proHealth

MODUL 3

Theoretical Background

IMPORTANT PLANTS FOR TURKEY

The Turkish flora includes more than 9000 plants species. About 3000 are endemic and 1000 are used as medicine and spice in Turkey. Turkish people are interested in wild plants. Some of these plants are used as flavoring agents, spices, natural dyestuff, perfumes, cosmetics, and pharmaceutical and biological agents. In addition, because of widely divergent views of what constitutes a medicinal agent in particular culture, there are many thousands of plant extracts and plant materials which are employed commercially in various parts of the world.

Some plants are also important because of their poisonous characteristics. In addition, poppy (*Papaver somniferum*), tobacco (*Nicotiana tabacum*), snowdrop (*Galathus nivalis* spec), cyclamen (*Cyclamen cilicium*), tulip (*Tulipa*), etc. have industrial and commercial importance for Turkey. The future of our plants is very important from both economic and environmental view point. They are in danger because of over picking for commercial purposes and the destruction of natural areas.

The usage of plants in Turkey are classified as;

Foods: Plants are widely used as a foodstuff in Anatolia. Their fresh (*Crocus, Rheum, Rumex,* etc) or cooked (*Malvae, Urtica, Gundelia, Apium* etc) herbs or roots are used as vegetables.

Spices: Some plants are used because of their flavoring properties such as *Allium, Menthae, Thymus, Origanum,* and so on.

Dyestuffs: Carpet and fabric dying is very popular work in Anatolia. Natural plants such as *Rubia* and *Gallae* are used as natural dyestuff.

Drugs: Turkish people are used naturally growing or cultivated plants as natural medicine since ancient times. For example usage of oils (O. Rosae, O. Thymi), aquas (Aqua Menthae, Aqua Melissa) and some parts of the plants (Semen Pegani, Terebenthina, Radix Liquiritae, Folia Lauroceraci, Valonea) are widely occured in Anatolia.

Previously, these plants were collected from nature without any control, and they were growing naturally. Since the natural products have become an increasingly popular treatment option for people, cultivating of the plants are getting more important. Recently, in Turkey, it has been started to cultivation of some important medicinal and aromatic plants with international standards. The number of national and international commercial plants in Turkey is 347 and 139 of which are exported. In addition, the most important cultured plants are *Papaver, Rosa, Nicotiana* species and some aromatic and industrial plants such as cummin, anise, thyme, caper are also cultivated in some areas in Turkey (Table 1).

Exportation Data of Turkish Medicinal/Aromatic Plants and Turkish Volatile Oils, Some cultured Medicinal and Aromatic Plants in Turkey, Commercial Medicinal Plants provided by “Aktars” in Turkey and The Commercial plants collected from Nature in Turkey in recent years is outlined in Tables 1-5 and Graph 1.

Table 1. Some cultured Medicinal and Aromatic Plants in Turkey

Plant	Area (Hectare)	Production (Tone)
Poppy	40.000	20.000
Cummin	30.438	18.980
Anise	28.300	15.860
Rosa	1902	10.594
Fenugreek	1.046	1.142
Peppermint	-	5.600
Thyme	4.500	5.700
Hop	258	806
Tobacco	229.458	200.119
Sugar beet	315.344	13.517.241
Caper	160	67,35

Table 2: Exportation Data of Turkish Medicinal and Aromatic Plants

	Exported Amount (tone)	Total 1000 $
Poppy	34.480	32.289
Cummin	11.550	14.536
Tyme	8.123	14.983
Carob	5.190	2.563
Caper	5.158	6.197
Daphne	4.564	7.802
Anise	3.456	5.977
Fennel- Juniper	1.874	1.551
Sage	1.189	2.568
Tobacco	105	330
Fenugreek	660	282
Liquorice	584	436
Other Spices	540	795
Rosemary	328	523
Sumac	503	380
Mixed Spices	212	497
Mahaleb	128	681
Lime	125	423
Love-in-a-mist	125	178
Coriander	57	33
Pepermint	20	19
Wormwood	4	8
Saffron	0.528	1.955
Hop	0.085	0.231
Total	**78.975**	**93.053**

Graph 1: Turkish Medicinal and Aromatic Plants Export Proportion According to Exported Amount

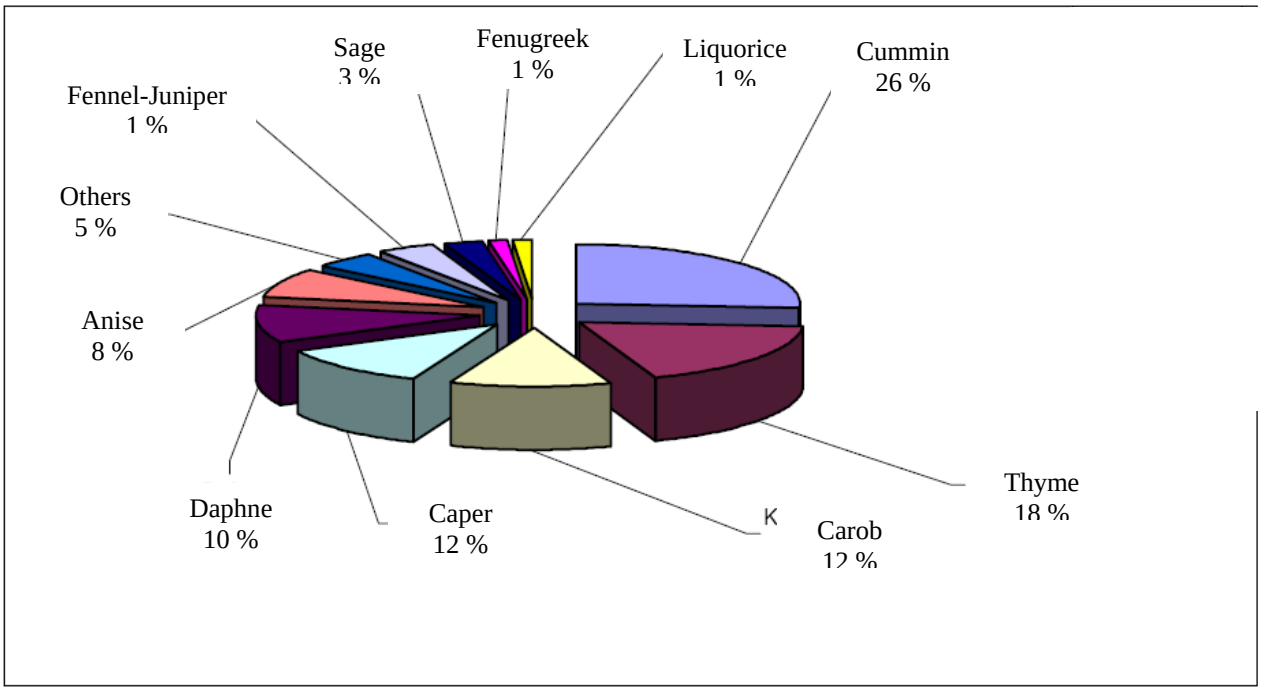

Table 3. Exportation Data of Turkish Volatile Oils

Volatile Oils	Total Cost ($)	Countries
O. Rosae	6.593.709	France, Germany, Switzerland, USA
O. Thymi	550.816	France, USA
O. Lauri	484.523	
O. Citri	198.589	United Arab Emirates, Kazakhistan. Macedonia. Saudi Arabia. Germany
Sweet lemon Oil	19.789	Turkish Republic of Northern Cyprus
O. Lavandula	5.295	Aegean free zone, France
O. Menthae	7.307	Albania, Azerbaijan
Other Citrus Oils	3.294	Holland
O. Bergamie	1.792	Saudi Arabia
O. Citri aurathii	5.467	Iran. Ozbekhistan, Turkish Republic of Northern Cyprus, Azerbaijan
Güveotu yağı	715	England
Other volatile oils	1.680.702	
Stearopten	2.727.699	France, Germany
Terpenic products	259.261	France, Germany, Israel
Resinoids	34.076	Turkish Republic of Northern Cyprus

Table 4. Commercial Medicinal Plants Provided by “Aktars” in Turkey

Latin name	Turkish name (Commercial name)

Abies cilicica	toros köknarı
Acer pseıidoplatanıis	akçaağaç, isfendan
Acer tataricum	adi akçaağac
Achillea aleppica	sarı civanperçemi
A. millefolium	binbiryaprak otu
A. nobilis	ayvadana
Acorus calamıis	hazanbel, eğir
Adiantum capillus veneris	baldırıkara otu
Agropyron repens	ayrıkotu, ayrık
Ajuga chamaepitys	yer çamı
Alkanna tinctoria	kök boya, hava civa otu
Alliaria petiolata	kuşekmeği
Althaea officinalis	hatmi kökü, hatmi
Ammi visnaga	hultan, diş kürdanı
Anthemis chia	margarit
A. nobilis	alman papatyası
A. tinctoria	boyacı papatyası
Arbutus unedo	kocayemiş
Arctium tomentosum	dulavratotu
Artemisia spec.	kişut
A. abrotanıim	miskotu, misk-i arabi
A.absinthium	pelinotu
A.vulgaris	ayvadana
Asparagus officinalis	kuşkonmaz
Asphodelus spec.	kirişotu, çirişotu
Asplenium adiantum nigrum	baldırıkara
Astragalus gummifer	kitre zamkı, kitre
Atropa belladonna	atropa, güzel avrat otu
Berberis vulgaris	amberbaris, amberparis
Bongardia chrysogenunı	çatlak otu
Buxus sempervirens	şimşir
Capparis spinosa	keditırnağı, kebere
Capsella bursa pastoris	çoban çantası
Carthamus tinctoriiis	aspur, aspir
Celtis glabrata	dağdağan
Centaurea cyanus	peygamber çiçeği

Ceratonia siliqua	keçiboynuzu, harnup
Cheiranthus cheiri	mentir, şebboy
Cichorium intybus	hindiba
Cionura erecta	bodur otu

Cistus salviifolius	şapla
Cnicus benedictus	şevketi bostan
Conium maculatum	baldıran
Convolvulıs scammonia	mahmude
Cornıis mas	kızılcık
Cotinus coggyria	boyacı sumağı, tetra, tetre
Crataegus monogyna	yemisen
C. tanacetifolia	alıç
Crocus chrysanthus	çiğdem
Cyclotrichum origanifolium	yayla kekiği, İsparta dağı kekiği
Cyperus rotundus	arap toplağı, topalak
Datura stramonium	boru çiçeği
Delphinium staphisagria	mözvenk
Dianthus spec.	dağ karanfili
Ecballium elaterium	acı kavun, acıdülek
Echium vulgare	engerek otu
Elaeagnus angustifolia	iğde
Equisetum arvense	atkuyruğu, kırkboğum otu, kırkkilit otu
Erica arborea	funda
Erythraea cenlaurium	kırmızı kantaron
Fagus orientalis	kayınağacı
Ferula elaeochytris	çakşır
Fumaria officinalis	şahtere, şahter otu
Gallium aparine	yoğurtotu
Gentiana lutea	centiyan
G. olivieri	afat
Geraniıım robertianum	turna gagası
Glycyrhiza glabra	biyam, meyan
Gundelia tournefortii	kenger dikeni, kenger sakızı
Gypsophila venusta	çövenotu, helvacı kökü
Helichrysum spec.	uludağ çiçeği, ölmez çiçek, kuru çiçek
Helleborus orientalis	karacaot, karaot, bohça otu
H. vesicarius	çöpleme kökü, patlak otu, hummuz kökü
Humulus lupulus	şerbetçiotu
Hyacinthus orientalis	inci sümbülü
Hyoscyamus spec.	tatala
Hyoscyamus niger	delipatpa
Hypericum perforatum	sarı kantaron
llex aquifolium	çoban püskülü
lnula helenium	andız kökü

Juniperus communis	ardıç yaprağı
J. drupacea	andız, ardıç
J. oxicedrus	ardıç
Laser trilobum	kefekimyon
Lavandula stoechas	karabaş otu
Liquidambar orientalis	sığala yağı, buhur yağı, günlük emmi
Lupinus albus subsp.albus	acı bakla, yahudi baklası
Malva neglecta	küçük ebegümeci
M. silvestris	büyük ebegümeci
Mandragora autumnalis	adamotu, ademotu
Matricaria chamomilla	papatya
Melissa officinalis	oğulotu, melisa
Mentha aquatica	su yarpuzu
Mercurialis annua	dağ fesleğeni
Mespilus germanica	muşmula
Micromeria fruticosa	kaya yarpuzu, taşnane
Muscari moschatum	siyah misk
Myrtus communis	mersin
Narcissus tazetta	nergis
Nepeta spec.	balotu
Nepeta nıussinii	arıotu
Nerium oleander	zakkum
Onobrychis viciaefolia	korunga
Origanum majorana	yabani mercanköşkü
0. onites	izmir kekiği
O. sipyleum	yabani orman şimşiri
O. vulgare	keklikotu
Paliurus spina-christi	Çeşmezan, ekzema bitkisi
Papaver rhoeas	gelincik
Peganum harmala	üzerlik
Physalis alkekengi	Tesbihotu
Pistacia lentiscus	damla sakızı, çitlenbik
Plantago psyllium	karnıyarık tohumu
Platanus orientalis	çınar
Polygonatum multiflorum	mührü Süleyman, mühlü Süleyman
Polygonum aviculare	çoban değneği
Polypodium vulgare	eğreltiotu, eğrelti
Portulaca oleracea	semizotu
Potentilla erecta	incibar
Prosopis farcta	çeti

