Florapal an ethnobotanical website of Flora Palaestina reflects changing patterns of plant use in this region during the mid-20th to 21st century

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Research

Abstract

Background: Flora Palaestina, a term first used by Linnaeus in the 18th century, describes plants native to the Holy Land, today comprising Israel, Palestinian Authority (West Bank), Gaza and Western Jordan. Consisting of ca. 2750 species and 114 families these plants have a long history of traditional use by Jews and Arabs; a rich legacy rapidly being lost as societies develop and modernise. Construction of *Florapal* an open-access website describing ethnobotanical uses of 316 *Flora Palaestina* species provides an important tool for preserving and researching this unique resource.

Methods: Florapal contents are derived from combining previously unpublished surveys of plant use amongst Jewish and Arab populations in this region (1950-1979) with later surveys amongst the Arab population of West Bank and Gaza (1996-2016). Using separate but related information fields, *Florapal* preserves original descriptions of plant use, categorizes complaints/uses within defined body systems or states, and provides a potential interpretation of their mechanisms of action

Results: Analysis of 2319 specific complaints/uses described in the *Florapal* website shows a higher prevalence of plant use in earlier surveys compared to later ones for various infections, infectious diseases, general non-specific symptoms, and culinary uses. Later surveys show increased plant use for endocrine/metabolic, cardiac, and infertility conditions and veterinary uses. These findings suggest the continuing popularity and adaptation of plant use to changing patterns of morbidity and social development during survey periods.

Conclusions: Florapal an important educational resource preserves the historical legacy of plant use in this region, contributing to its conservation, research, and development

Keywords: Ethnobotany, Flora Palaestina, Florapal website

Background

Flora Palaestina is a botanical term used since the 18th century to describe plants native to the area of the Holy Land, today comprising Israel, the Palestinian Authority (West Bank and Gaza) and Western Jordan. First published as a botanical treatise in 1756 by Johan Strand and Carl Von Linne (Linnaeus) (Linne 1756) and based on earlier regional descriptions (Gronovius 1755, Hasselquist 1756, Celsius 1748), *Flora Palaestina* initially comprised some 600 native species. By the 20th century, following comprehensive systematic studies including those by Eig (Eig *et al.* 1931) and Zohary (Zohary & Feinbrum-Dothan 1985), *Flora Palaestina* comprised ca. 2470 species, based mostly on plants deposited in the Herbarium of the Hebrew University of Jerusalem. More recently, a quantitative assessment of the flora of the West Bank and Gaza documented 1,826 taxa, representing 686 genera and 108 families (Ali-Shtayeh *et al*. 2022).

Currently, *Flora Palaestina* includes ca. 2750 species and 114 families**.** This rich diversity in a relatively small area is attributed to the region`s unique position at the meeting of three phyto-geographical regions: Mediterranean, Irano-Turanian, and Saharo-Sudanian (Zohary & Feinbrum-Dothan 1986, Ali-Shtayeh *et al.* 2003, Ali-Shtayeh *et al.* 2025) and to its varied topography, climate and soil (Zohary 1973)**.** Since Biblical times the flora of this region has played an integral role in the region's inhabitants' religious, ritual and daily life (Post 1896, Post 1932-1933, Low 1924, Feliks 1981, Feliks 1994, Hareuvini 1984, Zohary 1988, Amar 2012, Ali-Shtayeh *et al.* 1997, Dafni & Block 2019). With some 100 species mentioned in the Bible and many descriptions in post Biblical literature including the Talmud, Mishna and Midrashic sources (Low I 1924, Rosner F 1977, Feliks 1981, Feliks 1994, Zohary 1988, Dafni & Block 2019), this information has provided important insights into the economic, cultural and historical uses of local species in antiquity. Over the following centuries traditional knowledge passed down verbally from generation to generation within local Arab communities and by Jewish immigrants to the region from Middle Eastern countries which share many of the same species, has provided valuable insights into the practical uses of hundreds of plants, trees and shrubs and their contribution to: agriculture, food, medicine (human and veterinary), cosmetics, perfumes, dyes, spices, ritual, raw materials for building, clothing, basket, rope-making etc. (Ali-Shtayeh & Abu Ghdeib 1999, Ali-Shtayeh *et al.* 1998, Ali-Shtayeh *et al.* 2000, Dafni *et al.* 1984, Lev 2006, Palevitch & Yaniv 1991, Said *et al.* 2002, Elachouri & Benaicha 2024).

Today, however, modern medical clinics have taken over the role once played by local healers while village economies formerly dependent on local plant resources have largely been replaced by manufactured and imported goods. Thus, a rich legacy of plant use acquired by Jews and Arabs over hundreds of years is rapidly being lost.

The current study, part of a larger project between Israeli and Palestinian researchers supported by USAID-MERC (United States Agency for International Development- Middle East Regional Cooperation Program: Award No. SIS70015G36010), attempts to address this valuable historical tradition in the following ways: firstly through the construction of *Florapal* (Flora Palaestina Ethnobotany 2025), an ethnobotanical web site providing for the first time in English a systematic and detailed description of the traditional uses of over 300 species of *Flora Palaestina*; secondly the use of descriptive statistics to summarise some of the key features of this data.

Information for the *Florapal* website is derived from two sources: the previously unpublished ethnobotanical surveys (in Hebrew) of the late Dr David Zaitschek of the School of Pharmacy, Hadassah-Hebrew University School of Medicine, Jerusalem, describing plant use amongst Jewish and Arab populations in this region from ca.1950 to 1979; surveys (in Arabic) conducted by the Biodiversity and Environmental Research Centre (BERC), Nablus Palestinian Authority (PA) documenting local plant use by the Palestinian population in the West Bank and Gaza from 1996 to early 2016 (Ali-Shtayeh *et al*. 2008, Ali-Shtayeh *et al*. 2011, Ali-Shtayeh *et al*. 2012, Ali-Shtayeh *et al*. 2013, Bar-Sela *et al*. 2014, Ali-Shtayeh *et al*. 2015, Ali-Shtayeh *et al*. 2016, Ben-Arye *et al*. 2016).

In ***Florapal*** these two valuable data sources are combined and presented for the first time in English with descriptions of traditional uses of 316 species native to this region. The web site uses an innovative approach to presenting this information by describing and categorizing the data in separate but related information fields that can be used both for research as well as educational and conservation purposes.

By comparing data from the early and later surveys we aimed to show how various species retained their traditional uses over a period of some 70 years and how ethnobotanical preferences changed as Jewish and Arab populations transitioned to a greater reliance on modern health care systems.

Our hypotheses are that ***Flora Palaestina*** an ethnobotanical website preserves an important historical legacy of plant use in this region, contributes to a greater understanding of how traditional plant use continues to adapt to societal changes and draws attention to their potential and important need to conserve species particularly those that are rare and endangered.

Materials and Methods

Construction of the *Florapal* web site

Data sources

Data for *Florapal* is derived from two sources; earlier ethnobotanical surveys described in the archival Zaitschek collection and later surveys carried out by the Biodiversity and Environmental Research Centre (BERC).

