

Ethnobotanical uses of alien and native plant species of Yeşilirmak Delta, Samsun, Turkey

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Abstract: Plants produce chemicals, known as secondary metabolites, have a variety of ecophysiological functions e.g. defense against herbivory/pathogen attacks and competitor plants, attracting pollinators and symbionts, protection against abiotic stresses, etc. These metabolites also have potential medicinal effects on humans. The Yeşilirmak Delta, Samsun, Turkey, is the second largest delta plain of Turkey. Among the plants distributed in different habitats of the delta, medically important species and their usage were investigated based on the literature. It has been determined 160 species and infraspecific taxa belonging 61 families and 141 genera which can be used for medicinal purposes in the research area. Our aim is to provide a database in relation to medicinal plants distributed naturally in such a region that 65.4% of which is assigned as agricultural area.

Keywords: Ethnomedicine, Toxic effect, Yeşilirmak Delta.

Introduction

Food and medicines are integral part of human life (Dahir and Bhore, 2017) and the plants we have consumed are also used as traditional medicines. Many “medicinal plants” exert specific medicinal actions and may be used in response to specific health problems over short- or long-term intervals while “nutraceuticals” have a nutritional role in the diet and the benefits to health as foods phytochemical constituents can have long-term health promoting or medicinal qualities (Briskin, 2000). For many of the medicinal plants of current interest, a primary focus of research to date has been in the areas of phytochemistry, pharmacognosy, and horticulture. In the area of phytochemistry, medicinal plants have been characterized for their possible bioactive compounds while research in the pharmacognosy of medicinal plants has also involved assays of bioactivity, identification of potential modes of action, and target sites for active phytomedicinal compounds. Horticultural research on medicinal plants has focused on developing the capacity for optimal growth to deal with many important problems such as biodiversity loss, biological and phytochemical variations in plants, and occasionally, improper plant

identification (Briskin, 2000).

While primary metabolites (such as carbohydrates, lipids, proteins, heme, chlorophyll, and nucleic acids) play a role in the building and maintaining plant cells, secondary metabolites appear as a result of the ecophysiological characteristics of the plant and these metabolites have both a defensive role against herbivory, pathogen attack, and inter-plant competition and an attractant role towards beneficial organisms such as pollinators or symbionts (Kaufman et al., 1999; Wink and Schimmer, 1999). In addition, these metabolites also have protective actions in relation to abiotic stresses, such as those associated with changes in temperature, water status, light levels, UV exposure, and mineral nutrients (Kaufman et al., 1999). Previously, secondary metabolites were assumed to be specific to certain species or groups and closer look indicated that some of the genes have a much wider distribution by horizontal gene transfer (i.e. via bacteria) (Wink, 2010).

Therapeutic or toxic effects of plants appear by the secondary metabolites they contain. Some secondary metabolites appear to be specific for one or a limited number of molecular targets (such as alkaloids, cardiac

glycosides) whereas most secondary metabolites which are present in extracts used in herbal medicine (various phenolics, terpenoids) are multitarget agents modulating the activity of proteins, nucleic acids and biomembranes in a less specific way (Wink, 2015). A great number of fruits, vegetables, aromatic, spicy, medicinal and other plants may contain bioactive compounds exhibiting free radical scavenging activity (Özkan et al., 2016).

Interestingly, although secondary products can have a variety of ecological functions in plants, they also have potential medicinal effects (diuretic, antirheumatic, antiparasitic, anti-inflammatory etc.) on human. For example, secondary products involved in plant defense through cytotoxicity towards microbial pathogens could provide benefit as antimicrobial medicines in humans, if they are too toxic. Likewise, secondary products involved in defense against herbivores through neurotoxin activity could have beneficial effects on humans (i.e. as antidepressants, sedatives, muscle relaxants, or anesthetics) through their action on the central nervous system (Briskin, 2000). To promote the ecological survival of plants, structures of secondary products have evolved to interact with molecular targets affecting the cells, tissues, and physiological functions in competing microorganisms, plants and animals (Wink and Schimmer, 1999). In this respect, some plant secondary products may exert their action by resembling endogenous metabolites, ligands, hormones, signal transduction molecules, or neurotransmitters and thus have beneficial medicinal effects (diuretic, antirheumatic, antiparasitic, anti-inflammatory etc.) on humans due to similarities in their potential target sites (e.g. central nervous system, endocrine system, etc.) (Kaufman et al., 1999). These secondary metabolites have been utilized by human for several purposes, especially as healing agents for medicine production (Altundağ and Öztürk, 2011). As a lot of medicinal plants include many bioactive molecules such as phenolic and nitrogen compounds, vitamins, terpenoids, antioxidants and other endogenous metabolites (Kamiloğlu et al., 2014; Karadeniz et al., 2015), they have been one of the biological elements that humans have benefited since ancient times.

The Yeşilirmak Delta provides a wide range of medicinal plants with its rich flora arising by the means of its rich variety of habitats. However, the disturbance of natural areas threatens all biodiversity as well as medicinal plants in delta. In the delta area, 65.4% of which

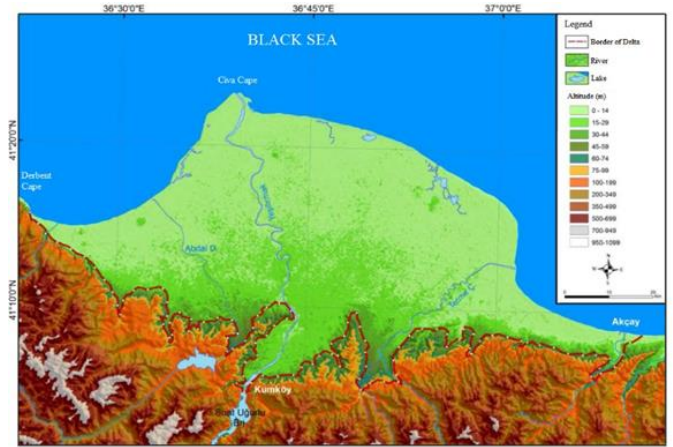


Figure 1. Map of Yeşilirmak Delta.

is used as agricultural field (Özçağlar, 1994), agriculture on medicinal plant cultivation has not been carried on although some plant species that can be evaluated as nutraceutical are being cultivated.

Our aim in this study is to provide a database of which medicinal plants can be grown in such a region, more than half of which is assigned as agricultural area, by identifying plants that have medicinal usage in Yeşilirmak Delta's natural flora.