Prunus spinosa	Yunuserigi, yabani erik
Pyrus elaeagnifolia	ahlat, yunuseriği
Quercus infectoria	mazı
0. ithaburensis subsp. macrolepis	palamut, meşe kabuğu, çeft
Ranunculus ficaria	basurotu
Rhamnus petiolaris	cehri
Rhododendron ponticunı	komar
Rhus coriaria	somak
Ribes nigrunı	yabani kuşüzümü
Rosa canina	kuş burnu
Rosmarinus officinalis	biberiye
Rubia tinciorium	çöpboya
Rubus caesius	böğürtlen
Rumex acetosella	kuzukulağı yaprağı
Rumex crispus	kuzukulağı
R.patientia	labada
Ruscus aculeatus	sılcan
Ruta montana	sedefotu çiçeği
Salix alba	aksöğüt
Salvia spec.	dağ şaplası
S. multicaulis	kürtreyhani çiçeği
S. tmolea	balbaşı çayı
S. triloba	izmir adaçayı, elma yağı
Sambucus nigra	mürver
Saponaria officinalis	sabunotu
Sarcopoterium spinosum	çakırdikeni
Satureja hortensis	cıbrıka, şıbıkıra
Scabiosa argentea	uyuzotu
Scorzonera latifolia	çingan sakızı
Sedum acre	kayakoruğu
Senecio vulgaris	kanarya otu
Sideritis tmolea	balbaşı
Silybum marianum	devedikeni
Sorbus domestica	üvez
Spartium junceum	katırtırnağı
Tanacetum spec.	çit civanperçemi
Taraxacum offıcinale	karahindiba
Teucrium chamaedrys	yer meşesi, bodurmahmut, kısamahmut
T. chamaepytis	mayasılotu
T. polium	par yavşanı

Thymbra spicata	karabaş kekiği, karakekik, ayaklı kekik
Thymus spec.	kırkekiği
T. longicaulis	zahter
Typha domingensis	semercik koza
Tilia argentea	ıhlamur
Tragopogon porrifolius	yemlik, iskorçina, sarı tekesaları
Tribulus terrestris	demirhindi, deve çökerten, demirdikenotu
Trifolium arvense	yonca
Trigonella foenum- graecum	çemen boy
Ulmıis campestris	karabaş otu
Urginea maritima	adasoğanı
Urtica dioica	ısırgan
U. pilulifera	//
Vaccinium arctostaphylos	ayıüzümü
V. mytillıis	çoban üzümü
Valeriana spec.	kediotu
Valeriana officinalis	kediotu
Veratrum album	enfiye, kökenfiye
Verbascum spec.	ayıkulağı
Verbascum phlomoides	sığırkuyruğu, calba
Verbena officinalis	mine
Vicia ervilia	burçak
Viola odorata	kokulu menekşe
Viscıum album	ardıç burcu, çekem, gül burcu
Vitex agnus-castus	hayıt
Wiedemannia orientalis	ballıbaba

Table 5. The Commercial Plants Collected from Nature in Turkey

	Scientific Name	**Family**	**Commercial Name**
	Abies cilicica	Pinaceae	köknar reçinesi
	Acer pseudoplatanus.	Aceraceae	akçaağaç, isfendan

			yaprağı
	A. tataricum	"	adi akçaağaç
	Aceras anthropophorum	Orchidaceae	salep
	Achillea aleppica	Compositae	sarı civanperçemi çiçeği
	A. millefolium		binbiryaprak otu
	A. nobilis	"	ayvadana
	Acorus calamıis	Araceae	eğir
	Adiantum capillus-veneris	Adiantaceae	baldırıkara otu
	Agropyron repens	Gramineae	ayrıkotu, aynk kökü
	Ajıiga chamaepitys	Labiatae	mayasılotu
	Alkanna tinctoria	Boraginaceae	kök boya, hava civa otu
	Alliaria petiolata	Cruciferae	kuşekmeği yaprağı
	**Alchemilla* spp.	Rosaceae	fındıkotu
	**Althaea officinalis*	Malvaceae	hatmi
	Ammi visnaga	Umbelliferae	hultan, diş kürdanı
	Anacamptis pyramidalis	Orchidaceae	salep
	**Anemone blanda*	Ranunculaceae	Manisa Lalesi
	**Ankyropetalum gypsophylloides*	Caryophyllaceae	Siirt çöveni
	Anthemis chia	Compositae	margarit çiçeği
	A. nobilis	"	alman papatyası
	A. tinctoria	"	boyacı papatyası
	Arbutus unedo	Ericaceae	kocayemiş kökü, kocayemiş yaprağı
	Arctium tomentosum	Compositae	dulavratotu kökü
	Arieniisia abrotanum	"	miskotu, misk-i arabi
	**A. absinthium*	"	pelin otu
	**A.vulgaris*	"	pelin otu
	**Arum italicum*	Araceae	yılanyastığı
	Asparagus officinalis	Liliaceae	kuşkonmaz
	Asphodelus spp.	"	kirişotu, çirisotu
	Asplenium adiantum-nigrum	Aspleniaceae	baldırıkara
	Asperula odorata	Rubiaceae	kokulu ot
	**Astragalus aureus*	Leguminosae	geven
	**A. gummifer*	"	geven
	**A.kurdicus*	"	geven
	**A. microcephalus*	Leguminosae	geven
	Atropa belladonna	Solanaceae	atropa yaprağı, güzel avrat otu
e	**Ballota crisiata*	Labiatae	salba
e	**B.saxatilis ssp.brachyodonta*	"	şalba
	B. saxatilis ssp. *saxatilis*	"	"
	Barlia robertiana	Orchidaceae	salep
	Bellis perennis	Compositae	koyungözü
	**Berberis crataegina*	Berberidaceae	diken üzümü
	**B.vulgoris*	"	karamuk
	Bongardia	"	catlak otu

	chyrsogenunı		
	Buxus sempervirens	Buxaceae	şimşir
	**Calamintha nepeta* var. *nepeta*	Labiatae	
	Calluna vulgaris	Ericaeae	süpürge çalısı
	**Capparis ovata*	Capparaceae	kebere, kedi tırnağı
	**C. spinosa*	"	gülik
	Capsella bursa-pastoris	Cruciferae	çoban çantası
	Carthamus tinctorius	Compositae	aspur, aspir
	Celtis glabrata	Ulmus	dağdağan meyvası
	Centaurium erythraea ssp.erythraea	Gentianaceae	
	**Ceratonia siliqua*	Leguminosae	keçiboynuzu
	Cichorum intybıus	Compositae	hindiba kökü
	Cionura erecia	Asclepiadaceae	dağ sarmaşığı
	**Cistıus crelicus*	Cisiaceae	pamuklu
	**C.salviifolius*	"	pamuklu
	Cnicus benedictus	Compositae	şevketi bostan
	**Colchicum cilicicum*	Liliaceae	acı çiğdem
	**C. speciosum*	"	aci çiğdem
	Comperia comperiana	Orchidaceae	salep
	Canium macıılalum	Umbelliferae	baldıran tohumu
	Convolvulus scammonia	Convolvulaceae	mahmude kökü
	**Coridothymus capitatus*	Labiatae	
	Cornus mas	Cornaceae	kızılcık
	Cotinus coggyria	Anacardiaceae	bovacı sumağı, tetra, tetre
	**Crataegıus monogyna*	Rosaceae	Alıç
	**C. pentagyna*	"	Alıç
	**C. szovitsii*	"	alıç
	C. tanacetifolia	"	alaç çiçeği
	Crocıus chrysanthus	Iridaceae	çiğdem
	**Cyclamen cilicium*	Primulaceae	siklamen
	**C. coum*	"	siklamen
	**C.hederifolium*	"	siklamen
	Cyperus rotundus	Cyperaceae	arap toplağı, topalak
	Cyclotrichum origanifolium	Labiatae	yayla kekiği, İsparta dağ kekiği
	Dactylorhiza iberica	Orchidaceae	salep
	D.osmanica	"	salep
	D. romana	"	salep
	**Daphne sericea*	Thymeliaceae	
	Datura stramonium	Solanaceae	boru çiçeği
	Delphinium staphisagria	Ranunculaceae	mözvenk
	Dianthus spec	Caryophyllaceae	dağ karanfili
	**Dracunculus vulgaris*	Araceae	yılanbıçağı
	Ecballium elaterium	Cucurbitaceae	acı kavun, acıdülek
	Echium vulgare	Borasinaceae	engerek otu
	Elaeagnus angustifolia	Elaeagnaceae	iğde çiçeği
	**Equisetum arvense*	Equisetaceae	

	**Eranthis hyemalis*	Ranunculaceae	karçiçeği
	Erica arborea	Ericaceae	funda yaprağı
	Erysimum cheiri	Cruciferae	mentir, şebboy çiçeği
	Fagus orientalis	Fagaceae	kayınağacı kabuğu
	Ferula elaeochytris	Umbelliferae	çakşır kökü
	**Frangula alnus*	Rhamnaceae	barut ağacı
	Frittillaria imperialis	Liliaceae	ağlayan gelin
	F. persica	"	Adıyaman lalesi
	Fumaria officinalıs	Fumariaceae	şahtere, sahter otu
	**Galanthus elwesii*	Amaryllidaceae	kardelen
	**G. ikariae*	"	kardelen
	**Galega officinalis*	Leguminosae	
	Galium aparine	Rubiaceae	yoğurtotu
	Gentiana asclapiadea	Gentianaceae	mavi çiçekli gentiyan
	**G. lutea* ssp. *symphyandra*	"	sarı centiyan
	G. olivieri	"	afat
	Geranium robertianum	Geraniaceae	turna gagası
	**G. tuberosum*	"	devetabanı
	** Glycyrrhiza glabra var.glabra*	Leguminosae	meyan
	*** G. *glabra ssp. glandulifera*	"	meyan
	Gundelia tournefortii	Compositae	kenger dikeni kenger sakızı
e	**Gypsophila arrostii var. nebulosa*	Caryophyllaceae	çöven
	**G. bicolor*	"	"
e	**G.eriocalyx*	"	"
e	**G.perfoliata var.anatolica*	"	"
	**G.venusta*	"	"
	**Hedera helix*	Araliaceae	sarmaşık
	Helichrysum spp.	Compositae	kuru çiçek, ölmez çiçek
	Helleborus orientalis	Ranunculaceae	karacaot, karaot, bohça otu
	H. vesicarius	"	çöpleme kökü, patlak otu, hummuz kökü
	Herniaria 'eupatoria'	Illecebraceae	kasıkotu
	Himantoglossum affıne	Orchidaceae	salep
	H. caprinum	"	"
	Humulus lupulus		şerbetçiotu
	Hyacinthus orientalis	Liliaceae	inci sümbülü
	Hyoscyamus niger	Solanaceae	delipatpat
	**Hypericum perforatum*	Guttiferae	Sarı kantaron
	**H. Scabrum*	"	"
	llex aquifolium	Aquifoliaceae	çoban püskülü
	**Inula germanica*	Compositae	
	I. helenium	Compositae	andız
	**I. viscosa*	"	
	Jıniperus communis	Cupressaceae	ardıç
	J. drupacea	"	andız meyvası, ardıç katranı

	J. oxycedrus	"	ardıç tohumu, ardıç katranı, ardıç meyvası
	Laser trilobum	Umbelliferae	kefekimyon
	**Laurus nobilis*	Lauraceae	defne
	Lavandula stoechas	Labiatae	karabaş otu
	**Leucojum aestivum*	Amaryllidaceae	akçabardak
	Liquidambar orientalis	Hamamelidaceae	sığala yağı, buhur yağı, günlük
	Lupinus albus subsp. albus	Leguminosae	acı bakla, yahudi baklası
	**Lycopodium annotinum*	Lycopodiaceae	kibrit otu
	**L. clavatum*	"	"
	**L. selago*	"	"
	**Malus sylvestris subsp.orientalis*	Rosaceae	geycek, yabani elma
	Malva neglecta	Malvaceae	küçük ebegümeci
	**Malva silvestris*	"	ebegümeci
	Mandragora autumnalis	Solanaceae	adamotu, ademotu, adem kökü
	Matricaria chamomilla	Compositae	papatya
	**Melissa officinalis ssp.officinalis*	Labiatae	oğul otu
	**M. officinalis* ssp. *inodora*	"	oğul otu
	**M. officinalis ssp.altissima*	"	
	Mentha aquatica	"	su yarpuzu
	**M. longifolia*		nane
	**M. pıı!egium*	"	"
	Mercurialis annua	Euphorbiaceae	dağ fesleğeni
	Mespilus germanica	Rosaceae	muşmula
	Micromeria fruticosa	Labiatae	kaya yarpuzu, tasnane
	**M. myrtifolia*	"	kekik
	Muscari muscarimi	Liliaceae	siyah misk
	Myrtus communis	Myrtaceae	mersin
	Narcissus tazetta	Amaryllidaceae	nergis
	**Nasturtium officinale*	Cruciferae	su teresi
	Neotinea maculata	Orchidaceae	salep
	Nepeta mussinii	Labiatae	arıotu
	Neriıım oleander	Apocynaceae	zakkum çiçeği
	Onobrychis viciifolia	Leguminosae	korunga
	Ophrys bombyliflora	Orchidaceae	salep
	O .ferrum~equinum	"	"
	O.fusca	"	"
	O.holoserica	"	"
	O. lutea var. *minor*	"	"
	O. mammosa	"	"
	O. phrygia	"	"
	O. reinholdii	"	"
	O. scolopax (oestrifera)	"	"
	0. tenthredinifera	"	"
	O. umbillicata	"	"

