Chiang Mai J. Sci. 2016; 43(1) : 54-67
http://epg.science.cmu.ac.th/ejournal/
Contributed Paper

An Investigation on North Adana (Turkey) Myxomycetes

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Received: 29 April 2014
Accepted: 1 June 2015

ABSTRACT

The myxobiota of northern Adana provinces was investigated on various occasions in the period from 2010 to 2013. As a result of field and laboratory studies we identified 54 species belonging to six ordo, ten familia and twenty genera. Three species (*Hemitrichia montana* (Morgan) T. Macbr., *Physarum psittacinum* Ditmar, and *Symphytocarpus herbaticus* Ing) were recorded for the first time from Turkey. 45 species were collected in field, 4 species were developed in moist chamber culture and 5 species appeared in both natural habitat and moist chamber culture in the laboratory. Morphological, chorological and ecological characteristics of identified species were revealed and discussed in comparison with the support of relevant literature. Fruiting bodies and microscopic structures photographs belonging to new record samples were taken with light microscopy and scanning electron microscope (SEM).

Keywords: Diversity, plasmodial slime moulds, taxonomy, new records, north Adana, Turkey

1. INTRODUCTION

Myxomycetes are characterised by an amorphous, multinucleate, protoplasmic mass called the plasmodium as well as fruiting bodies. Myxomycetes; also known as myxogastrids or plasmodial slime molds comprise a monophyletic group. Physiology, morphology, life history, and genetic analysis support the classification of myxomycetes as Protoctista along with other eukaryotic microorganisms [1]. In the vegetative stage, these organisms survive as complex macroscopic multinucleate, single-celled structures known as plasmodia that feed upon microorganisms and are able to move short distances across or within particular substrata [2]. During the reproductive stage, myxomycetes produce meiotic spores in small fruit bodies, that superficially resemble those of certain macroscopic fungi and occur primarily on dead plant materials [3].

Plasmodial slime molds are usually present and abundant in terrestrial forest ecosystems. They are generally found decaying or living on plant materials. The majority of the species described are spread globally. However a few species appear to be confined to the tropics or subtropics while some are only known in the temperate zone of the world [4].

Now myxomycota contains 63 genera and 958 species [5]. There have been several studies on myxomycetes in various parts of the world [6-13] So far, 236 species of myxomycetes have been reported in Turkey [8,14-16]. The myxobiota of Turkey has not been fully explored and there isn't any Myxomycetes research in our study area. For this reason there is a great need for an increase in the frequency of taxonomical and myxobiota studies. By the increase in the number of similar studies it will be possible to fill in the gap and it may cause an increase in new Myxomycetes taxa in Turkey.

2. MATERIALS AND METHODS

2.1 Description of The Research Area

Adana is located in the south of Turkey, between 35-38 N latitude and 34-46 E longitude, located in the Eastern section of Mediterranean region (Figure 1). The region is divided into two morphological parts; mountainous and bottomland. The studied area is surrounded by Adana's northwest, north and northeast sections and by the central Toros mountains. The eastern border reaches to the Amonos mountains. Adana carries the characteristics of the Mediterranean climate. The summers are hot and dry, and the winters are warm and rainy. Two types of climate can be observed in Adana. The first type is Mediterranean climate at the shore and in the plains and the second type is continental climate in high places. Due to the Northern parts of the research area being surrounded by high mountains the region is protected from northern winds, which leads to the summer months being very hot. With increasing elevation, towards the North the climate become cooler and precipitation increases. The avarege precipitation is 625 mm^3. 51% of the precipitation falls in winter, 26% in spring, 18% in autumn and 5% in summer. The average relative humidity is 66% but in summers it increases to 90%. The average annual temperature is 18.7 °C (Figure 2). Due to the hot and dry summer season in the region natural vegetation show a wise character. The mountains in the Northeast are almost naked while the southern region is covered with forest. Vegetation in the region can be divided into two zones the main Mediterranean zone and the Mediterranean mountain zone [17].

Figure 1. Map of study area.

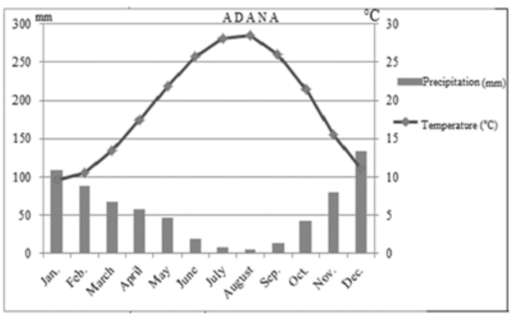

Figure 2. Average annual precipitation and temperature.