Materials and Methods

Yeşilirmak Delta (Samsun/Turkey), the second largest delta of Turkey, is composed by plains where Yeşilirmak flows to Black Sea on the east of Samsun (36°23'E, 37°14'E and 41°05'N, 41°23'N) (Fig. 1). The delta which its surface area is 1042.4 km² is limited to the Canik Mountains in the south, Derbent Burnu (Kirazlık/Tekkeköy) in the west and Akçay River (Terme) in the east (Şahin and Bağcı, 2016). Yeşilirmak Delta Plain is a region that comprises flooding-alluvial plains, both large and small lakes, lagoons and terrestrial areas which is not flooded.

Among the plants distributed in different habitats of the region (Korkmaz et al., 2011; Korkmaz et al., 2012; Ministry of Forestry and Water Affairs, 2012; Mumcu, 2017), medicinally important species and their usage areas were investigated (Bremness, 1994; Ekici et al., 1998; Gladstar and Hirsch, 2000; Şener et al., 2003; Kültür, 2007; Fakir et al., 2009; Kaya et al., 2010; Altundağ and Öztürk, 2011; Amessis-Ouchemoukh et al., 2014; Bulut et al., 2014; Wink, 2015; Akbulut and Karaköse, 2016). The plant list (Table 1) is arranged alphabetically according to Güner et al. (2012). The taxa which are included in a threat category are shown as a column in Table 1 (Ekim et al.,