	O. vernixia	"	"
	Orchis anatolica	"	"
	0. coriophora	"	"
	O.italica	"	"
	0. laxiflora	"	"
	O.mascula ssp. *pinetorum*	"	"
	O.morio	"	"
	O.pallens	"	
	O.palustris	"	"
	0. papilionacea	"	"
	O.provincialis	"	"
	O.purpurea	"	"
	O.sancta	"	"
	O.simia	"	"
	O.spitzelii	"	"
	O. tridentata	"	"
e	*Origanum acutidens*	Labiatae	kekik
	**O. majorana*	"	kekik, yabani mercanköşkü
e	**0.minutiflorum*	"	kekik
	**O.onites*	"	kekik,izmir kekiği
	0. sipyleum	"	yabani orman şimşiri
	**O.syriacum var.bevanii*	"	kekik
	** O.vulgare var. hirtum*	"	"
	**O. vulgare var. viride*	"	"
	**O. vulgare var. vulgare*	"	"
	Ornithogalum nutans	Liliaceae	yoğurt otu
	**Paeonia macula*	Paeoniaceae	şakayık
	P. officinalis	"	udu salip
	**P. peregrina*	"	şakayık
	**Paliurus spina-christi*	Rhamnaceae	karaçalı, çeşmezan, ekzema bitkisi
	Papaver rhoeas	Papaveraceae	gelincik çiçeği
	Peganum harmala	Zygophyllaceae	üzerlik tohumu
	**Physalis alkekengi*	Solanaceae	güvey feneri, tesbihotu
	Phytolacca americana	Phytolaccaceae	şerbet boyası
	Pistacia lentiscus	Anacardiaceae	damla sakızı, çitlenbik
	Plantago major	Plantaginaceae	
	Plantago ovata	"	karnıyarık tohumu
	Plantago psyllium	"	"
	Platanus orientalis	Platanaceae	çınar ağacı kabuğu
	Polygonatum multiflorum	Liliaceae	mührü Süleyman, mühlü Süleyman
	Polygonum aviculare	Polygonaceae	çoban değneği
	Polypodium vulgare	"	eğreltiotu, eğrelti
	Portulacca oleracea	Portulacaceae	semizotu
	Potentilla erecta	Rosaceae	incibar kökü
	Primula veris	Primulaceae	kaymak çiçeği
	P.vulgaris	"	çuha çiçeği
	Prosopis farcta	Leguminosae	çeti
	Prunus spinosa	Rosaceae	yunuseriği yaprağı, yabani erik
	Pulmonaria officinalis	Boraginaceae	ciğerotu

	Pyrus elaeagnifolia	Rosaceae	ahlat çiçeği, yunuseriği çiçeği
	Quercus infectoria	Fagaceae	mazı
	**Q. ithaburensis ssp.macrolepis*	"	mazı meşesi
	Ranunculus fıcaria ssp.ficariiformis	Ranunculaceae	
	Rhamnus petiolaris	Rhamnaceae	cehri yaprağı
	Rhododendron ponticum	Ericaceae	komar
	**Rhus coriaria*	Anacardiaceae	sumak
	Ribes nigrum	Grossulariaceae	yabani kuşüzümü
	**Rosa canina*	Rosaceae	kuşburnu
	R. elymaitica	"	"
	R.gallica	"	"
	R.hirtissima	"	"
	R. iberica	"	″
	R.micrantha	"	″
e	*R.pisiformis*	"	"
	R.pıılverulenta	"	″
	R. tomentosa	"	″
	**Rosmarinus offıcinalis*	Labiatae	biberiye
	Rubia tinctorum	Rubiaceae	çöpboya
	Rubus caesius	Rosaceae	böğürtlen kökü
	Rumex acetosella	Polygonaceae	kuzukulağı yaprağı
	R. crispus	"	kuzukulağı tohumu
	R. patientia	"	labada
	**Ruscus aculeatus*	Liliaceae	diken kökü
	Ruta graveoleıis	Rutaceae	sedefotu çiçeği
	Salix alba	Salicaceae	aksöğüt
e	**Salvia cryptantha*	Labiatae	Şalba, adaçayı
	**S. fruticosa (= S. triloba)*	"	"
	S. multicaulis		kürtreyhani
	**S. sclarea*	"	Şalba, adaçayı
	S. tmolea		balbaşı çayı
	**S. tomentosa (=S. grandiflora)*	"	şalba, adaçayı
	Sambucus nigra	Caprifoliaceae	mürver
	Santolina chomaecyparissus	Compositae	kurtotu
	Saponaria officinalis	Caryophyllaceae	sabunotu
	Sarcopoterium spinosum	Rosaceae	çakırdikeni
	**Satureja cuneifolia*	Labiatae	sivri kekik
	S. hortensis	"	cıbrıka, şıbıkıra
	Scabiosa argentea	Dipsacaceae	uyuzotu
	Scilla bifolia	Liliaceae	sümbül
	Scolymus hispanicus	Compositae	
	Scorzonera latifolia	"	çingan sakızı
	Sedıım acre	Crassulaceae	kayakoruğu

	Sempervivum tectorum	"	kulakotu
	Senecio vulgaris	Compositae	kanarya otu
	Serapias vomeracea	Orchidaceae	salep
e	*Salvia arguta*	Labiatae	dağ çayı, yayla çayı
	**T.praecox ssp.skorpilii var. skorpilii*	"	
	Tilia argentea	Tiliaceae	ıhlamur
	Trachystemon orientalis	Boraginaceae	hodan
	Tragopogon porrifolius	Compositae	yemlik, iskorçina, sarı tekesakalı
	Tribulus terrestris	Zygophyllaceae	demirhindi, deve çökerten, demirdikenotu
	Trifolium arvense	Leguminosae	yonca
	Trigonella foenum - graecum	"	çemen boy
	Typha domingensis	Typhaceae	semercik koza
	Ulmus campestris	Ulmaceae	karabaş otu
	Urginea maritima	Liliaceae	adasoğanı
	**Urtica dioica*	Urticaceae	ısırgan
	U. pilulifera	"	ısırgan tohumu
	U. urens	"	ısırgan
	**Vaccinium arctostaphylos*	Ericaceae	yaban mersini
	**V.myrtillus*	"	"
	Valeriana officinalis	Valerianaceae	kediotu
	Veratrum album	Liliaceae	enfiye, kökenfiye; kunduziye
	Verbascum phlomoides	Scrophulariaceae	sığırkuyruğu çiçeği, calba çiçeği
	Verbena officinalis	Verbenaceae	mine çiçeği
	Vicia ervilia	Leguminosae	burçak
	Viola odorata	Violaceae	kokulu menekşe
	**Viscum album*	Santalaceae	ökse otu
	**Vitex agnus-castus*	Verbenaceae	hayıt
	Wiedemannia orientalis	Labiatae	ballıbaba

*** exported plants**
***e* endemic plants**

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P R O H E A L T H P R O J E C T
M E D I C A L P L A N T S O F G R E E C E

Greece is the county of contracts and differences in climate, people behavior, animals and plants. Those differences gave birth to the unique civilization of ancient Greece.

This highly variable setting explains why such a small country has 6,000 different species of plant, of which fully one-tenth are unique to Greece. Many of them have marvellous and even exotic flowers and look like precious jewels set against the green velvet of meadows and pastures or the ash grey harshness of rock. Among these insignificant species, which are easily passed by unnoticed and carelessly trodden underfoot, are some of the most valuable medicinal plants which for thousands of years have been used to cure human ailments.

It is not by accident that almost all of the pharmaceutical plants or herbs are common and widespread. Only with such species could people have experimented, have compared the effects of specimens after collecting them from different localities and in different seasons, and arrived at a common agreement on their therapeutic properties.

People throughout the world have used herbs to treat sickness since time immemorial. Ancient writers and physicians -Aristotle, Hippocrates, Dioscurides, Theophrastus, Galen, to mention but a few- have written treatises on the therapeutic qualities of certain plants and on how to use them, based on the folk tradition of their time.

To use of herbs continued to be very widespread in Greece, as in the rest of Europe, during the Middle Ages and in the subsequent long years of Ottoman rule. The folk doctors, known as *komboyannites* or *Viko doctors* after the valley of Vikos where they gathered their herbs, handed down their prescriptions orally, or occasionally in writing, from generation to generation and from teacher to pupil, often mixing them with magical incantations or Christian prayers to create the suitable psychological atmosphere for the patient to trust in his certain cure.

Since the beginning of the last century, and with the huge strides made by scientific developments generally, herbal therapy has fallen into neglect, and the medicinal ingredients of living plants have to a large extent been replaced by chemical preparations. The last of the folk doctors were discredited as quacks by the increasingly powerful scientific establishment,

and many of them died in goal for their knowledge of the impressive cures that could be wrought by simple preparations from the commonest wild plants. The chemical and pharmaceutical industry and scientific medicine, for whom the *komboyannites* were obnoxious rivals treatening their profits, did all they could to eradicate traditional folk medicine. Their efforts were aided by the fact that there undoubtedly were quack doctors posing as serious physicians, whose useless prescriptions were nothing more than confidence tricks. This played its part in making people lose faith in herbal medicines, and the world *komboyannites* eventually became synonymous with trickster.

However, in more recent years a number of scientists in many different countries have taken a closer look at the plants which were once famed for their therapeutical value. Their studies soon showed that these plants do in fact contain active constituents truly valuable to medicine. Isolating these elements and administering them to patients in natural preparations has proved much more effective than using the equivalent synthetic medication, since the natural form of the active constituent is much more easily assimilated by the human organism.

Today, hundreds of drugs of which the active ingredients are culled from living plants are on sale throughout the world, and there are entire factories devoted solely to the preparation of natural plant essences. To give just a few simple examples: Belladonna (Atropa belladonna) provides an effective medicine against Parkinson's disease; Lesser periwinkle (Vinca minor) contains a depressant; and White false helleborine (*Veratrum album*) is used against hypertension. In neighbouring Bulgaria especially, extensive scientific work is being done on the study of pharmaceutical plants and the production of various highly effective preparations, even though Bulgaria does not have the floral wealth of Greece.

In Greece itself, recognition of the merits of pharmaceutical herbs is still rudimentary, and their exploitation is at the stage where they are not collected so much as plundered like loot by various speculators. As a result, a number if species (*Gentiana lutea, Atropa belladonna. Arctostaphylus uva-ursi,* among others), have already disappeared almost entirely from regions where they once flourished. There is an immediate need to take protective measures, and particularly to forbid the commercial exportation of wild plants. Only properly organized and systematic cultivation of these species can prevent their extinction and conversation laws will have to be promulgated to achieve this.

Basic rules to be followed:

For herbal therapy to be properly effective, the following instructions must be observed:

- Remedies must be applied repeatedly and regularly and for an extended period, especially if the illness is a chronic one.
- The plants must be gathered in the proper seasons as given, and dried as soon as possible after collection by spreading them out well in the shade, unless the sun is specifically indicated. Roots should be washed, and thick roots should always be cut lengthwise before drying.
- Thoroughly dried plants must be stored in a closed glass container in a dry, darkish place.
- No dried plants should be kept for more than two to three years at the most, because they gradually lose their therapeutic effectiveness.
- Care must be taken that the plant being collected or bought is really the one required.
- If after two weeks of using a certain plant remedy it shows no result whatsoever, a different method or a different plant should be tried instead. Not every human organism reacts in exactly the same way.

Be careful

- When you have found the species of plant you wish to gather, do not abuse it by crippling in hopelessly.
- Never uproot the plant unless it is specifically the root you require, and then be particularly careful not to denude the location of all specimens.
- Take only that part of the plant which is needed, and leave some of the flowers for natural re-seeding to repair the damage.
  Nature is not inexhaustible. Ruthless collecting of even the most common plant can lead to its extinction.

Notes on preparing remedies

TEAS or **TISANES** depend for their effectiveness on proper preparation. Whether they are made with cold water only, heated, or actually boiled for a while has a crucial effect on the active constituent of the plant. Unless otherwise stated, it is usually the dried drug that is used, and the teas may be made stronger than here given, depending on individual taste.

Infusions are made by either pouting boiling water on to the plant and allowing the liquid to stand for 10-15 minutes, or by putting plant and water in a covered pan, heating it to boiling point, at once removing from heat and leaving to stand for 10-15 minutes.

Decoctions are made by placing in cold water, heating slowly, boiling for 10-15 minutes, and allowing to stand for 15 minutes before straining.

For **Poultices**, the plants (usually fresh) are bruised with the flat side of a strong knife or ground in a mortar to make a pulp, and applied externally. Sometimes the plant is boiled in a minimum of water.

