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The State of the Art of Traditional Herbal Medicine in the Eastern Mediterranean Coastal Region of Libya

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Abstract: Historical studies indicate that the eastern Mediterranean coastal region of Libya (Benghazi-Albaida-Sahahat-Derna-Tobruk) has been characterized by a rich inventory of herbal medicine. Contradictory, data presented in this cooperative study indicate that only 208 species out of 450 field-surveyed and 101 intervieweed-mentioned species (152 wild and 56 cultivated) were acknowledged by the local inhabitants to be used for disease treatment. Such high ratios may be considered as one of the richest regions of medicinal and aromatic plants, which are used in folkloric medicine and in the spice business. Ten out of 208 species identified in this article, have medicinal uses coincided with their characteristic features (the Doctorine of Signatures). Informants with good herbal knowledge live in the northern region, in which more practitioners were found to depond on their practice as a sole source of income. The total number of diseases mentioned together in all districts was 201 disease. Generally, the five districts significantly differed concerning the total number of the medicinal species and diseases mentioned by natives. The herbal remedies are simple in most cases and infusion, decoction, poultice or cataplasm, fomentation and hydrotherapy are the most dominant preparations in the study area. As a final conclusion the following must be taken into consideration: 1) the conservation of the medicinal plants in the region will be crucial to the continued availability of this threatens natural resource, 2) phytochemical and pharmacological studies must be completed in order to confirm the validity of the plant folk-medicinal use and 3) awareness of the local inhabitants with danger of loss of their surrounding plants and encourage them to increase their income without damaging of their ecosystems.

Key words: Conservation · Doctrine of signature · Eastern Mediterranean coastal region of Libya · Ethnomedicine · Medicinal plants · Traditional medicine

INTRODUCTION

The universal role of plants in the treatment of diseases is exemplified by their employment in all the major systems of medicine irrespective of their underlying philosophical premise [1]. Restrictly, plants have provided the basis for the great medical systems in human history. More than 60% of the world's people and 80% in developing countries depend directly on plants for their medicines. There are innumerable accounts of medicinal plant use by different communities around the world, living wholly within the natural world and crafting their survival from the facilities around them [2, 3]. During the last decade and between 1990 and 1994, considerable attention has focused not only on how plants are used, but also on how they are perceived and managed [4]. Recently, the medicinal plants, as endangered component of biodiversity, received special attention [5]. They are important health and economic components of the floras in the developed as well as the developing countries. The literature on quantitative ethno-ecology, management and conservation has been increased in recent years [6-9]. The medicinal plants are now considered within the global biodiversity strategy. They are termed the "sleeping giant" and will continue to be an important source of drugs because they are manufactured inexpensively and are a source of new products that are seemingly in exhaustive [10].

Libya supported one of the oldest civilizations of the world and has a long history of intense human occupation. Doubtless, the Libyans through successive eras depended on plants for food, fuel, fibers,

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constructions and folk medicine [11,12]. Indigenous people (natives) in the region of the eastern Mediterranean coast of Libya tend to be dependent on medicinal plants and often possess exceptional medicinal plant knowledge. However, exposure to modern culture, increased trade and access to modern conveniences (including modern medicines) are altering the distribution and extent of local knowledge and use of medicinal plants in these societies. Explicitly, the present study is an attempt to: 1) reveal the criteria used to identify a potential medicinal plant, 2) record the most dominant preparation techniques, 3) elucidate the status of the proficiency of herbalists in the region and 4) clarify the ethnomedicinal uses of different plant species in phytotherapy.

MATERIALS AND METHODS

Data were collected during years 2008-2010 from five different social communities (Benghazi (I); Albaida (II); Sahahat (III); Derna (IV) and Tobruk (V)) distributed along the north eastern Mediterranean coastal region of Libya (Fig.1). The following established techniques were applied for data collection in the present study:

Participant Observation Technique: That included living with people and sharing with them many facts of their life, from subsistence activities such as cooking, farming, or gathering firewood, to ritual occasions such as marriage, religious celebrations, or initiation rites. Such a way was applied partially in the present study whenever possible.