The Zaitschek Collection: This important archive was compiled by the late Dr David Zaitschek (1904-1990), a Slovakian born botanist, bacteriologist and pharmacognosist who from 1936 headed the botanical laboratories at the Dept of Botany, Hebrew University of Jerusalem (now part of the Alexander Silberman Institute of Life Sciences) and was later Director of the Dept of Pharmacognosy at the School of Pharmacy, Hadassah-Hebrew University School of Medicine, Jerusalem, which he helped establish in the 1950`s. The archive itself was based on ethnobotanical surveys carried out from ca.1950 (and possibly earlier) to ca.1979 by Prof Zaitschek himself and a team of Jewish and Arab interviewers (students of Prof Zaitschek) describing plant use amongst different ethnic communities in Israel, the West Bank and Gaza including local Palestinian Arab, Bedouin, Druze, Samaritan, and immigrant Jewish communities from around the Middle East and North Africa including Yemen and Persia. Containing traditional uses of over 500 species (including some entries only for a genus) the archive included 212 native *Flora Palaestina* species and ca. 300 introduced species originating from other parts of the Middle East, Asia, Europe, Africa, and the Americas. At the time of collection voucher specimens of all plants were deposited in Prof Zaitchek`s laboratory at the Hebrew University where they were identified by Prof Avinoam Danin (1939-2015), a leading botanist at the Hebrew University of Jerusalem, author of "*The Distribution Atlas of Plants in the Flora Palaestina Area*" (Danin 2004) and the on-line data base "*Flora of Israel and surrounding areas*" (Danin & Fragman-Sapir 2016).

The archive itself situated in Dr Zaitscheks laboratory consisted of a cardex containing several thousand, alphabetically indexed, handwritten notes in Hebrew (by Dr Zaitschek), some but not all of which were dated, describing plant uses. The rest of the collection included ca.3000 labelled dried plant voucher specimens and an extensive botanical library. Largely unpublished during Dr Zaitschek`s lifetime, the contents of the cardex were made available for research and study after he died in 1990, following a request to Dr Zaitschek`s family in 1995 by Prof Clara Heyn (1924-1998), Director of The National Herbarium, Hebrew University of Jerusalem and Dr Sarah Sallon, (lead author), Director of the Natural Medicine Research Centre (NMRC) at Hadassah Medical Organization.

The contents of the handwritten cardex were subsequently translated from Hebrew to English by NMRC staff (1995-2000) and then entered into a specially designed database, where it formed the basis of NMRC`s *"Middle Eastern Medicinal Plant Project*" (MEMP), an ethnobotanical, conservation, and educational program focusing on extant and extinct flora in this region (Sallon *et al.* 2008, Solowey *et al.* 2014, Tsalkovitch *et al.* 2015, Sallon *et al.* 2020, Gross-Balthazarda *et al.* 2021, Sallon *et al.* 2024). After the information was entered into the MEMP database, the cardex containing Prof Zaitschek`s original handwritten notes was returned by NMRC to the permanent Biological Collections (now the Herbarium Collection of The National Natural History Collections) at the Givat Ram campus of the Hebrew University Jerusalem, where the rest of the Zaitschek collection had previously been deposited in 1995.

The Biodiversity and Environmental Research Centre (BERC): This leading research institution, based in Til, Nablus, specializes in biodiversity, biotechnology, and environmental sustainability. With six state-of-the-art laboratory units, including molecular plant biology, plant health diagnostics, bio-exploration, microbiology, plant breeding, and water research, BERC plays a pivotal role in advancing sustainable agricultural practices. It also operates controlled greenhouse facilities, a gene bank, experimental fields, and botanical gardens to support research and innovation.

Between 1996 and 2016, BERC staff carried out ethnobotanical surveys in the West Bank and Gaza on the use of medicinal plants by local communities based on Traditional Arabic Palestinian Herbal Medicine (TAPHM) (Ali-Shtayeh *et al.* 2008, Ali-Shtayeh & Jamous 2008, Hussein *et al.* 2014). This information was used to establish the "Palestinian National Inventory of Medicinal Plants: West Bank and Gaza" (Ali Shtayeh *et al.* 2008), describing in Arabic the uses of 355 plants. It has also served as the basis for BERC`s focused in-vitro screening programs of selected species (Ali-Shatyeh & Abu Ghdeib 1999, Ali-Shtayeh *et al.* 1998, Ali-Shtayeh *et al.* 2000, Ali-Shtayeh *et al.* 2008, Husein *et al.* 2014, Husein *et al.* 2014). Voucher specimens of plants identified in the surveys were deposited at the BERC herbarium.

Plant selection

For species to be included in the *Florapal* website, only those in the Zaitschek and BERC collections considered native to the region were selected. This selection was based on the following sources: *"Flora Palaestina*" (Zohary & Feinbrum-Dothan 1986), the most comprehensive study on regional flora; the online database *Flora of Israel and the surrounding areas* (Danin & Fragman-Sapir 2016); and *The World`s Flora Online* (*World Flora Online* 2025).

A total of 228 species from the Zaitschek collection and 207 species described by BERC were selected as *Flora Palaestina* plants. Alien/invasive and/or introduced species in both collections and those in which only the genus was described were excluded from the *Florapal* website.

Website design

Florapal was designed using MySQL database, the standard database for internet use. PHP and JQUERY were used to create web pages, permitting user-friendly, easy access to data. An existing Content-Managing System (CMS), WordPress, was used to establish the site, which is in English but with colloquial plant common names also provided in Hebrew and Arabic. Information is presented using a relational structure based on multiple tables of related data with relationships between tables representing the "real world" multi-dimensions. This scheme includes all relevant tables and the correct relationship between them, permitting e.g., comparison of the use of a specific taxon from different sources or retrieval of all plants sharing a specific combination of medicinal attributes or uses. The structure, therefore, allows for a "normalization" approach where the schema can be refined so that data and data dependencies are preserved and make sense while enabling redundant data to be eliminated. Florapal website contents are freely available in the public domain and open to additional contributions using controlled access and entry passwords available through the principal investigators.

Species Page

Botanical data particularly from the archival Zaitschek collection was updated using currently accepted nomenclature to include the following information: scientific/botanical name: (genus, species), authority, family, synonyms, infra-specific rank and epithet (sub-species or variety if present); common/vernacular names: presented in English, Hebrew and Arabic characters with phonetic pronunciation (in Latin script) of Hebrew and Arabic words. Additional common names recorded by Zaitschek in other Middle Eastern languages, including Persian, are presented in a separate Notes section on the website (described below). As the same vernacular name may be applied to more than one scientific taxon, and a taxon may also be known by several vernacular names, these "many-to-many" relationships were avoided in the relational structure of the website by creating a separate entity that combined keys to both tables. This entity has a "one-to-one" relationship with the scientific taxon table and vernacular name table creating a valid downward link to both tables and facilitating questioning on either entity; Habitat and life form: this information was obtained from the online website "*Flora of Israel and surrounding areas*" (Danin & Fragman-Sapir 2016) with a link enabling the user to access additional botanical information not presented in *Florapal* including plant distribution and status (*frequent, common, occasional, rare, endangered, invasive,* etc.).

Ethnobotanical Page

Complaint/use. This field contains the original descriptions of plant use supplied by the informants. However as much of the information in the Zaitschek and BERC collections was duplicative, with similar or identical complaint/uses often described for the same species several times by different informants, this information was combined in *Florapal* into one "specific" entry and its source designated as either Z (Zaitchek), B (BERC) or ZB when the same "specific" complaint/use was described in both data sets.

On the website, site complaints/uses were further subdivided into medical and non-medical uses as follows:

Medical complaint/uses: A total of 300 specific medical complaints/uses are described on the website. Because Zaitschek's data often contains antiquated medical terms no longer in use today (e.g., dropsy, ischia, etc.), these terms, while preserved in the website, are accompanied in parentheses by a modern medical term and, if necessary, a further explanation in the **Notes** section (see below). BERC data generally uses only current medical terms.