Table 1. The used parts of alien and native plant species determined in Yeşilirmak Delta in terms of human health.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|----|---|---------------------|-------------|---|
| | PTERIDOPHYTA | | | |
| | EQUISETACEAE | | | |
| 1 | <i>Equisetum arvense</i> L. | atkuyruğu | | Leaf / Poisonous, diuretic, spontaneous, kidney stone and sand passage, gum inflammations and tonsillitis (gargle), eczema, rheumatismal pain, arteriosclerosis |
| | DRYOPTERIDACEAE | | | |
| 2 | <i>Dryopteris filix-mas</i> (L.) Schott | erkek eğrelti | | Rhizome / Poisonous, treatment of human intestinal parasites |
| | MAGNOLIOPHYTA | | | |
| | PINOPHYTINA | | | |
| | CUPRESSACEAE | | | |
| 3 | <i>Juniperus oxycedrus</i> L. subsp. <i>oxycedrus</i> var. <i>oxycedrus</i> f. <i>oxycedrus</i> | katran ardıcı | | Fruit / Tar / Antirheumatic, antiparasitic, Cough |
| | MAGNOLIOPHYTINA | | | |
| | ADOXACEAE | | | |
| 4 | <i>Sambucus ebulus</i> L. | mürver otu | | Aerial parts / Cold; Leaf / Urticaria, kneeache |
| 5 | <i>Sambucus nigra</i> L. | ağaç mürver | | Leaf / Abscess; Flower/Asthma |
| 6 | <i>Viburnum opulus</i> L. | gilaburu | | Fruit / Antitussive, nephralgia |
| | AMARANTHACEAE | | | |
| 7 | <i>Chenopodium album</i> L. subsp. <i>album</i> var. <i>album</i> | aksirken | | Aerial parts / Diuretic, women' sterility, anaemia |
| 8 | <i>Salsola kali</i> L. | döngöle | | Aerial parts / Diuretic |
| | AMARYLLIDACEAE | | | |
| 9 | <i>Allium scorodoprasum</i> L. subsp. <i>ajlajae</i> (Vved.) Stearn | karga sarmısağı | | Bulb / Orexigenic, hypertension, anthelmintic, diuretic, antiseptic; Seed/Goiter |
| 10 | <i>Panacratium maritimum</i> L. | kum zambağı | EN | Bulb / Antimalarial, cytotoxic |
| | APIACEAE | | | |
| 11 | <i>Apium graveolens</i> L. | kereviz | | Fruit / Urinary system diseases, kidney ailments, aphrodisiac; Aerial parts / Abdominal pain, prostate ailments |
| 12 | <i>Apium nodiflorum</i> (L.) Lag. | bendik | LC | Aerial parts / Appetizer, antihypertensive |
| 13 | <i>Chaerophyllum aromaticum</i> L. | mishandok | | Aerial parts / Digestive; Young stem / Constipation |
| 14 | <i>Daucus carota</i> L. | yabani havuç | | Aerial parts / Intestinal diseases, diabetes, hemorrhoids, intestinal diseases; Fruits / Kidney stones, eye diseases; Root / Increasing milk secretion, abortive, diarrhea, expectorant |
| 15 | <i>Eryngium creticum</i> Lam. | gözdikeni | | Aerial parts / Ulcer; Flowering brunchs / Cough, diuretic |
| 16 | <i>Eryngium maritimum</i> L. | kum boğadikeni | | Leaf / Stem / Diuretic, antiscorbutic, cytotoxic, urethritis remedy, stone inhibitor, aphrodisiac, expectorant, anthelmintic, antinociceptive, anti-inflammatory |
| 17 | <i>Oenanthe pimpinelloides</i> L. | deli maydanoz | | Aerial parts / Burned, antihypertensive, analgesic |
| 18 | <i>Sanicula europaea</i> L. | sanikel | | Aerial parts / Diarrhea, urinary, liver disorders, internal bleeding, stomach or intestine inflammation |
| 19 | <i>Torilis arvensis</i> (Huds.) Link subsp. <i>arvensis</i> | dercikotu | | Aerial parts / Abdominal pain (children) |
| | APOCYNACEAE | | | |
| 20 | <i>Cynanchum acutum</i> L. subsp. <i>acutum</i> | bacırgan | LC | Leaf / Vulnerary |
| 21 | <i>Nerium oleander</i> L. | zakkum | | Leaf / Poisonous, antipruritic (relieves itching) |
| 22 | <i>Vinca major</i> L. subsp. <i>hirsuta</i> (Boiss.) Stearn | pervane çiçeği | | Leaf / Astringent, menstrual regulator, ulcer, sore throat, antihypertensive |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|----|--|---------------------|-------------|---|
| | ARALIACEAE | | | |
| 23 | <i>Hedera helix</i> L. f. <i>helix</i> | duvar sarmaşığı | | Leaf / Fruit / Poisonous, neural disease, rheumatic pain, gynaecology, treatment of human intestinal parasites (worm) |
| | ASPARAGACEAE | | | |
| 24 | <i>Ruscus aculeatus</i> L. | tavşanmemesi | | Cladode / For uterine complaints; Root / Arthritis; Aerial parts / Anti-inflammatory, antihemorrhoidal, for chilblain |
| 25 | <i>Ruscus hypoglossum</i> L. | atdili | | Aerial parts / Cold, mastitis |
| | ASTERACEAE | | | |
| 26 | <i>Anthemis cotula</i> L. | hozan çiçeği | | Aerial parts / Jaundice, dysentery, intestinal disorders, cough, stomach ache; Capitulum / Hair care |
| 27 | <i>Arctium minus</i> (Hill) Bernh. | löşlek | | Leaf / Sunstroke |
| 28 | <i>Bellis perennis</i> L. | koyungözü | | Flower / Diuretic, purgative, tonic, cough |
| 29 | <i>Centaurea iberica</i> Trev. ex Sprengel | deligözdikeni | | Aerial parts / Leaf / Vulnerary |
| 30 | <i>Chondrilla juncea</i> L. | karakavuk | | Latex / Stomach disorders |
| 31 | <i>Cichorium glandulosum</i> Boiss. & Huet | akkanak | | Latex / Skin disorders; Root / Asthma, ulcer |
| 32 | <i>Cichorium intybus</i> L. | hindiba | | Aerial parts / Root / Diuretic, constipation, diaphoretic, stomach pain |
| 33 | ** <i>Cirsium arvense</i> (L.) Scop | köygöçüren | | Stem / Root / Orexigenic, tonic, antihemorrhoidal, cough, bronchitis |
| 34 | * <i>Conyza canadensis</i> (L.) Cronquist | selviotu | | Aerial parts / Antihemorrhagic, diuretic, carminative, osteoarthritis, diarrhea, dysentery |
| 35 | <i>Cota tinctoria</i> (L.) J. Gay ex Guss. var. <i>tinctoria</i> | boyacı papatyası | | Capitulum / Jaundice, stomachic, anthelmintic, antipyretic, colds, throat ache |
| 36 | <i>Crepis foetida</i> L. subsp. <i>rhoeadifolia</i> (M.Bieb.) Čelak. | sakarkanak | | Flower / Aerial parts / Cardiovascular diseases |
| 37 | * <i>Eupatorium cannabinum</i> L. (End.) <i>Helichrysum arenarium</i> (L.) Moench subsp. <i>aucheri</i> (Boiss.) P. H. Davis & Kupicha | koyuntırpağı | | Aerial parts / Diuretic, immunostimulant |
| 38 | (End.) <i>Inula helenium</i> L. subsp. <i>orgyalis</i> (Boiss.) Grierson | yayla çiçeği | LC | Aerial parts / Diuretic, nephralgia, kidney stones |
| 39 | (End.) <i>Inula helenium</i> L. subsp. <i>orgyalis</i> (Boiss.) Grierson | koca andızotu | NT | Aerial parts / Root / Diuretic, antitussive, anthelmintic, tonic, backache |
| 40 | <i>Scolymus hispanicus</i> L. subsp. <i>hispanicus</i> | şevketi bostan | | Root / Diuretic, ulcer |
| 41 | <i>Senecio vernalis</i> Waldst. & Kit. | kanaryaotu | | Aerial parts / Anti-inflammatory |
| 42 | <i>Sonchus asper</i> (L.) Hill. subsp. <i>glaucescens</i> (Jord.) Ball. | gevirtlek | | Latex / Antidote for insect bite |
| 43 | <i>Tanacetum parthenium</i> (L.) Sch.Bip. | beyaz papatyası | | Aerial parts / Tonic, stimulant, antipyretic, headache, diuretic, stomachic, gall stone |
| 44 | <i>Taraxacum macrolepium</i> Schischk. | kars çitliğı | | Leaf / Antirheumatic, wounds, stomach disorders, internal medicine, kidney stones, anti-inflammatory |
| 45 | ** <i>Tussilago farfara</i> L. | öksürükotu | | Aerial parts / Cough, antitussive, expectorant |
| 46 | ** <i>Xanthium strumarium</i> L. subsp. <i>strumarium</i> | koca pıtrak | | Aerial parts / Fruit / Rhinitis, rheumatic arthritis, diaphoretic, sedative, lumbago |
| | BERBERIDACEAE | | | |