Interview Technique: the technique refers to asking people about their lifestyles through interview techniques named open-ended questionnaires, which may be used for quantitative analyses [13]. The informants give extensive responses to a series of general questions, some of which have been prepared in advance and some of which arise naturally during the course of the conversation. A total of 101 household (Benghazi 31, El-Baida 26, Sahahat 19, Derna 15 and Tubruk 10 individuals) were interviewed in the five districts. Informants were carried out separately for each individual in the same household. Usually men were in the first category but in some cases women were also interviewed. Plant specimens were collected when available and nomenclature followed Ali and Jafri [14], Jafri and El-Gadi [15] and El-Gadi [16]. Wherever possible, identification was confirmed by comparing with the authentically identified specimens in the herbarium. The voucher specimens have been deposited in the Omar El-Mukhtar Herbarium, Botany Department, Omar El-Mukhtar University.

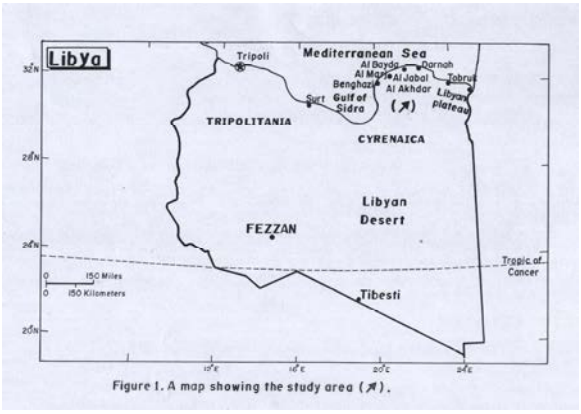

Fig 1: A Map Showing the Study Area.

RESULTS

Criteria Used to Identify Potential Medicinal Plants: A significant number of plants used by the informants and herbalists in the present survey are linked to the "Doctrine of Signatures" which implies that plants have specific characteristics that can disclose their medicinal use. These characters may be the flower and fruit colour, the shape of the root, the taste of the juice (bitter, sour, sweet… etc), seed shape, the habitat and in some times the common names in Arabic may refer to its use (e.g. *Citrullus colocynthis, Ecballium elaterium, Helichrysum stoechas, Myrtus communis, Ammi visnaga* etc*)*. According to this theory 10 out of 208 species identified in this article, have medicinal uses coincided with their features.

Preparation Techniques: The simple formula (one plant species is used to treat a certain disease) is the most dominant herbal formula in the present study. Mixtures from plant species (complex herbal formula) were rarely used. Several techniques are used by traditional herbalists to obtain the beneficial phytochemical components from the selected species. The majority of botanically based remedies are consumed orally in the form of teas. The tea is generally produced from the various parts of the herbs through infusion or as decoctions. Heating the crude plant in a liquid medium not only aids the extraction and concentration of active substances, it also acts to eliminate poisons and impurities prior to consumption. In some cases, local remedies by hot suspension of crushed plant parts to create a medicinal paste or plaster were applied. The resulting crush was wrapped in gauze and placed directly on wounds, bruises, knees, chest,

burns, insect and animal bites, rashes, swellings, wrinkles or dermatological irritations. Local remedies were also applied through fomentation. A towel is soaked in an infusion or decoction, wring out the excess and apply as hot as possible to the area of pain. A fomentation has about the same application as a poultice but is generally less effective [e.g. *Seriphidium herba-album* (shoots), *Deverra tortusa* (shoots), *Zea mays* (corn silk) and *Hordeum vulgare* (grains)]. Full bath preparations were also applied for aged people suffering from neurasthenia (e.g. *Haplophyllum tuberculatum* and *Eucalyptus gomphocephala*) and rheumatic pains (e.g. *Astragalus spinosus*, *Marrubium vulgare*, *Teucrium polium*) and tubers of (*Asphodelus microcarpus*). Such baths are calming and soothing to the nerves and can also be helpful for bladder and urinary problems. The use of *Reaumuria hirtella* in hot full bath to eliminate body wastes and toxins was also applied by some people. After in hot baths the individual must be bundled in blankets from the neck down. The sitting in a relatively small amount of warm water mixed with the decoction of *Seriphidium herba-album* and *Globularia alypum* was found beneficial for genitor-urinary tract, lower abdomen and rectum. Another important method mentioned in the study area was the preparation and use of ointment to treat some diseases. For example, the bulbils of the *Allium sativum* cooked on water vapor then mixed with olive oil to prepare an ointment to treat piles. The roots of *Echinops galalensis* are burned and the resulted ash mixed with olive oil for arthritis. The seeds of *Citrullus colocynthis* ground and mixed with olive oil and small amount of kerosene to make an ointment for lumbago. The powder of *Marrubium vulgare* leaves spread on the burns after its painting by olive oil.

