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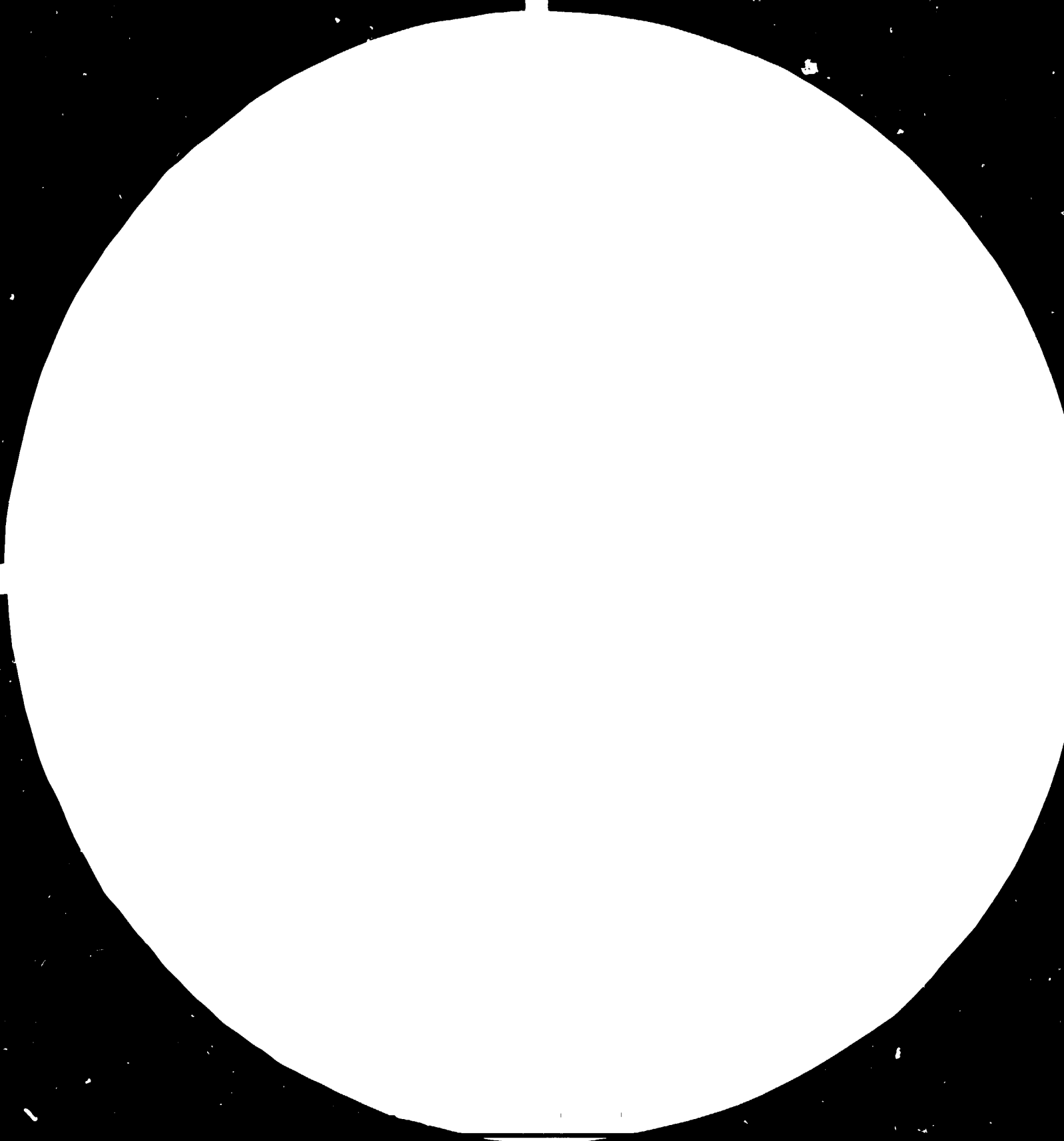


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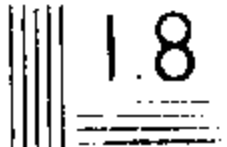
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10 June 1983
English

Turkey

PRODUCTION OF PHARMACEUTICAL MATERIALS FROM MEDICINAL AND AROMATIC PLANTS

DP/TUR/83/003

TURKEY

Terminal report*

Prepared for the Government of Turkey
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Norman G. Bisset, pharmacognosist

United Nations Industrial Development Organization
Vienna

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1. Introduction

Plants are a major source of medicinal agents throughout the world and UNIDO has been playing an important role in promoting the utilization of medicinal and aromatic plants for the production of pharmaceuticals in African and Asian countries.[1] In Europe, medicinal plants are being well utilized in the Eastern European countries; but so far the flora of Turkey, which is one of the largest in Europe with more than 10,000 species, has been little exploited. As a first step in improving this state of affairs, an Institute for Research into Medicinal Agents was set up in 1980 at the then Eskişehir Academy of Economic and Commercial Sciences with aim of investigating the potential of the medicinal and aromatic plants growing in the country. This Academy has become part of the recently created University of Anatolia and the Institute has been renamed the University of Anatolia Medicinal Plants Research Centre.

The Turkish Government now wishes to see this Research Centre play a leading part in investigating the potential of the flora of the country and the present job description (Annex I) was framed with the purpose of assessing the potential of the flora and of the facilities available at the Centre in order to enable it to fulfil its role most effectively. To do this, relevant scientific literature has been examined, Departments of Pharmacognosy in the Faculties of Pharmacy of the Universities have been visited, discussions held with other appropriate Departments, Institutes, and individuals, and pharmaceutical and chemical industrial aspects have been explored. The list of contacts is given in Annex II.

2. Medicinal and Aromatic Plants Potential of the Turkish Flora

2.1 Turkish Medicinal and Poisonous Plants

A list of the medicinal and poisonous plants growing in Turkey[2] is given in Annex III, together with information on the plant parts used and on the types of conditions treated. 199 Genera are represented, and of these 111

have been included in the pharmacopoeias of various countries and 26 are to be found in the list of plants used in modern medicine given by Tcheknavorian-Asenbauer and Wijesekera.[1]

2.2 Aktars' (Herbalists') Plants

In Turkey, aktars, or herbalists, are known to sell more than 200 plants, belonging to 154 genera, but available information is far from complete and much further investigation is required. The plants include well-known pharmacopoeial plants as well as a few imported drugs such as Anamirta cocculus, Cinchona succirubra, Cinnamomum zeylanicum, and Strychnos nux-vomica. The list is to be found in Annex IV.

2.3 Pharmacopoeial Galenical Preparations

Among the galenical preparations in the current Turkish pharmacopoeia are:

Extracts: Bella-donna, Cinchona, Datura, Hyoscyamus, Liquorice, Malt, Nux-vomica, Passiflora, Rhubarb, St.Ignatius beans, Valerian.

Fluid Extracts: Cinchona, Coca, Cola, Condurango, Crataegus, Ipecacuanha, Salix, Senna, Tolu.

Tinctures: Aconite, Bella-donna, Benzoin, Canella, Capsicum, Coca, Cola, Drosera, Ipecacuanha, Lobelia, Quillaia, Valerian, Vanilla.

Syrups: Adianthum, Althaea, Cherry, Cinnamon, Eucalyptus, Iris, Lactucarium, Liquorice, Polygala, Raspberry, Seville orange-peel, Tolu.

Only a few galenical preparations are at present made in Turkey:

Extracts: Capsicum, Gentian, Jerusalem artichoke, Liquorice, Opium.

Fluid Extracts: Cola, Liquorice, Passiflora.

Tinctures: Bella-donna, Benzoin, Capsicum, Crataegus, Gentian, Nux-vomica, Passiflora, Strophanthus, Valerian.

It has to be mentioned here that such preparations are decreasing in

use, since they are being prescribed less frequently by doctors. The reason is that the Ministry of Health is requiring the drug companies to change their formulations by eliminating crude plant materials and to include instead purified active principles.[3] This is a retrograde step and is greatly to be deprecated. It goes against the present world-wide revival of interest in remedies from plants and is costing the country considerable foreign currency without necessarily conferring corresponding advantages.

A brief list of other plants which grow in Turkey and which are used in pharmacy is given in Annex V.