| 47 | <i>Berberis vulgaris</i> L. | kızılkaramuk | | Fruit / Colds, diabetes; Root / Brunch / Antipyretic, astringent, hepatitis, urinary and kidney infection |
| | BETULACEAE | | | |
| 48 | <i>Betula pendula</i> Roth | huş ağacı | | Leaf / Antibacterial for gout, antirheumatic, kidneystones |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|------------------------|--|---------------------|-------------|---|
| BORAGINACEAE | | | | |
| 49 | <i>Anchusa azurea</i> Mill. var. <i>azurea</i> | sığirdili | | Aerial parts / Vulnerary; Root / Basal leaves / Women' sterility, vulnerary |
| 50 | <i>Trachystemon orientalis</i> (L.) G.Don | kaldirik | | Aerial parts / Diuretic |
| BRASSICACEAE | | | | |
| 51 | <i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande | sarmısakhardalı | | Aerial parts / Expectorant, antiseptic, stimulant, anti-asthmatic, expels worms |
| 52 | <i>Barbarea vulgaris</i> R. Br. subsp. <i>vulgaris</i> | nicarotu | | Leaf / Vulnerary, diuretic |
| 53 | <i>Capsella bursa-pastoris</i> (L.) Medik. | çobançantası | | Aerial parts / Kidney stones, antitussive, diuretic, diabetes, astringent |
| 54 | <i>Cardamine hirsuta</i> L. | kıllı kodim | | Aerial parts / Diuretic |
| 55 | <i>Nasturtium officinale</i> R. Br. | suteresi | | Leaf / Flower / Expectorant, diuretic, diabetes, tranquilizer |
| 56 | <i>Raphanus raphanistrum</i> L. subsp. <i>landra</i> (DC.) Bonnier & Layens | kalpakturpu | | Aerial parts / Orexigenic, diuretic |
| 57 | <i>Sisymbrium officinale</i> (L.) Scop. | ergelen hardalı | | Aerial parts / Irritation larynx, throat disease |
| CAMPANULACEAE | | | | |
| 58 | <i>Campanula glomerata</i> L. subsp. <i>hispida</i> (Witasek) Hayek | yumak çanı | | Aerial parts / Internal medicine |
| CANNABACEAE | | | | |
| 59 | <i>Humulus lupulus</i> L. | şerbetçiotu | | Aerial parts / Mild sedative, muscle relaxant, for lactation, anaphrodisiac for men |
| CARYOPHYLLACEAE | | | | |
| 60 | <i>Agrostemma githago</i> L. | buğday karamuğu | | Seed / Anthelmintic, diuretic, expectorant |
| 61 | <i>Arenaria serpyllifolia</i> L. | kuru kumotu | | Aerial parts / Diuretic, antipyretic, coughs |
| 62 | <i>Saponaria officinalis</i> L. | sabunotu | | Rhizome (young) / Expectorant, diuretic, laxative |
| 63 | <i>Stellaria media</i> (L.) Vill. | kuşotu | | Aerial parts / Inflamed skin, itching eczema, psoriasis |
| CONVOLVULACEAE | | | | |
| 64 | <i>Convolvulus arvensis</i> L. | tarla sarmaşığı | | Leaf / Stomachic |
| 65 | ** <i>Cuscuta campestris</i> Yunck. | kafırsaçı | | Seed / Aerial parts / Sciatica pain, impotence |
| CUCURBITACEAE | | | | |
| 66 | <i>Ecballium elaterium</i> (L.) A.Rich. | eşek hıyarı | | Fruit / Root / Poisonous, sinusitis, jaundice, diuretic, diarrhea, egzema, skin disorders |
| CYPERACEAE | | | | |
| 67 | * <i>Cyperus rotundus</i> L. | topalak | | Root / Diuretic |
| EBENACEAE | | | | |
| 68 | <i>Diospyros lotus</i> L. | hırnık | LC | Calyx / Hiccups, hiatal hernia; Fruit / Hypertension |
| ELAEAGNACEAE | | | | |
| 69 | <i>Elaeagnus rhamnoides</i> (L.) A.Nelson | çıçırğan | | Fruit / Cough |
| EUPHORBIACEAE | | | | |
| 70 | <i>Euphorbia falcata</i> L. subsp. <i>falcata</i> var. <i>galilaea</i> (Boiss.) Boiss. | eğri sütleğen | | Latex / Eczema, fungal infection |
| FABACEAE | | | | |
| 71 | <i>Galega officinalis</i> L. | keçisedefi | | Aerial parts / Diuretic, antipyretic, expels parasitic worms |
| 72 | <i>Glycyrrhiza echinata</i> L. | pıtırak meyan | | Rhizome / Bronchitis, asthma, antitussive, stomachic, nephralgia, diuretic, antiseptic |
| 73 | <i>Glycyrrhiza glabra</i> L. var. <i>glabra</i> | meyan | | Root / Cough, bronchitis, stomachic, bronchitis, asthma, antitussive, nephralgia, diuretic, epilepsy, cancer, kidney stones; Leaf / Sunstroke |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|---------------------|--|---------------------|-------------|---|
| 74 | ** <i>Lotus corniculatus</i> L. var. <i>corniculatus</i> | gazalboynuzu | | Aerial parts / Sedative, antihemorrhoidal, abdominal, pain, diuretic, stomach pain, nephralgia |
| 75 | <i>Medicago minima</i> (L.) Bartal. var. <i>minima</i> | gurnik | | Fruit / Cardiac disorders |
| 76 | <i>Medicago x varia</i> Martyn | yaban yoncası | | Leaf / Abscess |
| 77 | <i>Melilotus officinalis</i> (L.) Desr. | kokulu yonca | | Leaf / Anemia, sedative, constipation, antirheumatic |
| 78 | <i>Ononis spinosa</i> L. subsp. <i>hircina</i> (Jacq.) Gams | şırbık | | Root / Spontaneous kidney stone passage, diuretic |
| 79 | * <i>Robinia pseudoacacia</i> L. | yalancı akasya | | Bark / Wood / Purgative |
| 80 | <i>Sophora alopecuroides</i> L. var. <i>alopecuroides</i> | acımeyan | | Root / Scabies |
| 81 | <i>Trifolium pratense</i> L. var. <i>pratense</i> | çayır üçgülü | | Leaf / Vulnerary |
| 82 | <i>Trifolium repens</i> L. var. <i>repens</i> | ak üçgül | | Aerial parts / Tonic, antirheumatic |
| HYPERICACEAE | | | | |
| 83 | <i>Hypericum perforatum</i> L. subsp. <i>veronense</i> (Schrank) H.Linb. | sarı kantaron | | Aerial parts / Stomache pains, ulcer, antiseptic, vulnerary, sedative, kidney disorders, antihemorrhoidal |
| IRIDACEAE | | | | |
| 84 | <i>Iris pseudacorus</i> L. | batak süseni | LC | Rhizome / tooth-ache, menstrual regulator |
| JUGLANDACEAE | | | | |
| 85 | <i>Juglans regia</i> L. | ceviz | NT | Leaf / Antihemorrhoidal, anthelmintic, women's sterility, fungal infection, eczema, Sunstroke, hemostatic, vulnerary, abscess |
| JUNCACEAE | | | | |
| 86 | <i>Juncus effusus</i> L. subsp. <i>effusus</i> | has kofa | LC | Pith / Antipyretic, diuretic, sore throats |
| LAMIACEAE | | | | |
| 87 | <i>Ajuga reptans</i> L. | meryemsaçı | | Aerial parts / Analgesic, laxative, throat irritation, mouth ulcer |
| 88 | <i>Glechoma hederacea</i> L. | yernanesi | DD | Leaf / Blood cleanser, diuretic, anti-inflammatory |
| 89 | <i>Lycopus europaeus</i> L. | kurtayağı | LC | Aerial parts / Astringent, sedative, cardiac tonic for anxiety, tuberculosis, palpitation |
| 90 | <i>Melissa officinalis</i> L. subsp. <i>officinalis</i> | oğulotu | | Leaf / Soothes insect bite, headache, indigestion, nausea, sedative |
| 91 | <i>Mentha aquatica</i> L. | su nanesi | LC | Aerial parts / Stimulant, emetic, astringent |
| 92 | <i>Mentha longifolia</i> (L.) L. subsp. <i>longifolia</i> | pünk | LC | Aerial parts / Colds, flu, cough, catarrh, diseases, abdominal pain, menstrual pain, stomachic, bronchitis, headache, pulmonic disorders, diarrhea, asthma, antihemorrhoidal; Leaf / Sunstroke, aphta |
| 93 | <i>Mentha longifolia</i> (L.) L. subsp. <i>typhoides</i> (Briq.) Harley | dere nanesi | | Aerial parts / Throat pain, carminative, intestinal disorders |
| 94 | <i>Mentha pulegium</i> L. | yarpuz | LC | Aerial parts / Vulnerary, gall bladder, cold and flu, diarrhea, indigestion |
| 95 | <i>Nepeta cataria</i> L. | kedinanesi | | Aerial parts / Stomachic, stimulant |
| 96 | <i>Prunella vulgaris</i> L. | gelinciklemeotu | | Aerial parts / Expectorant |
| 97 | <i>Satureja hortensis</i> L. | çibriska | | Aerial parts / Immunostimulant |