The Status of the Know-How (Proficiency) of Herbalists in the Region: The present study revealed that most of the practitioners do not have any formal education in the field of medicine and pharmacy where traditional healers acquire their positions through inheritance ('transmission'). It is believed that these skills and abilities are passed down from generation to generation through family lines, visions, stories, talks and advices rather than also by training and apprenticeship. In regard to the status of the know-how (proficiency) of herbalists, unfortunately, herbal medicine in the region is mostly prescribed by herbalists and herb sellers symptomatically based on signs and symptoms alone, rather than as a result of a full understanding of the underlying disease. A total of 101 (81 men and 20 women) households were interviewed in the five districts but many of them were excluded from the survey because their know-how was very limited. Only ten professional practitioners are still practicing. Each interviewee has his own methods of preparation, following the tradition of his parents or teachers.

The scope of experience of those surveyed practitioners varied greatly, depending upon their district. Informants with good herbal knowledge live in the northern region, in which more practitioners were found to depend on their practice as a sole source of income. Summarily, the status of the herbalists according to the present survey is listed below:

- Most practitioners have very limited knowledge in the identification of species and procedures for preparing medicinal remedies.
- Younger practitioners were even less experienced than their older counterparts, indicating that traditional knowledge is being partially lost with new generations.
- The level of education of practitioners is in decline, probably due to the shifting from folk to biomedical therapies.
- Plant mixtures are of poorer quality and less variety in comparison to the past. Moreover, plant species used in certain regions are not used in others. For example, local practitioners from Tobruk area use only plant species found in the desert while those of Benghazi prepared remedies from 'Attarah' shops, where plant materials are sold and do not collect plants from natural sources.
- A very limited exchange of information takes place between the healers in the same area. The occupation of traditional healer is a family matter and passed on by inheritance; therefore, when the present generation of healers dies, the know-how may die with it because children of the practitioners have no interest in the subject.

Ethnomedicinal Knowledge: Table 1 showed the medicinal uses, parts used and methods of preparations of some selected plant species in the study area. The total number of medicinal species mentioned together in all districts was 208 including 152 wild and 56 cultivated. On the other hand, the total number of diseases mentioned together in all districts was 201 diseases. Generally, the five districts significantly differed concerning the total number of the medicinal species and diseases mentioned by natives. A detailed complete list of medicinal plants and the

Table 1: Number of plant species, informants and diseases in each location of the study area.

Location	Number of plant species	Number of informants	Number of diseases
Benghazi	122	31	134
Albaida	111	26	117
Sahahat	96	19	109
Derna	88	15	96
Tobruk	54	10	66

Table 2: Medicinal uses of some selected plant species in the eastern Mediterranean region of Libya.

Medicinal use	Species	Parts used	Preparation
Gastritis	*Ajuga iva*	Shoot	Decoction - Infusion
	Arbutus pavarii	Leaves - Fruits	Decoction – Eaten fresh
	Ballota pseudodictamnus	Shoot	Decoction
	Cistus salvifolius	Leaves	Decoction
	Globularia alypum	Shoot	Decoction- Hot infusion
	Juniperus phoenicea	Leaves	Decoction
	Matricaria aurea	Flowers	Hot infusion
	Pistachia lentiscus	Leaves	Decoction - chewing
	Rhus tripartita	Shoot - Bark	Decoction
	Viburnum tinus	Fruits	Hot infusion – Eaten fresh
	Cymbopogan schoenanthus	Shoot	Hot infusion - Decoction
Anti-tumer	*Capparis spinosa*	shoot	Decoction
	Retama raetam	Fruits	Hot infusion – powder
	Astragalus spinosus	Leaves	Decoction
	Lonicera etrusca	Leaves	Decoction
Renal stones	*Alhagi groecorum*	Whole plant	Decoction
	Convolvulus arvensis	Shoot	Decoction
	Seriphidium herba-album	Shoot	Decoction
	Hordeum vulgare	Grains	Decoction
	Emex spinosus	Leaves	Decoction
	Marrubium alysson	Shoot	Decoction
	Peganum harmala	Seeds	Powder
	Helichrysum stoechas	Shoot	Decoction
	Polygonum equisetiforme	Shoot	Decoction
	Teucrium polium	Whole plant	Decoction
	Zea mays	Corn silk	Hot infusion
	Phagnalon rupestre	Shoot	Decoction
4- Colitis	*Ballota pseudodictamnus*	Leaves	Decoction
	Achillea santolina	Flowering shoots	Hot infusion
	Alhagi groecorum	Shoot	Decoction
	Pistachia lentiscus	Leaves	Decoction
	Lotus tetragonolobus	Whole plant - fruits	Hot infusion- Eaten fresh
	Polygonum equisetiforme	Shoot	Decoction
	Punica granatum	Bark	Decoction
	Teucrium polium	Whole plant	Hot infusion
5- Arthritis	*Asphodelus aestivus*	Roots	Externally
	Citrullus colocynthis	Fruits	Externally
	Thapsia garganica	Roots	Decoction
	Marrubium alysson	Shoot	Hot infusion
	Peganum harmala	Seeds	Powder
	Solanum nigrum	Fruits	Externally
	Thymus capitatus	Oil	Massage
6- Hepatitis B&C	*Ecballium elaterium*	Fruit juice	Orally in cold water
	Citrullus colocynthis	Fruit Juice	Orally in cold water

