Medicinal Plants of the Northern West Bank in Palestine: Diversity and Traditional Uses

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Medicinal and aromatic plants (MAP) are valuable sources of herbal products and they are used in local traditional medicine. Intensive collection of the MAP may threaten the conservation of globally significant MAP biodiversity rapidly. This paper discusses efforts to assess the traditional uses of MAPs by local people and the diversity status, including: Simpson's diversity index, relative abundance, frequency and density of the medicinal plants in the Northern West Bank in Palestine. The study is based on the data collected from seven representative sites of the northern part of the Palestinian West Bank using the belt transect survey method. In total 16 plant species were observed in the selected sites. Herbs are the most common plant spp. in all sites followed by shrubs and bushes. The site in the village of Sanour was considered the most diverse site with 0.79 D followed by the village of Hashemia with 0.73 D. The frequency of MAP spp. is ranged from 10 to 80%. Teucrium capitatum and Chiliadenus iphionoides were the most frequent spp. in the Taloza site. The relative abundance of different MAP plant species in all sites found that Urtica pilulifera have the highest frequency with 26.67%. This was followed by Chiliadenus iphionoides and Teucrium capitatum with 14.98% and 13.19%, respectively. Paronychia argentea was reported to have the least with 0.44%. The density of different plant species in all sites found that Urtica pilulifera have the highest with 960 plant/ha followed by Cenchrus ciliaris and Salvia dominica with 192 and 112, respectively. Crataegus aronia was reported to have the least with eight plant/ha. The surveyed MAP plant species were distributed among 12 families. Nine of the plants are chemophytes where two are shrubs and two hemicryptophytes and the other three plants are Geophytes tree and annual. The surveyed MAP plant species are well known for their medicinal properties and broadly used in traditional medicine in the target sites, in Palestine and in neighbouring countries. The traditional knowledge gathered through this research project can be used for effective in situ conservation of MAPs.

Keyword: MAP, relative abundance, frequency and density

Introduction

More than 80% of the world's population depends on medicinal and aromatic plants (MAPs) for their indigenous health care practice (Kalauni and Joshi n.d.). Over the past decade, there has been a dramatic increase in the demand for medicinal plants for use in medicine for some aspect of a primary health care needs (Valeggia and Snodgrass 2015). People used medicinal plants to fight against pandemics in the past and dependency of people on medicinal

plants might have increased in these days around the world as medicinal plants can be an alternative option to prevent some dangerous disease (Luo et al. 2020). The use and conservation of medicinal plants is folk-based and transmitted through generations in the form of community-based health traditions (Shukla and Gardner 2006). Most of the MAPs have commercial value and with the increasing demand for herbal drugs, natural health products, and secondary metabolites of medicinal plants, the use of medicinal plants is growing rapidly throughout the world (Cole et al. 2007). While cultivation of some commercial species occurs, wild stocks supply approximately 97% of the MAP market. The collection of wild stocks now threatens the conservation of globally significant MAP biodiversity and according to the International Union for Conservation of Nature and the World Wildlife Fund, about 15 000 species of MAPs are threatened with extinction from overharvesting and habitat destruction (Chen et al. 2016b). Palestine constitutes approximately 3% of the world's biodiversity (EQA 2020). At least 80 species of wild mammals are found in Palestine, and its reputation as a geographical and ecological crossroads is reinforced by the fact that 380 different species of birds can be identified there. Historic Palestine also is very rich in flora with over 4 500 species. The West Bank alone has over 1600 species. Approximately 800 of these plants are considered rare, and around 140 are endemic (PIBS 2021). Moreover, more than 700 of MAPs species in Palestine are noted for their uses as medicinal herbs or as botanical pesticides (Said et al. 2002). Since overgrazing and collection of wild stocks is now threatening this richness in biodiversity of the wild plants in general and MAPs in particular, efforts should be undertaken for MAP conservation and documentation. Therefore, this research was carried out to determine different MAP species that are found in the Northern West Bank and their abundance, status, vulnerable to extinction and medicinal importance.