2.4 Specialities

Between 2500 and 3000 specialities[4-6] are being produced in Turkey and more than 50% of them contain plant materials and adjuvants of plant origin. The numbers of specialities grouped according to type of active principle is shown in the following table:[4]

Type of active principle	No. of active principles	No. of specialities
Sugars and sugar derivatives	30	202
Glycosides	44	131
Tannins	5	22
Fixed oils and Glucoresins	17	28
Alkaloids	85	680
Volatile oils, balsams, etc.	52	386
Antibiotics	52	279
	Total	1728

Certain of the active principles, e.g. tropane alkaloids, protoveratrine, glycyrrhizin, menthol, could undoubtedly be replaced by extracts;

but for many of the alkaloids and glycosides, the raw materials from which they are obtained do not grow in Turkey.

However, only 43 drug plants available in the country are ingredients of medicines made in Turkey,[5] either as such or in galenical forms; 16 of the plants are cultivated. 36 Foreign drug plants are used for the same purpose. These 80 plants are constituents of some 232 preparations. The list of genera is set out in Annex VI. On the other hand, there are 226 species growing in Turkey (or related species) which are used abroad in specialities as such or in galenical forms, but only 43 of them are included in Turkish preparations. See Annex VII. Drug materials obtained from Capsicum, Eucalyptus, and Atropa, for example, are imported in spite of the fact that they grow in Turkey.

2.5 Economic Aspects

One of the clearest indications for the potential economic value of the Turkish flora in the field of medicinal and aromatic plants is to be seen in the selected import/export data for the years 1980 and 1981 given in Annex VIII. The data for imports relate to materials which could in large measure also be obtained by exploitation of Turkish plant sources. The situation has changed little in recent years and is much the same as that evident from the detailed 1980 report by J.T.Brown.[7] In view of this, further elaboration here is unnecessary and suffice it to say that the recommendations put forward in that report still stand.

Among the plants whose early investigation was recommended in the 1980 report and is endorsed here are:

(i) Gypsophila species. These yield roots containing up to 25% saponin. In 1980/81 400-500 tonnes were exported, valued at $500,000. In the period 1976/81 3.6 tonnes of saponin valued at $43,000 was imported. Processing the root to yield a purified saponin mixture (at present carried out in Germany) would thus give a product which could also be exported worth about 10x the value of the root extracted and at the same time the necessity of importing it

would be avoided.

(ii) Capsicum annuum fruits yield an oleoresin much in demand for the preparation (spicing) of bulk foods. In 1981 225 tonnes of fruits with a value of $402,000 were exported. The yield of capsicum oleoresin varies from ca. 9 to 17%.[8] The price of the oleoresin in 1982 was $147 per kg, so that processing the capsicum could be an attractive proposition and the technology involved could be extended to other spices. However, the technology and marketing will have to be thoroughly researched.

(iii) Solanaceae alkaloids (hyoscyamine, atropine, hyoscine) are currently imported - in 1980/81 1.2 tonnes was imported, valued at $1,100,000. Datura, Atropa, and Hyoscyamus species are native to Turkey and cultivating and processing the plants to give extracts and tinctures can be expected to yield sufficient materials to cover domestic consumption and thus to obviate the necessity of importing the pure alkaloids.

(iv) Currently, purified Digitalis glycosides are imported - at a cost of over $100,000 annually. Several species of the genus are native to Turkey and re-evaluation of them could well uncover a local source of the glycosides which could be processed to give products for import substitution. Cultivation of D.lanata, the usual source of the glycosides, has been successfully carried out in the Marmara region and further work on this aspect should be pursued.

(v) Several Turkish aromatic plants have industrial potential and could be used to expand and improve the range of the existing essential oil industry:

- In 1980/81 12-14 tonnes mint essential oil was imported, valued at $81,000-106,000. In the same period 14-25 tonnes of menthol, valued at $129,000-293,000 was imported. Mentha piperita var. 'Mitcham" has been grown successfully in the Cappadocia region and has been shown to produce good quality oil with up to 62% menthol. Figures for the production are not available, but the work should be continued and further evaluated.

- At present, terpenes like citronellal, camphor, eucalyptol, and geraniol and linalool and their acetates, etc. are imported, e.g. in 1981 55 tonnes costing $10,500,000. Much of these terpenes could be produced from the essential oils of plants growing in Turkey, e.g. Eucalyptus, Lavandula, Rosa, Laurus, Citrus, etc. However, a proper evaluation of the local essential oil industry and its potential is a prerequisite for further development.

(vi) Other plants, e.g. Rhamnus frangula, Ammi majus, Ephedra spp., Chamaecytisus sp., Scilla maritima, etc., have development potential, but in all cases selection and agronomic studies, laboratory work, and pilot-plant experimentation are needed. Quality assessment will also be an essential requirement.

(vii) Over $2,000,000 worth of Ergot alkaloids is imported annually. These alkaloids are nowadays produced by fermentation and Turkey has expertise in this field (antibiotics industry) which could perhaps be broadened to include ergot. However, feasibility studies are required and the patent situation will need clarification before further development can be undertaken. The necessary technology may have to be bought in.

3. Research and Development

Research into medicinal and aromatic plants is concentrated almost entirely in the Departments of Pharmacognosy of the Faculties of Pharmacy in Ankara (Universities of Ankara, Gazi, and Haceteppe), Eskişehir (University of Anatolia), Istanbul (University of Istanbul), and Izmir (University of Izmir). Information on the plants being investigated in some of these departments is summarized in the report of a trip to Turkey sponsored by the British Council in 1981, parts of which are reproduced in Annex IX. While some of this work is capable of being scaled up, neither the pharmaceutical industry nor the university pharmacy departments have the pilot-plant and appropriate quality-control facilities to carry out the necessary development work.

Products such as the solanaceous alkaloids (atropine, hyoscyamine,

scopolamine), caffeine, saponin, etc. are therefore, as already indicated, still being imported, although the plant sources are part of the flora of the country. On the other hand, it is understood that steps are currently being taken to realize an industrial project for the production of caffeine.

While it is clear that many potentially useful medicinal plants occur in the Turkish flora, adequate knowledge of where they are to be found in the wild and of the quantities available for exploitation on a commercial scale is not usually forthcoming; and currently, little is being done to find out more. Some of the plants in question have to be cultivated, e.g. Atropa, Datura, since there is apparently not enough growing wild, but in some cases after a certain time has been given up in favour of more valuable cash crops such as tobacco. A limited amount of selection work is being carried on in order to obtain plant materials which will give improved yields. This work needs to extended with a greater range of varieties and to a wider range of ecological environments.

At present there is little or no research into the pharmacology of drug plants occurring in Turkey.

A point worth noting is that there is some interest in the Universities in marine products. While this is currently an active area of research in several parts of the world, in the present context work in this direction is better considered as a longer-term objective.

However, on the positive side a promising start has been made with the foundation in 1980 of what is now known as the University of Anatolia Medicinal Plants Research Centre (= Anadolu Universitesi Tibbi Bitkiler Araştirma Merkezi = TBAM) in Eskişehir. At present it has been given limited space in and is being run from the Department of Pharmacognosy, Faculty of Pharmacy. So far, the Director of the Centre has been appointed, and up until now in the activities undertaken by the Centre he has been helped by his assistants in the Department of Pharmacognosy. The Centre has been accepted by

the Stsate Planning Organization and it has its own budget. The equipment available is limited to that normally found in a university department of pharmacy and is insufficient to meet the needs of a fully-fledged research institute. Location of the Centre on the campus at Eskişehir is well chosen, since, in addition to being able to call on the resources of the excellent Medical and Education Faculties, other Government agencies such as the Soil and Water Research Institute and the Agricultural Research Institute (Toprak-su Acaştirma Enstitüsü and Zirai Araştirma Enstitüsü) are conveniently close at hand and are eager to collaborate in cultivation trials with medicinal plants.

The Centre is currently engaged in limited chemical screening of the plants sold by aktars.

At present, the Centre collects relevant documentation and information on a purely ad hoc basis.

4. Recommendations

4.1 Research and Development into the medicinal and aromatic plants potential of Turkey should be concentrated in the University of Anatolia Medicinal Plants Research Centre at Eskişehir.