PHARMACOLOGICAL ASPECTS of HERBAL REMEDIES
PHYTOTHERAPY

Humans and animals have always used plants. The initial use of plants as medicines by humans is thought to have been the result of “instinctive” dowsing. Animals in the wild provide evidence that this phenomenon still occurs: they eat plants that heal them, and avoid plants that do them harm. Presumably humans also possessed this instinct at one time.
Herbs are simply sources of compounds to isolate and then market as drugs, but to some herbs
and crude plant extracts are effective medicines to be respected and appreciated.
The term used to describe the modern clinical use of herbs in many European countries is phytotherapy. "Phytotherapy" (from Greek "phyton" plant and "therapy" treatment) is a treating method by using phytomedicines. Phytotherapy is the science of using plant medicines to treat illness. The term of phytotherapy was reported from Henri Leclerc (1870-1955) firstly.
With the growing interest for alternative approaches in treating diseases, phytomedicines have
an important role for the development of new therapeutic agents. Formulation of national policy, legislation, regulation and licensing as well as approval of selected phytomedicines for use in human life should be realized by Health Authorities
The traditional herbal medicines (HM) and their preparations have been widely used safely and effectively for existence of human race in many countries. In 1985, the World Health Organization (WHO) estimated that perhaps 80 percent of the world’s population depend on plants to treat many common ailments. Approximately 50 % of modern drugs are derived from plant source. Despite its existence and continued use over many countries and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries. When traditional medicine is introduced into the western world, it becomes Complementary /Alternative Systems of Medicine. The reason is because of the comparative lack of evaluation of their quality, efficacy and safety issues. The Western medical system does not encourage the use or scientific validation of herbal therapy,
so the mainstream public knows relatively little about it. Consequently, education, training and research in this area have not been accorded due attention and support. The quantity and
quality of the safety and efficacy data on traditional medicine are far from sufficient to meet the criteria needed to support its use world-wide. Herbal remedies have reached their highest usage since the FDA’s decision to categorize them as food supplements in 1990.
Medicinal plants are an important source for drug development not only when plant material is used directly as therapeutic agents, but also as starting materials for the synthesis of drugs and as models for pharmacologically active compounds. Approximately 50 % of modern drugs are derived from plants. Demand for medicinal plants is increasing in both developing and developed countries. Therefore, regulation of exploitation and exportation is essential, together with international cooperation and coordination for their conservation to ensure their availability for the future.
In recent years, many developed countries have shown growing interest in alternative or complementary systems of medicine, with a resulting increase in international trade in herbal medicinal products. This stimulus consequently exists in both developed and developing countries, to assess and rationalize practices, and to control commercial exploitation through OTC sale of proprietary labelled herbal medicines.
Legislative controls in respect of medicinal plants have not evolved around a structured control model. There are different ways in which countries define medicinal plants or herbs or products derived from plant material. The countries have adopted various approaches to licensing, dispensing, manufacturing and trading to ensure their safety, quality and efficacy. On the other hand, a relatively small number of plant species has been studied for possible medicinal applications. Therefore, appropriate research methodology, standardization of herbal medicines; safety and efficacy of traditional remedies as well as national policy for legislation, regulation and licensing of herbal medicines by health authoritieshave to be realized.
The definition of ***herb*** is a plant or plant part or plant material used for medicinal purposes.

Herbal medicine is a medicinal preparations made from a plant, can include the fresh or dried herb or herb part, whole, chopped or powdered or an advanced form of the herb usually made via extraction by a solvent such as water, ethanol or an organic solvents (acetone). Such advanced herbal preparations often processes in a way that establishes relatively fixed chemical parameters are called as ***standardized extracts***. Advanced herbal products are usually referred to as ***Phytomedicines***.

Herbal medicines have been playing an important role in the primary health care of the people around the worlds. In order to keep place with the modern medicines, the production of safe and effective herbal medicines in a standardized way is essential.

In general, one or two markers or pharmacologically active components in herbs and or herbal mixtures were currently employed for evaluating the quality and authenticity of herbal medicines in the identification of the single herb or HM preparations, and in assessing the quantitative herbal composition of an herbal product. This kind of the determination, however, does not give a complete Picture of a herbal product, because multiple constituents are usually responsible for its therapeutic effects. These multiple constituents may work synergistically and could hardly be separated into active parts. It has also been demonstrated with many plants that the whole plant or crude extract is much more effective than isolated constituents. Moreover, the chemical constituents in component herbs in the HM products may vary depending on harvest seasons plant origins, drying process and other factors. Thus it seems to be necessary to determine most of the phytochemical constituents of herbal products in order to ensure the reliability and repeatability of pharmacological and clinical research, to understand their bioactivities and possible side effects of active compounds to enhance product quality control. Herbal medicines are mixtures of more than one active ingredient. The multitued of pharmacologically active compounds obviously increases the likelihood of interaction taking place. Hence, the likelihood of herb-drug interactions is theoretically higher than drug-drug interactions, if only because synthetic drugs usually contain single chemical entities.

Herbal preparations are less toxic than their synthetic counterparts and offer less risk of side effects.

The growth of the pharmaceutical industry and the increasing development of new synthetic and biological medicines have not diminished the importance of medicinal plants. During the 21st century, increasing interest in the industrialized nations have greatly expanded the demand for medicinal plants and their products. Regulations in countries for the assessment of the quality, safety and efficacy of phytomedicines and the work of WHO in supporting the preparation of model guidelines in this field have been helpful in recognition of their role in health care systems in different parts of the world.

Improvements in cultivation techniques, coupled with improvements in quality control and standardisation of potency, will continue to increase the effectiveness of herbal medicines.

Commercial herbal preparations are available in several different forms: bulk herbs, teas, tinctures, fluid extracts, and tablets or capsules. An extract is a concentrated form of the herb, obtained by mixing the crude herb with an appropriate solvent (such as alcohol and / or water). When an herbal tea bag in hot water, it is actually type of herbal extract known as an infusion. Teas often are better sources of bioactive compounds than the powder herbs, but are relatively weak in action compared to tinctures, fluid extracts, and solid extracts.

Herbal medicines, Dietary Supplements, Nutraceuticals and Functional Foods should be good described, otherwise, all terms are confused.

HERBAL MEDICINES

Production of herbal products

Collection-Harvesting

When plants are collected from their natural habitat they are said to be “wild-crafted”. When they are grown, utilizing commercial farming techniques, they are said to be “cultivated”. When a herb is wild-crafted, there is a much greater chance that the wrong herb will be picked, a situation that could lead to serious consequences. In addition, the content of secondary metabolites are changed depends on different factors. Collection of plants from cultivated sources ensures that the plant collected is the one that is desired.

Drying

After harvesting, most herbs have a moisture content of 60 to 80 percent and cannot be stored

without drying. Otherwise, important compounds would break down or microorganisms would break down or microorganisms would contaminate the material. The majority of herbs require relatively mild conditions for drying. Commercially, most plants are dried within a temperature rannge of 30-40oC. During drying the plant material must not be damaged or suffer losses that would prevent it from conforming to accepted standards. With proper drying, the herb’s moisture content will be reduced to less than 14 %.

Garbling

Garbling refers to the separation of the portion of the plant to be used from other parts of the plant, dirt, and other extraneous matter. This step is often done during collection. Although there are machines that perform garbling, garbling is usually performed by hand.

Grinding

Grinding or mincing an herb involves mechanically breaking down either leaves, roots, seeds or other parts of a plant into very small units ranging from larger, coarse fragments to fine powder. Grinding is employed in the production of crude herbal products as well as in the initial phases of extracts.

Extraction

The process of extraction is used in making tinctures, fluid extracts, and solid extracts.

Commercial herbal preparations are available in many different forms:

Herbal powders

Usually available in capsules or tablets, herbal powders typically have minimal processing and a reasonably priced.

Teas

Herbs are prepared as medicinal teas. An infusion and a decoction are made by combining bulk herbs in water;

Decoctions: Bulk herbs are boiled in water

Infusions: Boiling water is poured over the herb and let it step.

Many plants have active constituents that are not soluble in water. Liquid or solid extracts are prepared in such cases.

Tinctures

Herb is soaked in a solvent (alcohol or water) for several hours, days, or even weeks, depending on the herb. Tinctures are most commonly made with alcohol. Tinctures are typically a 1:5 or 1:10 concentration. This means that one part of the herbal material is prepared with five to ten parts (by weight) of the liquid. A tincture is therefore usually considered a more diluted herbal preparation.

Fluid extracts

Fluid extracts are most concentrated than tinctures. Fluid extracts are typically a 1:1 concentration.

Solid extracts

A solid extract represents the most concentrated form of an herbal product. It results when all of the solvent is evaporated off, leaving a solid residue. These residues are usually available in

powdered form. Solid extracts are typically 2:1 to 8:1 concentration

Standardized extracts

The term standardized extract refers to an extract guaranteed to contain a standardized level of

active compounds. Stating the content of active compounds rather than the concentration ratio

allows for more accurate dosages to be made. The best way to express the quality of herbs in
terms of its active components. Regardless of the form the herb is in, it shold be analyzed to ensure that it contains these components at an acceptable standardized level.

Comparing dosage

A rough comparisons are:

1 g of a 10:1 solid extract equals, 10 ml of a 1:1 fluid extract and 100 ml of a 1:10 tinctures

Herbal medicines have been playing an important role in the primary health care of the people
around the worlds. In order to keep place with the modern medicines, the production of safe and effective herbal medicines in a standardized way is essential.

- Quality assessment: crude plant material, plant preparation, finished product
- Manufacturing practice
- Safety assessment: documentation safety based on experience and toxicology studies
- Assessment of efficacy: documented evidence of traditional use and activity determination (animals and human)

QUALITY ASSESSMENT

Quality control steps necessary for the registration of plant based drug formulation:

1. Selection of suitable plant material
2. Botanical investigation
3. Chemical analysis, using appropriate laboratory equipment
4. Screening for biologically activity
5. Analysis of active fractions of crude extracts
6. Isolation of active principles
7. Determination of chemical structure of active principles
8. Comparison with compounds of similar structure
9. Analytical method developed for formulation
10. Detailed pharmacological evaluation
11. Studies performed to determine activity and toxicity formulation
12. Studies on absorption, distribution and elimination of herbal compounds
13. Clinical trials performed to determine activity in humans
14. Registration by national Drug Authorities

Quality control steps of phytomedicines contain properties of crude plant material, plant preparation and manufacturing practice along with the properties of finished product. Quality assurance of control steps should be done according to the rules of International Conference on Harmonization (ICH-Q).

Quality control methods

Improvements in analytical methods have led to definite improvements in harvesting schedules, cultivation techniques, storage, activity, stability of active compounds, and product
purity. All of these gains have resulted in tremendous improvements in the quality of herbal preparations now available.

For example, optimal activity and quality collection should be done at a time when the active ingredient is present in the greatest amount. Improvements in analysis have led to more precise harvesting of many herbs.

Methods currently utilized in evaluating herbs and their extracts include the following:

- Organoleptic
- Microscopic
- Physical
- Chemical/physical
- Biological

Organoleptic analysis involves the application of sight, odor, taste, touch, and occasionally even sound, to identify the plant. The initial sight of a plan tor extract may be so specific that is sufficient for identification. If this is not enough, perhaphs the plan tor extract has a characteristic odor or taste.

Microscopic evaluation is the initial identification of herbs, as well as in identifying small fragments of crude or powdered herbs adulterants (e.g., insects, animal feces, mold and fungi)

and characteristic tissue features of the plant. Every plant possesses a characteristic tissue structure.
In crude plant evaluation *physical methods* are often used to determine the solubility, specific gravity, melting point, water content, degree of fiber elasticity.
Various *chemical/physical method*s are also used to determine the percentage of active principles, alkaloids, flavonoids, enzymes, vitamins, essential oils, fats, carbohydrates, protein, ash, acid-insoluble ash, or crude fiber present.
The final analytical process requires more precise assays to determine quality. Sophisticated techniques, such as high-pressure liquid chromatography and nuclear magnetic resonance, are
often used to separate molecules. The readings from these machines provide a chemical "fingerprint" as to the nature of chemicals contained in the plant or extract. These techniques are invaluable in the effort to identify herbs, as well as to standardize extracts.
The plant or extract can then be evaluated by various *biological methods*, mostly animal tests,
to determine pharmacological activity, potency and toxicity.

Quality control in herbal products

Quality control refers to process involved in maintaining the quality or validity of a product . Regardless of the form of herbal preparation, some degree of quality control should exist. Without quality control, it can not be sure that the herb contained in the bottle is the same as what is stated on the label.
The solution to the quality control problem of herbal products, which should be produced in GMP (good manufacturing practices) put into practice factory. With improvements in the identification of plants by laboratory analysis, consumers should at least be guaranteed that the right plant is being used. Consumers, health food stores, pharmacists and physicians who
use or sell herbal products should ask for information from the suppliers of herbal products on
their quality control process.
In general, it is believed that if the active components of a particular herb are known, the herbal product should be analyzed to ensure that it contains these components at an acceptable/standardized level.

A. Control of starting materials

1. Authentication of the plant material,
2. Guidelines on sampling,
3. Inspection of the contents of the units selected for sampling organoleptic characteristics (color, texture and odor), presentation of the material (raw, cut, crushed, etc)
4. Drying methods, stabilizing methods (if available)
5. Storage conditions and period prior to use of specifications are an important for the quality of phytomedicines. Therefore, the following parameters are to be taken care of:

Properties and Specifications of plants / plant parts/ standardized extracts
Specification of excipients
Routine tests and validation of analytical tests

a. Properties and specifications **for plants**

Latin name of the plant (subspecies, variety and hybrid details of the plants which formed the hybrid should be given, if necessary)
Author (s) name of the plant species
Family of the plant species
Local name of the plant species (if any)
Data for wild or cultivated plant species

b. Properties and specifications **for cultivated plant species**

Certificate of Good Agricultural Practice-GAP
Collection site, address, and date

c. Properties and specifications **for plant parts used**

Latin name and description
Monographs in Pharmacopoeias, WHO (World Health Organization),
ESCOP(European Scientific Cooperative on Phytotherapy) and Commission E
Drying methods

Stabilization method (if available)
Storage conditions and period prior to use Specifications
Macroscopic, microscopic, chemical and biological analysis, control methods and acceptable limits
Determination of Ash (Total and insoluble in HCl)
Determination of Moisture
Determination of Foreign materials
Determination of major compound (s)
Determination of extractable matter
Determination of water and volatile matter
Determination of volatile oils (if available)
Determination of bitterness value
Determination of haemolytic activity
Determination of tannins
Determination of swelling and foaming index
Specific analytical development and control methods
Examination of potential contamination by microorganisms
Examination of pesticide residues
Examination of fumigants (if necessary)
Examination of radioactive residues and afflatoxin (if necessary)
Examination of heavy metals (Pb and others if necessary)
Examination of potential adulterant materials
Finger-printing validation by modern instrumental techniques
d. Properties and specifications **for standardized extract, volatile oil, fixed oil, resin etc. used** as active ingredient (s)
Scientific Latin name and description
Monographs in Pharmacopoeias, WHO (World Health Organization), ESCOP(European Scientific Cooperative on Phytotherapy) and Commission E
Method of the preparation process
Specifications
Specific analysis and control methods and acceptable limits
Storage conditions and period prior to use
List and copies of the literature used
There are standard analytical methods recommended by other organizations such as WHO, EU, UNIDO, etc. are available for the above parameter determination) if not validation of analytical methods.