| 98 | <i>Teucrium chamaedrys</i> L. subsp. <i>chamaedrys</i> | kısamahmut | | Aerial parts / Tootache, kidney pain, stomachic, indigestion, heart diseases |
| 99 | <i>Teucrium polium</i> L. subsp. <i>polium</i> | acıyavşan | | Aerial parts / Stomach, diarrhea, antihemorrhoidal, internal diseases, diabetes, analgesic, antiinflammatory, edema, stomach ache, digestive, orexigenic, carminative, sunstroke, hemostatic |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|-----|--|---------------------|-------------|--|
| 100 | <i>Vitex agnus-castus</i> L. LYTHRACEAE | hayıt | | Seeds / Menstrual regulator |
| 101 | ** <i>Lythrum salicaria</i> L. MALVACEAE | hev hulma | | Leaf / Astringent, tightens skin; Flowering plant / Intestinal disinfectant, antidiarrhea |
| 102 | <i>Althaea officinalis</i> L. | deli hatmi | | Aerial parts / Diuretic, kidney stones |
| 103 | <i>Malva sylvestris</i> L. MYRTACEAE | ebegümeci | | Fruit / Sore throat; Aerial parts / Skin disorders, wounds, maturation, abscess, abortive |
| 104 | * <i>Eucalyptus camaldulensis</i> Dehnh. subsp. <i>camaldulensis</i> MORACEAE | sıtma ağacı | | Oil / Antiseptic, expectorant, antiviral |
| 105 | <i>Ficus carica</i> L. subsp. <i>carica</i> | incir | LC | Fruit / Diarrhea, ulcer; Latex / Inflamed wounds |
| 106 | <i>Morus alba</i> L. OLEACEAE | ak dut | | Fruit / Abscess, stomach disorders, gastric ulcer |
| 107 | <i>Ligustrum vulgare</i> L. OROBANCHACEAE | kurtbağrı | | Flower / Burned |
| 108 | <i>Orobanche alba</i> Stephan ex Willd. subsp. <i>alba</i> PAPAVERACEAE | boğasak | | Aerial parts / Astringent, sedative, mild laxative |
| 109 | <i>Chelidonium majus</i> L. | kırlangıçotu | | Aerial parts / Diuretic, gall-bladder, purgative, caustic; Sap / For warts, ringworm |
| 110 | <i>Papaver rhoeas</i> L. PHYTOLACCACEAE | gelincik | | Aerial parts / Sedative |
| 111 | * <i>Phytolacca americana</i> L. PLANTAGINACEAE | şekerciboyası | | Root / Anti-inflammatory, purgative, narcotic, catarrh, arthritis, kills sperm; Leaf / Anti-fungal |
| 112 | <i>Plantago lanceolata</i> L. | damarlıca | | Leaf / Abscess, anti-parasitic, vulnerary, astringent, anti-inflammatory; gynecologic diseases, stomachic, ulcer |
| 113 | <i>Plantago major</i> L. subsp. <i>major</i> PLATANACEAE | sinirotu | | Leaf / Vulnerary, abscess, inflamed wounds, burns; stomach ailments, antihemorrhoidal |
| 114 | <i>Platanus orientalis</i> L. POACEAE | çınar | | Branch / Antipyretic, skin burn |
| 115 | <i>Avena sativa</i> L. | yulaf | | Branch / Anti-cholesterol; Aerial parts / Depression, menopausal oestrogen deficiency, muscular sclerosis |
| 116 | <i>Cynodon dactylon</i> (L.) Pers. var. <i>dactylon</i> | köpekdişi | | Aerial parts / Diuretic |
| 117 | * <i>Imperata cylindrica</i> (L.) Raeusch. | çardakotu | | Aerial parts / Antiviral, antihypertensive, anticancer; Rhizome / Antipyretic, astringent, diuretic |
| 118 | <i>Phragmites australis</i> (Cav.) Trin. ex Steud. POLYGONACEAE | kamış | LC | Rhizome / Root / Nausea, urinary problems, arthritis |
| 119 | <i>Polygonum aviculare</i> L. | köyotu | | Aerial parts / Cough, antirheumatic, anemia, stomach disorders |
| 120 | <i>Polygonum cognatum</i> Meissn. | madımak | | Aerial parts / Abscess, Emetic, cough, antirheumatic, anemia, stomach disorders |
| 121 | <i>Rumex crispus</i> L. | labada | | Leaf / Cough, colds, asthma, antiinflammatory, antihemorrhoidal, gynecologic diseases, antiphlogistic, antirheumatic; Fruit / Goiter |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|-----|---|-------------------|------|--|
| 122 | <i>Rumex patientia</i> L. | efelek | | Leaf /, antihemorrhoidal, asthma, kidney disorders |
| 123 | <i>Rumex tuberosus</i> L. subsp. <i>tuberosus</i> | kuzukıkırdağı | | Aerial parts / Constipation |
| | PORTULACACEAE | | | |
| 124 | <i>Portulaca oleracea</i> L. | semizotu | | Aerial parts / Orexigenic, antihelminthic, diuretic, stomachic, urethra infection, inflamed wound |
| | PRIMULACEAE | | | |
| 125 | <i>Anagallis arvensis</i> L. var. <i>arvensis</i> | farekulağı | | Aerial parts / Poisonous bites, edema |
| 126 | <i>Primula acaulis</i> (L.) L. subsp. <i>rubra</i> (Sm.) Greuter & Burdet | evvelbahar çiçeği | | Flower / Headache, mildly sedative; Root / Expectorant |
| | RANUNCULACEAE | | | |
| 127 | <i>Clematis vitalba</i> L. | akasma | | Leaf / Poisonous, neural disease |
| 128 | <i>Ranunculus arvensis</i> L. | mustafaçiçeği | | Root / Swollen wounds; Aerial parts / Antirheumatic |
| 129 | <i>Ranunculus repens</i> L. | tiktakdana | | Aerial parts / Antirheumatic, edema |
| | RHAMNACEAE | | | |
| 130 | <i>Paliurus spina-christi</i> P. Mill. | karaçalı | | Fruit / Constipation, diuretic |
| | ROSACEAE | | | |
| 131 | <i>Agrimonia eupatoria</i> L. subsp. <i>asiatica</i> (Juz.) Skalicky | fitikotu | | Roots / Constipation, diuretic; Aerial parts / Hernia |
| 132 | <i>Crataegus monogyna</i> Jacq. var. <i>monogyna</i> | yemişen | | Fruit / Sedative, antispasmodic, cardiovascular diseases |
| 133 | <i>Cydonia oblonga</i> Mill. | ayva | | Barks / Colds; Leaf / Diarrhea |
| 134 | <i>Geum urbanum</i> L. | meryemotu | | Root / Peptic pain, antipyretic, antiseptic |
| 135 | <i>Malus sylvestris</i> (L.) Mill. subsp. <i>orientalis</i> (Uglitzk.) Browicz var. <i>orientalis</i> | acı elma | | Fruit / Colds, diabetes |
| 136 | <i>Potentilla reptans</i> L. | reşatinotu | | Aerial parts / Constipation, antipyretic, tonic |
| 137 | <i>Prunus spinosa</i> L. | çakal eriği | | Fruit / Astringent |
| 138 | <i>Rosa canina</i> L. | kuşburnu | | Fruit / Root / Anti-hemorrhoidal, cough, stomachic, constipation, malaria, diabetes, tonic, antitussive, bronchitis, diuretic, asthma, immunostimulant; Leaf / Colds, tonic, asthma, kidney stones |
| 139 | <i>Rubus canescens</i> DC. var. <i>glabratus</i> (Godr.) Davis & Meikle | çobankösteği | | Shoots / Roots / Fruit / Tonic, diuretic, diabetes, hypertension |
| 140 | <i>Rubus sanctus</i> Schreb. | böğürtlen | | Fruit / Colds |
| 141 | <i>Sanguisorba minor</i> L. subsp. <i>balearica</i> (Bourg. ex Nyman) Muñoz Garm. & C. Navarro | kelekayağı | | Aerial parts / Diuretic, constipation, stomachic, orexigenic |
| | RUBIACEAE | | | |
| 142 | <i>Galium verum</i> L. subsp. <i>verum</i> | boyalık | | Flower / Treating burns, cancer |
| | SALICACEAE | | | |
| 143 | <i>Populus nigra</i> L. subsp. <i>nigra</i> | kara kavak | | Leaf / Wood / Antirheumatic, hemostatic |
| 144 | <i>Salix alba</i> L. subsp. <i>alba</i> | ak söğüt | LC | Leaf / Antirheumatic, tonic, antidiarrhea |
| | SAPINDACEAE | | | |
| 145 | * <i>Aesculus hippocastanum</i> L. | atkestanesi | | Seed / Cardiovascular diseases, Bark/ Antipyretic |
| | SCROPHULARIACEAE | | | |
| 146 | <i>Verbascum thapsus</i> L. | burunca | | Leaf / Expectorant, spasm-sedating; Aerial parts / Antituberculosis; Flower / Eczema inflammation, wound; Root / Diuretic |
| | SIMAROUBACEAE | | | |
| 147 | * <i>Ailanthus altissima</i> (Mill.) Swingle | kokarağaç | | Bark / Antipyretic, astringent, antispasmodic, dysentery, cardiac palpitations |