4.2 The Centre should have its own building and its own range of facilities.

4.3 For the Centre to realize its full potential, it should undertake the following activities:

(a) cultivation trials; in addition to having its own acreage, it should enter into an agreement with, for example, Topraksu, which has locations scattered throughout the country, so that a wide range of ecological conditions and climates is available for exploitation.

(b) investigation of the extraction of selected plants on a pilot-plant scale as part of the development towards industrial exploitation.

Since there are no adequate pilot-plant facilities in Turkey, first priority should be given to the provision of a suitable stainless-steel multi-purpose plant, along with appropriate training, through UNIDO.

(c) quality control analysis of the extracts and other materials produced in the pilot plant. The Centre should therefore have its own analytical laboratories, both pharmaceutical (chemical) and pharmacological; here again, UNIDO can help in providing appropriate instrumentation and training. Pharmacological and animal-house facilities are currently available in the University's Medical Faculty, but ultimately it is desirable for the Centre to have its own pharmacological testing laboratory and animal house.

(d) economic mapping of the medicinal plant flora of the country in order to determine what is available for direct exploitation and what needs to be cultivated. This aspect of the Centre's activities should be extended country-wide. The plant materials acquired in the course of the project should be screened chemically and pharmacologically to determine whether they have potential for further development.

(e) documentation and information on all aspects of medicinal and aromatic plants work: phytochemical, pharmacological, agricultural, economic, etc., so that the Centre can function effectively as the national coordinating centre for research, development, and pharmaceutical industrial exploitation. Here, collaboration with TURDOC, the country's national documentation centre, and other Government facilities may be expected to be of great value.

The University of Anatolia has a computer centre which is in the process of being updated. The Medicinal Plants Research Centre could

store the information in the university computer and access it via its own terminal. In this way and through TURDOC, the Centre will have access to international data bases and will itself be able to input information.

A program suitable for storing and accessing information on plants and their uses, constituents, and other aspects is being developed in the Department of Pharmacy, Chelsea College, University of London, and would undoubtedly be appropriate for the present purpose.

A knowledge of general marketing management will also be required in due course.

A Draft Project Proposal designed to enable the realization of these recommendations is set out in Annex X.

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LIST OF ANNEXES

ANNEX I. JOB DESCRIPTION

The essential parts of the job description were as follows:

(a) In collaboration with the Director, University of Anatolia Medicinal Plants Research Centre, to assess the potential for the production of medicinal agents from Turkish medicinal and aromatic plants.

(b) To assess the present facilities at the Centre for carrying out the purpose indicated under (a) and to formulate future requirements regarding:

(i) pilot-plant facilities

(ii) ancillary processing equipment

(iii) quality control needs

(iv) training of personnel

(v) short-term experts

(c) To propose means of gathering and storing scientific, economic, and folkloric information on medicinal and aromatic plants.

ANNEX II. PEOPLE AND ORGANIZATIONS CONTACTED

Doc. Dr. K.H.C.Başer, Director, University of Anatolia Medicinal Plants Research Centre, Eskişehir

Prof. Dr. I. Sarikardaçoglu, Dean, Faculty of Pharmacy, University of Anatolia, Eskişehir

Prof. Dr. Yilmaz Büyükersen, Rector, University of Anatolia, Eskişehir

Doç. Dr. E. Alper, Chemical Engineering Department, University of Anatolia, Eskişehir

Dr. M. Kara, Chemical Engineering Department, University of Anatolia, Eskişehir

Mr. Ş. Oylukan, Director, Topraksu Research Institute, Eskişehir

Doç. Dr. E. Sezik, Faculty of Pharmacy, Hacettepe University, Ankara

Prof. Dr. N. Noyanalpan, Dean, Faculty of Pharmacy, Gazi University, Ankara

Prof. Dr. M. Tanker, Department of Pharmacognosy, Faculty of Pharmacy, University of Ankara

Prof. Dr. N. Tanker, Department of Pharmcognosy, Faculty of Pharmacy, University of Ankara

Doç. Dr. E. Şarer, Department of Pharmacognosy, Faculty of Pharmacy, University of Ankara

Mr. I. Yurt, Social Planning Department, State Planning Organization, Ankara

Prof. Dr. O. Tarhan, Department of Chemistry, Middle East Technical University, Ankara

Dr. S. Ungan, Food Technology Department, Middle East Technical University, Ankara

Dr. H. Alim, Alfa-Tek Ltd., Ankara

Mr. Ç. Atuk, General Manager, Tumaş (Turkish Engineering Consulting and Contracting Co.), Ankara

Miss. M. Jack, British Council, Ankara

Prof. Dr. T. Baytop, Department of Pharmacognosy, Faculty of Pharmacy, University of Istanbul

Prof. Dr. A. Baytop, Department of Pharmacognosy, Faculty of Pharmacy, University of Istanbul

Prof. Dr. B. Çubuçu, Department of Pharmacognosy, Faculty of Pharmacy, University of Istanbul

Mr. I. Çetinkaya, President, Central Committee of the Turkish Pharmaceutical Associations, Istanbul

Mr. N. Turan, Secretary-General. Central Committee of the Turkish Pharmaceutical Associations, Istanbul, and Managing Director, ABFAR Pharmaceutical Industrial and Commercial Co., Istanbul

ANNEX III. LIST OF MEDICINAL AND POISONOUS PLANTS GROWING IN TURKEY

This list has been compiled mainly from Prof. Dr. T. Baytop's book: Turkiyenin Tibbi ve Zehirli Bitkileri (= Medicinal and Poisonous Plants of Turkey) (Istanbul, 1963), supplemented by information from other sources. The information has been kindly made available by Doç. Dr. K.H.C.Başer, Director, University of Anatolia Medicinal Plants Research Centre.

Those genera marked * are also to be found in the list of plants occurring in various regions of Africa, Asia, and Latin America, whose active principles are used in modern medicine given by Tcheknavorian-Asenbauer and Wijesekera.[1]

Those genera marked ** have at various times been included in various pharmacopoeias, according to Imbesi.[9]

Plant Species	Plant part	Uses
** Equisteum arvense	Herb	Diuretic, internal haemostatic; kidney stones, tuberculosis, diabetes
E.hiemale		Poisonous
E.palustre		"
** Lycopodium clavatum	Spores	Skin diseases
	Herb	Kidney diseases, diuretic, antispasmodic, rheumatism
** Adiantum capillus-veneris	Leaves	Expectorant, emollient, antitussive
Aspidium filix-mas	Rhizome	Taenifuge
A.spinulosum	"	"
** Polypodium vulgare	Rhizome	Expectorant, cholagogue, vermifuge, mild laxative
Taxus baccata	Leaves	Emmenagogue, vasoconstrictor, poisonous
Cedrus libanotica	Tar	Diseases of urinary tract and trachea; externally in skin diseases, antiseptic
Pinus brutia	Oleoresin	Antiseptic

	Cupressus sempervirens	Volatile oil (stem, leaves)	Whooping cough
		Cone	Astringent, vasoconstrictor
**	Juniperus oxycedrus	Volatile oil (fruit)	Antiseptic
	J.nana	"	"
*,**	Ephedra campylopoda	Branches	Diaphoretic, antipyretic in
		Herb	rheumatism, asthma
**	Populus nigra	Bud	Rheumatism, haemorrhoids
	P.tremula	Bark	Antipyretic in rheumatism
**	Salix alba	Bark	Astringent, tonic, anti-pyretic, antirheumatic
	S.caprea	"	" "
	S.cinerea	"	" "
	S.fragilis	"	" "
	S.purpurea	"	" "
	S.triandra	"	" "
	S.viminalis	"	" "
**	Juglans regia	Leaves	Astringent, tonic, blood purifier
		Fixed oil	Edible oil
*,**	Betula alba	Leaves	Diuretic, mild antiseptic, blood purifier
		Tar	Chronic eczema, skin diseases
	B.pubescens	"	" " " "
**	Quercus coccifera	Stem and root bark	Astringent
	Q.infectoria	Galls	"
	Q.macrolepis	Fruit	"
	Q.pseudocarris	"	"
	Ficus carica	Fruit	Expectorant, emollient, mild laxative
**	Morus nigra	Fruit juice	Throat diseases
		Stem and root bark	Vermifuge
**	Cannabis sativa	Herb	CNS depressant, hypnotic
	Humulus lupulus	Female flowers	Sedative, hypnotic, tonic
		Root	Diuretic, blood purifier
	Parietaria officinalis	Herb	Diuretic, emollient

