

A Chorological Study on the Taxa Naturalized in the Eastern Black Sea Region

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Abstract: Diaspores of taxa with large ecological tolerance can be easily carried between continents and some of these taxa become an important factor, threatening the maintenance of plant species diversity, in addition to other factors, such as clear-cutting, over-grazing and dwellings. Chorological study is an important step for conserving plant species diversity, and it provides information about naturalized plant taxa that have migrated from one continent to others. Presenting the floristic relationships between the continents is important for plant geography and paleobotany. The chorological features of 32 taxa of flowering plants belonging to 14 families, naturalized in the Eastern Black Sea Region of Turkey, were examined and discussed. Most of these taxa come from parts of North America, China and Japan, all of which are areas with climatic conditions similar to those of this region. These taxa have been dispersed by human activity, wind, animals and water. Because of the high rainfall throughout the year, diaspores of naturalized taxa can germinate easily and become new individuals in the study area. Consequently, there have been plant migrations in the temperate region of the world, where the eastern Black Sea region is a plant migratory route between Europe and Caucasia.

Key Words: Chorology, Naturalized Taxa, Eastern Black Sea Region

Doğu Karadeniz Bölgesi'nde Doğallaşmış Taksonlar Üzerine Korolojik Bir Çalışma

Özet: Geniş ekolojik toleransı olan taksonların diasporları kıtalar arasında kolaylıkla taşınabilir ve bu taksonların kimileri tıraşlama kesim, aşırı otlatma ve yerleşim gibi diğer faktörlerle birlikte bitkisel tür çeşitliliğinin devamını tehdit eden bir faktör haline gelmektedir. Korolojik çalışmalar bitkisel tür çeşitliliğini korumada önemli bir adımdır ve bir adadan diğerlerine göçen bitki taksonları hakkında bilgiler vermektedir. Kıtalar arasındaki floristik ilişkilerin ortaya konması bitki coğrafyası ve paleobotanik açılarından önemlidir. Doğu Karadeniz Bölgesi'nde doğallaşmış, 14 familyaya mensup 32 adet çiçekli bitki taksonunun korolojik özellikleri araştırılmış ve tartışılmıştır. Bu türlerin çoğu, iklim şartları bölge ile benzer olan Kuzey Amerika, Çin ve Japonya'dan gelmektedir. Taksonlar insan faaliyetleri, rüzgar, hayvanlar ve su ile yayılmaktadır. Tüm yıl boyunca düşen yüksek yağış nedeniyle doğallaşmış bitkilerin diasporları çalışma alanında kolaylıkla çimlenebilmekte ve yeni bireyler oluşturabilmektedir. Sonuç olarak, bitki göçlerinin devam ettiği dünyanın ılıman bölgeleri içindeki Doğu Karadeniz Bölgesi, Avrupa ve Kafkasya arasında bir bitki göç yolu oluşturmaktadır.

Anahtar Sözcükler: Koroloji, Doğallaşmış Taksonlar, Doğu Karadeniz Bölgesi

Introduction

A large number of plant taxa have diaspores which can be carried for great distances. This feature makes such taxa worthy of study from a biogeographic point of view. Diaspores may take the form of seeds, fruits or spores, and some taxa may have more than one type of diaspore which might be employed for dispersal. The chorological abilities of diaspores differ according to their type. Wind-dispersed seed such as those of *Epilobium* with a chalazal

plume of hairs, and many genera of *Compositae*, are perhaps the most easily dispersed and may occasionally be carried between continents.

Dispersal mechanisms may be divided into autochory, wherein a plant physically disperses seeds by mechanical means (e.g. *Geranium*, *Impatiens*), and allochory, wherein the plant employs some outside factor for dispersing its seeds. Seeds may only be carried small distances by autochory, so this factor is of little

importance for long distance dispersal of naturalized taxa. Allochory, or passive spreading, may be further subdivided into four categories (Karamanoğlu, 1973; Akman, 1993):

① **Anemochory**, i.e. wind dispersal. As mentioned above, this is generally the most efficient mechanism.

② **Zoochory**, i.e. dispersal by animals (especially birds). This includes both seeds that are ingested then passed out as dung or vomit, and those which attach to the outside of animals' bodies.

③ **Hydrochory**, i.e. dispersal by water. Diaspores may be carried up to 1600 km, downstream or sometimes in the ocean.

④ **Anthropochory**, i.e. by people. Seeds may be carried as a result of many human activities, such as wars, migrations, commercial activities, journeys and sailing. Such carriage is entirely accidental, whereas seeds are generally specifically adapted for other forms of allochory.

As a result of the four factors listed above, but especially anthropochory, diaspores have been carried out of their natural habitats and distributions. In cases where they reach suitable habitats elsewhere, they may germinate and give rise to new populations. The Eastern Black Sea Region of Turkey, the Colchis sector of the Euxine Province, has high rainfall throughout the year, and when it is not raining the hills are frequently swathed in mist. The climate is so wet that tea has become a successful crop in Rize and Hopa (Davis, 1965-1985). Diaspores of naturalized taxa which are adapted to humid conditions can germinate easily in these conditions and become new individuals.

