Here, another important aspect is apparent, the future implications

if continuation of the existing 'no control' situation for long, the Ethiopian culture of the traditional cuisines will ultimately become non-existent, the herbal spices production, use and trade will be threatened. As part of the obligations to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), Ethiopia should consider the geographical indication (GI) and its application to the traditional goods like the spice mixes and their herbal ingredient. As now well adopted by many parties, GI can be a name or sign used on certain products which corresponds to a specific geographical location or origin (e.g. a town, region, or country), this acting as a certification that the product possesses certain qualities, produced according to traditional methods, or enjoys a certain reputation, all due to the geographical origin. The key elements in the definition are : an indication to mark out the particular goods, a symbol or a word (like barbere or mitmita) , the goods must possess some distinctive quality or characteristic or reputation linked to the geographical region (like Ethiopia), reflecting a mix of environmental factors, human practice and cultural norms. The application requires documentation to help establish the distinctive qualities of the product in question and its link to the demarcated geographical region. In Ethiopia, despite the existence of the need for the protection of GIs, the issue of GIs has not been given due attention (Sileshi Bedasie, 2011). There are obvious rural development impacts of GI, some of which are : a structuring of the supply chain around the common product of reputation (cf barbere or mitmita), resulting in an increased price and stabilized production management for the GI product (WTO,2008) . This also expected to result in added value distributed through all the levels of the supply chain, thus contributing to sustainable utilization of the biodiversity or resources on which the product is based, ensure the preservation of the traditions and consumer satisfaction as well as health and nutritional needs. In 1994, negotiations on the WTO, governments of all WTO member countries (155 countries, by 10 May 2012) had agreed to set certain basic standards for the protection of GIs in all member countries. The accession process (initiated in 2003) has thus given impetus for Ethiopia to embark on a reform of its IP regime, which is being carried out in two fronts: the enactment of new IP laws in areas where little or none existed before, and revising existing IP law.

Recently (IUCN 2012), in IUCN Resolution WCC-2012-Res-092, notes that that local communities should not be treated any differently to other natural resource users, and discussions should focus more on the nature of resource management regimes rather than the actors carrying out the management, Community Resource Management (CRM) attempts to combine social, cultural, political, economic and ecological considerations to achieve desired conservation and livelihood outcomes outside protected areas, often under difficult political and economic circumstances. Required to adopt community-based natural resource management and conservation systems as traditional community-based management systems that support the conservation and sustainable use of natural resources by the local community, through adopting and applying local and traditional knowledge, and through customary institutions and regulations, but needs external help and support.

The production and trade of the home garden products like the spice producing herbal species that involves small-scale producers and low-income consumers is a ideal example of the ' informal sector', the benefits of the small-scale producers and consumers are important not only for them but also for the market and economy. So the analysis and understand how they make the existing market works and what are the spill-overs for extending or modifying the production and marketing system is needed before intervention . In an economy where there is high concern about food security from continuously rising food prices, resource constraints, climate change, globalization and urbanization with growing populations, this need of understanding the

linking small-scale farmers with modern value chains and formal markets (Vorley *et al.*2012) can never be over emphasized.

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