** Urtica urens	Leaves	Rubefacient, haemostatic in nose bleeding, against alopecia
U.dioica	"	" "
U.pilulifera	"	" "
** Viscum album	Herb, leaves	Antispasmodic, hypotensive, diuretic, arteriosclerosis, epilepsy
Aristolochia clematidis	Root	Diuretic, rheumatism,
A.rotunda	"	poisonous
A.hirta	Whole plant	Against crab bite
Asarum europaeum	Rhizome, herb	Diuretic, antipyretic, emmenagogue, sternutatory, aperient, emetic, poisonous
** Polygonum bistorta	Rhizome, herb	Astringent, tonic, haemostatic
P.aviculare	"	" "
P.hydropiper	"	" "
P.persica	"	" "
Rumex patientia	Root	Skin diseases, aperient, tonic
R.alpinus	"	" " "
R.aquaticus	"	" " "
R.crispus	"	" " "
R.hyrolapathum	"	" " "
R.obtusifolius	"	" " "
R.acetosa, R.acetosella	Leaves	Vegetable
	Root	Astringent
*,** Rheum ribes	Shoots	Vegetable
	Root	Astringent
Phytolacca decandra	Root	Emetic, chronic rheumatism, antiparasitic
Gypsophyla arrostii	Root	Detergent
** Saponaria officinalis	Rhizome	Blood purifier, diaphoretic, expectorant, poisonous
S.vaccaria	"	" "
Nuphar luteum	Rhizome, flowers	Astringent, sedative
Nymphaea alba	Rhizome, flowers	Sedative, astringent aphrodisiac
*,** Aconitum orientale	Rhizome	Poisonous
A.ponticum	"	"
A.nasutum	"	"
A.cochleare	"	"

** Adonis aestivalis	Herb	Cardiotonic, diuretic
Delphinium staphysagria	Seed	Poisonous, antiparasitic, fish poison
D.ajacis	"	" "
D.consolida	"	" "
** Helleborus orientalis	Rhizome	Lung diseases of cows
H.vesicarius	"	" " " "
Nigella sativa	Seed	Carminative, stimulant, diuretic
N.damascena	"	" "
N.arvensis	"	" "
** Paeonia officinalis	Root	Anti-epileptic, sedative epilepsy and whooping cough, oxytocic
P.corallina	"	" " "
P.decora	"	" " "
P.peregrina	"	" " "
P.mascula	"	" " "
P.triternata	"	" " "
** Ranunculus acer	Whole plant	Irritant, hyperaemic, poisonous
R.bulbosus	" "	" "
R.sceleratus	" "	" "
R.ficaria	Whole plant	Haemorrhoids
*,** Berberis vulgaris	Root	Tonic, vasoconstrictor, aperient
** Laurus nobills	Fruit	Stomachic, diaphoretic, diuretic
	Fruit oil	Antiparasitic, local irritant in veterinary medicine
	Leaves	Condiment
Persea gratissima	Buds, leaves	Astringent
** Chelidonium majus	Latex	Warts, corns, eye diseases, poisonous
*,** Papaver rhoeas	Petals	Emollient in catarrh and coughs, hynotic
P.dubium	"	" " "
P.hybridum	"	" " "
P.argemone	"	" " "
P.somniferum	Latex	Analgesic, narcotic, astringent, antitussive, antispasmodic
	Leaves	Analgesic
	Fruit	Analgesic, narcotic
	Seeds	Spice

** Fumaria officinalis	Herb	Blood purifier, tonic, arteriosclerosis
F.capreolata	"	" " "
F.micrantha	"	" " "
F.parviflora	"	" " "
Brassica nigra	Seed	Stomachic, sedative, rubefacient, condiment
B.juncea	"	" " "
B.rapa	Seed oil	Emollient, cicatrizant
	Root	Expectorant in whooping cough, coughs, and asthma
Capsella bursa-pastoris	Herb	Regulates menstruation, haemostatic for bladder stones
** Nasturtium officinale	Whole plant	Sedative, diuretic, antiscorbutic
** Liquidambar orientalis	Balsam	Antiseptic, antiparasitic in scabies and fungal infections
** Crataegus monogyna	Flowers	Cardiotonic, angina pectoris, arteriosclerosis, hypotensive
C.oxyacantha	"	" " "
** Cydonia vulgaris	Fruit	Astringent in infantile diarrhoea
	Seed	Eczema, chapped lips
	Leaves	Astringent
Fragaria vesca	Rhizome	Astringent, diuretic
*,** Prunus amygdalus	Seed and seed oil	Astringent in infantile diarrhoea, emollient
P.armeniaca	Leaves	Fish poison
P.cerasus	Bark	Astringent, antipyretic
	Fruit stalk	Diuretic
P.laurocerasus	Leaves, distillate	Antispasmodic, antitussive, sore throat
P.spinosa	Flowers	Aperient, blood purifier
** Rosa damascena	Petals, distillate	Astringent aperient in eye diseases
R.canina	Fruit	Diuretic, astringent
** Rubus fruticosus	Leaves	Astringent in inflammation and infection of tonsils, throat, gums, haemorrhoids
R.caesius	"	" " "
R.glandulosus	"	" " "
R.tomentosus	"	" " "
R.ulmifolius	"	" " "

R. idaeus	Leaves Flowers	Sore throat, dysentery Diaphoretic in gout and rheumatism
Arachis hypogaea	Seed oil	Aperient
Astragalus microcephalus	Gum	Slimming agent
A.aureus	"	" "
A.gummifer	"	" "
A.kurdicus	"	" "
A.stromatodes	"	" "
A.versus	"	" "
* Ceratonia siliqua	Fruit	Gastrointestinal troubles in babies
** Galega officinalis	Herb	Lactogogue
* Glycyrrhiza glabra	Root	Expectorant, emollient, diuretic, peptic ulcer
Lathyrus tuberosus	Tuber	Astringent, diuretic
L.niger	"	" "
L.annuus	Seed	Poisonous
L.aphaca	"	"
L.ochrus	"	"
L.cicera	"	"
L.clymenum	"	"
L.sativus	"	"
L.sylvestris	"	"
Lupinus hispanicus	Seed	Diuretic, blood purifier, vermifuge
L.pilosus	"	" " "
L.hirsutus	"	" " "
L.albus	"	" " "
L.angustifolius	"	" " "
** Melilotus officinalis	Herb	Emollient, antirheumatic, mild astringent
M.albus	"	" " "
** Ononis spinosa	Root	Diuretic, diaphoretic
Robinia pseudacacia	Leaves	Poisonous, cholagogue, gastrointestinal troubles
	Young bark	Poisonous
Trigonella foenum-graecum	Seed	Emollient, expectorant in veterinary medicine, tonic, condiment
Oxalis acetocella	Herb	Diuretic, antiscorbutic, haemostatic
O.corniculata	"	" "
Pelargonium endlicherianum	Flowers	Vermifuge

** Linum usitatissimum	Seed	Emollient, aperient
Peganum harmala	Seed	Vermifuge, narcotic, eczema, haemorrhoids
** Citrus aurantium var. amara	Fruit peel	Flavouring
C.bergamia	Oil	Aromatic
C.medica var. limonum	Peel	Stimulant
** Ruta graveolens	Leaves	Diaphoretic
R.montana	Seed	Vermifuge, sedative, poison, emmenagogue
R.bracteosa	"	" " "
Ailanthus glandulosa	Root, stem bark, flowers	Astringent
** Euphorbia spp.	Seed oil	Cathartic
	Latex	Aperient, poisonous, fish poison, malaria, jaundice
Mercurialis annua	Herb	Aperient, emollient, diuretic
M.perennis	Herb	Poisonous
*,** Ricinus communis	Seed oil	Purgative
Buxus sempervirens	Leaves, stem, bark	Diaphoretic, blood purifier, aperient, diseases of liver biliary tract
** Pistacia lentiscus	Gum	Stomachic
P.terebinthus	Oleoresin	Diuretic, emollient, expectorant
Rhus coriaria	Fruit	Haemostatic, astringent, spice
	Leaves	Astringent
R.cotinus	Bark, leaves	Antipyretic
Schinus molle	Fruit	Stomachic,diuretic, antiseptic
*,** Aesculus hippocastanum	Bark	Antipyretic, tonic
	Seed	Haemorrhoids, varices, phlebitis
	Seed oil	Rheumatism, gout
Paliurus aculeatus	Fruit	Astringent, diuretic
	Leaves	Furuncles
*,** Rhamnus cathartica	Fruit	Laxative
R.frangula	Bark	Laxative
** Zizyphus vulgaris	Fruit	Emollient, expectorant, diuretic
** Vitis vinifera	Leaves	Tonic, menopause
	Stem juice	Diseases of the eyes