FIGURE1
The Study Area

Methodology

The Study Area

A field survey was carried out during 2021 in north part of the West Bank lying between N32- 23 and N32 – 49 (Figure 1). In total seven sites were selected after consultation with local community and expertise. The sites were: Tammun, Tayaseer, Faqo'a, Hashimia, Sanour, Asera and Taloza.

The selected sites represent all patterns of the ecosystem in northern part of the Palestinian West Bank (Table 1). Range-

lands and scattered trees is the characteristic of the vegetation zone. The climate of the area is a semi-arid and dry climate. Rainfall ranges from 301 to 633.5 mm and elevation ranges from 230 to 550 meters above sea level.

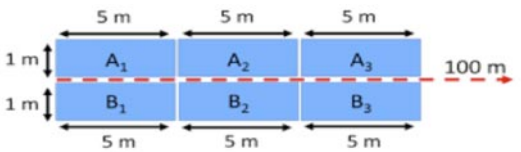
TABLE 1
Ecosystem, Elevation, coordinates and climate information for the selected sites

Sites	Ecosystem	Elevation	Coordinates	Rainfall (ml/year)
Tammun	Eastern slope	300	32°16'3" N 35°24'27" E	301
Tayaseer	Eastern slope	230	32°20'59" N 35°24'37" E	350
Faqo'a	Eastern slope	360	32°28'52" N 35°24'6" E	380
Hashimia	Simi costal	220	32°28'16" N 35°12'53" E	602
Sanour	Highlands	550	32°20'37" N 35°14'44" E	633.5
Asera	Highlands	540	32°16'36" N 35°16'20" E	588
Taloza	Highlands	400	32°16'36" N 35°17'60" E	601.1

Data Collection

The study is based on the data collected from the field using the belt transect survey method (Figure 2). This method provided data useful and efficient due to the time required to locate and place quadrats (Grant et al., 2004). The transect line was 100 m (two in each area) and was divided into equal intervals (20 m) and the quadrat in each point is 5m*5m

FIGURE 2
Transects Type and point count



The field work was carried out within two months from March to April, 2021. The data obtained were quantitatively analyzed. Frequency, Density and Relative abundance (Kutawa and Adi 2021) was analyzed noting in each quadrate how many individual species are present there and expressing this as a percentage of the total number of species in the quadrate. This is given by relative abundance = frequency of species / Sum of frequency of all species x 100 / 1

Frequency = number of times the species occur in the quadrants / total number of quadrants x 100 / 1

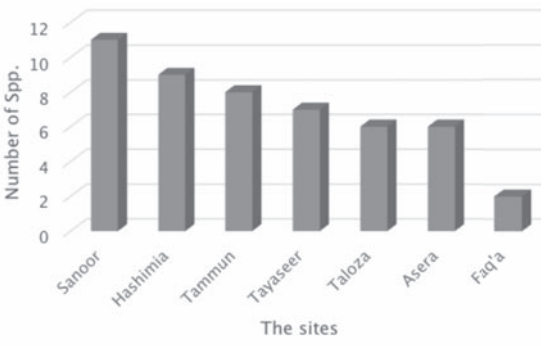
Density = total number of a species in all quadrants/hectar / total number of hectars studied x 100 / 1

Simpson's diversity index (SDI) was used to quantify the biodiversity of each site by calculating the number of species present, as well as the abundance and density of each species (Kotera et al. 2022). The range is from 0 to 1, where: high scores (close to 1) indicate high diversity and low scores (close to 0) indicate low diversity.

Where: n = number of individuals of each species and N = total number of individuals of all species. percent of plant availability in each site, plant density, number of spp. per each site and proportion of endemic and threatened medicinal plant species were also calculated.