2.2 Collection, Moist Chamber Culture and Identification

Samples were collected at 13 stations from different types of habitats in Northern Adana (Table 1). The specimens were collected natural substrata, bark and debris, the bark of living trees, as well as on decaying fruits, bark, wood, leaves, litter and animal dung. Natural mature fructifications were gently collected from the substratum and placed in cardboard fungarium boxes. In addition, the fructifications of myxomycetes were obtained from the moist chamber culture in the laboratory. All moist chamber cultures were prepared within a week after returning from the field survey. Substratum samples were placed in Petri dishes lined with filter paper. Distilled water was added to each Petri dish and the samples allowed to soak overnight. After 24 hours, excess water was poured off. Cultures were maintained under diffuse light at room temperature (22-25°C) for a period of approximately three month. All cultures were checked each week for the presence of myxomycete plasmodia or fruiting bodies.

Table 1. Dates altitude and coordinates of stations.

No	Stations name	Date	Altitude (m)	Coordinates
1	Akkaya	25.05.2013	749	37° 45' 01" N; 35° 53' 12" E
2	Avcipinari	24.05.2013	1588	38° 04' 18" N; 36° 11' 15" E
3	COöbük	23.05.2013	1648	38° 02' 40" N; 36° 09' 36" E
4	Çulluuşaği plateau	26.05.2013	705	37° 40' 58" N; 35° 52' 16" E
5	Ese stream	21.11.2010	1621	38° 01' 40" N; 36° 07' 35" E
6	Himmetli	04.12.2010	818	37° 52' 46" N; 36° 04' 15" E
7	Horzum plateau	25.05.2013	742	37° 37' 47" N; 35° 50' 41" E
8	İmamoğlu	14.06.2011	76	37° 15' 32" N; 35° 40' 01" E
9	Kozan	15.06.2011	257	37° 30' 50" N; 35° 50' 28" E
10	Obruk	26.05.2013	1199	38° 01' 44" N; 36° 05' 48" E
11	Saimbeyli	25.05.2013	1139	37° 58' 57" N; 36° 05' 42" E
12	Saksanboğazi	24.05.2013	1596	38° 03' 43" N; 36° 06' 46" E
13	Tufanbeyli	16.06.2011	1367	38° 14' 43" N; 36° 12' 55" E

Microscopic and macroscopic features of the samples were determined in the laboratory. Fruiting bodies were identified to species using light microscopy and consideration of such morphological characters as fruiting bodies; shape, size and colour, peridium; colour, presence and calyculus situation, spore; size, colour and ornamentation, capillitium and columella; colour and branching, lime crystal size and morphology, stalk; length, colour and proportion to fruiting bodies, hypothallus; presence or absence, colour, shape, width.

The Myxomycetes specimen was identified and samples were prepared as fungarium material and stored in the laboratory of the Department of Biology at the Faculty of Arts and Science at Mustafa Kemal University Hatay.

The relative abundance of fruit bodies of a particular species was determined by placing it in categories following a modification of the method proposed by Stephenson et al. (1993). For this, species represented by more than 3.0 % of the total number of collections were considered as abundant (A), those falling between 1.5 % and 3.0 % as common (C), between 1.5 % and 0.5 % as occasional (O), and those less than 0.5 % as rare (R) [9]. The mean number of species per genus (S/G) was calculated from the data sets for the study area.

3. Results

In this study 54 species belonging to three subclasses, six orders, ten families and twenty genera were identified using both field and moist chamber technique (Table 2). 45 species of myxomycetes were collected in the field, 4 species were developed in moist chamber culture and 5 species appeared in both natural habitat and moist chamber culture in the laboratory (Figure 3).

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

No	Species	S.N.	Sub	Habitat	Localities
	CERATIOMYXACEAE				
1	*Ceratiomyxa fruticulosa* (O.F. Müll.) T. Macbr.	14	a	N,MCT	1,2,4,5,6,7,10,12
	ECHINOSTELIACEAE				
2	*Echinostelium minutum* de Bary	1	a	MCT	11
	CRIBRARIACEAE				
3	*Cribraria argillacea* (Pers. ex J.F. Gmel.) Pers.	15	a,b	N	2,3,5,7,10
4	*Cribraria cancellata* (Batsch) Nann.-Bremek.	31	a,b	N	1,2,3,4,5,6,7
5	*Cribraria costata* Dhillon & Nann.-Bremek.	3	a	N	1,4
6	*Cribraria intricata* Schrad.	1	a	N	7
7	*Cribraria microcarpa* (Schrad.) Pers.	2	a	N	4
8	*Cribraria persoonii* Nann.-Bremek.	5	a	N	4,7
9	*Cribraria piriformis* Schrad.	1	a	N	3
10	*Cribraria violaceae* Rex	1	a	N	4
11	*Cribraria vulgaris* Schrad.	15	a	N	1,2,3,4,5,7
	LICEACEAE				
12	*Licea biforis* Morgan	2	e	N	13
13	*Licea castanea* G. Lister	6	a	N,MCT	2,4
14	*Licea kleistobolus* G.W. Martin	1	a	MCT	7
15	*Licea minima* Fr.	1	c	MCT	13
	ENTERIDIACEAE				
16	*Lycogala epidendrum* (L.) Fr.	14	a,b	N	1,2,3,4,5,7
17	*Tubifera ferruginosa* (Batsch) J.F. Gmel.	10	a,b	N	1,4,7
	DIDYMIACEAE				
18	*Didymium difforme*(Pers.) Gray	2	g,h	N,MCT	8,9
19	*Didymium melanospermum* (Pers.) T. Macbr.	2	a,d	N	2,4
20	*Didymium squamulosum* (Alb. & Schwein.) Fr.	3	a,b	N	8,9,13
	PHYSARACEAE				
21	*Badhamia capsulifera* (Bull.) Berk.	2	a	N	11
22	*Badhamia utricularis* (Bull.) Berk.	1	a	N	11
23	*Physarum album* (Bull.) Chevall.	3	a	N	3,4
24	*Physarum leucopheum* Fr.	1	a	N	2
25	**Physarum psittacinum* Ditmar	2	a,b	N	4
26	*Physarum viride* (Bull.) Pers.	2	a	N	2
	STEMONITIDACEAE				
27	*Comatricha ellae* Härk.	3	a	N	1,5,12