Table 3: Medicinal herb used to treat diabetes in the eastern Mediterranean region of Libya.

Plant species	Preparation	Additional uses
Ajuga iva	Decoction and infusion	Diarrhea, gastritis, ulcer and vermicide
Balanitis aegyptiaca	Decoction and eaten fresh	Liver diseases
Caralluma europaea	Powder and eaten fresh	Hair-fall
Cassia alexandrina	Legume and leaves	Constipation and blood purification
Cyclamen rohlfsianum	Leaves and tuberous	Anaemia and abscess
Cymbopogan schoenanthus	Shoot	Colic, prostatitis, cough and urinary tract infection
Eruca sativa	Leaves	Diuretic, jaundice and menstruation
Marrubium vulgare	Shoots and leaves	Arthritis, rheumatic and dermatitis
Myrtus communis	Leaves and fruits	Gingivitis, gastritis and liver diseases
Polygonium equisetiforme	Shoot and roots	Renal stones, rheumatic and wounds
Retama raetam	Shoots	Sinusitis, anti-tumer
Salix subserrata	Leaves	Anticancer, fever, enuresis and gastritis
Teucrium polium	Shoots and leaves	Thyroiditis, anaemia, hypertension and renal stones
Thymus capitatus	Shoots and leaves	Common cold, cough, vermicide and expectorant
Zygophyllum album	Leaves	Hypertension and flatulence

Table 4: Medicinal herb used to treat skin diseases in the eastern Mediterranean region of Libya.

Plant species	Preparation	Additional uses
Achillea santolina	Decoction	Toothache
Arum cyreanicum	Decoction	Psoriasis, corn and bone spur
Asparagus stipularis	Decoction	Allergy and prostatis
Asphodelus aestivus	Juice	Arthritis, rheumatic and ovulation
Cictanche violacea	Powder, decoction and ointment	Diuretic, renal stones and diarrhea
Convolvulus arvensis	Decoction, gargle	Varicose veins, gingivitis and rheumatic
Euphorbia paralias	Juice	Rheumatic
Lycium europaeum	Powder	Rheumatic and constipation
Matricaria aurea	Decoction and douche	Gastritis, menstruation, colic and diuretic
Nerium oleander	Decoction	Psoriasis
Pistachia lentiscus	Decoction and chewing	Colic, gastritis, piles, gingivitis and colitis
Quercus coccifera	Decoction	Cough, hypertension, ulcer and diarrhea
Ruta chalepensis	Decoction	Earache, menstruation and headache
Smilax aspera	Decoction	Blood purification
Solanum nigrum	Decoction and douche	Arthritis, rheumatic and diuretic
Urginea maritima	Juice, macerated and local packs	Back pain, rheumatic, bone spur and vulnerary