** Tilia cordata	Flowers	Sedative, diuretic, emollient, expectorant
T. platyphyllos	"	" "
T. rubra	"	" "
T. tomentosa	"	" "
** Althaea officinalis	Leaves, root, flowers	Emollient
A. rosa	" "	"
A. hirsuta	" "	"
** Malva silvestris	Leaves, flowers	Emollient, soothes in coughs, bronchitis, laryngitis, abscesses in mouth, skin diseases, furuncles
M. rotundifolia	" "	" " "
M. montana	" "	" " "
** Thea sinensis	Leaves	Stimulant, astringent, diuretic
T. assamica	"	" "
** Hypericum perforatum	Herb	Sedative, emollient, diuretic, flavouring, expectorant, cicatrizant, peptic ulcers, poisonous to animals
** Viola odorata	Flowers	Diaphoretic, expectorant
	Leaves	Emollient, diuretic
	Root	Aperient, emetic
V. tricolor	Herb	Diuretic, blood purifier, skin diseases, gout, rheumatism
Daphne mezereum	Stem bark	Aperient, emmenagogue, antirheumatic, fish poison
Lythrum salicaria	Herb	Haemorrhoids, dysentery, diarrhoea, cicatrizant
Punica granatum	Trunk, stem, root bark	Taenifuge
** Myrtus communis	Leaves	Astringent, stomachic, antiseptic
Epilobium angustifolium	Root	Astringent, emollient
E. hirsutum	"	" "
E. montanum	"	" "
E. palustre	"	" "
** Hedera helix	Leaves	Cicatrizant
	Fruit	Aperient, emetic, poisonous
* Ammi visnaga	Fruit	Carminative, diuretic, antispasmodic, antiparasitic, anthelmintic, stomach and gall bladder diseases

*,** Anethum graveolens	Fruit	Sedative, carminative, against hiccough and indigestion
** Angelica sylvestris	Root	Stomachic, nerve tonic, anti-spasmodic, asthma
*,** Carum carvi	Fruit	Stomachic, diuretic, carminative, lactogogue
** Cicuta virosa	Herb	Rheumatism, gout, poisonous
Conium maculatum	Fruit, herb	Antispasmodic, sedative, sciatica, asthma, whooping cough, analgesic in rheumatism
** Coriandrum sativum	Fruit	Carminative, for dizziness
** Cuminum cyminum	Fruit	Stomachic, carminative, diaphoretic
Ferula meifolia	Root	Aphrodisiac
** Foeniculum vulgare	Fruit	Stomachic, carminative, lactogogue, sedative
** Petroselinum sativum	Root, fruit	Diuretic, stomachic, hypertensive, tonic
	Leaves	Cicatrizant
Pimpinella anisum	Fruit	Stomachic, digestive, emollient, carminative, abdominal pain in children, coughs
P.saxifraga	Root	Sedative, stomachic, tonic, emollient
** Cornus mas	Stem bark, fruit	Antipyretic, astringent
C.australis	" "	" "
C.sanguina	" "	" "
Arbutus unedo	Leaves	Astringent, urinary antiseptic
	Fruit	Edible
Erica arborea	Flowering shoots	Diuretic, against urinary calculi
E.verticillata	"	" " "
** Rhododendron ponticum	Leaves	Narcotic, analgesic for rheumatic pains
Vaccinium arctostaphylos	Leaves	Diseases of urinary tract
V.myrtillus	Leaves	Diabetes
V.vitis-idaea	Fruit	Antidiarrhoeic in dysentery

Cyclamen coum	Tuber	Anthelmintic, aperient, emmenagogue, vermifuge
** Primula officinalis	Rhizome, roots	Emollient, diuretic, sedative in bronchitis, lung troubles and migraine
Plumbago europea	Root	Antibacterial, anti-spasmodic, skin irritant
Diospyros lotus	Wood	Blood purifier
D.kaki	Fruit juice	Astringent
Fraxinus excelsior	Leaves	Diuretic, aperient, lactogogue, rheumatism
	Bark	Antipyretic, astringent
	Seed	Diuretic
F.ornus	Stem juice	Laxative for children
Olea europaea	Fixed oil	Cholagogue, aperient, gall stones, liver pain, jaundice
	Leaves, bark	Vermifuge, hypotensive
Erythraea centaurium	Herb	Tonic, antipyretic
** Gentiana lutea	Root	Tonic, stomachic
Menyanthes trifoliata	Whole plant	Digestive stimulant, tonic
Nerium oleander	Leaves	Cardiotonic, diuretic
* Vinca minor	Herb	Astringent, haematemesis, diarrhoea, dysentery, cicatrizant
Marsdenia erecta	Whole plant	Poisonous to animals
Convolvulus scammonia	Root, resin	Cathartic
C.arvensis	Root	"
C.sepium	Root, leaf	"
** Alkanna tinctoria	Root	Astringent
** Borago officinalis	Root	Diaphoretic, diuretic, expectorant
** Cynoglossum officinale	Root	Cicatrizant, emollient, sedative
Pulmonaria officinalis	Herb	Antitussive, emollient, diuretic
Symphytum officinale	Root	Mild laxative, emollient, cicatrizant in burns
* Lippia citriodora	Leaves	Diabetes, stomachic, anti-spasmodic, antipyretic
Verbena officinalis	Herb, root	Astringent, fatigue, lack of appetite, insomnia

Vitex agnus-castus	Herb, fruit	Antaphrodisiac, sedative, diuretic, carminative
Betonica officinalis	Leaves	Stomachic, stimulant, tonic, cicatrtizant, sternutatory
Calamintha officinalis	Herb	Stimulant, antispasmodic
Lamium album	Flower	Mild aperient, haemostatic, diseases of urinary tract
L.galeobdolon	"	" " "
L.maculatum	"	" " "
L.purpureum	"	" " "
** Lavandula apica	Flower	Tonic, diuretic, antirheumatic
	Volatile oil	External anodyne
** Melissa officinalis	Leaves	Stomachic, sedative,
** Mentha piperita	Leaves	Sedative, stomachic, anti-diarrhoeic, antiemetic, carminative
** Ocimum basilicum	Fresh herb	Stomachic, sedative, carminative
	Volatile oil	Diseases of urinary tract
	Seed	Antitussive
** Origanum heracleoticum	Herb	Used like Thymus serpyllum
O.smyrnaeum	"	" " " "
O.vulgare	Herb	Stomachic, indigestion, anti-spasmodic, antitussive, sedative, lack of appetite
Satureia spicigera		Used like Origanum vulgare
S.hortensi		" " " "
S.cuneifolia		" " " "
** Rosmarinus officinalis	Leaves	Cholalogue
	Herb	Stimulant for GI tract
** Salvia officinalis	Leaf	Sedative, stomachic, diuretic diaphoretic, disinfectant
** Teucrium chamaedrys	Herb	Stomachic, stimulant, tonic
T.polium	"	" " "
Thymbra spicata	Herb	Stomachic
*,** Atropa bella-donna	Leaves, root,	Analgesic, antispasmodic, antidiaphoretic in tuberculosis, antiasthmatic
*,** Datura stramonium	Leaves, seed, flower	Narcotic, antispasmodic, antiasthmatic, poisonous
D.metel	" "	" "