Focus group meetings were conducted for the key farmers in the selected sites in order to document the important MAPs, their traditional usages, parts used for treating various diseases, and sources of collection. The plant species used for medicine were identified by local name. The scientific name was obtained by consulting the literature and expertise. (Xu et al. 2020)

FIGURE 3
Total number of spp. per each sites



Results and Discussion

In total 16 plant species were observed in the selected sites. Sanour village has the highest number of spp. per site (11 spp.), followed by Hashimia village (9 spp.) and Faqo'a village was the lowest (2 spp.) (Figure 4). This variation stems from the variation in the rain fall and from overgrazing. Cheng et al. (2011) found that long-term vegetation change in semi-arid grasslands responds to both climatic variability and grazing pressure.

Herbs are the most occurrence plant spp. in all sites followed by shrubs and bushes (Figure 4).

Sanour site is considered the most diverse site with 0.79 D, followed by Hashemia with 0.73 D. The frequency of MAPs spp.ranged from 10 to 80%. Teucrium capitatum and Chiliadenus iphionoides were the most frequent spp. in Taloza site (Table 2).

The relative abundance of different MAP plant species in all sites found that Urtica pilulifera have the highest amount with 26.67%. This was followed by Chiliadenus iphionoides and Teucrium capitatum with 14.98% and 13.19%, respectively. Paronychia argentea was reported to have the least with 0.44%. The density of different plant species in all sites found that Urtica pilulifera have the highest amount with 960 plant/ha followed by Cenchrus ciliaris and Salvia dominica with 192 and 112, respectively. Crataegus aronia was reported to have the least with 8 plant/ha (Table

FIGURE 4
Proportion of medicinal plant species by occurrence

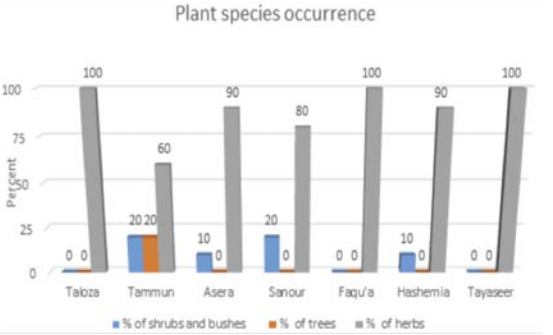


TABLE 2
Frequency percent and diversity index of the MAPs

plants	Taloza	Sanour	Asera	Tammun	Tayaseer	Faqo'a	Hashemia
Teucrium capitatum	100	35	80	20	55	60	40
Anchusa strigose		10	20	60	20	60	20
Urtica pilulifera					10		
Chiliadenus iphionoides	100	60	20	55	60		60
Crataegus aronia				20			10
Ephedra foeminea		15	10	30			10
Salvia dominica				20			
Arum palaestinum	10		50	30	30		
Ruta chalepensis	40	10			30		60
Micromeria fruticosa	20				20		
Origanum syriacum	10	40	70	10			50
Ruscus aculeatus		25					
Foeniculum vulgare		20					20
Paronychia argentea		10					
Cistus incanus		10					
Calamintha incana							35
Diversity index (D)	0.56	0.79	0.68	0.69	0.51	0.45	0.73

3). Relative abundance tends to conform to the specific patterns of plant macro-ecology and species richness is the key element of biodiversity (Bem et al. 2020).

TABLE 3
Relative abundance and density

Plants	Relative abundance (%)	Density /ha
Teucrium capitatum	13.19	49.6
Anchusa strigose	2.22	8.4
Urtica pilulifera	26.67	960
Chiliadenus iphionoides	14.98	60.48
Crataegus aronia	11.56	8
Ephedra foeminea	1.33	4.48
Salvia dominica	0.89	112
Arum palaestinum	3.11	14.08
Ruta chalepensis	6.67	48
Micromeria fruticosa	2.22	26.6
Origanum syriacum	6.10	31.3
Ruscus aculeatus	1.33	20
Foeniculum vulgare	1.78	14
Paronychia argentea	0.44	20
Cistus incanus	5.33	192
Calamintha incana	2.22	96

More than 90% of the surveyed MAP plant species are wild species and distributed among 12 families. Nine of the plants are chemophyte where two are shrubs and two are hemicryptophytes and the other three plants are Geophytes tree and annual (Table 4). This agrees with (Bem et al., 2020), where they found in Edremit Bay, Turkey that 99 of surveyed MAP plant species are wild and 19 species are cultivated plants.