treated diseases in each district may be requested from the first author. Some informants recommended the use of *Reaumuria hirtella* as anti-poisonous and for snake bite. *Citrullus colocynthis* is used by sheep and goats when suffers from constipation and *Acacia* spp. in case of diarrhea. Interestingly, some informants suggested the use of *Alhagi groecorum* for sex promotion and fertility in males and as cleaner for the urinary tract, *Retama raetam* and *Capparis spinosa* as anti-tumor and *Ecballium elaterium* for hepatitis B and C and inflammatory liver diseases. In the same context, *Achillea santolina* is used to treat anemia, loss of appetite, bronchitis, colitis, coronary artery, diabetes, herpes and hypertension and *Olea europaea* for diabetes, hypertension, anti-cholesterolic and as immune booster. On the other hand, one may conceive the use of a group of plant species to treat specific diseases (Table 2) such as Gastritis (e.g. *Arbutus pavarii*, *Pistacia lentiscus*, *Rhus tripartita*), renal stones (e.g. *Phagnalon rupestre*, *Helichrysum stoechas*), colitis (e.g. *Teucrium polium*, *Ballota pseudodictamnus*, *Achillea santolina*), arthritis (e.g. *Thapsia garganica*, *Thymus capitatus*, *Citrullus colocynthis*) and conjunctivitis (e.g. *Reaumuaria hirtella*, *Allium cepa*, *Seriphidium herba-album*). Table 3 lists a number of plant species that have been used traditionally to treat diabetes in study area, while Table 4 summarizes a partial list of plants prescribed by informants for treating skin disorders. Surprisingly, some plants (e.g. *Lathyrus aphaca* and *Arisarum vulgare*) which are recorded in early Arabic and Islamic medicine, Chinese, Indian and in Europe for long time were not being used in the surveyed area.

DISCUSSION

The use of plants for medicines around the world vastly exceeds the use of modern synthetic drugs and appreciated in pharmaceutical research as a major resource for new medicines [17, 18, 19]. Rossato *et al.* [7] confirmed that medicinal plants are usually an important category for native peoples everywhere. The crucial role played by these plants, to sustain the requirements of local inhabitants in different life styles, is an unquestionable fact that will still be a major subject for future research [20, 21]. There is a great wealth of knowledge concerning the medicinal, narcotic and other properties of plants that is still transmitted orally from generation to generation by tribal societies. There is a pressing need to record such knowledge before it is lost forever [1]. The physical characteristics of the herb, including size, shape, color, texture, taste and habitat have traditionally served as important criteria in their selection for therapeutic purposes [22]. Doctrine of Signature is reflected in some of uses of certain herbs. For examples, plants with yellow fruits, or sap (e.g. *Citrullus colocynthis and Ecballium elaterium*) can be used to treat jaundice; those with yellow flowers and bitter taste (*Achillea santolina*) are used to treat spleen and blood disorders; those with kidney shaped seeds (reniform) (e.g. *Alhagi groecorum* and *Astragalus spinosus*) are used for treating kidney stones and urinary tract infections; those with root shape similar to human body or fruits that resemble human testis are used traditionally for stimulating sexual desire or treating sexual weakness (impotence) (e.g. *Astragalus spinosus*). For several herbs, the plant's common name in Arabic refers to its use. This is the case for *Ammi visnaga* for kidney stones (*Ammi* derived from the Greek word "Ammo" which mean "sand" indicating either the habitat or the main medicinal action of the plant); *Myrtus communis* L. (name in Arabic Eshbet Al-Suker) refers to its use to treat diabetes; *Matricaria chamomilla* for stomach aches; *Malva parviflora* (Khobbeiza) for constipation and wounds (Italians named it "Omnimorbia" which mean "treatment for all diseases"; *Nicotiana glauca* (Massasa = suck up) for abscess and *Achillea* spp. (named after using by the Greek hero "Achil" in some battles for healing the king wounds) for wounds. *Trigonella foenum-groecum* has a trifoliate leaf that supposedly bears a resemblance to the liver. Because of this, herbalist believed the plant to be effective in treating liver ailments. *Helichrysum stoechas* with a urine odor and yellow flowers is used to treat renal stones and urinary tract infections.

The indigenous knowledge related to the medicinal uses of plant species in the eastern Mediterranean coastal region of Libya is threatened. The region is undergoing remarkable urbanization together with the recent social changes causing the rural society to be less dependent on the environment, leading to a rapid and irreversible loss of the ethnobotanical heritage of the region. The informants held with natives in the present study indicate that a lot of their experience on medicinal plants has been passed on as indigenous knowledge from generation to generation via stories, talks and advises some others by spot observation and imitation of animal behavior. For example, *Seriphidium herba-album* is used as vermicide the patient should be outside of the home when they started decoction of the herb. *Citrullus colocynthis* is used by sheep and goats when they suffer from constipation and legumes of some *Acacia* spp. when suffering from diarrhea. The waral (an animal from reptiles) tends to wrap itself immediately before and during fighting snake with shoots of *Reaumuria hirtella* to safe guard against poison. Therefore, people there use *Reaumuria hirtella* as anti-poisonous agent. Interestingly to note the use of *Alhagi groecorum* for sex promotion and fertility in males and as cleaning agent for the urinary tract from the behavior of male camel which feed mainly on such species during the teaming time. Camels intensively feeding on this herb were found to have healthy livers. *Deverra tortusa* is consumed by goats and *Foeniculum vulgare* by snakes for sharp vision. One of the impressive stories mentioned by some informants was that related to the feeding of *Thapsia garganica* (poisonous herb) to sheep and goats. Herders force feed their animals with very light single diet from this herb to acquire them immunity against the poisonous matter inside the herb. Some informants reported that recently some traditional practices have taken by satellite receivers, television, radio and, to a lesser extent books. Otherwise, the continued and massive arrival of foreigners has also contributed applications and knowledge previously unknown in the area (e.g. herbal dose, increase the herbal efficacy, eliminate the side effects of the herbal formula and also how to select the plant organ to treat a certain disease).