Materials and Methods

Fruiting and flowering material of the studied taxa was collected during botanical field trips from April to September, between 1994 and 1998. By scraping the plant with different apparatuses the specimens were collected and the samples were cleaned of soil. Labels stated such details as the location of the collection, the altitude of the area and the date of collection. All the collected specimens were placed in the KATO (Herbarium of Forestry Engineering Department, Faculty of Forestry, Karadeniz Technical University). In addition, data was compiled from other taxa which were not collected, and

from the Flora of Turkey and the East Aegean Islands (Davis, 1965-1988). Information on the diaspore types of all these species was compiled to determine and compare the ways in which they spread.

The following list of introduced taxa provides all taxonomic categories, author(s), voucher numbers and natural distributions. The number(s) before the scientific name of each taxon shows its possible way(s) of spreading from its natural habitat into the study area. The numbers are given in decreasing order of significance for dispersal. All the taxa were listed according to Cronquist's method (Cronquist, 1968).

Results and Discussion

Thirty-two naturalized taxa from the study area were determined and examined. The numbers and proportions of these belonging to certain families are as follows:

Family	Number	Proportion
<i>Compositae</i>	11	35.5%
<i>Gramineae</i>	5	16.1%
<i>Cruciferae</i>	2	6.5%
<i>Leguminosae</i>	2	6.5%
<i>Commelinaceae</i>	2	6.5%
Others	9	29.0%

ANGIOSPERMAE

A. *MAGNOLIATAE*, *Dilleniidae*, *Violales*, *CUCURBITACEAE*

④..... *Sicyos angulatus* L., KATO 9600, N. America. Naturalized in S., E. & C Europe, on cultivated land as a climber, new record from Turkey (Duman and Güner, 1996; Terzioğlu and Anşin, 1999).

Capparales, *CRUCIFERAE*

②,④.....*Brassica oleracea* L.var. *acephala* DC., KATO 11928, Mediterranean. Escape from cultivation.

②,④.....*Lepidium virginicum* L., AG 3800, N. America. Naturalized in Europe.

Rosidae, *Rosales*, *ROSACEAE*

②,③,④.....*Duchesnea indica* (Andrews) Focke, AG 4442, India, Malaysia, Philippines, China, Japan.

Naturalized in Caucasia, W., C. & S. Europe. Rapidly naturalized in NE Anatolia, new record from Turkey (Sorger and Bucher, 1983).

LEGUMINOSAE

④.....*Albizia julibrissin* Durazz., KATO 12147, N. Iran. Ornamental tree, escape from cultivation.

④.....*Robinia pseudoacacia* L., KATO 12157, N. America. The commonest naturalized tree in Turkey, escape from cultivation.

④,③.....*Ulex europaeus* L., KATO 1056, W Europe. Extending eastwards to Italy, widely introduced elsewhere.

Sapindales, ACERACEAE

①,④.....*Acer negundo* L., KATO 4845, N. America. Naturalized or planted elsewhere.

SIMAROUBACEAE

①,④.....*Ailanthus altissima* (Mill.) Swingle, KATO 12328, China. Introduced and naturalized in many parts of the world.

RUTACEAE

④.....*Poncirus trifoliata* (L.) Rafin, YILDIRIMLI 4419, N China, Japan. As edge plants, escape from cultivation.

Umbellales, UMBELLIFERAE

③,①.....*Hydrocotyle ramiflora* Maximow., KATO 12373, Japan. Naturalized Black Sea coast of Turkey and Georgia.

Polemoniales, CONVULVACEAE

④.....*Ipomoea purpurea* (L.) Roth., KATO 12455, America. Widely naturalized in S. Europe, apparently frequently grown in gardens and sometimes escaping.

Lamiales, LABITAE

④.....*Elsholtzia ciliata* (Thunb.) Hyl., KATO 12560, C.& E. Asia. Naturalized in Europe, cultivated for ornament and naturalized.

Dipsacales, CAPRIFOLIACEAE

④,②.....*Lonicera japonica* Thunb., KATO 12697, E. Asia. Grown as ornament, escape from cultivation.

Asterales, COMPOSITAE

①,②.....*Artemisia verlotorum* Lamotte, KATO 12818, S.& W. China. Introduced and naturalized in W. & C. Europe.

①,②.....*Aster squamatus* (Sprengel) Hieron, SORGER & BUCHER 82-116-7, C. & S. America. Spreading in Mediterranean and Caucasia.

①,②.....*Aster subulatus* Michaux, KATO 12749, N. America. It may spread rapidly in Turkey.

①,②.....*Conyza bonariensis* (L.) Cronquist, KATO 12756, S. America. Widely distributed throughout the warmer regions of the world.

①,②.....*Conyza canadensis* (L.) Cronquist, KATO 12757, N. America. Widely distributed throughout the temperate regions of the world.