The surveyed MAP plant species are well-known for their medicinal properties and broadly used in traditional medicine in the target sites, in Palestine and in neighbouring countries (Ali-Shtayeh et al. 2008; bu-Reidah et al. 2015; Ben-Arye et al. 2016; Baydoun et al. 2015; Said et al. 2005; Al-Kassie 2009 ;Marc et al. 2008 ; Stefkov 2011 ; Deeb et al. 2013) (Table 5).

Out of the total 16 plants, one species is considered as a very rare and it is under threat because of over collecting. One species is considered rare and four species are frequent, five are common and five are very common (Table 6). Origanum syriacum plant was ranked as priority for all of the farmers in the target sites.

Conclusion

This study documents data for ethnopharmacological knowledge regarding a segment of the medicinal plants in the Northern West Bank in Palestine. The abundance, density and diversity of medicinal plants as well as their local and scientific use and the priority for the farmers of the Northern West Bank are reported. The local knowledge and scientific experimental

TABLE 4
Family, abundance type and life form of the surveyed plants spp

Plants	Family	Abundance type	Life form
Anchusa strigose	Boraginaceae	Very common	Hemicryptophyte
Arum palaestinum	Araceae	frequent	Geophytes
Calamintha incana	Lamiaceae	Frequent	Chemophyte
Chiliadenus iphionoides	Asteraceae	common	Chemophyte
Cistus incanus	Cistaceae	Very common	Chemophyte
Crataegus aronia	Rosaceae	common	Tree
Ephedra foeminea	Ephedraceae	common	Shrubs
Foeniculum vulgare	Umbelliferae	Very common	Hemicryptophyte
Micromeria fruticose	Lamiaceae	frequent	Chemophyte
Origanum syriacum	Lamiaceae	common	Chemophyte
Paronychia argentea	Caryophyllaceae	Very common	Chemophyte
Ruscus aculeatus	Liliaceae	Very rare	Shrubs
Ruta chalepensis	Rutaceae	rare	Chomophyte
Salvia dominica	Lamiaceae	common	Chemophyte
Teucrium capitatum	Lamiaceae	Very common	Chemophyte
Urtica pilulifera	Urticaceae	frequent	Annual

TABLE 5
Scientific and Arabic name, used part, local use and scientific use of the selected MAPs

Teucrium capitatum	Je'da	Aerial part	Gastrointestinal disorders, inflammations, diabetes, and rheumatism	Anti-proliferative, anti-oxidant, anti-inflammatory activities. contain flavonoids with insulinotropic and anti-hyperglycemic effects on the lipid and carbohydrate metabolism in rats.
Anchusa strigosa	Himhim	Leaves	gastric protective effect, antimicrobial, hypotensive and antidiabetic effects	Anti-ulcer, for wound healing, as a tonic and tranquilizer, as a diuretic and for abdominal pain. It also used as diaphoretic antipyretic, narcotic, antipyretic, anti-rheumatic, cathartic, hypnotic and anti-arthritis
Urtica pilulifera	Qurras	Aerial part	nephritis, haematuria, jaundice, menorrhagia, arthritis and rheumatism.	Anti-bacterial, anti-oxidant, analgesic, anti-inflammatory, anti-viral, immunomodulatory, hepatoprotective, anti-colitis and anti-cancer effects.
Chiliadenus iphionoides	Ktailla	Aerial part	stomach ailments, diabetes, male and female fertility problems, eye infection, kidney stones, and as an anti-inflammatory	Anti-cancer, anti-diabetic, anti-microbial, anti-oxidant, antis-pasmodic, and anti-platelet activities which might be due to the excitant of flavonoids and phenolic compounds
Crataegus aronia	Za'ror	lower, fruit, leaves	cancer, diabetes and sexual weakness in Arab traditional medicine	cardiovascular diseases
Ephedra foeminea	Alanda	Aerial part	cancer patients	a reduced cytotoxic effect of chemotherapy on breast cancer cell cultures
Salvia dominica	Khwakha	Fruits and leaves		anti-inflammatory agents, anti-oxidant and anti-proliferative effects. Moreover, wound healing ointments are prepared from its leaf extract supporting the reported anti-microbial activity of isolated flavonoids
Arum palaestinum	Loof	Leaves		Anti-bacterial infection, urinary retention, kidney infections, cancer, poisoning and circulatory system