Instrumental determination

• TLC and HPTLC – fingerprinting, less accurate (overlap, constituent not determined. etc), but cheap
• GC-FID/MS – constituent determination, rather cheap, limited for volatiles
• HPLC – fingerprinting, more accurate than TLC, more expensive
• UPLC – newer technique, higher resolution, more accurate
• LC-MS – constituent determination capability, more information can be derived by knowing the constituents, expensive (instrument)
• LC-NMR - constituent determination capability, more information can be derived by knowing the constituents, expensive (instrument as well running)
• Total Quality Profiling -NMR Fingerprinting
• AAS, ICP-OES, ICP-MS for determination of trace elements and heavy metals.

B. Manufacturing Practice

• Manufacture formula
• Manufacturing process
• In-Process Controls

C. Control of Finished Product

a. Specifications
b. Tests for Identification and Quantitative Determination for the Standardized Extracts, Excipient and Related Substances
-Purity tests
-Microbiological quality

-Pharmaceutical tests
Pharmaceutical properties depends on pharmaceutical dosage forms (tablet, capsule, solution, suspension, etc.)
-Dissolution tests
-Stability tests
Stability tests of the quality characteristics for the recommended shelf-life and validation of test methods
Characteristics investigated
Physical / chemical / microbiology / chromatographic
Product interaction with closure / container system

D. Control of Packaging Material

Specifications
Interactions with final product
Analysis and control methods

Standardization of herbal preparations

Advances in chemical and biological techniques have resulted in scientific evidence to substantiate the use of many herbal products and have enabled manufacturers to produce standardized herbal preparations. Standardization is necessary to optimise effects and to guarantee of reproducible pharmacological and clinical studies as well as to adjuce individual dosages.
Standardised extracts are adjusted within an acceptable tolerance to a given content of constituents with known therapeutic activity.
Standardisation is achieved by adjustment of the extract with inert material or by blending batches of extracts.

Standardized extracts

Standardized extracts are adjusted to a definite range of marker compound(s)
-to guarantee of reproducible pharmacological and clinical studies
-to adjuce individual dosages
• Quality control tool- Monitoring markers allows confirmation that product contains the correct amount of extract
• Positive control for production finished product that fails to contain appropriate amount of marker(s) has not been manufactured properly
• Guarantees batch to batch consistency but not necessarily *in vivo* potency

Importance of standardization

Standardized herbal products of consistent quality, containing well-defined constituents, are required for reliable clinical trials and to provide consistent beneficial therapeutic effects.
Pharmacological properties of a herbal formulation depend on phytochemical constituents present therein. Development of authentic analytical methods, which can reliably profile the phytochemical composition, including quantitative analyses of marker/bioactive compounds and other major constituents, is a major challenge to the scientists. Without consistent quality of phytochemical mixture, consistent pharmacological effect is not expected.
Emergence of new interest and growing market of Herbal Medicinal Products (HMP's) needs commitment from the stakeholder to safeguard the consumer and the industry.
Standardization will enhance the value and acceptance of Phytomedicines.

ISSUES IN STANDARDIZATION

1. Inherently complex mixture of constituents in medicinal herbs
2. Biological effects and mechanism of action of not all constituents are known.
3. Existing technologies are not adequate for complete analyses of constituents.
4. High cost of analyses.
5. Inherent variation in phytochemical constituents depending on sourcing, collection time and sampling techniques
6. Effect of post-harvest handling and processing on phytochemical profiles.
7. Non-availability of facilities, expertise and trained human resources.

Marker compounds

Marker compounds are one or more constituents that occur naturally in order to use
-Botanical description
-Detection of adulteration
-Quality indicators

Shelf-life indicators (Stability)

• Monitoring the markers allows confirmation that product contain the correct amount of extract (Quality control tool)

• Positive control for production of finished product that fails to contain appropriate amount of markers has not been manufactured properly

• Guarantees batch to batch consistency but not necessarily

• Spectroscopic fingerprinting of standardized formulations may be useful in monitoring herbal medicine.

Benefits of marker compounds

• Quality control tool-Monitoring markers allows confirmation that product contains the correct amount of extract

• Positive control for production finished product that fails to contain appropriate amount of marker(s) has not been manufactured properly

• Guarantees batch to batch consistency but not necessarily *in vivo* potency

SAFETY and EFFICACY ASSESMENTS

Herbal medicinal products are largely unregulated as drugs and contamination is an important safety issue with them. They have to be manufactured in good quality specifications.

It is important that the manufacture of herbal medicines moving in international commerce needs to be governed by similar standards of quality, safety and efficacy as those required for pharmaceutical products

-Development of monitoring and surveillance systems for herbal medicines

-Establishment of Pharmacovigilance activities

-Collaboration with poison control centers

-Development of Public information and educational tools for consumers

FUTURE DIRECTION

All of the supporting evidence behind the use of phytomedicines has been on use of standardized extracts of the plant material to ensure reproducibility in the clinical setting.

For the future development of phytomedicines, researches can be focused;

• characterization of phytomedicines in terms of chemical composition and biofunctional activity (HPLC fingerprint analysis of plant extracts for quality controls)

• studying the effects of certain processing and extraction methods and parameters on the chemical characteristics of phytomedicines source materials

• development of chemo-based and bio-based standardization methods for phytomedicines.

Good Medicinal Plant Practice (GMPP) consisting of the following should be enforced:

• Good Agricultural Practice (GAP)

• Good Gathering Practice (GGP)

• Good Harvesting Practice (GHP)

• Good Laboratory Practice (GLP)

• Good Manufacturing Practice (GMP)

• Good Storage Practice (GSP)

• Coordinated efforts of

• Traditional practitioner

• Taxonomist

• Pharmacognosist

• Analytical chemist

• Toxicologist

• Microbiologist

• Instrument technician / technologist

• Clinical pharmacologist–necessary to ensure acceptance and safety

LEGAL REQUIREMENTS and ASSESSMENT of HERBAL MEDICINAL PRODUCTS

A. Classification of Herbal Medicinal Products

Herbal medicinal products are classified as a drug without a therapeutic claim. If they do a therapeutic claim, they are classified as a drug product and subject to drug regulations.

Before November 1999, all of these products could be registered as food supplements by the Ministry of Agriculture. After this date, the Ministry of Health strengthened its classification criteria and started requesting herbal medicinal product manufacturers to register their products as medicinal products. A medicinal product should have rehabilitating, preventive or curing properties and to be presented in a pharmaceutical form. Their effects are based on their traditional use.

B. Application of the General Health Law to Herbal Medicinal Products

The general health law has a specific set of articles that regulate all pharmaceutical activities in Turkey including registration and selling of medicinal products.

Herbal medicinal products should submit the complete dossier prepared according to the guideline.

Microbiological tests are used as a means to assess safety.

Efficacy should be supported by bibliographic references from well-known sources. Other references used by the Health Authorities are the monographs of the Ph.Eur., WHO and ESCOP.

C. Application of GMP to Herbal Medicinal Products

Herbal Medicinal Products are subject to the GMP.

Control of the starting materials of herbal medicinal products is made by comparing with the standards of the Ph.Eur. and other major pharmacopoeias.

D. Post-marketing Surveillance

The adverse drug reaction reporting systems in Turkey also monitor herbal medicinal products. At this time, the system has little information on herbal medicinal products. Withdrawal of herbal products from Turkish market has occurred as a result of adverse drug reactions reported in other countries.

E. Labeling and Advertising of Herbal Medicinal Products

All of the herbal medicinal products have to comply with the labeling norm. They have developed appropriate advertising campaigns.

F. Distributions

The registered herbal medicinal products are distributed in Turkey through pharmacies as non-prescriptional drugs.

REGULATION ISSUE

The legal situation of herbal preparations varies from country to country. In some, phytomedicines are well established whereas in others they are regarded as food, dietary supplement and therapeutic claims are not allowed. Developing countries often have a great number of traditionally used herbal medicines and much folkloric knowledge about them however they have hardly any legislative criteria to establish these traditionally used herbal medicines as part of the drug legislation.

The following factors applied in regulatory systems for the classification of herbal products:

- Description in a Pharmacopoeia monograph,
- Prescription status,
- Claim of a therapeutic effect,
- Scheduled or regulated ingredients and
- Period of use.

The varies legislative approaches for herbal medicinal products fall into one or other of the following categories:

- same regulatory requirements for all products
- same regulatory requirements for all products, with certain types of evidence not required for herbal medicines
- exemption from all regulatory requirements for herbal medicines
- exemption from all regulatory requirements for herbal medicines concerning registration or marketing authorization
- herbal medicines subject to all regulatory requirements
- herbal medicines subject to all regulatory requirements concerning registration or marketing authorization

International Conference on Drug Regulatory Authorities (ICDRA)

Herbal medicines have been included in the International Conference on Drug Regulatory Authorities since the Fourth conference in 1986. Conferences in 1986 and 1989, both confining their deliberations to the commercial exploitation of traditional medicines through

OTC labeled products. It was concluded that the World Health Organization should consider preparing model guidelines containing basic elements of legislation and registration.
Then, a WHO consultation in 1991, drafted guidelines for the assessment of herbal medicines
which were adopted for general use by the Sixth ICDRA in Ottawa, 1991. These guidelines define basic criteria for the evaluation of quality, safety and efficacy of herbal medicines to assist national regulatory authorities, scientific organizations and manufacturers to undertake an assessment of the documentation of submissions and the dossiers in respect of such products. These guidelines also contain and important requirements for labeling and the package insert for consumers' information.
The requirements for pharmaceutical assessment cover issues such as identification, galenic forms, analysis and stability.
Safety assessment should at least cover the documented experience of safety and toxicological
studies, where indicated.
The assessment of efficacy and intended use includes evaluation of traditional use through appraisal of the literature and evidence to support the indication claims.
The recommendations of the sixth ICDRA prompted WHO to continue to develop pharmacopaeial monographs on herbal medicines on the basis of the guidelines for the assessment of herbal medicines. These monographs include two parts:
• Part I consists of summaries of the botanical characteristics, major active chemical constituents and quality control of each plant,
• Part II consists of summaries of clinical applications, pharmacology, possible contrindications and precautions as well as potential adverse reactions.
The purpose of these monographs is
• to provide scientific information on the safety, efficacy and quality control of widely used medicinal plants and
• to facilitate the proper use of herbal medicines.
• Regulatory Situation
Although, the discovery of useful therapeutics from plants has changed the face of medicine and the course of civilization, many people, especially some in the Federal Government, evaluate herbal remedies as though they were either worthless or dangerous. Today in the United States, herbal products can be marketed only as food supplements. An herb manufacturer or distributor can make no specific health claims without FDA approval. A growing number of Americans are interested in herbal preparations.
European guidelines for the assessment of herbal remedies follow up on WHO's Guidelines for the Assessment of Herbal Medicines, which state that a substance's historical use is a valid way to document safety and efficacy in the absence of scientific evidence to the contrary.
In the developing world, herbs used for medicinal purposes are "crude drugs." These are unprocessed herbs--plants or plant parts, dried and used in whole or cut form. Herbs are prepared as teas (sometimes as pills or capsules) for internal use and as salves and poultices
for external use. Most developing countries have minimal regulation and oversight.

European Guidelines for the Assessment of Phytomedicines

Drug approval considerations for phytomedicines (medicines from plants) in Europe are the same as those for new drugs in the United States, where drugs are documented for safety,
effectiveness, and quality. But two features of European drug regulation make that market more hospitable to natural remedies. First, in Europe it costs less and takes less time to approve medicines as safe and effective. This is especially true of substances that have a long
history of use and can be approved under the "doctrine of reasonable certainty." According to this principle, once a remedy is shown to be safe, regulatory officials use a standard of evidence to decide with reasonable certainty that the drug will be effective. This procedure dramatically reduces the cost of approving drugs without compromising safety. Second, Europeans have no inherent prejudice against molecularly complex plant substances; rather, they regard them as single substances.

The European Community (EC), has developed a comprehensive legislative network to facilitate the free movement of goods, capital, services and persons in the Community. According to the directives 65/65/EECand 75/318/EEC, pharmaceutical products require premarketing
approval before gaining access to the market. Requirements for the documentation of quality, safety and efficacy, the dossier and expert reports are laid down in directive 91/507/EEC. Directive 75/319/EECobliged member states to check all products on the market
at that time, with a deadline of 12 years, to determine whether they met the requirements of these directives.
According to the directive 65/65/EEC, herbal medicinal products includes plants, parts of plants and their preparations mostly presented with therapeutic or prophylactic claims. If they do mot make these claims, they are not classified as medicinal products. They belong to the food or cosmetic area.
To achieve free movement of medicines within the common market of the European Union, and a centralized system of marketing authorization with the possibility of application at national level only, a system of mutual recognition of marketing authorization decisions has been installed. This decentralized procedure provides as a general rule, that an assessment by
one national authority should be sufficient for subsequent registration in other Member States.
Under this procedure, “Summary of Product Characteristics” (SPC) approved by the first authority must be taken into account. In the field of phytomedicines, there are different national viewpoints and traditions therefore, the harmonization of scientific assessment is considered for the adjustment of different marketing authorization decisions.
The European Scientific Cooperative on Phytotherapy (ESCOP) was founded in 1989,
• to establish harmonized criteria for the assessment of phytomedicines,
• to support scientific research and
• to contribute to the acceptance of phytotherapy at a European level.
Criteria for the selection of medicinal plants to prepare ESCOP monographs is mainly their importance in European countries and their inclusion in the European Pharmacopoeia or a national Pharmacopoeia. ESCOP and WHO monographs are used in many Member States as
a summary of bibliographic data.
In 1978, the Commission E was formed as a division of the German Federal Health Agency to
evaluate the safety and efficacy of 380 herbal medicines sold in Germany. Positive and negative monographs were prepared and published. Positive monographs are widely used to document safety and efficacy of herbal medicines. Monographs have pharmacological, toxicological and clinical documentation as can bibliographic data.
Inspections concerning Good Manufacturing Practice (GMP) are carried out in all Member States. All Member States apply the manufacturing requirements of the directive 75/319/EEC to herbal medicinal products. Starting materials of herbal medicinal products are controlled in accordance with the European Pharmacopoeia in all Member States.
The adverse reaction reporting systems of the Member States also monitor herbal medicinal products.
Directive 92/27/EEC on labelling and leaflets has been implemented by all Member States.
All Member States have implemented directive 92/28/EEC on advertising into national law.
Distribution and the retail sale of herbal medicinal products is restricted to pharmacies (directive 92/25/EEC)

Intellectual Property Rights

• To change import policy in order to encourage local manufacture of raw materials.
• To produce of herbal preparations from medicinal plants
• To organize farming of medicinal plants for industrial scale

Single herbs or herbal combinations?

