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Araştırma Makalesi

Diversity and Ecology of Myxomycetes in Antakya-Hatay (Turkey)

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Abstract

This taxonomic study has been made on the specimens which were obtained from different region of Antakya (Hatay) and near environment in 2010 and 2011. The specimens on natural substrata, barks and debris material, the bark of living trees, as well as decaying bark, wood, leaves and litter were collected. In this study forty four species belonging to *Protosteliomycetes* and *Myxomycetes* were identified both in field and moist chamber culture. This is the first study in Antakya and all of the species are recorded for the first time in Antakya-Hatay

Key Words: Myxomycetes diversity, Ecology, Antakya-Hatay, Turkey.

Antakya-Hatay (Türkiye) Miksomisetlerinin Çeşitliliği ve Ekolojisi

Özet

Bu taksonomik çalışma Antakya (Hatay) merkez ve yakın çevresinden 2010 ve 2011 yılları arasında toplanan örnekler üzerinde yapılmıştır. Doğal ortamdan bitkisel substratlar, kabuk, döküntü materyaller, yaprak odun ve canlı bitkisel substratlar toplandı. Doğal ortamda ve nem odası tekniği ile *Protosteliomycetes* ve *Myxomycetes* sınıfında 44 tür elde edildi. Bu çalışma Antakya'da ilk defa yapılmıştır ve toplanan tüm türler Antakya'da ilk defa kaydedilmiştir.

Anahtar kelimeler: Miksomiset çeşitliliği, Ekolojisi, Antakya-Hatay, Türkiye

Introduction

Myxomycetes are characterized by an amorphous, multinucleate, protoplasmic mass called plasmodium and fruiting bodies. Myxomycetes are widespread and relatively diversed in their distribution throughout the world. *Myxomycetes* were previously classified in the Kingdom *Plantae* and later in the Kingdom *Animalia*. Because of being typically found with fungi in the same habitats, they were treated as taxa within the Kingdom *Fungi*. Unlike fungi, *myxomycetes* do not excrete extracellular digestive enzymes and the role of *myxomycetes* in the environment is not as decomposers or pathogens (Keller and Braun, 1999).

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A detailed analysis of DNA sequence data has recently shown beyond any doubt that these inhabitants of soil and other habitats containing moist, decomposing organic matter comprise a sister taxon to the *Amoebozoa* and hence are members of the Kingdom *Protoctista* (Hoppe et al., 2010).

Many myxomycete species produce colorful fruiting bodies that are seen with the naked eye in natural or man-made habitats such as decaying wood, leaf litter, garden or bark mulching, lawns, and the bark of living trees and vines. *Myxomycetes* mostly sporulate at certain periods in the year, and certain myxomycete species tend to be associated with certain substrates. Majority of the described species are of cosmopolitan distribution, although a few species appear to be confined in the tropics or subtropics while some have been collected only in the temperate regions of the world (Ko et al., 2011).

Antakya (Hatay) is situated at Mediterranean phytogeographical region in Turkey, climatic conditions and vegetation are suitable for the growth of *Myxomycetes*. Antakya is located in a valley surrounded by mountains, the Nur Mountains in the North, Mount Keldağ in the South and with the 440 m height the Mount Habib-i Neccar forming its eastern (Figure 1).

Despite the formation of the natural vegetation forests, forests have been destroyed in many areas today has taken place different types of shrubs. In protected areas and away from destruction there is *Pinus brutia* (Red pine), *Pinus nigra* (Larch), *Abies cilicica* (fir), *Quercus* spp. (oak) and *Juniperus* spp. (juniper) and *Daphne* forests.

According to meteorological data from the directorate of Hatay, the highest average monthly temperature is in August and 27.6°C, the lowest average monthly temperature is in December 7.7°C. The average monthly maximum rainfall of Antakya is in December and 192.4 mm, the lowest average monthly rainfall is in August 3.5 mm (Anonymous, 2007).

•Approximately 923 species of *Myxomycetes* are known worldwide (Edison et al., 2009) and 226 species of *Myxomycetes* have been reported from Turkey (Kaşık, 2010). The *Myxomycetes* flora of Turkey has not been fully explored and there have been no previous studies involving Antakya-Hatay.