Non-medical uses: these uses are described using terms based on the *Economic Botany Data Collection Standard* (Cook 1995) and include the following: food, spice, soap, dye, beverage, cosmetics, perfume, cleaning products, preservatives, animal care, (veterinary), agriculture, poison, insect repellent, and ceremonial/ ritual uses. The last term includes magical protection from the "evil eye", a use that takes into consideration local understanding of disease and illness, which may have relevance for traditional healers, and where an understanding of the logic of plant use in these emic (culture-specific) categories is

important for understanding their use in other medical and non-medical categories. Any plant uses not described above were placed in an "Other" category. A full list of medical and non-medical uses is described in the Glossary section on the main menu of the website.

Body system/state. This separate field categorizes each specific medical complaint/use within a defined body system (WHO International Classification of Diseases 1994), e.g., *Gastrointestinal, Respiratory, Nervous, Urogenital, Hematological,* etc. or in a broader health-related state/focus area, e.g., *Women`s Health, Men`s Health, Reproductive Health, Wound Healing,* etc. For non-medical uses, separate categories include *Culinary, Ritual, Veterinary, etc.*

A total of 30 medical and 7 non-medical categories (including "Other") are described on the website.

Glossary.
Action/interpretation This field interprets the possible mechanism of action underlying a plant's use, using either modern scientific terms to suggest potential bioactivity, e.g., *anti-inflammatory*, *anti-infective, anti-cancer,* etc., and/or standard herbal/ botanical terms, e.g., *carminative, cholagogue, demulcent,* etc. So, for example a plant described as a treatment for diabetes may be described in this field as having potentially "*hypoglycemic"* action, one used to treat high blood pressure as "*hypotensive*", inflammation as *anti-inflammatory,* infections as *anti-infective*, assisting digestion and/or reducing gas as *carminative,* improving liver function as *hepatic,* etc. (In the Zaitschek data herbal/botanical terms are sometimes used interchangeably with the complaint/use).

A total of 121 "actions" are listed and explained in the Glossary. However, while many of the plants described in the *Florapal* website have been the subject of scientific investigation, the website`s Disclaimer (see below) points out that the action/interpretation described in this field are speculative, have not been validated for the website and are not intended as scientific evidence or a recommendation for use.

Preparation/Administratio. This field describes the various ways a plant is prepared and administered for each specific complaint/use. It includes: plant part (26 different plant parts are listed and explained in the Glossary including root, stem, tuber inflorescence, leaves, fruit, gall, flowers etc.); type of preparation (16 different types of preparation are listed and explained in the Glossary including decoction, infusion, plaster, poultice, salve, suppository, tincture, gargle, compress etc.). When more than one preparation is described for a specific complaint/use, each "recipe" is numbered consecutively with any additional ingredients (e.g., other plants, minerals, organic and nonorganic compounds, animal parts, dung etc.) identified as far as possible and further explanations provided, if necessary, in the Notes section (see below).

Notes. This field contains additional information on a species, including other common names, e.g., in Persian and Arabic; historical and anecdotal details; descriptions and warnings relating to added ingredients in certain preparations; debates on accepted and/or unresolved names or synonyms; and conflicting opinions on whether a species is native Flora Palaestina or an introduced/ alien.

Cautions This field provides a limited summary of toxic, adverse, and allergic effects of species described on the website based on information from various sources in the public domain (Duke 2002, FDA Poisonous Plant Database 2022, European Food Safety Authority 2002, WebMD 2025).

Disclaimer The Disclaimer is presented on accessing the website, and the viewer must agree to the terms/conditions described below before access to *Florapal* is granted. It includes the following statement: "Information in the Cautions section is neither comprehensive nor error free; any copyrighted or privately owned material inadvertently included will be removed as soon as possible; the website does not itself recommend the use of these herbal preparations and if herbal preparations are taken, advice should first be taken from a qualified physician or pharmacist; if there are concerns about the toxicity of plants, the local Poison Control Centre should be contacted".

Search engine. On the Home page, ethnobotanical information can be obtained using the following searches:
1. Species: using either botanical/scientific name and/or common names in English, Hebrew, and Arabic.
2. Complaint/use (derived from a drop-down list of 300 Complaint /uses).
3. Action/interpretation (derived from a drop-down list of 121 actions).
4. Body System/state (derived from a drop-down list of 37 medical and non-medical categories).
(A search using criteria 2-4 provides a list of relevant species on the website)

Analysis of information on the Florapal website

To gain a better understanding of basic differences and similarities between the Zaitschek and BERC collections on the website, Excel files containing the website data, including the combined "specific" entries, were analysed using descriptive statistics. Value or cultural importance indices were not evaluated in the current study as they had been previously published elsewhere for BERC data, or in the case of the original Zaitschek data, will be published in the future. (See Discussion below).

Data analysis Evaluative count data were presented as percentages for each category of the variable described. Pearson`s Chi-squared non-parametric test was used for differences in proportions between two categorical variables. All statistical tests applied were two-tailed, with a p-value of 5% or less considered statistically significant

Results

A total of 316 species were included on the website, of which 228 were described by Zaitschek (Z) and 207 by BERC (B). Of these, 109 species were described only by Z, 88 only by B (total 197 species), and the remaining 119 by both Z and B. (Fig. 1).

For the 316 species, a total of 2319 specific complaint/use entries were described. Of these 1482 (64%) complaints were described by Z, and 837 (36%) complaints by B (*p>0.001*).

Of the 119 species described by both Z and B there were 1575 (68%) specific complaint/use entries (out of the total 2319 specific complaint/uses) of which 915 (58%) were described only by Z, 498 (32%) only by B *(p>0.001*), and 81 (10%) by both Z and B. Of the 197 species described either by Z (109 species) or B (88 species) (but not both), there was a total of 744 specific complaint/use entries, of which 486 (65%) were described by Z and 258 (34.6%) by B. (Fig.1)

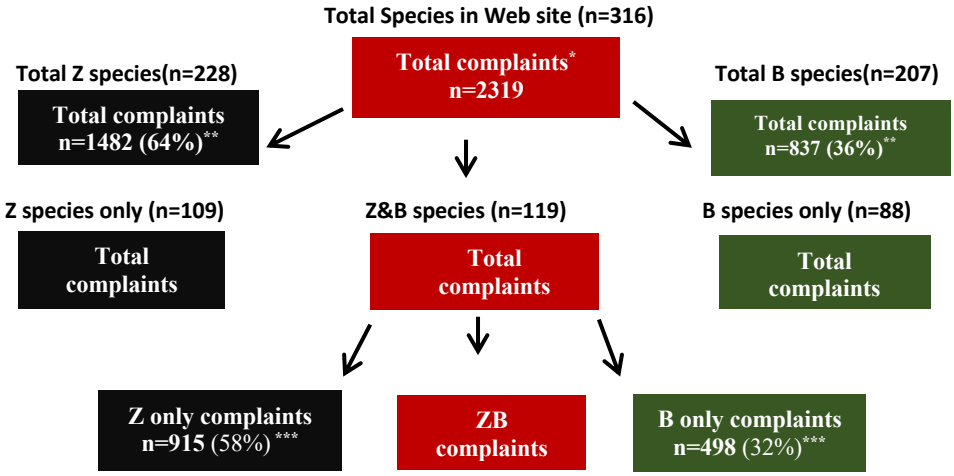

Figure 1. Numbers of species and specific complaint/use entries described by Zaitschek (Z) and BERC (B). **Represents combined "specific" entry of similar or identical complaints for each species; **% of all Z complaints vs % of all B complaints out of total number complaints for all species. p>0.001; ***% of Z only complaints vs % of B only complaints in species described by both Z and B sources p>0.001*

For all species in the website (n=316), an evaluation of the number (n) and percentage (%) of specific (i.e. combined similar/identical) complaint/use entries in each body system/state category, showed significantly more specific complaints described by BERC vs Zaitschek in the following categories: Cancer (5.5 vs 0.4%), Endocrine/metabolic diseases (5.5 vs 2%), Cardiovascular disease (4.1 vs 2.1%) *(p=0.007*), Men`s health (including reproductive health and sexuality) (2.3 vs 0.9% (*p=0.007*) and Veterinary uses (3.9 vs 0.1%) *(p >0.001)* (Table 1).