Using single herb preparations or small combinations should be prefered for the treatment of health conditions. Sometimes combinations help more. For example a person with high cholesterol and intermittent claudation will benefit far more if he combines garlic and ginkgo.

But putting ginkgo in formula with valerian and other herbs and claiming it's good for hyperactive kids is senseless.
A health care professional can be useful guide. Also finding a retail outlet with an educated staff will make your decision easier.
Use the advice of an expert in herbal medicine

Where can I buy herbal products from?

First criterion should be quality control. A quality herb company buys the best raw materials and maintains strictest quality assurance in its manufacturing methods. This includes testing raw materials for adulterants, heavy metals, pesticides, and bacteria. Assaying for levels of active constituents. A quality herb company will continue to test for contaminants and bacteria during manufacturing. Its labels and packaging will accurately depict the contents of the product and its shelf life. This includes the content of the herb(s) in the product as well as any fillers and excipiens. For example: if it's a liquid product, what is the concentration of alcohol or glycerin?
Companies labels will be based on research and clinical information instead of hypothesis.
Shop assistants should be educated. Educated shop assistants help ensure that you receive accurate and reliable information.

Organically grown or wild-crafted?

Organically grown means that no pesticides, herbicides, chemical fertilizers or irridation were used to produce, grow or preserve the plant.
Wild-crafted usually means that the herb is not grown in a controlled setting such as a farm. Wild crafted herbs are usually picked in the wild by an experienced persons, it is fraught with potential problems:
1. The environmental impact.
2. Consistency in wild-crafted herbs. Different growing conditions can significantly change the concentration of medically active constituents.

FUNCTIONAL FOODS, DIETARY SUPPLEMENTS and NUTRACEUTICALS

The area of functional foods and nutraceuticals is growing worldwide and has emerged as a major trend in the food and nutrition industry. Functional foods and nutraceuticals are clearly poised as a 21st century industry. They promise value-added oppotunities in the food industry
and new market opportunities for the pharmaceutical industry. They also offer advances in public health claim marketing messages empower consumers to select healthier food choises.
In recent years, consumers have begun to look at food not only for basic nutrition but also for health benefits. Therefore, the functional food and nutraceutical industry is responding to a continuing increase in consumer understanding of the link between diet and disease, rising health care costs, aging populations and advances in food technologies. This industry has significant potential to improve the health of citiizens, reduce health care costs, support economic development in rural communities. Regulating the growing nutraceutical industry is important to maintain the high standard of food safety.
The physiological benefits of nutraceuticals are achieved only if
• The product is consumed and
• The bioactive substance is present at the required concentration.
In addition, education of health professionals on the rational use of nutraceuticals and public information and educational tools for consumers should be developed.

FUNCTIONAL FOODS

Functional foods are similar in appearance to, or may be a conventional food that are consumed as a part of a usual diet and they are demonstrated to have a physiological benefit and reduce the risk of chronic disease beyond basic nutritional functions. They contain bioactive compound (s).

DIETARY SUPPLEMENTS

Dietary supplemnts are a product that are intended for ingestion in pharmaceutical form, contain vitamins, minerals, amino acids, plant extract and/ or bioactive compounds such as DHEA, melatonin.

NUTRACEUTICALS

Nutraceuticals are a product isolated or purified from foods that are generally sold in

pharmaceutical forms not usually associated with foods.
They are demonstrated to have a physiological benefit or provide protection against chronic disease. They must not only supplement the diet but also aid in the prevention of disease.

Modul 3: **INFORMATION ABOUT AGRICULTURAL ASPECTS – Slovak University of Agriculture in**
Nitra (CURRICULUM)
Modul 3 of Ing. Miroslav Habán, PhD. (Slovak University of Agriculture in Nitra) is concentrated on the nost frequently grown and
used inland medicinal plants. The perspective and the increase of interest on medicinal plants in the Slovakia are limited by factors.
As open, continually changing problems remain question connected with rules of good agricultural and production practices,
cultivation efficiency, value of subsidy and with real possibilities of market and grown raw materials processing.

I. INTRODUCTION

- Why medicinal, aromatic and spicy plants (MASP), historical background, current sources

II. BASIC INFORMATION ABOUT MEDICINAL PLANTS

- Scientific (Latin) Names, Synonyms
- Importance of Cultivation
- Description, Taxonomy and History
- Biological and Botanical Characteristics
- Ecobiology and Biodiversity, Occurence and Amplify
- Agroecological and Cultivation Notes
- Climate: Water, Temperature, Light;
- Soil, Nutrients

III. MOST POPULAR GROWING MEDICINAL PLANTS IN SLOVAKIA - TECHNOLOGY OF CULTIVATION (Propagation
and Cultivation)

- Commercial Varieties and Cultivars Assortment
- Crop Rotation
- Soil Cultivation
- Nutrition and Fertilizing
- Crop Establishment
- Plants Care During Vegetation
- Plants Protection Against Damaging Factors
- Diseases Control
- Pest Control
- Weed Control

IV. GOOD AGRICULTURAL AND COLLECTION PRACTICE

- WHO guidelines
- Basic Information

V. MEDICINAL PLANTS FROM NATURE

- Scientific (Latin) Names, Synonyms
- Importance of the Localities
- Description, Taxonomy and History
- Biological and Botanical Characteristics
- Ecobiology and Biodiversity, Occurence and Amplify
- Agroecological and Localities Notes
- Engendared species of Medicinal Plants in Slovakia

V. TECHNOLOGY OF HARVEST AND STORAGE

- Harvest Technology
- After-harvest Technology
- Conservation and Plant Drying

VI. CHEMISTRY - CHEMICAL COMPOSITION AND DRUG QUALITY

VII. USAGE

- Traditional /Folk/ Medicine and Ethnomedicine
- Oficial and Alternative Medicine

- Potentional Toxicity and Warnings (□)
- Pharmaceutics
- Others

CULTIVATION OF MEDICINAL, AROMATIC AND SPICY PLANTS IN SLOVAKIA AFTER JOIN THE EUROPEAN UNION

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SUMMARY
European Union represents the biggest unique market with medicinal, aromatic and spicy plants (MASP) in the world. It was about 120,000 tons (e.g. 200 million USD) of this plant material during the years 1991-2004. Paper is orientated on the current status and situation in the field of MASP grown and produced in Slovakia. Growing areas of these plants were the lowest in 1999 (467.44 ha) and the highest in 2003 (851.85 ha). Global production varied between 222.2 (2000) and 1380.2 tons (2004). Average yields ranged from 0.32 (2000) to 2.60 t.ha-1 (2004). Acute problem is to increase and stabilize the production and to obtain stronger position on global herbal market. The objectives of future medicinal plant strategy are: (1) To ensure the quality of MASP material used as the source for herbal medicine to improve the quality, safety and efficacy of finished herbal products; (2) To improve national and/or regional good agricultural practice, processing guidelines, publications about MASP and related standards for operating procedures; (3) To encourage and support the sustainable cultivation and collection of good quality MASP, in ways that respect and support the conservation of the environment. As an alternative for MASP producers can be the organic production of MASP. Demand for organic products is still increasing in EU as well as the consumption of natural substances.

Key words: *cultivation, medicinal, aromatic, spicy plants, production*

INTRODUCTION

Cultivation of medicinal, aromatic and spicy plants (MASP) has recorded long tradition in the agri-ecological conditions of Europe. It was originated in Mediterranean, where many MASP species were produced in the past. From the point of view biodiversity, there are approximately 130 – 150 MASP species cultivated in Europe and 150 – 170 MASP species are collecting from their natural resources nowadays. As the most cultivated MASP in Europe are: *Carum carvi* L., *Coriandrum sativum* L., *Foeniculum vulgare* Mill., *Silybum marianum* (L.) Gaertn., *Pimpinella anisum* L., *Artemisia absinthium* L., *Matricaria recutita* L., *Hypericum perforatum* L., *Mentha piperita* L., *Melissa officinalis* L., and *Lavandula angustifolia* Mill.

Producers in most Central European countries are in close contact with processors, which determine requirements for type and amount of demanded MASP raw material. Different types of private or state producers cultivate the MASP species in Slovakia:

- Specialized farms for MASP cultivation;
- Farms produce MASP supplementary;
- Agricultural companies with their own processing of MASP products or semi-products
- Industrial processing organizations – pharmaceutical, food or cosmetics, including global companies. They secure the required amount of raw material by contracts with individual producers;
- Research, educational organizations or botanical gardens;

- Gardens on small areas (less than 400 m2).

The importance of MASP is varied. It is orientated to different using of processed plants, their parts or utilizing of active ingredients in these areas:

- Human and veterinary medicine, pharmaceutical and cosmetics industry use the medicinal plants as a raw material;
- Food industry (e.g. brewery), tobacco industry, cosmetics industry use aromatic plants as a raw material;
- Food industry (producing of foods, canning industry, alcohol production) as well as homes are using of spicy plants.

RESULTS AND DISCUSSION

Current status of MASP cultivation in Europe

European Union represents one of the biggest unique markets with medicinal, aromatic and spicy plants (MASP) in the world. It imports about 120,000 tons with the value of 200 millions US$ in average during 1991 – 2004 (UN Comtrade, 2004). This market exchanges increase every year between 5 – 10 % (Lange, 1998). The most important importer within European MASP market is Germany with more than 45,000 t.year-1 (e.g. 38 % of global European import). It is followed by France with 17 % and Italy with 9 % of global import (Commonwealth Secretariat, 2001). Germany is also the biggest (re-) exporter of MASP within EU (Tables 1 and 2). It exports circa 15,000 t.year-1 to the other EU countries and to the USA. The next big exporters are: France, Poland, Hungary, and Czech Republic etc. The most important non-European suppliers of MASP to the EU countries from the point of view value of global import of these commodities are: USA (15.80 %), India (8.00 %), China (7.45 %), Bulgaria (6.44 %) and Egypt (5.47 %).

Table 1: The cultivation acreage of medicinal, aromatic and spicy plants (MASP) in selected European countries in 2003 (UN COMTRADE, 2004).

Country	Acreage [ha]	Country	Acreage [ha]
Belgium	100	Poland	30,000
France	25,000	Austria	4,300
Netherlands	2,500	Slovakia	1,500
Ireland	50	Slovenia	100
Hungary	37,500	Switzerland	150
Germany	12,000	Great Britain	4,000

Table 2: Market with MASP in selected EU countries in 2003 (UN COMTRADE, 2004).

Country	Export [t]	Import [t]	Balance (I – E) [t]	Export value [$]	Import value [$]
Slovakia	603.2	347.8	-255.4	1,206,720	971,495
Germany	16,729.9	45,700.5	28,970.7	73,449,000	100,720,000
France	8,150.0	18,234.3	10,084.3	52,500,880	48,902,956
Belgium	1,935.4	4,795.5	2,860.1	19,888,968	23,879,468
Poland	14,469.9	4,755.2	-9,714.7	27,935,000	8,069,000
Czech Republic	767.2	2,835.7	2,068.5	2,487,306	7,202,909
Hungary	3,012.9	983.1	-2,029.7	6,845,000	3,060,000
Austria	1,625.7	2,160.9	535.2	4,975,798	7,590,191
Italy	2,216.8	11,509.1	9,292.2	10,530,507	38,672,596
Latvia	5.5	180.7	-255.4	41,207	714,030

Current status of MASP cultivation in Slovak Republic

Cultivation of MASP as a part of special plant production is a main activity to obtain required amount and quality of domestic MASP species when the protection of natural resources is increasing. Because of multi-year results of research and their application in

agricultural practice, the technology of MASP cultivation of 30 species is described in details. About 50% of these species belongs to produce of high capacity drugs.
Ministry of Agriculture of Slovak Republic in cooperation with Research Institute of Agri-ecology in Michalovce published “Development program of production and processing of medicinal, aromatic and spicy plants in Slovak Republic” (Šalamon, 2000). Prognosis of MASP acreage (Table 3), improvement of technology in production and processing of MASP as well as analysis of MASP industry in Slovakia are given in the document.
Table 3: Prognosis of MASP cultivation area as enlarging in Slovak Republic (Šalamon, 2000).

Years	Unit	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Cultivation acreage	ha	150	350	370	1,500	2,500
Production	t	165	385	410	1,650	3,000

Development of cultivation acreages of MASP has oscillated in the last decades. The MASP were cultivated in the 1989 at the area of 408.3 ha, in 2000 it was 783.6 ha and in 2004: 540.4 ha. Cultivation of MASP in Slovak Republic according to Statistical institute of Slovakia during 1997 – 2005 is presented in Table 4.
Table 4: Development of harvested acreage and production of cultivated medicinal plants in Slovak Republic (1997-2005).