Table 2. Continued.

No	*Species*	SN.	Sub	Habitat	Localities
28	*Comatricha laxa* Rostaf.	1	a	N	1
29	*Comatricha nigra* (Pers. ex J.F. Gmel.) J. Schröt.	9	a	N	1,2,5,11
30	*Comatricha pulchella* (C. Bab.) Rostaf.	8	a	N,MCT	1,2,4,5
31	*Enerthenema papillatum* (Pers.) Rostaf.	10	a,b	N,MCT	3,4,5,6,11
32	*Macbrideola cornea* (G. Lister & Cran) Alexop.	2	a	MCT	11
33	*Lamproderma arcyrioides* (Sommerf.) Rostaf.	1	a	N	4
34	*Stemonitis axifera* (Bull.) T. Macbr.	5	a	N	4,7
35	*Stemonitis flavogenita* E. Jahn	2	a	N	1,10
36	*Stemonitis fusca* Roth	6	a,f	N	2,3,4,5,7
37	*Stemonitis herbatica* Peck	1	a	N	3
38	*Stemonitis pallida* Wingate	3	a	N	1,2,3
39	*Stemonitopsis amoena* (Nann.-Bremek.) Nann.-Bremek.	5	a	N	2,3,5,7
40	*Stemonitopsis subcaespitosa* (Peck) Nann.-Bremek.	1	a	N	7
41	**Symphytocarpus herbaticus* Ing	1	a	N	3
	ARCYRIACEAE				
42	*Arcyria cinerea* (Bull.) Pers.	8	a	N	1,2,5,6,7,11
43	*Arcyria denudate* (L.) Wettst.	1	a	N	3
44	*Arcyria incarnata* (Pers. ex J.F. Gmel.) Pers.	4	a	N	1,2,3,7
45	*Arcyria insignis* Kalchbr. & Cooke	6	a	N	3,5
46	*Arcyria minuta* Buchet	5	a	N	2,11
47	*Arcyria obvelata* (Oeder) Onsberg	8	a,b	N	2,4,5,6,7,10
48	*Arcyria pomiformis* (Leers) Rostaf.	10	a	N	1,2,4,6,7,10,11,12
49	*Perichaena corticalis* (Batsch) Rostaf.	2	c,d	N	8,13
	TRICHIACEAE				
50	********Hemitrichia montana* (Morgan)TMacbr	4	a	N	1
51	*Trichia botrytis* (J.F. Gmel.) Pers.	2	a	N	4,5
52	*Trichia contorta* (Ditmar) Rostaf.	1	b	N	12
53	*Trichia decipiens* (Pers.) T. Macbr.	4	a	N	3,5
54	*Trichia favoginea* (Batsch) Pers.	13	a,f	N	2,3,5

Note: * New record in Turkey.
S.N: sample number.
Sub: Substrates- **a**: Dead wood, **b**: Dead bark, **c**: Dead debris, **d**: Fallen bark, **e**: Dead log, **f**: Living substrat, **g**: Petri dishes, **h**: Filter paper
Habitat: **MCT**: MoistChamber Technique, **N**: Natural
Localities: at Table 1

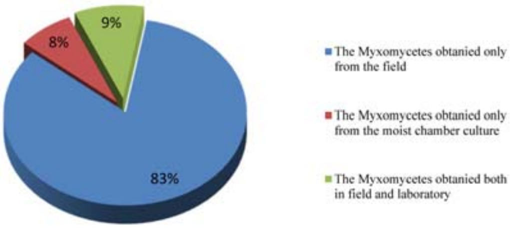

Figure 3. Myxomycetes obtaining ways.