Table 2. Continued.

| | Taxon name | Turkish name | IUCN | Part used/usage |
|-----|---|----------------|------|---|
| | SMILACACEAE | | | |
| 148 | <i>Smilax excelsa</i> L. | dikenucu | | Leaf / Anticancer, stomach ache, intestinal ache |
| | SOLANACEAE | | | |
| 149 | <i>Datura stramonium</i> L. | boru çiçeği | | Seed / Toothache; Leaf / Aerial parts / Poisonous, antipyretic, antirheumatic, sedative |
| 150 | <i>Hyoscyamus niger</i> L. | banotu | | Aerial parts / Digestive, urinary, asthmatic spasm, poisonous |
| 151 | <i>Physalis alkekengi</i> L. | güveyfeneri | | Root / Sedative, antipyretic |
| 152 | <i>Solanum americanum</i> Mill. | itüzümü | | Leaf / Fruit / Poisonous, painkiller, hemorrhoid treatment |
| 153 | <i>Solanum dulcamara</i> L. | sofur | | Aerial parts / Burn, expectorant |
| | TYPHACEAE | | | |
| 154 | ** <i>Typha latifolia</i> L. | cil | | Flower / Hemostatic |
| | ULMACEAE | | | |
| 155 | <i>Ulmus minor</i> Mill. | ova karaağacı | | Root / Bark / Anti-inflammatory, wounds, cough, asthma |
| | URTICACEAE | | | |
| 156 | <i>Urtica dioica</i> L. subsp. <i>dioica</i> | ısrıgan | | Aerial parts / Cancer, antirheumatic, diabetes, stomachic, cough, colds, throat diseases, analgesic, edema, sedative, laxative, antiinflammatory, hypertension, kidneystones, emmenagogue, asthma; Leaf / Hair care |
| | VERBENACEAE | | | |
| 157 | <i>Verbena officinalis</i> L. var. <i>officinalis</i> | mineçiçeği | | Aerial parts / Aphrodisiac; liver stimulant; Inflorescence / Depression, insomnia, nervous headache, urinary problems, stomach, bowel, menstrual cramps |
| | VIOLACEAE | | | |
| 158 | <i>Viola odorata</i> L. | kokulu menekşe | | Flower / Antiseptic, mild laxative; Leaf / Cough, headache, insomnia; Root / Bronchitis |
| | VITACEAE | | | |
| 159 | <i>Vitis vinifera</i> L. | asma | | Seed / Anticarcinogenic |
| | ZYGOPHYLLACEAE | | | |
| 160 | <i>Tribulus terrestris</i> L. | çobançökerten | | Aerial parts / Expectorant, diuretic, diarrhea |