The relatively high number of informants having good herbal information lives in the southern part (40-50km from the coast) in small villages and nomadic settlements which are less influenced by modern medical practices. It is evident that the study area of the current work since 30 years ago was one of the most ideal examples of desert communities in which the inhabitants

did not or a very little received a proper medical health care. Instead and to fill this gap, they have to use folk medicine formulae based on crude materials from their local environment. Infusions, decoctions, powders, teas, juices and others constitute the major of their medical activities and practices [23]. Unfortunately, one may report that recent different land-uses and urbanization and the loss of traditional knowledge through acculturation pretense twin challenges to the persistence of traditional medicinal plant use in the northeastern Mediterranean region of Libya. The obtained results are consistent with those recorded by El-Darier and El-Mogaspi [24]. Surprisingly, some plants that are common and recorded to herbal practice in early Arabic and Islamic medicine, Chinese, Indian and in Europe for long time are not used as herbal medicine in the surveyed area. The assertion of this phenomenon is beyond the available information of the present study. One may suggest that this may be due to unawareness of the inhabitants of the medicinal values of these species or it may be ascribed to lack of success in trials in ailment treatments.

From the ethnomedicinal point of view, it is difficult to confirm completely the present use of many plants in this study, as on some occasions the uses of plants were described very vaguely and in many cases the treatment had been forgotten. Otherwise, treatments were often described in the past tense, which may suggest that they be no longer used. Nevertheless, it seems that inhabitants maintain great faith in the curative properties of many plants, which are still used to treat minor ailments and for different other purposes of life. For these reasons a complimentary article is now in preparation to validate from scientific literatures the herbal remedies suggested by people in the study area. The total number of field-surveyed species in all districts was 450 species. Only 208 species were acknowledged by the local inhabitants to be used for disease treatment. Such high ratios may be considered as one of the richest regions of medicinal and aromatic plants, which are used in folkloric medicine and in the spice business. The primary cause of the decay of biodiversity is not direct human exploitation, but the habitat destruction that inevitably results from the expansion of human population and human activity [25]. The continued uncontrolled wood cutting, overgrazing and rain-fed farming for cultivation of annual crops in addition to other recent land uses such as intensive agriculture, obliteration of limestone ridges for brick making is endangering many plant and animal species [26]. In the habitat of sand dunes many specific problems related to different land uses and human activities is faced. Badi [12] and El-Darier and El-Mogaspi [24] stated that there is a severe degradation of major habitats resulting from poorly planned or unplanned coastal development. Who added that, the crowding of coastal villages, villas, chalets, lawns, gardens etc. has resulted in the disappearance of some important species such as, the sand-fixing *Ammophila arenaria*, potentially medicinal species such as *Pancratium maritimum* and *Centaurea pumilio* and the endemic *Arbutus pavarii*. The same trend was noticed by Rossato *et al*. [7] at Atlantic forests.

CONCLUSION

From the findings of the present survey we can conclude the following:

- The loss of these natural sites is a national disaster, which definitely affects the abundance, distribution and availability of medicinal plants in the eastern coastal region of Libya.
- The conservation of these sites will be crucial to the continued availability of traditional medicinal plants. Such conservation will require a new policy in economy, socio-economy, agriculture and constructions to relieve and minimize the risk upon these areas.
- Much more research is still needed concerning exploitation and conservation technique for the medicinal plants in the area.
- The local communities must attended courses or meetings with the specialists in herbal medicines to define their needs for plant resources more clearly; the use, manage and conserve the resources of their environments (ecological awareness).
- Increase efforts towards the conservation of the gene pools of the medicinal plants in the region.
- It is a matter of urgency that this traditional knowledge and culture heritage in the region be recovered before it is completely lost.

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