Ruta chalepensis	Faijan	Aerial part	convulsions, dropsy, fever, mental disorders, menstrual problems, microbial infections, neuralgia, rheumatism, and other bleeding and nervous disorders	analgesic, anthelmintic, anti-acetylcholinesterase, anticancer, anti-inflammatory, anti-microbial, anti-oxidant and anti-parasitic properties
Micromeria fruticosa	Ze'tman	Aerial part	abdominal pains, diarrhea, colds, wounds and skin infections	against heart diseases, anti-microbials, anti-fungals, anti-bacterials and anti-oxidants
Origanum syriacum	Za'tar	Aerial part	Against colds infections	treatment of toothache and oral inflammations, a carminative, digestive, diaphoretic, tonic, relief of arthritic joints and nervous headaches
Ruscus aculeatus	Oshbar Ramael	Aerial part	kidney stones and nephritis	Anti-microbial and anti-oxidant activity
Foeniculum vulgare	Shomer	Seeds, leavesd	carminative, digestive, lactogogue and diuretic and in treating respiratory and gastrointestinal disorders	Anti0fungal, anti-bacterial, anti-oxidant, anti-thrombotic and hepatoprotective activities
Paronychia argentea	Regel hamam	Aerial part	diabetes, kidney stones, anti-microbial	preventing urinary stone retention
Cistus incanus	Lubad	Aerial part	galactagogue, emollient, purgative and diuretic	Anti-fungal, anti-bacterial, anthelmintic, anti-schistosomial activity
Calamintha incana	Za'tar Zahef	Aerial part	including anti-microbial, anti-oxidant and anti-inflammatory, as well as anti-ulcer and insecticidal properties	toxic effects of oxidants or from bacteria and fungi

TABLE 6
Priority for the farmers, Plant propagation and Threatened level

Plants	Arabic name	Proiarity rank	Threatened level	Plant propagation
Teucrium capitatum	جعدة	7	Low	Seeds / leaves
Anchusa strigosa	حمحم	2	Medium	
Urtica pilulifera	قريص	2	Medium	Seeds
Chiliadenus iphionoides	كتيلة	7	Low	Seeds / leaves
FEphedra foeminea	علندة	2	Medium	Seeds
Salvia dominica	خويخة	4	Medium	
Arum palaestinum	لوف	6	Medium	Bulbs
Ruta chalepensis	فيجن	4	Low	Seeds
Micromeria fruticosa	زعيتمان	9	Medium	Leaves
Origanum syriacum	زعتر	10	Medium	Seeds / leaves
Ruscus aculeatus	عشبة الرمل	8	High	Leaves
Foeniculum vulgare	شومر	7	Low	Seeds
Paronychia argentea	رجل الحمام	7	High	Leaves
Cenchrus ciliaris	لبيد	3	Low	Seeds
Calamintha incana	زعتر زاحف	8	Medium	Seeds

base can serve as an innovative and powerful discovery engine for newer, safer and affordable medicine. This study will also help in the conservation of the medicinal plants in Palestine.

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