In this study 14 (1 species) samples are members of the ordo Ceratiomyxales (5%), 1 (1 species) are members of Echinosteliales (0.3%), 107 (15 species) are Liceales (40%), 68 (13 species) Trichales (26%), 18 (9 species) Physarales (6.7%), and 58 (15 species) Stemonitales (22%). Among the five ordo of myxomycetes (excluding Ceratiomyxales), the Liceales and Stemonitales are the most specious, whereas the Echinosteliales are poorest in species.

The most common families are Stemonitidaceae, Cribrariaceae, Arcyriaceae and Physaraceae. 15 species are in Stemonitidaceae, Cribrariaceae is 9, Arcyriaceae is 8, Physaraceae is 6, Trichiaceae is 5, Liceaceae is 4, Didymiaceae is 3, Enteridiaceae is 2, Ceratiomyxaceae and Echinosteliaceae is 1 species. The most common genera are *Cribraria* 9, *Arcyria* 7, *Stemonitis* 5, *Physarum, Comatricha*, *Licea*, and *Trichia* 4 (each of genera), *Didymium* 3 species. *Arcyria pomiformis, Ceratiomyxa fruticulosa, Cribraria argillaceae, C. cancellata, C. vulgaris, Enerthenema papillatum, Lycogala epidendrum* and *Trichia favoginea* are the most common species in our investigation.

In our study 13 species are abundant (A), 10 species are common (C), 16 species are occasional (O), 14 species are rare (R) (Table 3). The mean number of species per genus (S/G) was calculated from the data sets for the study area and our research area species/ genus ratio (S/G) is 2.7.

Table 3. Occurrence of myxomycetes in study area.

Ceratiomyxa fruticulosa (O.F. Müll.) T. Macbr.	A	*Comatricha laxa* Rostaf.	R
Echinostelium minutum de Bary	R	*Comatricha nigra* (Pers. ex J.F. Gmel.) J. SchrÖt.	A
Cribraria argillacea (Pers. ex J.F. Gmel.) Pers.	A	*Comatricha pulchella* (C. Bab.) Rostaf.	A
Cribraria cancellata (Batsch) Nann.-Bremek.	A	*Enerthenema papillatum* (Pers.) Rostaf.	A
Cribraria costata Dhillon & Nann.-Bremek.	O	*Macbrideola cornea* (G. Lister & Cran) Alexop.	O
Cribraria intricata Schrad.	R	*Lamproderma arcyrioides* (Sommerf.) Rostaf.	R
Cribraria microcarpa (Schrad.) Pers.	O	*Stemonitis axifera* (Bull.) T. Macbr.	C
Cribraria persoonii Nann.-Bremek.	C	*Stemonitis flavogenita* E. Jahn	O
Cribraria piriformis Schrad.	R	*Stemonitis fusca* Roth	C
Cribraria violaceae Rex	R	*Stemonitis herbatica* Peck	R
Cribraria vulgaris Schrad.	A	*Stemonitis pallida* Wingate	O
Licea biforis Morgan	O	*Stemonitopsis amoena* (Nann.-Bremek.) Nann.-Bremek.	C

Table 3. Continued.

Licea castanea G. Lister	C	*Stemonitopsis subcaespitosa* (Peck)	R
Licea kleistobolus G.W. Martin	R	Nann.-Bremek	
		**Symphytocarpus herbaticus* Ing	R
Licea minima Fr.	R	*Arcyria cinerea* (Bull.) Pers.	A
Lycogala epidendrum (L.) Fr.	A	*Arcyria denudate* (L.) Wettst.	R
Tubifera ferruginosa (Batsch) J.F. Gmel.	A	*Arcyria incarnata* (Pers. ex J.F. Gmel.)	
Didymium difforme(Pers.) Gray	O	Pers.C	
		Arcyria insignis Kalchbr. & Cooke	C
Didymium melanospermum (Pers.)	O		
T. Macbr.		*Arcyria minuta* Buchet	C
Didymium squamulosum	O		
(Alb. & Schwein.) Fr.		*Arcyria obvelata* (Oeder) Onsberg	A
Badhamia capsulifera (Bull.) Berk.	O	*Arcyria pomiformis* (Leers) Rostaf.	A
Badhamia utricularis (Bull.) Berk.	R	*Perichaena corticalis* (Batsch) Rostaf.	O
Physarum album (Bull.) Chevall.	O	**Hemitrichia montana* (Morgan)	C
Physarum leucopheum Fr.	R	TMacbr	
		Trichia botrytis (J.F. Gmel.) Pers.	O
**Physarum psittacinum* Ditmar	O	*Trichia contorta* (Ditmar) Rostaf.	R
Physarum viride (Bull.) Pers.	O	*Trichia decipiens* (Pers.) T. Macbr	C
Comatricha ellae Härk.	O	*Trichia favoginea* (Batsch) Pers.	A

A: abundant, C: common, 0: occasional and R: rare

4. Discussion

4.1 Distribution and Biogeographical Relationships of Myxomycetes

The most common four families are (Stemonitidaceae, Cribrariaceae, Arcyriaceae and Physaraceae), with 38 species and representing 70% of all identified species. This percentage similar to study of Baba (2012) 72.4% [16].