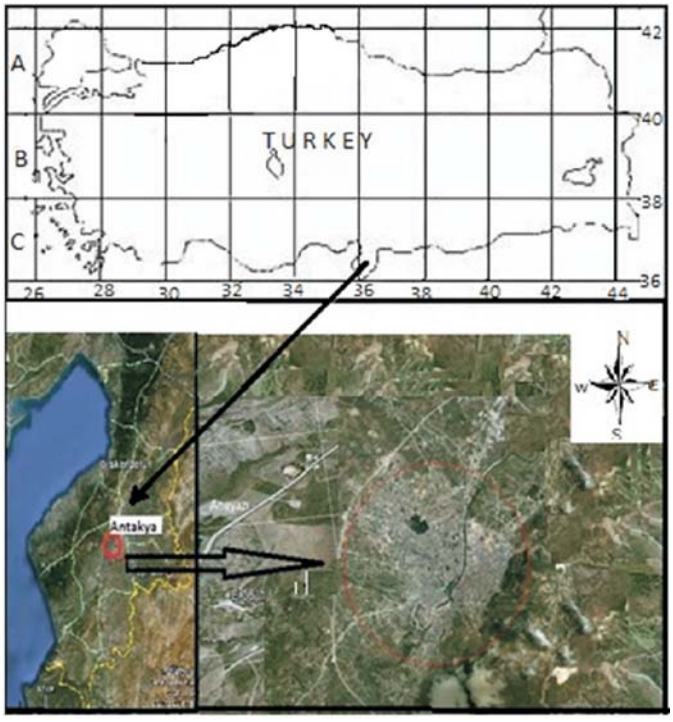

Figure 1. Map of study area

Materials and Methods

The specimens on natural substrata, barks and debris material, the bark of living trees, as well as decaying bark, wood, leaves and litter were collected from different 20 stations (Table 1). Natural mature fructifications were gently and directly collected from the substratum and placed in cardboard herbarium boxes. In addition, the fructifications of myxomycetes were as obtained from the moist chamber culture in the laboratory. The cultures were moistened with distilled water. The moist chambers were examined every day under a dissecting microscope. When developing myxomycetes were found, the moist chamber was allowed to dry slowly and the myxomycetes were then dried for one week. The same chambers were then rewetted for another 4 week period and examined as before.

Microscopic and macroscopic features of the samples were determined in the laboratory. The morphological characters examined included fruiting bodies shape, size and colour, spore size and ornamentation, capillitium colour and branching, lime crystalsize and morphology, stalk colour and proportion**.** The Myxomycetes specimen was identified according to the relevant references (Martin and Alexopoulos, 1969; Neubert et al., 1993, 1995 and 2000; Sesli and Denchev, 2010). The samples were prepared as fungarium material and stored.

Table 1. Coordinates, altitude and dates of stations

	Stations name	Coordinates		Altitude	Date
a.	Akevler	36' 21" 46N,	36' 15" 30E	90 m	18.10.2010-17.3.2011
b.	Anayazı	36' 31" 57N,	36' 18" 87E	120 m	09.03.2010
c.	Armutlu	36' 19" 33N,	36' 15" 08E	58 m	09.03.2010
d.	Atatürk high sch.	36' 20" 78N,	36' 15" 46E	70 m	14.11.2010-21.3.2011
e.	Batıayaz	36' 15" 99N,	36' 04" 20E	127 m	02.11.2010
f.	Esentepe	36' 20" 84N,	36' 14" 04E	88 m	10.11.2010
g.	Harbiye	36' 13" 88N,	36' 14" 34E	227m	11.12.2010-17.3.2011
h.	Kavaslı	36' 22" 08N,	36' 16" 18E	70 m	21.03.2011
i.	Köy Garajları	36' 20" 63N,	36' 16" 48E	70 m	21.11.2010
j.	Küçükdalyan	36' 22" 33N,	36' 17" 63E	70 m	21.11.2010
k.	Meteoroloji	36' 21" 00N,	36' 14" 66E	70 m	10.11.2010
l.	Mezarlık	36' 21" 50N,	36' 14" 70E	82 m	11.12.2010-03.04.2011
m.	Otogar	36' 23" 14N,	36' 13" 63E	182 m	02.03.2010
n.	Serinyol	36' 36" 20N,	36' 21" 22E	119 m	02.04.2011-12.02.2011
o.	SHMYO	36' 19" 46N,	36' 16" 54E	112 m	10.10.2010-17.03.2011
p.	Sümerler	36' 18" 72N,	36' 15" 02E	55 m	14.01.2010- 11.04.2011
q.	Stadyum	36' 21" 15N,	36' 15" 82E	70 m	19.09.2011
r.	Uzunalıç willage	36' 40" 29N,	36' 21" 16E	412 m	22.12.2010
s.	Vali Parkı	36' 20" 85N,	36' 15" 91E	70 m	17.03.2011
t.	Yeşilpınar willage	36' 14" 68N,	36' 12" 21E	122 m	22.12.2010-17.3.2011