Significantly more specific complaints were described by Zaitschek vs BERC in the following categories: General conditions (including non-specific complaints e. g. coldness, heat, fevers use of tonics etc.) (6.7 vs 1.9%), Culinary uses (1.5 vs 0%) (*p=>0.001*), Infectious diseases (2.3 vs 0.2%) *(p= 0.001*), Nervous system (3.3 vs 1.3%) *(p=0.005),* Ear, Nose and Throat (ENT) (3.2 vs 1.7 %) *(p=0.03*) and Ophthalmic (2.6 vs 1.1) (p=0.01).

Table 1. Specific complaint/use entries in each body system/state category.

Body system/state	Z complaint/ use* n (%)	B complaint/ use** n (%)	p-value	Body system/ state	Z complaint/ use* n (%)	B complaint/ use** n (%)	p-value
Ageing	4 (0.3)	7 (0.8)	0.06	**Men`s Health/ reproductive health/sexuality**	13 (0.9)	**19 (2.3)**	**0.007**
Bites/ Stings/Venoms	11 (0.7)	6 (0.7)	NS	**Mental Health**	23 (1.6)	17(2)	NS
Cancer	6 (0.4)	**46 (5.5)**	**>0.001**	**Musculoskeletal / joints**	87 (5.9)	51 (6.1)	NS
Cardiovascular	31 (2.1)	**34 (4.1)**	**0.007**	**Nervous System**	**49 (3.3)**	11 (1.3)	**0.005**
Child Health	19 (1.3)	7 (0.8)	NS	**Ophthalmic**	**39 (2.6)**	9 (1.1)	**0.01**
Cosmetic	7 (0.5)	2 (0.2)	NS	**Oral Health**	48 (3.2)	35 (4,2)	NS
Culinary	**22 (1.5)**	0 (0)	**>0.001**	**Pain Relief**	14 (0.9)	5 (0.6)	NS
Dermatological	131 (8.8)	72 (8.6)	NS	**Poisoning**	4 (0.3)	0 (0)	NS
Ear, Nose, Throat (ENT)	**47 (3.2)**	14 (1.7)	**0.03**	**Repellant**	1 (0.1)	0 (0)	NS
Endocrine/ Metabolic	29 (2)	**46 (5.5)**	**>0.001**	**Reproductive Health (General**	2 (0.1)	0 (0)	NS
Gastrointestinal	307 (20.7)	156 (18.6)	NS	**Respiratory**	114 (7.7)	54 (6.5)	NS
General	**99 (6.7)**	16 (1.9)	**>0.001**	**Ritual /Ceremonial**	10 (0.6)	1 (0.1)	0.06
Genitourinary	4 (0.3)	0 (0)	NS	**Sexuality**	4 (0.3)	5 (0.6)	NS
Hematology	21 (1.4)	18 (2.1)	NS	**Smoking**	2 (0.1)	0 (0)	NS
Helminth infections	18 (1.1)	7 (0.8)	NS	**Surgical/ Trauma**	9 (0.6)	2 (0.2)	NS
Industrial	4 (0.3)	0 (0)	NS	**Veterinary**	2 (0.1)	**33 (3.9)**	**>0.001**
Infectious Diseases	**34 (2.3)**	2 (0.2)	**>0.001**	**Women`s health/ reproductive health /sexuality**	65 (4.4)	40 (4.8)	NS
Kidney & Urinary Tract	128 (8.6)	76 (9.1)	NS	**Wound Healing**	72 (4.9)	43 (5.1)	NS
Medical Preparations	2 (0.1)	0 (0)	NS				

*Total number entries for all Z (Zaitschek) specific complaint/uses =1482; **Total number of entries for all B (BERC) specific complaint/uses =837; NS=Not Significant

In body system/state categories where there were significant differences in the number of complaint/use entries (Table1), the type of complaint/use and it`s action/interpretation often differed in the two data sources (Table 2). For example: in the Endocrine /Metabolic category, Z complaints /uses (29) were all for diabetes (hypoglycemic), while for B complaint/uses 33 (71%) were for diabetes, (hypoglycemic), 8 (17%) for obesity (anti-obesity), and 5 (10%) for raised cholesterol (cholesterol-lowering); in the Cardiovascular category the majority (51%) of Z complaints/ uses were for chest and heart pain (analgesic), while 47% of B complaints were for high blood pressure (hypotensive); in Infectious Diseases, Z complaints/uses were for a wide range of infections including tropical and sub-tropical diseases e.g. malaria, leprosy, elephantiasis, mumps, measles, tetanus, tuberculosis, typhoid, chicken pox, herpes, gonorrhea and cholera, while B complaint/uses were only for malaria and leprosy. However, in the Nervous system category, most complaints in both Zaitschek and BERC data (Z 55%, B 72%, NS) were for headaches (analgesic), while for Ophthalmic, the majority (Z 48%, B 77%, NS) were for infections (anti-infective).

Table 2. Type of complaint /use and action/ interpretation according to body system/ state category

Body System /State	**Complaint/use** (*Action/interpretation*) *	**Z** (n)	**B** (n)	**Body System/ state**	**Complaint/use** (*Action/interpretation) *	**Z** (n)	**B** (n)
Cancer	Cancer (*anti-cancer*)	6	46	**Nervous system**	Nerve weakness, paralysis, stroke (*nervine*)	11	2
Cardio-vascular	Vascular arterial problems (*anti-atherosclerotic*)	1	7		Tremor	2	
	High blood pressure/ hypertension (*hypotensive*)	4	16		Headache, migraine *(analgesic*)	27	8
	Weak heart, palpitations, regulate heart function (*cardiac*)	8	5		E*pilepsy,* fits, (*anti-convulsant*)	2	1
	Vasoprotective	1	4		Induces sleep (*hypnotic*)	4	
	Chest and heart pain (*analgesic*)	16	0		*Stimulant/narcotic*	2	
	Improve circulation, chilblains (*rubefacient*)	0	2		Other: reduce BP after cerebral haemorrhage	1	
	Total	**31**	**34**		**Total**	**49**	**11**
Veterinary	Jaundice in livestock	1	0	**Ophthalmic**	Infections *(antiseptic, anti-infective, anti-inflammatory*	19	7
	Hatching chickens	1	0		Strengthens vision (*visual health*)	5	1
	Anti-infective / Anti-inflammatory		14		Cataract	6	1
	Stimulates birth (*parturient*), cleans uterus (*depurative*)		3		Nonspecific *(*eye lesions /disease /drops)	5	
	Carminative, Stomachic		6		Eye pain	3	
	Encourage milk production (*galactagogue*)		2		Excess tearing	1	
	Scabies (*scabicide),* bleeding (*haemostatic*), anaemia, poisoning, constipation, food (*nutritive*)						
	Total	**2**	8		**Total**	**39**	**9**
Men`s Health	Prostate problems	0	**33**	**Infectious Diseases**	Tuberculosis	5	
	Improve fertility	0	5		Tetanus	1	
	Arousal etc (*aphrodisiac)*	12	6		Gonorrhoea	3	
	Reduce Scrotal oedema	1	8		Measles	10	
	Total	13	0		Mumps	2	
Endocrine /Metabolic	Obesity (*anti-obesity*)	0	19		Typhoid	1	
	Raised cholesterol (*anti-cholesterol*)	0	8		Chickenpox	1	
	Diabetes (*hypoglycaemic)*	29	5		Herpes	1	
	Total	29	33		Cholera	1	
Culinary	Food/beverage (*nutritive*)	14	46		Elephantiasis	1	
	Spice/seasoning	7	0		Malaria	5	1
	Preservative	1	0		Leprosy	2	1
			0		Diphtheria	1	
	Total	**22**	**0**		**Total**	**34**	**2**