Arcyria pomiformis, Ceratiomyxa fruticulosa, Cribraria argillaceae, C. cancellata, C. vulgaris, Enerthenema papillatum, Lycogala epidendrum and *Trichia favoginea* are the most common species in our investigation. Most Myxomycota species are spread globally and in most studies these species were observed to be most widely spread in many different substrates [4, 6, 8, 15, 18-19]. Fourteen species were recorded as rare in our research area. These species are known in Turkey and before collected, *Arcyria denudata* (7 times), *Badhamia utricularis* (4 times), *Comatricha laxa* (8 times), *Cribraria piriformis* (3 times), *C. intricata* (5 times), *C. violaceae* (6 times), *E. minutum* (10 times), *Hemitrichia montana* (new record) *L. arcyrioides* (3 times), *Licea kleistobolus* (7 times), *L. minima* (6 times), *Physarum leucopheum* (5 times), *P. psittacinum* (new record), *Stemonitis herbatica* (7 times), *Stemonitopsis subcaespitosa* (2 times), *Symphytocarpus herbaticus* (new record) *Trichia contorta* (7 times) collected. In our study most samples collected natural in field. For that reason some small species didn't see in area.

Forty five species (83%) were collected only field. Macabago et al., (2010) also recorded higher percentage yield in aerial leaf litter compared to ground leaf litter [20]. Our results were similar with the studies of Novozhilov et al., (2000) where high productivity (35%) were recorded from leaf litter collected from different forest types in Puerto Rico [21].

The best months for finding Myxomycota in north Adana is autumn, winter and spring months. Because there is rain, relative humidity is apparently optimum and the temperature is mild. In general temperature and moisture appear to be the primary factors affecting the seasonal distribution of myxomycetes. Warm-wet conditions were characterized by a more diverse myxomycete assemblage than cool-dry conditions [22]. Due to the geograpical features, high mountains and the different climatic conditions, hot and dry summers and cold and rainy winters, the precipitation falls in the form of snow in winter, and autumn and spring are rainy, Northern Adana has a rich biodiversity. The primary characteristics of these months in our research area is 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.

As Simberloff (1970) and others have pointed out, a biota in which the species are divided among many genera is intuitively more diverse than one in which most species belong to only a few genera. Consequently, a low value for S/G implies a higher overall diversity than a high value [9]. In our research area species/genus ratio (S/G) is 2.7. This rate is calculated from Stephenson et al (1993) and the data set for southern India had 2.24 and North America 4.13. Alexopoulos (1970) reported that species diversity of myxomycetes is lower in tropical forests than in temperate forests. The S/G value calculated for southern India is rather comparable to the value (3.93) which can be derived from the data provided by Alexopoulos and Saenz (1975) on the myxomycetes of Costa Rica [9].

4.2 Substrate Relationships of Myxomycetes

Literature search has shown that the analyzed sample of myxomycetes consist mostly of G*ymnosperms* found on decayed wood, bark, leaves and debris materials [1, 2, 8, 15, 16]. According to Ing (1994) Myxomycetes separated in seven main phytosociological groups; Forests, plains and meadows, aquatic, desert, by the sea, herbivore manure and areas of human influenced areas [23]. Myxomycetes are well-known inhabitants of decaying plant material such as wood and litter. In our study species are obtained on decomposed or dead wood (49), dead bark (9), dead debris (2), fallen bark (2), dead logs (1), on living substrate (2), on petri dishes (1) and on filter paper (1) in laboratory.

Some species create sporocarp very often on bark of deciduous trees but some partly on coniferous wood, most species are often on dead leaves, very few species can only be seen other plants material [24]. Myxomycete species richness and diversity varied considerably on different substrats. The bark and woods were characterized by the highest diversity and species richness (60 species) in this study. On all of substrats examined in this present study, all having a high frequency of occurrence, were always recorded. For example, on the wood (49 records) the dominant species were *Ceratiomyxa fruticulosa, Cribraria argillaceae, C. cancellata, C. vulgaris, Lycogala epidendrum, Enerthenema papillatum, Arcyria pomiformis, Comatricha nigra, C. pulchella* and *Trichia favoginea.* On the bark (9 records) the dominant species were *Ceratiomyxa fruticulosa, Cribraria argillaceae, C. cancellata, Lycogala epidendrum, Enerthenema papillatum* and *Trichia favoginea.* In our study the percentage of Lignicolous Myxomycetes is 70% while

Corticolous Myxomycetes represent 11% (Figure 4). The rough, thick, and furrowed barks may presumably be better spore traps for myxomycetes, and thus, yield better results [25].