Results

In this study forty four species belonging to six ordo, eleven family and eighteen genus were identified both in field and moist chamber technique. Eleven myxomycetes were collected in field, twenty-five myxomycetes were developed in moist chamber culture and eight myxomycetes appeared in both natural habitat and moist chamber culture in laboratory. Taxonomic categories of identified species is below;

Regnum: *Protista*
Divisio: *Myxomycota*
Classis: *Protosteliomycetes*
1.Subclassis: *Ceratiomyxomycetidae*
Ordo: *Ceratiomyxales*
i. Familia: *Ceratiomyxaceae*
Genus: *Ceratiomyxa*

Classis: *Myxomycetes*
2.Subclassis: *Myxogasteromycetidae*
Ordo: *Echinosteliales*
i. Familia: *Echinosteliaceae*
Genus: *Echinostelium*
Ordo: *Liceales*
i. Familia: *Cribrariaceae*
Genus: *Cribraria*
ii. Familia: *Dictydiaethaliceae*
Genus: *Dictydiaethalium*
iii. Familia: *Enteridiaceae*
Genus: *Lycogala*
iv. Familia: *Liceaceae*
Genus: *Licea*
Ordo: *Trichiales*
i. Familia: *Arcyriaceae*
Genus: *Arcyria, Perichaena*
ii. Familia: *Trichiaceae*
Genus: *Trichia*
Ordo: *Physarales*
i. Familia: *Didymiaceae*
Genus: *Didymium*
ii. Familia: *Physaraceae*
Genus: *Badhamia, Physarum*

3.Subclassis: *Stemonitomycetidae*
Ordo: *Stemonitales*
i. Familia: *Stemonitidaceae*
Genus: Collaria, Comatricha, Lamproderma, Macbrideola, Stemonitis, Stemonitopsis

List of identified species in the research area, their sample number, substrates habitat and localities is below at Table 2.

Table 2. *Myxomycetes* sample number, substrates, habitat and localities

	Species	SN	Substrates	Habitat	Localities
1	*Ceratiomyxa fruticulosa,* (O.F. Müll.) T.Macbr.	1	1	N, MCT	d
2	*Echinostelium minutum* de Bary.	3	2	MCT	b, h, q
3	*Cribraria cancellata* (Batsch) Nann.- Brem. var. *fusca* (A.Lister) Nann.- Brem.	2	7	N	d, p
4	*Cribraria violaceae* Rex.	4	1, 5, 7	MCT	h, i, r, q
5	*Cribraria vulgaris* Schrad.	1	8	N	l
6	*Dictydiaethalium plumbeum* (Schumach.) Rostaf.	4	1, 2	N	a, k, j , r
7	*Licea biforis* Morgan	2	1	MCT	c, k
8	*Licea castanea* G.Lister	2	1	N	c, k
9	*Licea kleistobolus* G.W.Martin	4	1	MCT	b, c, g, i
10	*Licea minima* Fr.	1	1	MCT	b
11	*Licea pedicellata* (H.C.Gilbert) H.C.Gilbert	1	1	MCT	c
12	*Licea tenera* E. Jahn	1	7	MCT	q
13	*Lycogala epidendrum* (L.) Fr.	1	8	N	g
14	*Didymium bahiense* Gottsb	1	1	MCT	g
15	*Didymium difforme* (Pers.) S.F.Gray	2	1	MCT	g, s
16	*Didymium melanospermum* (Pers.) T. Macbr	1	1	MCT	a
17	*Didymium squamulosum* (Alb.& Schw.) Fr.	3	9, 11	N	k, p, q
18	*Badhamia macrocarpa* (Ces.) Rostaf.	1	2	MCT	t
19	*Badhamia utricularis* (Bulliard) Berkeley	1	7	MCT	g
20	*Physarum auriscalpium* Cooke	1	5	N	c
21	*Physarum cinereum* (Batsch) Pers	2	1	MCT	b, t
22	*Physarum compressum* Alb.& Schw	1	1	MCT	g
23	*Physarum ovisporum* G.Lister	1	1	MCT	t
24	*Physarum notabile* Macbr.	2	1	N, MCT	g, l
25	*Collaria lurida,* A. Lister	1	3	MCT	o
26	*Comatricha ellae* Hark.	5	1, 2, 3, 5	N, MCT	d, f, l, o, q