2000; Yılmaz and Korkmaz, 2017; URL-1), alien taxa and invasive taxa are marked with “*” and “**”, respectively (Güner et al., 2012; Önen, 2015; URL-2. Endemic species are indicated as “End.” in the list.

Results and Discussions

It has been determined 160 species and infraspecific taxa belonging 61 families and 141 genera which can be used for medicinal purposes in the research area. The families that include most number of medicinal species are Asteraceae (21), Lamiaceae (14), Fabaceae (12), Rosaceae (11), Apiaceae (9), Brassicaceae (7), Polygonaceae (5), Solanaceae (5), Caryophyllaceae (4) and Poaceae (4). Table 1 shows the list and usage of natural plant species determined in Yeşilirmak Delta in

terms of human health.

Among these plants, there are species included the threat categories according to IUCN (for worldwide distribution) and Red Data Book of Turkish Plants (2000) (for distribution in Turkey). Of the taxa in the study area, 13 are in least concern (LC), 1 are in data deficient (DD), 2 are in near threatened (NT) and only one is in endangered (EN) category (Ekim et al., 2000; Yılmaz and Korkmaz, 2017; URL-1) (Table 1). Endemic plant species in the list are *Helichrysum arenarium* subsp. *aucherii* and *Inula helenium* subsp. *orgyalis*.

The plant species which also have poisonous effects in the research area are *Equisetum arvense*, *Dryopteris filix-mas*, *Nerium oleander*, *Hedera helix* f. *helix*, *Ecballium elaterium*, *Clematis vitalba*, *Datura stramonium*,

Hyoscyamus niger, *Solanum americanum*. Medicinal plants, also known as curative plants, are widely used and assumed to be safe. However, they should never be overlooked they may be potentially toxic. Unfavourable effects of medicinal plants result from usually due to misidentification of the plants (Nasri and Shirzad, 2013) or due to the fact that therapeutic and toxic doses are unknown (Ross, 2005). Medicinal plants should be used more carefully especially for children, pregnant and elderly in considering the side effects (Izzo et al., 2016).

It has been benefited from different parts of plants for various medicinally purposes. Among the most used parts for the plants distributed that region, there are aerial parts (of 78 taxa), leaves (of 41 taxa), underground parts (of 34 taxa), fruits (of 23 taxa) and flowers (13 taxa). However, it's seen that the less used parts are seeds, brunches, barks and shoots. Plants which distribute in the research area have been used especially diuretic (44 taxa), antirheumatic (17 taxa), antihemorrhoidal (14 taxa), antipyretic (14 taxa), anti-inflammatory (13 taxa) and anti-constipation (9 taxa) etc.

Plants usually produce complex mixtures of secondary metabolites, as well. It's likely that the individual components of a mixture can exert not only as additive but certainly also as synergistic effects by attacking more than a single molecular target. Because structures of secondary meabolites have been shaped and optimized during more than 500 million years of evolution, many of them exert interesting biological and pharmacological properties which make them useful for medicine (Wink, 2010).

Animal experiments on medical herbs provide valuable information, even if the herb has been traditionally used over hundreds of years. The differences in the pharmacokinetic and pharmacodynamic phases between species would inevitably lead to some degree of error in extrapolation of result. However, correct design and interpretation of animal studies can provide information that is not able to be provided by *in vitro* studies, computer modeling or even traditional use. By the means of these experiments, it has been seen the combinations of herbs may result in organ damages especially in kidneys that are not seen with one agent individually (Kincaid-Smith, 1968; Molland, 1978; Wojcikowski and Gobe, 2014). In like manner, especially in Europe, several of the traditional medicines have been developed into modern drugs which have been studied in clinical trials and for a number of these plant drugs

have been proven their efficacy (Wink, 2015).

Because of the mismanagement of natural resources and inaccurate agricultural practices, many medicinal plant species have become rare, even endangered or reached to extinction level. Therefore, alternative strategies are needed to protect medicinally important plant species (Datir and Bhore, 2017; Alamgir, 2017). For example, agricultural production of medicinal plant species (except invasives and aliens) that their natural populations may be in damaged due to excessive consumption may be proposed as an alternative method for herbs, shrubs and trees (Tüfekçioğlu, 2005; Karhagomba et al., 2013; Nabavi et al., 2015; Alamgir, 2017)

References

- Alamgir A.N.M. 2017. Cultivation of herbal drugs, biotechnology, and in vitro production of secondary metabolites, high-value medicinal plants, herbal wealth, and herbal trade. In: Therapeutic Use of Medicinal Plants and Their Extracts: Volume 1. Progress in Drug Research, vol 73. Springer, Cham.
- Akbulut S., Karaköse M. 2016. Some Wild Plants Commonly Used in Folk Medicine in Turkey. In: A.A. Çamlı, B. Ak, R. Arabacı, R. Efe. (Eds.). Recent Advances in Health Sciences, , St. Kliment Ohridski University Press, Sofia. pp: 547-559.
- Altundağ E., Öztürk M. 2011. Ethnomedicinal studies on the plant resources of east Anatolia, Turkey. *Procedia-Social and Behavioral Sciences*, 19: 756-777.
- Amessis-Ouchemoukh N., Madani K., Falé P.L.V., Serralheiro M.L., Araújo M.E.M. 2014. Antioxidant capacity and phenolic contents of some Mediterranean medicinal plants and their potential role in the inhibition of cyclooxygenase-1 and acetylcholinesterase activities. *Industrial Crops and Products*, 53: 6-15.
- Bremness L. 1994. *Herbs*. Dorling Kindersley, London.
- Briskin D.P. 2000. Medicinal Plants and Phytomedicines. Linking Plant Biochemistry and Physiology to Human Health Source. *Plant Physiology*, 124(2): 507-514.
- Bulut G., Tuzlacı E., Doğan A., Şenkardeş İ. 2014. An ethnopharmacological review on the Turkish Apiaceae species. *İstanbul Üniversitesi Eczacılık Fakültesi Dergisi*, 44(2): 163-179.
- Datir S.S., Bhore S.J. 2017. Biotechnological approaches for conservation and sustainable supply of medicinal plants. In: S. Bhore, K. Marimuthu, M. Ravichandran. (Eds.). *Biotechnology for Sustainability Achievements, Challenges and Perspectives*. AIMST University, Malaysia. pp: 117-128