Year	Harvested acreage [ha]	Total yield [t]	Yield [t.ha-1]
1997	527.37	328.9	0.62
1998	540.55	439.9	0.81
1999	467.44	475.2	1.02
2000	696.56	222.2	0.32
2001	623.98	873.1	1.40
2002	601.65	989.9	1.65
2003	851.85	821.4	0.96
2004	531.07	1380.2	2.60
2005	*709.71		

* Harvested acreage in 20th May 2005.
T
he harvested acreages of aromatic plants are presented in Table 5.
Table 5: Development of harvested acreage and production of aromatic plants in Slovak Republic (1997-2005).

Year	Harvested acreage [ha]	Total yield [t]	Yield [t.ha-1]
Humulus lupulus L.			
1997	816.41	742.1	0.91
1998	151.29	261.4	1.73
1999	238.30	233.6	0.98
2000	273.39	95.7	0.35
2001	246.16	188.1	0.76
2002	317.60	297.6	0.94
2003	318.41	323.2	1.02
2004	307.82	363.8	1.18
2005	*310.66		
Nicotiana tabacum L.			
1997	649.16	994.1	1.53
1998	958.87	1487.4	1.55
1999	834.89	1288.6	1.54

2000 1133.57 1870.4 1.65
2001 1245.27 1986.9 1.60
2002 1099.83 2020.1 1.84
2003 1079.55 1932.1 1.79
2004 934.51 1298.2 1.39
2005 *957.33
* Harvested acreage in 20th May 2005.

As the most cultivated spicy plant was red pepper (*Capsicum annuum* L.) despite the fact, that acreage decreased from 2,289 ha (1975) to 254 ha (2003). Global acreage of red pepper was the lowest in 2003: 254 ha with yield of pepper fruits about 228.1 t. The largest harvested area was 718 ha (1998) with yield of 1,024 t (Table 6).

Table 6: Development of red pepper (*Capsicum annuum* L.) acreage and its production in Slovak Republic (1997-2005).

Year Harvested acreage [ha] Total yield [t] Yield [t.ha-1]
1997 551.67 666.3 1.21
1998 718.12 1024.2 1.43
1999 560.34 827.0 1.48
2000 536.28 540.2 1.01
2001 333.06 482.1 1.45
2002 272.52 377.8 1.39
2003 254.00 228.1 0.90
2004 460.32 450.2 0.98
2005 *463.38
* Harvested acreage in 20th May 2005.

Caraway (*Carum carvi* L.) is the second most produced spicy plant in Slovak Republic. Statistical data are documented from 1998 (Table 7).

Table 7: Development of harvested acreage of Caraway (*Carum carvi* L.) and its production in Slovak Republic (1997-2005).

Year Harvested acreage [ha] Total yield [t] Yield [t.ha-1]
1997 - - -
1998 90.26 49.1 0.54
1999 80.03 19.3 0.24
2000 51.00 14.5 0.28
2001 117.00 75.5 0.65
2002 258.28 216.3 0.84
2003 174.31 37.9 0.22
2004 249.78 54.6 0.22
2005 *166.82
* Harvested acreage in 20th May 2005.

Main aspects that determined cultivation of MASP in Slovak republic are:

- Market demand – production depends on requirements of processors;
- Supplier – consumer contracts;
- Prices of production;
- Development of processing subjects;
- Competition;
- Availability of traditionally required or introduction of non-traditional plant species;
- Macro-economic processing conditions – support possibilities of business activities

(EU funds, state subsidies, tax benefits etc.).
Balance of foreign trade with MASP and their products obtained always-negative values (Table 8) because of higher import of these commodities. Slovakia imported about 5,048.5 t of MASP raw material or products. In comparison to the year 1997 (1,308.4 t) import was increased almost four times. This fact confirms higher consuming of these commodities in the country.
Table 8: Balance of foreign trade with MASP in Slovak Republic (UN Comtrade, 2004).

Year	Export [t]	Import [t]	Balance (I – E) [t]	Export value [$]	Import value [$]
1994	507.3	3,030.1	- 2,522.8	1,629,466	1,772,966
1995	560.3	2,859.1	- 2,298.8	1,624,248	2,104,958
1996	675.2	3,235.1	- 2,559.9	1,601,461	1,780,203
1997	429.8	1,308.4	- 878.6	1,015,778	890,356
1998	478.3	1,980.7	- 1,502.4	1,055,366	1,126,275
1999	536.0	5,092.6	- 4,556.6	1,052,977	2,071,783
2000	456.1	4,657.7	- 4,201.6	720,065	1,718,252
2001	538.7	4,334.1	- 3,795.4	835,739	1,636,996
2002	293.6	4,697.2	- 4,403.5	614,437	2,092,672
2003	603.2	5,389.5	- 2,522.8	1,206,720	2,994,152
Year	Export [t]	Import [t]	Balance (I – E) [t]	Export value [$]	Import value [$]
2004	211.9	5,048.4	- 4,836.6	423,710	3,732,313

Main MASP supplier countries to Slovak Republic are: Czech Republic, Bulgaria, Poland, Croatia, Romania, and Ukraine. Export in 2004 was about 211.9 t and in comparison to 2003 (603.2 t) significantly decreased. Export of domestic MASP products is orientated mainly to EU market: Czech Republic, Poland, Italy, Germany, Hungary, and Australia as well. Very important factor when to export these commodities is optimizing of deliverysupply relationships with the aim of purchase guarantee.

CONCLUSION

Cultivation of medicinal, aromatic and spicy plants (MASP) in Slovak Republic after the EU accession knots at the pre-accession period. Situation in agricultural subjects is dramatically developing. Reserves in supporting of MASP producers are necessary to solve systematically through Ministry of Agriculture. Stabile realization of production with optimum qualitative parameters and existence of products with competition ability, strengthens the position at the domestic market and creates the better position to success at the
European trade. One of the alternatives for MASP producers could be production of these commodities in organic (ecological) farming systems. Realization of organically certified products as well as the consuming of natural products has recorded increasing demand in the
EU trade during the last years.

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PRODUCTION OF MEDICINAL, AROMATIC & SPICY PLANTS IN SLOVAK REPUBLIC AND ITS PERSPECTIVE

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INTRODUCTION

Slovakian Basic Facts:

Establishment: Republic headed by the President
Government: Parliamentary democracy
Area: 49,035 square km

Elevation: the Bodrog river 94 m above sea level,
the lowest elevation; Gerlach, the highest peak
of the Tatras 2,655 m above sea level, the highest elevation
Inhabitants: 5,395,000 (census 1999)
Density of population: 100 inhabitants per square km
Capital: Bratislava (449,500 inhabitants /1999/)

Slovak Republic is placed in the Central Europe. It lies in the climatically favourable mild zone of
Northern hemisphere. Generally the nature of the country is very heterogenous and has some interesting features.
In the territory two fundamental regions of flora can be observed. The thermophilic flora is present in the
Pannonian region in warm basins with a great number of xerophytic species. The Carpathian flora is present in
the majority of the Slovak mountains with a market differentiation of the plant cover according to the elevation
above sea level (1).

WHY MEDICINAL, AROMATIC & SPICY PLANTS

THE 5th CONGRESS OF EUROPEAN SOCIETY OF AGRONOMY (June 1998, Nitra, Slovakia)
*One from the conclusions: * we have overproduction of main crops and foods in Europe. In regard to*
this fact the agricultural cultivation needs to start an introduction of profitable new crops (the medicinal &
aromatic plants).
THE INTERNATIONAL CONFERENCE “SUSTAINABLE AGRICULTURAL PRODUCTION ON THE
REGIONAL LEVEL” (November 1998, Michalovce, Slovakia)
The East-Slovak Lowlands belong to the very intense agricultural part of Slovakia. Our results of
economical calculation in this area are showed that the agricultural production per capita is 372 kg of cereals,
560 kg of sugar, 92 kg of fruits, 139 kg of meat and 337 l of milk. Overproduction of these commodities will be
needed to sell their to another parts of Slovakia, to the international market or to introduce a new crop
cultivation (the medicinal & aromatic plants).

HISTORICAL BACKGROUND

Since time immemorial medicinal plants have played the most important part in the composition of
therapeutic and various preparations used in popular doctoring, the experience of simple people being the basin
for the use of these medicinal plants. In past centuries about 600 or 800 species were used for curative purposes
(6).
There exists evidence that as early as in the Old Slavonic period (about 900 AD) a lot of plants were

used. In the course of the 17th century the peasants acquired the ability to produce vegetable and plant oils. These
essential oils were exported by the so-called „oilmen“ of East and West Europe (4). The travelling “oilmen”
prepared the oils and peddled them along with other pharmaceutical preparations between villages. Essential
oils, obtained by distillation or pressing of various herb parts, were used as the basis of many treatments with the
practice becoming widespread during the 18th and 19th centuries.
2
In this short survey of traditions in popular doctoring it is necessary to mention also the herbalists, i.e.
people who dispensed medicinal herbs in order to cure specific diseases. In the regions of their activity these
„popular doctors“ were highly respected.
Picture 1: The using of herbs in the Old Slavic period (about 900 AD).
Because of the therapeutically effective substances contained in medicinal plants the latter are
important aids in the therapy of diseases in our human medicine. In regard to Slovak history contemporary
modern phyto-therapy in our country continues with the rich traditions of popular doctoring. Of course, the
development of natural sciences with their exact methods of investigation makes the therapeutic effect of the
substances contained in these plants and the therapeutic value of each plant more precise.

CURRENT SOURCES

Nowadays 150 and about 200 medicinal plants are used in the official therapy and in popular doctoring,
respectively (6). The medicinal, aromatic and spicy plants are mainly used in Slovak Republic in : phytotherapy,
veterinary, medicine, cosmetics and food industry; they have additive, ecological, decorative and
sanitary-hygienic functions and positive influence on water system, soil conservation and plant pasture for bees
(15).
3
Picture 2: The Slovakian „Oilmen“.
The medicinal, aromatic & spicy plants in Slovak Republic are originated into the natural raw material
resources of plants, which are the gene-pool of these plants and an introduction of new plants from abroad. Our
present research and development is orientated to: -collecting expeditions of genetic resources, -determination of
chemotypes, -protection of genetic resources in the Slovak Gene Bank and -visions of introduction to
agricultural production with pharmaceutical proceeding and using (3).
Drugs, i.e. dried medicinal and aromatic plants or their parts (roots, leaves, flowers, fruits, seeds,
greens) or plant products (balms, resins, glycosides, essential oils ...) are obtained from: - collection in the wild
(individual or organized), - contracted deliveries of small-scale growers and - large-scale cultivation on the
agricultural enterprises (15).

LARGE-SCALE CULTIVATION

The large-scale cultivation of medicinal and aromatic plants belongs to the special agricultural
production (table 1). It is an only way of supply the contracted volume and quality of these crops (5).

Table 1: Special crop large-scale cultivation in Slovak Republic in 2000.

Private Sector	Cooperative Farms	Total
Medicinal Plants [ha]	782.61	1,184.40
Caraway [ha]	82.00	2,369.56
Other Spices [ha]	58.50	113.50
Red Pepper [ha]	564.78	56.00
Tobacco [ha]	1,184.40	-
Poppy [ha]	2,369.56	70.00
	113.50	382.00
	56.00	540.00
	-	896.11
	70.00	138.00
	382.00	58.50
	540.00	634.78
	896.11	1,566.40
	138.00	2,909.50
	58.50	
	634.78	
	1,566.40	
	2,909.50	

This special crop production is of great importance from several points of view in the specialized agricultural farms: * rational (offering appropriate occasion for unemployed people), * production (better exploitation of problematic land resources /salty soil, lower quality soils in sub-mountainous or mountainous areas/) and * economic (from the viewpoint of market value the medicinal plants belong to the most effective agricultural crops) (7). Table 2 presents an actual situation in medicinal and aromatic plant cultivation in Slovakia.

4

Table 2 : Species of medicinal and aromatic plants and their produce volume.

Cultivate area [ha]	Volume of production [t]	Plant species
896.11	905.05	Chamomile, St. John’s Worth, Marigold, Balm, Mint, Agrimony, Sage, Dill, Plantain, Hyssop, Marjoram, Yarrow, Coriander, Angelica, Basil, Lavender, Marshmallow, etc.

The Slovak Ministry of Agriculture mandated the Research Institute of Agroecology in Michalovce to elaborate „ *The Development Programme of Medicinal, Aromatic and Spicy Plant Cultivation and Processing in the Slovak Republic“* in the first half of the year 1999 (10). More than 60 specialists from the sector of medicinal plant cultivation, processing, business and science were contacted. All material has presented to the

leader-ship of the Slovak Ministry of Agriculture. The program is a basis to the state support of this special crop
production & development into the future long conception (table 3).
Table 3 : Medicinal and aromatic plant prediction of an increase cultivation
in Slovak Republic.

Years	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Cultivation area	ha	150	350	380	1,500	2,500
Raw-material production	t	165	385	410	1,650	3,000

Picture 3: The large-scale cultivation of German chamomile in Streda nad Bodrogom, the Eastern Slovakia.
Generally, the new development program should contribute to the solution of following tasks: *
decrease a risk of production, * to improve variable profitability of the single medicinal plant species, * to
propose and develop suitable special mechanization, chemical protection, high quality of seeds, determination
of radiation and pollution, etc., * to design progressive trimming lines, store-rooms, extraction and distillation
equipment – post harvest technologies, * to decrease a ration of manual labor, * to establish functioning
relation between suppliers and customers, * to improve the skill of people working in the herb production (10).
5
The claims to the Slovak Ministry of Agriculture have been formulated in these points:
* in regard to the large-scale cultivation :
- appropriate state subsidies,
- suitable state grand to capacity of harvest and post-harvest technologies,
- additional payment for the high quality of medicinal plant drug, which is determined by a quality
certificate.