Abbreviations: SN: sample number,
Substrates: Dead wood:1, Dead bark:2, Fallen twigs:3, Fallen bark:4, Dead log: 5,
Living substrat:6, Dead trunk:7, Dead debris:8, Fallen leaves:9, Fallen branch:10, Dead twigs: 11.
Habitat: MCT: Moist Chamber Technique, N: Natural Localities: at Table 1

List of identified *Myxomycetes* family, number and percentage is showed below in Figure 2.

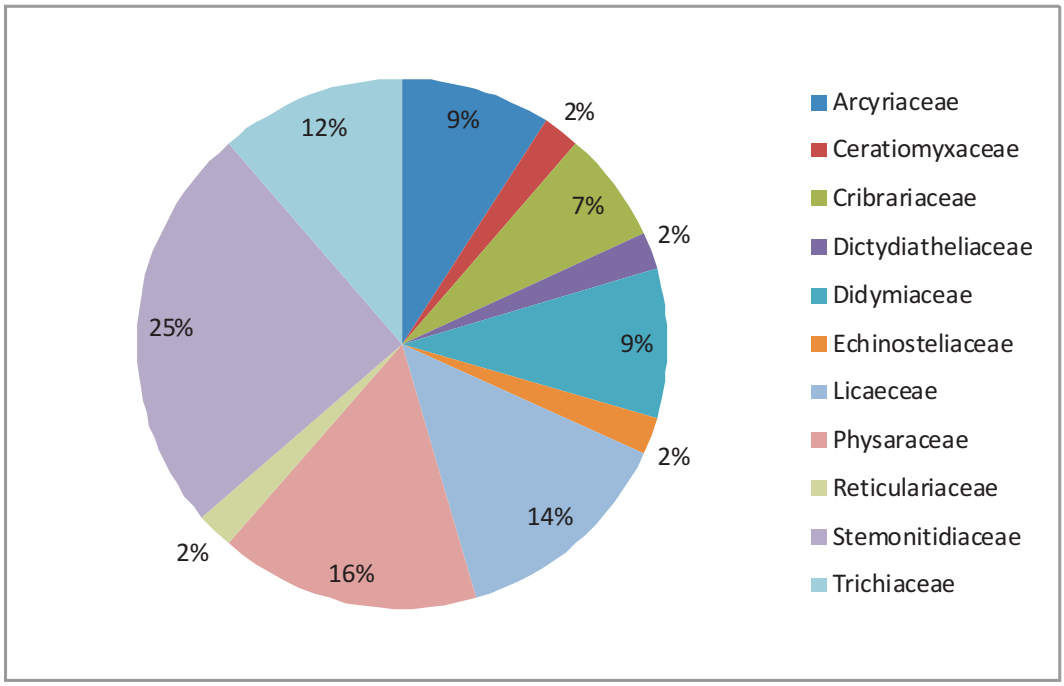

Figure 2. *Myxomycetes* identified families and percentage.

Discussion

Ceratiomyxa fruticulosa, Echinostelium minutum, Arcyria cinerea, Didymium difforme, Didymium squamulosum, Cribraria violaceae, Licea kleistobolus are the most common species in our investigation, but some species are only from certain substrates and there are a small number (*Trichia lutescens, Physarum compressum, Physarum ovisporum, Physarum auriscalpium, Didymium melanospermum, Arcyria minuta, Lamproderma arcyrioides,* and *Licea tenera*).

Most *Myxomycota* species are cosmopolitan; humidity and temperature are main factors in diversity and abundance of this group. Eliasson (1981) claimed that due to develop sporocarp in every special circumstances many species of *Myxomycota* may occur at certain times of the year. The best months for finding Plasmodial slime molds in Antakya are October and November in Autumn. Because there is rain, relative humidity is apparently optimum and the temperature is mild. The primary characteristics of this months in Antakya are the alternation of rainy and sunny periods and these seem to provide favourable conditions of adequate levels of moisture and suitable temperatures to allow Plasmodial slime molds to complete their life cycle.