①,②.....*Crassocephalum crepidioides* (Benth) S. Moore, KATO 12907, Tropical Africa and Mascarene Island. Now an aggressive and rapidly spreading weed in the Old World tropics and subtropics, where it occurs in such habitats as tea plantations, similar to those met with Colchis sector.

①,②,③.....*Dichrocephala integrifolia* (L.) Kuntze, KATO 12758, Tropical Asia and Africa. Naturalized in Italy, Caucasia and N. Iran.

①,③.....*Erigeron annuus* (L.) Pers., KATO 12754, N. America and Canada. Naturalized in Europe and Asia.

①,②.....*Galinsoga parviflora* Cav., KATO 12725, S. America. Spreading cosmopolitan weed, naturalized in Europe.

①,③,②.....*Matricaria matricarioides* (Less.) Porter ex Britton, SORGER 81-62-2, Unalashca. A very common alien naturalized in much of Europe and Caucasia; a frequent weed of disturbed ground which will doubtless spread rapidly in Turkey.

①,②,③.....*Tagetes minuta* L., KATO 12909, S. America. An agricultural weed elsewhere, being naturalized or at least casual in S. Europe, Caucasia, Yemen, Africa, Australia etc. T. Ekim stated that the species has been present at Sürmene since 1984 and is becoming abundant; it may well spread in Turkey.

B. LILIATAE, Commelinidae, Commelinales, COMMELINACEAE

②,④.....*Commelina communis* L., KATO 12911, China. Introduced to America, naturalized in S. & C. Europe.

②,④.....*Tradescantia fluminensis* Vellozo, KATO 3597, N. America. Naturalized and escape from cultivation.

Cyperales, GRAMINEAE

②,①,④.....*Eleusine indica* (L.) Gaertn., BAL. 1548, Tropical and subtropical regions. Naturalized in S. Europe.

②,①,④,③.....*Paspalum dilatatum* Poiret, KATO 13019, S. America; from Brazil to Argentina. Introduced in S. Europe, Egypt, Sinai, Caucasus, N. Iran, Transcaspia, Pakistan.

②,①,④,③.....*Paspalum paspalodes* (Michx.) Scribner, KATO 13018, Old and New World tropics. Naturalized in S. Europe, Cyprus, Egypt, Sinai, Pakistan.

②,①,④,③.....*Paspalum thunbergii* Kunth ex Steudel, HUB.-MOR. 16295, E. Asia. Introduced in Caucasus and Transcaspia.

②,①,④,③.....*Phylostachys bambusoides* Sieb. Et Zucc., MV 4290, China. In vegetative form, naturalized.

A new species, which is not co-evolved with other elements of a recipient ecosystem, may threaten the indigenous species as an effective competitor, a new predator, or a new pathogen (Vitousek et al., 1987). Naturalized taxa have large ecological tolerance which enables them to live in other ecosystems and compete with the indigenous taxa. They may cause the extinction of native species through climbing, as seen in *Sicyos angulatus* and *Lonicera japonica*, and fast-growing, as seen in *Robinia pseudoacacia*, *Acer negundo*, *Ailanthus altissima* and *Phylostachys bambusoides*. Some of the other naturalized species, such as *Crassocephalum crepidioides* and *Galinsoga parviflora*, are annual and produce many plumed diaspores that are easily dispersed.

More than two-thirds of these taxa come from North America (the relatively humid, coastal and mountainous regions), Japan and China. Seven of them are recorded as being naturalized in Caucasus as well. It is notable that these regions also contain close relatives of many species from NE Turkey (Davis, 1971), and have similar climates.

Whereas some species of the Colchis region are endemic to Turkey, others extend into Caucasus and a few have close relatives in the Sino-Japanese region and/or Eastern North America (e.g. *Epigaea*, *Castanea*, *Rhododendron*) (Davis, 1971; Milne et al., 1999).

Fifteen of the 32 taxa are also naturalized in Europe. This might indicate that many naturalized species have employed Europe and Anatolia as a bridge via which they reached NE Turkey.

All of the taxa listed above are Angiospermae. This might indicate that diaspores of other taxonomic categories lack the ability to disperse long distances. According to the four possible ways of spreading, all the listed taxa can be divided into four categories: 17 of them use two possible ways, six of them use only one possible way, five of them use three possible ways, and four of them use four possible ways.

Some American species have become naturalized in Europe and some Chinese and Japanese species have reached Caucasus, but these have not yet reached (or been recorded in) Turkey. The migration is a continuous process between continents and countries and some taxa, such as *Verbascum*, have their centre of diversity in Turkey and have been spreading from Turkey to other regions.

It is notable that the majority of species in this study belong to the Compositae. This is mostly because of their easily dispersed achenes, but also the family (like *Cruciferae*) contains many weedy opportunist species which readily adapt to new habitats.

Five of the taxa, *Albizia julibrissin*, *Robinia pseudoacacia*, *Acer negundo*, *Ailanthus altissima* and *Phylostachys bambusoides*, have also been used as fuel wood or timber in the region. In addition, *Robinia pseudoacacia* has been planted for protection against soil erosion and producing honey.

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