*,** Hyoscyamus niger	Leaves, root, seed	Narcotic, analgesic, poisonous
H.muticus	" "	" "
** Mandragora officinarum	Root	Aphrodisiac, narcotic, antispasmodic
Physalis alkekengi	Fruit, leaves	Diuretic, external emollient, sedative, vermifuge
*,** Solanum dulcamara	Branch	Skin diseases, narcotic, for rheumatic pains, aphrodisiac, poisonous
S.nigrum	Herb	Emollient, sedative, narcotic
Galium verum	Herb	Diuretic, cholagogue, mild laxative, mild sedative
G.aparine	"	" " "
G.mollugo	"	" " "
G.cruciata	"	" " "
** Rubia tinctorum	Root	Diuretic, oxytocic, anti-scorbutic
R.peregrina	"	" " "
** Sambucus nigra	Flowers	Diaphoretic, diuretic, emollient, aperient
	Fruit	Aperient
	Stem bark	Aperient
S.ebulus	Leaves, fruit	Aperient
	Flowers	Diaphoretic, mild sedative, aperient
** Viburnum opulus	Trunk bark	Sedative, diuretic, against kidney stones
*,** Valeriana officinalis	Rhizome	Cicatrizant
	Root	CNS sedative in neurasthenia
Cephalaria syriaca	Fruit	Bitter
** Cucurbita pepo	Seed	Taenifuge, vermifuge
C.maxima	"	" "
** Ecballium elaterium	Fruit juice	Aperient, diuretic, jaundice, sinusitis, skin diseases
Momordica charantia	Fruit	Eczema, wounds
Achillea millefolium	Herb	Tonic, diuretic, stomachic, haemorrhoids
A.micrantha	Flowers	Against fleas
*,** Artemisia absinthium	Herb	Tonic, antipyretic
A.fragrans	Volatile oil	Antidiabetic
A.vulgare	Herb	Tonic, emmenagogue

Carthamus tinctorius	Fruit oil	Aperient, externally in rheumatism and paralysis
C.lanatus	Flowers	Diaphoretic, vermifuge, emmenagogue
** Cichorium intybus	Root	Diuretic, sedative, stomachic
** Cynara scolymus	Fresh leaves	Cholagogue diuretic, tonic, antipyretic
C.cardunculus	Flowers	Against indigestion of milk in children
Gundelia tournefortii	Flowers	Coffee substitute
Helichrysum graveolens	Herb	Diuretic, kidney stones, emmenagogue
H.siculum	"	" " "
Lappa major	Root	Diaphoretic, diuretic, emollient, skin diseases
L.minor	"	" "
** Matricaria chamomilla	Flowers	Antipyretic, antispasmodic, sedative, diaphoretic, carminative, analgesic, emetic
	Volatile oil	Antispasmodic, anaesthetic, analgesic
** Pyrethrum roseum	Flowers	Insecticide
** Senecio vulgaris	Herb	Regulates menstruation, against menstrual pain, vermifuge, cicatrizant
** Tussilago farfara	Flowers, leaves	Antitussive
Agropyrum repens	Rhizome	Diuretic, blood purifier
Cynodon dactylon	Rhizome	Diuretic, blood purifier
Zea mays	Styles	Diuretic, urinary antiseptic, diaphoretic, eczema
	Oil	Skin troubles
** Arum italicum	Rhizome	Aperient, analgesic for rheumatic and neural pains
** Allium sativum	Bulb	Hypotensive, tonic, antiseptic for respiratory and GI systems, vermifuge
	Juice	Rubefacient, antiseptic in scabies
A.cepa	Whole plant	Tonic, stomachic, diuretic, infections, cardiotonic

** Asparagus officinalis	Root	Diuretic
A.acutifolius	"	"
A.tenuifolius	"	"
** Colchicum autumnale	Seed, tuber	Gout, poisonous
C.atticum	" "	" "
C.speciosum	" "	" "
C.tauri	" "	" "
** Convallaria majalis	Whole plant	Cardiotonic, diuretic, aperient
** Polygonatum multiflorum	Rhizome	Aperient, emetic, anti-diabetic, cicatrizant, expectorant for animals
P.officinale	"	" " "
** Ruscus aculeatus	Rhizome, root	Diuretic
R.hypoglossum	Phylloclads	Diuretic
*,** Urginea maritima	Bulb	Irritant, cardiotonic, expectorant, rubefacient
Smilax aspera	Root	Diaphoretic, blood purifier
** Veratrum album	Rhizome	Externally: neuralgia, skin diseases; internally: gout, heart conditions
Tamus communis	Root, rhizome	Rubefacient, emetic, aperient
** Crocus sativus	Stigma	Sedative, tonic, analgesic in toothache, oxytocic
** Iris germanica	Rhizome	Expectorant, emetic, cicatrizant
I.florentina	"	" "
I.pallida	"	" "
I.pseudacorus	Rhizome (fresh)	Emetic, aperient
	(dry)	Dropsy
	Seed	Stomachic, carminative
Orchis spp.	Tuber	Emollient, antidiarrhoeic
Ophrys	"	" "
*,** Digitalis cariensis	Leaves	Cardiotonic
D.davisiana	"	"
D.ferruginea	"	"
D.grandiflora	"	"
D.orientalis	"	"
D.schischkinii	"	"
D.trojana	"	"
D.viridiflora	"	"
** Verbascum phlomoides	Flowers	Expectorant, emollient
V.thapsus	"	" "

	V.sinuatum	Seed	Fish poison
	Sesamum indicum	Seed oil Leaves	Gallstones, liver diseases Emollient
*,**	Plantago lanceolata	Leaves	Cicatrizant, antitussive
	P.psyllium	Seed	Laxative
	P.arenaria	"	"

ANNEX IV. LIST OF PLANTS USED IN TURKISH POPULAR MEDICINE

The University of Anatolia Medicinal Plants Research Centre has so far identified about 200 plants which are prescribed by aktars (herbalists) for various ailments. The data have not yet been fully worked out. Nevertheless, the follcwing list of plant names, even although the conditions for which they are used cannot yet be indicated, is of interest in showing not only the indigenous plants that are used, but also that well-recognized pharmacopoeial and imported drugs are among the remedies prescribed by the aktars. The list is again made available by courtesy of Doç. Dr. K.H.C.Başer, Director, University of Anatolia Medicinal Plants Research Centre.

Acacia catechu, Achillea millefolium, Acorus calamus, Aesculus hippocastanum, Agropyrum repens, Allium porum, A.sativum, Alkanna tinctoria, Althaea officinalis, A.rosea, Ammi visnaga, Amomum grana-paradisii, Amygdalus communis var. amara, Anacyclus pyrethrum, Anamirta cocculus, Anethum graveolens, Aquilaria agallocha, Artemisia absinthium, A.vulgaris, A. sp., Asphodelus microcarpus, A.racemosus, A.ramosus, Astragalus spp., Athamanta cretensis, Avena sativa.

Beta vulgaris (seeds), Brassica rapa var. rapa.

Callitris quadrivalis, Calluna vulgaris, Cannabis sativa, Capsicum annuum, Carduus annuus, Carum carvi, Cassia fistula, Celtis australis, Ceratonia siliqua, Ceterach officinarum, Chrysanthemum sp., Cinchona succirubra, Cinnamomum zeylanicum, Cistus sp., Citrullus vulgaris, Citrus aurantium var. amara, Coriandrum sativum, Crocus sativus, Cucumis sativus, Cucurbita pepo, Cuminum cyminum, Cupressus sempervirens, Curcuma longa, C.zeodoariae, Cyclamen coum.

Dahlia sp., Datura arborea, D.stramonium (tatula), Daucus carota, Delphinium staphysagria, Dorema ammoniacum, Dracaena draco.

Ecballium elaterium, Elettaria cardamomum, Equisetum sp., Erythraea centaurium, Eucalyptus spp., Eugenia caryophyllatum, Euphorbia lathyrus, Euonymus sp.

Ferula asafoetida, F. sp., Foeniculum vulgare, Fraxinus ornus, Fumaria officinalis.

Glycyrrhiza glabra, Gypsophila arrostii.

Helianthus annuus, Helichrysum graveolens, H. sp., Helleborus spp., Hibiscus esculentus, Hordeum vulgare, Hypericum perforatum (?).