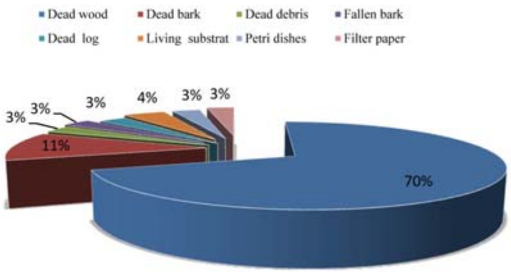

Figure 4. The distribution of myxomycetes according to their substrates.

Among the substrates dead debris, fallen bark, dead logs, and living substrates was characterized by the lowest diversity of myxobiota. *Licea minima* and *Perichaena corticalis* were found on dead debris, *Didymium melanospermum* was found on fallen bark, *Licea biforis* was found on dead log, *Trichia favoginea* and *Stemonitis fusca* was found on living *Pinus* sp., *Didymium difforme* was found on petri dishes and on filter paper.

Three species recorded for the first time from Turkey: *Hemitrichia montana* (Morgan) T. Macbr., *Physarum psittacinum* Ditmar and *Symphytocarpus herbaticus* Ing.

4.3 Description of New Record Species

4.3.1 *Hemitrichia montana* (Morgan) T. Macbr., N. Amer. Slime-moulds, ed. 1; 208 (1899).

Syn.: *Hemitrichia clavata* var. *montana* (Morgan) Meyl., Bull. Soc. Vaud. Sci. Nat. 53: 461 (1921). *Hyporhamma montanum* (Morgan) Lado, Cuad. Trab. Fl. Micol. Iber. 16: 48 (2001).

Morphology: Sporocarps densely gregarious or clustered on a common hypothallus, flattened-globose or globose to obovate or pyriform, pale yellow to dull ochraceous, sessile on a constricted base or short-stalked, 1-2 mm diam., rarely sub-plasmodiocarpous. Peridium thin, shining, translucent or sometimes appearing dull when thickened by spore deposits, delicately reticulate within, breaking away in patches above, but persisting below as a deep cup with ± petaloid lobes. Stalk, when present, short, thick, rarely exceeding 33% of the total height, merging gradually into the cup. Capillitium dense, compact, moderately elastic, bright yellow to ochraceous orange, becoming duller and darker with age, branched and anastomosed, with few to many free ends and often with vesicular enlargements, 6-8 (-11) µm diam., bearing 4-6 spiral bands, close-set to loose in the same sporotheca, and occasional rings and scattered spines, the basal portions tending to be wider and smoother. Spore-mass bright ochraceous. Spores almost colourless, minutely spinulose, 10-13 µm diam. Plasmodium unknown (Figure 5).

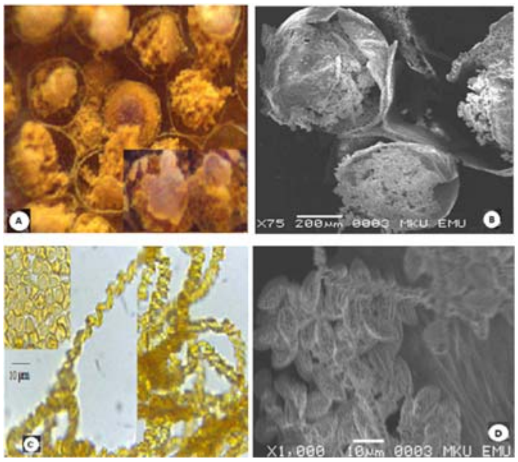

Figure 5. *Hemitrichia montana;* A, B: sporangium, C, D: capillitium and spores, (A and C in light microscope, B, D in SEM).

Chorological and Ecological Data: Adana: Akkaya, on *Pinus* sp. wood, natural, *Baba et al.* 9, 14, 15, 24.

Habitat: Dead wood [26].

Distribution: Austria, Germany, Switzerland and USA.

4.3.2 *Physarum psittacinum* Ditmar, in Sturm, Deutschl. Fl., Pilze 1(4): 125 (1817).

Syn.: *Physarum psittacinum* var. *chlorantum* Fr., Syst. mycol. 3: 134 (1829). *Physarum psittacinum* var. *intermedium* Rostaf., Sluzowce monogr. suppl. 8 (1876). *Physarum carlylei* Massee, in Cooke, Grevillea 17: 56 (1889). *Physarum psittacinum* var. *fulvum* Lister & G. Lister, J. Bot. 44: 228 (1906). *Physarum psittacinumf. fulvum* (Lister & G. Lister) Y. Yamam., Myxomycete Biota Japan 475 (1998).