Z= Zaitschek data; **B**= BERC data; *In cases where italicised brackets are not shown complaint/use and action/interpretation are the same.

Of the 119 species that were described by both Zaitchek and BERC, 50 species had 81 identical or very similar specific complaint/use entries and action/interpretations (shown in italics) described in each data source for the same plant. (Table 3). These specific complaint/use entries (described in the web site as ZB source) were categorized into 17 Body System/States including: Gastrointestinal (21 complaint/uses) most frequent action/interpretation: antidiarrheal (6), carminative /antispasmodic (6), laxative (3), antacid (2) anti-haemorrhoid (2), anti-inflammatory (1) and hepatic (1); Musculoskeletal (10 complaint/uses): analgesic/anti-arthritic/anti-inflammatory (9) and muscle relaxant (1); Endocrine/metabolic (9 complaint/uses all for diabetes): hypoglycemic; Kidney and Urinary tract (8 complaint/uses): anti-lithic (5), demulcent /anti-inflammatory (1), deobstruent (1) and diuretic (1); Dermatological (6 complaint/uses) mostly for skin infections particularly warts (3), antifungal (1) and hair loss (1). In the remaining systems the following complaints/uses and their action/ interpretations are described: Respiratory (4) mainly coughs and colds: anti-tussive, anti-infective, demulcent); Oral (4) toothache: all analgesic; Wound healing (4): vulnerary; Haematology (3): all anaemia; Cardiovascular (2) high blood pressure: hypotensive; ENT (2): earache/infection: analgesic/ anti-infective; **Women`s health** (2) induce/increase lactation: galactagogue; **Cancer** (1); anti-cancer; **Helminth** (1); anti-helminthic; **Ageing** (1); improve memory; **Ritual/Ceremonial** (1); unspecified.

Table 3. Body system/state categories with similar complaint/use entries in 50 species described by both Zaitschek and BERC.

Body system/State	**No. of complaints**	**Complaint/uses**	**Action/interpretation (n)**
Gastrointestinal	21	Diarrhea	Anti-diarrheal /infective (6),
		Abdominal pain/ gas bloating/ colic	Carminative/Anti-spasmodic (6)
		Constipation	Laxative (3)
		Heartburn /gastric acidity	Antacid (2)
		Hemorrhoids	Anti-hemorrhoidal (2)
		Stomach / small intestine inflammation	Anti-inflammatory (1)
		Jaundice	Hepatic (1)
Musculoskeletal/ Joints	10	Arthritis rheumatism / Joint inflammation	Analgesic/anti-arthritic/anti-inflammatory (9)
		Muscle contraction/spasm	Muscle relaxant (1)
Endocrine/ Metabolic	9	Diabetes	Hypoglycemic (9)
Kidney/ Urinary Tract	8	Kidney stones	Anti-lithic (5)
		Urinary tract inflammation	Demulcent /Anti-inflammatory (1)
		Urinary tract obstruction	Deobstruent (1)
		Diuretic	Diuretic (1)
Dermatological	6	Warts	Anti-infective (3)
		Ringworm (Tinea capitis)	Anti-fungal (1)
		Skin diseases	Nonspecific (1)
		Hair restorer	Hair loss (1)
Respiratory	4	Cough/and or Cold	Anti-tussive and /or Anti-infective (3)
		Soften throat	Demulcent (1)
Oral health	4	Tooth ache	Analgesic (4)
Wound Healing	4	Wound healing/ burns/ bleeding wounds	Vulnerary (4)
Hematology	3	Anaemia	Anti-anaemic (3)
Cardiovascular	2	High blood pressure	Hypotensive (2)
Ear, Nose, Throat (ENT)	2	Earache/ear infection	Analgesic, anti-infective (2)
Women`s Health	2	Induce & increase lactation	Galactagogue (2)
Ageing	1	Strengthens memory	Nootropic (1)

Body system/State	No. of complaints	Complaint/uses	Action/interpretation (n)
Cancer	1	Cancer	Anti-cancer (1)
Helminth	1	Intestinal worms	Anti-helminthic (1)
Mental Health	1	Anxiety	Anti-anxiety (1)
Ritual/ Ceremonial	1	Against the "evil eye"	Ritual (1)

Of the 50 species described by both Zaitschek and BERC with common specific complaint/uses (Table 3), those with the most complaints in common (number in brackets) were: *Olea europaea* L. (Oleaceae), *Laurus nobilis* L.(Lauraceae), *Pimpinella anisum* L. (Umbelliferae) (5 complaint/uses), followed by *Citrullus colocynthis* L.(Cucurbitaceae), *Hordeum vulgare* L. (Gramineae), (3 complaint/uses), *Artemisia sieberi* Besser (Compositae), *Ceratonia siliqua* L.(Fabaceae), *Cichorium pumilum* Jacq. (Compositae), *Ecballium elaterium* L. (Cucurbitaceae), *Glebionis coronaria* (L.) Cass.ex Spach, (Compositae), *Origanum syriacum* L. (Labiatae), *Phoenix dactylifera* L. (Palmae), *Plumbago europaea* L., (Plumbaginaceae), *Prosopis farcta* (Banks & Sol.) J. F. Macbr. (Mimosaceae), *Rhus coriaria* L (Anacardiaceae), *Ricinus communis* L. (Euphorbiaceae), *Salvia fruticosa* Mill.(Labiatae), *Teucrium capitatum* L. (Labiatae), (2 complaint/uses). The remaining 32 species all had 1 complaint/use in common (Table 4). Of these 50 species, 29 (57%) were classified as locally common or very common (including cultivated), 12 (23.5%) uncommon, 8 (15.6%) rare or very rare, 1 casual and 1 extinct (Danin & Fragman-Sapir 2016).