Indigofera tinctoria, Inula helenium, Iris sp., Isatis tinctoria.

Juniperus oxycedrus.

Lactuca sativa, Laurus nobilis, Lawsonia inermis, Lepidium sativum, Levisticum officinale, Linum usitatissimum, Liquidambar officinale, L.orientale, Lupinus albus, L. sp.

Malva sp., Matricaria chamomilla, Melissa officinalis, Mentha piperita, Momordica charantia, Morus alba, Myristica fragrans, Myrtus communis.

Nicotiana tabacum, N. sp., Nigella damascena.

Ocimum basilicum, Olea europea, Onobrychis viciifolia.

Paeonia officinalis, Paliurus spina-cristi, Papaver rhoeas, P.somniferum, Peganum harmala, Persea gratissima, Petroselinum sativum, Physalis alkekengi, Pimenta officinalis, Pimpinella anisum, Pinus pinea, P. spp., Piper cubeba, P.longum, P.nigrum, Pistacia lentiscus, P.terebinthus, Prunus cerasus, P.mahalep.

Quassia amara, Quercus macrolepis.

Raphanus sativus, Rheum palmatum, R.raponticum, Rhus coriaria, Ricinus communis, Rosa damascena, Rosa sp., Rosmarinus officinalis, Rubus fruticosus, Ruscus sp.

Saintpaulia ionantha, Salvadora persica, Salvia officinalis, S. sp., Sambucus nigra, Sassafras officinale, Schoenocaulon officinale, Sesamum indicum, Sinapis nigra, Smilax china, S. sp., Solenostemma argel, Sorbus domestica, Spinacia oleracea, Strychnos nux-vomica, Styrax bezoin.

Tamarindus indicus, Terminalia chebula, T.citrina, Teucrium chamaedris, T.polium, Theobroma cacao, Thymbra spicata, Thymus sipyleus, T. sp., Tilia sp., Tribulus terrestris, Trigonella foenum-graecum, Typha sp.

Urtica sp.

Vaccinium myrtillus, Veronica sp., Vicia faba, Vigna sinensis.

Zea mays, Zingiber officinale, Z.zerumbet, Zizyphus vulgaris.

Other products sold by the aktars include:

camphor, carrageen moss, white and yellow beeswax, cocci cacti (Dactylopius coccus), oak galls, gelatin, salep, etc.

ANNEX V. OTHER PLANTS USED IN PHARMACY WHICH GROW IN TURKEY

Cf. Ref. 1.

Astragalus spp. (tragacanth)

Eucalyptus spp.

Liquidambar orientalis (storax)

Mentha spp. (peppermint, spearmint)

Ricinus communis (castor oil)

Pinus spp. (colophony, oil of turpentine)

ANNEX VI. DRUG PLANTS WHICH ARE INGREDIENTS, AS SUCH OR IN GALENICAL FORMS, OF MEDICINES MADE IN TURKEY

The asterisk indicates that the plants are cultivated. The information is taken from ref. 6.

Plants growing in Turkey	Foreign drug plants
Acorus calamus	Acacia senegal
Adiantum capillus-veneris	Aconitum napellus
Aesculus hippocastanum*	Aloe ferox
Atropa bella-donna	Carica papaya
Capsicum annuum*	Cassia angustifolia
Citrus aurantium*, C.bergamiae*	Centella asiatica
Crataegus oxyacantha	Cinchona
Crocus sativus*	Cinnamomum camphora, C.cassia
Cynara scolymus*	Cocos nucifera
Drosera	Cola nitida
Eucalyptus	Commiphora abyssinica
Faex medicinalis	Curcuma aromatica
Foeniculum vulgare	Erythroxylon coca
Hyoscyamus	Ferula galbaniflua
Hypericum perforatum	Gelidium amansii
Juniperus communis	Geranium robertianum
Lactuca	Hydrastis canadensis
Laurus nobilis	Jambosa caryophyllus
Lavandula spica	Lobelia inflata
Linum usitatissimum*	Melaleuca viridiflora
Liquidambar orientalis	Myristica fragrans
Matricaria chamomilla	Myroxylon balsamum, M.pereirae
Melissa officinalis	Peumus boldus

Mentha piperita*

Olea europea*

Origanum

Papaver rhoeas, P.somniferum*

Passiflora incarnata*

Pimpinella anisum*

Pinus

Prunus amygdalus*, P.laurocerasus

Quercus infectoria

Rhamnus frangula

Ricinus communis*

Rosa*

Rosmarinus officinalis*

Salix alba

Thymus vulgaris

Valeriana officinalis

Viola odorata

Podophyllum peltatum

Quillaja saponaria

Rauvolfia serpentina

Rheum palmatum

Rubus fruticosus

Strychnos nux-vomica

Styrax tonkinensis

Theobroma cacao

Cephaelis ipecacuanha

Vanilla planifolia

Zingiber officinalis

ANNEX VII. PLANTS GROWING IN TURKEY BUT ONLY USED, AS SUCH OR IN GALENICAL FORMS, IN MEDICINES MADE ABROAD

In a number of cases, the species growing in Turkey is different from the species used abroad; these are indicated by an asterisk. The information is taken from ref. 6.

Abies balsamea,* Achillea millefolium, Adonis vernalis,* Agrimonia eupatoria, Agropyrum repens, Ailanthus glandulosa,* Alchemilla vulgaris,* Allium cepa, Althaea officinalis, Ammi visnaga, Anethum graveolens, Angelica archangelica,* Antennaria dioica, Anthemis nobilis,* Anthillis vulneraria, Apium graveolens, Apocynum sp., Aquilegia vulgaris,* Arachis hypogea, Arctium majus,* Aristolochia sp., Artemisia absinthum, Arundo donax, Asparagus officinalis, Asperula odorata, Avena sativa.

Bellis perennis, Berberis vulgaris, Betula alba, Borago officinalis, Brassica nigra, Bryonia dioica,* Buxus sempervirens.

Calendula offficinalis, Calluna vulgaris, Calystegia sepium, Capsella bursa-pastoris, Carthamus tinctorius, Carum carvi, Castanea vulgaris, Cedrus libanotica, Centaurea cyanus, Centranthus ruber, Ceratonia siliqua, Cheiranthus cheiri, Cicuta virosa, Cnicus benedictus, Conium maculatum, Corydalis tuberosa,* Cyclamen europeum.

Daphne mezereum.

Fraxinus ornus, Fumaria officinalis.

Galega officinalis, Galeopsis segetum, Gentiana lutea, Geum urbanum, Globularia alypum, Glechoma hederalea, Glycyrrhiza glabra, Gossipium sp., Gratiola officinalis.

Hedera helix, Helianthus annuus, Helichrysum arenarium,* H.italicum,* Helleborus sp., Herniaria glabra, Hordeum vulgare, Humulus lupulus.

Iberis amara, Ilex paraguariensis,* Inula helenium, Ipomea orizabensis,* Iris florentina.*

Juglans regia.

Lamium album, Lappa bardana,* Lavandula vera,* Leonurus cardiaca, Lilium candidum,* Lippia citriodora, Lycium barbarum, L.europeum, Lycopodium clavatum, Lycopus europeus, Lythrum salicaria.

Malva sylvestris, Mandragora officinarum, Marrubium vulgare, Marsdenia condurango,* Melilotus officinalis, Menyanthes trifoliata, Mercurialis annua, Myosotis sp.

Nasturtium officinale, Nerium oleander.

Ocimum basilicum, Ononis spinosa.

Parietaria officinalis, Pelargonium sp., Petroselinum sativum, Peucedanum ostruthium,* Phaseolus vulgaris,* Phytolacca decandra, Piscea foliorum, Pisum

sativum,* Plantago psyllium, Polygala senegae,* Polygonatum vulgare, Polygonum bistorta, Polypodium vulgare, Populus sp., Potentila anserina, Primula officinalis, Prunus avium var. juliana, P.cerasus, Punica granatum, Pteris aquilina, Pulmonaria officinalis, Pulsatilla armena.

Raphanus sativus, Rhododendron sp., Rhus coriaria, Ribes nigrum, Robinia pseudacacia, Rosa canina, Rubia tinctorium, Rumex sp., Ruscus aculeatus, Ruta graveolens.