Myxomycetes are commonly occur in association with decaying plant material in terrestrial ecosystems. According to Stephenson and Stempen (2000) suitable substrates for *Myxomycetes* are; bark of living trees, plant litter, aerial plant litter, standing dead wood or stumps, dead but still attached herbaceous plant parts such as old inflorescences, downed and decayed wood or bark. *Myxomycetes* are well-known inhabitants of decaying plant material such as wood and litter. In our study; species are collected in forest on decomposed or dead wood (50 species), bark (13 species), debris (5 species), trunks (3 species), twigs (4 species), logs (5 species), fallen leaves (2 species) and living *Salix* sp. (1 species).

According to Ing (1994) *Myxomycota* separated in seven main phytosociological groups; Forests, plains and meadows, aquatic, desert, by the sea, herbivore manure and areas of human influenced areas. Decomposing material provides more suitable microhabitat for *Myxomycetes* due to the presence of more available food microorganisms, bacteria, yeasts, fungal spores (Stephenson and Stempen, 2000). Some *Badhamia* species create sporocarp very often on bark of deciduous trees but some *Cribraria species* partly on coniferous wood, most *Didymium* species are often on dead leaves. Very few species can only be seen particularly on animal dung (Eliasson and Lindguist, 1979). In our study *Didymium* species are collected on dead wood, *Badhamia* species are on dead trunk, dead log and dead wood, *Cribraria species* are collected on dead trunk, dead debris and dead wood.

Altitude is an important factor in different families of *Myxomycota*. According to Rojas and Stephenson (2008) with increasing altitude, the type and number of *Myxomycota* decreases extremely. The rise of altitude is decrease in pH values of substrate. *Didymiaceae* and *Liceaceae* are more common at low altitudes and the increase of altitude distribution of these families are decreases. *Arcyriaceae* is more common at medium altitudes *Stemonitidiaceae* is adapted to all altitudes except the seaside. Despite the presence of all altitudes, *Physaraceae* is more common at higher altitudes. In Antakya altitude is about 80 m. and its environment the most is 400 m. In our study *Stemonitidiaceae* have 14 species and has got the most species; the other families are *Physaraceae* (7 species), *Liceaceae* (6 species), *Trichiaceae* (5 species) and *Didymiaceae* (4 species). Most of the examples are spread between 80-120 meters. These results are similar to the other researches.

Warm-wet conditions were characterized by a more diverse myxomycete assemblage than cool-dry conditions (Koo et al., 2011). Antakya is situated at Mediterranean phyto-geographical region, with hot and dry summers and mild and wet winters. Since warm-wet season is over than cool-dry season in our study area and climatic conditions and vegetation are suitable for *Myxomycetes* in our study area Myxomycete flora was very rich and diverse. Naturally growing *Myxomycetes* fructifications are more common in the samples collected in rainy seasons of Autumn. As previously reported in many studies the frequency of *myxomycetes* from natural habitats is affected by climatic conditions, rainfall and temperature.

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References

Anonymous. *Hatay iline ait sıcaklık ve yağış değerleri*, Ankara (2007).

Edison T., Cruz E.D., Kuhn R.V., Javier A.O.M.J., Parra C.M., Quımıo T.H., *Status of the Myxomycete collection at the UPLB-Museum of natural History (UPLB-MNH). Mycological Herbarium.* Philippine Journal of Systematic Biology (2009).

Eliasson U.H. and Lundqvist N., *Fimicolous myxomycetes*. Bot Not 132:551–568 (1979).

Eliasson U.H., *Patterns of occurrence of myxomycetes in a spruce forest in south Sweden*. Holarctic Ecology 4: 20–31, (1981).

Hoppe T., Müller H., Kutschera U., *A new species of Physarum (Myxomycetes) from a boreal pine forest in Thuringia (Germany)*. Mycotaxon *114, 7-14 (*2010).

Ing B., *The phytosociology of Myxomycetes. New Phytol.* 126: 175-201 (1994).

Kaşık G., *Mantar Bilimi (1. baskı)* Marifet matbaa ve Yay. 432 sayfa Konya (2010).

Keller H.W. and Braun K.L., *Myxomycetes of Ohio: Their Systematics, Biology, and Use in Teaching*. Ohio Biological Survey Bulletin New Series, Ohio Biological Survey. 13, 2 (1999).

Koo K.T.W., Stephenson S.L., Hyde K.D. and Lumyong S.. *Influence of Seasonality on the Occurrence of Myxomycetes*, Chiang Mai J. Sci. 38(1) : 71-84 (2011).

Martin G.W., Alexopoulos C.J., *The Myxomycetes*. University of Iowa pres, Iowa City, pp. 560 (1969).