Table 4. Species described by both Zaitschek and BERC with common complaint/uses

Family/species	D*	CC**	Family/species	D*	CC**
Anacardiaceae	VC	2	**Lauraceae**	P, UC	5
Pistacia lentiscus L.			*Laurus nobilis* L.		
Plantago ovata Forssk.	VC	1	**Labiatae (Lamiaceae)**	P, VC	2
			Origanum syriacum L.		
Rhus coriaria L.	UC	2	*Salvia fruticosa* Mill.	P, V	2
Amaryllidaceae	P, C	1	*Teucrium capitatum* L.	VC	2
Allium ampeloprasum L.					
Apocynaceae	UC	1	*Micromeria nervosa* (Desf.) Benth.	C	1
Nerium oleander L.					
Compositae (Asteraceae)	VC	1	**Malvaceae**	R	1
Achillea fragrantissima (Forssk) Sch. Bip.			*Corchorus olitorius* L.		
Artemisia arborescens L.	VR	1	**Moraceae**	VC	1
			Ficus carica L.		
Artemisia sieberi Besser	VC	2	**Mimosaceae**	C	2
			Prosopis farcta (Banks & Sol.) J. F. Macbr.		
Chiliadenus iphionoides (Boiss. & Blanche) Brullo	VC	1	**Oleaceae**	UC	5
			Olea europaea L.		
Cichorium pumilum Jacq *(Cichorium endivia*)	VC	2	**Plumbaginaceae**	UC	2
			Plumbago europaea L.		
Glebionis coronaria (L.) Cass.ex Spach	VC	2	**Primulaceae**	P, VC	1
			Cyclamen persicum Mill.		
Caryophyllaceae	VC	1	**Palmae**	P, UC	2
Paronychia argentea Lam.			*Phoenix dactylifera* L.		
Cucurbitaceae	C	3	**Rosaceae**	P, C	1
Citrullus colocynthis (L.) Schrad.			*Prunus dulcis (Mill. D.A Webb (Amygdalus communis* L.)		
Ecballium elaterium (L.) A. Rich.	C	2	*Sarcopoterium spinosum* (L.) Spach	VC	1
Cruciferae (Brassicaceae)	C	1	**Rutaceae**	UC	1
Raphanus raphanistrum L.			*Ruta chalepensis* L.		
Cupressaceae	E	1	**Rhamnaceae**	P, VC	1
Cupressus sempervirens L.	VR		*Ziziphus spina-christi* (L.) Desf.		

Family/species	D*	CC**	Family/species	D*	CC**
Euphorbiaceae	T, I,		**Santalaceae**	R	1
Ricinus communis L.	UC		*Viscum cruciatum* Sieber ex Boiss.		
Fabaceae	P, NT,	1	**Solanaceae**	UC	1
Glycyrrhiza glabra L.	R		*Lycium europaeum* L.		
Ceratonia siliqua L.	P, UC	2	**Salicaceae**	P, C	1
			Salix acmophylla Boiss.		
Lens culinaris Medik.	R	1	**Umbelliferon (Apiaceae)**	VC	1
			Ammi visnaga (L) Lam.		
Lupinus albus L	R	1	*Apium graveolens* L.	UC	1
Senna alexandrina Mill.	EX	1	*Daucus carota* L.	VC	1
Gramineae (Poaceae)	CU	3	*Pimpinella anisum* L.	CAS	5
Hordeum vulgare L.					
Triticum aestivum L.	CU	3	**Urticaceae**	C	1
			Urtica pilulifera L.		
Hypericaceae	UC	1	**Zygophyllaceae**	C	1
Hypericum lanuginosum Lam.			*Peganum harmala* L.		

***D= Distribution** (VC=Very common, C=Common, UC=Uncommon, P=Protected, CU=Cultivated, R=Rare, VR =Very Rare, E=Endangered, NT=Near Threatened, T=Tropical, I=Invasive, EX=Locally Extinct, CAS= Casual) (Danin & Fragman-Sapir 2016)*
***CC**=Complaint/uses in Common (n).*

Discussion

For thousands of years the region known as the Holy Land, today comprising Israel, the Palestinian Authority (West Bank), Gaza and Jordan has been central to the beliefs, culture and traditions of three monotheistic faiths Judaism, Christianity and Islam. With a long history of settlement, invasion and conquest the region over the centuries has attracted travellers, explorers and scholars including archaeologists, theologians, students of natural history, botany and geography (Table 5).

Table 5. *Flora Palaestina* in classical, medieval and later sources.

Author	Place/Period	Source
Theophrastos of Eresos	b. Lesbos Greece ca. 371-ca.287 BCE Considered "Father of botany", established foundations of botanical science.	Hist. Plant. 9: 6:1-4; 9:7:3
Nicolaus of Damascus	b. Damascus 64 BCE- after 4 CE. Writings include "The Universal History" of which fragments remain	"On Plants" (*De plants*)
Strabo	b. Amaseia (modern Amasya, Turkey) 64/63 BCE -24CE. Geographer travelled extensively throughout Mediterranean and Near East.	Geography XVI Chap 2
Pliny the Elder	b. Italy 23/24 - 79 CE Naturalist, wrote encyclopedic 37 volume *Naturalis Historia*	Natural History XIII Chap 9
Al-Tamimi	b. Jerusalem 10th century CE - 990 CE Physician, geography & natural history of region	"Guidebook to basics in food nutrition & properties of non-compounded medicines" ("*Maddat al-baqa' fī islah fasad al-hawa' wa-al-taharruz min darar al-awba*' (*Al-Murshid)*
Al-Muqaddasi	b. Jerusalem 945/946- 991 CE. Geographer, traveller throughout 10th century Islamic world	"Best Classification for Knowledge of Climes or Regions" *(Ahsan at-Taqasim fi Ma'arifat Al-Aqalim*)
Ibn Hawqal	b. Nisibis, Mesopotamia 920-990 CE Writer, geographer travelled widely in region Asia and Africa	"Face of the Earth"(*Ṣūrat al-'Arḍ*)
Avicenna	b. Afshana (Uzbekistan) ca. 980-1037 CE Physician contributed to *"Unani"/* "*Yunani"* traditional Persian-Arabic medical system. Five	*"*Canon of Medicine" (*Al-Qanun fi't-Tibb)*

Author	Place/Period	Source
	volume canon & standard medical work in Islamic world & Europe until 18th century.	
Al-Istakhari	b. Estakhr, Iran 977 CE. Geographer, describedMuslim territories visited during Abbasid era	"Book of Routes and Realms (or Kingdoms)" *(Kitab al-masalik wa-al- mamalik*)
Moses Maimonides	b. Cordoba, Spain 1135-1204 CE. Philosopher, rabbi, physician. Writings on plants & medicine, pharmacopeias (including species found in this region), medical treatises etc.	"Works of Moses Maimonides: new English translations based on critical editions of the Arabic manuscripts". Ed: Gerrit Bros, Brill, Netherlands 2021
Yaqut al-Hamawi	b. Constantinople 1179-1229 CE. Travelled Iran Syria, Egypt- historical, biographic, geographical material	"Dictionary of Countries" (*Mu'jam ul-Buldān)*
Ibn al-Baytar	b. Andalusia 1197-1248 CE. Pharmacist, botanist, physician, collected plants N. Africa, Anatolia, Syria, Arabia, Palestine	"Encyclopedia of Islamic Medicine" (*Kitāb al-Mughnī fī al-Adwiya al-Mufrada*,) "Compendium on Simple Medicaments and Foods ("*Kitāb al-Jāmiʿ li-Mufradāt al-Adwiya wa-l-Aghdhiya*)
Abu l-Fida	b. Damascus, Syria, 1273-1331 CE Ayyubid prince, geographer, historian, statesman	"Concise History of Humanity" (*Tarikh al-Mukhtasar fi Akhbar al-Bashar) &* geographical work "Locating the Lands" (*Taqwim al-Buldan)*
Abbot Daniel	b. Ukraine 12th century Priest. Travelled widely in Holy Land after 1st Crusade 1106 and 1107 CE	"Life and Pilgrimage of Daniel Hegumen from Land of the Rus" *(Puteshestive igumena Daniila*) (Ed: CW. Wilson, Palestine Pilgrims' Text Society, London 1895)
Burchard of Mount Sion	b. Germany 13th century. Dominican friar recounted travels in Middle East between 1271-1285	"Description of the Holy Land" (*Descriptio Terrae Sanctae) (*Ed: JR. Bartlett, Oxford 2019)
Felix Fabri	b. Switzerland 1441-1502. Dominican theologian described pilgrimages in Holy land 1483-84	"Wanderings in the Holy land Arabia and Egypt" (*Evagatorium in Terrae Sanctae, Arabiae et Egypti peregrinationem*) (Ed; Aubrey Stewart, Palestine Pilgrims Text Society, London 1896)