Morphology: Sporocarps scattered or gregarious, stalked and then 0.8-1.2 mm tall. Peridium bronze or iridescent blue, ± mottled with flecks of orange lime. Stalk rugose, limeless, orange, orange-red, fulvous or yellow. Capillitium dense, persistent, the threads hyaline to dark, often flattened, the brilliant orange nodes numerous and often confluent in the centre. Columella absent. Spore-mass dark brown. Spores pale brown, minutely but distinctly warted, the warts often in groups, 8-10 µm diam. Hypothallus small, concolorous with the stalk. Sporotheca globose, depressed-globose or reniform, 0.5-0.8 mm diam. Plasmodium yellow or orange (Figure 6).

Chorological and Ecological Data: Adana: Çulluuşaği plateau, on *Pinus* sp. bark and wood, natural, *Baba et al.,*10, 12.

Habitat: on rotten logs and stumps in ancient broad-leaved woodland, occasionally as a casual on bark of living trees, on dead wood [26], and leaves [27]. According to Neubert et al. (1993) on dead wood of coniferous and deciduous trees, mostly in its final phase, and plant debris, leaves, mosses and grasses in the neighborhood are inhabited [28].

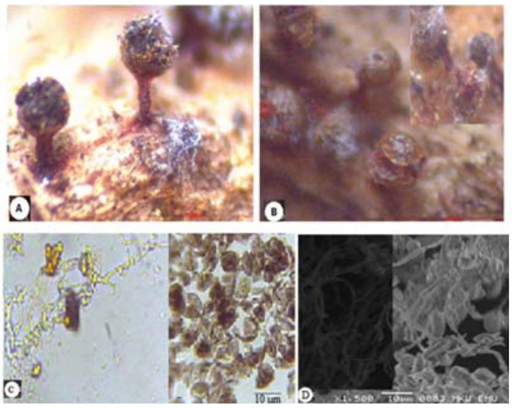

Figure 6. *Physarum psittacinum;* A, B: sporangium, C, D: capillitium and spores, (A, B and C in light microscope, D in SEM).

Distribution: China, Dominica, Germany, India, Japan, Philippines, Rumania, Sri Lanka, USA, Venezuela.

4.3.3 *Symphytocarpus herbaticus* ing, in ing & nannenga-bremekamp, proc. kon. ned. akad. wetensch., C. 70 (2): 229 (1967).

Syn.: *Stemonitis herbatica* var. *confluens* G. Lister, in Lister, Monogr. mycetozoa, ed. 2: 148 (1911).

Morphology: Pseudoaethalium sessile on a thin hypothallus, 8-25 mm diam., the upper surface areolate with conspicuous ridges and with flakes of adhering peridium. Sporothecae subcylindrical, confluent throughout, pale grey-brown, up to 6 mm high and 0.5 mm diam., blunt at the apices. Peridial flakes, irregular, present within the pseudo-aethalium and at the bases of the outer sporothecae, silvery shiny, very pale ochraceous, showing a curious structure of thin areolae ringed in by thickened margins. Capillitium pale brown, anastomosed and forming an irregular net of rather small meshes, mostly 20-50 µm diam., the joints with membranous expansions, some branches also with ± nodular swellings in the straight parts, the ultimate branches free or attached to the peridial flakes. Columellae usually absent, when present irregular, dark brown, opaque. Spore-mass grey, spores nearly colourless, 6-8.5 µm diam., faintly and minutely spinulose. Plasmodium white (Figure 7).

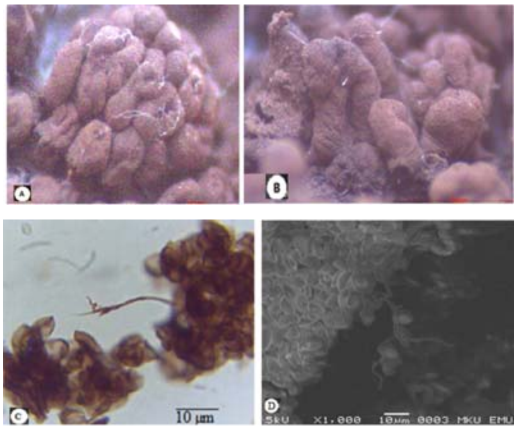

Figure 7. *Symphytocarpus herbaticus*: A, B: sporangium, C, D: capillitium and spores, (A, B and C in light microscope, D in SEM).

Chorological and Ecological Data: Adana: Cöbük, on *Pinus* sp. wood, *Baba et al.,* 12.

Habitat: on dead leaves [26] forest leaf litter [27].

Distribution: England, Germany, India, Japan, Sri Lanka, USA.

Hemitrichia montana may show similarities to both *Trichia contorta* as well as to *T. varia* and *T. verrucosa.* It can be recognized by its peculiar pallid, sessile sporangia and by its internal structure [26]. Peridium thin, shining, translucent or sometimes appearing dull, breaking away in patches above, but persisting below as a deep cup (Table 4).