- Ekici M., Satılmış A., Ay Y.D., Dülger B., Mal Yer H. 1998. *Ecballium elaterium* (L.) Meyvelerinin Sinüzite Karşı Kullanımı. *Ekoloji*, 7(27): 24-25.
- Ekim T., Koyuncu M., Vural M., Duman H., Aytac Z., Adıgüzel N. 2000. Türkiye Bitkileri Kırmızı Kitabı [Red Data Book of Turkish Plants], Nature Protect Institution, Van 100th Year University Press, Ankara, Turkey.
- Fakir H., Korkmaz M., Güller B. 2009. Medicinal plant diversity of Western Mediterranean Region in Turkey. *Journal of Applied Biological Sciences*, 3(2): 30-40.
- Gladstar R., Hirsch P. 2000. *Planting our future: Saving our medicinal herbs*. Rochester, VT: Healing Arts Press.
- Güner A., Aslan S., Ekim T., Vural M., Babaç M.T. 2012. Türkiye Bitkileri Listesi (Damarlı Bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını, İstanbul.
- Izzo A.A., Hoon-Kim S., Radhakrisnan R., Williamson E.M. 2016. A critical Approach to evaluating clinical efficacy, adverse events and drug interactions of herbal remedies. *Phytotherapy Research*, 30(5): 691-700.
- Kamiloğlu S., Capanoğlu E., Yılmaz O., Duran A.F., Boyacıoğlu D. 2014. Investigating the antioxidant potential of Turkish herbs and spices. *Quality Assurance and Safety Crops and Foods*, 6(2): 151-158.
- Karhagomba I.B., Mirindi T.A., Mushagalusa T.B., Nabino V.B., Koh K., Kim H.S. 2013. The cultivation of wild food and medicinal plants for improving community livelihood: The case of the Buhozi site, DR Congo. *Nutrition Research and Practice*, 7(6): 510-518.
- Karadeniz A., Çinbilgel I., Gün S.S., Çetin A. 2015. Antioxidant activity of some Turkish medicinal plants. *Natural Product Research*, 29(24): 2308-2312.
- Kaufman P.B., Cseke L.J., Warber S., Duke J.A., Briemann H.L. 1999. *Natural products from plants*. CRC Press, Boca Raton, FL.
- Kaya G.I., Sarıkaya B., Çiçek D., Somer N.U. 2010. In vitro cytotoxic activity of *Sternbergia sicula*, *S. lutea* and *Pancreatium maritimum* extracts. *Hacettepe University Journal of Faculty of Pharmacy*, 30(1): 41-48.
- Kincaid-Smith P. 1968. Analgesic nephropathy and papillary necrosis. *Postgraduate Medical Journal*, 44(516): 807-810.
- Korkmaz H., Mumcu Ü., Kutbay H.G., Alkan S. 2011. Vascular flora of the Gölardı Wildlife Protection Area and its surroundings (Terme/Samsun, Turkey). *Phytologia Balcanica*, 17(3): 315-331.
- Korkmaz H., Mumcu Ü., Alkan S., Kutbay H.G. 2012. A Syntaxonomical Study on The Psammophyl, Hygrophyll and Forest Vegetation of Gölardı (Terme/Samsun) Wildlife Protecting Area, *Ekoloji*, 21 (85): 64-79.
- Kültür S. 2007. Medicinal plants used in Kırklareli Province (Turkey). *Journal of Ethnopharmacology*, 111(2): 341-364.
- Ministry of Forestry and Water Affairs, 2012. Yeşilirmak Deltası Sulak Alan Yönetim Planı Projesi Yeşilirmak Deltası Sulak Alan Alt Havzası Biyolojik Çeşitlilik Araştırma Alt Projesi Nihai Raporu.
- Molland E.A. 1978. Experimental renal papillary necrosis. *Kidney International*, 13(1): 5-14.
- Mumcu Ü. 2017. Yeşilirmak Deltası (Çarşamba /Samsun) Orta ve Batı Kesiminin Floristik, Fitososyolojik ve Ekolojik Yönden Araştırılması, Phd Thesis, Institute of Science, Ondokuz Mayıs University, Samsun.
- Nabavi S.M., Marchese A., Izadi M., Curti V., Daglia M., Nabavi S.F. 2015. Plants belonging to the genus *Thymus* as antibacterial agents: From farm to pharmacy. *Food Chemistry*, 173: 339-347
- Nasri H., Shirzad H. 2013. Toxicity and safety of medicinal plants. *Journal of HerbMed Pharmacology*, 2(2): 21-22.
- Önen H. 2015. Türkiye İstilacı Bitkiler Kataloğu. Ezgi Ofset Matbaacılık, Ankara.
- Özçağlar A. 1994. Çarşamba Ovası ve Yakın Çevresinde Araziden Faydalanma, Ankara Üniversitesi Türkiye Coğrafyası Araştırma ve Uygulama Merkezi Dergisi, 3: 93-128.
- Özkan G., Kamiloğlu S., Özdal T., Boyacıoğlu D., Capanoğlu E. 2016. Potential use of turkish medicinal plants in the treatment of various diseases. *Molecules*, 21(3): 257.
- Ross I.A. 2005. *Medicinal plants of the world: chemical constituents, traditional and modern medicinal uses*, Vol. 3, Humana Press, Totowa, New Jersey.
- Şahin K., Bağcı H.R. 2016. CBS ve UA teknikleriyle Türkiye'nin başlıca deltalarının morfolojik özelliklerinin değerlendirilmesi. *Uluslararası Sosyal Araştırmalar Dergisi*, 9(42): 984-990.
- Şener B., Orhan I., Satayavivad J. 2003. Antimalarial activity screening of some alkaloids and the plant extracts from Amaryllidaceae. *Phytotherapy Research*, 17(10): 1220-1223.
- Tuzlacı E., Tolon E. 2000. Turkish folk medicinal plants, part III: Şile (İstanbul). *Fitoterapia*, 71(6): 673-685.
- Tüfekçioğlu A., 2005. Effects of some soil properties on the growth of hybrid poplar in Terme-Gölardı region of Turkey. *Turkish Journal Agriculture and Forestry*, 29(3): 221-226.
- Uğurlu E., Seçmen Ö. 2008. Medicinal plants popularly used in the villages of Yunt Mountain (Manisa-Turkey). *Fitoterapia*, 79(2): 126-131.
- Wink M. 2010. Introduction: biochemistry, physiology and ecological functions of secondary metabolites. In: M. Wink (ed.). *Annual Plant Reviews Volume 40: Biochemistry of Plant Secondary Metabolism*, Second Edition. Wiley-Blackwell, Oxford, UK.
- Wink M., 2015. Modes of action of herbal medicines and plant secondary metabolites. *Medicines*, 2(3): 251-286,

- Wink M., Schimmer O. 1999. Modes of action of defensive secondary metabolites. In: M. Wink (ed.). *Functions of Plant Secondary Metabolites and Their Exploitation in Biotechnology*. CRC Press, Boca Raton, FL. pp: 17-112.
- Wojcikowski K., Gobe G. 2014. Animal studies on medicinal herbs: predictability, dose conversion and potential value. *Phytotherapy Research*, 28(1): 22-27.
- Yılmaz C., Korkmaz H. (eds.) 2017. *Terme'nin Biyoçeşitlilik ve Doğal Ortam Özellikleri*. Serander Yayınları, Trabzon.
- URL-1: The IUCN Red List of Threatened Species. Version 2017-1. <www.iucnredlist.org>. (accessed 23.05.2017).
- URL-2: Global Invasive Species Database. <http://issg.org/index.html> (accessed 10.01.2018).