Amongst the earliest floristic descriptions of the region are those found in the Bible where some 100 species of plants, trees and shrubs are mentioned (Low 1924, Feliks 1981, Dafni 2019, Hareuvini 1984, Zohary 1988, Amar 2012). Later descriptions in the classical period are attributed to Theophrastos of Eresos (ca. 371-287 BCE), considered the "Father of Botany" who reputedly received plants collected during the campaigns of Alexander the Great. From the 1st century BCE to the 1st century CE, a period dominated by control of this region by the Roman Empire, botanical descriptions of local flora include those by Nicolaus of Damascus, Strabo and the thirty-seven volume "Natural History" by Pliny the Elder (Table 5)

From the 3rd century onwards, following this region`s inclusion as a province (Palaestina Secunda) of the Byzantine Empire (4th -7th centuries CE), descriptions of local flora can be found in important Jewish sources including the Mishna (organization and codification of Jewish oral traditions and legal teachings), Talmud (2-5th centuries CE) (Low 1924, Feliks 1981, Rosner 1977) as well as in detailed floral mosaic depictions found in many synagogues, churches and private homes dating from this period (Hepper 2004).

From the 10th to 14th centuries CE descriptions of plant use in this region are found in writings of renowned Arab geographers and physicians including; Al-Muqaddasi, Ibn Hawqal, Yaqut al-Hamawi, Abu l-Fida, Al-Istakhari**,** Al-Tamimi, Avicenna (Ibn-Sana) and Ibn al-Baytar. Amongst medieval Jewish physicians, Moses Maimonides, personal physician to the Sultan in Cairo, visited this region in the 12th century and wrote prolifically on plants and medicine including many *Flora Palaestina* species. Christian pilgrimage literature from the 12th to 16th centuries CE including Abbot Daniel, Burchard of Mount Sion and Felix Fabri also contain important contributions on the natural history of this region.

Following the first published work on *Flora Palaestina* by Carl Linnaeus in the 18th century (Linne 1756) many botanists and collectors visited the region including; Pierre Martin Rémi *Aucher-Éloy* (1792-1838), pharmacist and botanist who made extensive botanical collections in Turkey, Egypt, Arabian peninsula and Iran, Karl Kotschy (1813 -1866) who collected over 300,000 botanical specimens throughout the Middle East and N. Africa and the German physician and botanist Albrecht W. Roth (1757 -1834). Together their works served as the basis for "*Flora Orientalis"* published by the Swiss botanist Edmond Boissier from 1867-88 (Boissier & Hermann 1867). Later valuable contributions were made by the English Bible scholar and naturalist H. B. Tristam (Tristam 1885**)** and American physician and botanist George E. Post whose description of 221 taxa (Post 1896**)** was republished posthumously by J.E. Dinsmore in an extensive volume on the Flora of Syria, Palestine and Sinai (Post 1932).

In the 20th century botanical research on *Flora Palaestina* was enriched through taxonomic and phytogeographical studies including those by the Romanian botanist and agronomist, Aaron Aaronsohn who from 1905-15 established a herbarium near Haifa and was the discoverer of *Triticum dicoccoides* (wild emmer) considered the "mother of wheat", a find of great importance for future agronomists and historians of human civilization. (Davidson & Kohler 1928). Important contributions were also made by the Czech botanist František Nabalek who explored this region particularly southern Jordan from 1909-10. Hillel Oppenheimer and Michael Evanari who in 1940 edited Aaronsohn`s works and later Michal Evanari`s own significant contribution particularly to desert agriculture (Evenari 1981). Many more additions were made to the flora of this region through the establishment of the Dept. of Botany initially at the Institute of Agriculture and Natural History in Tel Aviv in 1925 and its transfer in 1929 to the Hebrew University, with new species recorded by botanists including Alexander Eig, Naomi Feinbrum-Dotan (Feinbrun-Dothan & Danin 1991) and Michael Zohary (Zohary 2013). Originally published in 1966, the later edition of *Flora Palaestina* contains many new taxa, changes to eco-geographical distribution, and amendments of taxonomic status and nomenclature. (Zohary & Feinbrum-Dothan 1966- 86).

The rich diversity of *Flora Palaestina* has been associated with this region`s varied topography, climate and soil including; broad expanses of alluvial soils with rich weed flora and abundant multi-regional types; Mediterranean coast with typical sand dune vegetation; Judean mountains containing Mediterranean forest and maquis vegetation; Judean desert with Irano-Turanian vegetation; a desert landscape with tropical savannah, salines and rock-floored "hammadas" (a type of desert landscape consisting of high, barren, hard rocky (basalt) plateaus where most sand has been removed by deflation) (Zohary 1973).

Florapal, an ethnobotanical website of *Flora Palestina* (Flora Palaestina Ethnobotany 2025), provides for the first time in English an extensive description and categorization on the economic and ethnobotanical uses of 316 plants native to this region. The website itself is based on two sources of information: the Zaitschek data based on surveys conducted from ca.1950-1979 of plant use in Jewish and Arab communities in Israel, West Bank and Gaza; and later surveys carried out by the Biodiversity and Environmental Research Centre (BERC) between 1996-2016 amongst Palestinian Arab communities in the West Bank and Gaza.

The web site itself was constructed as an open and accessible resource for conservation, educational and research purposes using several innovative tools. Firstly, the web site allows for extensive ethnobotanical searches of the data to be made using both scientific and common names of plants in English, Hebrew and Arabic as well as through lists of specific complaint/uses, categories of body system/states and action/interpretations.

Originally derived from multiple informants, this information often repetitive, was combined in *Florapal* into single specific complaint/use entry with origin attributed to either Zaitchek, BERC or both. Therefore, in the current paper we did not apply commonly used quantitative techniques e.g. value or cultural importance indices where the number of uses for an individual species is divided by number of informants (Phillips & Gentry 1993). These evaluations have previously been made on the BERC data (Ali-Shtayeh *et al.* 2000, Ali-Shtayeh *et al.* 2008**)** and will be the subject of future publications on the original Zatichek data

Categorization of the Zaitschek and BERC data for the web site did however allow us to make some basic observations on various differences between these ethnobotanical sources, which to some extent reflect societal changes, health care and emerging patterns of disease amongst communities in this region over a period of some 70 years.