Physarum psittacinum differs from *Physarum pulcherripes* in external coloration, the peridium a rich blue, mottled but not with lime, in the capillitium dense, calcareous, with large angular or branching nodes, in the stipe without lime, in the spores a little larger than in *P. pulcherripes* and by transmitted light much more distinctly brown in color. The sporangia are also broader in the present species, reaching 1 mm. Brilliant orange stalk, iridescent bronze sporangia and orange nodes make this an unmistakable species, in bark cultures the colours are usually more subdued. The usually orange, limeless stipes, iridescent peridium, and orange lime nodes are the distinctive marks of this species. It resembles *P. pulcherripes* in habit, but differs by the absence of a columella and of lime in the stipes and by the angular or stellate shape of the lime nodes. Among all the known species of the genera *Physarum, P. psittacinum* is distinctive by striking iridescent blue sporocarpien with bright orange stalks and lime (Table 5) [27].

Table 4. Comparison of *Hemitrichia montana* according to different researchers.

	Martin and Alexopoulos (1969)	Neubert et al., (1993)	Baba et al.(2014)
Sporocarps	Obovate, globose or pyriform, pale yellowto dull ochraceous	Short plasmodiocarp,dark ochrto reddish brown,	Flattened-globose pyriform pale yellow
Peridium	Thin, shining, paler color, persisting below,translucent	Translucent, colorless to dark dull, presisting below	Thin, shining, translucent
Stalk	Sessile or short stalked 1-2 mm	Sessile if present short thick	When present,
Capilitium	Dense, compact wider 6-8 .00m, bright Yellow, branchingand anastomosing	Pale yellow to ochr-brown, 4-6 smooth spiral afford 4-8 .00m,	short thick, Dense, compact bright yellow to ochr
Columella	Absent	Absent	Absent
Spores	Globose, colorless by light, minutely spinulose 10-13 µm	Round, with fine warts, light brown-yellow, 10-13 (15) µm	Almost colourless, minutely spinulose, 10-13 µm
Hypothallus	Uncertain	Together sporocarps group	Together sporocarps group

Table 5. Comparison of *Physarum psittacinum* according to different researchers.

	Martin and Alexopoulos (1969)	Ing (1999)	Baba et al.(2014)
Sporocarps	Depressed globose or reniform,	Globose	Globose scattered or gregarious
Peridium	Bronze or iridescent metallic blue,	Membranous, bronze or iridescent blue	Bronze or iridescent blue mottled with flecks of orange lime
Stalk	Rarely sessile, cylindric, limeless, orange red	Brilliant orange or reddish Brown	Rugose, limeless orange-red, fulvous or yellow
Capilitium	Dense, threads hyaline to dark, Orange nodes numerous.	Dense, colourless or dark, brilliant orange nodes	Dense, threads hyaline to dark brilliant orange nodes
Columella	Absent	Absent	Absent
Spores	Pale brown, minutely warted, warts often in groups 8-10 μm	Pale brown, minutely warted, warts often in groups 8-10 μm	Pale brown, minutely warted, warts often in groups 8-10 μm
Hypothallus	Yellow or orange	Yellow or orange	Yellow or orange

The compact aethalia of *Symphytocarpus herbaticus* are paler than *Stemonitis herbatica* and the habitat rules out all species except the next, which is larger, darker and usually on twigs when in the litter. The present species is very different from the usual idea of a confluent *Stemonitis* (Table 6). [27].

Due to the different geographic characteristics, climate and vegetation northern Adana has a rich biodiversity. In our study this richness have been shown and 54 taxa belonging to 10 families and 20 genera (with 3 new record) were added to the Turkey Myxobiota and we revealed the morphological, ecological and chorological features of *Myxomycetes*.

Table 6. Comparison of *Symphytocarpus herbaticus* according to different researchers.

	Martin, Alexopoulos and Farr (1983)	Ing (1999)	Baba et al.(2014)
Sporocarps	Pseudoaethaloid, pulvinate deep brown or black	Pseudoaethalia, blunt, grey-brown	Pseudoaethalia pale grey-brown, blunt at the apices
Peridium	Membranous, brown, fugacious	Silvery grey brown flakes	Silvery shiny, very pale ochr.
Stalk	Absent	Absent	Absent
Capilitium	Stout, violet brown or brownish black branched and anastomosed	Pale brown forming irregular net branched and anastomosed	Pale brown anastomosed forming an irregular net
Columella	Absent	Usually absent if present irregular dark brown	Usually absent if present dark brown, opaque
Spores	Globose, 6.3-8.5 μm faintly warted warts arranged in lines.	Nearly colourless, 6-8.5 μm. minutely spinulose	Nearly colourless, 6-8.5 μm. minutely spinulose
Hypothallus	Inconspicuous	White	White

ACKNOWLEDGMENTS

This study was supported by Mustafa Kemal University Scientific Research Projects (BAP) (Project No: 1204 Y 0129).

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