Salix alba, Salvia officinalis, Sambucus nigra, Sanicula europea, Santolina chamaecyparysus, Saponaria officinalis, Sarothamnus scoparius, Scabiosa succisa, Scrophularia nodosa, Sedum sp., Sempervivum tectorum,* Senecio jacobaea, Sylibum marianum, Smilax sp., Solanum dulcamara, Spergularia rubra, Spartia junceum, Soja hispida, Spiraea ulmaria, Solidago virga-aurea, Sorbus aucuparia, Symphytumconsolida,* S.officinale.

Taraxacum sp., Tanacetum vulgare, Teucrium marum,* Thea sinensis, Tilia cordata, Trifolium arvense, Trigonella foenum-graecum, Triticum sp., Tussilago farfara.

Ulmus campestris, Urginea scilla, Urtica dioica, U.urens.

Vaccinium myrtillus, Veratrum viride, Verbascum phlomoides, Verbena officinalis, Veronica officinalis, Viburnum prunifolium,* Vicia graminae,* Vinca minor, Vitis vinifera.

Zea mays.

ANNEX VIII. SELECTED IMPORT/EXPORT FIGURES FOR 1980/1981

The first row of figures relates to 1980 and the second row to 1981. The difference in the US$ values for the two years is accounted for by the decrease in the value of the Turkish lira.

Imports:

Material	Kg	TL ('000)	US$ ('000)
Artemisia	304	113	1.6
	783	523.5	4.6
Hops	-	-	-
	25,000	21,267	212.5
Hop extract	500	929	10
	-	-	-
Castor oil	267,859	27,930	384
	116,493	17,846	165
Menthol	14,285	10,352	129
	25,385	32,725	293
Eucalyptol, Guiacol	17,755	11,745	150
	16,980	15,448	139
Vanillin	20,823	17,960	228
	36,646	30,751	290
Citral	8,551	5,101	72
	5,821	6,690	61
Citronellal, Hydroxycitronellal	2,047	1,985	26
	3,798	4,888	42
Cinnamaldehyde	910	324	4
	1,766	1,036	9.6
Camphor	43,655	3,676	46
	10,174	3,155	28
Saponins	1,870	1,337	16
	3	16	0.013
Digitalis	4	2,072	42
	-	-	-
Digitoxin	23	1,358	16.5
	-	-	-

Atropine	46	2,674	43
	-	-	-
Homatropine	2	49.6	0.5
	2	55	0.56
Caffeine	53,892	43,103	559
	44,390	41,193	376
Scopoline, Scopolamine	441	30,234	367
	708	75,600	661
Codeine	6,716	170,823	2,781
	-	-	-
Papaverine	1,635	6,874	84
	1,500	7,189	63
Sparteine	-	-	-
	25	1,467	14
Mint essential oil	11,613	6,137	81
	13,778	11,216	106
Citronella oil	111,625	30,683	398.5
	56,750	33,326	313.6
Lemon oil	8,830	2,944	36
	12,765	7,845	78
Melissa	400	519	7
	100	101	1.35
Pine needle oil	5,026	776	5
	5,980	1,215	10.5

Exports:

Material	Kg	TL ('000)	US$ ('000)
Bay leaves	1,928,460	217,146	2,870
	1,815,256	302,332	2,702
Poppy seeds*	2,225,100	106,515	1,339
	4,362,000	407,057	3,526
Poppy heads*	-	-	-
	600,000	32,000	300
Hops*	119,799	106,821	1,197
	-	-	-
Liquorice root	298,077	8,108	101
	543,000	44,770	370
Liquorice extract	750,247	149,966	2,056
	1,129,000	266,493	2,481
Tilia (lime) flowers*	60,993	18,457	236
	124,000	56,000	473
Salvia (sage)	488,218	38,504	505
	587,000	52,000	460
Capsicum (red pepper)	-	-	-
	225,238	43,438	402
Ceratonia (locust bean)*	3,379,149	42,602	630
	7,259,000	109,037	986
Galls	772,685	113,839	1,639
	984,406	206,564	1,901
Sumach leaves*	601,915	49,982	612
	1,195,000	170,080	1,511
Valonea*	498,500	5,761	77
	91,000	2,717	24.7
	20,000	368	4.6
	34,000	656	7
Valonea extract	435,000	18,982	258
	-	-	-
Walnut root*	9,000	849	10
	1,500	276	3.1
Pistacia (mastic)	30	8	0.1
	645	527.5	4.1

Tragacanth	132,838	108,558	3,411
	222,746	232,000	2,064
Liquidambar (storax)	20,289	15,378	205
	20,625	20,285	188
Gypsophila	402,565	33,886	428
	479,500	63,834	546
Bay oil	178,228	37,256	561
	408,759	125,184	1,166
Rose oil*	3,085	248,851	3,244
	3,099	313,303	2,902
Rose water	24,842	2,933	37.5
	22,354	3,236	28.3

* Cultivated.

ANNEX IX. EXTRACTS FROM THE REPORT OF A BRITISH COUNCIL-SPONSORED TRIP TO TURKEY FROM 30/3/81 TO 11/4/81

8. Institute for Research into Medicinal Plants

The initiative behind this project is due almost entirely to Dr. Başer of the Eskişehir Academy, and has the support of a number of colleagues in other departments and institutes. Turkey is fortunate in having one of the most extensive floras in Europe (more than 10,000 species) and plants are widely used medicinally by the population. Nevertheless, little is known about the folk-medicinal uses and as the country becomes drawn more and more into the Western orbit these uses are likely to decrease and much potentially useful knowledge will be lost. It is vitally important, therefore, to record and document this information before it is too late and also to carry out research to determine its validity or otherwise with a view to its ultimate exploitation. These are the primary aims of the Institute. The regulations have been published in the Official Gazette no. 17126, 5th October 1980, pages 5-8. The project still has to go before the State Planning Board and, if accepted, will then be included in the State Budget and realization of the project can begin.

It is proposed that the Institute be set up as a specialist Institute of the Eskişehir Academy with its own accomodation and its own staff. Locating the Institute at Eskişehir is a sensible proposal since it will then be an appropriate place from which to conduct investigations in the provincial areas of the country. Having its own staff will have the advantage of allowing full-time research; this will, of course, be supplemented by the part-time work being carried out by the staff in the Faculties of Pharmacy of the Universities and by inviting specialists from abroad to visit the Institute. Moreover, it will be able to call upon (and has been promised) the expertise of other Institutes in and around Eskişehir.

The Institute will require:

a) Its own transport and facilities for collecting information and plant materials.

b) Botanical laboratory and herbarium; ....

c) Facilities for drying and grinding plant materials.

d) Chemical laboratory, including a small pilot plant for large-scale extraction of plant materials.

e) Pharmacological laboratory, including animal house.

f) Library and documentation centre.

g) Botanic garden.

For a project of this kind an initial period of at least 5 years would be necessary to get it properly started and outside help is clearly desirable....

1. Department of Pharmacognosy, Faculty of Pharmacy, Eskişehir

Research is also being carried out in the Department on the use and constituents of indigenous drugs and also on the reputed anticancer alkaloids of Thalictrum species ....

2. Department of Pharmacognosy, Faculty of Pharmacy, Ankara University

Among the research topics are the alkaloids of Fumaria species and essential oils of Salvia and Geum species, including chemotaxonomic aspects. Further studies on the alkaloids of Delphinium and Aconitum species are planned. The faculty has a fine herbarium ....

3. Department of Pharmacognosy, Faculty of Pharmacy, Hacettepe University, Ankara

The research programme is wide-ranging and embraces investigations into the saponins, both triterpenoid and steroid, in species of Saponaria, Polygala, Primula, Gypsophila, Paris, and Bolanthus; the flavonoids of Thymus, Sideritis, Hypericum, and Helichrysum species; the volatile oils from species

of Eucalyptus, Ziziphora, and Stachys. Other projects deal with caffeine, Orchidaceae, and the antifungal and antiviral activity of certain saponins

5. Department of Pharmacognosy, Faculty of Pharmacy, Istanbul University

the research includes the alkaloids of Papaver, Colchicum, and Solanaceous species. Also the flavonoids of Helichrysum are being examined ....

N.G.Bisset