In the earlier Zaitchek survey significantly more plant uses were recorded compared to later BERC surveys in categories for local infections, including those affecting the eye (2.6 vs 1.1%), ear, nose and throat (3.2 vs 1.7%) and non-specific problems

(e.g coldness, heat, fever, tonic etc.) (6.7 vs 1.9%), which were included in a “general" category. These differences may suggest a greater reliance amongst both Jewish and Arab communities in the earlier period (1950s-1970`s) on traditional healers and plants for treating common infections and non-specific problems, due to less well-developed primary and secondary health care services at that time (Abu Morad *et al.* 2010, Rubin *et al.* 2017). The earlier Zaitschek data also shows more plant uses for serious infectious diseases (2.3 vs 0.2%) such as diphtheria, typhoid, tetanus, cholera and measles as well as various tropical/sub-tropical infections including malaria, elephantiasis and leprosy, once prevalent conditions (Davies 1972, Masterman 1913), but rarely seen in the region today due to overall improved public health and vaccination programs (Abu Morad *et al.* 2010, Rubin *et al.* 2017). The greater use of local plants in the culinary category (food, seasoning) (1.5% vs 0%) in the earlier Zaitchek data compared to later BERC surveys also suggests changing nutritional habits over this period where increased consumption of processed meals and “fast foods” have often replaced traditional diets and natural foods in the Palestinian population (Mikki *et al.* 2010).

Data collected by BERC during the 1990s until 2016 does however show significantly more plant use categories compared to the earlier Zaitschek survey for various chronic diseases including cancer (5.5 vs 0.4%), endocrine/metabolic diseases (diabetes and obesity) (5.5 vs 2%) and cardiovascular disease (4.1 vs 2.1%) (Ali-Shtayeh *et al*. 2011, Ali-Shtayeh *et al*. 2012, Ali-Shtayeh *et al*. 2013, Bar-Sela *et al*. 2014, Ben-Arye *et al*., 2016, Ali-Shtayeh *et al*. 2016). This period, marked by rapid urbanization and modernization in the Palestinian community (Abu-Rmeileh *et al*. 2008) has been accompanied by significant lifestyle changes associated with these conditions (Naamnih *et al*. 2010) including transition from traditional, healthy food to calorically dense, fast and processed food (Mikki *et al.* 2010) and decreased levels of physical activity. To some extent the later BERC survey reflects both the rise of these diseases in the Palestinian population (Abu-Rmeileh *et al.* 2008, Naamnih *et al.* 2010) as well as the continuing application of plants in their treatment.

Of interest is the increased use of plants for men`s health (including reproductive health and sexuality) in the later BERC survey compared to the earlier Zaitschek data (2.3% vs 0.9% respectively). Male infertility is common today in the Middle East (Inhorn 2012) and is the most common diagnosis in primary fertility centers including in Israel (Jacob 2015). Since the late 1970`s a nearly two-fold increase in the incidence of male factor has been found in similar infertile populations with some studies (though not all) noting a decline in sperm quality attributed to factors related to environmental exposure (Inhorn 2012, Jacob 2015). The BERC data may reflect this trend in the Palestinian male population together with the continuing interest, popularity and relatively low expense of traditional herbal remedies for conditions that may otherwise require expensive treatment in private fertility clinics (Jardat & Zaid 2019).

The greater use of plants used in the veterinary category in the later BERC survey (3.9 vs 0.1%) *(p >0.001)* is also of interest and may be explained by the significant rise in livestock production in the Palestinian territories specifically small ruminants. Regarded as an economic activity of growing importance in the West bank, it has been associated both with an increased desire for food security amongst the local population and the costly but often ineffective local veterinary services (Sinjilawie & Nori 2005).

While traditional healers are disappearing from the region and approximately 70 years have passed since the beginning of the Zaitschek collection in the 1950`s, fifty (15.8%) of the 316 *Flora Palaestina* species included in the website have retained a number of very similar or identical uses over the whole collection period (1950`s -1979 and 1996-2016). Most of these species (57%) are currently locally described as common or very common (including cultivated species), however the remainder are either uncommon (23.5%), rare or vary rare (15.6%), casual or extinct (Danin & Fragman-Sapir 2016).

Today global biodiversity is seriously threatened by environmental degradation, climate change, urban expansion, invasion of alien species and an accelerating loss of wild habitat. (Butchart *et al.* 2010). Based on the most recent surveys in Israel carried out in 2021 (Lebel Vine *et al.* 2024), 434 plant species are currently on the Israeli red list of endangered plant species (a list of plants ranked for prioritization of conservation based on evaluation of all rare plants of Israel using a “red number,” an additive index developed for local evaluation) (Sapir *et al.* 2003). Using IUCN criteria (IUCN 2012), a recent assessment of 157 endemic and sub-endemic species on the Israeli red list, indicated that only 22 (14%) were of Least Concern (LC), 4 (2%) as Near Threatened (NT), 17 (11%) as Vulnerable (VU), while 34 (22%) were Endangered (EN), and 80 (51%) Critically Endangered (CR) (Lebel Vine *et al.* 2024).

Recent surveys conducted in the Palestinian West Bank (Ali-Shtayeh *et al*. 2025) evaluated the conservation status of 1,741 native plant taxa based on the IUCN Red List criteria (IUCN, 2022). Of these, 482 taxa (27.69%) were classified under threatened categories: 94 taxa (5.40%) as Critically Endangered (CR), 170 taxa (9.76%) as Endangered (EN), and 218 taxa

(12.52%) as Vulnerable (VU), collectively constituting the Red-listed flora of the region. Additionally, 401 taxa (23.03%) were categorized as Near Threatened (NT), 710 taxa (40.78%) as Least Concern (LC), and 121 taxa (6.95%) as Data Deficient (DD). Notably, 27 species were listed as Extinct (EX), known only from historical type specimens collected in the previous century.

Conclusion

Florapal an open access ethnobotanical website of Flora Palaestina species in English is an important educational, conservation and research tool, categorizing species within a modern classification system and showing changing patterns of historical plant use in this region over a period of some 70 years. By helping to preserve this valuable knowledge for future generations Florapal draws attention to an important historical legacy, the urgent need for conservation of many of these species, their continuing importance to a healthy environment and a potential source of novel foods, natural products and new drugs.

Declarations

List of abbreviations: D- Distribution; VC-Very common; C-Common; UC-Uncommon; P-Protected; CU- Cultivated; R-Rare; VR-Very Rare; E-Endangered; NT-Near Threatened; T-Tropical; I-Invasive; EX-Locally Extinct; CAS-Casual.

Ethics approval and consent to participate: The need for ethics approval of this study was waived by the Hadassah and BERC ethics committees. Consent to use and document the Zaitschek archive by Dr Sallon for study and research purposes and the transfer of the Zaitschek collection to the permanent Biological Collections at the Hebrew University Jerusalem, was given by the family of the late Prof Zaitschek in 1995 to Prof Clara Heyn (1924-1998), Director of The National Herbarium, Hebrew University of Jerusalem and to Dr Sallon, Director, The Natural Medicine Research Centre (NMRC), Hadassah Medical Organization. Prof Zaitschek`s handwritten notes were returned by NMRC to the permanent Biological Collections (now the Herbarium collection of The National Natural History Collections) of the Hebrew University where the rest of the Zaitschek archive had previously been deposited in 1995. The study complies with and follows the Protocol of Nagoya on Access and Benefit sharing.

Consent for publication: Not applicable

Availability of data and materials: Data used in the current study is available at **https://florapal.org/** The original Zaitschek data is available at the Herbarium Collections of The National Natural History Collections of the Hebrew University, Jerusalem, Israel. https://en-nnhc.huji.ac.il/national-nature-collections

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