* in regard to the market support :
- prevent an import of medicinal plant drugs from abroad,
- suitable state additional payment to each kilogram of herbs, which is exported,
- creation of market-manager companies or partnerships to arrangement of cultivation, processing and
business of all herbal items.

* our general claim is :
- support of complex cooperation and the exchanging information among all parts of the Slovak
economy.

The Program SAPARD (the Special Access Program for Agriculture & Rural Development) has just
become a very important aspect of the European Union, which sponsors this field of crop production, specially,
in Slovak Republic.
Picture 4: Marigold flowers before their harvest in Streda nad Bodrogom.

TECHNOLOGICAL PROCESSING

A
t present good breeding methods, cultivation, harvesting and processing, produce plants with high
quality of natural supplements and products. The leaders of this production in Slovakia are several companies,
which are situated in the West and East part of Slovakia. This production are orientated to large-scale destillation
of essential oils, extraction of wateralcoholic and propylenglycol extracts, dry powder extracts and isolation of

clean substances.
The information about quality of several essential oils can be given as an examples (12,13):
The main qualitative and quantitative characteristics of Scot's pine (*Pinus silvestris* L.) essential oil
are: □-pinene (27.4 %), □-pinene (9.7 %), □-phellandrene (10.0 %), bornyl acetate (18.8 %), camphene (15.5
%) and limonene (6.1 %). The results show a similarity with the Siberian origin chemotypes, besides bornyl
acetate and limonene contents.
Peppermint (*Mentha xpiperita* L.) plant material is usually obtained from large-scale cultivation in the
West Slovakia. This essential oil contents up to 46 % of menthol, menthofuran: 22.6 %, (-)-mentylacetate: 3.5
%, neomenthol: 3.6 %, pulegone: 1.9 %, isomenthone: 8.8 % and linalool: 0.6 %.
6
The essential oil of coriander (*Coriandrum sativum* L.) is contained pinene (9.6 %), *p*-cymene (6.9 %),
limonene (3.5 %), □-terpinene (6.6 %), linalool (61.4 %), camphor (2.3 %) and isobornyl acetate (2.5 %).
Sage (*Salvia officinalis* L.) has just started to produce on the large-scale cultivation in several parts of
Slovakia. In regard to the GC-MSD analyse of sage essential oil, the major compounds were □-pinene (9.2 %),
1,8 -cineole (12.6 %), □-thujone (24.7 %), □-thujone (5.2 %), camphor (16.8 %),. □-caryophyllene (5.0 %) and
□-caryophyllene (2.8 %).
Hyssop (*Hyssopus officinalis* L.) is cultivated for medicinal uses or it is now grown mostly as an
ornamental shrub. The levels of the two major ketones: pinocamphone (15.7 %) and isopinocamphone (36.0 %)
are within normal limits.
Rosemary (*Rosmarinus officinalis* L.) is now widely cultivated for its aromatic leaves and as a kitchen
seasoning. Sample of rosemary essential oil contained □-pinene (11.9 %), camphene (8.4 %), □-pinene (2.8 %),
limonene (11.5 %), 1,8-cineole (34.4 %), camphor (7.4 %), borneol (4.4 %), □-terpineol (3.3 %) and boranyl
acetate (4.4 %). No verbenone was found.
Picture 5: Schema of the large-scale distillation apparatus (2).

ENVIRONMENTAL FACTORS

a) heavy metals

The industrial pollution of agricultural lands belongs to the serious ecological problems in Slovakia.
There are 9 localities in the Central Zemplin (a part of the East-Slovakian Low-lands), where the soils are
contained by excessive amounts of these hazardous elements. Of course, a heavy metal contamination in these
areas is characteristic into crop production too.
7
There was made a study of the heavy metal pollution into dry medicinal plant raw-materials, which
were cultivated and collected in the Central Zemplin during the years 1997 – 2000 (8).
For determination 4 heavy metal contents (cadmium [Cd], lead [Pb], chrome [Cr], nickel [Ni]) were
used 7 samples of medicinal plants (flowers, herbs, leafs, roots).
The samples of plant materials for our heavy metal determination were decomposed by 10 ml HNO_3

and 1 ml H2O2 into vessels, which were given in a pressure autoclave. Mineralization was taken place at the
temperature 150 □C during 5 hours. The AAS results for Cd, Pb, Cr , Ni, were obtained using *SHIMADZU*,
model 660, with Graphite fumace, Deuterium background corrector and autosamples. Sample volume was 20 ul.

Table 4 : The average content of heavy metals in medicinal plants in 1997-2000 [mg.kg-1].

Heavy metals: Medicinal plants :	Cadmium [Cd]	Lead [Pb]	Chrome [Cr]	Nickel [Ni]
German chamomile, *Matricaria recutita* L., flowers	0.186	0.551	0.446	2.595
Black elder, *Sambucus nigra* L., flowers	0.014	0.242	0.437	2.790
Shave grass, *Euquisetum arvense* L., herba	0.022	0.070	0.202	1.768
Agrimony, *Agrimonia eupatoria* L., herba	0.076	0.280	0.096	4.035
Mistletoe, *Viscum album* L., herba	0.163	0.318	0.278	0.543
Common dandelion, *Taraxacum officinalis* Web., roots	0.067	0.372	0.851	0.546
Stinging nettle, *Urtica dioica* L., leaves	0.056	0.092	0.075	0.099

The high accumulation ability were determined into these medical plant species: chamomile (Cd, Pb,
Cr, Ni), mistletoe (Cd, Pb), common dandelion (Pb, Cr), black elder (Cr, Ni), agrimony (Ni) and the lowest
accumulation ability of heavy metals were showed shave grass and stinging nettle (table 4). The heavy metal
contents of these herb samples are not higher than the maximum permissible concentration of these elements into
food - the standard tea, which is enacted by the Slovak Ministry of Agriculture in the Regulation No. 14/1996.

b) radioactivity

The largest catastrophe in history of civil using of nuclear energy was in Chernobyl, Ukraine, in April
26, 1986. In regard to special expertise the radioactivity, which was relieved with Chernobyl explosion, is
corresponded to 50-times of bomb radioactivity from Hiroshima.

The medical quality and effect of medicinal plants are depended on the conditions of environment,
which is influenced direct to their grow on the place of an occurrence and cultivation. The radioactivity has
effected to vegetation in the Slovak Republic even if the Chernobyl crash was many years ago. In regard to
medicinal plant market, it is very important to determine the radioactivity values of herb goods to foreign
customers (9).

The conserve plant parts (flowers, herbs, leaves and roots) of 11 botanical species by drying were used
to determination of the mass radio-nuclide activities. This plant material was originated from a wild plant
collection and large-scale cultivation of these medicinal plants in Slovak republic in years 1997, 1998 and 1999
(14). The gama-spectrometric determination of selected medicinal plants by the HPGe detector with using of

Cesium radio nuclides (134Cs & 137Cs) was carried out at the Special State Health Institute, Department of Health
Protection against the Radioactivity, in Banska Bystrica, the Middle Slovakia.
The dry flowers of chamomile, elder, marigold and lime are determined the highest average activity of
radio-nuclides (1.34 Bq.kg-1). The lower average levels of radioactivity (0.96 Bq.kg-1) are showed the agrimony,
mistletoe, horsetail herbs and birch leaves and the lowest (0.79 Bq.kg-1) the dandelion, burdock and nettle roots.
In regard to medicinal plant species, the highest result of radioactivity, 2.45 Bq.kg-1 , was determined in the lime
flowers in 1998, following the horsetail herb, when average per 3 years was 1.98 Bq.kg-1 and in chamomile
flowers with average result 1.42 Bq.kg-1. The lowest results in general were evaluated in dandelion roots (0.50
Bq.kg-1).
The regulation on the highest permissible radioactivity in food was notified in the Slovak Republic in
January 2001. In spite of these facts, the trace radioactivity values of medicinal plants in this country were stated.
This herbal raw-material is accepted on the market with medicinal plants in the world. In regard to next monitor
radioactivity the very interesting results have been obtained; the topicality of this field solution is confirmed.
8
Picture 6: Leuzea plants and their successful introduction into large-scale cultivation.

RESEARCH AND DEVELOPMENT (R & D)

Modern phytotherapy is direct successor of the rich tradition of popular doctoring in Slovak Republic. It
is based on the years of experience of people having direct contact with nature. Over the years this experience
has been verified in practice, supplemented and classified – folk herbalist wisdom formed and passed from
generation to generation. The use of natural drug resources and the experience of folk medicine has been a
continuous subject of research & development at many universities and research institutes.
Generally, research & development should contribute to the solution of following tasks: * monitor
of the Slovak gene-pool of herbs, * collecting expeditions of genetic resources, *determination of chemotypes, *
protection of genetic resources in the Gene Banks, * breeding of medicinal, aromatic and spices plants, *
development of seed production, * introduction of new medicinal plant species into large-scale cultivation, *
improvement of the methods of large-scale cultivation, harvest and post-harvest technologies, * creation of
extension offices, * giving of the quality certificates of the all herb items, * introduction of the without waste
technologies,* presentation of the results of research and development at the domestic and foreign actions and
exhibitions, *marketing investigation of the world market and presentation of information review about this
situation (10).
Main medicinal plant which is the subject of our research & development are German chamomile
(*Matricaria recutita* L.). It is the most popular and used medicinal plant. The research of this medicinal plant is

continued with different aspects of chemotype determination, cultivation and processing (2,11).
The wild chamomile flowers in the East-Slovakian Lowlands are usual collected and sold by Gypsies to
next pharmaceutical processing. The qualitative and quantitative characteristics of essential oil and its
composition for these wild chamomile populations were determined. Results were statistically evaluated using a
t-test at the 0.05 level and the exploratory analysis are illustrated their variations. The results show that there is a
bisaboloxide chemotype of chamomile with a lower content of essential oil.
Additional research work is aimed at the compare of qualitative – quantitative characteristics of dry
chamomile flower anthodia and chamomile essential oil coming from experimental cultivation in different areas
of the world. The production of secondary metabolites of chamomile essential oil depends on exogenous and
endogenous conditions of environs. Qualitative characteristics of essential oil received from different
9
cultivation areas in the world are genetic determined, however differences from each other depend on mutual
interactions between plants and environment.
The quantitative and qualitative composition of chamomile essential oil were determined of a diploid
and tetraploid variety after a large-scale distillation. Both the quantity and the constituents of the essential oil
were modified by the raw material using: herb or flower-heads respectively fresh or dry. A major factor causing
differences in yield of chamomile essential oil may be the time between harvest and distillation, and the variety
origin of chamomile plants. Next differences may be have to resulted from using of various harvesting methods,
size of green parts, drying and still size.
Picture 7: The Experimental Research Centre of Medicinal, Aromatic & Spices Plants Cultivation
in Nova Lubovna.

CONCLUSION

In last years the awareness of therapeutics among the population in the Slovak Republic was investigated. From this investigation it followed that 95 % of those questioned believed in the beneficial effects
of medicinal plants. Any way, worldwide demand for medicinal and aromatic plants and for products derived of
them is permanently increasing. This is well documented in one of our old proverbs: *„There is not plant without
use“* and our prosperous work can decisively contribute the exploitation of the properties of the single plants to
benefit mankind. In regard to this predication and the valuable experiences the production of medicinal and
aromatic plants in Slovak Republic has a big perspective.

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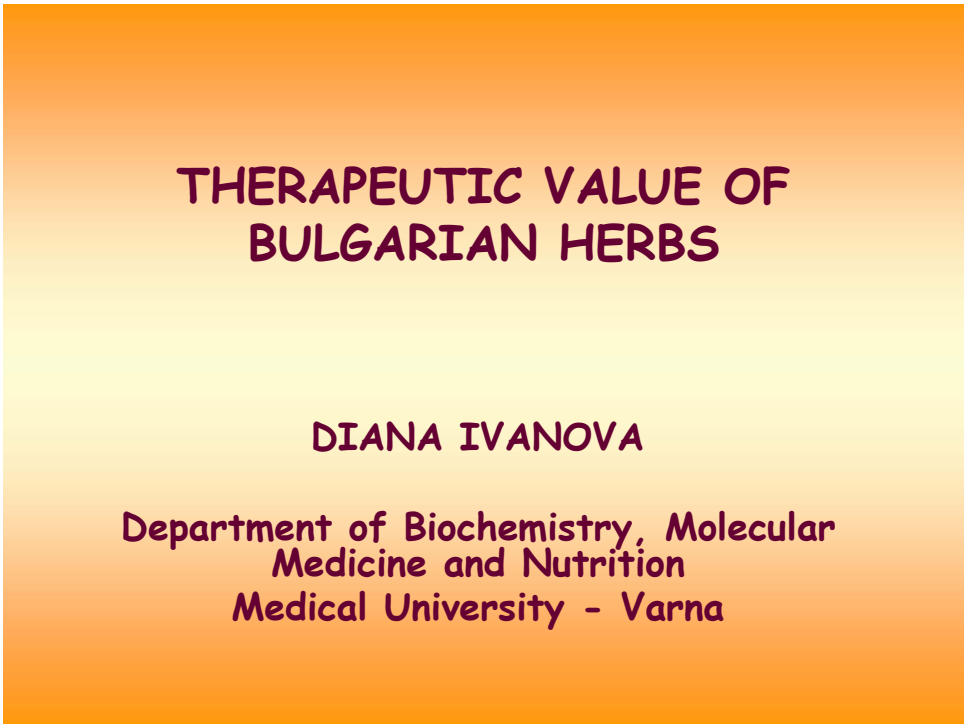

see: presentation Ivanova

PHARMACOLOGICAL ASPECTS OF HERBAL REMEDIES

Prof. Dr. Omur Demirezer

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